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The Selected Properties of Wood Structure of Scots Pine (*Pinus sylvestris* L.) Growing on Forest Experimental Station in central Poland

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Scots pine (*Pinus sylvestris* L.)

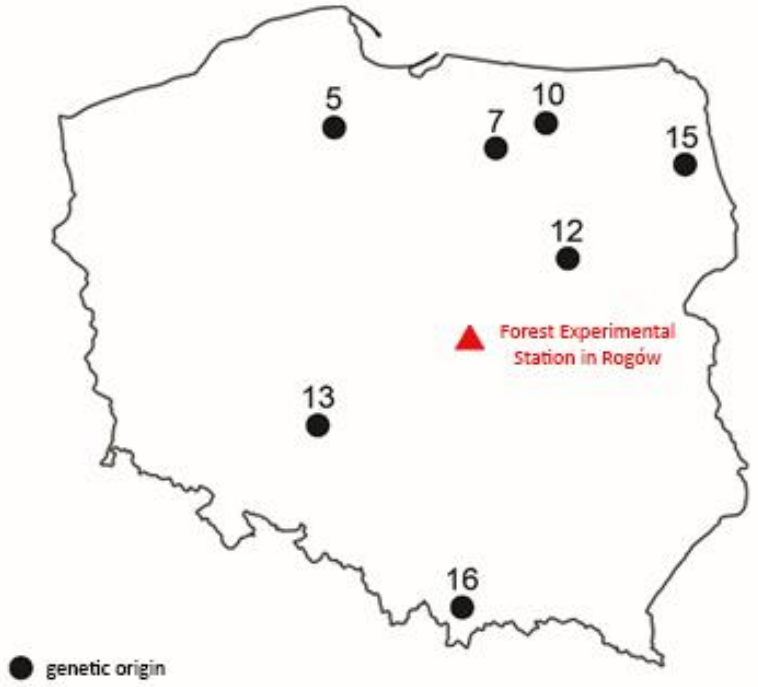
Scot pine in Poland is a dominant forest species, covering 66.5% of total forest area. Poland is in the seventh place when it comes to the total EU forested area and in the fifth place in tree felling and harvesting forests. The technical quality of wood in practical applicability is very important for pellet market and wood industry: building constructions, ship and marinas building, veneered, model building, toys or in making musical instruments.

The aim of the work

The aim of the study was to determine the relationship between the origin and the quality of Scots pine wood. We determined the tree-ring width (TRW) and latewood width values (LW) of seven origins located in one place at the Forest Experimental Station in Rogów (51°49' N, 19°53' E, ca. 190 m a.s.l – central Poland).

Study site

The experimental site is located in central Poland, at an elevation of 160 m above sea level. Average annual precipitation is 595 mm, and the average annual air temperature is 7.2 °C. All trees from the seven parent populations grow in a fresh mixed forest habitat, under identical growing conditions.



<u>These are the parent stands numbered:</u>

- **5** (Lipowa, the Tucholskie Forest 130 m a.s.l.)
- **7** (Dłużek, the Napiwodzko-Ramuckie Forest 145 m a.s.l.)
- **10** (Ruciane, the Piska Forest 145 m a.s.l.)
- **12** (Jegiel, the Biała Forest m 95 a.s.l.)
- **13** (Rychtal, the Namysłowsko-Ostrzeszowskie Forest 190 m a.s.l.)
- **15** (Supraśl, the Knyszyńska Forest 165 m a.s.l.)
- **16** (Nowy Targ, the Nowotarskie Forest 590 m a.s.l.)

Tree-ring width (TRW)

The average width of the ring and the density of pine wood play a role in our physical and mechanical properties of conifers.

The width of the annual rings depends on:

- tree species
- age
- environmental conditions

Latewood width values (LW)

