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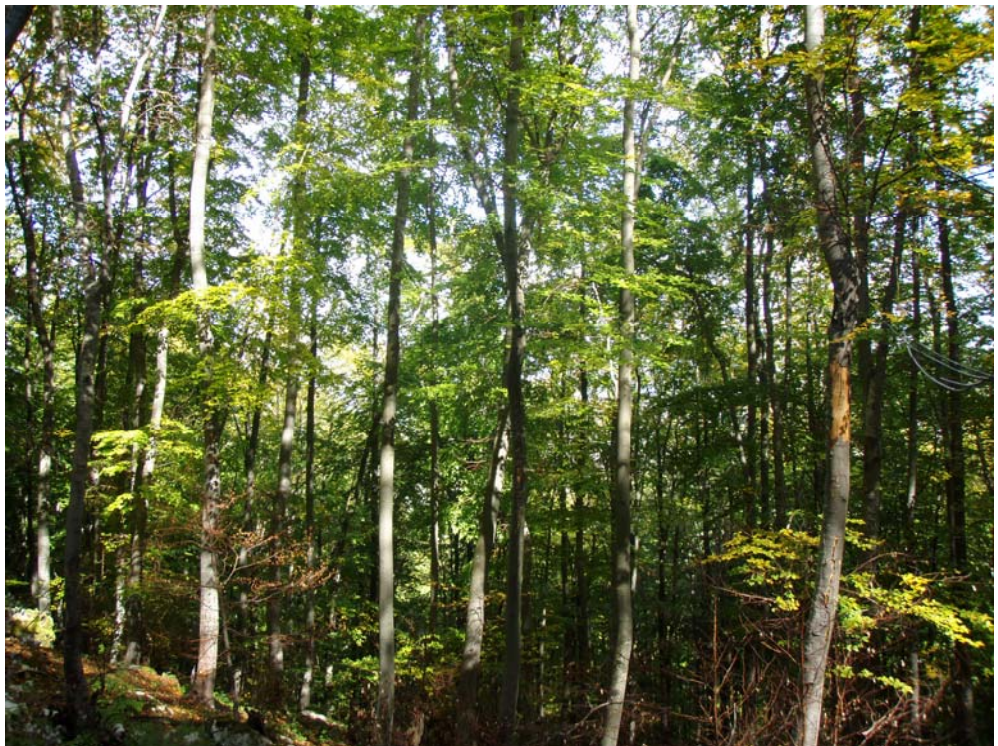


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SUSTAINABLE FORESTRY ODRŽIVO ŠUMARSTVO

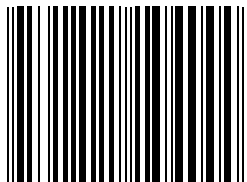
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**THE ASSOCIATIONS OF MARSH BLACK ALDER FORESTS IN
SOUTHWESTERN SERBIA – ALLIANCE *ALNION GLUTINOSAE*
(MALK. 29) MEIJER DREES 1936**

*Ljubinko RAKONJAC¹, Mihailo RATKNIĆ¹, Milorad VESELINOVIĆ¹,
Aleksandar LUČIĆ¹, Vladan POPOVIĆ²*

Abstract: *This paper presents the research results of the marsh black alder forests in Southwestern Serbia, i.e. in Pester Plateau, in which these associations are located. The site conditions in which these forests grow, parent rock, the soil characteristics and basic assumptions on the climate parameters necessary for the survival of these forests are presented. Two associations from this alliance were researched: black alder forest with tufted hairgrass and black alder forest with wood avens on the neogene sediments. The floristic composition, biological spectrum and spectrum of the floral elements are presented.*

Key words: black alder, Southwestern Serbia, tufted hairgrass, wood aven, pseudogley.

