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IDENTIFYING BEECH ROUND WOOD QUALITY – DISTRIBUTIONS AND THE INFLUENCE OF DEFECTS ON GRADING

The classification of round wood depends on the defects and other morphological features of a tree trunk. Various tree species growing on different forest sites and in different conditions eventually present a wood quality influenced by said factors. The objective of this paper was to find out: 1) the distribution of round wood quality classes of beech in three different site conditions and 2) the frequency of the defects influencing timber grading. The research was carried out on 15 different sample plots of three site quality classes, on which 1389 beech logs were classified according to the existing grading scheme. The most common timber quality (by volume) was WC0 and then in decreasing order: WD, WB0 and WA0, in proportions of: 15:10:4:1. This order was the same for the assortments obtained from the trees in all the analysed site quality classes. The most frequent defects influencing wood quality were knots, among which sound knots were in the majority. The proportion of the appearance of knots was 7:3:2 for sound knots, unsound and dead knots, as well as covered knots, respectively. Sweep, red heart and scars were of a similar frequency to sound knots, approx. 20%. Double pith, shakes, rot, top diameter and spiral grain were of a minor influence on WQCs and together amounted to approx. 10% of the frequency among other defects.

Keywords: wood defects, beech timber quality classes, wood grading, *Fagus sylvatica*

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Introduction

Studies related to wood quality focus on three different stages: 1) in the forest – standing tree quality, 2) after harvesting – round wood, and 3) in the saw-mill – processed wood. At each stage, timber quality is assessed using different measures.

The first field of research mentioned above mostly looks into the influence of silviculture treatments and other operations strictly related to forest management. Hein et al. [2007] suggest that the best assortment proportions can be obtained when thinning from above is applied and ca. 50 trees per hectare are selected as final crop trees. Additionally, some research is dedicated to the juvenile stage of stands and its quality [Pazdrowski et al. 1995; Spława-Neyman et al. 1995; Tomczak and Jelonek 2012]. It was found that the structure and density of wood are related to the social position of a tree in the forest as well as the age of the forest stand [Pazdrowski, Spława-Neyman 1993].

Studies within the second area (round wood quality) consider local classification schemes and are based on wood defects which are very well described in literature [Giefing, Pazdrowski 2012]. There is also more detailed work related to 1) softwood: knots and inner decay [Michalec 2007], and 2) hardwood: knots and red heart in particular [Jednoralski 1993; Knoke 2002; Trenčiansky, Kolenka 2006; Wernsdörfer et al. 2006]. However, there is a visible lack of a complete study concerning the influence of a complete set of wood characteristics on classification. These characteristics (local standards) heavily influence the further use of wood and the final price of each log. A set is described as a standard with a precisely explained way of measuring each defect.

The assessment of sawn wood is the most accurate when compared with the two above-mentioned classification stages. Timber without bark, sawn into boards and beams, bears all the defects, which could be hidden in round wood or standing trees. Studies on the quality of sawn products obtained from primarily classified round wood were carried out by Dziewanowski and Jorasz [1972].

In the study presented here, the primal wood defects impacting the quality class of round wood (logs) in mature beech stands were under scrutiny. It was hypothesised that some wood defects have a stronger impact on the graded quality class of beech logs than others. This hypothesis was derived from results in earlier studies, which showed that certain pine and spruce defects appear more often than others, and therefore have a stronger impact on lowering round wood quality classes [Krotkievič 1955, after Giefing 1999; Taffe 1955, after Giefing 1999].

In general, wood quality can be understood as wood having both positive and negative features influencing its further use [Jackowski 1972]. Jozsa and Middleton [1994] interpreted wood quality in a similar way stating that wood quality may be understood as the suitability of wood for a particular end-use. These two interpretations contribute to a definition or an understanding of *wood quality*, but are common among wood science researchers rather than foresters.

The objective of this research was to find out the proportions (in volume) of four quality classes of beech round wood graded according to the existing classification scheme. Additionally, the study aimed to classify beech wood defects to find out which of them have the biggest impact on a particular class of round wood. This analysis was also conducted with regards to different site quality classes (SQCs) on which the trees had grown.

