

PHYTOSOCIOLOGICAL DESCRIPTION OF MESOPHILOUS COLLINE-SUBMONTANE *FAGUS SYLVATICA* AND *CARPINUS BETULUS* FORESTS IN SLOVENIAN ISTRIA

FITOCENOLOŠKA OZNAKA MEZOFILNIH BUKOVIH IN BELOGABROVIH GOZDOV V GRIČEVNEM IN PODGORSKEM PASU SLOVENSKE ISTRE

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ABSTRACT

A phytosociological analysis of 46 relevés of mesophilous colline and submontane *Fagus sylvatica* as well as (or) *Carpinus betulus* forests was conducted in Slovenian Istria. It was established that they are frequently syndynamically interrelated: in places, common hornbeam stands are merely a degradation stage on beech sites, and can be classified into the subassociation *Ornithogalo pyrenaici-Fagetum fraxinetosum orni* (its locus classicus is in the Goriška Brda Hills) and into the new subassociation *Ornithogalo pyrenaici-Carpinetum betuli seslerietosum autumnalis*. Compared with similar submontane stands from other parts of the western and southwestern Slovenia they are slightly poorer in species, with fewer diagnostic species of alliances *Erythronio-Carpinion*, *Aremonio-Fagion* and *Tilio-Acerion*, order *Fagetalia sylvaticae* and class *Vaccinio-Piceetea*, and with more diagnostic species of the order *Quercetalia pubescenti-petraeae*. Geographically, they are characterised by the taxon *Helleborus odorus* subsp. *istriacus*. Although they cover small areas these forests generate high yields and are therefore important both economically and as biotopes of protected species.

Key words: phytosociology, synsystematics, beech sites, *Ornithogalo-Carpinetum*, *Ornithogalo-Fagetum*, Istria, Slovenia

IZVLEČEK

Fitocenološko smo analizirali 46 popisov mezofilnih gozdov bukve in (ali) belega gabra v kolinskem in submontanskem pasu slovenske Istre. Ugotovili smo, da so med seboj pogosto sindinamsko povezani: sestoji belega gabra so ponekod le degradacijska stopnja na bukovih rastiščih, tako da jih lahko uvrstimo v subasociacijo *Ornithogalo pyrenaici-Fagetum fraxinetosum orni* (ki ima klasična nahajališča v Goriških Brdih) in v novo subasociacijo *Ornithogalo pyrenaici-Carpinetum betuli seslerietosum autumnalis*. V primerjavi s podobnimi podgorskimi sestoji iz drugih delov zahodne in jugozahodne Slovenije so vrstno nekoliko revnejši, z manjšim deležem diagnostičnih vrst zvez *Erythronio-Carpinion*, *Aremonio-Fagion* in *Tilio-Acerion*, reda *Fagetalia sylvaticae* in razreda *Vaccinio-Piceetea* in z večjim deležem vrst reda *Quercetalia pubescenti-petraeae*. Fitogeografsko jih označuje takson *Helleborus odorus* subsp. *istriacus*. Kljub majhnim površinam so ti gozdovi zaradi donosnih rastišč pomembni gospodarsko in zaradi zavarovanih vrst tudi biotopsko.

Ključne besede: fitocenologija, sinsistematika, bukova rastišča, *Ornithogalo-Carpinetum*, *Ornithogalo-Fagetum*, Istra, Slovenija

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1 INTRODUCTION

1 UVOD

Phytosociological characteristics of beech forests in Slovenian Istria have already been discussed in several papers (Dakskobler, 1996a, 2013, Sadar and Dakskobler, 2015), but were mainly focused on the stands of the association *Seslerio autumnalis-Fagetum* that dominate on shady convex slopes. We also discussed more mesophilous beech and common hornbeam forests growing on levelled terrain, colluvial foothills and

gullies with deeper and moister soil than in the predominant stands of the association *Seslerio autumnalis-Fagetum*. We provisionally classified such mesophilous stands into associations *Ornithogalo pyrenaici-Fagetum* and *Ornithogalo pyrenaici-Carpinetum*. However, slightly similar beech and common hornbeam stands in the Croatian part of Istria are classified into two other associations, *Carici pilosae-Fagetum* Oberdorfer 1957 (Trinajstić, 1994, 2008) and *Anemono nemorosae-Carpinetum* Trinajstić 1964 (Trinajstić, 1994,

2008, Vukelić, 2012). The purpose of our analysis of 46 relevés was therefore to test the accuracy of our preliminary and provisional classifications.

1.1 Ecological description of the study area

1.1 Ekološki opis raziskovanega območja

The surveyed stands were situated mainly on shady aspects at 30 to 400 m a.s.l. The parent material consists of Eocene flysch and flysch-like sediments with alternating marlstone and sandstone layers and intercalations of breccia and limestones (Pleničar et al., 1973: 32–33, Buser, 2009). Several stands were recorded also on alluvium along small Istrian rivers and streams. Beech and common hornbeam stands in Slovenian Istria occur mainly on Eutric brown soils, along rivers also on better-developed fluvisols (Stepančič, 1974, Lovrenčak, 1998). The climate in the study area is warm, with mean annual temperature of 11 °C–12 °C and the vegetation period with the mean daytime temperature exceeding 10 °C for around 200 days, from early April to the end of October (Cegnar 1998). The average annual precipitation is 1000 to 1200 mm, with more than half of the rainfall incurring during the vegetation period. Spring and autumn receive more rainfall than winter and summer (Zupančič, 1998). Narrow valleys and gorges where beech and common hornbeam have survived have a colder local climate.

