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FIR AND NORWAY SPRUCE STANDS FROM THE PLANNING ASPECT IN THE AREA OF ĐEREKARSKI OMAR FOREST MANAGEMENT UNIT IN SOUTHWESTERN SERBIA

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Abstract: *The results of the research of fir and Norway spruce mixed stands in the area of Đerekarski Omar Forest management unit situated in southwestern Serbia are presented in this paper. The stands which are the subject of this research belong to a complex of frigophilic coniferous forest types. The forests in the Đerekarski Omar Forest management unit are managed in accordance with the planning documents starting from 1961 when the first planning of these forests was performed. The results of this paper were based on the measurement of stationary sample plots established in homogeneous parts of the stands. In all sample plots fir is a dominant tree species. The values of volume and volume increment in studied stands are significantly above the average at the level of Serbia for fir and Norway spruce stands. The health condition of the stands is good, whereby a positive circumstance is the process of natural regeneration of these stands both on locations where there is a sparse canopy and in closed-canopy stands. On the other hand, number of trees, mean tree diameter and qualitative stand structure indicate the need for a detailed analysis of the planned works.*

Key words: fir and Norway spruce forests, southwestern Serbia, forest management plans.

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SASTOJINE JELE I SMRČE SA PLANSKOG ASPEKTA NA PODRUČJU GAZDINSKE JEDINICE „ĐEREKARSKI OMAR“ U JUGOZAPADNOJ SRBIJI

Izvod: *U radu su predstavljeni rezultati istraživanja mešovitih sastojina jele i smrče na području gazdinske jedinice „Đerekarski Omar“ koja se nalazi u jugozapadnoj Srbiji. Sastojine koje su predmet ovog istraživanja pripadaju kompleksu frigorifilnih četinarskih tipova šuma. Šumama u gazdinskoj jedinici „Đerekarski Omar“ gazduje se u skladu sa planskim dokumentima počevši od 1961. godine, kada je izvršeno prvo uređivanje ovih šuma. Rezultati ovog rada nastali su na osnovu premera stacioniranih oglednih polja postavljenih u homogenim delovima sastojina. Na svim oglednim poljima jela je dominantna vrsta drveta. Vrednosti zapremine i zapreminskog prirasta u istraživanim sastojinama su znatno iznad prosečnih na nivou Srbije za sastojine jele i smrče. Zdravstveno stanje sastojina je dobro, pri čemu pozitivnu okolnost predstavlja proces prirodne obnove ovih sastojina kako na mestima gde je došlo do otvaranja sklopa tako i pod potpunim sklopom sastojine. S druge strane, broj stabala, srednji prečnik stabala i kvalitativna struktura stastojine ukazuju na potrebu detaljne analize planiranih radova.*

Ključne reči: šume jele i smrče, jugozapadna Srbija, planovi gazdovanja šumama.

1. INTRODUCTION

Serbia is considered a country with a medium forest coverage. Of its total area, 29.1% (Vojvodina 7.1%, Central Serbia 37.6%) is under forests. Compared to the global aspect, forest coverage of Serbia is close to the global forest coverage which amounts to 30%, and significantly lower than the European which reaches 46% (Banković, S. et al., 2009).

An important indicator of forest coverage is related to the qualitative structure of forests, whereby their origin is one of the attributes which most closely determine forest coverage in a qualitative sense. Compared to the total vegetation coverage in the growing stock of Serbia coppice forests are dominant with 64.7%, natural stands of high origin cover 27.5%, and artificially established stands (with plantations) 7.8%. The average volume in forests of Serbia amounts to 161 m^3/ha, whereby in high forests it is 254 m^3/ha, in coppice forests 124 m^3/ha and in artificially established forests (plantations) it is 136 m^3/ha (Banković, S. et al., 2009a).

The growing stock of the Republic of Serbia is dominated by beech which participates in the total volume with 40.5%, and in volume increment with 30.6%, followed by Turkey oak with 13.0% share in volume and 11.4% in volume increment and Sessile oak with 5.9% in volume and 6.1% in volume increment. Norway spruce is the most wide-spread coniferous species and its share in volume and volume increment is 5.2%, and 6.7% respectively. The share of Austrian pine and Scots pine in total volume and volume increment is 4.5% and 9.8%, respectively, while fir’s share in volume and volume increment is 2.3% and 2.2% (Banković, S. et al., 2009a).

