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FLORISTIC COMPOSITION AND ECOLOGICAL ANALYSIS OF THE MIXED FORESTS (BEECH, FIR, SPRUCE) IN THE MANAGEMENT UNIT „BJELASICA“ (BJELASICA Mt, MONTENEGRO)

SUMMARY

Paper dealing with characteristics of the fir and beech association (*Abieti-Fagetum moesiaca* B. Jov. 1976.) and beech, fir and spruce association (*Piceo-Fago-Abietetum* Čol. 1965) on the territory of the management unit „Bjelasica“ (Mt Bjelasica, Montenegro). A total of 45 phytocoenological relevés were analysed, 34 for association *Abieti-Fagetum moesiaca* B. Jov. 1976. and 11 for association *Piceo-Abieti-Fagetum* Čol. 1965. In the beech and fir association significantly more plant species (60) were found compared to the association of beech, fir and spruce (30). Spectrums of life forms and areal types were made for these associations. In the fir and beech association, in spectrum of life forms phanerophytes are dominant (37.28%), followed with hemicryptophytes (35.59%) and geophytes (23.73%). In the second association hemicryptophytes are dominant with 40%, while phanerophytes constitute 36.67%, and geophytes 20%. Within the spectrum of *Abieti-Fagetum moesiaca* areal types the most common is Euro-Asian areal type (33.33%), followed by Holarctic (18.33%) and central-European (16.66%). Within the spectrum of *Piceo-Fago-Abietetum* Čol. 1965 areal types the most frequent are central-European and Holarctic with 21.87% both, but large percent is constituted of Euro-Asian areal type (18.75%).

Keywords: forest plant community, mixed forests, Bjelasica, Montenegro

INTRODUCTION

According to the First national forests inventory of Montenegro (MARD, 2013) fir and beech associations constitute 6.1% of the surface area covered with the forest or 11.8% of the total wood volume. Forests of fir, spruce and beech constitute 4.7% of the surface area or 10.7% of the total wood volume. Annual volume increment of these forests is from 9.6% (fir and beech forests) till 10.3% (fir, spruce and beech forests). Aforementioned forests have great economic value, but they are also significant regarding their ecological aspect.

On the most part of former Yugoslavia forest association *Abieti-Fagetum* s. l. is well noticeable and it represents one of the first associations in Europe that

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was distinguished and analysed in details (Horvat, 1938). These forests construct climate-regional altitudinal belt within the range of 700/800 to 1700/1800 m altitude. Fir and beech forests on Dinarides represent the most stabile forest type that retains all important natural characteristics in spite of the external influences (Stefanović and Beus, 1991).

Piceo-Fago-Abietetum Čol. 1965 is specific three-dominant association, with equal involvement of all three edificators in natural conditions, and with very different relations in the forests that are managed during the longer period of time. This association is limited at the altitudinal belt (1000-1550 m a.s.l.) where beech and fir achieve optimal growth in height and thickness, but it can descend below at wetter and sheltered places. Historically, it is older forest type compared with beech, beech-fir and spruce-fir forest types; it is closer to the ancestral deciduous-conifer type of forest that was been characteristic for the most part of the mountainous refugium belt from Plješevica to the Rodopi (Horvat, 1950; Jovanović, 1967; Mišić, 1982).

Investigations in mixed forests of fir and beech, and fir, spruce and beech were provided on several localities in Montenegro, only, mostly on Ljubišnja Mt, inside the Biogradska Gora National Park (Čurović and Medarević, 2011; Čurović *et al.*, 2011; Čurović *et al.*, 2012, Čurović *et al.*, 2013) and in the vicinity of Rožaje town (Martinović and Markišić, 2002). This research has included soil and phytocoenological studies, as well as structural, developmental and production characteristics of mixed forests. Investigations of biological and horological spectrums were not been provided, in spite that they are significant indicators of ecological conditions at some locality. Beside the phytocoenological characteristics of mixed forests in management unit "Bjelasica", analyses of those spectrums were done in our paper, with goal to expand the knowledge about these associations. Particularly interesting are data about forest communities of beech, fir and spruce, because investigated area is near to the southern border of distribution of this community and under certain maritime impact (Čurović *et al.*, 2013).

