



PHYTOCENOLOGIC DIVERSITY OF KRAJIŠTE IN SOUTHEASTERN SERBIA

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Key word:

Krajište,
vegetation,
diversity

SYNOPSIS

Krajište is situated at southeast of Serbia, and it represents mountain region which is part of Vlasina's complex of Serbian-Bulgarian mass. In the paper, the vegetation variety in this area is described, that belongs to Serbian-Bulgarian type. The near-river vegetation and the vegetation of moisture habitats, hilly, submountain, mountain, subalpine and alpine vegetation are showed.

In this context, the 52 herb associations are analyzed which we studied in this area, many of them are similar with associations of east and west parts of Serbia and Bulgaria, but some of them can be found only here, and they are represented like endemic associations of Krajiste: *Geo-Filipenduletum ulmariae*, *Vaccinio-Pinetum pallasianae*, *Diantho-Armerietum rumelicae*, *Danthonio-trifolietum velenovskyi*, *Edraiantho-Anthylletum aureae*, *Achilleo-Genistetum sericeae*, *Sempervivo-Minuartietum bulgaricae*, *Linario-Polygonetum alpinae* etc.

Ključne riječi:

Krajište,
vegetacija,
diverzitet

SINOPSIS

Fitocenološki diverzitet Krajišta u Jugoistočnoj Srbiji

Krajište se nalazi na jugoistoku Srbije, a predstavlja planinsku oblast koja je deo Vlasinskog kompleksa Srpsko-makedonske mase. U radu je obrađena raznolikost vegetacije na tom području koje je u vegetacijskom smislu pripada srpsko-bugarskom tipu. Prikazana je krajrečna i vegetacija vlažnih staništa, brdska, predplaninska, planinska, subalpska i alpska vegetacija.

U tom kontekstu analizirane su 52 biljne asocijacije koje smo do sada proučili na ovom području, a od kojih su mnoge slične zajednicama istočnih i zapadnih delova Srbije i Bugarske, ali ima i zajednica koje se samo ovde sreću i predstavljaju endemičnim zajednicama Krajišta, a to su: *Geo-Filipenduletum ulmariae*, *Vaccinio-Pinetum pallasianae*, *Diantho-Armerietum rumelicae*, *Danthonio-trifolietum velenovskyi*, *Edraiantho-Anthylletum aureae*, *Achilleo-Genistetum sericeae*, *Sempervivo-Minuartietum bulgaricae*, *Linario-Polygonetum alpinae* i dr.

INTRODUCTION

Krajište is large mountain region, situated in the valley of the river Struma (beginning part), and the part of Krajište in Serbia (which is object of this researches) is situated in the basin of the river Dragovištica and its numerous creeks: Brankovačka, Jarešnička, Dukatska, Ljubatska, Lisinska and Božička river and minor becks which disembugue from Rodopian mountains of this region.

There are many mountains in this region, and the biggest are: Vardenik, Besna Kobila, Široka Padina, Dukat mountain, Gloška, Milevska, Rudina, Bistarska, Krvavi Kamik, Crnook etc.

By herbal-geographical meaning, Krajište is situated at southeast of Middle-European region in Mesian province, and vegetation belongs to Serbian-Bulgarian-Macedonian type. The silicate mountains look monotonuos, but we found great number of habitats there with 52 associations. Such vegetation diversity is possible because of different climate, geologic, pedologic and hydrologic conditions.

Geologic texture: By geologic meaning, Krajište belongs to Serbian-Macedonian mass (Dimitrijević, 1955), which belongs to Rodopian mountains formation. It is made by metamorphic complex of slates, built by metamorphic-silicate boulders from Cambrian period, made in series of green slate facies. The main mass of these boulders, in north part of area, is consisted of micashists where granite-gneisses, diabase-phyllites formations and lake sediments of Neogene are incorporated, in the form of tuff. By significance, the second formation is gneisses, in the middle and west part of Krajište, where granite-gneisses and andesites are incorporated. The far south part of Krajište is made by andesites, where micashists and maritime "melasa" of high Eocene are incorporated punctately.

Except silicates, in some places of Krajište there are limestones and dolomites, mostly on Rudina mountain, and few tuffs more, near Gornja Lisina and Gornja Ljubata.

Pedologic structure: The soil is made by common activity of geologic foundation, vegetation and climate. After forming, it defines spatial distribution of phytocenosas, so studying vegetation means great knowledge of soil types. Because of diversity of geologic foundation and vegetation of researched area, the soil is also very diverse, considering its texture, structure and types.

Mostly, we can find here azonal, zonal and intrazonal soil. Zonal soils are climatogene, and there is reddish-brown soil in hilly areas. In submountain and mountainous part, there is brown forest soil, in different stages of podzolization. In subalpine and alpine part of region, the climatogene soil is mountain black soil.

