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## **A COMPARATIVE ANALYSIS OF PINE AND BEECH WOOD CLASSIFICATION ACCORDING TO POLISH AND EU NORMS**

*Investigations were carried out at timber storage sites (depots) on large-sized pine (110 pieces) and beech (130 pieces) wood from three forest districts within the territory of the Regional Directorates of the State Forests (RDSF) of Łódź, Lublin and Kraków. As a result of a comparison of both classification systems, it was proved that in the case of pine wood classified according to EU norms, the shares of the number of pieces and volume in classes B and C decreased, whereas they increased in class D when compared with Polish classification. Analogically, in the case of beech wood, a decrease in the share of the number of pieces and volume in classes A, B and D, and an increase in class C were recorded. Among the most common defects that influence the classification of both sorts of wood, open and burl knots as well as curvatures are recognised, while in the case of beech wood, shakes and galls (disease T stains) are encountered. The results of the classification determined differences in the wood value. According to the pricelists for wood standing in forest districts where the raw wood under investigation originated, it was established that the value of the pine wood classified according to the EU norm decreased by ca. 7.6% when compared with the value estimated using the Polish norm. The value of the beech wood was nearly identical in both cases, which was mainly due to the higher share of wood of class C and lower share of class D upon applying the EU standards, in comparison with the Polish classification system.*

**Keywords:** pine timber, beech timber, Polish standards, European Union standards, timber defects

### **Introduction**

On joining the European Union, Poland was obliged to adapt its legal provisions to EU law. This process also concerned Polish norms, including those applied in

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the classification of roundwood. Regardless of the necessity to introduce changes in the content of the Polish standards to ensure the coherence (conformity) of both systems, the original EU norms were established in Poland and, upon passing a period of experimental implementation, they gained the status of Polish standards (PN-EN). They may now be applied concurrently with Polish norms (PN).

The EU standards, implemented in the quality classification of roundwood, are far more complex than the Polish national norms. They contain more requirements in respect of quality, and furthermore, they frequently refer only to single sorts or species of wood. Due to the possibility of applying both the Polish as well as the EU norms in the domestic trade of timber, it is beneficial to undertake comparative studies on the effects of wood classification by means of the Polish norms and their EU counterparts.

The aim of the study was to compare the quality and value structure of pine and beech wood classified by means of Polish and EU norms.

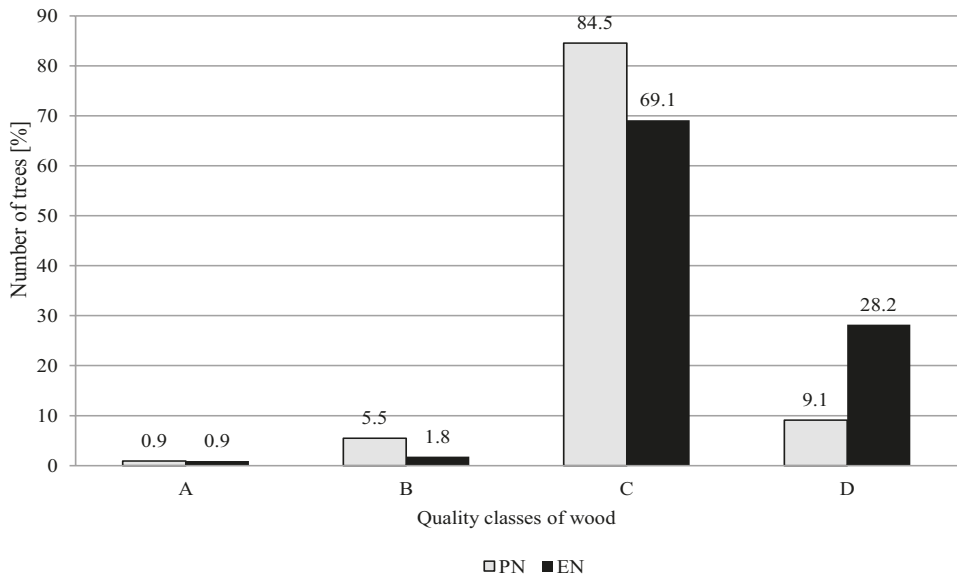
## Materials and methods

The field survey comprised material from three forest districts located within the boundaries of the RDSFs of Łódź, Lublin and Kraków. The material subjected to analysis contained long timber or logs of large-sized wood, including 110 pieces of pine wood and 130 pieces of beech wood which were chosen at random from piles of stacked wood. The measurement parameters were as follows: length, mid- and top diameter and, in the case of coniferous timber, nominal diameter also. Visible wood defects and other features, taken into account during wood classification according to the Polish and EU norms, were recorded. The sorts of defects considered were the ones that determined the quality class of certain pieces of wood and, based on these criteria, the quality class of the wood was estimated according to the Polish and EU norms [PN-92/D-95008; PN-EN 1316-1:1999; PN-ENV 1927-2:2002; Warunki Techniczne... 2002], respectively.