Fir forests cover relatively small area of 25,600 ha, 65.6% of which is state-owned. In addition, stands of natural origin dominate with a share of 95.3%, and cultivated stands are present on 4.7% of the area (Banković, S. et al., 2009a)

In Serbia, fir is spread on high mountain massifs and the most important sites are in the west, on mountains Tara, Zlatibor (Murtenica), Zlatar, Čemerno, Golija, Mokra Gora, Prokletije, Šar Planina, Kopaonik and Goč, Veliki Jastrebac, and in the east on Stara Planina. The northernmost site is on Rtanj and Malinik.

Within the basic ceno-ecological coordinate system fir occurs in two forest complexes (Jovanović, B., Jović, N. 1981., Jović, N. et al., 1991):

- Complex (belt) of mesophilic beech and mixed beech and conifer types of forests;
- Complex (belt) of frigophilic coniferous forest types.

The researched stands are located in the complex of frigophilic coniferous forest types within Đerekarski Omar Forest management unit (FMU) which belongs to Gornjeibarsko forest area. Norway spruce and fir forests (*Piceo-Abietetum*) on brown podzolic soils within state-owned forests in Gornjeibarsko forest area are spread on an area of 1,749.6 ha.

Considering the above, the objective of this paper is an analysis of the condition of fir and spruce stands and natural regeneration process in these stands with particular reference to forest management plans for these forests.

2. OBJECT OF THE RESEARCH, MATERIAL AND METHODS

Đerekarski Omar Forest management unit is located between 20˚06′30" and 20˚11′30" of east longitude and 42º55′30" and 43˚01′00" of north latitude. Pešter plateau stands out in this mountainous area and for small part of its length it borders with this forest management unit. The FMU belongs to Dinaric mountain massif. The characteristic of these mountains are mostly limestone ridges which are torn and diverge. The FMU is located in Đerekarska depression which is situated on the sides of such two ridges that start from Krstača top. The lowest elevation within the FMU and the highest point of the FMU are at 1,160 m and 1,689 m above mean sea level, respectively. The main characteristic of the relief in the FMU is brokenness of the terrain, large abundance of hills with depressions and steep sides, so it is normal that different exposures are present, although northern and southern and partly eastern exposures are predominant.

The researched stands belong to the group of ecological units (ecological types) – Norway spruce and fir forests (*Abieti - Piceetum abietis*, Mišić et Popović, 1978) on acidic brown and brown podzolic soils and they are situated on the sites which are regularly managed in accordance with the Forest Management Plan. The basic function of these forests is production.

For the purpose of presenting the climate of the subject area the data have been collected from meteorological station in Sjenica which is the closest to the sample plots, for the reference period from 1981 to 2010. In terms of regional climate, this area belongs to humid continental climate of slightly altered type. The mean annual temperature in the analysed period is 6.7°C with the maximum

measured temperature being 36.2°C and the minimum -35.6°C. The mean annual precipitation is 749.5 mm, while mean annual relative humidity is 77%.

Within the Đerekarski Omar FMU, six sample plots were established with the average area of 0.25 ha. When setting up sample plots, care was taken to meet the conditions of habitat and stand homogeneity. Sample plots 1, 2 and 6 are located in the compartment 31, section A. Sample plots 4 and 5 are situated in the compartment 23, section A. Sample plot 3 is located in the compartment 22, section B. Sample plots are square in shape. The diameters and heights of all trees above taxation limit were measured on all sample plots and bore cores were extracted from five trees in each diameter size class in order to determine volume increment. Also, on all sample plots the abundance of young growth was determined by placing four square surfaces 1x1 m, at 10 m from the tops of the corners at an angle of 45° (Figure 1).

In addition, for each tree on the sample plot a silvicultural class was determined. Quality is determined using grades from 1 to 8 whereby grades 1, 2 and 3 were assigned to trees in the first biological position (dominant trees). Grade 1 is given to the best quality trees, straight, full-boled, with a properly developed canopy. Grade 2 was given to lower quality trees that are located in the first biological position and grade 3 was given to curved trees, trees with improperly developed canopy and trees with damages that are located in the first biological position. Grades 4, 5 and 6 are assigned to codominant trees according to the same criteria as for trees in the first biological position based on the quality of the trunk and the canopy. Grades 7 and 8 are assigned to the trees of the understorey, whereby 7 is assigned to healthy and vital trees and 8 to the trees that are not vital but damaged or dead.