2 MATERIALS AND METHODS

2 MATERIALI IN METODE

Phytosociological relevés of beech and hornbeam stands in Slovenian Istria were made applying the Central-European method (Braun-Blanquet, 1964) and entered into the FloVegSi database (Fauna, Flora, Vegetation and Paleovegetation of Slovenia) of the Jovan Hadži Institute of Biology ZRC SAZU (Seliškar et al., 2003). The first step in arranging the relevés was hierarchical classification, so we transformed the combined cover-abundance values with numerical values (1–9) according to van der Maarel (1979). All calculations were carried out with the programme package SYN-TAX 2000 (Podani, 2001). We used the dendrogram obtained with the (unweighted) average linkage method (UPGMA) and Wishart's similarity ratio as the basis for the arrangement of relevés into analytic Table 1. All the recorded species were classified into sociological groups (groups of diagnostic species) taking into account numerous review papers and our long-standing experience. The nomenclature source for the names of vascular plants is the Mala flora Slovenije (Martinčič et al., 2007), except for the taxon *Helleborus odoratus* Waldst. et Kit. subsp. *istriacus* Schiffner. Martinčič (2003, 2011) is the nomenclature source for the names of mosses. The nomenclature sources for the names of syntaxa are Šilc and Čarni (2012), except for the name

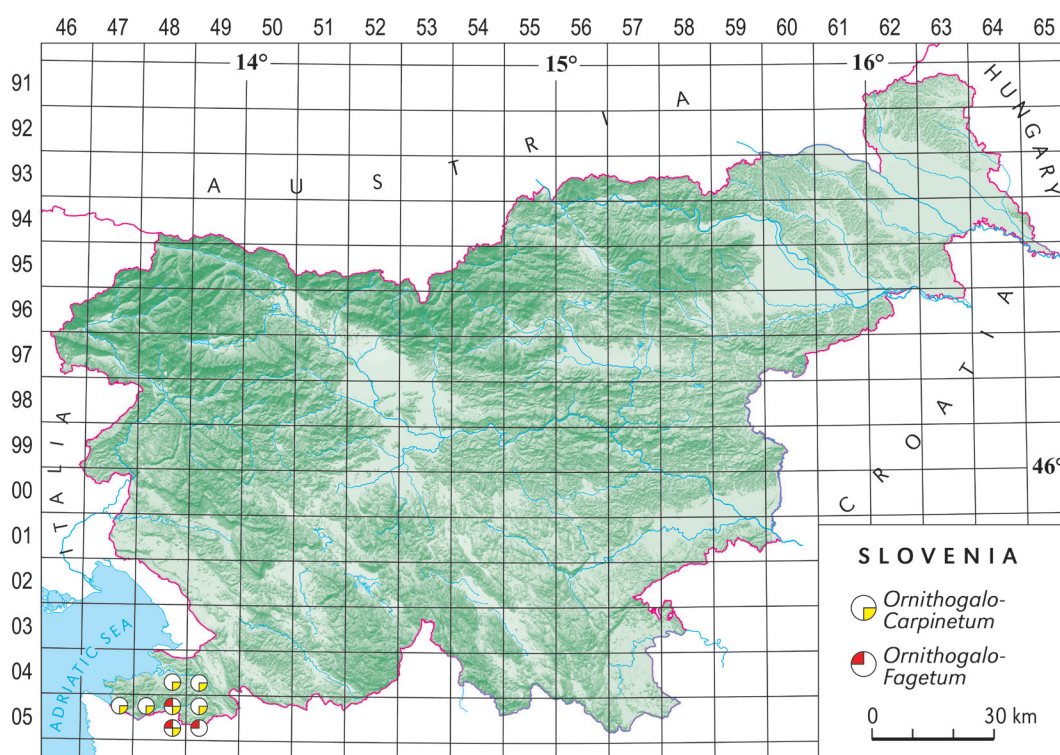


Fig. 1: Localities of recorded stands of the associations *Ornithogalo-Fagetum* and *Ornithogalo-Carpinetum* in Slovenian Istria

Slika 1: Nahajališča sestojev asociacij *Ornithogalo-Fagetum* in *Ornithogalo-Carpinetum* v slovenski Istri

of the class *Quercio-Fagetea* Braun-Blanquet et Vlieger in Vlieger 1937. The data on the parent material follow Buser (2009). The source for the nomenclature of soil types is Urbančič et al. (2005).

3 RESULTS AND DISCUSSION

3 REZULTATI IN RAZPRAVA

The 46 relevés of mesophilous stands, the tree layer of which is dominated by *Fagus sylvatica* and (or) *Carpinus betulus* (Figure 1) formed two larger and one smaller group (Figure 2). The first group comprises beech stands, the second common hornbeam stands; three relevés have a different species composition. One of them is a degradation stage of black locust (*Robinia pseudoacacia*) and beech (on a beech site), the other two are a fascinating pioneer forest of common hawthorn (*Crataegus monogyna*) on alluvium, likely a pioneer form of common hornbeam riparian forest classified into the association *Carici pendulae-Crataegetum monogynae* nom. prov.