Azonal soils are rendzinas on limestones, and intrazonal are swamp-hydrogen soils (swamp-gley, gley, gley-sandy etc.) and organogene-swamp soils (bog soils: *Phragmitetum*-bog, *Caricetum*-bog and moss-bog). Vertisols are relic hydrogen soils.

Climate conditions: By analyzing of two parameters, temperature and downfalls, we obtain the rain factor (KF), and according to it, we define humidity (H) and heat characteristics of climate (TK).

Table 1. The average monthly and annual temperature values in °C (T), the quantity of downfalls in mm (P), the rain factor (Kf), humidity (H) and heat characteristics of climate (Tk) for period from 1925-1940. (by Đukanović, 1967)

	T	P	Kf	H	Tk
January	-0.7	43	61.4	ph	n
February	0.4	40	100	ph	n
March	3.7	50	13.5	h	hl
April	9.2	52	5.6	sh	ut
May	13.8	65	4.7	sa	t
June	17.4	78	4.5	sa	t
July	19.5	55	2.8	a	t
August	19.5	26	1.3	pa	t
September	15.3	41	2.8	a	t
October	9.7	52	5.4	sh	ut
November	5.0	66	13.2	h	uhl
December	0.8	51	64	ph	hl
ANNUAL	9.5	619	65	sh	ut

The data from tables show the climate in winter months (I, II) is moderate cold (uh) and nival (n), in springtime (III) it is cold (h) in the beginning, moderate warm (ut) in April, and from the end of spring to the fall it is semiarid (sa), arid (a) and per arid (pa) (V-IX), the fall is at first warm (t), moderate cold (uh) and cold (h). On annual level, the climate is semiarid (sa) and moderate warm (ut).

Near-river vegetation

This specific vegetation, hygrophily made by the rests of forest, shrub, swamp, bog and high greens associations, is developing in the valleys of the rivers and mountain creeks where the water is decanting and overflowing the terrain, making permanent or periodical ponds and swamps.

The rests of forest vegetation

Today, these are small associations of various alders and willows in the valleys of mentioned rivers and in the swamps. Next associations belong to this vegetation:

1. *Alnetum glutinosae fluviatilis* B.Jov. (58) 83 – this association can be found in the lower flow of mentioned rivers: Dragovištica, Ljubatska and Brankovačka river, on the altitude from 600 to 1300 m, at hygrophil gley soil with alluvial characteristics. There is a bit of elements of atochthonous vegetation: *Alnus glutinosa*, *Humulus lupulus*, *Clematis vitalba*, *Aegopodium podagraria*, *Calystegia sepium* etc. It belongs to alliance of *Alnion glutinosae* (Malc.29) M. Dries 36.

2. *Salicetum albae fragilis* Soó (33) 58 – the remains of this forests can be found in the valleys of the bigger rivers, on the banksides or in the swamp places, in the forms of individual or group of trees *Salix alba* i *Salix fragilis*. In these associations there are very old samples: *Lysimachia vulgaris*, *Lythrum salicaria*, *Juncus*- species, *Epilobium parviflorum*, *Potentilla reptans*, *Equisetum palustre* etc. It is developing on gley sandy soil. It belongs to alliance *Salicion albae*.

3. *Salicetum purpureae* Zel. 52. – with previous associations, it makes mosaic complex in the valleys of all mentioned rivers, on sandy, easy moving gley soil. It is tough and flow resist, followed with many psamophytes: *Chenopodium botrys*, *Veronica beccabunga* etc. It belongs to alliance *Salicion triandrae* (Malc. 29) Müll. et Görs 58

4. *Salicetum cinereae* B. Jov. 53 – this association can be found in central parts of some ponds in mountain part of Krajište, like progressive stage in their overrunning. The association is dominated by *Salix cinerea*, but there is and other species of the genus *Salix*, most often *Salix alba*. Around them, there are: *Tipha latifolia*, *Scirpus sylvaticus*, *Carex vesicaria*, *Gentiana pneumonanthe*, *Serratula tinctori*, *Deschampsia caespitosa*, *Centaurea jacea* etc. It belongs to alliance *Salicion cinereae* Müll. et Görs 58

The associations of water plants

The floating no enrooted plant species which belong to float associations of plant species from genus *Lemna* and enrooted species from genus *Hara* are often in small puddles and ponds.

5. *Lemnetum minoris* W. Koch et R.Tx. 54 –In summer time, the green floating plant species of genus *Lemna* (*Lemna minor* and *Lemna gibba*) are developing In the puddles in the area of Krajiste. They belong to alliance *Lemnetum minoris* W. Koch et R.Tx. 54 ex Oberd. 54.