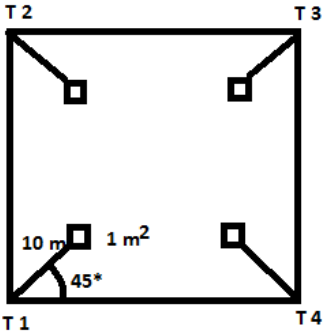

Figure 1. *Schematic representation of a sample plot*

Figure 2. *The researched stand on SP 1 (Source: Martać N.)*

The volume tables method was used for calculation of volume, whereby for fir two-way table for fir on Goč was used (Banković, S. et al., 1990), while for Norway spruce two-way table for Norway spruce on Kopaonik was used (Banković, S. et al., 2003). The current volume increment was determined according to the diameter increment method, by applying Meyer's differential method. Different functions were tested for modelling the height curve, and the selection of the final model was made on the basis of statistical parameters of regression and correlation analysis, as well as on the basis of the degree of

coincidence of equalized and empirical data. Data processing was performed using Microsoft Excel and Stat graphics.

3. RESULTS OF THE RESEARCH AND DISCUSSION

Habitat, as well as stand conditions with different intensity affect the development of trees in the stand and exactly those different development processes of certain trees in a stand lead to differentiation of trees in terms of diameter, height and other structural elements, which creates a specific internal structure of stands – stand structure.

For the purpose of creation of quality forest management plans at the stand level it is necessary to have a reliable information on forest condition which also means performing permanent monitoring of forest condition. Furthermore, considering that one of the strategic goals of forest management in Serbia is the increase of stand mixedness in order to provide greater forest stability, the knowledge on the structural development of these stands becomes even more significant.

Table 1. *Overview of taxation indicators*

Sample plot	Number of trees N/ha			Basal area G (m^2)			Volume V (m^3)			Volume increment Iv (m^3)		
	Fir	Norway spruce	Total	Fir	Norway spruce	Total	Fir	Norway spruce	Total	Fir	Norway spruce	Total
SP 1	872	45	917	54.1	3.8	57.9	732.1	55.7	787.8	9.4	0.9	10.4
SP 2	819	33	852	53.9	4.3	58.2	735.6	61.8	797.4	8.7	0.9	9.6
SP 3	864	18	882	39.2	1.3	40.5	518.6	83.6	602.2	8.9	0.9	9.8
SP 4	631	99	730	42.5	3.8	46.3	594.4	82.6	677.0	11.9	1.9	13.8
SP 5	731	87	818	43.8	5.8	49.6	601.1	80.17	681.27	11.3	1.5	13.0
SP 6	486	37	523	34.8	3.8	38.6	480.3	55.0	535.3	11.7	1.1	12.8
$\bar{x}$	**733.8**	**53.2**	**787.0**	**44.7**	**3.8**	**48.5**	**610.3**	**69.8**	**680.2**	**10.3**	**1.2**	**11.6**
$S_{\bar{x}}$	**62.0**	**13.2**	**58.9**	**3.2**	**0.6**	**3.4**	**43.3**	**5.6**	**41.8**	**0.6**	**0.2**	**0.8**
cv (%)	**20.7**	**60.8**	**18.3**	**17.5**	**38.1**	**17.3**	**17.4**	**19.7**	**15.1**	**14.3**	**34.6**	**15.9**

3.1. Number of trees and diameter structure

In the researched stands on sample plots the total number of trees pre ha above the taxation limit (10 cm) ranges from 523 (SP 6) to 917 (SP 1) (Chart 1).