On the whole, the species composition of beech stands is very similar to the species composition of common hornbeam stands. At least in places the studied common hornbeam stands are only a degradation stage on former beech sites. Trinajstić (1994) came to similar conclusions for the Croatian part of Istria.

Compared to similar submontane stands on flysch and mixed flysch-limestone bedrock elsewhere in the sub-Mediterranean and pre-Alpine sub-Mediterranean part of Slovenia (the lower course of the Idrijca and Bača valleys, the Soča Valley between Most na Soči and Solkan, the Idrija Valley, the valleys of the Vipava, Brannica and Raša) the mesophilous beech stands in Istria are poorer in species. Very rare or completely absent in Istrian submontane beech forests are some diagnostic species of the alliances *Erythronio-Carpinion* and *Aremonio-Fagion* (*Helleborus odoratus* subsp. *odoratus*, *Lamium orvala*, *Hacquetia epipactis*, *Euphorbia carnio-lica*), as well as some species of the order *Fagetalia sylvaticae* (*Fraxinus excelsior*, *Daphne mezereum*, *Galeobdolon flavidum*, *Asarum europaeum* subsp. *caucasicum*, *Prenanthes purpurea*) and of the classes *Quercio-Fagetea* (*Veratrum nigrum*, *Vinca minor*, *Hepatica nobilis*) and *Vaccinio-Piceetea* (*Aposeris foetida*, *Veronica urticifolia*, *Maianthemum bifolium*, *Luzula pilosa*). More common in Istrian mesophilous beech forest are some diagnostic species of the order *Quercetalia pubescenti-petraeae* (*Quercus cerris*, *Sorbus torminalis*, *Heleborus odoratus* subsp. *istriacus*). Certain floristic curiosities that very rarely occur in other so far described forms of the association *Ornithogalo-Fagetum* are *Arum italicum* and *Asparagus acutifolius*. Nevertheless, mesophi-

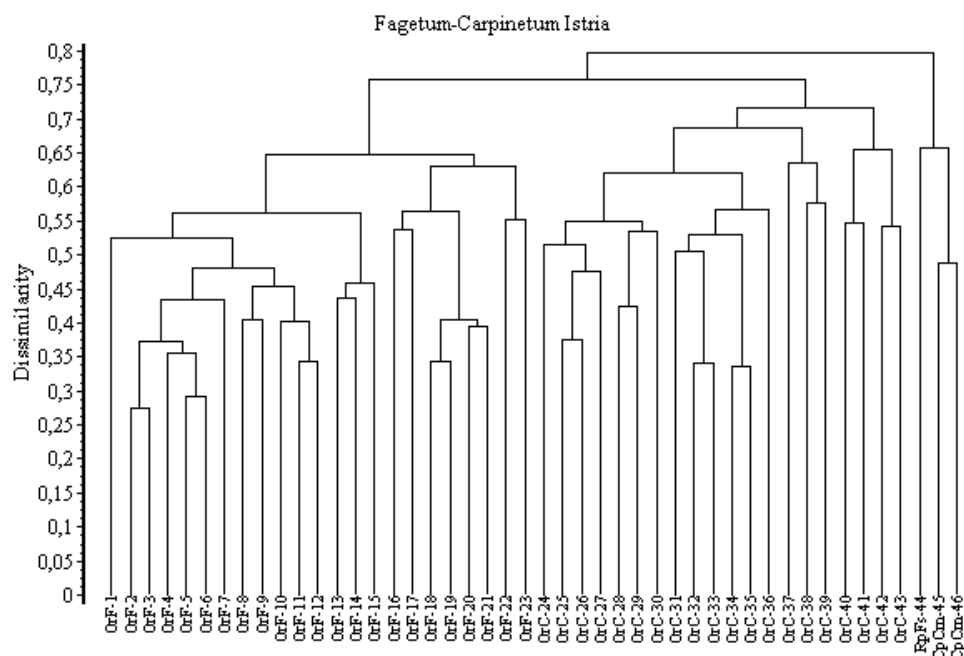


Fig. 2: Dendrogram of mesophilous colline-submontane forest stands with dominating *Fagus sylvatica* and (or) *Carpinus betulus* in Slovenian Istria, UPGMA, 1-similarity ratio: OrF – *Ornithogalo-Fagetum*, OrC – *Ornithogalo-Carpinetum*, RpFs – *Robinia pseudoacacia-Fagus sylvatica* stage, CpCm – *Carici pendulae-Crataegetum monogynae* nom. prov.