6. *Charetum vulgaris* Corollion 57. –*Chara vulgaris* is developing in the same or special puddles, which associations belong to alliance *Charion fragilis* (Sauer 37) Karush 64.

Swamp vegetation

This vegetation is more various from water vegetation, it covers many associations developed on the places where water stagnates, making small or great ponds and swamps. In mountain part of Krajište, this vegetation covers next associations:

7. *Scirpo-Phragmitetum* W. Koch. *Typhetosum latifoliae* Pignati 53 –we found this association near Bosilegrad, Donji Tlamin and Žeravinski egal. In association, we can find: *Phragmites communis*, *Tipha latifolia*, *Scirpus sylvaticus*, *Lysimachia vulgaris*, *L. nummularia*, *Lychnis flos-cuculi*, *Trifolium hybridum*, *T. fragmiferum* etc. It belongs to alliance *Phragmition communis* W. Koch. 26.

8. *Glycerietum plicatae* Oberd. 52 – this association is fragmentarily widespread in the area of Krajište, on brims of ponds, near the previous association. Beside species *Glyceria plicata*, we can find: *Juncus effusus*, *Ranunculus repens*, *Equisetum palustre*, *Trifolium hybridum*, *Ranunculus acris* etc. It belongs to alliance *Sparganio-Glycerion* Br.-Bl. et Siss. 42.

9. *Caricetum rostrato-vesicariae* W. Koch 26 – We find small forms of this association on Žeravinski egal, but there are bigger forms on Goleško field, which is mosaic complex of swamp, bog, mountain and high greens vegetations. *Carx vesicaria* dominates there, and it can be found next species: *Lysimachia vulgaris*, *Ranunculus acris* etc. It belongs to alliance *Caricion rostratae* Bul-Tul 63.

10. *Equiseto-Scirpetum sylvaticae* Šegulja 74 – it can be found in the valleys of creeks at Rudina, Žeravinski egal and Goleško field, with dominating species *Equisetum palustre* and *Scyrcus sylvaticus*, and there are also: *Hypericum acutum*, *Cirsium palustre*, *Epilobium hirsutum*, *Juncus filiformis* etc. The alliance *Calthion*.

11. *Junco-Menthetum longifoliae* Lohm. 53 – in the area of Krajište, this association can be found in creeks and near springs. Dominating species are from genus *Juncus* (*J.inflexus*, *J.effusus*, *J.filiformis*) and *Mentha longifolia*, followed by: *Hypericum acutum*, *Epilobium parviflorum*, *Lathyrus pratensis*, *Bidens cernuus*, *Menianthes trifoliata*, *Lychnis flos-cuculi*, *Cirsium palustre*, *Alchemilla vulgaris* etc. It belongs to alliance *Agropyro-Rumicion* Nordh 40.

12. *Deschampsietum caespitosae* H-ić 30 – it is developing on mountain areas of Vlasina, and in Krajište the biggest areas are in Goleško field, on altitude over 1000 m. The association is dominated by *Deschampsia caespitosa*, followed by *Serratula tinctoria*, *Succisa pratensis*, *Gentiana pneumonanthe*, *Juncus effusus*, *Lysimachia vulgaris*, *Trifolium hybridum* etc. It belongs to alliance *Deschampsion caespitosae* H-ić 30.

The high greens vegetation

The vegetation, called „mountain little gardens“ by I. Horvat, is developing in mountain areas, near the creeks and at moisture places. This is specific vegetation for Balkanian mountains, made by Balkanian endems: *Geum rhodopeum*, *Rumex balcanicus*, *Cirsium appendiculatum*, *Leucorchis frivaldii*, *Cirsium helenioides* etc. There are many associations in the area of Krajiste.

13. *Trolio-Geetum rhodopei* V. Randj. 2001 – the association is described on Vlasina for first time, and in the Krajiste area, it can be found on Božička and Dukat mountain, Vardenik and Besna Kobila. Beside the species *Geum rhodopeum*, we can find on it *Leucorchis friwaldii*, *Gymnadenia conopaea*, *Dactylorhiza cordigera*, *Sanquisorba officinalis*, *Juncus thomasii*, *Parnassia palustris*, *Agrostis canina*, *Sysirinchium montanum* etc. It belongs to alliance *Geion rhodopaei* V. et N. Rand. 2008.

14. *Rhumicetum balcanici* (R. Lakušić, 65) V. Rand.2001 – For the first time, this association is described in detail for the area of Vlasina, and for Krajište, it can be found at Besna Kobila and Široka mountain. Beside the species *Rumex balcanicus*, we can find there *Trifolium spadiceum*, *Chaerophyllum hirsutum*, *Veratrum lobelianum*, *Filipendula ulmaria*, *Deschampsia caespitosa*, *Succisa pratensis*, *Caltha palustris* etc. The alliance is *Rumicion balcanici* Lakušić 65.