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ZAJEDNICE MOČVARNIH ŠUMA CRNE JOVE U JUGOZAPADNOJ SRBIJI – SVEZA *ALNION GLUTINOSAE* (MALK. 29) MEIJER DREES 1936

Izvod: U radu su prikazani rezultati istraživanja močvarnih šuma crne jove u jugozapadnoj Srbiji, odnosno na Peštarskoj visoravni, gde se i nalaze ove zajednice. Prikazani su uslovi staništa u kojima se nalaze ove šume, geološka podloga, karakteristike zemljišta i osnovne postavke o klimatskim parametrima neophodnim za opstanak ovih šuma. Istražene su dve asocijacije iz ove sveze: šuma crne jove sa visokim busom i šuma crne jove sa zečjom stopom na neogenim sedimentima. Prikazan je floristički sastav, biološki spektar i spektar flornih elemenata.

Ključne reči: crna jova, jugozapadna Srbija, visoki bus, zečja stopa, pseudoglej.

1. INTRODUCTION

The black alder occupies the lower warm oak altitudinal range near the brooks and rivers, or in the vicinity of the stagnant water. In Pester Plateau the black and grey alder forests account for 400 ha, and are located at the altitudes from 1,000 to 1,200 meters. Jovanovic, B. et al. (1997) considers such a great complex to be very interesting, and it is mainly covered by black alder forests. The fact that its wide sites appear at extremely high altitudes, i.e. in the oroclimatogenic altitudinal range of beech, fir, spruce and little-leaf deciduous trees (*Alnus incana*, *Betula pubescens*, *Betula pendula*, *Populus tremula*, *Sorbus aucuparia*, *Salix* sp.) needs to be explained. It can be safely assumed that black alder spread to these altitudes in the post glacial climatic optimum, i.e. in the Atlantic period. According to Fukarek (1969), black alder appears at the altitudes above 1,000 meters, only in the narrow zone in the vicinity of Perucica brook. In Serbia only one black alder association with spruce in Mitrovac, located at the altitudes from 1,065 m to 1,082 m, the association *Omorikae-Piceeto-Alnetum glutinosae* Col. et Gig. (Colic, Gigov, 1958) (quoted by Jovanovic, B. et al, 1983), was studied in a great detail.

2. IMPORTANCE AND AIM OF THE RESEARCH

The research is important because it is aimed at the study of the condition of these forests the site conditions of which are peculiar, and they greatly differ from the conditions in which black alder forms the natural stands at other sites. The researches should provide the base for the special forest

management treatment, which should be different from the previous ones. It is necessary to single out the whole complex of these forests in the Pester Plateau and subject to the special protection regime, as the protected natural area, because of its peculiarities and in the aim of the its preservation.

3. METHOD OF WORK

For the determination of the **soil characteristics** in the forest associations the sufficient number of the pedological profiles, in the places where the phytocoenological records were taken, was analyzed. The soil types were determined based on the soil classification (Skoric, Filipovski, Ciric, 1985). The soil characteristics of the sites on which this association appears were researched, but on the soils with such characteristics other black or grey alder associations occur as well, and they are the subject of other papers. The table with the soil characteristics of the whole locality was presented in the previous papers, which treat the forest vegetation of Stavljanska breza site.

For the determination of the characteristics of the soil samples the following laboratory methods were used:

- Mechanical composition of the soil was determined by the international Pipet B method, and the texture classes of fine soil by Fere's triangle;
- Sum of the absorbed base cations and hydrolytic acidity were determined by Kapenn's method, and the acidity of the soil which is water-soluble by KCL electrometrical method as well;
- Content of the total humus was determined by Tjurin's method;
- Content of the total nitrogen was determined by macro-Kjeldahl method;
- Available forms of phosphorous and potassium in the soil were determined by Al-method.

The **recent forest vegetation** was studied based on the principles and methods of the French-Swiss school of Braun-Blanquet (B r a u n - B l a n q u e t , J., 1928, 1921), which is typical and generally accepted in the phytocoenological researches in this country.

The starting point for the study of the vegetation was the collection of the phytocoenological records, which included the basic characteristics of the sites, floristical content, composition and site conditions. The initial researches were conducted in 1997, and the detailed studied in 2007, by which the results of the previous ones were confirmed.