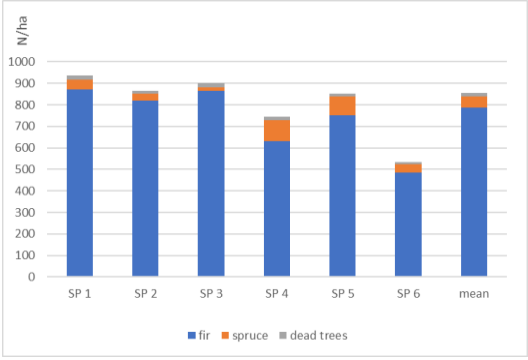

Chart 1. *Number of trees in the researched stands*

Fir is a dominant tree species in all sample plots and according to mean values number of trees per hectare amounts to 787. The share of fir in the total number of trees is 93%, while remaining 7% belongs to Norway spruce. The average number of dead trees per hectare is 23. Observing the obtained results and the results of previous research carried out on Mt.Tara (Stamenković et. al., 1990), Kopaonik (Šljukić et. al., 2017) and Zlatar (Popović., 2017) it is evident that the number of trees per sample plot as well as the average number is within the range of number of trees on other sites in Serbia where these forests occur.

Diameter structures of fir and Norway spruce in the researched stands are presented in Chart 2.

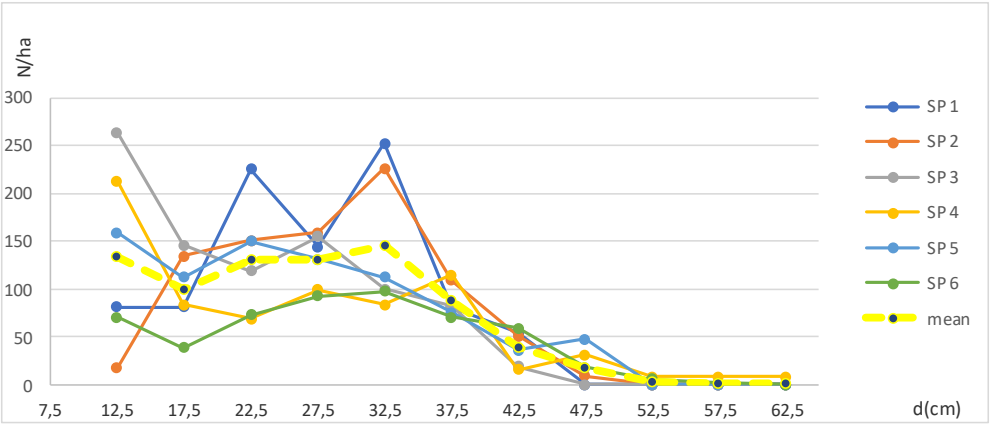

Chart 2. *The structure of the researched stands*

In structural terms, these forests are characterized by a pronounced diversity of structural forms, from a structure close to even-aged stands (SP 2), through a structure close to selection forests (SP 3) to the structure similar to all-aged stands (SP 1). The shape of summary lines of tree distribution in all cases is conditioned by fir as a dominant species. If the line representing the average for all sample plots is observed, we come to the conclusion that the structure of the researched stands corresponds the most to the structure of even-aged stands, whereby thin and trees of medium thickness are dominant with a minimal presence of trees of large dimensions. The results of this research show that the researched stands are similar to the researched stands on other sites in Serbia. On the basis of a research carried out in Norway spruce and fir forest on Kopaonik, Šljukić et al. (2017), state those are very diverse stands in terms of structural forms, from a structure close to even-aged stands, two-storied, to typical multi-storied all-aged stands.

The values of stand mean diameter and mid-diameter of dominant fir and Norway spruce trees in researched stands are presented in Table 2.

Table 2. *Stand mean diameters (dg) and mid-diameters of dominant fir and Norway spruce trees (dg max) in the researched stands*

Sample plot	Type of tree	d_g (cm)	$d_{g\ max}$ (cm)
SP 1	Fir	28.1	37.6
	Norway spruce	26.2	34.2
SP 2	Fir	28.9	38.2
	Norway spruce	24.7	37.1
SP 3	Fir	24.1	42.5
	Norway spruce	24.0	35.8
SP 4	Fir	29.3	37.4
	Norway spruce	27.8	34.4
SP 5	Fir	27.6	36.5
	Norway spruce	24.2	32.8
SP 6	Fir	30.4	41.1
	Norway spruce	28.7	37.6

Stand mean diameter (d_g) and mid-diameter of dominant trees ($d_{g\ max}$) are calculation categories which are under dominant influence of stand conditions that arise as a consequence of silvicultural treatment. Stand mean diameter of fir (d_g) ranges from 24.0 cm (SP 3) to 30.4 cm (SP 6), while mid-diameter of dominant trees ($d_{g\ max}$) ranges from 37.4 cm (SP 4) up to 42.5 cm (SP 3). On the other hand, Norway spruce as an accessory tree species reaches lower diameter values of both stand mean diameter and mid-diameter of dominant trees. The above confirms the statement that there is a small number of trees of the largest dimensions in the researched stands, as well as that the trees of medium and small dimensions are dominant there.