Slika 2: Dendrogram mezofilnih kolinsko-submontanskih gozdnih sestojev s prevladujočima bukvijsko (*Fagus sylvatica*) in (ali) belim gabrom (*Carpinus betulus*) v slovenski Istri, UPGMA, 1-similarity ratio: OrF – *Ornithogalo-Fagetum*, OrC – *Ornithogalo-Carpinetum*, RpFs – *Robinia pseudoacacia-Fagus sylvatica* stage, CpCm – *Carici pendulae-Crataegetum monogynae* nom. prov.

lous beech stands from Slovenian Istria still comprise most of the diagnostic species of the association *Ornithogalo pyrenaici-Fagetum* (Marinček et al., 1990, Dakskobler, 1996b, 2006), and we can still classify them into the geographical variant *Ornithogalo pyrenaici-Fagetum* var. geogr. *Helleborus istriacus* (Dakskobler, 2006), while on the level of subassociation they can be classified into the subassociation of drier sites - *fraxinetosum orni* (Dakskobler, 1996). But our comparison clearly shows that phytogeographical differences between the Central Soča Valley, Goriška Brda and the Vipava Valley on one side and Slovenian Istria on the other side are considerable. With comparison of Istrian communities (*Ornithogalo-Fagetum*, relevés 1–23 in Table 1, *Ornithogalo-Carpinetum*, relevés 24–43 in Table 1, *Seslerio autumnalis-Fagetum* – Dakskobler, 1996a) and two communities from the Goriška Brda and Vipava Valley (*Ornithogalo-Fagetum fraxinetosum orni*, Dakskobler, 1996b, *Ornithogalo-Fagetum*, (mostly) Hills near Gorica, Dakskobler, unpublished) we obtained the following result (Table 2, Figure 3).

Istrian communities are grouped together, apart of communities from the Gorica region. Rang of geographical variant is in some way adequate to “small”

association, but the existing Code of phytosociological nomenclature (Weber et al., 2000) does not consider it. Stands of the association *Ornithogalo-Fagetum* from the Central Soča Valley and lower Vipava Valley should be classified into the new geographical variant var. geogr. *Anemone trifolia*.

The rarest among the character species of the association *Ornithogalo-Fagetum* in Istrian mesophilous beech community are *Ornithogalum pyrenaicum* and *Crocus vernus* subsp. *vernus*. These two species are still present in Istria, but are not as common as, for example, in the Central Soča Valley. The reason for less frequent presence of *Ornithogalum pyrenaicum* in Slovenian part of Istria possibly lies in the geological bedrock and soil conditions. The optimum for this species are mixed (limestone with marlstone) bedrock and more or less neutral brown soils with enough water supply. Parent material in Istria is mainly flysch and soils are drier and more acid than in the Central Soča Valley. Classification of these stands into the Central-European association *Carici pilosae-Fagetum* (Trinajstić, 1994, 2008) is inappropriate, because the stands of this association have recently been discussed within the framework of the association *Cephalanthero*

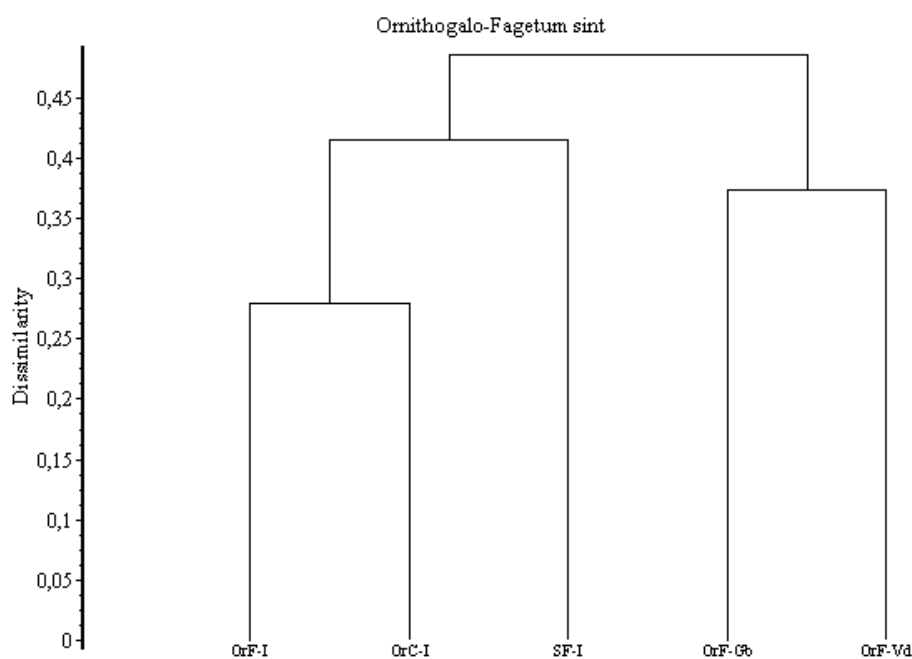


Fig. 3: Dendrogram of five types of the sub-Mediterranean *Fagus sylvatica* (and *Carpinus betulus*) communities, UPGMA, 1-similarity ratio: OrF-I – *Ornithogalo-Fagetum*, Istria, this article, OrC-I *Ornithogalo-Carpinetum*, Istria, this article, SF-I – *Seslerio autumnalis-Fagetum*, Istria (Dakskobler, 1996a), OrF-Gb – *Ornithogalo-Fagetum fraxinetosum orni* (Dakskobler, 1996b), OrF-Vd – *Ornithogalo-Fagetum*, the lower Vipava Valley, Dakskobler, unpublished

