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SUSTAINABLE FORESTRY **ODRŽIVO ŠUMARSTVO**
COLLECTION OF PAPERS 85-86, 2022 ZBORNIK RADOVA 85-86, 2022

DOI: 10.5937/SustFor2285157M
Original scientific paper

CHARACTERISTICS OF STRUCTURE AND PRODUCTION IN *VINATOVAČA* VIRGIN FOREST

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Abstract: *The paper presents the results of the research conducted in the "Vinatovača" virgin forest in northeastern Serbia. The investigated stands belong to the complex of mesophilic beech forest types. These stands haven't had any management treatments carried out since 1957 when the virgin forest was placed under state protection as a strict natural reserve of beech with the character of a virgin forest. The results of this research were obtained by selecting homogeneous parts of the virgin forest and surveying sample plots established evenly over the entire surface of the virgin forest. Beech is the dominant tree species in all sample plots. Besides beech, there are individual specimens of maple, common ash, cherry, hornbeam, manna ash and Norway maple in the virgin forest area. The investigated stands have a structure typical of virgin forests with the highest number of trees found in the lowest diameter degrees. The investigated stands have a similar volume as other beech virgin forests in Serbia. The obtained value of the stand volume indicates the high production potential of beech forests in northeastern Serbia*.

Key words: virgin forests, beech, northeastern Serbia, structure.

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STRUKTURNE I PROIZVODNE KARAKTERISTIKE PRAŠUME VINATOVAČA

Izvod: *U radu su predstavljeni rezultati istraživanja prašume „Vinatovača“ koja se nalazi u severoistočnoj Srbiji. Sastojine koje su predmet ovog istraživanja pripadaju kompleksu mezofilnih bukovih tipova šuma. U predmetnim sastojinama ne sprovode se nikakavi gazdinski tretmani još od 1957. godine, kada je prašuma stavljena pod zastitu države kao strogi prirodni rezervat bukve prašumskog karaktera. Rezultati ovog rada nastali su na osnovu, izdvajanja homogenih delova prašume a zatim i premera stacioniranih oglednih polja postavljenih ravnomerno na čitavoj površini prašume. Na svim primernim površinama bukva je dominantna vrsta drveta, pored bukve na području prašume stablimično javljaju se još javor, beli jasen, trešnja, grab, crni jasen i mleč. Struktura istraživanih sastojina odgovara tipičnoj strukturi za šume prašumskog karaktera pri čemu je najveći broj stabala skoncentrisan u najslabijim debljinskim stepenima. Vrednosti zapremine u istraživanim sastojinama su približne zapremini ostalih prašuma bukve na teritoriji Srbije, ovakva vrednost zapremine sastojina ukazuje na visoki proizvodni potencijal bukovih šuma na području severoistočne Srbije.*

Ključne reči: prašuma, bukva, severoistočna Srbija, struktura.

1. INTRODUCTION

Virgin forests are completely natural ecosystems undisturbed by human activity. They are under the strictest protection regime, which besides logging, forbids any human interference in the natural flows of the living and non-living world. Not only is it forbidden to extract any natural resources from these forests, but the human footprint is also undesirable. They serve primarily for scientific and research purposes. The strict protection regime doesn’t apply only to living and dead trees but to the whole living and non-living world.

Untouched nature can give us answers to many questions about forest growth and development. Virgin forests reveal the laws by which forest stands grow and regenerate. There, we can learn that forest stands are nature's eternal attempt to adapt the living to the dead space. They have an inherent dynamism with stand images changing before our very eyes. There are no indications of a permanent balance between the dead and living parts of nature (Mlinšek, 1968).

The virgin forest is an undisturbed primeval natural ecosystem that develops according to its specific laws that have not been fully studied yet. That is why research conducted in virgin forest stands is of great importance both for fundamental science and practical disciplines of forestry (Bucalo et al., 2008).

The research conducted in intact ecosystems has an important role in determining site potentials. Given the state of our forests, intact ecosystems can only be found in nature reserves (Stamenković et al., 1988).

