

Impact of Tending Measures on Assortment Structure of Fellings in Central Croatian Beech Stands

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Abstract – The effects of management of even-aged beech stands on the quality of beech timber assortments by type of cut were investigated in the region of Bjelovar. The research was carried out using Croatian timber standards. Assortment tables were developed separately for thinning and intermediate felling, and separately for regeneration and final felling in accordance with the interventions of management. The average shares of assortments maintained the same ratios by quality classes regardless of the applied standards (HRN or HRN EN). The research identified the problems in production of assortments, and justified the need for developing separate tables for thinning, intermediate felling, and for regeneration and final felling. Through forest management the quantity and quality of timber assortments may be oriented to a certain extent towards the production target. With the application of tending measures the value of the stand and timber assortments increases over time. In economic respect, the development of false heartwood shows an opposite trend. Therefore a compromise must be achieved by proper management and determination of appropriate harvesting age of beech stands.

forest management / thinning / intermediate and final felling / timber standards / false heartwood

1 INTRODUCTION

When considering assortment structure of the main forest products and the compilation of assortment tables, patterns of growth and development of stands come into conflict with the provisions of the standards for the classification of forest timber products and common practices in timber trade, subject to change over time. Presently Croatian forestry faces additional uncertainties brought by the application of new standards in beech stands.

Tables showing the share of forest timber assortments (assortment tables) are important tools necessary for the forestry staff, and common beech is the most represented species in the Croatian forests. When planning fellings and annual allowable cuts, it is necessary to know the quantity and quality of timber assortments, determined in accordance with the applicable standards. Reliable tables of timber assortments are necessary for the assessment of the efficiency of the forest harvesting process, and also for the comparison of work performed by different parts of an enterprise. Due to the diversity of their phenotype (morphology), broadleaved species are more demanding than conifers with respect to the investigation of assortment structure. Common beech almost always develops false heartwood, which

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additionally complicates the investigation. It can be concluded that in this respect common beech is the most demanding autochthonous species.

The occurrence of defects also affects the quantity and quality of timber assortments. The occurrence of defects, their size and number is of random character and cannot be correlated with measurable tree parameters. The determination of the felling time for individual trees represents a significant influence on stand structure, and also on the structure of timber assortments.

According to Benić (1987) forest assortments are standardized products determined by standards, common practices and trading practices, and can also be determined by agreement between the producer and purchaser. Assortment structure of a stand is determined by assortment proportions of individual trees. The selection of trees for felling during the rotation is a procedure based on rules and principles arising out of forest management. In even-aged beech stands, it is more convenient to investigate the assortment structure of individual cut types (felling sites) than the assortment structure of the stand. Only in clearcuts and in stands before the final felling, have the two terms the same meaning.

The basic principles of operations of forest tending and regeneration in nature close management are based on processes in virgin forests. Forests managed in this way have a strong ecological and economic foundation in all life conditions. If the forest has been managed from its establishment based on natural principles (operations of tending and regeneration) then it may be considered as natural forest management (Matić 2009).

The assortment structure of stands is directly affected by the type of forest management. The impact of management on the structure of beech stands and their timber production can clearly be seen after almost two centuries of organized forestry in the research area. This means that we no longer have virgin forest stands that developed with minimum or no human interaction. On the other hand, it is a fact that foresters have always known how to implement natural management in Croatian forests. This is best proven by the preservation of their natural structure and diversity. Natural approach to forest management in Croatia has been developed by the Faculty of Forestry of the University of Zagreb (Matić – Anić 2009).

Compilation, precision and application of tables in practice showing shares of forest assortments in the annual allowable cut (assortment tables) are connected with serious and numerous difficulties caused by the influence of biotic and abiotic factors on stand development. Among biotic factors, one of the most important is the impact of management, i.e. through implementation of criteria for selecting trees for felling. Of primary interest is the assortment structure, which can be achieved by implementing certain types of felling at a certain age of the stand, and not the assortment structure of all trees in the stand of a specific age. The effort to achieve the best possible quality of all trees in the stand of a specific age is the basis of all management procedures in even-aged beech stands.