4. RESULTS OF THE RESEARCH

The marsh associations of black alder in Mt. Tara and Pester Plateau, along with the partial floristical similarity, mainly differ in the site genesis, and particularly by the site conditions, soil, parent rock, and climate. The associations in Mt. Tara have the relict character. The association *Deschampsio-Alnetum glutinosae* in Stavlјanska breza is the association of the primary character, which differs (Jovanovic et al. 1983), by the origin, ecological conditions and floristical composition, from the previously described similar black alder associations. The very name of this site is also peculiar. Undoubtedly, it refers to the double named toponym (Jovanovic, B. et al., 1983), which has been explained above. The very name reminds to the fact that in this place the birch forests were present, and were destroyed by man. The association *Geo-Alnetum glutinosae montanum* occupies the greatest area of this complex of alder forests. This phenomenon in Pester was explained by Jovanovic, B. et al., 1983, according to Sinicin (1967), who claimed that black alder forests spread to the highest altitudes in the climatic optimum, i.e. in the Atlantic stadium. The subsequent fluctuations in the climate was not unfavourable to such a great extent to prevent the survival of the black alder in the relatively cold mountain climate in the vicinity of Sjenica. They report that the current black alder site was separated from the conifers (spruce, Scots pine) by the secondary succession and little-leaf deciduous trees (*Alnus incana*, *Betula pubescens*, *Populus tremula*, *Salix* sp.) when they retreated due to the climate change.

These researches proved that the results of the previous studies of the association in this area, which implied that the highest percentage of this area is covered by pseudogley, whereas the smaller micro-depressions near the brooks are covered by marsh-gley soil.

The higher quantity of precipitation, which is typical for the humid areas, is in this place compensated by the long presence of the snow (most frequently it lasts for 96 days), as well as by the small intensity of evaporation, due to the severe, cold and long winter and extremely low temperatures typical for other months. The long presence of snow and the gradual melting of it is the precondition for the relatively long and humid pedoclimate. This fact, in the combination with the above factors, was crucial for the wide spread of the pseudogley in the conditions of the mountain, relatively dry climate (Jovanovic et al., 1983).

4.1 Black alder forests with tufted hairgrass on the neogene sediments **Ass. *Deschampsio-Alnetum glutinosae montanum* Jov. et. Vuk. 1983**

The stands of this association are located along the basins and brooks on the flat or gently-inclined terrains of the northern and eastern exposures, at the altitudes from 1,000 to 1,050 m (Jovanovic, B. et al., 1983).

In regard to the floristical composition, this association is considerably poorer than the other alder forests. It is the result of the constant, multi-annual grazing, which started as early as in the first spring days and of the real attack of the cattle on the living world of the sites on which this association appears. In the tree layer the black alder is dominant, whereas the shrub layer is poorer, due to the fact that it is used by the rural population for the construction of fences and other purposes. In the shrub layer along with the black alder the following species were registered: *Rhamnus frangula*, *Viburnum opulus* and *Corylus avellana*.

In the ground flora layer the influence of the following species was registered: *Ranunculus repens*, *Lysimachia nummularia*, *Oxalis acetosella*, *Solanum dulcamara*, *Lycopus europaeus*, *Deschampsia caespitosa*, *Poa palustris*, *Glyceria plicata*, *Agrostis alba*, *Carex leporina*, *Filipendula ulmaria*, *Athyrium filix-femina*, etc.

According to Jovanovic, B. et. Al., the soil covered by this association is the marsh -gley character, with the profile composition At-Gso-Gr, which is for a long or short time over-damped by the complementary water (ground, lateral). In the profile of these soils, which are up to 1m deep, most frequently three zones can be singled out. In the deeper part of the profile, below 30 cm, which is constantly saturated with water, the processes of reduction are dominant and the typical reduced-gley horizon (Gr), which is bluish and of the heavy mechanical composition, is formed.

4.2 Association of black alder with wood aven on the neogene sediments **Ass. *Geo-Alnetum glutinosae montanum* Jov. et. Vuk. 1983**

The association of black alder with wood aven *Geo-Alnetum glutinosae montanum* in this area was described by Jovanovic et al. (Jovanovic, B. et al., 1983), on the Stavljanska breza site. The occurrence of the hybrid alder, the intermediate form between white and black alder (*Alnus hybrida*), points to intermediate character of this association between two associations of alders, marsh and alluvial (*Alnion glutinosae* and *Alnion glutinosae-incanae*).