15. *Cirsietum appendiculati* V. Rand. 2001 – In Krajište, it can be found in the valley of Ljubatska river and on Dukat mountain (Bele vode), it is dominated by *Cirsium appendiculatum*, and there it can be found also next species: *Chaeropyllum aureum*, *Valeriana officinalis*, *Geranium sylvaticum*, *Epilobium parviflorum*, *Athyrium filix-femina*, *Carex vulpina*, *Rubus idaeus*, *Hypericum maculatum*, *Rumex balcanicus*, *Myosotic sylvatica* etc. It belongs to alliance *Cirsion appendiculati* Ht, Pawl. et Walas 37.

16. *Geo-Filipenduletum ulmariae* (N. Rand. 84) V. Rand. 2001 – As like as on Vlasina where is described for first time, this association can be found in Krajište in mountain areas of Besna Kobila, Dukat and Božička mountain and Žeravinski egal. It is always dominated by *Filipendula ulmaria*, followed by *Geum rivale*, *Lysimachia vulgaris*, *Sanquisorba officinalis*, *Veratrum album*, *Mentha longifolia* etc. It belongs to alliance *Geion rhodopei* V. et N. Rand. 2008.

Bog vegetation

Beside the rest of vegetation types, in Krajište we can find bog vegetation also, in wellspring part of Božička river, and in mountain part near spring also, where the „mini“ bog area are formed. We found them at Besna Kobila and Dukat planina also, but for now we identified only three associations, and the researches will be continued.

17. *Eriophoro-Caricetum flavae* V. Rand. et Radak 84 – This association is frequent in the lower mountains of Krajište also, recognized by dominating species *Eriophorum angustifolius*, with snow white heads when it is in fruits, followed by *Carex flava*, *Carex oederi*, *Parnassia palustris*, *Carex vulpina*, *Carex pallescens* etc. It belongs to alliance *Caricion canescentis-nigrae* Nordh. 37

18. *Caricetum goodenovii* Penev 53 – This association is situated near Božička river, dominated by *Carex nigra*, *Carex echinata*, *Carex vesicaria*, *Epilobium hirsutum*, *Lycopus europeus*, *Parnassia palustris*, *Agrostis canina*, *Siccisa pratensis* etc. The association belongs to alliance *Caricion canescentis-nigrae* Nordh. 37

19. *Drosero-Caricetum stellulatae* Horvat 50 – The association where *Drosera rotundifolia* grows is found on Besna Kobila, with *Sphagnum*-moss. In association we met next species also: *Cares echinata*, *Carex canescens*, *Carex flava*, *Carex nigra*, *Eriophorum angustifolium*, *Juncus thomasi*, *Juncus effusus*, *Alchemilla* – species, *Trifolium spadiceum*, *Agrostis canina*, *Festuca pratensis* etc. It belongs to alliance *Rynchosporion albae* W. Koch 26.

Hilly and mountain vegetation

In hilly and submountain region which covers the area of 600-1000 m of altitude, at silicates and limestones, on the reddish-brown color grounds, we find next associations:

20. *Quercetum pubescentis-cerris* Rexhepi 84 – this association is developed on lower massifs turn to Bulgaria, it is dominated by *Quercus cerris*, followed by *Quercus pubescens*, *Fraxinus ornus*, *Sorbus graeca*, *Rhamnus saxatilis*, *Evonymus verrucosa*, *Melampyrum bihariense*, *Anemone sylvestris*, *Iris graminea*, *Trifolium medium*, *Lilium martagon* etc. It belongs to alliance *Quercion petraeae-cerris* Lakušić et Jovanović 80.

21. *Quercetum dalechampii-cerris* s.l. – this association is determined on Rudina mountain only, the village Miovci. It is dominated by *Quercus dalechampii* and *Quercus cerris*, followed by *Crataegus monogyna*, *Rosa canina*, *Calamintha sylvatica*, *Silene italica*, *Lathyrus hallersteinii*, *Hieracium murorum*, *Verbascum phoeniceum*, *Luzula forsteri* etc. It belongs to alliance *Quercion petraeae-cerris* R. Lakušić er B. Jovanović 80.

22. *Quercetum petraeae-cerris* Lakušić et Jovanović 1980 – In the part of Krajište, beyond Brankovačka river to the boundary with Bulgaria, the great complexes of this forest can be found, dominated by *Quercus cerris* (80%), followed by *Quercus petraea* (20%), and: *Quercus pubescens*, *Silene italica*, *Dactylis glomerata*, *Luzula pilosa* etc. It belongs to alliance *Quercion petraeae-cerris* R. Lakušić et B. Jovanović 80.