MATERIAL AND METHODS

The investigation of the forests community was carried out during the summers 2014. and 2015. In total, 45 phytocoenological relevés were taken, 34 in association *Abieti-Fagetum moesiaceae* B. Jov. 1976 and 11 in association *Piceo-Abieti-Fagetum* Čol. 1965. Dimensions of all phytocoenological relevés are 5x20 m (100m²). Methodology of phytocoenological studies followed Braun-Blanquet (1964). Phytocoenological relevés are grouped in the table where floristic composition of floors for each association is presented, and the degree of presence is given for each plant species. Identification of collected material was done according to Domac (1994), Pignatti (1982) and Tutin *et al.* (1964-80, 1993), and the nomenclature is in accordance with Euro+Med (2006). Life form classification is performed according to Raunkier, elaborated and updated by Ellenberg and Mueller-Dombois (1967). The categorisation of taxa to floral

element is determined by Meusel et al. (1965, 1978, and 1992) and Pignatti (1982), while grouping of floral elements in areal types is performed according to the plant-geographical classification of Stevanović (1992).

Meaning of used acronyms is given in alphabetical order: Central European (CEUR), Central European Mediterranean (CEMED), Central European mountainous (CEM), Central South European mountainous (CSEM), Euro-Asian (EAZ), Holarctic (HOL), Cosmopolitan (KOSM), Mediterranean-Sub-Mediterranean (MED-SUBMED), Mediterranean Pontic (MED PONT), South European mountainous monttainous (SEM). Presentation of horological and biological spectrum includes species cover, not only their presence in phytocoenological relevés. Syntaxonomic names follow Tomić and Rakonjac (2013).

Study area

Investigation was carried out on the Bjelasica Mt, on their northern slopes, in management unit „Bjelasica“. Surface area of this unit is 9205 ha, while the surface area of the forests and forestland is 5248.4 ha, and the natural tall forests cover 82% of them.



Figure 1. The position of investigated area.

The geological base and hydrology had significant influence during the process of relief forming. The geological groundwork is very heterogeneous, at higher altitudes the carbonate-silicate base prevails, while at the lower altitudes shale and sandstones predominate (Fuštić and Đuretić, 2000). The management unit is rich in water flows and springs with steep channels cut deep into the

ground. The ridges, in north-south direction, lay between the water flows. Steep slopes are predominating in the management unit, and 53% of the surface area covered with the forest are on the moderately steep terrains (11-20°) and 43% are on the steep terrains (21-30°). Terrain exposure to the north (N, NE and NW) constitutes 77% of the surface. The elevation of the lowest point in the management unit is 585 m a.s.l., and the highest elevation where the forest outreaches is 1850 m a.s.l.

The climate of the area is continental-mountainous perhumid, with long and cold winters and relatively short and coldish summers. The average annual temperature is 8.6°C, according to the meteorological station in Bijelo Polje (560 m altitude), average annual precipitation is 922 l/m² and the relative humidity is 78%.

RESULTS AND DISCUSSION

The results content floral diversity and structure, spectrums of life forms and spectrums of areal types for fir and beech (*Abieti-Fagetum moesiaca* B. Jov. 1976.) and fir, spruce and beech associations (*Piceo-Abieti-Fagetum* Čol. 1965).

Floristic composition and structure

In the community *Abieti-Fagetum moesiaca* B.Jov. 1976 ten species are recorded in the tree floor, from which only edificators have high level of permanence, while other taxa are sporadically noted. The shrub floor with 19 species is floristically richer, but only youth of edificators have high level of permanence, what was also noted on some other distributional areas of the association (Cvjetičanin and Novaković, 2010; Eremija et al., 2015). In the floor of herbaceous plants 58 species were recorded, and among them, except edificators, the remark level of presence possess *Galium sylvaticum*, *Pteridium aquilinum*, *Lamium galobdolon* and *Rubus ideus*.

