

## MACROSTRUCTURE OF SCOTS PINE WOOD FROM UNRIPE FOREST STANDS GROWN IN CONDITIONS OF FRESH FOREST

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An attempt was taken undertaken to characterise macrostructure of Scots pine (*Pinus sylvestris* L.) wood, which was grown in conditions of forest type- fresh coniferous forest, that is type of forest most often occurring in Polish forests. Macrostructure was expressed as average width of annual increment, width and share in annual increment of spring and summer wood, share of sapwood and heartwood in the volume of usable stems of trees.

**Key words:** fresh coniferous forest, growth ring in thickness, share of summer wood, sapwood, heartwood, volume of usable stem of tree

### INTRODUCTION

Accordingly to the forecasts in forestry, it is thought that harvesting of wood raw material from European forests will be growing slower than on other parts of the World. In 1990 year was cut there 390 mln m<sup>3</sup>, and in 2020 year wood cuts will increase to 480 - 490 mln m<sup>3</sup> (Strykowski 1996). It is to be stressed there, that the forecasted cuts will reach about 70% of annual growth of wood, what finally has to gain positive result, that is increase of forest resources of standing trees in the majority of European states, in that also in Poland.

One of basic variants of this forecast is assumption of dynamic development of European wood processing industry. It is forecasted, that between 1999 and 2020 year will occur increase of sawn wood about 25-35%, of particleboards about 20%, of cellulose 30%, and of paper about 50 % (Strykowski 1996). Forecasted so dynamic increase of production will need from one side considerable development of production potential, especially of cellulose-paper industry and wood based panels industry, and from other side of clear-sighted qualitative-quantitative evaluation of domestic raw material base. In this last point special stress is to be laid upon unripe forest stands.

Supply of wood raw material will be closely bound with the condition of wood raw material base in State Forests, and related to the conditions influencing it.

The forests in Poland are characterised by considerable share of coniferous species, which accordingly to the dominant species in forest stands jointly cover 77.9% of forests area, while the rest (22.1%) is covered by broadleaved species (Głaz 1996, Praca zbiorowa

1996). The Scots pine covers 69,4% of domestic forests area ,what places it on the first place among domestic forest creating species.

The age structure of our forests also is not ideal ,particularly if we take into account the needs of our country in the range of wood. Forest stands in the age up to 40 years we have in total 41.4 % in State Forests and 37.3% in other forests ,while in age of 41-60 years of age - 20,6% in total and 20,6% in State Forests (Głaz 1996, Praca zbiorowa 1996).

Cited there arguments are showing univocally ,that the needs of national economy in the range of wood will be covered by the wood raw material cut above all in the unripe pine forest stands in the range of selection logging. The wood raw material from mentioned above cuts is the middle- and small dimension wood, rarely big dimensions wood. The technical -usability properties of such wood raw material and in that macro-structure are accordingly to the opinions of authors not satisfactorily known and popularised , what often contributes to not always proper its assignments and uses.

The scope of presented paper is an attempt to make evaluation of wood quality expressed by its macrostructure at Scots pines from unripe forest stands which were grown in conditions of forest type- fresh coniferous forest. Obtained results could be the base of rational provisions and uses of wood cut in course of thinnings and other cuts in unripe pine forest stands.

## MATERIALS AND METHODS

Studies covered wood of pines cut from unripe fresh coniferous forests grown in conditions of fresh coniferous forest habitat on terrains of experimental forest district Zielonka near Poznań . Trees were cut accordingly to Ulrich II method (Grochowski 1973). The sample trees have age about 30,40 and 60 years of age. In each age division three trees were cut. After marking on each tree stem the North direction each tree was cut down, and discs were cut out- beginning from the butt,next 0.5 m and others 1.0 m to the end of stem. There was taken also disc on the height 1.30 m from the ground level,that is on the breast diameter of tree height.