The site and stand conditions affect the growth of stand trees with varying intensity. Precisely, different courses in the growth of individual trees in a stand contribute to the differentiation of trees in terms of thickness, height and other structural elements and thus produce a specific stand structure.

Everything that has been said above emphasises the importance of studying virgin forests. They give us deeper insight into natural flows and facilitate decision-making in forest management. Our research deals with a virgin forest of the most common tree species in the growing stock of Serbia, which gives it additional value.

In the Balkans, beech virgin forests were mostly studied from the thirties to the seventies of the twentieth century (Miletić, 1930; Milin, 1954; Drinić, 1957).

2. STUDY AREA, MATERIAL AND METHODS

The research was conducted in the "Vinatovača" General Nature Reserve (Figure 1) in northeastern Serbia. It is situated on the north-facing slopes of the Kučaj Mountains in the Resava Gorge (Upper Resava). No feeling has ever been conducted in the virgin forest, nor has the natural forest ecosystem been disturbed in any way. The reserve is located between 19° 22' and 19° 30' east longitude and 44° 02' and 44° 05' north latitude. It is managed by the "Srbijašume" State Enterprise, "Južni Kučaj" Despotovac Forest Estate, Despotovac Forest Administration. According to the spatial division of forests (Special Forest Management Plan for 2015-2024), this nature reserve is located in MU "Vinatovača-Vrtačelje", compartment 22 (sections b and c) and compartment 23 (sections a and b). The total area of the reserve is 37.43 ha. The terrain is of a gorge type. The lower part of the slope (sections 22b and 23a) at 640-800 m above sea level has a uniformly steep slope of 26-35°, while the upper part of the slope (sections 22c and 23b) at 800-870 m above sea level has a very steep slope of 35-47°. Practically the entire stand faces the northeast.

To study the production characteristics of the virgin forest, its homogeneous parts were first selected. The forest was then divided into two parts – the lower part that is less steep and grows in deep and fresh soil over chlorite-sericite shales and the upper one with steep terrain and shallow soil over limestone.

The investigated stands can be classified into the group of the montane beech forest (*Fagetum moesiacae montanum*) on different brown soils, with the lower wide part located on medium to deep, and the upper narrow part of the virgin forest on shallow soil. We established 14 sample plots in the lower (wide) part and two sample plots in the upper (narrow) part of the virgin forest, evenly distributed over the entire surface area (Figure 2). All sample plots were circular and 10 a in size.

Cross diameter at breast height and the total height of all trees whose diameter was above 10 cm were measured in all sample plots.

Besides measuring forest estimation elements, we collected descriptive attributes that characterised the investigated stands.

The method of constructing tree volume tables was used to calculate the volume. The current volume increment was determined by the percentage increment method since we could not extract cores in a virgin forest. Different functions were tested to model the height curve, and the final model was selected based on statistical parameters of regression and correlation analysis and the degree of coincidence between weighted and empirical data. Data were processed using Microsoft Excel and Statgraphics.

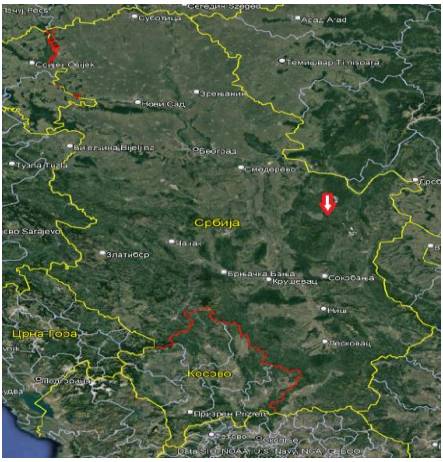


Figure 1. *Location of Vinatovača*

Figure 2. *Layout of sample plots*

3. RESEARCH RESULTS AND DISCUSSION

Considering that there were significant differences between the lower and the upper part of the virgin forest, the two parts were separated in the field, and the results are presented accordingly. Table 1 shows the values of the main forest estimation elements for the lower part named Sample Plot 1 (SP 1) and the upper part named Sample Plot 2 (SP 2). It should also be noted that all other species recorded in the virgin forest were classified in the category of other hardwoods (ohw) due to their small number.