All floors of association *Piceo-Abieti-Fagetum* Čol. 1965 are floristically poorer compared with afore mentioned association. But, we must take in mind that the second association covers lesser surface area within the management unit, resulting in fewer number of made phytocoenological relevés during the investigation. The tree floor contents 6 species, while the shrub floor, beside edificators, contents only *Corylus avelana*, presented in small number of relevés. In the tree floor, besides edificators, the high permanence possesses a pioneer species *Betula pendula*. The flora of a ground-floor consists of 31 species, and the greatest permanence possesses *Viola sylvestris* and *Luzula forstei*, along with young specimens of beech and fir. High permanence is shown by youth of pioneer species *Populus tremula*, and this, along with high representing of *Betula pendula* in the tree floor, indicates a certain degree of forest degradation. Forests of spruce, fir and beech in the management unit "Bjelasica" are floristically poorer in all floors, compared to the forests with the same edificators on the mountain Lisina (Bosnia and Herzegovina) and Pešter plateau (Serbia) (Eremija et al., 2015).

Table 1. Floors coverage in associations

	<i>Abieti-Fagetum moesiaca</i> B.Jov. 1976	<i>Piceo-Abieti-Fagetum</i> Čol. 1965.
Tree layer	0,75	0,82
Shrub layer	0,46	0,5
Herb layer	0,38	0,33

The floors coverage in associations is presented in table 1. The coverage is somewhat greater in floors of trees and shrubs in the community *Piceo-Abieti-Fagetum* Čol. 1965, while in the community of beech and fir the coverage is greater in the flora of the ground-floor.

Table 2. Phytocenological data

	Life form	Areal types	<i>Abieti-Fagetum moesiaca</i>	<i>Piceo-Abieti-Fagetum</i>
Number of relevés			34	11
Species			I layer	
<i>Abies alba</i> Mill.	P scap	SEM	V	V
<i>Fagus moesiaca</i> (K. Maly) Czech.	P scap	CEUR	V	V
<i>Picea abies</i> (L.) Karst	P scap	EAZ		V
<i>Betula pendula</i> Roth.	P scap	EAZ	II	IV
<i>Ostrya carpinifolia</i> Scop.,	P scap	MED-SUBMED	I	I
<i>Populus tremula</i> L.	P scap	EAZ	I	
<i>Acer pseudoplatanus</i> L.	P scap	CEMED	I	
<i>Pinus nigra</i> Arnold	P scap	CSEM	I	
<i>Quercus petraea</i> (Matt.) Lieblein	P scap	CEMED	I	
<i>Salix caprea</i> L.	P caesp	EAZi	I	
<i>Pyrus pyrastra</i> Burgsd.	P scap	EAZ	I	
<i>Fraxinus excelsior</i> L.	P scap	CEUR		I
			II 2 layer	
<i>Abies alba</i> Mill.	P scap	CEM	V	III
<i>Fagus moesiaca</i> (K. Maly) Czech.	P scap	CEUR	V	V
<i>Picea abies</i> (L.) Karst	P scap	EAZ	I	V
<i>Corylus avellana</i> L.	P caesp	EAZ	I	I
<i>Betula pendula</i> Roth.	P scap	EAZ	I	
<i>Populus tremula</i> L.	P scap	EAZ	I	
<i>Acer pseudoplatanus</i> L.	P scap	CEMED	I	
<i>Fraxinus excelsior</i> L.	P scap	CEUR	I	