2 RESEARCH SITE AND METHODS

2.1 Location of research

The state forests of Forest Administration Branch Office (FABO) Bjelovar involve the area of Northwest (Central) Croatia, they cover a total area of 131,820 hectares (*Figure 1*) and they are located in seven counties: Bjelovar and Bilogora, Brod and Posavina, Koprivnica and Križevci, Požega and Slavonia, Sisak and Moslavina, Virovitica and Podravina and Zagreb county. These forests owned by the Republic of Croatia are managed by „Hrvatske šume“

d.o.o. Zagreb through Forest Administration Branch Office Bjelovar. The whole area is divided into 15 forest offices and 34 management units.

In the total growing stock of these forests of almost 33,000,000 m³, common beech is the most represented species with the volume of almost 12,000,000 m³ or 36% (Figure 2). The total current annual increment is around 910,000 m³ with the share of beech of approximately 328,000 m³ or 37%. Beech in this area is vital and healthy. This is highly supported by the information on the average 3.3% of emergency beech felling compared to the annual allowable cut of beech in the area of FABO Bjelovar in the period 2001 to 2009. Within the research area (Forest Office Bjelovar) for the same period the average annual share of emergency felling in the annual allowable cut of beech was only 2.3%.

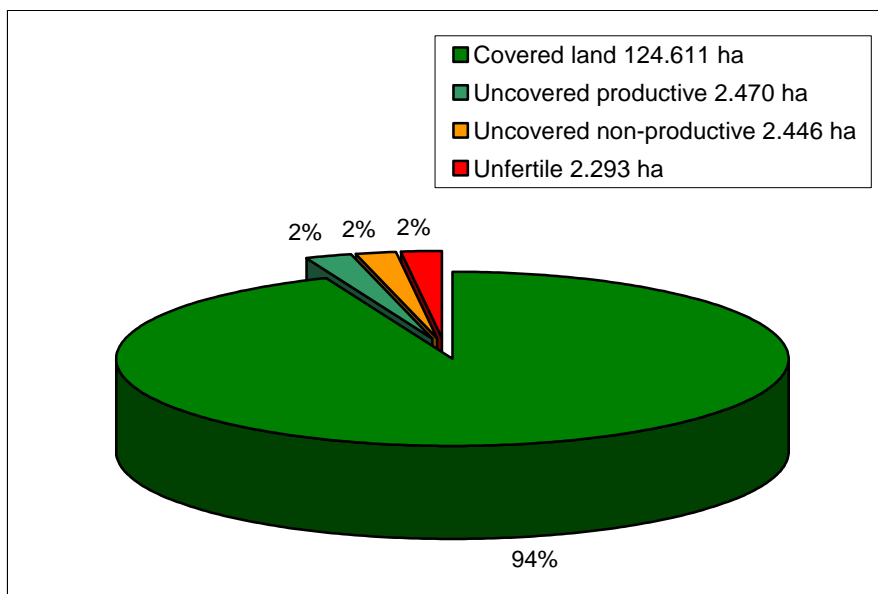


Figure 1. The area of FABO Bjelovar

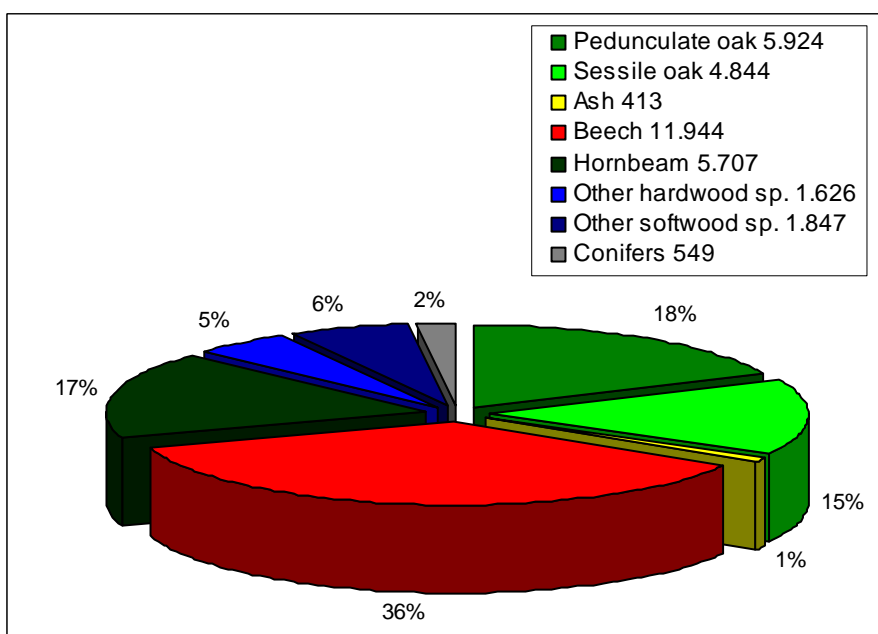


Figure 2. Growing stock of FABO Bjelovar (thousand m³)

The research was carried out in the management unit „Bjelovarska Bilogora” of the Forest Office Bjelovar, FABO Bjelovar. All research compartments belong to the ecological-management type II-D-11 and management class BEECH with a 100-year rotation, whose share in the area of the management unit is 76.1%, and in the growing stock 80.6%. The management unit „Bjelovarska Bilogora” is located on Southwest and South slopes of Bilogora, at the altitude ranging between 115 m and 307 m above sea level. Its total area is 7632.62 ha, of which 7444.17 ha is stocked. The management unit