4.2.1 Range, position in the research area and site conditions

The stands of the association *Geo-Alnetum glutinosae montanum* occupy the greatest area of Stavljanska breza site. They are located at the plateaus above the right bank of Vapa river, in the east to Stavlje. These terrains are gently sloped, with the gentle crests and curves, which have steep slopes only in the vicinity of the little brooks. Their current condition is somewhat more favourable than in the period when it was reported by Krstic (1956), which is the result of the greater protection, as well as of the decrease in the rural population, which devastated these forests. Between the groves of these forests the rural pastures are located, and abandoned rural fields are located on the slopes.

The forests of this association are located between the forest gaps and the areas which are turned into the meadows aimed at grazing. The black alder mainly appear in the smaller group and mounds. This association occupies flattened position and gentle slopes, at the south exposures. In regard to the altitudinal zone, it is located at the altitudes from 1,050 to 1,150 meters (Jovanovic, B. et al.). The records were taken at the altitudes from 1,050 to 1,100 meters, at the western and south-southeastern exposures. The terrain inclination on which the observed stands are located ranges from 5 to 10°. The parent rock on this terrain also refers to the neogene sediments: gravel-sands and clays. The clay is most frequently found in the layer up to 1.5 meters. Above this layer the neogene sediments of the different origin and composition, which participated in the formation of the soil, and with the lighter texture, are deposited.

The pseudogley on this site is of the lighter mechanical composition with the profile composition E/g-g-C. These pseudogleys are from 80 to 90 cm deep, up to the gravel-sand layer. In regard to the texture characteristics, A horizons are the sandy clay, and loam, and the low g horizon is clay. A horizon is not so potent; from 0 to 8 cm deep, whereas the very potent A3/g up to 70 cm layer appears, with the rust stains, which are the result of the oxidation-reduction processes. In regard to the acidity, the soils are acidified, and pH in water ranges from 4.3 to 4.9, and in KCl the pH value ranges from 3.3 to 3.9. The soil is very rich in nitrogen, whereas it is poor in humus. In addition, the quantities of the available forms of phosphorous is low, whereas there is the moderate potassium availability.

4.2.2 Floristical composition and structure

The floristical composition and structure is presented in the phytocoenological table 1. The phytocoenological table contains 73 plant species: 2 tree species, 6 shrub species and 65 species which occur in the layer

of the ground flora. In the layer of the ground flora the ferns and moss do not appear, but only the angiosperms. Some phytocoenological records contain from 42 to 61 species, which means 50 species in average. Undoubtedly, if it were not for the constant impact of the grazing on these sites, more forest species which occur in the alder forests, and, less meadow species would be present in the association. In this association the ground flora occurs only between the rows of trees. This layer is every year under the great influence of the grazing and subject to the permanent destruction. The smaller number of the species managed to survive and they as a rule do not finish their annual development cycle. In this regard, its current layer cannot be treated as suitable under such conditions, but as the degradation phase which is the result of the permanent grazing.

Life form spectrum – biological spectrum

The biological spectrum of the association is presented in the Table 1. The site on which the association of black alder and wood aven is not extreme, but the adverse effect of the felling and grazing did not significantly eliminated species of some life forms. The high percentage of the hemicryptophytes (71%) – the species which are well-adapted to the winter coldness and which are in winter protected by the snow, that is abundant in this area. There are significantly lower percentage of the other life forms. The low percentage of phanerophytes (9%) is the result of the extremely low percentage of nanophanerophytes. It can be said that the percentage of geophytes is low (4%), given the characteristics of the soil which is very humid for most part of the year, but the percentage of it is significantly lower than the percentage of the grey and black alder on this site, due to the drier soil conditions and more degraded stands. The chamephytes account for 4%, and all the representatives of herbaceous chamephytes are reported. There is a significant percentage of terophytes/ chamephytes, as well as terophyte-chamephyte species, i.e. 4%, as a result of the stands with the open canopies.