The calculations made it possible to establish the number of pieces and volume of the timber, in particular the quality classes, which resulted in two groups of data: the quality structure of the raw wood classified according to the Polish and EU norms. The statistical significance of the differences between the assortment structure (per number of pieces and volume of timber) obtained by means of the Polish and EU norms was determined using a chi square test ( $p = 0.05$ ). The frequency of the occurrence of various sorts of wood defects which affected the results of the pine and beech wood classification, according to both of the applied evaluation systems, was also established. Following this, changes in the percentage of particular quality classes and the value of the raw wood upon applying the EU norms in comparison with the value estimated by means of the Polish norms (considered as the level of reference) were identified [Cenniki drewna... 2012].

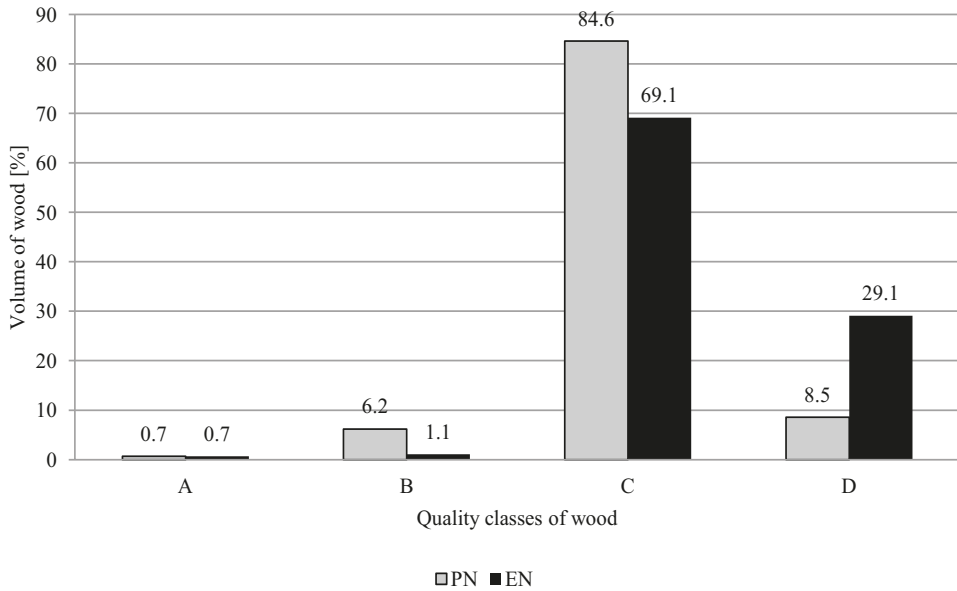
## Results and discussion

The vast majority of the pine wood with an overall volume of 90.2 m<sup>3</sup> was designated class C using both the Polish as well the EU classification. Wood of this class constituted over 84% (the Polish norm) and over 69% (the EU norm), respectively, in terms of both the number of pieces as well as the volume of the timber (figs. 1 and 2). The raw wood designated class D was less numerous and, classes B and A were represented the least frequently. According to the Polish norm, more wood of classes B and C, and less of class D, was obtained when compared with the EU system.