<i>Pinus nigra</i> Arnold	P scap	CSEM	I	
<i>Ostrya carpinifolia</i> Scop.	P scap	MED-SUBMED	I	
<i>Quercus petraea</i> (Matt.) Lieblein	P scap	CEMED	I	
<i>Salix caprea</i> L.	P caesp	EAZ	I	
<i>Pyrus pyraister</i> Burgsd.	P scap	EAZ	I	
<i>Juniperus communis</i> L.	P caesp	HOL	I	
<i>Crataegus oxyacantha</i> L.	P caesp	EAZ	I	
<i>Alnus incana</i> (L.) Moench.	P caesp	HOL	I	
<i>Sambucus nigra</i> L.	P caesp	EAZ	I	
<i>Rosa canina</i> L.	NP caesp	EAZ	I	
<i>Prunus avium</i> L.	P scap	EAZ	I	
			III layer	
<i>Fagus moesiaca</i> (K. Maly) Czech.	P scap	CEUR	V	V
<i>Abies alba</i> Mill.	P scap	CEM	IV	IV
<i>Galium sylvaticum</i> L.	H scap	CEUR	IV	II
<i>Pteridium aquilinum</i> (L.) Kuhn	G rhiz	KOSM	III	II
<i>Lamium galeobdolon</i> (L.) Crantz	H scap	CEUR	III	III
<i>Rubus idaeus</i> L.	NP rept	HOL	III	I
<i>Viola silvestris</i> Lam.	H scap	CEMED	II	V
<i>Luzula forsteri</i> (Sm.) DC	H caesp	HOL	II	V
<i>Rubus fruticosus</i> L.	NP rept	MED-SUBMED	II	II
<i>Oxalis acetosella</i> L.	G rhiz	HOL	II	I
<i>Aremonia agrimonioides</i> (L.) DC	H ros	CSEM	II	I
<i>Galium rotundifolium</i> L.	H scap	CEUR	II	I
<i>Picea abies</i> (L.) Karst	P scap	EAZ	I	III
<i>Betula pendula</i> Roth.	P scap	EAZ	I	I
<i>Populus tremula</i> L.	P scap	EAZ	I	III
<i>Acer pseudoplatanus</i> L.	P scap	CEMED	I	III
<i>Quercus cerris</i> L.	P scap	MED PONT	I	II
<i>Pinus nigra</i> Arnold	P scap	CSEM	I	I
<i>Vaccinium myrtillus</i> L.	Ch frut	HOL	I	I
<i>Fragaria vesca</i> L.	H semiros rept	HOL	I	I
<i>Dentaria bulbifera</i> L.	G rhiz	EAZ	I	I
<i>Prenanthes purpurea</i> L.	H scap	CEUR	I	I
<i>Luzula luzuloides</i> (Lamk.) Dandy&Wilmot	H caesp	EAZ	I	I

<i>Anemone apennina</i> L.	G rhiz	MED-SUBMED	I	I
<i>Euphorbium amygdaloides</i> L.	H scap	EAZ	I	I
<i>Epilobium angustifolium</i> L.	H scap	HOL	I	I
<i>Driopteris filix-mas</i> (L.) Schott.	G rhiz	HOL	I	I
<i>Sorbus austriaca</i> L.	P caesp	CSEM	I	I
<i>Hepatica triloba</i> Gilib.	G rhiz	CEUR	I	I
<i>Daphne blagayana</i> Freyer		SEM	I	I
<i>Fraxinus excelsior</i> L.	P scap	CEUR	I	
<i>Quercus petraea</i> (Matt.) Lieblein	P scap	CSEM	I	
<i>Crataegus oxyacantha</i> L.	P caesp	EAZ	I	
<i>Sambucus nigra</i> L.	P caesp	EAZ	I	
<i>Corylus avellana</i> L.	P caesp	EAZ	I	
<i>Rosa canina</i> L.	NP caesp	EAZ	I	
<i>Driopteris dilatata</i> (Hoffm.) A. Gray	G rhiz	HOL	I	
<i>Luzula sylvatica</i> (Huds.) Gaudin	H caesp	SEM	I	
<i>Galium odoratum</i> (L.) Scop.	G rhiz	CEUR	I	
<i>Anemone nemorosa</i> L.	G rhiz	HOL	I	
<i>Juniperus communis</i> L.	P caesp	HOL	I	
<i>Veronica urticifolia</i> Jacq.	H scap	CSEM	I	
<i>Allium ursinum</i> (L.) Moench.	G bulb	CEUR	I	
<i>Epilobium montanum</i> L.	H scap	EAZ	I	
<i>Polystichum aculeatum</i> (L.) Roth	G rhiz	EAZ	I	
<i>Mycelis muralis</i> (L.) Dum.	H scap	EAZ	I	
<i>Sanicula europaea</i> L.	H scap	EAZ	I	
<i>Hypericum maculatum</i> Crantz	H scap	CEUR	I	
<i>Festuca drymeia</i> Mert.& Koch	G rhiz		I	
<i>Senecium nemorensis</i> L.	H scap		I	
<i>Sorbus aucuparia</i> L.	P caesp	CSEM	I	
<i>Asarum europaeum</i> L.	Ch rept	EAZ	I	
<i>Mercurialis perennis</i> L.	G rhiz	CEMED	I	
<i>Nardus stricta</i> L.	H caesp	EAZ	I	
<i>Ajuga reptans</i> L.	H rept	CEMED	I	
<i>Neottia nidus-avis</i> (L.) L.C.Rich.	G rhiz	EAZ	I	
<i>Pulmonaria officinalis</i> L.	H scap	CEUR	I	
<i>Saxifraga rotundifolia</i> L.	H scap	CSEM		I

Spectra of life forms

The biological spectrum of beech-fir forest has phanerophyte-hemicryptophyte character, whereby the domination of phanerophyte is insignificant (table 3, graph 1). Significant participation of geophytes indicates to the mesophilic character of this association. Considering that the life form of chamaephyta is well adapted to the unfavourable ecological conditions and that it dominates in the opening habitats, no wonder is its low percentage participation in the spectrum of life forms of *Abieti-Fagetum moesiaca*e association.