Table 1. *Spectrum of the life forms of the plants in the association Geo-Alnetum glutinosae montanum Jov. et. Vuk. 1983*

Life forms							
Phanero- phytes	Nanophane- rophytes	Woody chamephytes	Herbaceous chamephytes	Chemicy- ptophyte	Geophytes	Terophytes	Terophytes/ chamephytes
P	np	dc	zc	h	g	t	th
6%	3%	0%	4%	71%	4%	7%	4%
9%		4%					

Spectrum of the floral elements

The spectrum of the floral elements of this association is presented in the Table 2.

Table 2. *The spectrum of the floral elements of the association Geo-Alnetum glutinosae montanum Jov. et. Vuk. 1983*

THE GROUP OF THE FLORAL ELEMENTS	Number of plants	Percentage		Floral elements	Number of plants
FLORAL ELEMENTS OF THE NORTHERN REGIONS	1	2%	2%	Boreal	1
MID-EUROPEAN	15	33%	33%	Mid-European	2
				Sub-Mid-European	12
				Alpine-Carpathian	1
Sub-Mediterranean					
East-Sub-Mediterranean	1	2%	4%	East-Sub-Mediterranean	1
Balkan and Balkan-Apennine	1	2%		Sub-Illyrian	1
PONTIC-CENTRAL-ASIAN			4%		
Pontic	2	4%		Sub-Pontic	1
				Pontic-Pannonian	1
EURO-ASIAN FLORAL ELEMENTS	18	39%	39%	Sub-South-Siberian	2
				Euro-Asian	10
				Sub-Euro-Asian	6
CIRCUMPOLAR AND COSMOPOLITES	8	17%	17%	Circumpolar	6
				Cosmopolitan	2
TOTAL:	46	100%	100%	TOTAL:	46

It can be observed that in this association there are not many individual floral elements, which is the result of the very floristic poverty. In regard to the collective floral elements, the Euro-Asian floral elements is the greatest group in this association (39%), as the element of the contrastive climate. The high percentage of the Mid-European floral elements (33%), as well as the high percentage of the circumpolar elements (17%) point to the significant impact of the colder northern regions. The lower percentage of the Sub-Mediterranean (4%) and Pontic-Central-Asian floral elements (4%) also points to this fact.

The mesophilic plants (of Mid-European and Sub-Atlantic floral elements) account for 33%, the plants of the xerophilic character (Pontic, Sub-Mediterranean, Balkan floral elements, as well as the floral elements of the desert regions) account for 8%, whereas the plants of the wide ecological altitudinal range (Euro-Asian and cosmopolitan floral elements) account for as much as 39%. The frigidophilic plants (floral elements of the northern regions and circumpolar floral elements) account for 14%.

The following individual types of the altitudinal range are mainly represented by the plant species: Sub-Mid-European (12), Euro-Asian (10), Sub-Euro-Asian, and Circumpolar (6), whereas the other individual types of the

altitudinal range are represented by a very small number of species. It can be said that this association belongs to the Mid-European-Euro-Asian-Circumpolar type.

4.2.3 Layers

The black alder is the dominant species in the association *Geo-Alnetum glutinosae montanum* Jov. et. Vuk. 1983, whereas only the individual trees of grey alder are reported. There is a low canopy closure, and it ranges from 0.4 to 0.5. The average heights of the stands range from 8 to 9 m, and the average diameters from 12 to 15 cm. The stand condition is characterized by the mainly curved, underdeveloped trees, which are frequently rot. The dimensions of the trees are smaller than in the black alder and grey alder forests which appear on the slopes with the higher inclinations and on sheltered positions. Owing to the high vigour of coppices, the new black alder trees develop from the mounds from the lateral side, and the distance between the trees frequently ranges from 0.2 to 4 meters. Such condition of population size, canopy coverage and degree of alliance was marked with 4.4 or with 3.3.