Table 1. *Forest estimation elements*

Area	Number of trees			Basal area			Volume			Volume increment		
	N/ha			G (m^2/ha)			V (m^3/ha)			Iv (m^3/ha)		
	beech	ohw	total	beech	ohw	total	beech	ohw	total	beech	ohw	total
SP 1	224	2	226	35.0	0.9	35.9	628.1	1.7	629.8	9.25	0.15	9.4
SP 2	420	40	460	30.3	4.2	34.5	340.4	16.6	357.0	6.38	0.2	6.58

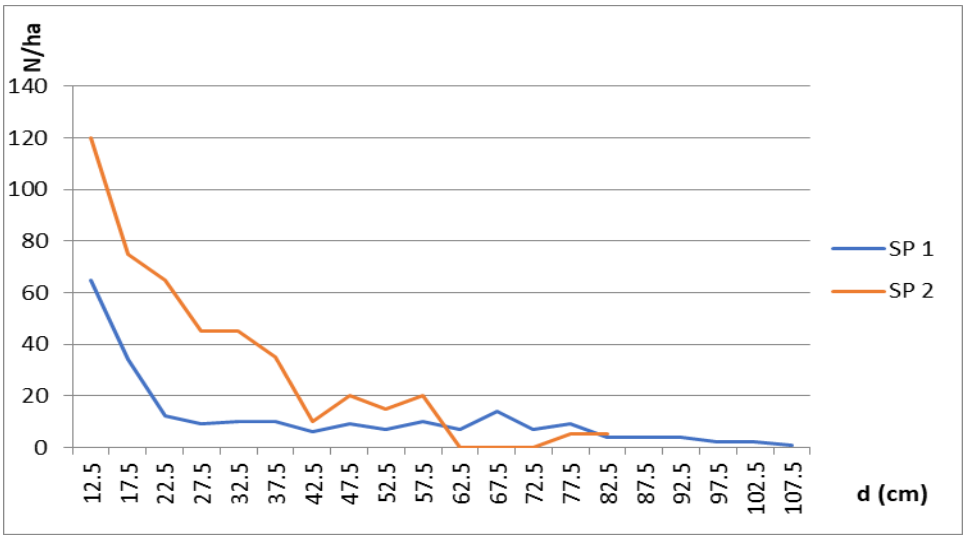
The data in the table above prove that there were significant differences between the upper and lower parts of the virgin forest and that it was necessary to divide them into two units. Extreme site conditions resulted in a greater number of tree species in the upper part of the virgin forests, where, besides beech, there were Norway maple, common ash, sycamore maple, manna ash, hornbeam and cherry, while the lower part of the virgin forests registered only hornbeam besides beech. Looking at the total volume values, it is evident that the upper part of the virgin forests had a smaller volume than that typical of virgin forests, while the lower part had a volume similar to other virgin forests in Serbia. If we compare the values of the forest estimation elements given for the lower part of the virgin forest with the results of earlier research, it is evident that this stand has a slightly higher number of trees compared to the number of trees in the virgin forests of “Danilova Kosa”, “Kukavica” and “Busovata” (Ostojić et al., 2008) and smaller compared to the “Felješana” and “Golema Reka” virgin forests. It is interesting to compare the

results of the research conducted in "Vinatovača" in 2008 (Ostojić et al., 2008) and today. The number of trees per hectare was 177 back then, and the volume amounted to 709 m^3/ha. Today, the number of trees is slightly higher but the volume is smaller. The basal area of the investigated stands is also lower than the basal area obtained in previous studies conducted in other beech virgin forests in Europe, one of them being "Dobra" in lower Austria with a basal area of 39.7 m^2/ha (Mayer & Reimoser 1978). Looking at the volume of the investigated stand and the volume obtained by previously conducted research in beech virgin forests in Serbia, we can conclude that, as was the case with the number of trees, the researched stand has a medium volume per hectare. The achieved volume increment values in the investigated stands can be explained in two ways. Namely, the lower part of the virgin forest has high volume increment values, although still lower than some economically managed stands. As shown in the research conducted in beech stands, the volume increment of these stands in the area of Kukavica amounted to 10.7 m^3/ha and 10.49 m^3/ha in East Boranja (Čokeša et al., 2008). The reason may be a high number of large-diameter trees that have long passed their culmination period. On the other hand, the volume increment values in the upper part of the virgin forest once again indicate the extreme site conditions that prevail there.