Table 3: Spectra of life forms in the associations *Abieti-Fagetum moesiaca*e B. Jov. 1976 and *Piceo-Fago-Abietetum* Čol.1965.

Life forms	<i>Abieti-Fagetum moesiaca</i> e		<i>Piceo-Fago-Abietetum</i>	
	%	Number of species	%	Number of species
<i>Phanerophyta</i> (P)	37,28	22	36,67	11
<i>Hemicryptophyta</i> (H)	35,59	21	40,00	12
<i>Geophyta</i> (G)	23,73	14	20,00	6
<i>Chamaephyta</i> (Ch)	3,39	2	3,33	1

Biological spectrum of beech, fir and spruce community is similar as afore mentioned, the difference is in somewhat greater participation of hemicryptophytes in compare to the phanerophytes (table 3, figure 3). Terophytes did not mention in any of associations, and they are rare elements in these woods, they are typical representations of open and warm habitats.

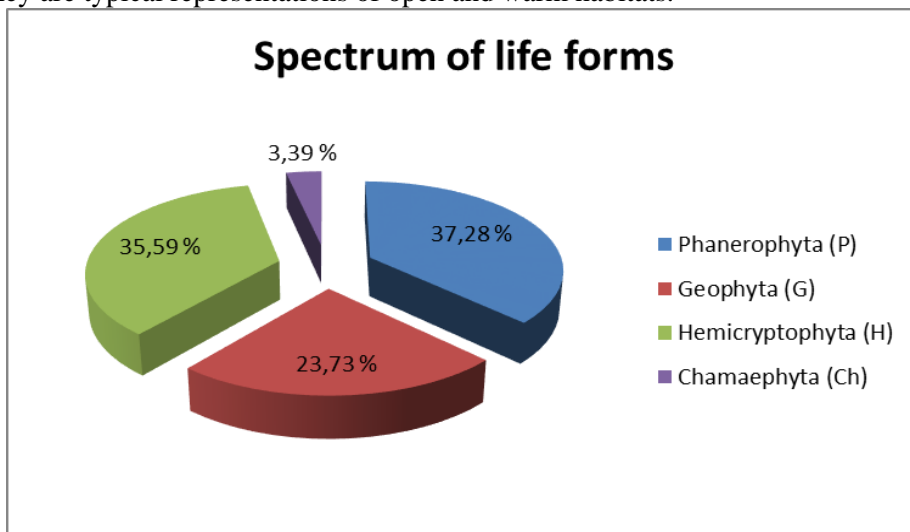


Figure 2. Spectrum of life forms in the association *Abieti-Fagetum moesiaca*e B. Jov. 1976.