In the second layer the following species are dominant: *Alnus glutinosa*, *Prunus spinosa*, *Crataegus monogyna*, *Evonymus europaeus*, whereas the following species are registered by one record: *Frangula alnus*, *Rosa agrestis* and *Juniperus communis*. In the layer of ground flora the great number of species occur in more records: *Oxalis acetosella*, *Ajuga reptans*, *Achillea millefolium*, *Alchemilla vulgaris*, *Bellis perennis*, *Cirsium acaule*, *Cynosurus cristatus*, *Festuca heterophylla*, *F. ovina*, *F. vallesiaca*, *Fragaria vesca*, *Geum urbanum*, *Leontodon autumnalis*, *Molinia coerulea*, *Plantago altissima*, *Poa annua*, *Potentilla reptans*, *P. erecta*, *Prunella vulgaris*, *Trifolium repens*. There is also a lower percentage of the following species: *Agrostis alba*, *Anthoxanthum odoratum*, *Carduus crispus*, *Cerastium glomeratum*, etc. The total of 24 species of ground flora are registered by one record.

The results of the previous researches (Jovanovic et al., 1983) showed that in the shrub layer the following species were dominant: *Rhamnus frangula*, *Crataegus monogyna*, *Juniperus communis*, *Corylus avellana*. In the layer of the herbaceous species the following species are dominant: *Lysimachia nummularia*, *Oxalis acetosella*, *Fragaria vesca*, *Ranunculus repens*, *Ajuga reptans*, *Geum urbanum*, *Nardus stricta*, *Potentilla erecta*. The following species which are typical for the black alder forests with the higher degree of canopy closure are not reported: *Deschampsia caespitosa*, *Poa palustris*, *Myosotis palustris*, *Caltha palustris*, *Galium palustre*. The absence of these species can be explained by the fact that these flattened terrains on which the association appears were subject to the more intensive felling by the population from the neighbouring areas, since they were more accessible to the tree felling

and extraction, which led to the creation of greater forest gaps and occurrence of the meadow plants. The authors state that based on the characteristics of the association and soil it can be safely assumed that some other types of forests used to be present. The black alder invaded the sites of some other deciduous-conifer forests.

5. CONCLUSION

1. The highest percentage of the marsh black alder forests in Southwestern Serbia appears on the pseudogley, whereas only the smaller micro-depressions are found near the brooks, on the marsh-gley soil. The higher quantity of precipitation, which is typical for the humid areas, is in this place compensated by the long presence of the snow as well as by the small intensity of evaporation.
2. The black alder forest with the tufted hairgrass on the neogene sediments ass. *Deschampsio-Alnetum glutinosae montanum* Jov. et. Vuk. 1983 occurs along the crests and brooks, on the flat or gently-inclined terrains of the north and east exposures, at the altitudes from 1,000 to 1,500 meters (Jovanovic, B. et al., 1983).
3. The stands of the association *Geo-Alnetum glutinosae* occupy the greatest area of the site Stavlјanska breza. The stands are located at the plateaus above the right bank of Vapa river. These terrains are gently sloped, with the gentle crests and curves, which have steep slopes only when they are in the vicinity of the little brooks. The forests of this association are located between the forest gaps and the areas which are turned into the meadows for the grazing. The black alder mainly appears in the smaller group and mounds.
4. The biological spectrum of the association *Geo-Alnetum glutinosae montanum* shows the high percentage of hemicryptophytes (71%) - the species which are well-adapted to the winter cold and which are in winter protected by the snow which is abundant in this area. There are significantly lower percentage of the other life forms.
5. The mesophilic plants account for 33%, the plants of the xerophilic character account for 8%, whereas the plants of the wide ecological altitudinal range (account for as much as 39%. The frigidophilic plants account for 14%.

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THE ASSOCIATIONS OF MARSH BLACK ALDER FORESTS IN SOUTHWESTERN SERBIA – ASSOCIATION *ALNION* *GLUTINOSAE* (MALK. 29) MEIJER DREES 1936

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Summary

The highest percentage of the marsh black alder forests in Southwestern Serbia is located on pseudogley, whereas only the smaller micro-depressions near the brooks are found on the marsh-gley soil. The higher quantity of precipitation, which is typical for the humid areas, is in this place compensated by the long presence of the snow, as well as by the small intensity of evaporation.

The black alder forest with the tufted hairgrass on the neogene sediments ass. *Deschampsio-Alnetum glutinosae montanum* Jov. et. Vuk. 1983 occurs along the crests and brooks, on the flat or gently-inclined terrains of the north and east exposures, at the altitudes from 1,000 to 1,500 meters (Jovanovic, B. et al., 1983).