3.2. Tree Height

Height curves of the researched stands are presented in Chart 3.

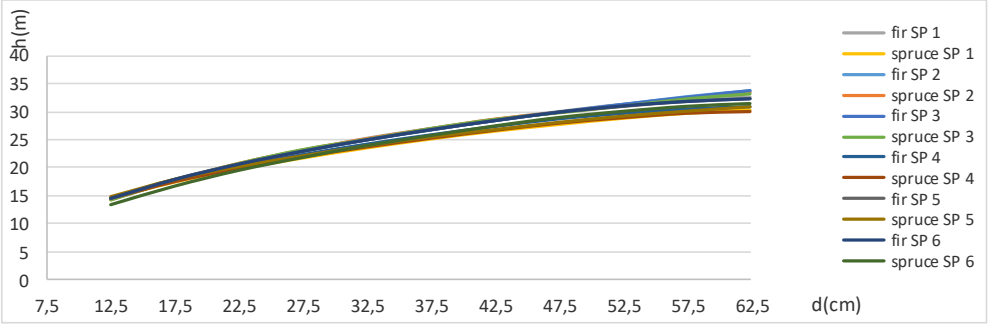

Chart 3. *Height curves of the researched stands*

Height curves confirm the statement that when establishing sample plots great attention was paid to achieving that the conditions in which sample plots were established were homogenous. Therefore, the variation of heights per sample plots is small, and differences are more pronounced in Norway spruce.

The values of mean stand height and mean height of the dominant trees of fir and Norway spruce in the researched stands are presented in Table 3.

Table 3. *Mean stand height (hg) and mean height of the dominant trees (hg max) of fir and Norway spruce in the researched stands*

Sample plot	Tree species	h_g (m)	$h_{g\,max}$ (m)
SP 1	Fir	23.2	26.8
	Norway spruce	22.9	26.6
SP 2	Fir	23.5	27.1
	Norway spruce	22.8	26.4
SP 3	Fir	20.2	29.9
	Norway spruce	20.1	27.9
SP 4	Fir	23.7	26.8
	Norway spruce	23.4	25.9
SP 5	Fir	23.1	26.4
	Norway spruce	22.6	26.2
SP 6	Fir	24.1	28.1
	Norway spruce	24.8	29.4

There is no pronounced variability of mean stand heights of fir *(h_g)*. The highest variability is on SP 4 where it amounts to 23.7 m, while the lowest variability amounting to 20.2 m is on SP 3. The largest mean height of the dominant trees *($h_{g\,max}$)* is on SP 3 amounting to 29.9 m. For Norway spruce, the variability of mean stand heights is somewhat more pronounced, whereby the difference between the highest on SP 6 and the lowest on SP 4 amounts to 4.7 m. Observing mean stand heights and mean heights of the dominant trees it can be concluded that fir is dominant in relation to Norway spruce in all sample plots, except for SP 6. Also, it can be stated that the heights in the researched stands approximate the heights in stands on other sites (Popović, 2017; Šljukić, 2017).

3.3. Basal Area

Basal area of the researched stands is presented on Chart 4.

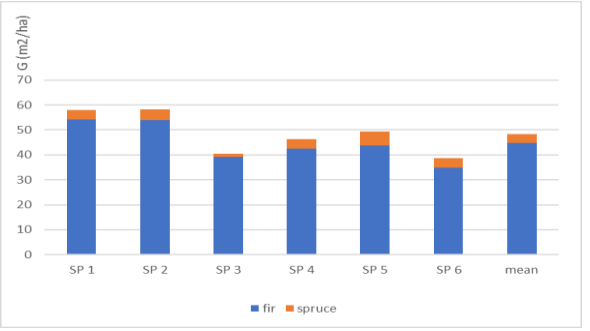

Chart 4. *Basal area of the researched stands*

Mean basal area in the researched stands amounts to 48.5 m^2/ha which is less than in the stands on Mt.Tara (Stamenković et al. 1990). Also, the obtained basal area is significantly smaller than the mean basal area in the stands on Kopaonik which amounts to 58.4 m^2/ha (Šljukić, 2017), as well as in the area of Kneževo (Govedar et al. 2008).