is divided into 180 compartments and 533 sub-compartments. In 2003 the total growing stock was 2,317,147 m³. In the growing stock, beech, as the most represented species, accounts for 1,036,386 m³ or 44.73%. The total 10-year allowable cut for I/1 management semi-period is 586,231 m³, of which 443,752 m³ is main felling, and 142,479 m³ is thinning. The share of beech in the 10-year allowable cut is 297,753 m³ (67.2%) in the main felling and 45,939 m³ (32.2%) in thinning, or a total of 343,692 m³ (58.6%).

The total allowable cut of the main felling of the Forest Administration Branch Office Bjelovar is approximately 400,000 m³ with the share of beech considerably higher than 50%. The total felling in the period 2001 to 2009 in the area of Forest Administration Branch Office Bjelovar can be seen in *Table 1*. Along with a continuous growth of the allowable cut in this period (from approximately 600,000 m³ to approximately 700,000 m³), an increasing share of beech can also be seen in the average wood volume (from approximately 34% to approximately 45%). Similarly, it can be said that the share of the main felling has increased considerably (from approximately 60% to almost 75%) in an average wood volume of beech in the area of FABO Bjelovar. The survey of fellings performed in the research area (Forest Office Bjelovar, *Table 2*) show the same increasing trend of allowable cuts (from approximately 50,000 m³ to approximately 85,000 m³), increase of beech share in the total wood volume (from approximately 40% to 50%) and considerable increase of the main felling (to more than 90%) in the average allowable cut of beech in the area of Forest Office Bjelovar (*Figure 3*). These trends are the effect of the growing stock structure of the research area, disproportion of age classes, as well as some inconsistencies in determining the rotation of beech stands. They should be taken into account when planning the development of both forestry and wood-processing activities in the area of Bjelovar.

Table 1. Felling from 2001 to 2009 - Forest Administration Branch Office Bjelovar