The stands of the association *Geo-Alnetum glutinosae* occupy the greatest area of the site *Stavljanska breza*. The stands are located at the plateaus above the right bank

of Vapa river. These terrains are gently sloped, with the gentle crests and curves, which have steep slopes only when they are in the vicinity of the little brooks. The forests of this association are located between the forest gaps and the areas which are turned into the meadows for the purpose of grazing. The black alder mainly appears in the smaller group and mounds. The biological spectrum of the association *Geo-Alnetum glutinosae montanum* shows the high percentage of hemicryptophytes (71%) - the species which are well-adapted to the winter cold and which are in winter protected by the snow which is abundant in this area. There are significantly lower percentage of the other life forms.

The mesophilic plants account for 33%, the plants of the xerophilic character account for 8%, whereas the plants of the wide ecological altitudinal range (account for as much as 39%). The frigidophilic plants account for 14%.

ZAJEDNICE MOČVARNIH ŠUMA CRNE JOVE U JUGOZAPADNOJ SRBIJI *ALNION GLUTINOSAE* (MALK. 29) MEIJER DREES 1936

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Rezime

Najveći deo površina močvarnih šuma crne jove na području jugozapadne Srbije nalazi pod pseudoglejem, a samo manje mikrodepresije pored potoka pod močvarno-glejnim zemljištem. Veća količina padavina, koja je karakteristična za humidne oblasti, kompezira se ovde dugotrajnim zadržavanjem snežnog pokrivača i malim intenzitetom isparavanja.

Šuma crne jove sa visokim busom na neogenim sedimentima ass. *Deschampsio-Alnetum glutinosae montanum* Jov. et. Vuk. 1983 javlja se duž uvala i potoka na ravnom ili blago nagnutom terenu severnih i istočnih ekspozicija, na 1000-1050 m nadmorske visine (Jovanović, B. et al., 1983).

Sastojine zajednice *Geo-Alnetum glutinosae montanum* imaju najveću površinu na lokalitetu Štavljanske breze. Sastojine se nalaze na uzvišenjima iznad desne obale reke Vape. To su zatalasani predeli sa blagim kosama i prevojima, koje samo u blizini malih potoka imaju nešto strmije strane. Šume ove zajednice nalaze se između progala i zalivađenih površina koje služe za ispašu. Crna jova se obično nalazi u manjim grupama i humkama. Biološki spektar asocijacije *Geo-Alnetum glutinosae montanum* pokazuje visoko prisustvo hemikriptofita (71%) vrsta koje su dobro prilagođene zimskim hladnoćama i koje zimi štiti sneg koga na ovom području ima u izobilju. Svi ostali životni oblici su znatno manje zastupljeni.

Mezofilne biljke učestvuju sa 33%, a biljke kserofilnog karaktera zastupljene su sa 8%, dok su biljke široke ekološke amplitude zastupljene sa velikim udelom od 39%. Frigidofilne biljke zastupljene su sa 14%.

Phytocoenological table 1.