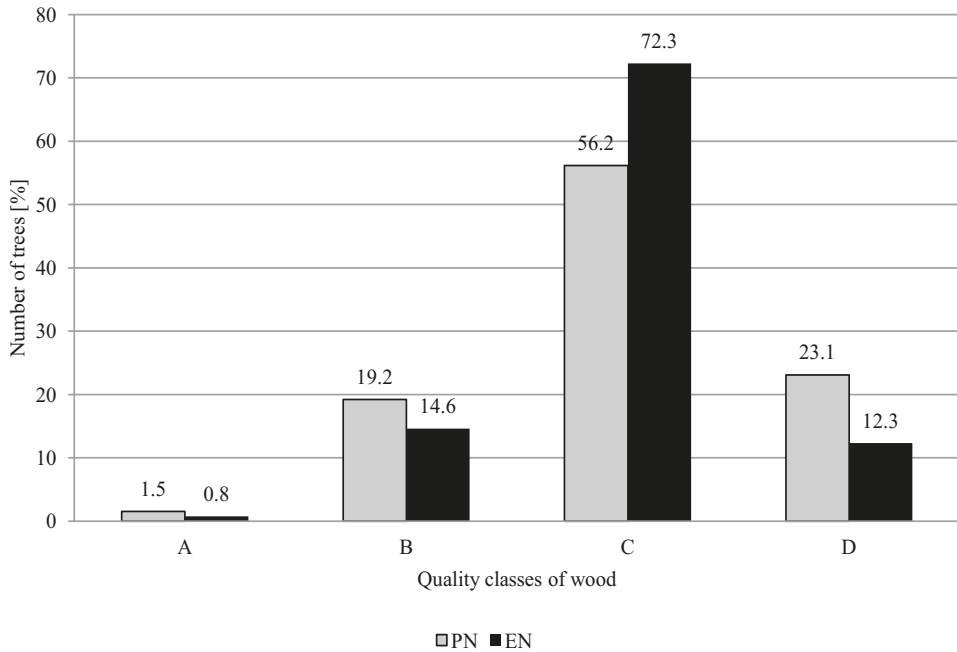


**Fig. 1. The structure of qualitative pine timber (pieces of wood) classified using standard Polish and EU**

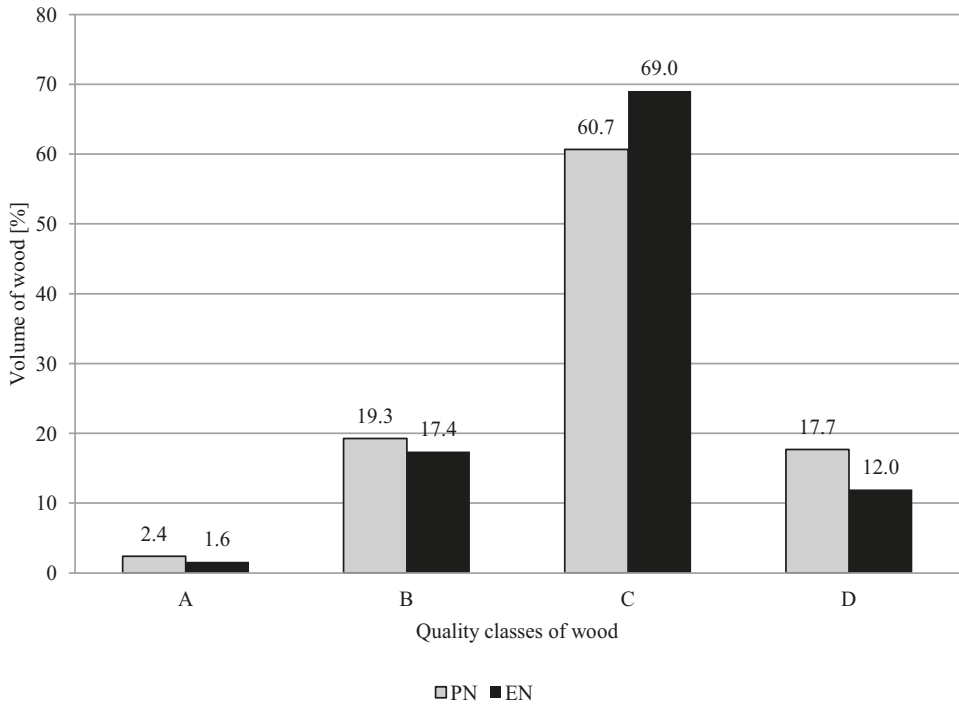
The analysis of the beech wood with an overall volume of 143.54 m<sup>3</sup> showed a significant prevalence of class C according to both classification systems. Pieces of wood designated this class according to the Polish norm constituted ca. 56%, whereas, according to the EU system the share was significantly higher, i.e. ca. 72%. With regard to the volume of the timber, over 60% and 69%, respectively, was designated this class (figs. 3 and 4). Moreover, according to the Polish standard, more wood of classes B and D was obtained in comparison with the EU norm. In the beech wood group, class B was more numerous according to both classification systems, and yet, at the same time, class D was also more frequent (in the Polish system exclusively) than in the pine wood group. Karaszewski et al. [2013] obtained a similar distribution of quality classes in the beech wood group, though more wood of class WD than that of class WB was recorded.



