UDK 581.9:630*182(497.11)=111
Original scientific paper

LOCALITY 'JOZICA KOLIBA' IN SERBIA-THE FOREST COMMUNITY CHARACTERISTICS

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Abstract: *The memorial complex “Jozića Koliba” is situated within the boundaries of Obrenovac Reserve forest complex. A special value of this locality is its group of protected pedunculate oak trees, which consists of six protected trees aged approximately 200 years with their crown projections. The idea to protect not only the trees themselves, but also their immediate surroundings of which the forest community forms a part, imposed the need for studying and describing the community. The study of current forest vegetation was performed according to the principle of French-Swiss school Braun-Blanquet, J (1921,1928). In total, 33 species were identified in the forest community. In the tree storey, three species were identified: *Quercus robur* L., *Fraxinus angustifolia* Vahl. and *Acer campestre* L. In the herb layer, two legally protected species were identified: *Ruscus aculeatus* L. and *Viola odorata* L. The presence of nine different areal types, dominated by species of sub central-European flora element, was established by means of a phytogeographic analysis. According to the results of the analysis of life-form representation, this community is of a phanerophyte-hemicryptophyte type, with an increased presence of geophytes.*

Key words: forest vegetation, natural resources, Obrenovac Reserve

1. INTRODUCTION

The memorial complex “Jozića Koliba” is situated within the boundaries of Obrenovac Reserve forest complex. It encompasses a natural property under the III category of protection, which consists of a natural monument with six protected

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pedunculate oak trees (*Quercus robur* L., syn: *Quercus pedunculata* Erh) with their horizontal crown projection (Official gazette...). The protected tree group represents a remnant of autochthonous Serbian pedunculate oak and ash communities (*Querceto-Fraxinetum serbicum* Rudski) (Gajić, 1984). The principal aim of the protection was precisely preservation of pedunculate oak trees, as edificators of once broadly-widespread autochthonous forest communities. The Kolubara River is in the immediate vicinity of the complex, while between the River and the complex itself, there is an embankment, which serves as a protection from high water-levels and it stretches along the left bank. Within this locality, there is a forest community which forms a spatial whole with protected trees. For the purpose of initiating the procedure of placing this part of the memorial complex under protection, the forest community was the subject of the study.

2. METHODOLOGY

The vegetation mapping was performed based on a standard methodology for the study of current vegetation, according to the principles and methodology of the French-Swiss school (Braun-Blanquet, J., 1921, 1928).

The analysis of stand conditions involves defining soil characteristics, based on the samples collected in the forest community. The identification of soil types was performed on the basis of soil classification (Škorić et al, 1985).

Based on the phytocoenological records, the floristic-structural phytocoenological tables were created. The spectra of floristic elements (the percentage representation of groups of floristic elements and the representation of individual floristic elements) for each community were prepared in accordance with the Gajić's systematisation of plant-geographic elements (Gajić, 1984) and Diklić, N. (1984). The biological plant spectra (the percentage representation of individual life-forms) were prepared according to Kojić, M. et al. (1977) and Diklić, N (1984), based on the classification of life-forms into types (Raunkiaer, 1934).

3. RESULTS

Ecological conditions of habitat

Sedimentary rocks of Cenozoic age are well-represented on this territory. Neogene deposits lay transgressively over older Paleozoic and Mesozoic deposits. Sands, gravels and loams are placed along the spacious Kolubara river bed.

The area is characterised by moderate continental climate with warm summers and cold winters. The average temperature is 11°C. As a result of its openness to the north and Pannonian Plain, the impact of continental pluviometric regime can be felt. The maximum amount of precipitation is in late spring, whereas the secondary maximum is in late autumn. Winters are cold, windy and dry. The annual amount of precipitation is about 640mm. In the dry period, the average amount is 440, while in the rainy period it is 940mm. The mean relative humidity is 74%. The wind most frequently blows from south-east. North winds rarely bring

precipitation. A large impact on direction of air currents is exerted by the valleys of rivers Drina and Kolubara (Radovanović, 2001).