This article is a summary of a comparative study based on the results obtained during the completion of four Master thesis projects carried out between 2010–2012 [Kozłowska 2010; Byczkowski 2011; Michnowicz 2011; Przytuła 2012].

Materials and methods

Beech logs were classified by foresters in 4 different Forest Districts: Gryfino, Karwin, Trzebież (Regional Directorate of the State Forests (RDSF) Szczecin) and Jugów (RDSF Wrocław). Data were collected from logs harvested on 15 sample plots, in mature beech stands (91–160 years-old). The plots were of different site qualities, I–IV (out of five) (table 1). The sample plots were divided into 3 groups/classes according to site quality: 1 – site quality I (the most productive), 2 – site quality II, and 3 – site qualities III and IV (the least productive).

1389 logs of 1029.32 m^3 were classified in sections, each section given one of the 4 quality classes (WA0 – the best, WB0, WC0 and WD – the worst) according to grading rules respected by the Director General of the Polish State Forests, based on the Polish Standard PN-92/D-95008 [Appendix A]. Eleven wood defects were taken into consideration during the research: sound knots, unsound and dead knots, covered knots/bumps, shakes, sweep, spiral grain, scars, double pith, red heart, rot, and minimum top diameter (dt). Three features strictly connected to branching – sound knots, unsound and dead knots as well as covered knots/bumps – were considered together or as separate types of knots. The participation of each group was calculated and this was done for each SQC.

The defects were divided into groups and then assessed due to the frequency of their presence on the logs. Additionally, the volume of wood declassified by the particular defect was considered. If two or more defects appeared on a log, the one which declassified the wood to the lowest class was taken into account. Afterwards, those parameters were analysed with regards to each SQC. Eventually, in class 1 there were 565 logs and 403.13 m^3 of wood, in class 2 and 3: 370 and 454 logs with 246.48 m^3 and 379.71 m^3 of wood, respectively.

Data analysis was carried out with the use of the analysis of variance (ANOVA) in order to find the significant differences between the means of the examined variables. On the basis of ANOVA, an average percentage of the volume of the particular wood class (WA0, WB0, WC0 and WD) was compared. Additionally, the same division for each class was made for each SQC. Furthermore, the percentage of wood volume having a particular defect was analysed. This was done for each site quality class. The mean percentage of defect occurrence in each SQC was also compared. In the case that the conditions of ANOVA were not fulfilled, the Kruskal-Wallis test was used, or, when data did not show homogeneity of variance, the analysis was then carried out on the basis of transformed data using arcsin(√x). Furthermore, when the significant differences between the means were determined, Tukey's test for group means was used. All the calculations were done with the use of Statistica 10 software. In the statistical hypothesis testing, the probability of error was 5% (p-value of 0.05).

Table 1. Characteristics of stands
Tabela 1. Opis drzewostanów

Forest district *Nadleśnictwo*	Forest subdistrict *Leśnictwo*	Forest code *Oddział*	Age *Wiek*	Site quality *Bonitacja*	Number of classified logs *Liczba dłużyc*	Volume [m^3] *Miąższość*
Gryfino	Klęskowo	148 c	160	I	56	76.60
Gryfino	Klęskowo	168 b	145		49	44.62
Gryfino	Klęskowo	186 a	135		48	59.26
Trzebież	Siedlice	807 j	125		200	100.07
Trzebież	Siedlice	824 b	110		126	83.08
Trzebież	Siedlice	838 b	91		86	39.50
Jugów	Nowa Wieś	193 b	130	II	107	85.69
Karwin	Solecko	198 j	121		25	13.12
Karwin	Solecko	229 a	145		26	17.09
Trzebież	Siedlice	827 b	130		133	108.81
Trzebież	Siedlice	851 l	120		79	21.77
Jugów	Nowa Wieś	113 d	110	III	127	104.98
Jugów	Nowa Wieś	119 a	110		247	202.35
Karwin	Ustronie	7 h	125		52	45.50
Jugów	Nowa Wieś	112 b	130	IV	28	26.88
Total					**1389**	**1029.32**