23. *Agrosti-Genistetum carinalis* N. Raň. et V. Milos. 2004. – this is meadow-pasture association with characteristic species: *Agrostis bysanthina*, *Genista alpina*, *Filipendula vulgaris*, *Trifolium montanum*, *Hypochoeris maculata*, *Centaurea tartarea*, *Anthyllis vulneraria*, *Stachis officinalis* etc. It belongs to alliance *Chrysopogono-Danthonion* Kojić 57.

24. *Sedo-Dianthetum pinifoliae* N. Raň. 73. – this pasture is developing on granodiorites in the village Sušice at Rudina mountain it is recognized by next species: *Dianthus pinifolius*, *Sedum acre*, *Phleum montanum*, *Trifolium lagopus*, *Trifolium trichopterum*, *Linaria pelisseriana*, *Jasione dentata*, *Dianthus corymbosus*, *Plantago holostea*, *Euphorbia stricta* etc. It belongs to alliance *Trifolion trichopteri* Raň.

25. *Astragalo-Calaminthetum hungaricae* N. Raň. 73. – there are the associations on silicates of Krajište that look like this association according to its floristic structure, and next species which belong to them can be identified: *Astragalus onobryshis*, *Acinos hungaricus*, *Petrorhagia illyrica*, *Trifolium hirtum*, *Koeleria macrantha*, *Thymus janke*, *Phleum montanum*, *Scabiosa ucranica*, *Asperula cynanchica*, *Bromus squarrosus* etc. They grow on skeletoid shallow soil in oak zone, at south expositions, and belong to alliance *Scabioso-Trifolion dalmatici* H-ić et N. Raň. 73.

26. *Carici-Festucetum stojanovii* N. Raň. et V. Milos. 2004 – it can be found only at Rudina mountain, on dolomites, it is characterized by next species: *Seseli varium*, *Convolvulus canthabricus*, *Onosma arenarium*, *Echium rubrum*, *Astragalus vesicarius* and *Linum tenuifolium*, and it is dominated by *Carex humilis* and *Festuca stojanovi*, and very important are *Satureja kitaibelii*, *Thymus striatus*, *Achillea serbica*, *Artemisia lobelii* etc. It belongs to alliance *Saturejon kitaibelii* N. et V. Raň.

27. *Astragalo-Silenetum supinae* N. Raň. et V. Milos. 2004. – it is developing on the most southern, the lowest and the most degraded parts of limestone part of Rudina, at 800-900 m of altitude, dominated by *Astragalus angustifolius*, followed by *Silene supina*, *Haplophyllum suaveolens*, *Astragalus wilmottianus*, *Bupleurum apiculatum*, *Petrorhagia illyrica*, *Allim moschatum*, *Globularia willkomii*, *Achillea clypeolata* and *Hyascinthella leucophea*. It belongs to alliance *Satureion kitaibelii* N. et V. Raň.

28. *Edraiantho serbici-Anthylletum aureae* N. Raň. et V. Milos. 2004 – it grows on the highest dolomite peaks of Rudina mountain, at altitude of 1100-1240 m, the dominating species is *Anthyllis aurea*. During the flowering of this species, the peaks of Rudina are gold-yellow colored. The significant species are: *Edraianthus serbicus*, *Hyssopus officinalis*, *Centaurea triumfetti*, *Aster lynosiris*, *Dorycnium pentaphyllum*,

Scorsonera purpurea, *Avenella pubescens*, *Agropyrum cristatum* ssp. *brandsae* etc. It belongs to alliance *Edriantho graminifoliae- Erysimion comatae*.

Mountain vegetation

In mountain part of area which covers the altitude of 900-1600 (1700) m, the region of beech forests are outspreaded where we can find next associations:

29. *Fagetum moesiacaе montanum* Blečić et Lakušić 70 – this is the most widespread forest in this area. The most significant species are: *Fagus moesiaca*, *Astrantia major*, *Anemone nemorosa*, *Chaerophyllum aureum*, *Mercurialis perennis*, *Stachys sylvatica*, *Campanula trachelium*, *Galium odoratum*, *Epilobium angustifolium*, *Pulmonaria officinalis*, *Cardamine bulbifera*, *Circea lutetiana* etc. It belongs to alliance *Fagion moesiacaе* Blečić et Lakušić 70.

30. *Luzulo albidaе-Fagetum montanum* Mišić et Popović 76 – this association grows in mountain areas, on acid soils over silicates, the most famous species are: *Luzula luzuloides*, *Veronica officinalis*, *Chamaecytisus austriacus*, *Aremonia agromonoides*, *Euphorbia amygdalides*, *Galium odoratum*, *Poa nemoralis*, *Brachypodium sylvaticum* etc. It belongs to alliance *Luzulo-Fagion moesiacaе* B.Jov. 76.