Discs after slight drying in aim to better revealing of the heartwood were used for measurements of the ring of sapwood and circle of heartwood on two perpendicular diameters in directions North -South and West -East. The obtained results of measurements allowed to calculate volume of of ring of sapwood and cylinder of heartwood in each 1 m long section of particular stems and in total usable part of sample tree. The butt discs were used for determination of the age of trees,and discs from breast diameter (1.30 m) for determination of the width of the annual increments in thickness, and the width of the zone of summer wood . At determination of the width of growth rings and the zone of summer wood was used workshop microscope.Measurements were made with the accuracy of 0.01 mm. For the analysis were applied arithmetic means of share of the sapwood and heartwood in stems of trees and width of growth rings and the zone of summer wood in the growth ring calculated from the three sample trees for each forest stand in adopted age intervalls.

## RESULTS

The macrostructure of wood was expressed in presented paper by the share of the zone of the summer wood in the annual increment in thickness, and also share in usable stems of pine trees of the sapwood and heartwood. Results of the studies were presented in the tables 1 and 2.

Width of annual increments in thickness was at trees in the analysed age groups differentiated, but much less then at pines grown in poor conditions that is of dry coniferous

Table 1

Tabela 1

Average occurrence of growth rings and share of summer wood in wood of Scots pines from unripe forest stands growing in conditions of forest type -fresh coniferous forest

Przeciętna słoistość i udział drewna późnego w drewnie sosen zwyczajnych z drzewostanów przedrębnych rosnących w warunkach siedliskowego typu lasu boru świeżego.

Age of trees (years) Wiek drzew (lata)	Measures Miary	Macrostructure feature Cecha makrostruktury	
		Year increment in thickness Przyrost roczny	Share of late wood Udział drewna
30	Minimum value (mm)	1.35	0.45
	Wartość minimalna (mm)		
	Maximum value (mm)	2.62	0.85
	Wartość maksymalna (mm)		
	Arithmetic mean (mm)	1.91	0.64
	Średnia arytmetyczna [mm]		
	(%)		
40	Coefficient of variation (%)	100	33.5
	Współczynnik zmienności (%)	33.8	31.1
	Minimum value[mm]	1.38	0.41
	Wartość minimalna [mm]		
	Maximum value [mm]	2.54	0.76
	Arithmetic mean [mm]	1.84	0.55
	(%)		
60	Coefficient of variation (%)	100	29.0
	Współczynnik zmienności (%)	33.3	34.2
	Minimum value (mm)	1.68	0.52
	Wartość minimalna (mm)		
	Maximum value	2.10	0.98
	Wartość maksimum (mm)		
	Arithmetic mean (mm)	1.82	0.72
60	Średnia arytmetyczna		
	(%)		
	Coefficient of variation (%)	100	39.6
	Współczynnik zmienności (%)	11.8	32.4

forest (Pazdrowski and Spława -Neyman 1996). The calculated coefficients of variation of this characteristic of macrostructure were higher at 30 and 40 years of age (about 33 and 34 %), and smaller at 60 years of age (11.8%)-(tab 1). The share of summer wood zone was about 30% to 40% - (tab.1). The higher share of summer wood zone occurred at pines from the forest stand 60 years old. The variation of characteristic of structure of wood was relatively even and was in the range about 31% to 34 % - (tab .1).

The share of the sapwood and heartwood is distinctly bound with the phase of the forest stand development, that means with the age of trees. In pines at the age of 30 years share of the heartwood in volume of usable stem was 2.6% what can be explained that Scots pine at Poland begins to produce heartwood after 20 years of age (Hejnowicz 1973, Krzysik 1974). In course of ageing of the trees this process of creation of heartwood increases, what results in the increase of heartwood in stems. At pines grown in conditions of fresh coniferous forest this share of heartwood was properly: 6.4% at 40 years old pines, and 11.4 % at 60 years old pines - tab. 2). Simultaneously the percentage of the sapwood in usable stems of Scots pines decreased.

Table 2

Table2

Average volume of the usable stems and percentage of sapwood and heartwood at Scots pines from unripe forest stands growing in conditions of forest type -fresh coniferous forest

Przeciętna objętość drewna strzał użytkowych oraz udział bielu i twardzieli u sosen zwyczajnych z drzewostanów przedrębnych rosnących w warunkach siedliskowego typu lasu-boru świeżego