Slika 3: Dendrogram petih submediteranskih bukovih (in belongabrovih) združb, UPGMA, 1-similarity ratio: OrF-I – *Ornithogalo-Fagetum*, Istra, ta članek, OrC-I *Ornithogalo-Carpinetum*, Istra, ta članek, SF-I – *Seslerio autumnalis-Fagetum*, Istra (Dakskobler, 1996a), OrF-Gb – *Ornithogalo-Fagetum fraxinetosum orni* (Dakskobler, 1996b), OrF-Vd – *Ornithogalo-Fagetum*, spodnja Vipavska dolina, Dakskobler, neobjavljeno

longifoliae-Fagetum Vukelić, Baričević et Šapić 2012 (Vukelić, 2012), the stands of which dominate in the sub-Pannonian part of Croatia. *Carex sylvatica*, *Carex pilosa* and *Dryopteris filix-mas* are good differential species of the Istrian form of the association *Ornithogalo-Fagetum* against contact stands of the association *Seslerio autumnalis-Fagetum*. In terms of their entire species composition the stands of these two associations are very similar (see Figure 3, Tables 2 and 3); decisive here is the difference in medium coverage of several key species (such as *Sesleria autumnalis*) and also much greater proportion of diagnostic species of the order *Fagetalia saylvaticae* in the association *Ornithogalo-Fagetum* and higher proportion of diagnostic species of the order *Quercetalia pubescenti-petraeae* in the association *Seslerio autumnalis-Fagetum* (Table 3). Considerable floristic similarity of various types of beech communities that occur in the same altitudinal belt was established also in the Central Soča Valley (Dakskobler, 1996b).

Despite the rare occurrence of *Ornithogalum pyrenaicum* we believe that the classification of these most mesophilous beech forests in the area into the association *Ornithogalo-Fagetum* is appropriate. In the framework of the described syntaxon (*Ornithogalo-Fagetum* var. geogr. *Helleborus istriacus fraxinetosum orni*) we distinguish between three variants: the most mesophi-

lous with *Allium ursinum* and *Arum maculatum* (var. *Allium ursinum*), the typical variant (var. *typica*) and a slightly acidophilic variant with *Pteridium aquilinum* and *Calamagrostis arundinacea* (var. *Pteridium aquilinum*). The current structure of these stands is poor, with predominating coppice. Remains of charcoal piles still bear witness to charcoal production that took place there in the past. Sites of sub-Mediterranean submontane beech stands can be very productive (Dakskobler, 2015) and offer the possibility of growing high-quality beech to be used for wood also in Istria.

The species composition of stands with predominating *Carpinus betulus* was compared with the species composition of similar common hornbeam stands in the valleys of the Branica and Raša (subassociation *Ornithogalo-Carpinetum lamietosum orvalae*) – Dakskobler (2016) and with the species composition of the stands of the association *Anemone nemorosae-Carpinetum* from Croatian Istria (the vicinity of Pazin) – Trinajstić (1994). The results of the comparison are shown in Figure 4. Forest stands with dominant *Carpinus betulus* in Slovenian part of Istria differ from similar stands in the vicinity of Pazin by presence of following species: *Ornithogalum pyrenaicum*, *Fraxinus ornus*, *Cornus mas*, *Sesleria autumnalis*, *Tamus communis*, *Asparagus acutifolius*, *Lathyrus venetus*, *Carpinus orientalis*, *Castanea sativa*, *Quercus petraea* and *Ajuga reptans*, while the

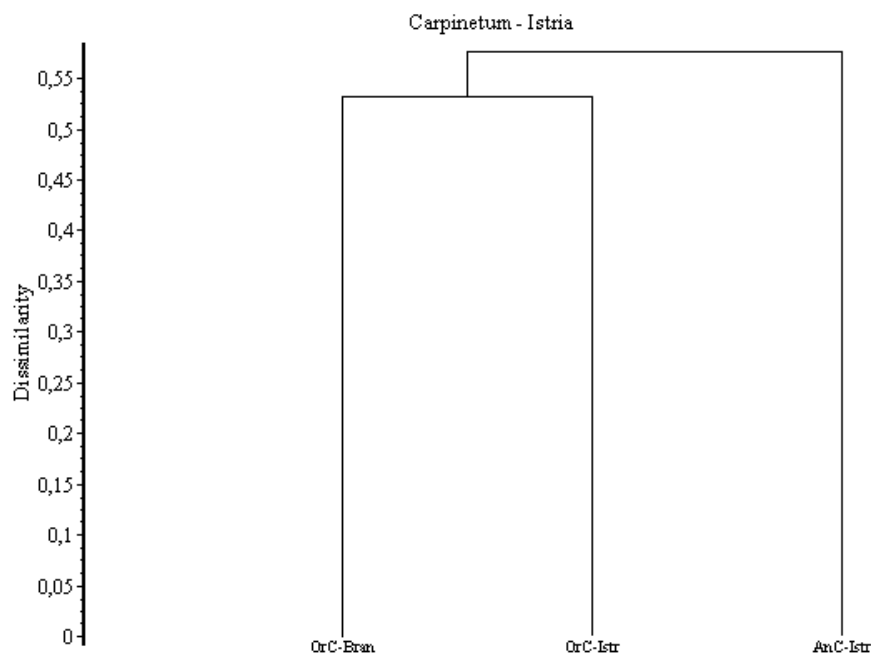


Fig. 4: Dendrogram of three types of the sub-Mediterranean *Carpinus betulus* communities, UPGMA, 1-similarity ratio: OrC-Bran – *Ornithogalo-Carpinetum lamietosum orvalae*, OrC-Istra – *Ornithogalo-Carpinetum*, Slovenian Istria, AnC-Istra – *Anemone nemorosae-Carpinetum*, Croatian Istria