Year	Beech						Allowable cut					
	Main felling		Thinning		Total		Main felling		Thinning		Total	
	m ³	%	m ³	%	m ³	%	m ³	%	m ³	%	m ³	
2001	122 384	60,4	80 340	39,6	202 724	33,7	325 923	54,1	276 139	45,9	602 062	
2002	129 999	59,0	90 525	41,0	220 524	35,7	289 554	46,9	327 778	53,1	617 332	
2003	171 831	69,6	74 934	30,4	246 765	40,0	338 814	54,9	278 530	45,1	617 344	
2004	184 957	72,1	71 729	27,9	256 686	39,6	366 680	56,5	282 180	43,5	648 860	
2005	192 115	70,6	79 925	29,4	272 040	41,2	339 610	51,4	320 912	48,6	660 522	
2006	205 372	71,2	82 895	28,8	288 267	43,6	383 765	58,0	277 367	42,0	661 132	
2007	199 731	70,9	81 923	29,1	281 654	41,7	388 054	57,4	288 013	42,6	676 067	
2008	226 122	72,4	86 313	27,6	312 435	45,8	375 802	55,1	306 020	44,9	681 822	
2009	227 579	74,6	77 307	25,4	304 886	43,9	413 830	59,6	280 435	40,4	694 265	
Total	1 660 090	69,6	725 891	30,4	2 385 981	40,7	3 222 032	55,0	2 637 374	45,0	5 859 406	

Table 2. Felling from 2001 to 2009 - Forest Office Bjelovar

Year	Main felling		Beech Thinning		Total		Allowable cut Main felling		Thinning		Total
	m ³	%	m ³	%	m ³	%	m ³	%	m ³	%	m ³
2001	13 570	55,1	11 048	44,9	24 618	39,7	30 991	50,0	31 011	50,0	62 002
2002	6 447	61,8	3 992	38,2	10 439	21,7	23 789	49,5	24 243	50,5	48 032
2003	27 702	84,7	5 018	15,3	32 720	47,9	43 746	64,0	24 603	36,0	68 349
2004	30 567	87,7	4 281	12,3	34 848	48,4	49 513	68,8	22 426	31,2	71 939
2005	36 268	92,1	3 110	7,9	39 378	51,3	49 766	64,8	27 049	35,2	76 815
2006	33 606	90,6	3 489	9,4	37 095	49,2	51 794	68,7	23 635	31,3	75 429
2007	27 084	81,9	5 979	18,1	33 063	38,1	58 030	66,9	28 760	33,1	86 790
2008	34 263	81,2	7 938	18,8	42 201	49,9	55 132	65,2	29 450	34,8	84 582
2009	28 379	82,1	6 194	17,9	34 573	41,9	53 970	65,4	28 517	34,6	82 487
Total	237 886	82,3	51 049	17,7	288 935	44,0	416 731	63,5	239 694	36,5	656 425

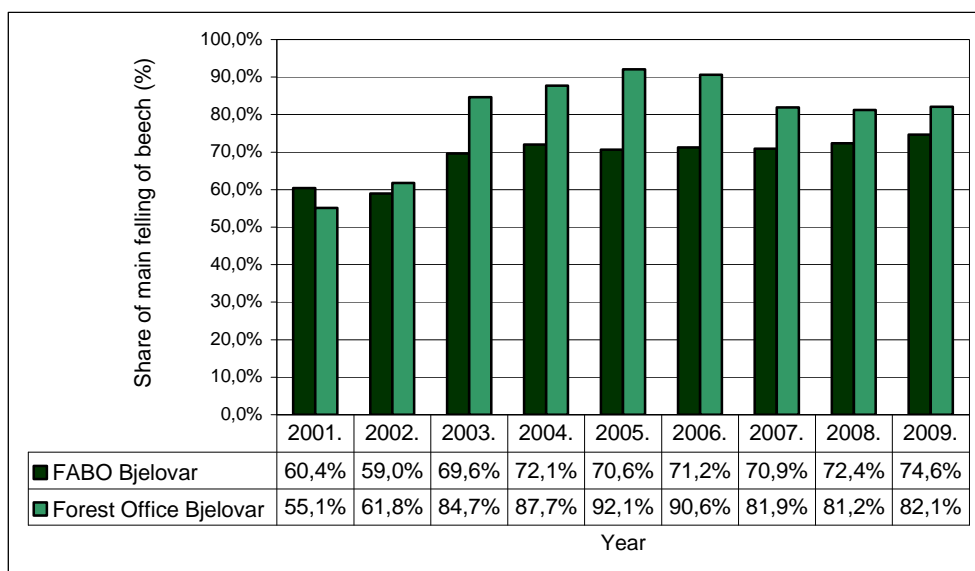


Figure 3. Share of main felling in felled volume of beech from 2001 to 2009

2.2 Method of work

The age of felling sites ranged between 59 and 91 with thinning operations, between 94 and 110 with intermediate felling, between 100 and 112 with regeneration felling and between 98 and 114 with final felling. The sample of model trees was taken by random selection of approximately 10% of marked trees. Moving around the stand at predetermined azimuths all marked beech trees found in the travel direction were included in the sample.