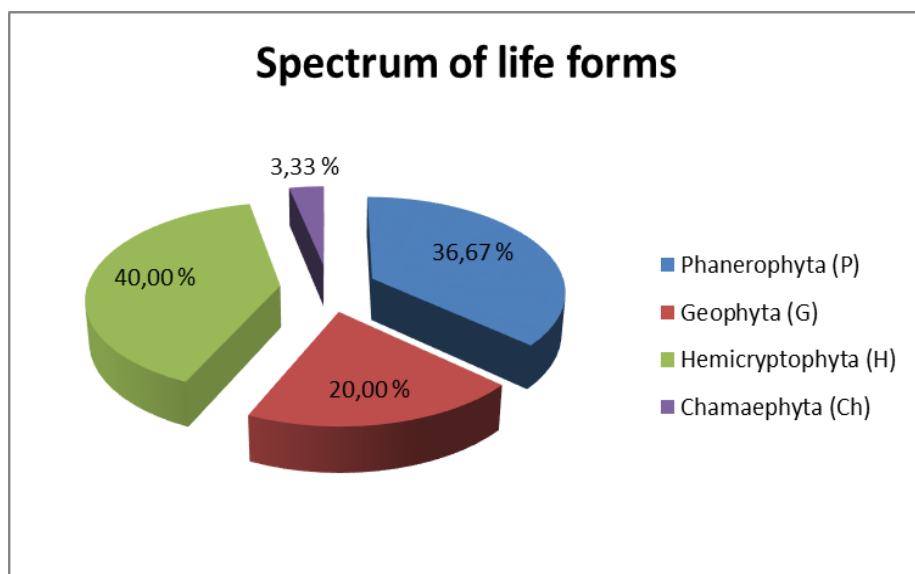


Figure 3. Spectrum of life forms in the association *Piceo-Fago-Abietetum* Čol.1965.

Spectrum of areal types

In the chorological spectrum of community *Abieti-Fagetum moesiaca* B.Jov. 1976 (graph 3) the most represented is Euro-Asian areal type with 33.33%, with mostly eurivalent species with large areale. It is followed by Holarctic areal type with 18.33%, that also containing the species with large areale, and Central-European with 16.66%. The species which areal is mostly Central-European with moderate climate, with smaller part of population that can be spread in the Mediterranean-sub-Mediterranean area, are presented with 8.33% in chorological spectrum (CEMED). Areal types with species that have the most part of their areal on mountainous belts in Central and/or in Southern Europe are presented with 6.66% (CSEM) and 3.33% (CEM). Participation of Mediterranean-sub-Mediterranean areal type is 5%, while cosmopolitan and Mediterranean-Pontic is represented with 1.67% each.

Regarding to the community *Piceo-Fago-Abietetum* Čol. 1965. in the spectrum of areal types (Graph 4), the most represented areal types are: Central European (CEUR) and Holarctic (HOL) with 21.87% each, large percentage has Euro-Asian (EAS), but with remarkably lesser representing compared to the previous community. In mixed community of fir, spruce and beech following areal types are also represented: Mediterranean-sub-Mediterranean (MED-SUBMED) with three species which consist 9.37%, Central-European-Mediterranean (CEMED) with 6.25%, Central-European Mountainous (CEM), Cosmopolitan (KOSM) and Mediterranean-Pontic (MED PONT) with 3.12% each.

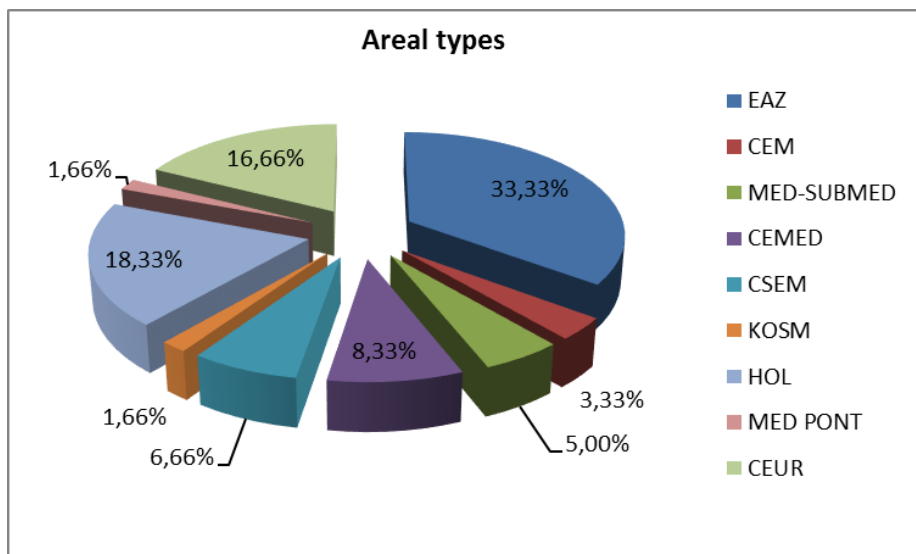


Figure 4. Spectrum of areal types in the association *Abieti-Fagetum moesiacaе* B. Jov. 1976.