Slika 4: Dendrogram treh submediteranskih združb belega gabra, UPGMA, 1-similarity ratio: OrC-Bran – *Ornithogalo-Carpinetum lamietosum orvalae*, OrC-Istra – *Ornithogalo-Carpinetum*, slovenska Istra, AnC-Istra – *Anemone nemorosae-Carpinetum*, hrvaška Istra

Table 2: Synoptyc Table: *Ornithogalo-Fagetum*, *Ornithogalo-Carpinetum*, *Seslerio-Fagetum*, Slovenian Istria, Goriška Brda, Vipava Valley

Successive number (Zaporedna številka)	1	2	3	4	5
Number of relevé (Število popisov)	23	19	15	15	10
Sign for syntaxa (Oznaka sintaksnov)	OrF-I	OrC-I	SF-I	OrF-Gb	OrF-Vd
AF <i>Aremonio-Fagion</i>					
<i>Cyclamen purpurascens</i>	E1	78	20	40	73
<i>Ruscus hypoglossum</i>	E2a	9	.	.	.
<i>Daphne laureola</i>	E2a	4	10	.	.
<i>Lamium orvala</i>	E1	.	5	.	33
<i>Anemone x pittonii</i>	E1	.	5	.	13
<i>Anemone trifolia</i>	E1	.	.	.	93
<i>Euphorbia carniolica</i>	E1	.	.	.	67
<i>Hacquetia epipactis</i>	E1	.	.	.	33
<i>Epimedium alpinum</i>	E1	.	.	.	10
<i>Cardamine enneaphyllos</i>	E1	.	.	.	10
<i>Cardamine trifolia</i>	E1	.	.	.	20
EC <i>Erythronio-Carpinion</i>					
<i>Lonicera caprifolium</i>	E2a	87	90	100	67
<i>Primula vulgaris</i>	E1	70	90	60	93
<i>Galanthus nivalis</i>	E1	35	25	.	7
<i>Ornithogalum pyrenaicum</i>	E1	4	40	.	13
<i>Crocus vernus</i> subsp. <i>vernus</i>	E1	4	20	.	93
<i>Erythronium dens-canis</i>	E1	4	15	.	40
<i>Knautia drymeia</i> subsp. <i>tergestina</i>	E1	.	15	7	.
<i>Helleborus odorus</i>	E1	.	.	.	27
TA <i>Tilio-Acerion</i>					
<i>Arum maculatum</i>	E1	30	35	.	20
<i>Athyrium filix-femina</i>	E1	26	.	.	67
<i>Acer pseudoplatanus</i>	E3	9	5	13	47
<i>Acer pseudoplatanus</i>	E2	4	10	27	93
<i>Acer pseudoplatanus</i>	E1	4	10	53	73
<i>Polystichum aculeatum</i>	E1	9	.	.	13
<i>Geranium robertianum</i>	E1	4	.	.	.
<i>Juglans regia</i>	E2a	4	5	.	30
<i>Ulmus glabra</i>	E3	4	.	7	7
<i>Ulmus glabra</i>	E2	4	.	13	40
<i>Dryopteris affinis</i>	E1	4	.	.	27
<i>Senecio nemorensis</i>	E1	4	.	.	7
<i>Aruncus dioicus</i>	E1	.	5	.	40
<i>Tilia platyphyllos</i>	E2	.	5	.	.
<i>Tilia platyphyllos</i>	E1	.	5	.	.
<i>Acer platanoides</i>	E1	.	.	.	10
AI <i>Alnion incanae</i>					
<i>Arum italicum</i>	E1	30	25	.	.
<i>Viburnum opulus</i>	E2	13	.	20	20
<i>Populus nigra</i>	E3b	4	5	.	.
<i>Populus nigra</i>	E2	.	5	.	.
<i>Carex pendula</i>	E1	.	10	.	10
<i>Allium vineale</i>	E1	.	10	.	.
<i>Rubus caesius</i>	E1	.	5	.	.
<i>Frangula alnus</i>	E2	.	5	.	10
<i>Fraxinus angustifolia</i>	E2	.	5	.	.
<i>Equisetum arvense</i>	E1	.	5	.	.
<i>Alnus glutinosa</i>	E3	.	.	.	7
FS <i>Fagetalia sylvaticae</i>					
<i>Fagus sylvatica</i>	E3	100	25	100	100
<i>Fagus sylvatica</i>	E2b	74	25	93	100
<i>Fagus sylvatica</i>	E1	74	15	60	67

Preglednica 2: Sintezna tabela sintaksonov: *Ornithogalo-Fagetum*, *Ornithogalo-Carpinetum*, *Seslerio-Fagetum*, Slovenska Istra, Goriška Brda, Vipavska dolina