**Fig. 2. The structure of qualitative pine timber (volume of wood) classified using Polish and EU standards**



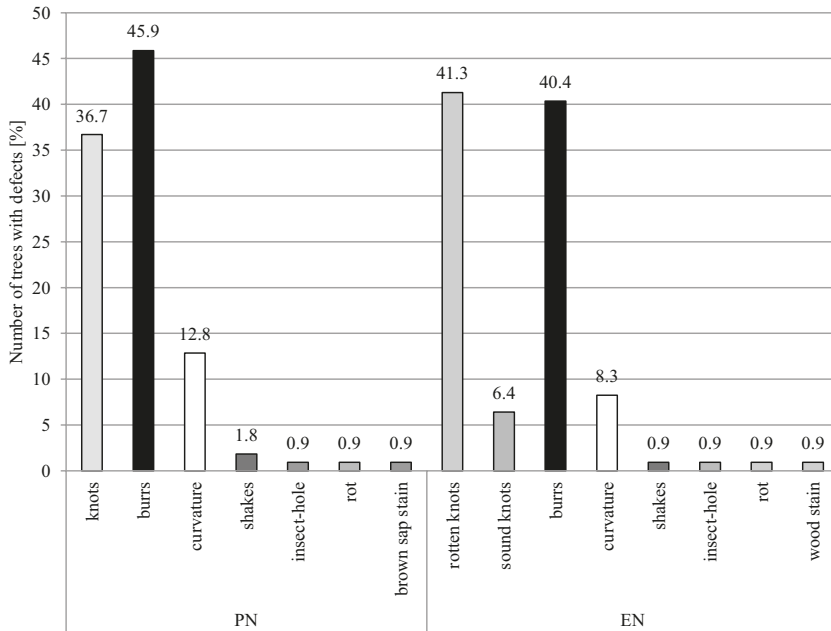
**Fig. 3. The structure of qualitative beech timber (pieces of wood) classified using Polish and EU standards**



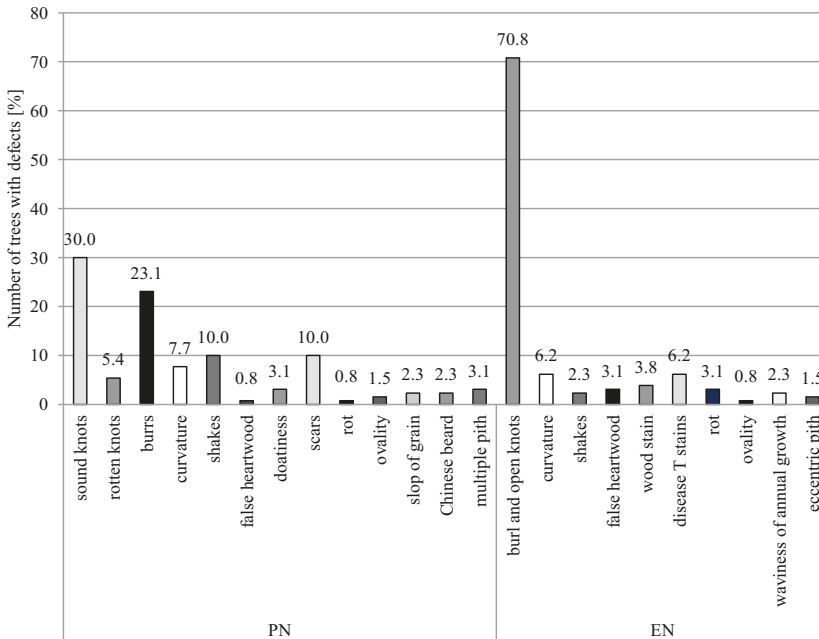
**Fig. 4. The structure of qualitative beech timber (volume of wood) classified using Polish and EU standards**

Statistically significant differences between the quality structure expressed by the share of the number of pieces and that expressed by the share of the volume of the timber in the particular quality classes of the pine wood were revealed with the use of a chi square test. The significance of these differences was also confirmed with respect to the beech wood, although only if the percentage of the pieces of wood in particular quality classes was taken into account ( $\chi^2 = 15.1299$ ,  $p = 0.0017$ ).