Results and discussion

Wood quality classes

A significant majority of all the logs (82%) were of WC0 and WD classes (with no distinction in site quality classes). In most cases, the wood defects caused a log or a log section to be classified as WC0. Logs of a higher class, WB0 and WA0, amounted to 15% and 3% (by volume), respectively. The distribution of wood quality classes (WQCs) in total, as well as in each of the 3 SQCs, showed the same sequence: WC0>WD>WB0>WA0 with the proportions 15:10:4:1, respectively (fig. 1). This is the typical distribution of round wood (not only beech) classified according to current Polish standards (based on PN-92/D-95008). However, there was a variation in the percentage of WQC in each SQC, but it was not statistically different. The biggest share of the best WA0, and concurrently the worst WD, was in SQC3. For this SQC, which was nominally recognized as the poorest site among those examined, the distribution of WQC was the most even. In SQC1, WB0 was in the highest percentage (20%). The lower the SQC, the more WD was classified, though this trend was not observed in the other WQCs (fig. 1).

The participation of WQCs was different in each SQC. The occurrence of WC0 was more frequent than WA0 and WB0, and in both cases it was statistically different. This was observed in each SQC. At the same time, WD was more frequent than WA0 in each SQC. Statistical differences were not observed between WQCs of WA0 and WB0, WB0 and WD, as well as WC0 and WD in all the analysed beech stands (fig. 1). The biggest differences between the WQCs were in SQC1.

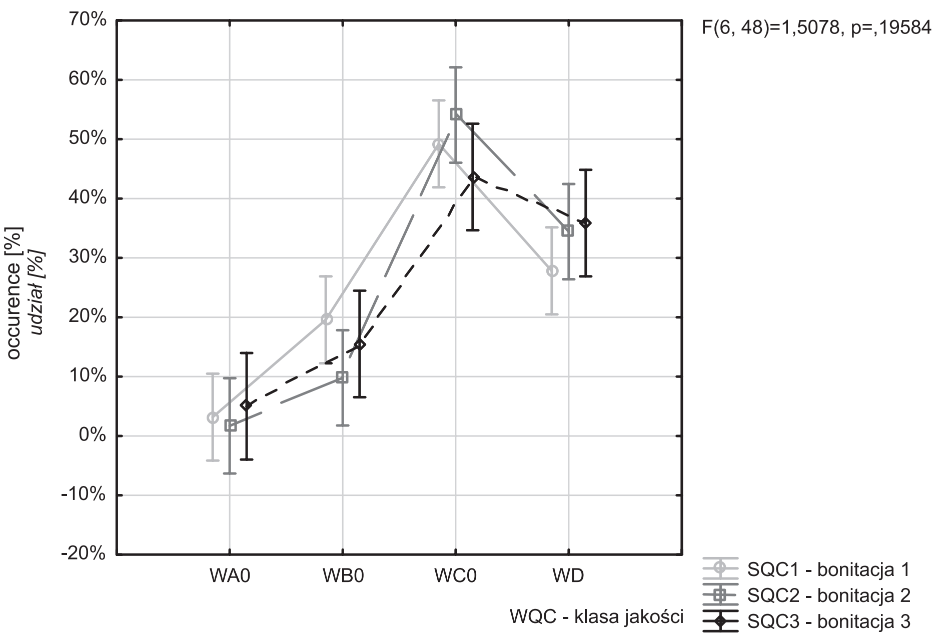

Fig. 1. The occurrence of WQCs in SQCs (by volume)
Rys. 1. Udział miąższościowy klas jakości drewna w zależności od bonitacji

The analysis of variance indicated no significant differences between the mean percentage of wood volume of WB0 and WD in SQC1, WA0 and WB0 in SQC2, as well as WA0 and WB0, WB0 and WD, WC0 and WD in SQC 3 (table 2).