Successive number (Zaporedna številka)	1	2	3	4	5
Number of relevé (Število popisov)	23	19	15	15	10
<i>Carex sylvatica</i>	E1	87	65	27	53
<i>Galeobdolon montanum</i>	E1	87	40	33	.
<i>Euphorbia amygdaloides</i>	E1	70	50	80	.
<i>Polygonatum multiflorum</i>	E1	65	35	60	93
<i>Symphytum tuberosum</i>	E1	61	60	53	87
<i>Viola reichenbachiana</i>	E1	61	70	33	60
<i>Lilium martagon</i>	E1	57	50	47	80
<i>Pulmonaria officinalis</i>	E1	57	30	20	47
<i>Prunus avium</i>	E3	35	25	7	40
<i>Prunus avium</i>	E2	22	10	13	73
<i>Prunus avium</i>	E1	57	35	40	53
<i>Dryopteris filix-mas</i>	E1	57	.	27	47
<i>Carpinus betulus</i>	E3	52	100	13	27
<i>Carpinus betulus</i>	E2a	4	35	.	6
<i>Carpinus betulus</i>	E1	17	50	.	6
<i>Euphorbia dulcis</i>	E1	48	50	67	53
<i>Carex pilosa</i>	E1	48	0	40	20
<i>Allium ursinum</i>	E1	35	25	.	30
<i>Lathyrus vernus</i>	E1	30	30	.	47
<i>Salvia glutinosa</i>	E1	26	25	27	53
<i>Campanula trachelium</i>	E1	22	40	20	13
<i>Mercurialis perennis</i>	E1	22	30	13	67
<i>Heracleum sphondylium</i>	E1	22	20	13	13
<i>Galium laevigatum</i>	E1	17	30	60	60
<i>Sanicula europaea</i>	E1	17	10	.	20
<i>Brachypodium sylvaticum</i>	E1	13	30	.	27
<i>Scrophularia nodosa</i>	E1	13	.	.	.
<i>Neottia nidus-avis</i>	E1	9	10	13	.
<i>Mycelis muralis</i>	E1	9	5	.	10
<i>Senecio ovatus</i>	E1	4	.	.	47
<i>Melica nutans</i>	E1	4	.	.	40
<i>Cardamine bulbifera</i>	E1	.	5	.	30
<i>Sambucus nigra</i>	E2	.	5	.	13
<i>Cephalanthera damasonium</i>	E1	.	.	27	.
<i>Galeobdolon flavidum</i>	E1	.	.	.	67
<i>Daphne mezereum</i>	E1	.	.	.	67
<i>Prenanthes purpurea</i>	E1	.	.	.	53
<i>Asarum europaeum</i> subsp. <i>caucasicum</i>	E1	.	.	.	40
<i>Fraxinus excelsior</i>	E2	.	.	.	26
<i>Tilia cordata</i>	E2	.	.	.	20
<i>Tilia cordata</i>	E3	.	.	.	13
<i>Actaea spicata</i>	E1	.	.	.	7
<i>Circaea lutetiana</i>	E1	.	.	.	10
<i>Lathyrus vernus</i> subsp. <i>flaccidus</i>	E1	.	.	.	10
<i>Paris quadrifolia</i>	E1	.	.	.	10
<i>Ranunculus lanuginosus</i>	E1	.	.	.	10
QP <i>Quercetalia pubescenti-petraeae</i> (inc. <i>Quercetalia ilicis</i>)					
<i>Ruscus aculeatus</i>	E2a	100	100	93	100
<i>Sesleria autumnalis</i>	E1	87	95	100	100
<i>Tamus communis</i>	E1	78	80	93	100
<i>Helleborus odorus</i> subsp. <i>istriacus</i>	E1	61	50	27	.
<i>Lathyrus venetus</i>	E1	48	35	27	10
<i>Fraxinus ornus</i>	E3	52	65	93	93
<i>Fraxinus ornus</i>	E2	57	85	80	66
<i>Fraxinus ornus</i>	E1	57	70	20	40
<i>Quercus cerris</i>	E3	52	40	60	13
<i>Quercus cerris</i>	E2	.	5	.	.