3.4. Volume and Volume Increment

The volume of the researched stands is presented in Chart 5.

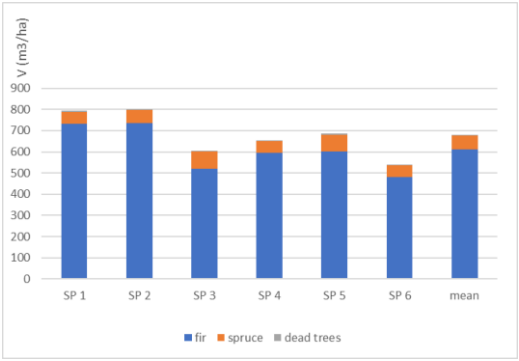

Chart 5. *Volume in the researched stands*

The mean volume of these forests amounts to 680.1 m^3/ha, with a mixture ratio of 0.9:0.1 in favour of fir, whereby the share of dead trees of both species amounts to 1.8% in total. Observing each sample plot individually, the lowest productivity is recorded in the stand on SP 6 and the highest in the stand on SP 2. Volume and volume increment of these stands indicate they are highly productive. A high value of volume (exceeding 400 m^3/ha) in preserved mixed stands of fir and Norway spruce is determined in the area of Ljubišnja in Montenegro (Stojanović et al., 2000), in the areas of Potok and Drinići in the Republic of Srpska ranging from 504 m^3/ha up to 716 m^3/ha (Govedar, 2005), in the area of Kneževo 726.9 m^3/ha (Govedar et al., 2008), in the area of Mt.Tara (Stamenković et al. 1990; Medarević, 2005), and in the area of Kopaonik 776.9 m^3/ha (Šljukić et al., 2017).

Volume increment in the researched stands ranges from 9.6 m^3/ha up to 13.8 m^3/ha, and it's mean value is 11.5 m^3/ha, whereby fir participates with 89%, and spruce with 11%. If diameter structure obtained on sample plots and increment are taken in consideration, with some caution it can be concluded that in terms of production structural all-agedness is more suitable to the current situation, presuming that it is a consequence of more favourable conditions of lateral light.

3.5. New Growth

Growth and development of new growth of various tree species depends on its microhabitat conditions, age, height and position (Krstić, et al., 1997) and its height increment depends on the tree species, edaphic, climatic and other factors (Bunuševac, 1951).

The average number of new growth individuals of fir in the researched stands amounts to 39,375, while the average number of new growth individuals of Norway spruce is 9,600, which is lower number of new growth individuals compared to even-aged stands in the area of Kneževo (Govedar, et al., 2008). New growth occurs equally both under the closed canopy and in places where canopy is sparse, considering that in the areas with sparse canopy its development is more intensive due to an increased amount of light. The age of the new growth is different and there is a new growth aged from 1 to over 10 years which is suppressed and dormant due to lack of light. When conducting the research individual seedlings aged up to 1 year were not taken into account due to a high risk of their decay, but it should be noted that that they are abundant due to a good seed yield of both tree species in the previous year.

Figure 3. *New growth development in the area with a sparse canopy (Source: Martać N.)*

3.6. Silvicultural Class

The trees of the 7th silvicultural class are the most abundant within the researched stands, followed by the 5th and the 4th classes which represent the trees from the second biological position. The fourth most abundant trees are the highest quality trees and in the fifth place are the trees of somewhat lower quality and are located in the first biological position. The 1st and the 2nd class represented by the trees from the first biological position are approximately equally represented with the total of about 250 trees per ha. Dead trees are also present in all three biological positions and their number in the researched stands is on average 23 trees per ha. Taking into account the above, it can be concluded that a sufficient number of the highest quality trees per hectare is present, but it is necessary to implement cultivation measures in the form of thinning which would provide more space for development of crowns of the highest quality trees and thus have effect on increase of tree diameters and stand quality.