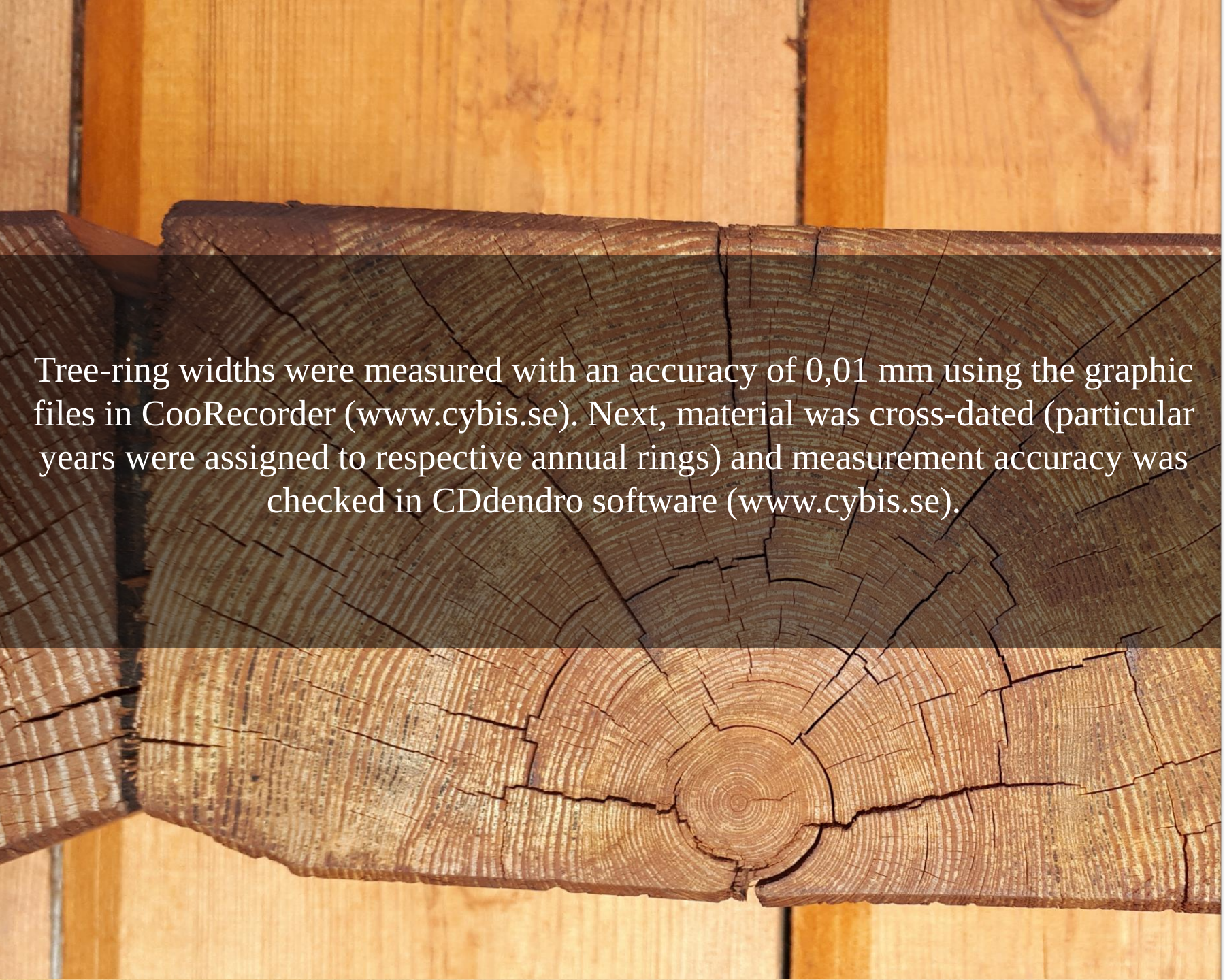
Wood in a growth ring of a tree that is produced late in the growing season and is harder and less porous than earlywood. The more latewood, the better mechanical properties. The tree-ring width and latewood width decrease from the base of the trunk to the top of the tree [Witkowska, Lachowicz 2013]. According to Hejnowicz: latewood of a 100-year-old pine at the base of the trunk is about 30% and in the crown zone is about 10%.