Association Geo-Alnetum glutinosae montanum Jov. Et Vuk. 1983

The ordinal number of the record	1	2	3	Percentage
The number of the record (field mark)	123	124	120	
Date of recording	27.7.97	25.7.97	25.7.97	
Site	Stavlјanska breza			
Size p.p. (m ²)	700			
Altitude (m)	1070	1080	1085	
Exposure	West	J-JI		
Inclination (°)	8	10		
Parent rock	Grevel, sand, and clay			
Soil	pseudogley			
I LAYER				
Canopy	0.4-0.5	0.5	0.5	
Height –average (m)	8	9	8	
Diameter -average (cm)	10-12	10-12	10	
Distance (m)	0.2-4	1-4	0.3-4	
Alnus glutinosa	4.4	4.4	3.3	V
Alnus incana	+1	+1		IV
II LAYER				
Canopy	0.1	0.1	0.2	
Average height (m)	1.5	1.5	2	
Alnus glutinosa	1.1	+1	1.1	V
Crataegus monogyna	1.1	+1	2.2	V
Evonymus europaeus	+1	+1	+1	V
Prunus spinosa	+1	1.1	1.1	V
Frangula alnus	+1	+1		IV
Juniperus communis	+1		+1	IV
Rosa agrestis	+1		1.1	IV
III LAYER				
Canopy	0,7	0,7	0,6	
Achillea millefolium	+1	+1	1.1	V
Ajuga reptans	1.2	1.1	+1	V
Alchemilla vulgaris	1.1	+1	+1	V
Bellis perennis	+1	1.1	+1	V
Cirsium acaule	+1	+1	+1	V
Cynosurus cristatus	1.1	+1	1.1	V
Festuca heterophylla	+1	1.1	1.1	V
Festuca ovina	+1	+1	1.1	V
Festuca vallesiaca	1.1	+1	1.1	V
Fragaria vesca	1.2	1.1	+1	V
Geum urbanum	+1	+1	+1	V
Leontodon autumnalis	+1	+1	+1	V
Molinia coerulea	2.3	1.2	1.1	V
Oxalis acetosella	1.2	1.1	+1	V
Plantago altissima	+1	+1	+1	V
Poa annua	1.2	1.2	1.1	V
Potentilla erecta	+1	+1	+1	V
Potentilla reptans	+1	+1	+1	V
Prunella vulgaris	1.1	+1	+1	V
Trifolium repens	1.1	1.1	1.1	V

The ordinal number of the record	1	2	3	Percentage
The number of the record (field mark)	123	124	120	
Date of recording	27.7.97	25.7.97	25.7.97	
Site	Stavljsanska breza			
Size p.p. (m ²)	700			
Altitude (m)	1070	1080	1085	
Exposure	West	J-JI		
Inclination (°)	8	10		
Parent rock	Grevel, sand, and clay			
Soil	pseudogley			
<i>Agrostis alba</i>	1.1	1.1		IV
<i>Anthoxanthum odoratum</i>	+1	1.1		IV
<i>Brachypodium silvaticum</i>	1.1	+1		IV
<i>Carduus crispus</i>	+1	+1		IV
<i>Cerastium glomeratum</i>	+1		+1	IV
<i>Crepis paludosa</i>	+1	+1		IV
<i>Dactylis glomerata</i>		+1	+1	IV
<i>Deschampsia flexuosa</i>	1.2	1.1		IV
<i>Galium aparine</i>	+1	+1		IV
<i>Galium mollugo</i>		+1	+1	IV
<i>Geum montanum</i>	+1	+1		IV
<i>Hieracium transsilvanicum</i>	1.1	1.1		IV
<i>Leontodon crispus</i>	+1	+1		IV
<i>Leucanthemum vulgare</i>	+1	+1		IV
<i>Lysimachia nummularia</i>	1.1	+1		IV
<i>Medicago sativa</i>	+1		+1	IV
<i>Minuartia glomerata</i>	+1	+1		IV
<i>Nardus stricta</i>	+1	+1		IV
<i>Ranunculus sardous</i>	+1	+1		IV
<i>Taraxacum officinale</i>	1.1	+1		IV
<i>Thymus serpyllum</i>		+1	1.1	IV

The following species were registered by one phytocoenological record:

Alchemilla glabra +.1 (120), *Anemone nemorosa* +.1 (120), *Angelica sylvestris* +.1 (123), *Campanula patula* +.1 (123), *Cirsium eriophorum* +.1 (123), *Galium rotundifolium* +.1 (123), *Hieracium levigatum* +.1 (120), *Lamium galeobdolon* +.1 (123), *Leontodon hispidus* +.1 (120), *Lolium perenne* 1.1 (123), *Luzula luzuloides* +.1 (123), *Melandrium rubrum* +.1 (120), *Mycelis muralis* +.1 (123), *Pedicularis baumgarteni* +.1 (123), *Peucedanum carvifolia* +.1 (123), *Plantago argentea* +.1 (120), *Plantago lanceolata* +.1 (123), *Plantago major* +.1 (123), *Prunella grandiflora* 1.1 (123), *Stachys officinalis* +.1 (120), *Trifolium diffusum* 1.1 (123), *Veronica acinifolia* +.1 (120), *Viola mirabilis* +.1 (120) i *Viola odorata* +.1 (123).

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