3.1. Diameter structure

The number of trees is the structural element that we first determine when we measure the diameter at breast height of all trees above the measurement limit. The number of trees varies, above all, with the silvicultural form, developmental phase, tree species, site quality class, biological and silvicultural measures provided by the management system, and other biotic and abiotic factors.

More precisely, as the investigated stands are virgin forests, the number of trees directly depends on the site quality class and the development phase of the virgin forest.

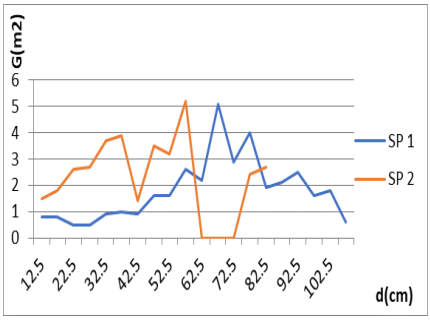


Graph 1. *Diameter structure*

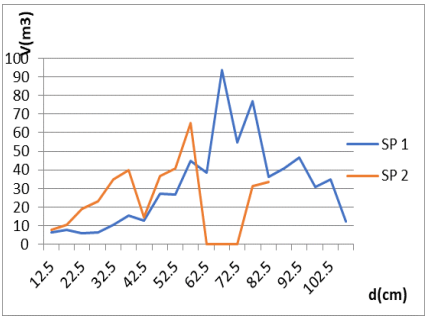
Looking at Graph 1, we see that in the lower part of the stand, the highest number of trees, or 45% of the total number of trees are in the first two diameter degrees. The diameter degrees of 22.5-77.5 cm have approximately the same number of trees, except for the 67.5 cm degree, which has a slightly larger number of trees, i.e., 6% of the total number. From the diameter degree of 82.5 cm to 107.5 cm, the number of trees decreases, and only 8% of the total number of trees can be found in these degrees. As for the upper part of the virgin forest, the largest number of trees are in the smallest-diameter degrees, which indicates that this part of the virgin forest is mostly in the initial phases of development. However, we should have a bit broader view of this. The largest number of trees in smaller-diameter degrees does not result only from natural regeneration, but from extreme site conditions too. Consequently, some diameter degrees (62.5-72.5) have no trees due to the conditions in which trees reached their maximum and died. In contrast, only about 10% of the total number of trees are found in this diameter degree in the lower part of the virgin forest. There are only individual trees in the highest diameter degrees in the upper part of the virgin forest. Most of them are in poor health.

Similar results were obtained in the study of tree diameter distribution in the virgin forests of Eastern, Central and Southern Europe by other authors (Meyer et al. 2003, Commarmot et al. 2005, Drössler & Lüpke 2007, Bilek et al. 2011, Kucbel et al. 2012)

3.2. Basal area and volume structures in investigated stands



Graph 2. *Basal area structure*



Graph 3. *Volume structure*

Looking at the graphs presenting the structure of the basal area and volume (Graphs 2 and 3), it is evident that in the lower part of the virgin forest, the trees that make up most of the basal area and the volume are in the diameter classes of 67.5 and 77.5 cm, which is correlated with the greater number of trees in these diameter degrees. We can also see that the investigated stand is all-aged. It is important to note that this state has resulted primarily from the spontaneous development of the stand and the presence of different development phases in it. Regarding the upper part of the virgin forest, the data on the structure of the basal area and the volume are correlated with the greater number of trees in the diameter degree of 57.5.