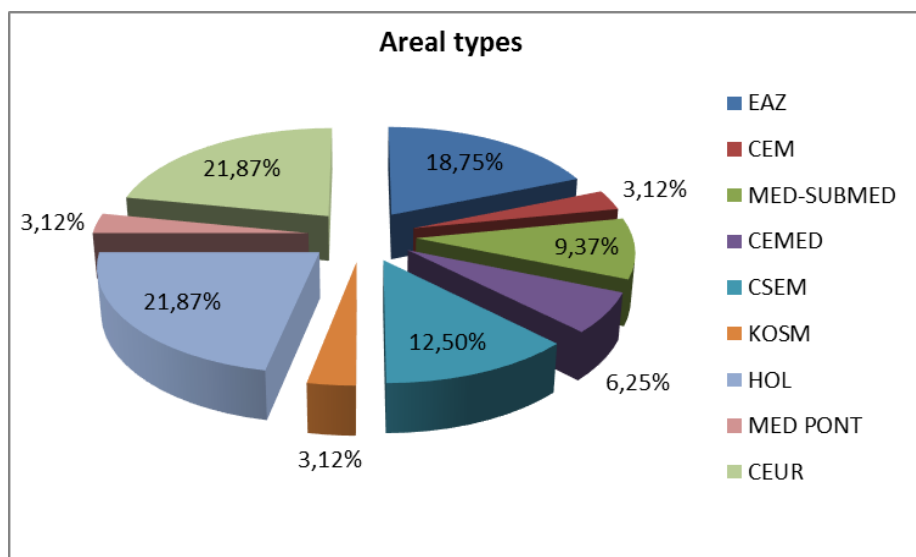


Figure 5. Spectrum of areal types in the association *Piceo-Fago-Abietetum* Čol. 1965.

Horvat (1950) considered that the belt of beech-spruce forests is refugial, because it has smallest changes in compare with other mountainous belts. This belt is situated between warm and dry oak belt, which was markedly changed during the post glaciation (mostly in kserophitisation) and cold and dry sub-Alpine belt, which rapidly changed during the glaciation and cold periods of post glaciation. Beech-spruce belt continuously had the most favourable conditions

for survival, and had conserve large number of species and their cenotic groups during the most critical moments in post tertiary history of our flora and vegetation (Janković, 1984).

Association *Abieti-Fagetum moesiaca* B.Jov. 1976 constitutes climate-regional altitude belt in span from 700/800 to 1700/1800 m a.s.l. across the former Yugoslavia (Jovanović, 1959). In Serbia it is developed as powerful climate-regional belt and covers large areas in different orograph, edaphic and microclimatic conditions, extending in different ranges of altitude on different mountainous belts: on Goč Mt 800-1200 m a.s.l. (Jovanović, 1959; Tomića and Cvjetičanin, 1991; Tomić and Jović, 2000), on Kopaonik Mt 1200-1550 m a.s.l. (Mišić and Popović, 1954), on Stara planina Mt 1200-1600 m a.s.l. (Mišić et al., 1978).

In Montenegro beech-fir forests are developed in the central and southern part of the country, where they constitute belt till 600 m wide (Petrović et al., 2012). They are mentioned on Mediterranean Dinarides, also, where they cover small surface areas, only at northern expositions (Komar, 1995). Regardless to the great economic and ecological importance, systematically investigations of this kind of woods did not provided, and detailed data about its distribution were given only for several mountainous ranges. On a silicate massif of central Bjelasica they extend between 950-1400 m a.s.l. on the northern expositions, while on the southern expositions they form narrower belt between 1200-1550 m a.s.l. On the carbonate massif of north-eastern Bjelasica they cover altitude range 950-1150 m a.s.l. on northern expositions, and 1100 – 1400 m a.s.l. on the southern expositions (Lakušić et al., 1990). On a vertical profile of mountains around Rožaje this type of forest is mostly extended above the belt of beech forest, while on some localities it constitutes first forest belt (Martinović and Markišić, 2002).

Association *Abieti-Fagetum moesiaca* B.Jov. in the management unit „Bjelasica“ is extended in wide range of altitudes, from 800 to 1650 m a.s.l. It covers northern expositions, mostly, that are dominant in the management unit otherwise. Its bedrock is diverse, at higher altitudes it is on the limestone, and on the lower altitudes on the sandstone and shale. The most common lands where this community is developed are brown ground on the limestone, acid and acid-brown grounds.