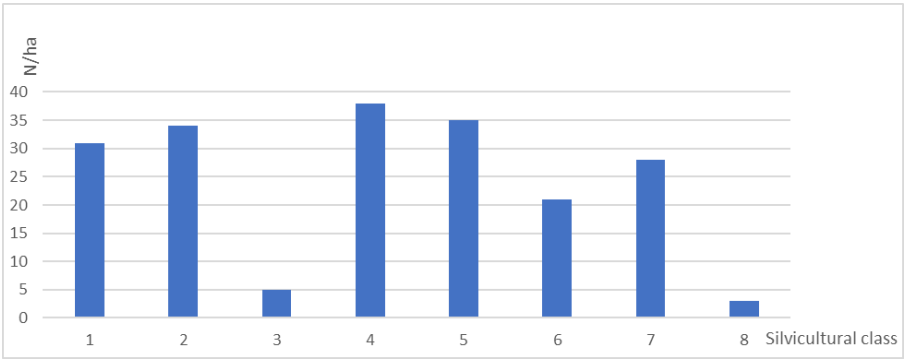

Chart 6. *Overview of stand quality*

4. CONCLUSIONS

Based on the obtained results on the structural characteristics of fir and Norway spruce forests within the researched area, the following can be stated:

- The volume of the researched stands per ha exceeds significantly the mean volume for Gornjeibarsko forest area and amounts to 262 m^3/ha.
- The volume increment of the researched stands also exceeds the mean for Gornjeibarsko forest area.
- The determined volume and volume increment of the researched stands are higher compared to the means of fir and Norway spruce forests in the territory of Serbia amounting to 301 m^3/ha and 8.35 m^3/ha, respectively.

According to the applicable Forest management plan all researched stands belong to the same forest management class and in all stands group shelterwood felling is planned. The above indicates that in all stands group-shelterwood system of management with long regeneration period is applied, which is typical for all-aged stands. Thereat, in all researched stands group-shelterwood felling is planned. Considering the above and the research results which clearly indicate that in terms of structure some of the researched stands are even-aged, (aged 85 at breast height), and that there is a number of suppressed trees (4^{th} and 5^{th} silvicultural class) in the stands that prevent normal crown development of the highest quality trees and thus affect their qualitative and quantitative characteristics, it should be noted that more attention should be paid to delineation of stands and creation of adequate Forest management plans in the form of planning of thinning and shelterwood felling with short regeneration period.

Furthermore, it is necessary to emphasize that the part of Gornjeibarsko forest area that has been included in this research is a special refuge habitat for fir regardless of whether pure or mixed stands are in question. Compared to other sites of mixed coniferous and broadleaved forests and coniferous forests in Serbia, fir (pure or mixed with Norway spruce) occurs here also in the structural form typical of even-aged forests.

Despite the increasingly intense effect of climatic extremes on forests, compared to some other sites in Serbia, these stands have a satisfactory health and negative biotic effects are present rarely and only in individual cases.

What completes the overall picture in a positive sense is an unhindered spontaneous forest renewal also under closed canopy, which clearly indicates the priority of natural regeneration in these forests. By "moderate and deliberate" intensity felling, in relation to the present condition of forests, a principle of sustainable production and yield will be ensured in a long-term, while supporting the permanence and evenness of water aquifers since this area is an active source of potable water for the nearby village.

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FIR AND NORWAY SPRUCE STANDS FROM THE PLANNING ASPECT IN THE AREA OF ĐEREKARSKI OMAR FOREST MANAGEMENT UNIT IN SOUTHWESTERN SERBIA

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Summary

The condition of fir and Norway spruce mixed stands in the area of Đerekarski Omar Forest management unit in southwestern Serbia are researched from the planning aspect in this paper.

The researched stands belong to the group of ecological units (ecological types) – Norway spruce and fir forests (Abieti - Piceetum abietis, Mišić et Popović, 1978) on acidic brown and brown podzolic soils. The basic function of these forests is production.