31. *Polytricho formosae- Fagetum* B. Jov. 53 – the association of this beech forest is developing on dry rocky habitat covered by moss (*Polytrichum*, *Hylocomium* and *Dicranum*) and green vegetation on lean skeletoid basis: *Hieracium murorum*, *Lembotropis nigricans*, *Galium odoratum*, *Melica uniflora*, *Poa nemoralis*, *Galium sylvaticum*, *Sanicula europea* etc. It belongs to suballiance *Luzulo-Fagenion moesiacaе* B. Jov. 76.

32. *Populo tremulae-Betuletum pendulae* Glišić (50) 75 – the initial stages of this association are very visible at mountains near Božica, on Vardenik, together with *Populus tremula*. Beside them, there can be found *Poa nemoralis*, *Anemone nemorosa*, *Dryopteris filix mas*, *Melica uniflora*, *Rosa vasogiaca*, *Avenella flexuosa*, *Gentiana aslepiadea*, *Dianthus superbus*, *Valeriana officinalis* etc. It belongs to alliance *Quercion robori- petraeae* Br.-Bl. 32.

33. *Seslerio-Pinetum pallasianaе* N. Rand., D. Avram. et V. Milos. 2006. – The parts of this association were growing on limestones of eastern Serbia, in Krajište on Rudina mountain. After their devastation, the next pastures grew on these habitats: *Anthylo-Seslerietum rigidaе*, *Fritillario-Seslerietum rigidaе*, *Centaureo atropurpureae-Seslerietum rigida*, and today some specimens of pine can be found in gorges of eastern Serbia. The next species grew there: *Sesleria rigida*, *Pinus pallasiana* ssp. *banatica*, *Anthyllis aurea*, *Edraianthus serbicus*, *Centaurea chrysolepis* etc. It belongs to alliance *Orno-Pinion Pallasianaе* Em 78.

34. *Vaccinio-Pinetum pallasianaе* N. Rand., D. Avram. et V. Milos. 2006 – today, this association is developing on Jarešnik and next species grow on it: *Pinus pallasiana* ssp. *caramanica*, *Fagus moesiaca*, *Vaccinium myrtillus*, *Ramaschia secunda*, *Rosa vasogiaca*, *Neottia nidusavis*, *Epipactis microphylla*, *Digitalis grandiflora*, *Danaa cornubiense*, *Symphytum tuberosum* etc. It belongs to alliance *Orno-Pinion Pallasianaе* Em 78.

35. *Diantho-Armerietum rumelicae* N. Rađ. 78. – this is one of the most beautiful associations in mountain region of Krajište, with variegated floristic structure, and it can be found in all parts of Krajište, at altitude from 1200-1400 m. The characteristic species are *Dianthus cruentus* and *Armeria rumelica*, and because of them, the association is easy identified. The other species are: *Polygala major*, *Thymus moesiacus*, *Thesium alpinum*, *Pastinaca hirsuta*, *Centaurea tartarea*. Once, the pine forest with *Pinus pallasiana* ssp. *caramanica* was growing on habitat of this association. It belongs to alliance *Armeriao-Potentillon* Micevski 78.

36. *Danthonio-Trifolietum velenovskyi* N. Rađ. 78 – this association is developing in the zone of beech forests, after degradation, dominated by *Danthonia alpina* and *Trifolium velenovskyi*, and next species come into them: *Leontodon hispidus*, *Euphrasia pectinata*, *Hypochaeris maculata*, *Veronica jaquinii*, *Koeleria macrantha*, *Potentilla rupestris* (makes subassociation at Rudina mountain), *Gladiolus imbricatus* (makes separate subassociation). The association belongs to alliance *Chrysopogoni-Danthonion* Kojić 57.

37. *Festuco nigrescenti-Nardetum strictae* N. Rađ. 78 – this association can be found in great areas, it is result of excessive depasturage. There dominate: *Festuca nigrescens*, *Nardus stricta*, and it can be found also *Avenella flexuosa*, *Crepis conycifolia*, *Sylene roemeri*, *Chamaespartium sagittale*, *Potentilla erecta*, *Danthonia decumbens*, *Avenella flabelata*, *Ranunculus montanus* etc. It belongs to alliance *Potentillo ternatae-Nardion* Simon 58

38. *Poo conccinae-Plantaginatum carinatae* N. Rađ. et V. Milos. 2008. – it is developing on shallow soils over granites and andesites in south parts of Krajište, where *Plantago carinata* dominates, followed by *Jasione dentata*, *Chamaespartium sagittale*, *Poa conccina*, *Koeleria macrantha*, *Carlina acaulis*, *Thymus janke*, *Silene otites*, *Hieracium pilosella*, *Acinos arvensis*, *Phleum montanum*, *Dianthus corymbosus*, *Dianthus potederae*, *Allium pulchellum*, *Trifolium trichopterum*. The association belongs to alliance *Trifolion trichopteri* Rađ.