Table 2. Results of Tukey's tests for WQCs (by volume)
Tabela 2. Wyniki testu Tukey'a miąższościowego udziału klas jakości drewna

WQC *Klasy jakości drewna*	WA0	WB0	WC0	WD
SQC1 (ANOVA: p= 0.0000) *I klasa bonitacji (ANOVA: p= 0,0000)*				
WA0		0.0018*	0.0002*	0.0002*
WB0	0.0018*		0.0002*	0.1602
WC0	0.0002*	0.0002*		0.0003*
WD	0.0002*	0.1602	0.0003*	
SQC2 (ANOVA: p= 0.0000) *II klasa bonitacji (ANOVA: p= 0,0000)*				
WA0		0.6263	0.0002*	0.0009*
WB0	0.6263		0.0002*	0.0094*
WC0	0.0002*	0.0002*		0.0418*
WD	0.0009*	0.0094*	0.0418*	
SQC3 (ANOVA: p= 0.0005) *III z IV klasy bonitacji (ANOVA: p= 0,0005)*				
WA0		0.4768	0.0009*	0.0046*
WB0	0.4768		0.0089*	0.0592
WC0	0.0009*	0.0089*		0.6988
WD	0.0046*	0.0592	0.6988	

Wood defects

The classification of round wood is inextricably linked to the measurement of a particular single wood defect. The presented research was strictly focused on whether the appearance of a particular wood defect was bigger than allowed in the regulations, not on the size of any examined characteristic.

The occurrence of wood defects shows that they can have a vital impact on the WQC, or they can appear rarely. In this study, the most frequent (with a vital impact) were (in decreasing order): knots, sweep, scars and red heart, and significantly less frequent were: shakes, spiral grain, double pith, rot and minimum top diameter (fig. 2).

Knots

The frequency of defects obtained for beech within the presented research showed that knots were the most common and influenced the timber quality. The proportion of knots were 7:3:2 for sound knots, unsound and dead knots, as well as covered knots, respectively. Although, knots were in the majority, they amounted to only 34%, significantly less than in pine (69.4%) [Krotkiewič 1955, after Giefing 1999] or spruce (87.0%) [Taffe 1955, after Giefing 1999].

This difference definitely depends on the tree species. However, it is worth mentioning that thinning has a negative impact on natural pruning, leading to a bigger number of knots [Ikonen et al. 2003].

Special attention was paid to knots, analysed as one merged group which included all types: sound, unsound and dead, and covered. This approach revealed the significant impact of knots on the WQC. Its frequency of occurrence (606) was significantly greater than the occurrence of other defects (fig. 2).

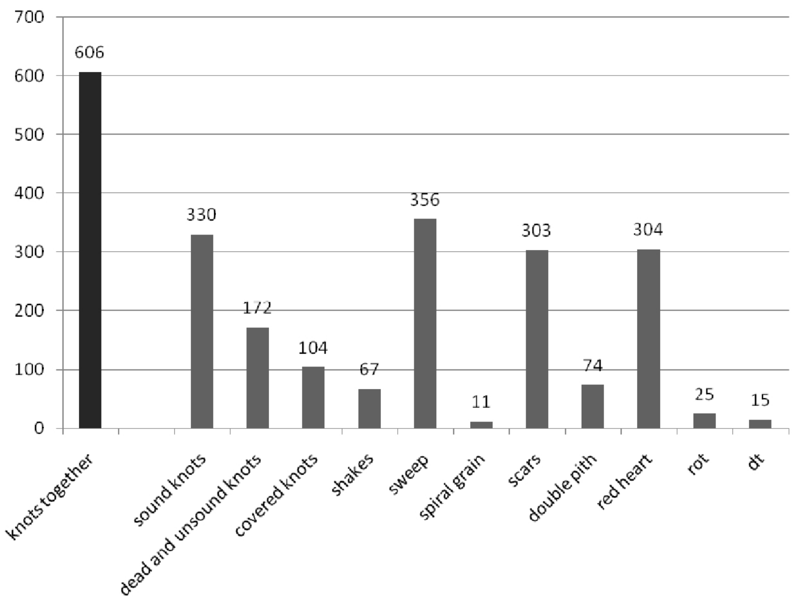

Fig. 2. The frequency of the occurrence of wood defects
Rys. 2. Częstość występowania wad drewna