At the locality 'Jozića Koliba', meadow black soil evolves under automorphic conditions (the processes of argillogenesis occur, that is, brownisation of lower parts of A horizon) and it is transformed into eutric cambisol. The most common locations for such soils are loess terraces, loess plateaux and alluvial plains. The primary pedogenetic process is humification and humization, which take place under the favourable soil humidity conditions. For the purpose of determining soil characteristics of the studied locality, the analysis of samples was performed by determining physical and chemical properties of the substrate.

Table 1. Physical properties of soil

Lrb	Client designation	Coarse sand	Fine sand	Powder	Clay	Total sand	Total clay	Texture class
		%	%	%	%	%	%	
118/10	1	1.90	14.70	32.50	50.90	16.60	83.40	Clay
119.00	2	1.40	14.90	31.30	52.40	16.30	83.70	Clay
120.00	3	1.10	13.40	32.50	53.00	14.50	85.50	Clay
121.00	4	1.10	14.70	29.00	55.20	15.80	84.20	Clay

Physical properties of all four analysed soil samples are characterised by a very heavy textural composition. All samples belong to a clay texture class. The texture composition is dominated by fraction of particles smaller than 0.002mm, while the total clay is represented by 80%. That means that the soil represented by these samples has low water permeability and is very poorly aerated.

Table 2. Chemical properties of soil

LRB	Client designation	pH		Adsorptive complex					Total			Accessible	
		H ₂ O	KCl	T	S	T-S	V	Y1	humus	N		P ₂ O ₅	K ₂ O
	ekv.m.mol/100g					%	cm3	%	%	C/N		mg/100g	
118/10	1	5.55	4.81	62.09	41.68	20.41	67.12	31.41	8.54	0.77	6.45	24.03	65.65
119/10	2	5.49	4.67	58.58	39.05	19.53	66.67	30.04	7.05	0.63	6.51	17.31	41.41
120/10	3	5.50	4.64	51.55	34.68	16.86	67.28	25.94	5.10	0.55	5.34	17.79	35.62
121/10	4	5.67	4.68	51.06	37.74	13.31	73.92	20.48	3.93	0.54	4.21	7.99	21.27

Chemical properties of soil are characterised by acid reaction of soil solution. As a result of a heavy textural composition of soil, dominated by the most sorption-active fraction of clay, the total adsorption capacity is very high. In addition to a heavy textural composition, a large quantity of humus also produces an impact on the high total adsorption capacity. In addition to the high total adsorption capacity, the sum of adsorbed based cations is high in all analysed samples. According to the level of saturation by base cations of the adsorptive complex, the studied soils belong to the euteric soil type.

The content of humus is high in all samples. The samples marked by 1, 2 and 3, according to their total humus content, represent highly humus-rich types of soil, while the sample 4 represents a very humus-rich type of soil. In addition to high humus content, the content of total nitrogen is also high in all four analysed profiles. This ensures a close C/N relation, which means that the character of organic matter is not the cause of stoppage of mineralisation of organic nitrogen and its transformation into forms accessible to minerals and plants.

In the soil represented by sample 1, the content of plant-easily accessible forms of phosphorus is within the limits of very well-supplied, according to the limit values for the AL method. The soils represented by samples 2 and 3 are medium well-supplied, whereas the soil represented by sample 4 is poorly supplied by the plant-easily accessible forms of phosphorus. All four analysed samples are very well-supplied by the plant-easily accessible forms of potassium.

Vegetation

Phytocoenological records are presented in Table 3. Phytocoenological table contains 33 species.

Table 3. *Phytocoenological records of the community Fraxino angustifolie-Quercetum roboris Jov. et Tom. 1979.*

Association	<i>Fraxino angustifolie-Quercetum roboris Jov. et Tom. 1979.</i>	
Record number	1	2
Date of recording	2 October 2010	2 October 2010.
Locality	Jozića Koliba	Jozića Koliba
Place	Veliko Polje	Veliko Polje
Size p.p. (m ²)	300	300
Altitude (m)	78.2	78.2
Geological layer	River sediments	River sediments
Soil	Meadow black soil	Meadow black soil
Tree storey		
Canopy (%)	70	70
Height-mean (m)	23	25-28
Diameter-mean (cm)	45	40
Distance (m)	4	3
<i>Quercus robur</i>	1.2	1.2
<i>Fraxinus angustifolia</i>	1.1	1.1
<i>Acer campestre</i>	+1	
Shrub storey		