Among the wood defects that influenced the classification of both sorts of wood under analysis, open and burl knots were most frequent as well as curvatures, although the latter were far less numerous. In the case of the beech wood, other defects, such as shakes and galls (according to the Polish classification) as well as disease T stains (counterparts of galls) in the EU system, were encountered relatively frequently (figs. 5 and 6).

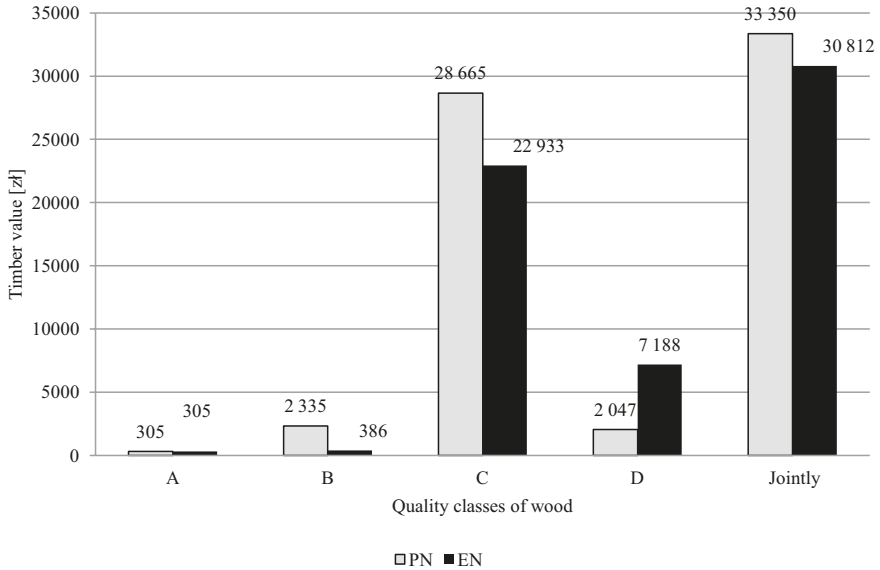


**Fig. 5.** The frequency of the wood defects affecting the results of the classification of pine timber

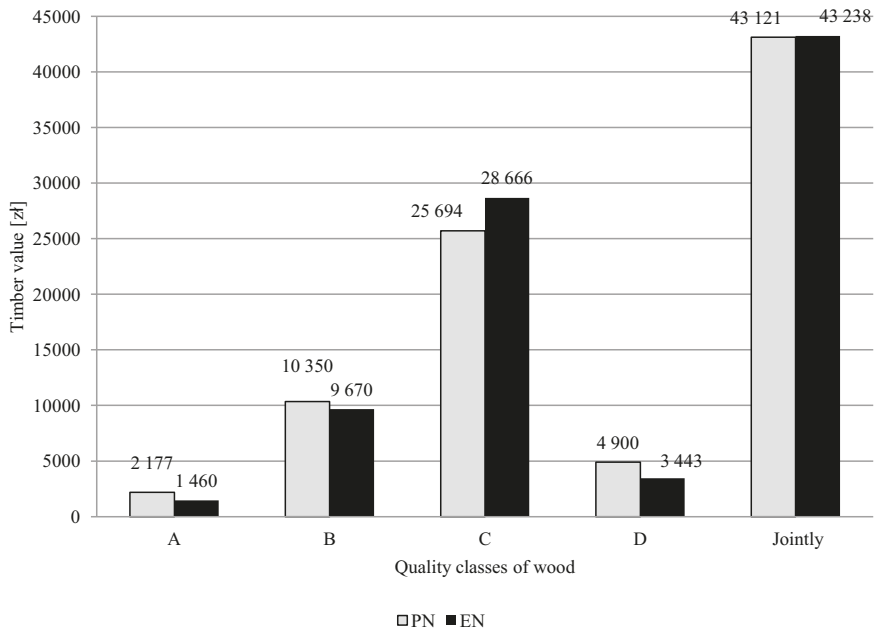


**Fig. 6.** The frequency of the wood defects affecting the results of the classification of beech timber

Differences in the results of the quality classification were also reflected by the value of the raw wood, although they were more distinctive in the pine wood group the (figs. 7 and 8).