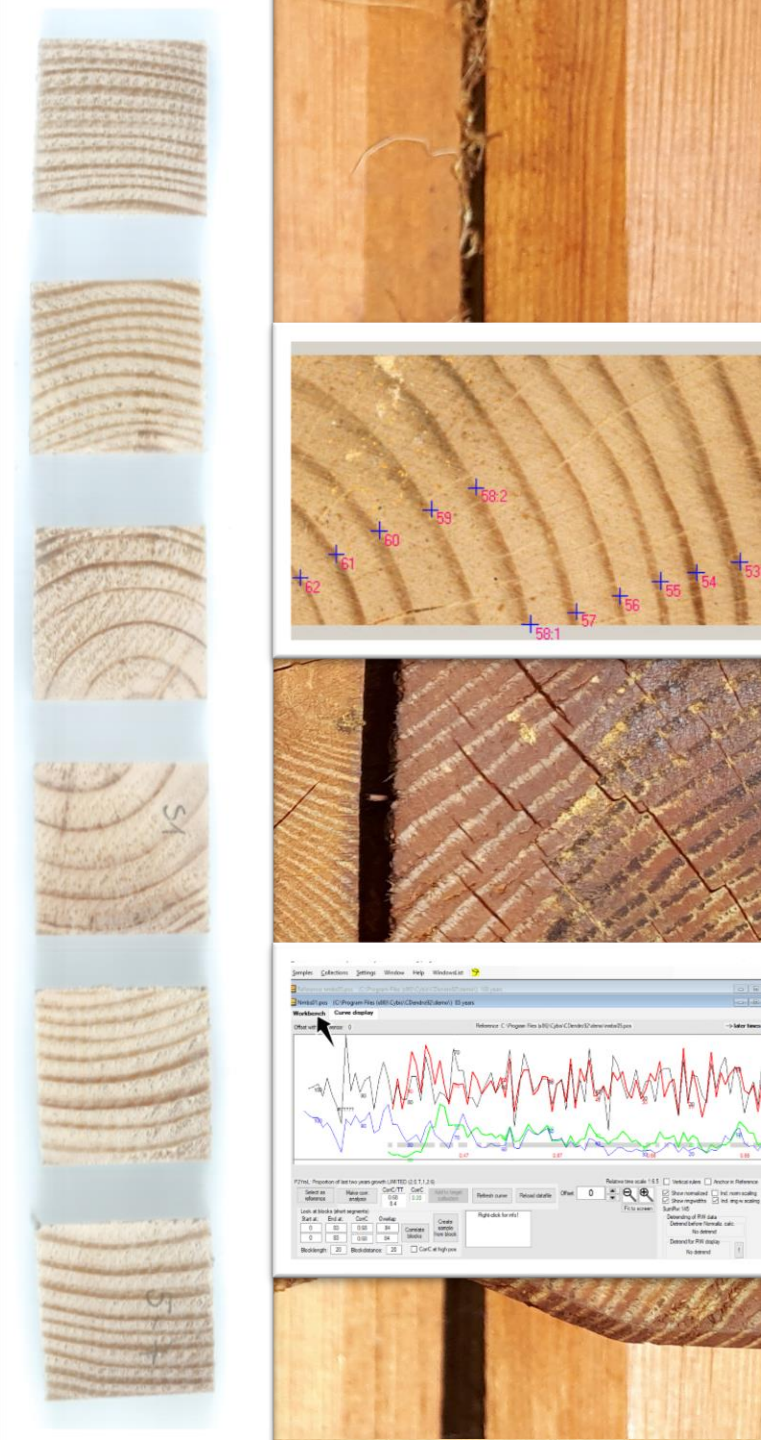
Scots Pine - about 140 years old

Methods

The tested wood was obtained in 2018 from trees aged 52 years. The research material came from 100 trees in total. After felling, two logs approximately 0.5 m in length were cut from each tree. The height on the tree from which the material was taken ranged from breast height (1.3 m) to approximately 2.5 m. Next, planks were cut from the logs in a north–south direction; these were precisely described, and then left to season. Samples were then produced for particular types of tests in accordance with the relevant provisions of the Polish Standards PN-77/D-04227.