The total number of trees in the researched stands ranges from 523 to 917 trees per ha, whereby fir is dominantly represented in all stands. Mean volume of these forests amounts to 680.1 m3/ha with a mixture ratio of 0.9:0.1 in favour of fir. Volume increment in the researched stands ranges from 9.6 m3/ha up to 13.8 m3/ha, and the mean value amounts to 11.5 m3/ha, whereby the shares of fir and Norway spruce are 89% and 11%, respectively. The volume and volume increment of the researched stands are significantly higher compared to the mean values of the same elements within Gornjeibarsko forest area, as well as compared to the Serbian average.

The average number of new growth individuals of fir in the researched stands amounts to 39,375, while the average number of new growth individuals of Norway spruce is 9,600. New growth occurs equally both under the closed canopy and in places where canopy is sparse, considering that in the areas with sparse canopy its development is more intensive due to an increased amount of light.

The part of Gornjeibarsko forest area that has been included in this research is a special refuge habitat for fir regardless of whether pure or mixed stands are in question. Despite the increasingly intense effect of climatic extremes on forests, compared to some other sites in Serbia, these stands have a satisfactory health and negative biotic effects are present rarely and only in individual cases. In addition, an unhindered spontaneous forest renewal represents a positive circumstance, which clearly indicates the priority of natural regeneration in these forests. By “moderate and deliberate” intensity felling, in relation to the present condition of forests, a principle of sustainable production and yield will be ensured in a long-term, while supporting the permanence and evenness of water aquifers since this area is an active source of potable water for the nearby village.

SASTOJINE JELE I SMRČE SA PLANSKOG ASPEKTA NA PODRUČJU GAZDINSKE JEDINICE „ĐEREKARSKI OMAR“ U JUGOZAPADNOJ SRBIJI

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Rezime

U radu je sa planskog aspekta proučavano stanje mešovitih sastojina jele i smrče na području gazdinske jedinice „Đerekarski Omar“ u jugozapadnoj Srbiji.

Istraživane sastojine pripadaju grupi ekoloških jedinica (ekoloških tipova) - šume smrče i jele (*Abieti - Piceetum abietis*, Mišić et Popović 1978) na kiselim smeđim i smeđim podzolastim zemljištima. Osnovna funkcija ovih šuma je proizvodna.

Ukupan broj stabala u istraživanim sastojinama se kreće od 523 do 917 stabala po ha, pri čemu je jela dominantno zastupljena u svim sastojinama. Prosečna zapremina ovih šuma iznosi 680,1 m^3/ha, sa razmerom smese 0,9:0,1 u korist jele. Zapreminski prirast u istraživanim sastojinama kreće se od 9,6 m^3/ha do 13,8 m^3/ha, a prosečna vrednost iznosi 11,5 m^3/ha, pri čemu jela učestvuje sa 89%, a smrča sa 11%. Zapremina i zapreminski prirast istraživanih sastojina su značajno veći u odnosu na prosečne vrednosti istih elemenata u okviru Gornjeibarskog šumskog područja, kao i u odnosu na prosek Srbije.

Prosečna brojnost podmlatka jele u istraživanim sastojinama iznosi 39 375, dok je prosečna brojnost podmlatka smrče 9 600 jedinki. Podmladak se podjednako javlja kako pod potpunim sklopom tako i na mestima gde je došlo do prekida sklopa, s tim da se na mestima prekida sklopa on intenzivnije razvija usled povišene količine svetlosti.

Deo Gornjeibarskog šumskog područja koji je bio obuhvaćen ovim istraživanjem predstavlja poseban stanišni refugijum za jelu, bilo da se radi o čistim ili mešovitim sastojinama. I pored sve intenzivnijeg uticaja klimatskih ekstrema na šume, ove sastojine u odnosu na neke druge lokalitete u Srbiji imaju zadovoljavajuće zdravstveno stanje i samo je pojedinačno i retko prisustvo negativnih biotičkih uticaja. Osim toga, pozitivnu okolnost predstavlja nesmetano spontano podmlađivanje, što jasno ukazuje na prioritet prirodnog obnavljanja u ovim šumama. Sečom „umerenog i odmerenog“ intenziteta u odnosu na sadašnje stanje šuma obezbediće se dugoročno princip trajnosti proizvodnje i prinosa, uz to podržavajući stalnost i ravnomernost izdani vode s obzirom da je ovo područje aktivno vodoizvorište pitke vode za obližnje naseljeno mesto.