This could be specific for the beech species where the impact of knots on the quality class of the timber is much lower than in alder wood. Giefing et al. [2012] emphasised the great importance of knots, which substantially decreased the quality of assortments in alder stands: 80% of the defects belonged to the group of knots altogether. This is much more than in beech logs, where only 34% of the defects were in the same category. Nonetheless, in both studies, sound knots (out of all the knots) most frequently caused the degrading of the wood, at a level of 35% and 19% in alder and beech, respectively. Knots are a natural consequence of branching. It seems that in beech trees, and consequently in round wood, other defects are more common than in alder trees. Growing alder creates straight stems (often comparable to the stems of coniferous trees), and as a consequence, knots are the major defects influencing grading. In contrast, in beech assortments, sweep is the most common single wood characteristic impacting the grading (fig. 2). This confirms that the stems of beech trees are more irregular and curved in comparison with alder.

Living branches leave sound knots, but dead branches (after natural pruning) can also leave sound knots if they are not rotten stubs that are on a tree for a long time. It seems that beech branches are not very vulnerable to the development of some defects. Wernsdörfer et al. [2005] found that only 17 out of 616 branch scars initiated red heart formation.

The appearance of knots depends also on the time of occlusion. It was proved by Hein [2008] that larger branches show a significantly longer occlusion time. This can lead to a higher risk of fungal infections – the longer the occlusion time, the longer the exposure to biotic threat [Giefing 1999].

A detailed analysis of the defect of the group of all knots together revealed no statistical difference in the occurrence of knots between SQCs (fig. 3). However, a significant difference between the occurrence of the sound knots vs. the unsound and dead knots was noted on all the examined forest sites. Additionally, in SQC3, the frequency of the sound knots was significantly higher than the frequency of the covered knots (fig. 3). In fact, covered knots are as frequent as other knots, but under layers of yearly wood increments. Ikonen et al. [2003] recognise covered knots as those which lower the quality of sawn timber.

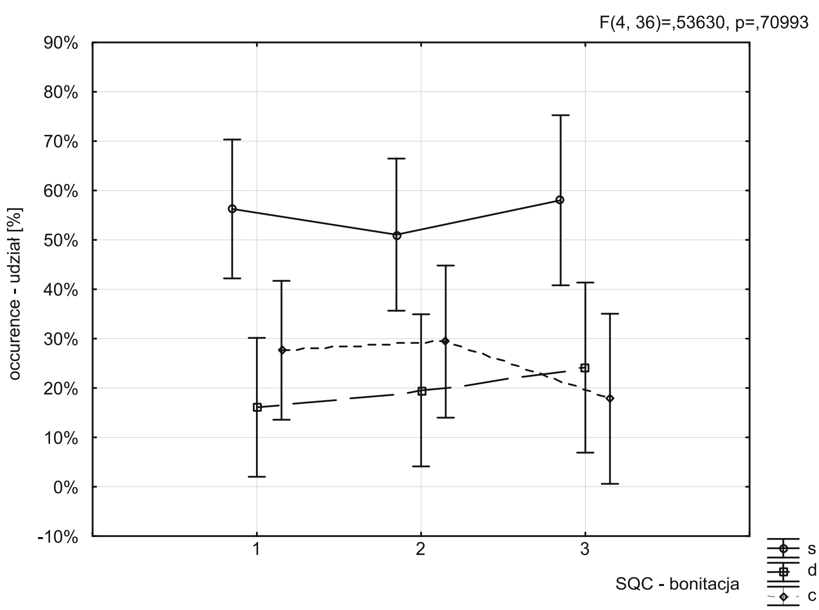

Fig. 3. The frequency of the occurrence of three types of knots in SQCs (s – sound knots, d – dead and unsound knots, c – covered knots)
Rys. 3. Częstość występowania trzech typów sęków w klasach bonitacji (s – sęki zdrowe, d – sęki nadpsute i zepsute, c – sęki zarośnięte (guzy))

Sweep

Taking into account all types of defects, in most cases the analysis of variance did not reveal significant differences between the defects in the 3 analysed SQCs (table 3).