Canopy (%)	50	60
Height-mean (m)	3	5-7
<i>Cornus mas</i>	1.2	1.2
<i>Ruscus aculeatus</i>	1.2	1.2
<i>Acer campestre</i>	1.1	1.1
<i>Prunus domestica</i>	1.1	1.1
<i>Rosa canina</i>	+1	1.1
<i>Fraxinus angustifolia</i>	+1	+1
<i>Ulmus carpiniifolia</i>	+1	+1
<i>Cornus sanguinea</i>	3.2	
<i>Prunus spinosa</i>		2.2
<i>Helianthus tuberosus</i>		1.3
<i>Evonymus europaea</i>		1.2
<i>Craegus monogyna</i>	1.2	
<i>Tilia platyphyllos</i>		0.1
Herb layer		
Coverage (%)	70	60
<i>Hedera helix</i>	3.2	2.2
<i>Convallaria majalis</i>	3.3	1.1
<i>Arum maculatum</i>	3.3	+1
<i>Viola silvestris</i>	1.1	+1
<i>Quercus robur</i>	+1	2.2
<i>Ligustrum vulgare</i>	+2	1.1
<i>Crataegus monogyna</i>	+1	+1
<i>Ruscus aculeatus</i>	+1	+1
<i>Ulmus carpiniifolia</i>	+1	+1
<i>Ranunculus repens</i>	+1	+1
<i>Linaria vulgaris</i>	+1	+1
<i>Galanthus nivalis</i>	3.3	
<i>Allium ursinum</i>	2.3	
<i>Viola odorata</i>	1.1	
<i>Rumex acetosa</i>	+2	
<i>Geum urbanum</i>	+1	
<i>Polygonum aviculare</i>	+1	
<i>Tamus communis</i>	+1	
<i>Veronica chamaedrys</i>	+1	

In river alluvia, pedunculate oak and narrow-leafed ash forests (*Querceto-Fraxinetum serbicum*) occupy the belt between hygrophilic willow-poplar forests, of the *Salicion albae* alliance, in riverine areas, and mesophilic pedunculate oak-hornbeam forests, of the *Carpinion betuli* alliance, situated beyond the reach of flood waters (Tomić & Rakonjac, 2012).

The community is characterised by abundance of dendroflora and a rich, densely covered shrub layer. In the tree storey, in addition to edificators pedunculate oak (*Quercus robur*) and narrow-leafed ash (*Fraxinus angustifolia*), field maple (*Acer campestre*) can also be found. In the rich shrub storey, the following species are present: *Cornus mas*, *Ruscus aculeatus*, *Acer campestre*,

Rosa canina, *Ulmus carpinifolia*, *Cornus sanguinea*, *Prunus spinosa*, *Helianthus tuberosus*, *Euonymus europaeus*, *Crataegus monogyna*, *Tilia platyphyllos*.

The coverage of herb layer ranges between 0.6 and 0.7. A characteristic group of species consists of *Hedera helix*, *Convallaria majalis*, *Arum maculatum*, *Viola silvestris*, *Quercus robur*, *Ligustrum vulgare*, *Crataegus monogyna*, *Ruscus aculeatus* and *Ulmus carpinifolia*. A significant number of mesophilic species occurs in the herb layer; however, there is an occasional presence of xero-mesophilic species, which indicates more xerothermic variant of pedunculate oak-ash forests.

Spectrum of areal types

The spectrum of areal types in the community *Querceto-Fraxinetum serbicum*. is presented in Table 4.

Table 4. *Spectrum of areal types in the community Querceto-Fraxinetum serbicum*

Individual areal types	Number	Representation (%)	Collective areal types	Representation (%)	
SUBPONTIAN	1	3.5	PONTIAN	13.8	13.8
PONTIAN-SUBMEDITERRANEAN	3	10.3			
CENTRAL-EUROPEAN	4	13.8	CENTRAL-EUROPEAN	44.8	61.9
SUBCENTRAL-EUROPEAN	9	31.0			
SUBATLANTIC-SUBMEDITERRANEAN	5	17.1	SUBATLANTIC	17.1	17.3
EURO-ASIAN	4	13.8	EURO-ASIAN	13.8	
COSMOPOLITAN	1	3.5	COSMOPOLITAN	3.5	
CIRCUMPOLAR	1	3.5	CIRCUMPOLAR	3.5	3.5
ADVENTIVE	1	3.5	ADVENTIVE	3.5	3.5
TOTAL:	29	100	TOTAL:	100	100

By means of a phyto-geographic analysis, the presence of nine different areal types was identified. Dominating species are the sub-central-European floristic element (31.0%), followed by plants of sub-Atlantic-sub-Mediterranean (17.1), central-European (13.8%), pontian-sub-Mediterranean (10.3%) and Euro-Asian areal type (13.8%).

