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Research Article

The Study of the Annual Ring Width of Bosnian Pine (Pinus Heldreichii–Christ.) that Grow in Bjeshket e Nemuna in Kosovo

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Abstract

This paper aims at analyzing and reviewing the annual ring width of the Bosnian pine (Pinus Heldreichii Christ. Var. leucodermis Antoine Markgraf) that grows in Mount Strellca in Bjeshket e Nemuna in Kosovo. Parallel to the study of the annual ring width of the mentioned tree, we have also compared the multiplication level in the areas under observation. The width of growth rings is very important in measuring the multiplication level of the trees, especially when deciding upon the forestation of new areas and the set up of plantations with intensive cultures. From the tree processing perspective, the width of growth rings conditions all physical-mechanical traits and directly influences the usage of the tree.

Keywords: *Bosnian pine, annual rings, growth, multiplication.*

1. Introduction

The pine tree within the territory of Kosovo expands mainly in two locations: in Bjeshket e Nemuna and Mount Sharr, covering an area of 4,970 Ha and matter power of 44.868 $m^{3.}$ In Bjeshket e Nemuna, the pine tree forms pure forests. It mainly grows in areas with altitude between 770 m and 2,300 m and reaches its optimum at 1,400 – 1900 m altitude. Usually, the pine tree in these areas grows in soil with calcareous rock composition and with warm expositions, forming a beautiful forest stripe, especially when combined with other forest trees, having in consideration the unfavorable conditions of its vegetation.

Having in consideration that the pine tree is an endemic species growing under specific ecologic conditions, mainly spread in our country and being important for the development of the tree industry here, there is a very sound reason to analyze its features and its rational use in depth, especially having in mind that no such studies have been performed in this region yet.

Being aware of the situation with forestry in Kosovo as well as of the limitations in utilizing these forests, where only specific types of trees are usually used, and considering the principles of rational and intensive use of forests, the need emerges to increase the growth of species that are otherwise present in Kosovo and as such be used for different purposes; new forests have been created by artificial means and as such need quite a long time to provide the necessary wooden material for everyday use.

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In this paper, the tree has been analyzed from the biological-technical aspect and will present the technology of its processing related to the sciences of forest utilization. Having in mind the whole usage cycle of forests, the cognition of technical features of the trees enables a more rational usage, standardization and application of them. The to-date analyzes relating to the usage of the pine tree have revealed that there is a lack of wooden matter every day, which creates the urge for studying other tree species as well and ascertain their factual and actual situation on the ground.

2. The core study material

The material for studying the annual ring width of the pine tree was obtained from the economic unit known as "Malet e Strellcit". There is a sufficient number of pine trees in the selected areas, which have met the criteria to be chosen as representatives of their own forest, including traits like breast diameter, length of the pure trunk, the crown diameter, the total height and the position in the forest. All locations had a same age and approximate breast diameter. The forests in locations "S" (Stanet e Strellcit) and "B" (Stanet Bjelopoles) are homogenous whereas in the location "L" Stanet e Lubeniçit) they are of a mixed composition. The total number of trees in all locations was greater than 120 pieces, which as sufficient to select representative samples.

The selection of tress to be cut down was made based on the method of random samples. The number

of trees for study purposes in the mentioned locations was made according to literature recommendations as well as on the methodology applied by the most renowned scholars in this field. The number of trees subject to this study was determined by the following formula:

$$N = \left(\frac{5}{P}\right)^2 \cdot 6 \quad (1)$$

where N – is the necessary number of the tress and P – the necessary study accuracy in %.

By using the above-mentioned formula, if we consider the accuracy measure to be 5%, which meets the criteria, then each study would require five tree samples.

The first conception was to take five sample trees from each location; however, after having analyzed the trees in the location of Lubeniç, we withdrew, because the trees in this location were very similar to one another and we thought that three such trees would be sufficient as samples taken from this location (this was also a request from the Association of Ecologists of Kosovo not to damage untouched forests, and we did respect that, as a matter of fact). In all locations, the tress were chosen by using the triangular and pentagonal scheme of selection.

Having in consideration the task in this study, we chose the trunk diameters to the breast height (1.3m) from 35 to 55 cm, because trunks with such diameters are present in greater numbers in the forest and at the same time the annual rings in these trunks are at an age that fit the study aims (thickness classes 3, 4, 5, Review 1).

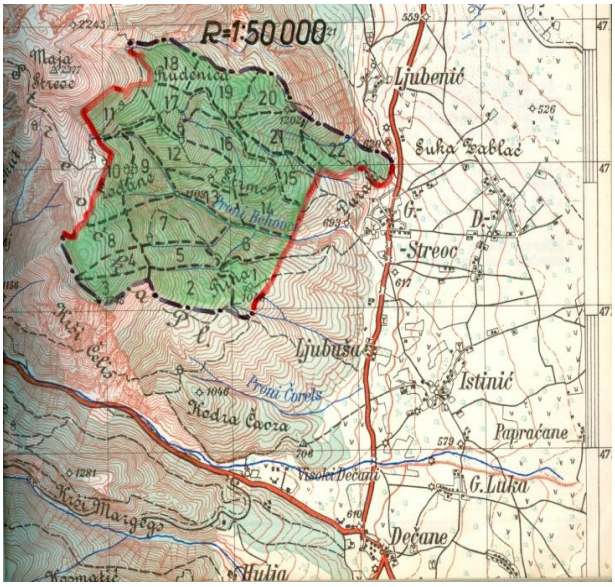

Fig.1 The position of the economic unit

After the collapse of selected trees to be cut has happened, we initially marked the north direction in them and we also put numbers there. After their collapse, the signs of the northern position were transmitted on the length of the tree (we made a shallow longwise canal with a chainsaw). After the collapse of trees, we stumped the trees and extracted the slabs and tester stumps (at a height of 0.3, 3.3, 5.3 m.).