3.3. Diameter and height of mean and dominant tree per basal area

Since the field data collection included the measurement of the height of all trees in the sample plots, it was necessary to produce height curves for the investigated stands and flatten them by diameter degrees to make a more detailed analysis. When generating the height curves, statistical parameters were taken into account. Hence, function 1, with a correlation coefficient of R=0.89, was used for the lower part of the stand, and function 2, where the correlation coefficient was R=0.87, for the upper part of the virgin forest.

$$H = d^2 / (1.407183 + 0.1472828 * d)^2 \quad (1)$$

$$H = d^2 / (1.380326 + 0.177082 * d)^2 \quad (2)$$

Table 2. *Mean* d_g *and dominant tree diameter* $d_{g\,max}$ *per basal area*

Sample plot	Tree species	d_g (cm)	$d_{g\,max}$ (cm)
SP 1	Beech	45.1	54.6
SP 2	Beech	31.4	79.4

The values of the mean and dominant tree diameter per basal area indicate different stand conditions and different productivity of the sites in the upper and lower parts of the virgin forest. Comparing these values with the values of the

mean tree diameter per basal area produced by the research carried out in the area of the virgin forests "Danilova Kosa" where dg was 61.1 cm and "Kukavica" with a dg of 50.2 cm (Matović et al., 2018), it is obvious that these stands have slightly smaller values of the mean stand diameter per basal area. On the other hand, they are higher than the values of the mean stand diameter per basal area in the beech virgin forests of the northwestern Carpathians, where it was 42.5 cm in the "Badin" virgin forest and 43.2 cm in the "Rožok" virgin forest (Kucbel et al., 2012).

Table 3. *Vrednosti visina srednjeg* h_g *i dominantnog stabla po temeljnici* $h_{g\,max}$

Sample plot	Tree species	h_g (m)	$h_{g\,max}$ (m)
SP 1	Beech	31.4	36.7
SP 2	Beech	20.5	24.4

The values of the mean and dominant tree height per basal area confirm the diversity of site conditions in the investigated virgin forest. If we compare these values with the values produced by previous research, it is evident that they are slightly lower than that measured in the "Danilova Kosa" virgin forest, where it was 39.2 m, and "Kukavica" 32.3 m (Matović et al., 2018).

4. CONCLUSIONS

The results of earlier research on the number of trees and the total volume indicate that more trees are in the "initial phase" of development in the total area of the virgin forest today than 15 years ago. We presume that at that time, there were more large trees in the maturity and decline phases and they died in the meantime.

The diameter structure of the investigated stand corresponds to the diameter structure of typical virgin forests. The structure of the basal area and the volume, as well as the values of the mean and dominant tree diameter and height per basal area in the lower part (SP 1) and the upper part (SP 2) of the virgin forest, call for further study of the entire area of the virgin forest, which was not the case before. Namely, earlier research obviously covered only the lower, more productive part of the virgin forest, while this research deals with the upper, more extreme and from the aspect of production less attractive part of the virgin forest

Based on the above, it is evident that the investigated virgin forest is in different development phases, which is reflected in its structure. In other words, the highest number of trees in the first two degrees, and slightly lower values of the diameter and height of the mean and dominant tree per basal area indicate the strong presence of the initial phase. An even number of trees in the highest number of diameter degrees also indicates the frequent presence of the optimal phase, and a slightly smaller number of trees in the strongest diameter degrees indicates a smaller presence of the aging phase.

Acknowledgments: *This study was realised within the Agreement on the realisation and financing of scientific research work of NIO in 2022, which is financed by the Ministry of Education, Science and Technological Development of the Republic of Serbia, no. 451-03-68/2022-14/200027*

REFERENCES

Bilek, L., J. Remes, D. Zahradnik, 2011: Managed vs. unmanaged. Structure of beech forest stands (Fagus sylvatica L.) after 50 years of development, Central Bohemia. Forest Systems 20(1): 122-138.
Bucalo, V., Brujić, J., Travar, J., Milanović, Đ. (2008): Flora prašumskog rezervata Lom. Faculty of Forestry, University of Banja Luka.

Drinić, P. (1957): Taksacioni elementi bukovih sastojina prašumskog tipa u Donjoj Drinjači [Structural elements of European beech virgin stands in Donja Drinjača]. Papers of the Faculty of Agriculture and Forestry 2: 105-140. [In Serbian].