39. *Pteridietum aquilinii* V. Rađ. 2001. – this association covers the habitats where the beech forest (*Fagetum montanum*) is disforest, it is dominated by *Pteridium aquilinum*, followed by: *Carlina alpina*, *Vaccinum myrtillus*, *Chamaecytisus tommasinianus*, *Verbascum adamovicii*, *Viola canina*, *Rubus hirtus*, *Sedum maximum*, *Rubus idaeus* etc. It belongs to alliance *Pteridion aquilinii*, nom. nud.

40. *Epilobietum angustifolii* Soó 33 – like the previos association, it belong to associations of “sečina” in beech region, it is characterized by domination of the species *Epilobium angustifolium*, followed by: *Galeopsis speciosa*, *Luzula pilosa*, *Veronica officinalis*, *Rubus idaeus*, *Gnaphalium sylvaticum*, *Dryopteris filix-mas*, *Hypericum maculatum*, *Verbascum chaixii*, *Athyrium filix-femina*, *Salvia glutinosa*, *Scrophularia nodosa*, *Circea lutetiana* etc. It belongs to alliance *Chemenerion angustifolii* (Rubel 33) Soó 33.

41. *Telekietum speciosae* Tregubov 41 – this association covers the edge of forests and near-creek places, the rare beautiful forest little gardens in beech zone, on Besna kobila and Bele vode (Dukat mountain), *Telekia speciosa* dominates, followed by *Chaerophyllum hirsutum*, *Athyrium filix-femina*, *Caltha palustris*,

Alchemilla vulgaris, *Mentha longifolia*, *Potentilla erecta*, *Myosotis palustris*, *Cardamine pratensis* etc. It belongs to alliance *Atropion belladonnae* Br.-Bl. 30 em. Oberd. 57

Subalpine and alpine vegetation

On the highest peaks of these mountains the subalpine vegetation is well developed, and alpine vegetation is just noted with next associations:

42. *Fagetum subalpinum sericum* Greb. 50 – it can be found on Vardenik, Besna Kobila and Dukat mountain. The *Fagus moesiaca* ssp. *subalpina* dominates, which trees are imbowed, and there are next species also: *Sorbus acuparia*, *Adenostyles alliariae*, *Luzula sylvatica*, *Saxifraga rotundifolia*, *Senecio nemorensis*, *Geranium robertanum*, *Cardamine bulbifera*, *Prenanthes purpurea*, *Aegopodium podagraria*, *Epilobium montanum* etc. It belongs to alliance *Fagion moesiacae subalpinum* B. Jov. 76.

43. *Lino-Nardetum strictae* Rexhepi et N. Rand. 80. – this association can be found on Vardenik, at south slopes and at Crnook, but small sizes. Beside the species *Linum capitatum* and *Nardus stricta*, in association we can find: *Pimpinella alpina*, *Peucedanum aequiradium*, *Campanula rotundifolia*, *Sedum sendtneri*, *Centaurea velenovskyi*, *Knautia magnifica*, *Verbascum longifolium*, *Hieracium hoppeanum* etc. It belongs to alliance *Poion violaceae* Ht 37.

44. *Centaureo- Festucetum validae* (N. Rand. 78) N. Rand. 81. – This association is located on Vardenik and Besna Kobila, the characteristic species are: *Festuca valida*, *Centaurea velenovskyi*, *Centaurea kotschiana*, *Crepis viscidula*, *Anthemis triumfetti*, and the next species are present also: *Thymus janke*, *Crocus veluchensis*, *Peucedanum aequiradium*, *Pimpinella alpina*, *Viola subalpina*, *Knautia magnifica* etc. It belongs to alliance *Festucion valido-paniculatae* (N. Rand. 84) V. Rand. 2001.

45. *Festucetum paniculatae* Ht 36 em. Simon 58 – on many localities in Krajište, in subalpine region we notice this beautiful association, dominated by *Festuca paniculata*, and there are the other species: *Genista depressa*, *Peucedanum aequiradium*, *Centaurea velenovskyi*, *Verbascum longifolium*, *Chamaecytisus polytrichus*, *Scleranthus neglectus*, *Campanula rotundifolia*, *Carx montana*, *Viola canina* etc. The association belongs to alliance *Festucion valido-paniculatae* (N. Rand. 84) V. Rand. 2001.