Table 3. Anova test results for wood characteristics
Tabela 3. Wyniki analizy wariancji dla wad drewna

ANOVA	Sound knots *Sęki zdrowe*	Dead and unsound knots *Sęki nadpsute i zepsute*	Covered knots/ buckles *Guzy*	Shakes *Pęknięcia*	Scars *Zabitki*	Double pith *Wielordzenność*	Red heart *Fałszywa twardziel*	Sweep *Krzwizna*
p_value for the number of defects occurring *p dla częstości wystąpienia wady*	0.3989	0.3714	0.5541	0.5043	0.7184	0.7979	0.0573	0.0096*
p_value for the wood volume with defects *p dla miąższości z wadami*	0.4798	0.4042	0.5731	0.4869	0.0223*	0.9943	0.3115	0.0211*

Considering wood volume with a particular defect, only the sweep on the logs in SQC1 was statistically different (and bigger) than the sweep on the logs in the other SQCs (table 4). Sweep was the only defect with a statistically proved difference within two assessments – the number of defects occurring and the volume with defects. In this case, sweep was a frequent cause of downgrading, because there were no other defects that could lower the timber class more than sweep.

Table 4. Tukey's test results for sweep in the 3 SQCs
Tabela 4. Wynik testu Tukey'a dla krzywizny w 3 klasach bonitacji

SQCs *Klasy bonitacji*	1	2	3
1		0.0183*	0.0241*
2	0.0183*		0.9990
3	0.0241*	0.9990	

In general, sweep in the presented research was an important factor in the degrading of the timber. With 356 observations, it was the second most frequent defect in the beech wood. In mountain beech stands Barszcz [2011] noted a very high percentage of sweep (74.7%), which was higher than in the presented results, where the share of the defect was at a level of 27%, 14% and 15% in SQC1, 2 and 3, respectively. Barszcz and Rutkowska [1999] suggest that to analyse spruce sweep, 248 samples should be taken to achieve a result at a confidence level of 5%. Similar coefficients of variance are not available for beech wood defects. In general, sweep is recognised as a defect influencing timber quality. Tong and Zhang [2008] point out that sweep limits the amount of quality sawlogs. Moreover, if sawlog has sweep, it raises the transport costs and lowers the productivity of processing. According to Rikala [2003, after Asikainen, Panhelainen 1970] sweep is very often accompanied by spiral grain, and after sawing and drying causes shakes and further sweep.

Rot and scars

The presence of wood decay was extremely marginal in the context of the results obtained by Dardziński and Giefing [2010]. In the research by these authors, the analysed spruce contained rot in more than half of the cut trees. Obviously, the main reason for this was the different tree species – spruce, which is vulnerable to rotting. The appearance of mechanical damage in beech trunks does not cause such a wide rot area, though it is still commonly believed to be a risk to tree health and a relevant factor in the declassing of logs. In contrast to this opinion, the study results of artificially wounded beech trees [Križaj 1995] should be considered. Two types of wounds were made: shallow and deep. Shallow wounding, which is supposed to reflect mechanical damage during extraction, was eventually not too much of a risk to tree health. The first change in the damaged and exposed wood was dehydration and aeration, followed by abiotic and biotic discoloration, and decay in the final stage. The author suggested that protective wood formed on the surface of the exposed xylem, and after 5 years of exposure, the underlying wood was still undamaged and could conduct water. However, these results are in contrast to Knorr and Prien [1988, after Nill et al. 2011]. These authors analysed the consequences of damage in a beech stand due to forest operations. 95% of the wounds on the tree trunks caused deep rot. Damaged roots seem to be more resistant to rotting. In Schulz's [1973] research, only 10% of the roots with damage suffered further wood depreciation.

The grading carried out within this research indicated that scars after mechanical damage lowered the wood class in 303 logs. A significant difference was noted in the frequency of the occurrence of scars between SQC2 and 3 (table 5). An essential issue is that the wounds are mostly caused by careless harvesting operations, both felling and wood extraction. The other matter of importance is that those logs were predominately obtained from the butt end, the most valuable part of tree bole. However, in the authors' opinions, the scars should not be considered, as only one board (a side board) would completely contain that defect, and it does not usually affect the deeper layers of a log. More dangerous could be damage to the natural regeneration of beech after the final removal of the trees, where 30–45% of young trees can be damaged after felling and skidding [Bembenek et al. 2011]. Due to the negative impact of mechanical wounds on remaining trees, Karaszewski et al. [2013] suggested the proper selection of extraction and logging methods.