Drössler, L., B.V. Lüpke, 2007: Bestandesstruktur, Verjüngung und Standortfaktoren in zwei Buchenurwald-Reservaten der Slowakei [Stand structure, regeneration and site conditions in two virgin beech forest reserves in Slovakia]. Allgemeine Forst und Jagdzeitung 178 (7/8): 121-135. [In German]

Commarmot, B., H. Bachofen, Y. Bundziak, A. Burgi, B. Ramp, Y. Shparyk, D. Sukhariuk, R. Viter, A. Zingg, 2005: Structure of virgin and managed beech forests in Uholka (Ukraine) and Sihlwald (Switzerland): a comparative study. Forest Snow and Landscape Research 79: 45–56.

Matovic B., Koprivica M., Kisin B., Stojanovic D., Kneginic I., Stjepanovic S. (2018) Usporedba strukture sastojina gospodarenih I prašumskih bukovih šuma Srbije. Šumarski list 1-2 2018, Croatian Forestry Society pp. 47-57).

Mayer, H., F. Reimoser., 1978: Die Auswirkungen des Ulmensterbens im Buchen-Naturwaldreservat Dobra (Niederösterreichisches Waldviertel) [Effects of elm disease in the beech virgin forest of Dobra]. Forstwissenschaftliches Centralblatt 97 (1): 314-321. [In German]

Meyer. P., V. Tabaku, B. von Lüpke, 2003: Die Struktur albanischer Rotbuchen-Urwälder-Ableitungen für eine naturnahe Buchenwirtschaft [Structural Characteristics of Albanian Beech (Fagus sylvatica L.) Virgin Forests – Deductions for Semi-Natural Forestry]. Forstwissenschaftliches Centralblatt 122: 47-58.
[In German].

Miletić, Ž. (1930): Istraživanja o strukturi bukovih sastojina karaktera prašume [Research of structure of virgin European beech stands]. Šumarski list 54 (1): 2-9.

Mlinšek, D. (1968): Slobodna tehnika gajenja šuma na osnovu nege. Yugoslav Agricultural and Forestry Center - Belgrade.

Milin, Ž. (1954): Istraživanje elemenata strukture u bukovoj sastojini karaktera prašume u Južnom Kučaju [Research of structure of virgin European beech stand at Južni Kučaj]. Bulletin of the Faculty of Forestry 7: 37-72. [In Serbian].

Stamenković, V. (1974): Prirast i proizvodnost stabala i Šumskih sastojina. Student Publishing and Information Center (ICS) – Belgrade.

Kucbel, S., M. Saniga, P. Jaloviar, J. Vencurik, 2012: Stand structure and temporal variability in old-growth beech-dominated forests of the northwestern Carpathians: A 40-years perspective. Forest Ecology and Management 264: 125–133.

Ostojić D., Jovanović B., Kisin, B. (2008): Beech Virgin Reserves in Serbia, Proceedings Congress of Ecologists of the Republic of Macedonia with International Participation, 06-0 9.10.200 7, Struga. Special issues of Macedonian Ecological Society, Vol. 8, Skopje.

Čokeša V., Koprivica M., Stajić S., Miletić Z., Matović B., (2012) Natural regeneration of beech forests in Serbia., Sustainable Forestry, vol 65-66: 27-39, Institute of Forestry, Belgrade.

CHARACTERISTICS OF STRUCTURE AND PRODUCTION IN *VINATOVAČA* VIRGIN FOREST

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Summary

This paper studies the characteristics of the structure and production in the "Vinatovača" virgin forest in northeastern Serbia.

The investigated stands belong to the beech mesophilic forest complex and a group of ecological units (ecological types) – montane beech forest (*Fagetum moesiacae montanum*) on different brown soils. Regarding its function, the forest is a strict nature reserve.