Fig.2 Pine stumps and slabs

3. Work methods

We noted down the cardinal directions, numbers and upper and lower plans of the traverse cutting on the slabs.

Fig. 3 Pine tree slabs

After we brought the slabs into the lab, we piled them for drying until the equilibrated moisture was achieved, and this is a process that lasted five months. The average moisture ranged between 11% and 13%, which was ascertained with the help of an electric device for measuring moisture (RIZ) with the ability to measure moisture between 0% and 40%.

After the smoothing and grinding, there are two parallel lines marked on the slabs in the north-south direction in a distance of six centimeters in between, whereas the marrow was situated between the two lines. The slabs were then photographed by using a Simplex DP-36M scanner with high resolution (600 dots per inch). A frame was previously prepared, which is 1mm taller compared to the height of the printer, in order to make scanning easier.

During scanning, we were careful to position the slabs in the north-south direction, according to their previous scanning.

The transfer of the image of the scanned tree was done from the Photoshop 5.5 application to Corel Draw 9. By using this program, we did the radial cutting of a segment of the photograph with a given width (according to previously drawn lines).

The photograph of the cross cutting segments of the tree were then zoomed ten times, so that we could see the annual rings on the screen, as well as the difference between the late and early tree. The view of the cross cutting of the scanned tree in the ratio 1:1 and 1:5 can be seen in Figures 4 and 5.

After these operations and preliminary actions, the measurements of the characteristics of the trees in cross-cutting were made, and at the same time the values were recorded in previously prepared charts. The controlling of the measurements made on the computer was done with a microscope of Polish origin (BRINEL-PZO) which has a gradient plate in its lens. Eventual errors during the measurement (especially during the design of the late and early tree border) were considered to be minimal, because the measurements were made only by one person (the authors).

Fig.4. View of the Bosnian pine tree scanned on the 1:1 ratio (the marrow part towards the north)

Fig. 5. View of the Bosnian pine tree scanned on the 1: 5 ratio (the separation of the later and earlier tree)

Chart 1 The width of annual rings in sample slabs

Location and number of trees		Width of annual rings (mm.)			Average for: (mm.)	
		I	II	III	Trees	Location
"L"	1	2.46	2.66	2.57	2.56	2.69
	2	2.39	2.43	2.68	2.50	
	3	2.92	2.88	3.23	3.01	
Average		2.59	2.65	2.82	2.69	
"B"	4	2.33	2.47	2.45	2.42	2.54
	5	2.09	2.22	3.34	2.55	
	6	2.17	2.19	2.27	2.21	
	7	2.47	2.81	3.02	2.77	
	8	2.35	2.37	3.52	2.75	
Average		2.28	2.41	2.92	2.54	
"S"	9	1.83	1.89	1.97	1.90	1.84
	10	1.72	1.77	1.83	1.77	
	11	1.39	1.26	1.73	1.46	
	12	1.96	1.98	2.53	2.16	
	13	1.66	1.83	2.31	1.93	
Average		1.71	1.75	2.07	1.84	
Common average		2.19	2.27	2.60	2.35	2.35

Chart 2: The average width of annual rings based on locations

Location and number of trees	Width of annual rings (mm.)	Average for: (mm.)			Location and number of trees
		1.30	7.0	12.0	
L –3	mm %	2.59 100.00	2.65 102.31	2.82 108.88	**2.69**
B – 5	mm %	2.28 100.00	2.41 105.70	2.92 128.00	**2.54**
S – 5	mm %	1.71 100.00	1.75 102.34	2.07 121.05	**1.84**
Average **L -S**	mm %	2.19 100.00	2.27 103.45	2.35 119.31	**2.35**

4. Results and conclusion

Chart 1 contains the data obtained from the carried out measurements. We can see that with the increase of the height of the tree the annual ring width also increases. This increase in location **B** between the first and second cut was 5.7%, whereas between the first and the third cut was 28%. In location **S** these values were 2.34% and 21.05% respectively, whereas in location **L** – 2.31% and 8.88%. the average increase of the width of annual rings for locations "**L**", "**B**", "**S**" was 3.45% and 19.31% between the first and second cut, and the first and third cut respectively.

The greatest average width of annual rings was recorded in location **L** (2.69 mm) whereas the smallest was recorded in location **S** (1.84 mm).

The average width of annual rings for the three locations under study was 2.35 mm.

The information on the width of annual rings according to the growth location and the location of the cutting has been presented in Chart 2.

We can see that the width of annual rings for the Bosnian pine tree was 2.35 mm.

The greatest average width of annual rings was recorded in location **L** (2.69 mm) whereas the smallest was recorded in location **S** (1.84 mm). The medium value was recorded in location **B** with 2.54 mm.

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