Table 5. Tukey's test results for the scars in the 3 SQCs
Tabela 5. Wynik testu Tukey'a dla zabitek w 3 klasach bonitacji

SQCs *Klasy bonitacji*	1	2	3
1		0.1012	0.1760
2	0.1012		0.0257*
3	0.1760	0.0257*	

It is not only beech wood that is afflicted by scars: 6% of mechanical surface wounds were identified by Szakiel [2009] while grading oak logs. Here the difference in the bark thickness between the two species can play a critical role. Beech bark is much thinner than oak bark and this difference is more evident in older stands with mature trees.

Red heart and other defects

The problem of the decrease in the value of butt ends is highlighted even more with regards to red heart. In this case, the lowest parts of the stems were also affected by red heart, but here the difference between the total frequency of red heart and the volume of logs in m^3 affected by this feature was clearly visible (with no distinction in SQCs). Considering occurrence, red heart consisted of 17% of all the wood defects, while in volume it was significantly higher: 22%. The obtained average frequencies can be compared with the results of Knoke [2003], in which only old trees (180-year-old) were greatly affected (nearly 100%) by this defect.

Spiral grain was observed on 11 of the 1761 measured logs sections and it was the most rare type of all the considered characteristics. Similarly, rot and dt were reported on just 25 and 15 logs, respectively. Double pith, shakes, rot, top diameter and spiral grain were of a minor influence on WQCs, and together amounted to approx. 10% of the frequency among other defects.

Conclusions

In all the analysed SQCs, most common by volume was the wood classified as WC0. Timber in classes WD>WB0>WA0 was less frequent and this order of WQC volume was observed in all the SQCs. The impact on the round wood classification of the selected defects was very different. However, the most common were knots, sweep, red heart and scars. In the presented research, knots were the most frequent defects. Nevertheless, the knots in the beech wood had less impact on the wood classification in comparison with knots in coniferous species (according to the quoted literature).

The appearance of some analysed defects could be limited in future by different management approaches. Knots could be limited by keeping stands of higher density (less intensive and more frequent thinning) or pruning. Sweep could be reduced by a more accurate grading process, possibly by obtaining shorter assortments. Environmentally-sound forest operations should cause fewer scars. This could also be achieved by the application of a short wood system, in which extraction by a forwarder usually causes less damage (scars) to the remaining stand than, for example, when using a long wood system with skidding. Red heart could also be avoided if the final felling age was not too high and the timber was harvested before the defect could develop inside the beech stem.

With regards to SQCs, it was observed that they can have some influence on the frequency of sweep and scars. Some of the defects rarely appeared (spiral grain, rot), although they should still be considered, especially when potentially high quality timber (WA0) could be selected.

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Appendix A. Rules of sawn beech wood grading in Polish conditions
Załącznik A. Zasady klasyfikacji tartacznego surowca bukowego w Polsce

Characteristics *Nazwa wady lub cechy drewna*	Classes *Klasa jakości*			
	WA0	WBO	WC0	WD
1	2	3	4	5
Minimum top diameter (dt) without bark *Średnica min. w górnym końcu bez kory*	30 cm	20 cm	18 cm	
Minimal length *Minimalna długość*	2.5 m – interval every 10 cm *2,5 m – z odstopniowaniem co 10 cm*			