In the period of 1997 to 2007, the field research involved a total of 3776 model trees. Table 3 and 4 show the number of model trees by research compartment according to the type of cut and applied standard.

Table 3. Distribution of model trees according to the standard HRN (1995)

Type of felling															
Thinning				Intermediate fellings				Regeneration fellings				Final fellings			
Forest Block	Number of marked trees	Number of trees in the sample	%	Forest block	Number of marked trees	Number of trees in the sample	%	Forest block	Number of marked trees	Number of trees in the sample	%	Forest block	Number of marked trees	Number of trees in the sample	%
7c	292	60	20,5	9a	1198	102	8,5	11a	1667	177	10,6	20d	394	46	11,7
13a	665	65	9,8	11a	683	78	11,4	21a	2112	108	5,1	21a	1201	74	6,2
13b	285	51	17,9	17a	865	91	10,5	38a	1308	109	8,3	42a	1239	118	9,5
20e	569	66	11,6	19b	490	58	11,8	59c	409	41	10,0	42c	876	104	11,9
29a	368	46	12,5	21a	1166	132	11,3	83a	166	31	18,7	59c	438	44	10,0
29b	229	34	14,8	38a	1164	102	8,8	94b	650	76	11,7	75a	547	55	10,1
37a	631	83	13,2	42a	456	63	13,8	95b	439	64	14,6	83a	445	42	9,4
37c	335	48	14,3	42c	394	42	10,7	-	-	-	-	89b	145	23	15,9
39b	368	56	15,2	60a	862	97	11,3	-	-	-	-	155f	953	57	6,0
65b	164	24	14,6	66a	577	64	11,1	-	-	-	-	166c	135	20	14,8
66b	163	31	19,0	73a	888	100	11,3	-	-	-	-	-	-	-	-
69b	515	67	13,0	94b	343	54	15,7	-	-	-	-	-	-	-	-
80b	46	17	37,0	95b	306	42	13,7	-	-	-	-	-	-	-	-
82a	159	49	30,8	-	-	-	-	-	-	-	-	-	-	-	-
162a	371	45	12,1	-	-	-	-	-	-	-	-	-	-	-	-
162c	282	45	16,0	-	-	-	-	-	-	-	-	-	-	-	-
Total	5442	787	14,5	Total	9392	1025	10,9	Total	6751	606	9,0	Total	6373	583	9,1