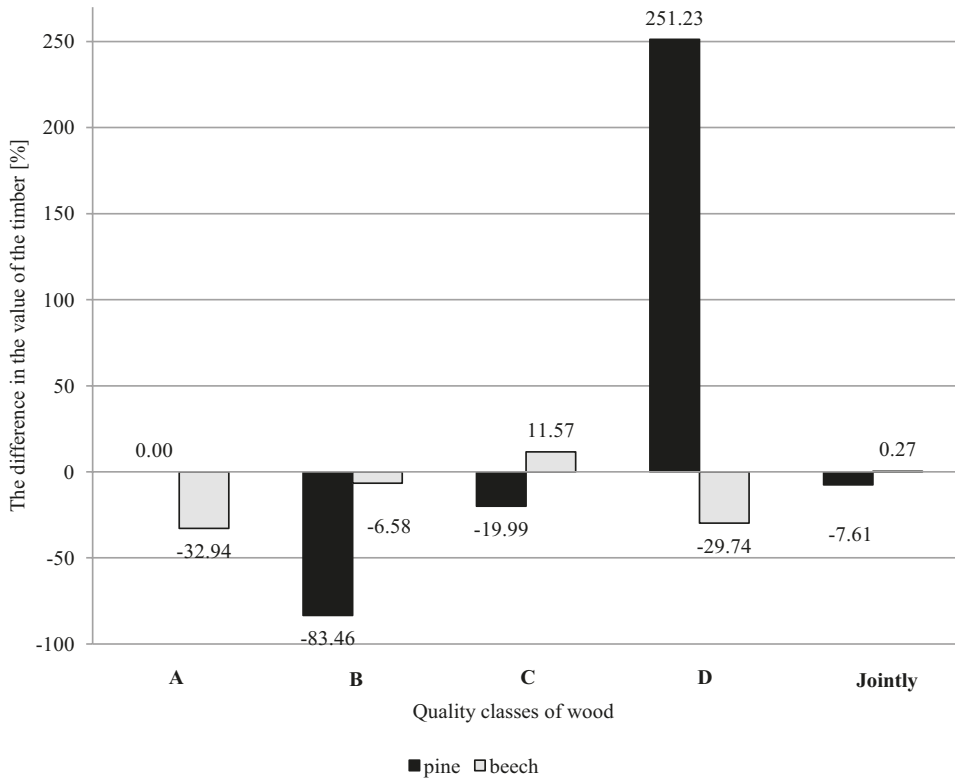


**Fig. 7. Comparison of the pine timber value classified using Polish and EU standards**



**Fig. 8. Comparison of the beech timber value classified using Polish and EU standards**

For instance, in the group in question, the value of the wood designated class D, upon applying the EU classification system, increased by more than 250% in relation to the level of reference (100%) determined as the value of the wood in every quality class estimated according to the Polish standard, while that of class B decreased by ca. 83% in this respect (fig. 9). It was established that the value of the pine wood of all the quality classes decreased, collectively, by 7.61% according to the EU classification, while the value of the beech wood remained steady.



**Fig. 9. Changes in the value of pine and beech timber as a result of the application of EU standards, compared to the baseline (using the Polish standard)**

There have been few studies concerning this matter. Szczepaniak and Spława-Neyman [2001], on the basis of conducted analyses, stated that in the case of pine wood, upon applying the EU norms (PN-EN), the share of wood of classes A and B decreased in favour of classes C and D when compared with the results of the Polish classification. A similar tendency was also detected in the course of the investigations presented here, except for the wood of class C, in which case the application of the EU standard caused a decrease in its share with respect to the level established according to the Polish norm. The tendency for the quality classes to change, as shown by the authors quoted above, as well as revealed in this paper, is



connected, among others with requirements concerning the occurrence of knots, which very frequently affect the result of classification. According to rules of national classification [Warunki Techniczne... 2002], knots in pine wood in classes A and B are inadmissible, whereas in classes C and D they are perfectly acceptable. On the other hand, according to the EU classification [PN-ENV 1927-2:2002], knots are inadmissible in class A, conditionally acceptable in classes B and C, and in class D they may occur without any restrictions. As a result, the raw wood of classes A and B, in certain cases C as well (according to PN), which did not meet the requirements referred to in the EU norm (PN-EN), migrated to class D.