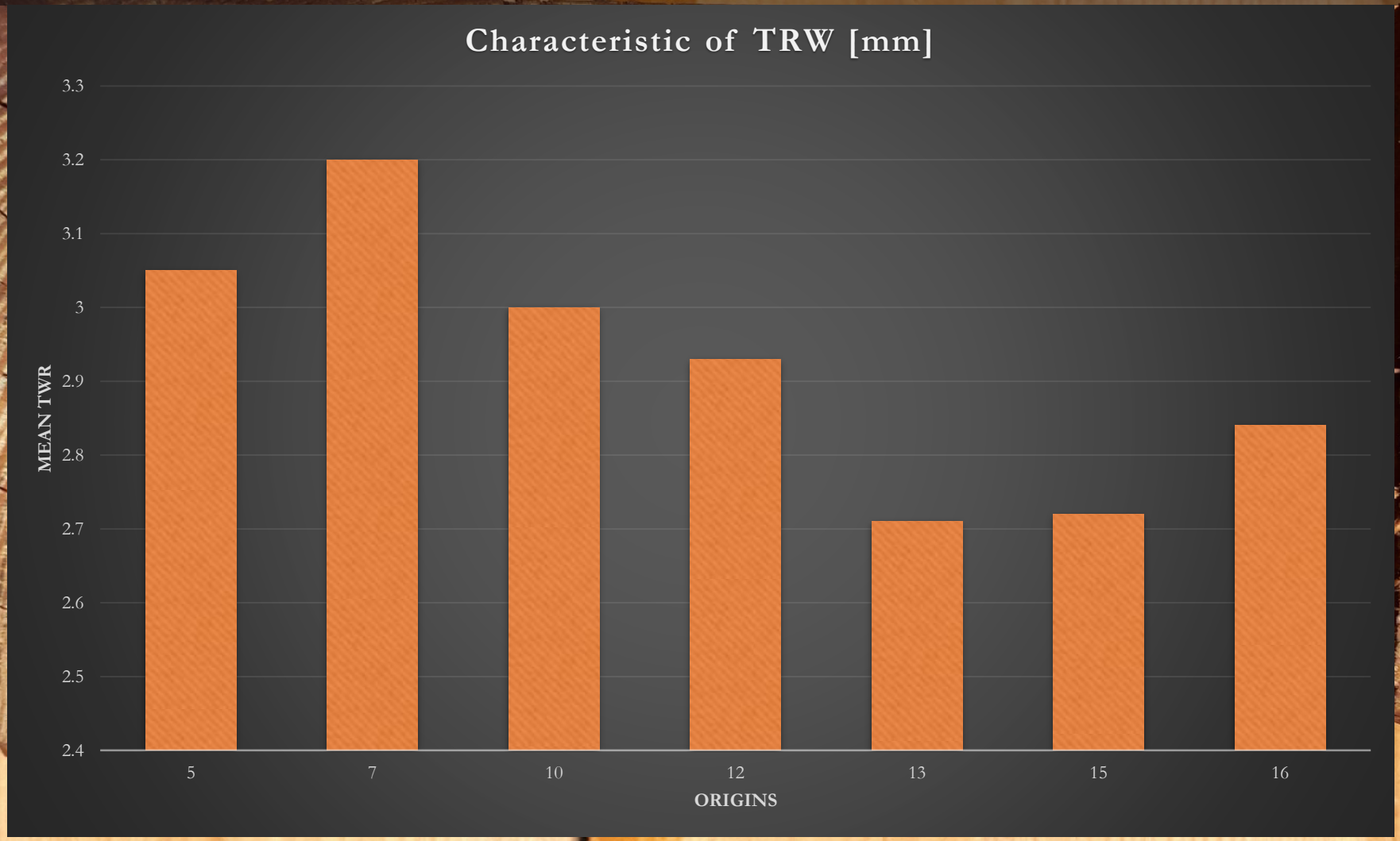
Tree-ring widths were measured with an accuracy of 0,01 mm using the graphic files in CooRecorder (www.cybis.se). Next, material was cross-dated (particular years were assigned to respective annual rings) and measurement accuracy was checked in CDdendro software (www.cybis.se).