Table 4. Distribution of model trees according to the standard HRN EN

Type of felling															
Thinning				Intermediate fellings				Regeneration fellings				Final fellings			
Forest Block	Number of marked trees	Number of trees in the sample	%	Forest block	Number of marked trees	Number of trees in the sample	%	Forest block	Number of marked trees	Number of trees in the sample	%	Forest block	Number of marked trees	Number of trees in the sample	%
7c	292	59	20,2	9a	1198	102	8,5	11a	1667	174	10,4	11a	721	76	10,5
13a	665	65	9,8	11a	683	78	11,4	38a	1308	109	8,3	38a	879	102	11,6
13b	285	51	17,9	17a	865	91	10,5	59c	409	41	10,0	42a	1239	118	9,5
20e	569	66	11,6	19b	490	58	11,8	66a	953	138	14,5	42c	876	104	11,9
29a	368	46	12,5	38a	1164	102	8,8	73a	1077	155	14,4	59c	438	44	10,0
29b	229	34	14,8	60a	862	97	11,3	94b	650	76	11,7	94b	711	133	18,7
37a	631	83	13,2	66a	577	64	11,1	95b	439	64	14,6	95b	378	68	18,0
37c	335	48	14,3	73a	888	100	11,3	124a	1134	105	9,3	-	-	-	-
39b	368	56	15,2	94b	343	54	15,7	-	-	-	-	-	-	-	-
65b	164	24	14,6	95b	306	42	13,7	-	-	-	-	-	-	-	-
66b	163	31	19,0	-	-	-	-	-	-	-	-	-	-	-	-
69b	515	67	13,0	-	-	-	-	-	-	-	-	-	-	-	-
80b	46	17	37,0	-	-	-	-	-	-	-	-	-	-	-	-
82a	159	50	31,4	-	-	-	-	-	-	-	-	-	-	-	-
162a	371	45	12,1	-	-	-	-	-	-	-	-	-	-	-	-
162c	282	45	16,0	-	-	-	-	-	-	-	-	-	-	-	-
Total	5442	787	14,5	Total	7376	788	10,7	Total	7637	862	11,3	Total	5242	645	12,3

Model trees were processed in accordance with the requirements of the *Croatian standards for forest harvesting products* (former JUS – standards of ex Yugoslavia) of 1995 (HRN D.B4.020, HRN D.B4.022, HRN D.B4.027, HRN D.B4.028, HRN D.B5.023), and «bucking simulation» was made on the same trees in accordance with the Croatian standard *Hardwood Round Timber – Qualitative classification, Part 1: Oak and beech HRN EN 1316-1:1999*. The defects of wood and processed round timber were measured in accordance with the terms of the standards HRN D.A0.101, HRN D.B0.022, and HRN EN 1309-2, HRN EN 1310, HRN EN 1311 and HRN EN 1315. Many other characteristics were also measured or assessed on model trees: diameter at breast height, tree height, trunk height, length of logs, trunk diameter, length of cut logs (1 m and longer), diameters of cut logs (1 m and longer),

lengths and diameters of fuel wood up to 4 m, length of waste wood, diameters of waste wood, bark thickness, false heartwood and described tree markings.

Out of the total number of model trees, 693 were processed and measured only in accordance with the requirements of the *Croatian standards for forest harvesting products* of 1995, on 2308 trees the measurements and classification of roundwood were carried out in accordance with the requirements of both standards, while 775 model trees were measured and then roundwood was classified in accordance with the requirements of the Croatian standard *Hardwood Round Timber – Qualitative classification, Part 1: Oak and beech HRN EN 1316-1:1999*.

In this way the sample for the preparation of assortment tables in accordance with the requirements of Croatian standards for forest harvesting products of 1995 covered 3001 model trees (*Table 3*). On the other hand, in accordance with the requirements of the Croatian standard HRN EN 1316-1:1999, assortment tables were prepared on the basis of the sample of 3082 model trees (*Table 4*).

3 RESULTS AND DISCUSSION

Obstacles related to processing, precision and practical application of assortment tables, and to the increase of reliability of business decision-making in planning the assortment structure of managed beech stands usually arise out of the following facts:

- quality of trees and of the whole stand is the result of continuing impact of different abiotic and biotic factors,
- total volume of the stand cannot be used as the basis for planning the felling, processing and extracting, and first of all not as the basis for calculating the financial income,
- usable volume of trees and stands varies in a wide range between values from approximately 30% to 80% (or more) compared to the total volume,
- distribution of timber assortments in individual trees is determined by the diversity of their phenotype (morphology) and occurrence of defects on and in the tree,
- occurrence of defects, their size and number on and in the tree is of random character and it cannot be correlated with measurable tree parameters,
- timber assortments of the same quality are not always produced from trees with the same dimensions and equal quality characteristics,
- there are differences between the classification of timber assortments in different countries, and the classification standards are subject to changes in time,
- in determining the quality of timber assortments, there is also a component of subjectivity,
- analysis of the structure of timber assortments achieved in the process of wood production provides no possibility to make final conclusions primarily because there is no correlation between breast-height diameters of individual trees and the produced assortment structure, and due to the effects of the market and other effects on the production process.
- assortment structure of managed stands is partly the result of human impact, and these have not been sufficiently researched or recognized.