Another tendency was observed while analyzing spruce wood [Michalec 2005]. The author recorded that having applied the EU norm, the share of wood in class A significantly decreased as the share of class B increased in relation to the results obtained according to the Polish standard. This was caused by a difference in the requirements concerning knots in both the classification systems applied: according to the Polish norm, in classes A and B, an occurrence of knots with a diameter of up to 2 cm inside the wood of this sort was admissible, regardless of the category, while the EU norm absolutely excludes this wood defect in class A. Due to this, the share of raw wood increased in class B, for which the requirements of the EU norms with respect to the occurrence of certain categories of knots are less restrictive than those contained in the national norm. Upon applying the EU classification, the author also noted a significant increase in the share of spruce wood in class D; in this case it was mainly due to inner rot (incipient decay) being perfectly acceptable in the class in question according to the EU norm.

Dzbeński and Wiktorski [2003], having compared requirements listed in the Polish and the EU standards with respect to coniferous and deciduous sawnwood, concluded that the sawnwood of higher quality (according to the Polish norm) migrated down to lower classes if classified by means of the EU norm. The authors quoted above stated that in the case of coniferous sawnwood this was due to more restrictive requirements with respect to knots, shakes, inbarks, galls and rots. In the case of deciduous sawnwood it was caused by the requirements concerning such defects as: knots, external and internal sapwood, shakes, curvatures and grain slope.

A comparative analysis of oak, beech and poplar roundwood classified with the use of the Polish and EU standards [Witkowska 2000] proved that the share of wood in classes A and B according to the Polish norm was significantly higher than the share of wood in the same classes according to the EU classification (simultaneously, the author observed an increase in the share of classes C and D). The studies presented here show that in the case of beech wood, a decrease in the share of wood in classes A and B, as well as an increase in class C in relation to the EU standards, was also recorded; however, in contrast to the results obtained by the author mentioned above, a decrease in the share of wood in class D classified by means of the EU norm [PN-EN 1316-1:1999] was noted. The studies presented

here reveal that a part of the wood that had previously been designated class D [PN-92/D-95008:1992], migrated to class C upon applying the EU standard. This is due to the differences in classification criteria in respect of knots, curvatures and necrosis that are treated less restrictively in the EU norms in comparison with the Polish standards.

## Conclusions

The conducted analysis prompted the authors to formulate the following observations and conclusions:

1. As a result of pine wood classification with the use of the EU norm, less wood of classes B and C, though more wood of class D was obtained when compared with the results of the classification conducted according to the Polish norm. Differences in the quality structure expressed by both the number of pieces and the volume of the timber between the results of the Polish and EU classification systems appeared to be statistically significant. The value of the wood classified in accordance with the requirements of the EU norm decreased by ca. 7.6%.
2. Having classified beech wood according to the EU standard, less wood of classes B and D, though more wood of class C, was obtained in relation to the Polish classification. The statistical test confirmed the significance of the differences between the results of both the classification systems, only in the case of the structure expressed by the number of pieces of wood in certain quality classes. The value of the timber upon applying the EU standard remained steady.
3. Open and burl knots, as well as curvatures, are among the most commonly encountered wood defects determining the results of both the classification systems with regard to pine and beech wood. In the case of the beech wood, shakes and galls (disease T stains) also occurred quite often.
4. Due to the great complexity of the EU norms and possible difficulties in the practical interpretation of the requirements they contain, it is recommended that quality inspectors receive professional training concerning their use.

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### List of standards

**PN-92/D-95008:1992** Polska Norma. Drewno wielkowymiarowe liściaste. Wspólne wymagania i badania (Wood large sized broadleaved. General requirements and methods of test)

**PN-EN 1316-1:1999** Drewno okrągłe liściaste – Klasyfikacja jakościowa – Dąb i buk (Hardwood round timber. Qualitative classification. Oak and beech)

**PN-ENV 1927-2:2002** Klasyfikacja jakościowa drewna okrągłego iglastego. Część 2: Sosna (Qualitative classification of softwood round timber – Part 2: Pines)

**Warunki techniczne. Drewno wielkowymiarowe iglaste** [2002]: Załącznik nr 1 do zarządzenia Dyrektora Generalnego Lasów Państwowych (Technical conditions – large-sized timber 2002. Annex no. 1 to the Regulation of the Director-General of the State Forests)