The total number of trees in the investigated stands ranges from 224 to 420 trees per ha, with beech being dominant in all parts of the stands. The mean volume of the investigated stands in the lower part of the virgin forest is 629.8 m^3/ha, while it is 357.0 m^3/ha in the upper part of the virgin forest. The share of other tree species in the total volume is below 10%, with a significantly higher number of trees registered in the upper part of the virgin forest. The volume increment in the investigated stands ranges from 6.58 m^3/ha to 9.25 m^3/ha. The volume of the investigated stands, especially in the lower part of the virgin forest, is significantly larger than the volume of the surrounding stands where regular management is carried out.

The forest estimation parameters obtained through this research indicate the stability of the investigated virgin forest. Compared to data from other beech virgin forests in Serbia, they have somewhat lower values, but this is due to the different stages of development in the investigated and other beech virgin forests in Serbia. This statement was also confirmed by the results of research studies carried out in Europe, according to which forest estimation parameters also fluctuate from one virgin forest to another. On the other hand, the typical virgin forest structure indicates its stability.

The part of northeastern Serbia where the virgin forest of this research is located is known as a special site refugium for beech, both in pure or mixed stands. The investigated stand certainly provides guidelines on how and what to do in adjacent stands that are regularly managed by implementing the necessary silvicultural measures. In order to conduct deeper analyses that will provide specific guidelines for managing beech forests based on natural processes that occur in virgin forests, it is necessary to carry out more detailed research, especially with reference to the processes of natural reproduction and regeneration of these forests.

STRUKTURNE I PROIZVODNE KARAKTERISTIKE PRAŠUME VINATOVACA

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Rezime

U radu su proučavane strukturne i proizvodne karakteristke prašume „Vinatovača“ u severoeistočnoj Srbiji.

Istraživane sastojine pripadaju kompleksu bukovih mezofilnih šuma, grupi ekoloških jedinica (ekoloških tipova) – planinska šuma bukve (*Fagetum moesiacae montanum)*) na različitim smeđim zemljištima. Osnovna funkcija ove šume je strogi rezervat prirode.

Ukupan broj stabala u istraživanim sastojinama se kreće od 224 do 420 stabala po ha, pri čemu je bukva dominantno zastupljena u svim delovima sastojina. Prosečna zapremina istraživanih sastojina u donjem delu prašume iznosi 629,8 m^3/ha, a gornjem delu prašume 357,0 m^3/ha sa učešćem drugih vrsta drveća u ukupnoj zapremini ispod 10%, s tim da je u gornjem delu prašume registrovan znatno veći broj vrsta šumskog drveća. Zapreminski prirast u istraživanim sastojinama kreće se od 6,58 m^3/ha do 9,25 m^3/ha. Zapremina istraživanih sastojina posebno donjeg dela prašume je znatno veća od zapremine okolnih sastojina u kojima se sprovodi redovno gazdovanje .

Taksacioni pokazatelji dobijeni ovim istraživanjem ukazuju na stablinost predmetne prašume i u poređenju sa podacima iz drugih prašuma bukve na teritoriji Srbije imaju nešto niže vrednosti ali to je posledica prisustva različitih faza razvoja u predmetnoj i drugim prašumama bukve u Srbiji. Potvrda ove konstatacije nalazi se u rezultatima sprovedenih istraživanja na području Evrope gde je takođe, evidentno određeno osciliranje taksacionih pokazatelja od jedne do druge prašume, ali s druge strane struktura koja je karakteristična prašumama ukazuje na njenu stabilnost.

Deo severostočne Srbije gde se i nalazi prašuma obuhvaćena ovim istraživanjem predstavlja poseban stanišni refugijum za bukvu, bilo da se radi o čistim ili mešovitim sastojinama. Istraživana sastojina svakakao mora biti pokazatelj kako i šta raditi u sastojinama koje se nalaze u okolini a sa kojima se pritom redovno gazduje sprovođenjem neophodnih uzgojnih mera. Za potrebe dubljih analiza i davanje određenih smernica za gazdovanje bukovim sumama utemeljenih na prirodnim procesima koji se dešavaju u prašumama neophodno je vršiti još detaljnih istraživanja posebno sa osvrtom na tokove podmlađivanja i obnove ovih šuma.