Due to the above reasons, the method for determining the assortment structure that would be relatively quick, simple and accurate is still to be found. In all methods used so far, model trees were used for determining the total volume and volume assortments by sectioning of standing and felled trees.

Tables showing shares of timber assortments determined in accordance with the *Croatian standards on forest harvesting products of 1995* and in accordance with the Croatian standard

HRN EN 1316-1:1999 Hardwood Round Timber – Qualitative classification, Part 1: Oak and beech were developed separately for thinning and intermediate felling, and separately for regeneration and final felling. This was done due to numerous reasons stated and explained above, and due to results of research published before. The reasons for separating thinning and intermediate felling trees into special assortment tables are as follows:

- thinning sites and intermediate felling sites have an exceptionally high share of undamaged trees of abnormal growth and generally a higher percentage share of trees with negative impact on assortment structure of the felling site in the total number of marked trees compared to regeneration and final felling (Prka 2005, 2006),
- marked trees of thinning and intermediate felling have on average a lower trunk height and consequently a lower share of industrial roundwood is made of tree trunks compared to regeneration and final felling (Prka 2005, 2006),
- validation analysis of trees by type of cut shows that thinning and intermediate felling trees have lower index values compared to trees from final and regeneration felling (Prka 2003, 2005),
- total percentage share of industrial roundwood in the net volume of trees is lower with thinning sites compared to other types of cut and it increases from thinning towards final felling (Prka 2005),
- analysis of total deviations of percentage shares of timber assortments of the highest quality from the plan (analysis carried out in a three-year period in the research area) shows that tables of timber assortments, currently in use, overestimate the percentage share of veneer logs and peeling logs in thinning and intermediate felling sites (Prka 2003),
- in thinning and intermediate fellings, the occurrence of trees with the highest quality assortments of industrial roundwood is less probable (F – veneer and L – peeling logs – A and B quality class) and consequently the percentage share of timber assortments of the highest quality in the volume of large dimension timber is also smaller compared to trees of regeneration and final felling (Prka 2005, 2008, Prka – Krpan 2007),
- occurrence of false heartwood is not significant in felling sites up to the age of approximately 90 years. In older thinnings false heartwood may be expected in around 15% of the trees. On the other hand in felling sites aged from 100 to 110 false heartwood is quite significant as it can be expected in more than 50% of marked trees (Prka 2003, 2005, Prka et al. 2009, Krpan et al. 2006),
- number of trees with false heartwood increases from thinning towards final felling, as well as the length of industrial roundwood with false heartwood and shares of industrial roundwood affected by false heartwood (Prka 2005, Prka et al. 2009, Krpan et al. 2006),
- regeneration and final felling compared to thinning and intermediate felling show higher shares of the highest quality timber assortments depending on the diameter class by: approximately 8 to 14% (veneer logs and peeling logs) with the application of the Croatian Standards for Forest Harvesting Products (1995), and approximately 11 to 13% (A and B – quality class) with the application of Croatian standard HRN EN 1316-1:1999 Hardwood Round Timber – Qualitative classification, Part 1: Oak and beech (Prka 2005, 2008, Prka – Krpan 2007),
- percentage shares of timber assortments by quality classes retain the same ratios (of course not the same percentage shares) regardless of the applied standards (Prka 2005, 2008, Prka – Poršinsky 2009).

A common feature of the marked trees in thinning and intermediate felling is that they are chosen by selection criteria, which become irrelevant when the intermediate felling is completed because the key role in selecting trees for felling in the regeneration phase is then played by seeding, presence and growth of regeneration and spatial distribution of remaining trees.

In short, when determining the mathematical model for the development of volume of timber assortments, it should be taken into account that it depends on natural laws of development, which are not well known and which are affected during the rotation cycle by changing the stand structure and by applying the system of standards and trade conventions, both subject to change in time.