Appendix A. Ciąg dalszy
Załącznik A. Continued

1		2	3	4	5
Knots *Sęki*	sound *zdrowe*	2 cm	5 cm	10 cm	permitted *dopuszczalne*
	unsound and dead *nadpsute i zepsute*	not permitted *niedopuszczalne*	5 cm	8 cm	10 cm
	covered knots *guzy*	not permitted *niedopuszczalne*	to 1 cm high not taken into account, higher permitted 1 no/2m *o wys. do 1 cm nie bierze się pod uwagę, wyższe dop. w liczbie 1 szt./2 m*	permitted *dopuszczalne*	
Shakes *Pęknięcia*	end shake *czołowe*	≤1/5 ø	≤1/3 ø	permitted *dopuszczalne*	
	crack and frost crack *czołowo-boczne i mrozowe*	not permitted *niedopuszczalne*	permitted one in straight line *dopuszczalne jedno w linii prostej*	permitted *dopuszczalne*	
Sweep *Krzywizna*		permitted when allowing for 2.5 m log with simple sweep *dopuszczalna pozwalająca na wymanipulowanie wyrzynków 2,5 m z krzywizną jednostronną do:*			
		2 cm/m	3 cm/m	4 cm/m	5 cm/m
Spiral grain *Skręt włókien*		7 cm/m	12 cm/m	permitted *dopuszczalne*	
Scars *Zabitki*		Permitted one with width ≤6 cm *dopuszczalna jedna o szerok. do 6 cm*	≤6 cm	12 cm	permitted *dopuszczalne*
Double pith *Wielordzenność*		not permitted *niedopuszczalne*		permitted *dopuszczalne*	
Red heart *Fałszywa twardziel*		≤1/3 Ø	≤1/2 Ø	permitted *dopuszczalne*	
Rot *Zgnilizna*	inner *wewnętrzna*	≤1/10 Ø	≤1/5 Ø	≤1/3 Ø	≤1/2 Ø
	outer *zewnętrzna*	not permitted *niedopuszczalne*		≤1/4 of circumference and ≤1/10 Ø *do 1/4 obwodu do 1/10 Ø*	≤1/2 of circumference and ≤1/10 Ø *do 1/2 obwodu do 1/10 Ø*

Appendix A. Ciąg dalszy
Załącznik A. Continued

Insect attack *Chodniki owadzie płytkie i głębokie*	not permitted *niedopuszczalne*	1/4 of circumference *do 1/4 obwodu*	permitted *dopuszczalne*
Foreign bodies *Ciała obce*	not permitted *niedopuszczalne*		permitted with agreement *dop. za zgodą*
Characteristics not mentioned in standard are not considered during grading *Wad nie wymienionych w tablicy nie bierze się pod uwagę*			

UDZIAŁ KLAS JAKOŚCI DREWNA BUKOWEGO ORAZ WAD WPŁYWAJĄCYCH NA KLASYFIKACJĘ SUROWCA OKRĄGŁEGO

Streszczenie

Klasyfikacja drewna okrągłego zależy od występowania i rozmiaru wad drewna. Występowanie wad o zróżnicowanym podłożu szczególnie zależy od warunków wzrostu i rozwoju drzewa. Celem pracy było rozpoznanie udziału klas jakości tartacznego drewna bukowego z trzech klas bonitacji oraz częstotliwości występowania wad. Sklasyfikowano 1389 kłód bukowych (1029,32 m^3) na 15 powierzchniach badawczych bazując na obowiązujących regulacjach w Lasach Państwowych. Najczęściej występującą klasą jakości drewna jest WC0, a następnie WD, WB0 i WA0 w proporcjach 15:10:4:1. Bardzo podobny rozkład klas miał miejsce we wszystkich analizowanych klasach bonitacji Sęki, a wśród nich sęki zdrowe były najczęściej występującą wadą drewna powodującą obniżenie klasy jakości. Udział sęków zdrowych do nadpsutych i zepsutych oraz guzów wyniósł 7:3:2. Krzywizna, fałszywa twardziel oraz zabitki wystąpiły na podobnym poziomie częstości, ok. 20%. Wielordzenność, pęknięcia, zgnilizna, zbyt mała średnica w cieńszym końcu oraz skręt włókien mają mniejszy wpływ na klasyfikację tartacznego drewna bukowego stanowiąc razem ok. 10% wszystkich stwierdzonych wad obniżających klasę jakości drewna. Stwierdzono zróżnicowany wpływ klas bonitacji na występowanie krzywizn oraz zabitek. Rozmiar krzywizn w I klasie bonitacji był statystycznie większy, niż w pozostałych klasach. W przypadku zabitek stwierdzono istotnie częstsze występowanie tej wady w III klasie bonitacji.

Słowa kluczowe: wady drewna, klasy jakości drewna bukowego, klasyfikacja drewna, *Fagus sylvatica*