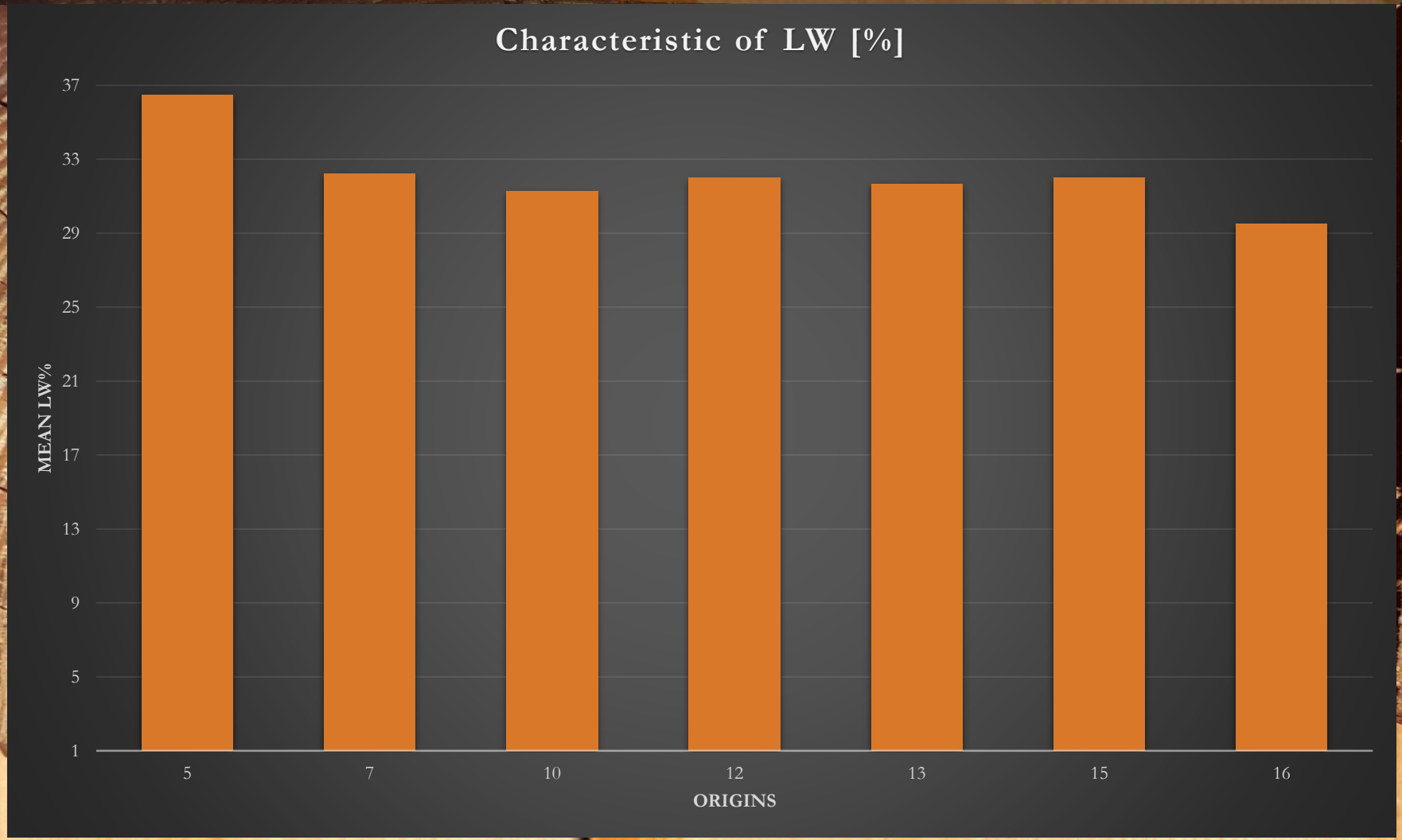
RESULTS

The highest mean TRW was obtained for trees from stand 7 (3,20 mm), and the lowest for stand 13 (2,71 mm). The average density of Scots pine wood for all of the studied material at Rogów Forest Experimental Station was 2,84 mm.



RESULTS

The highest mean LW was obtained for trees from stand 5 (36,48 %), and the lowest for stand 16 (29,51 %). The average density of Scots pine wood for all of the studied material at Rogów Forest Experimental Station was 32,28 %.



RESULTS

We used Kruskal–Wallis (for origins) and post hoc Mann–Whitney (for direction of samples) tests. It was found that the analysed samples differ statistically in origins not direction of sample at $p < 0.05$.

Wood properties	origin		direction of sample (N, S)	
	HKW	p	ZMW	p
TRW	23,99	0,001	0,91	0,360
%LW	26,72	0,000	0,29	0,770

RESULTS

Characteristics of TRW (mm) and %LW of seven genetic origins (N—Number of groups; M—Average; Me—Median; Min—Minimum; Max—Maximum; SD—Standard deviation; V—Coefficient of variation).

N – north direction of samples	TRW	%LW	S – south direction of samples	TRW	%LW
M	2,96	0,32	M	2,89	0,32
Me	2,67	0,33	Me	2,64	0,33
Min	1,36	0,12	Min	1,32	0,12
Max	6,23	0,55	Max	6,44	0,56
SD	0,97	0,10	SD	0,95	0,10
V	32,90	30,30	V	32,80	30,80

RESULTS

There is no correlation between wood density and TRW; wood density and LW.

ρ	TRW	LW
r	-0,628	0,685
t	-20,7	24,1
p	0,000	0,000

Conclusions

- It was shown that wood structure exhibits significant differences depending on its genetic origin.
- Origin was shown to have a significant influence on tree-ring width and latewood width values.
- The lowest mean TWR was found for trees originating from stand 13 (2,71 mm), 15 (2,72 mm) and stand 16 (2,84 mm). The worst wood structure had origin 7 (3,20 mm).
- The highest values mean LW was found for trees originating from stand 5 (36,48 %) and stand 7 (32,22 %). The lowest mean TWR was found for stand 16 Nowy Targ 590 m a.s.l. (28,55%).
- The optimal parameters of wood structure had origins 13 and 15.
- The results indicate that it ought to be possible to select the origin of planting material so as to obtain the highest quality and productivity of future stands.

THANK YOU FOR YOUR ATTENTION