Factors affecting the assortment structure of even-aged beech felling sites when implementing sustainable management of beech forests are therefore as follows:

- selection criteria of trees for felling by which the prescribed type of cut is performed in managing natural beech stands,
- technological level of wood production which involves both technical equipment and development of forest infrastructure, as well as professional competence of all participants in wood production and the whole forest management,
- defects of beech wood formed as the consequence of natural development of beech stands and human impact, among which false heartwood is the most conspicuous,
- procedures with beech roundwood during and after operations of wood production and the prescribed ways of measuring and calculating the volume,
- market relationships, which besides demand and supply are also greatly influenced by the development of capacities for processing beech into wood products and other products (energy and similar),
- level of knowledge of management of natural beech stands, and operational application of such knowledge.

4 CONCLUSION

There are many factors affecting the assortment structure of managed beech stands, and their impact is very complex. These factors are partly the result of natural laws of growth and development of beech stands and trees, and partly the result of human and environmental impact. Some of these factors are objective and their impact cannot be avoided, while others are of a subjective nature.

The effects on quantity and quality of assortments of a certain type of cut in even-aged stands are related to:

- abiotic factors such as climate, edaphic and orographic conditions, and their continuous and interdependent impact,
- biotic factors mostly affected by human interference although there are also others (bacteria, fungi, insects, game etc.),
- historic development of beech stand management, i.e. advance in forest sciences, operational practice and education of forestry staff,
- actual comprehensive management of beech stands and organization of forest economic activities, as well as position of these activities in a wider business (social) environment,
- technological level of wood production that provides the basis in the production of beech forest assortments, including technical equipment and professional competence of all participants in the process of wood production,

- occurrence and quantity of wood defects, although they are of random nature, can be partly affected by silviculture,
- rotation age, which is particularly important in this species due to the occurrence and pattern of development of false heartwood,
- bucking of beech industrial roundwood, precision of measurement and consistent use of applicable regulations (standards) for the classification of forest timber assortments into quality classes,
- research and application of research results with the aim of developing more precise assortment tables, more objective planning and control of production of beech assortments,
- development of standards for the classification of forest assortments as well as development of market relationships.

Production potential of managed stands are limited, they are more or less stable. Forestry is not in a position to achieve, in a short term, a considerable increase (if any) of the productivity of natural stands. The decisions may only affect where the increment of wood volume will be accumulated and when it should be sold. Short-term silvicultural interferences make optimal use of the stands and preserve the production potential, and leave stable stands of a potentially higher quality to future generations.

By managing beech stands, meeting scientific and professional requirements, the outlined impacts on the quantity and quality of forest timber assortments may be directed to a certain extent, towards the production target. With the application of tending procedures the value of the stand and that of timber assortments produced by individual type of cut increases in time. The positive selection of trees that determine the development of the stand and natural regeneration provide the transfer of the best properties to future generations. In economic context, the development of false heartwood in beech trees displays an opposite trend. A compromise must be accepted therefore by proper management and determination of harvest age.

Unfortunately, during the last turbulent 20 years, wood production in the region of Bjelovar has been losing the potential based on traditional and natural resources. This has a negative effect both on forestry and the development of this region as a whole. The reasons are manifold, and one of the most important is the lack of objective planning of the achievable assortment structure of the allowable cut. Although such analyses are part of decision making at the strategic level, in the Republic of Croatia they have not been implemented satisfactorily.

Regardless of the degree of (de)centralization of management, the profit of forestry activities should not be the primary interest of the state. The permanent interest of the owner (society as a whole, the state) should be to employ as many people as possible based on sustainable and economic principles of forestry, and utilize natural potentials.

Compared to timber assortments of some other species, the market demand of beech assortments is less stable. Therefore, beech roundwood (e.g. compared to roundwood of pedunculate oak) is often treated as necessary evil in commercial and processing context. On the other hand, the quality of beech timber and its share in the allowable cut of this area show that such attitude should be changed. This requires considerable changes in the approach to this problem of all involved in this segment of Croatian economy, especially on regional and local level.

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