Age of trees (years) Wiek drzew (lata)	Measures Miary	Volume Objętość		
		Total Całkowita	Sapwood Biel	Heartwood Twardziel
30	Minimum value (m <sup>3</sup> )	0.01762	0.01722	0.00040
	Wartość minimalna (m <sup>3</sup> )			
	Maximum value (m <sup>3</sup> )	0.11790	0.11470	0.00320
	Wartość maksym. (m <sup>3</sup> )			
	Arithmetic mean (m <sup>3</sup> )	0.05969	0.05816	0.00153
40	Średnia arytmetyczna (%)	100.0	97.4	2.6
	Minimum value (m <sup>3</sup> )	0.03958	0.03738	0.00220
	Wartość minimalna (m <sup>3</sup> )			
	Maximum value (m <sup>3</sup> )	0.18195	0.17005	0.01190
	Wartość maksymalna (m <sup>3</sup> )			
60	Arithmetic mean (m <sup>3</sup> )	0.10417	0.09754	0.00663
	Średnia arytmetyczna (%)	100.0	93.6	6.4
	Minimum value (m <sup>3</sup> )	0.11335	0.09715	0.01620
	Wartość minimalna (m <sup>3</sup> )			
	Maximum value (m <sup>3</sup> )	0.38177	0.34827	0.03350
60	Wartość maksymalna (m <sup>3</sup> )			
	Arithmetic mean (m <sup>3</sup> )	0.22407	0.19843	0.02563
	Średnia arytmetyczna (%)	100.0	88.6	11.4

Calculated variation coefficients characterising total volume of stems, sapwood and heartwood volume, were highest at 30 years old trees and together with the age they decreased distinctly - (tab. 2).

In recapitulation it is to be stated, that wood raw material from unripe Scots pine forest stands grown in conditions of the fresh coniferous forest, cut in the course of the thinnings and other cuts is characterised by average growth ring below 2 mm and share of the summer wood zone in the growth ring of about 30-40 %. This wood raw material that is mainly sapwood. The share of this sapwood in stems was about 88-97 %. This fact is to be taken into consideration at the use of such wood from unripe forest stands in respect to the low durability of such wood against biological corrosion (Spława-Neyman and Wojcieszyn 1995). When using such wood for construction purposes indispensable will be application of various treatments of the wood protection.

## CONCLUSIONS

1. The age of the trees influences in distinct way the macrostructure of wood of Scots pines from unripe forest stands, that is annual increment in thickness, share of sapwood and heartwood in usable stems of trees. This influence was revealed with various intensity and in various ways.

2. Characteristic of macrostructural features of wood of Scots pines from unripe forest stands grown in conditions of fresh coniferous forest on the pattern of increased supply of pine wood raw material cut in younger age class forest stands will force the customers to the change of the approach, to the designing constructions and to elaborate new technologies enabling application of elements with smaller crosssections.

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## MAKROSTRUKTURA DREWNA SOSNY ZWYCZAJNEJ Z DRZEWOSTANÓW PRZEDRĘBNYCH WYROSŁYCH W WARUNKACH SIEDLISKOWEGO TYPU LASU BORU ŚWIEŻEGO

### Streszczenie

Podjęto próbę scharakteryzowania makrostruktury drewna sosny zwyczajnej (*Pinus sylvestris* L.), która wyrosła w warunkach siedliskowego typu lasu boru świeżego. Makrostrukturę wyrażono przeciętną szerokością słoja rocznego, szerokością i udziałem w przyroście rocznym grubości strefy drewna późnego, udziałem drewna bielastego i twardzielowego w objętości strzał drzew.

Stwierdzono, że wiek drzew w sposób zdecydowany wpływa na makrostrukturę drewna sosen z drzewostanów przedrębnych tj. słoistość drewna, udział drewna późnego w słoju rocznym oraz udział w strzałach drzew drewna bielastego i twardzielowego. Wpływ ten wyrażał się w różny sposób i ze zróżnicowaną intensywnością.

Charakterystyka cech makrostrukturalnych drewna sosen z drzewostanów przedrębnych wyrosłych w warunkach siedliskowego typu lasu boru świeżego na tle zwiększonej podaży surowca drzewnego sosnowego pozyskiwanego z drzewostanów młodszych klas wieku, zmusi odbiorców drewna do zmiany podejścia do jego wykorzystania, projektowania konstrukcji oraz wypracowania nowych technologii umożliwiających zastosowanie elementów o małych przekrojach.

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