Plants of sub-pontian, cosmopolitan and circumpolar areal type, along with adventive plants, are equally represented and account for 3.5%.

Graph 1. Spectrum of areal types of the community *Querceto-Fraxinetum serbicum*

Generally speaking, the most represented are mesophilic plants, which account for 61.9%, (of central-European and sub-Atlantic areal types). In terms of representation, they are followed by the plants of a broad ecological amplitude, which account for 17.3% (of Euro-Asian and cosmopolitan areal types), then by xero-thermophilic species, (of a pontian areal type), accounting for 13.8%.

Adventive flora includes those species which were introduced into our country as a result of human activities, and are more or less well-adapted to local conditions. In this case, the presence of only one such species was identified (3.5%).

Spectrum of life-forms

The correlation between plants and life-forms in the community *Querceto-Fraxinetum serbicum* is presented in Table 5.

Table 5. Plant life-forms in the community *Querceto-Fraxinetum serbicum*

Phanerophytes	Nano-phanerophytes	Phanaerophytic lianas	Hemi-cryptophytes	Geophytes	Terophytes
P	np	pl	H	g	t
25%	25%	4%	21%	18%	7%
54%					

The differences in living conditions are most clearly reflected in the structure of plants, proving their obvious adaptedness to the environment in which they live. Illustration of living conditions, the climate in particular, which prevail in a certain area, reflects the percentage representation of all plant life-forms in flora of that area, that is, its biological spectrum (Diklić, 1984).

Graph 2. Plant life-forms in the community *Querceto-Fraxinetum serbicum*

By the analysis of life-forms in the community *Querceto-Fraxinetum serbicum*, it was established that phanerophytes (P) account for 54% of the total flora of this community. This community is typical for having large number of woody species, which can also be seen from the biological spectrum (pure phanerophytes, nano-phanerophytes and phanerophyte lianas constitute 54% of the life spectrum). The second most numerous species among life-forms is hemicyptohytes (H), which are also the most numerous life-form in the moderate climate belt and Serbia, and which constitute 21% in this community. The plant life-form geophytes (G) also have a high representation, as many as 18%, which points out to more humid and edaphic conditions in this community.

The least represented are perennial plants therophytes (T), which account for 7%. No plants from the chamaephytes (Ch) group was identified.

It can be concluded that this community is of a phanerophyte-hemicyptophyte type, with an increased representation of geophytes.

4. CONCLUSION

The forest community contains 33 species. Generally speaking, the most represented species are mesophil plants, which account for 61.9% (of central-European and sub-Atlantic areal types). They are followed by plants of a broad ecological amplitude, which account for 17.3% (of Euro-Asian and cosmopolitan areal types), then by xero-thermophilic species, (of a pontian areal type), accounting for 13.8%.

Adventive flora includes those species which were introduced into our country as a result of human activities and are more or less well-adapted to local conditions. In this case, the presence of only one such species was identified (3.5%).

By the analysis of life-forms in the community *Querceto-Fraxinetum serbicum*, it was established that phanerophytes (P) account for 54%, while hemicryptophytes (H) constitute 21% of this community. As a result of humid climatic conditions, geophytes (G) account for as many as 18%, which indicates that this community is of a phanerophyte-hemicryptophyte type, with an increased representation of geophytes.

The species identified in the forest community include legally protected *Ruscus aculeatus* L. and *Viola odorata* L. Placing this community under protection would also mean better safeguarding of protected species from the anthropogenic impact, which is intensive in this area as a result of proximity of town, but also a popular outing spot, frequently visited by the inhabitants of towns Obrenovac and Ub.

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