46. *Thymo-Poetum violaceae* Micevski 76 – in the area of Krajište, this association grows on Vardenik and Besna Kobila, on the highest peaks, and beside the species mentioned in the name of association, next species can be find: *Chamaecytisus polytrichus*, *Linum capitatum*, *Antennaria dioica*, *Verbascum longifolium*, *Peucedanum aequiradium*, *Ranunculus montanus*, *Euphrasia pectinata*, *Anhoxanthum odoratum* var *montanum*, *Crocus veluchensis*, *Gentianella bulgarica*, *Potentilla chrysocraspeda*, *Gentiana asclepiadea* etc. The association belongs to alliance *Poin violaceae* Ht 37.

47. *Vaccinio-Bruckenthalietum spiculifoliae* R. Jov. 72 – The bushy subalpine association characterized by two dominating plant species: *Vaccinium myrtillus* and *Bruckenthalia spiculifolia*. It can be found in subalpine region, over forest allianceary

on Vardenik, Besna Kobilica, Crnook etc. Except the mentioned species, it can be found there also: *Achillea lingulata*, *Festuca nigrescens* (subass. *festucetosum falacis*), *Arctostaphylos uva-ursi* (subass. *arctostaphylletosum*), *Vaccinium vitis-idaea*, *Linum capitatum*, *Agrostis capillaris*, *Jasione orbiculata*, *Calamagrostis arundinacea* etc. It belongs to alliance *Bruckenthalion spiculifoliae* Ht 49.

48. *Cetrario-Vaccinietum uliginosi* Gančev 63 – in the area of Krajište, this association can be found on Besna Kobilica and Dukat mountain, and, beside dominating species *Vaccinium uliginosum*, next species grow in it: *Cetraria islandica*, *Vaccinium myrtillus*, *Sesleria comosa*, *Antennaria dioica*, *Thlaspi precox*, *Potentilla chrysocraspeda*, *Campanula pinifolia* etc. The association belongs to alliance *Vaccinion uliginosi* Lakušić 74.

49. *Festuco-Seslerietum comosae* N. Rađ. 81 – it is association which grows in alpine region of Besna Kobilica and Široka mountain, characterized by species *Festuca nigrescens*, *Sesleria comosa*, *Thymus balcanus*, *Potentilla aurea*, *Linum carniolicum* ssp. *janke*, *Pimpinella alpina*, *Centaurea velenovskyi*, *Crepis conycifolia*, *Knautia magnifica*, *Gentiana asclepiadea*, *Campanula rotundifolia* ssp. *pinifolia*, *Hieracium pratense* etc. It belongs to alliance *Seslerion comosae* Ht 35

50. *Achilleo- Genistetum sericeae* N. Rađ. 81 – this well developed association can be found on rocky peaks of Besna Kobilica and Prosečenica, it get the name according to endem plants *Achillea chrysocoma* and *Genista sericea*, and except them, we can find also: *Sempervivum heuffeli*, *Vaccinium myrtillus*, *Poa violacea*, *Plantago holostea*, *Botrychium lunaria*, *Phleum michelli* etc. It belongs to alliance *Genistion sericeae* Rađ. 2008.

51. *Sempervivo-Minuartietum bulgaricae* N. Rađ. 84. – this association is developing on silicate boulders (granodiorites and andesites), it is characterized by next species: *Minuartia bulgarica*, *Sempervivum heuffelii*, *Sile lerchenfeldiana*, *Silene saxifraga*, *Silene waldsteinii*, *Allium pulchellum*, *Dianthus petreus* (andesites), *Seseli rigidum*, *Phleum alpestre* etc. It belongs to alliance *Silenion lerchenfeldianae* Ht 35.

52. *Linario-Polygonetum alpini* N. Rađ. 1995. – this association covers friable silicate boulders, it is characterized by next species: *Polygonum alpinum*, *Linaria dalmatica* ssp. *macedonica*, *Campanula persicifolia*, *Verbascum longifolium*, *Vincetoxicum hirundinaria*, *Poa violacea*, *Carex vulpina*, *Chanaecytisus polytrichus* etc. It belongs to alliance *Polygonion alpini* N. Rađ. 1995.

CONCLUSIONS

On vertical profile from 600 m (Ribarci) to 1921 m (Besna Kobilica), we made to identify, to know and to study 50 phytocenoses. We identified some weed, ruderal and the other vegetations also, but they are not represented in this paper.

In the area of Krajište, it is clearly cognized near-river and moisture vegetation with 20 associations, hilly and submountain vegetation with 9, mountain with 13, subalpine and alpine vegetation with 11 associations. Total: 52 associations.

The area Krajište looks monotone on first look, but it has geologic, pedologic and hydrologic diversity, and according to it, it has vegetation diversity also.

The researches need to be continued because the weed vegetation, ruderal vegetation and vegetation of forest edges remain uncover and they are not represented.

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