Mixed deciduous-coniferous community of beech, fir and spruce *Piceo-Fago-Abietetum* Čol. 1965. for a long time was considered as a sub-association of beech-fir association, but opinion that it is separate association prevailed (Mišić and Jovanović, 1983). According to the domination of two edificators (beech and fir), floral content and altitude belt this community is closer to the beech-fir type of wood compared to the spruce type. This community is limited at the altitude belt (1000-1550 m a.s.l.) (Jovanović, 1980).

In the management unit „Bjelasica“ association *Piceo-Fago-Abietetum* Čol. 1965., as well as association *Abieti-Fagetum moesiaca* B.Jov. 1976, dominantly covers northern expositions. It is spread in the belt from 900 to 1700

m a.s.l., resulting in no significant differences within the range of altitudes where associations are present. Due to the northern expositions that are dominates on the investigated area (77% of surface) and higher humidity as result of several water flows, this association can be spread down at the lower altitudes than usually. The spruce is preserved at lower altitudes (below its belt) thanks to the protection provides from fir and beech. Fir determinates lower and upper limits of this wood by its altitudinal and ecological range. Numbered investigations show that the fir has conspicuous individual and group variability, and in spite of limitation on a particular mountain belt, it inhabits ecologically different habitats with tendency to climb in higher, sub-Alpine regions (Fukarek, 1954, Mišić and Popović 1954, Stefanović, 1970, Jovanović, 1980, Mišić and Jovanović, 1983).

Considering that analyses of biological and horological spectrums of before mentioned forests are not provided in Montenegro, we compare obtained results with spectrums of these forests in Bosnia and Herzegovina (Lisina Mt) and Serbia (Pešter plateau) (Eremija *et al.*, 2015). The great similarity is noticed in the spectrum of life forms between forests of the management unit “Bjelasica” and Lisina Mountain. On both localities hemicryptophytes are dominant and represented with approximately equal percentage (Bjelasica 40%, Lisina 41%), they are followed by phanerophytes that are somewhat numbered on Bjelasica (Bjelasica 36.67%, Lisina 31%) and geophytes with equal representation (20% each). In the biological spectrum of Pešter plateau the order of life forms is the same, but hemicryptophytes significantly dominate (54%) in compare with phanerophytes (21%) and geophytes (14%). So, although the management unit „Bjelasica“ is near to the southern distributional border of communities of beech, fir and spruce, the influence of Mediterranean on biological spectrum is not prominent, because the spectrum is very similar to the same on Lisina, which is located more northern. This indicates that edificators have strong influence on the microclimate conditions in the community, thus on the biological spectrum, also. Similarly conditions are in the horological spectrum in which, on Bjelasica and Lisina Mt, the species group of Central-European floral elements are dominant, and Holarctic floral elements and species of broad ecological amplitude of the Euro-Asian distribution type have high participation.

CONCLUSIONS

In the management unit „Bjelasica“ analysed associations of mixed deciduous-conifer forests *Abieti-Fagetum moesiace* B.Jov. 1976 and *Piceo-Fago-Abietetum* Čol. 1965 dominantly cover northern expositions. Their altitude range of extend is similar: first association from 800 to 1650 m a.s.l., and second from 900 to 1700 m a.s.l. Beech and fir community is floristically richer (60 species) in compare with the beech, fir and spruce community (30 species).

The biological spectrum of the beech-fir forest has phanerophytical-hemicryptophytical character, whereby the domination of phanerophytes is insignificant, while in the biological spectrum of second community hemicryptophytes are represented in slightly higher percentage in compare with

phanerophyte. In both communities geophytes have significant participation, hamephytes are represented in small percentage and terophytes are absent.

In the horological spectrum of community *Abieti-Fagetum moesiaca* B.Jov. 1976 Euro-Asian areal type is most represented with 33.33%, followed by Holarctic with 18.33% and Central-European areal type with 16.66%. In the spectrum of areal types of *Piceo-Fago-Abietetum* association Čol. 1965 the most represented areal types are: Central European and Holarctic with 21.87% each, Euro-Asian areal type constitutes large percentage (18.75%), but with noticeably lower representing in compare with previous community. Although the management unit „Bjelasica“ is near to the southern distributional border of communities of beech, fir and spruce, the analysis of biological and horological spectrum did not shown significant influence of Mediterranean.

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