Successive number (Zaporedna številka)	1	2	3	4	5	Successive number (Zaporedna številka)	1	2	3	4	5		
Number of relevé (Število popisov)	23	19	15	15	10	Number of relevé (Število popisov)	23	19	15	15	10		
<i>Quercus cerris</i>	E1	43	20	33	7	.	<i>Viola riviniana</i>	E1	22	15	.	7	20
<i>Cornus mas</i>	E2	35	65	33	53	30	<i>Rosa arvensis</i>	E2a	22	10	.	.	10
<i>Sorbus torminalis</i>	E3	30	45	100	33	10	<i>Ilex aquifolium</i>	E3a	13	.	20	.	10
<i>Sorbus torminalis</i>	E2	22	30	87	27	10	<i>Ilex aquifolium</i>	E2	22	5	60	7	20
<i>Sorbus torminalis</i>	E1	9	20	7	.	10	<i>Aegopodium podagraria</i>	E1	9	25	.	20	30
<i>Ostrya carpinifolia</i>	E3	26	55	20	46	20	<i>Cephalanthera longifolia</i>	E1	9	20	13	.	.
<i>Ostrya carpinifolia</i>	E2	.	5	.	.	10	<i>Festuca heterophylla</i>	E1	4	25	20	.	10
<i>Melittis melissophyllum</i>	E1	22	20	100	40	10	<i>Cerastium sylvaticum</i>	E1	9	.	.	.	.
<i>Tanacetum corymbosum</i>	E1	17	25	53	46	10	<i>Moehringia trinervia</i>	E1	9	.	.	.	.
QI <i>Asparagus acutifolius</i>	E2a	13	45	20	.	.	<i>Carex montana</i>	E1	4	55	.	.	.
<i>Sorbus domestica</i>	E3	9	10	60	7	.	<i>Platanthera chlorantha</i>	E1	4	15	47	.	.
<i>Carpinus orientalis</i>	E3	4	30	.	.	.	<i>Pyrus pyraeaster</i>	E3b	.	10	13	.	.
<i>Carpinus orientalis</i>	E2	.	20	.	.	.	<i>Pyrus pyraeaster</i>	E1	4	.	7	.	10
<i>Lathyrus niger</i>	E1	4	20	53	7	.	<i>Ranunculus ficaria (Ficaria verna)</i>	E1	4	5	.	.	10
<i>Orchis purpurea</i>	E1	4	10	.	.	.	<i>Lathraea squamaria</i>	E1	4	.	.	.	.
<i>Carex flacca</i>	E1	4	5	.	.	.	<i>Platanthera bifolia</i>	E1	4	.	.	.	.
<i>Buglossoides purpureo-caerulea</i>	E1	.	15	.	.	10	<i>Stellaria holostea</i>	E1	4	.	.	.	.
<i>Asparagus tenuifolius</i>	E1	.	10	7	13	20	<i>Scilla bifolia</i>	E1	.	35	.	33	20
QI <i>Laurus nobilis</i>	E2	.	5	.	.	.	<i>Ulmus minor</i>	E3	.	10	7	.	10
QI <i>Rubia peregrina</i>	E1	.	5	.	.	.	<i>Ulmus minor</i>	E2	.	20	7	.	10
<i>Convallaria majalis</i>	E1	.	5	.	.	10	<i>Ulmus minor</i>	E1	.	5	.	.	.
<i>Cotinus coggygria</i>	E2	.	5	.	.	.	<i>Malus sylvestris</i>	E3	.	20	.	.	.
<i>Orchis mascula subsp. speciosa</i>	E1	.	5	.	.	.	<i>Listera ovata</i>	E1	.	15	.	13	.
<i>Pulmonaria australis</i>	E1	.	5	.	.	.	<i>Pulmonaria stiriaca</i>	E1	.	.	.	27	.
<i>Quercus pubescens</i>	E3	.	.	20	40	.	<i>Veratrum nigrum</i>	E1	.	.	.	13	.
<i>Quercus pubescens</i>	E1	.	5	7	20	.	<i>Vinca minor</i>	E1	.	.	.	7	40
<i>Sorbus aria</i>	E2	.	.	.	13	.	<i>Hepatica nobilis</i>	E1	.	.	.	7	20
<i>Aristolochia lutea</i>	E1	.	.	.	7	30	VP Vaccinio-Piceetea						
<i>Acer obtusatum</i>	E1	.	.	.	.	10	<i>Calamagrostis arundinacea</i>	E1	26	5	33	73	.
QR Quercetalia roboris							<i>Gentiana asclepiadea</i>	E1	13	.	27	20	.
<i>Castanea sativa</i>	E3	39	30	87	100	50	<i>Luzula luzuloides</i>	E1	9	.	27	7	30
<i>Castanea sativa</i>	E2	17	.	87	87	10	<i>Hieracium murorum</i>	E1	4	5	47	7	10
<i>Castanea sativa</i>	E1	13	5	33	33	20	<i>Orthilia secunda</i>	E1	4	.	.	.	.
<i>Pteridium aquilinum</i>	E1	39	15	33	80	20	<i>Oxalis acetosella</i>	E1	4	.	.	13	20
<i>Rubus hirtus</i>	E2a	39	10	47	60	10	<i>Solidago virgaurea</i>	E1	.	15	40	27	10
<i>Hieracium racemosum</i>	E1	17	15	80	13	30	<i>Picea abies</i>	E2	.	5	.	.	.
<i>Populus tremula</i>	E3b	9	.	.	.	.	<i>Aposeris foetida</i>	E1	.	.	.	29	60
<i>Luzula forsteri</i>	E1	4	.	.	.	.	<i>Veronica urticifolia</i>	E1	.	.	.	27	10
<i>Populus tremula</i>	E1	4	.	.	.	.	<i>Abies alba</i>	E3	.	.	.	7	10
<i>Veronica officinalis</i>	E1	4	.	.	.	.	<i>Maianthemum bifolium</i>	E1	.	.	.	.	30
<i>Serratula tinctoria</i>	E1	.	15	50	.	20	<i>Luzula pilosa</i>	E1	.	.	.	.	30
<i>Hieracium sabaudum</i>	E1	.	.	20	.	.	<i>Larix decidua</i>	E3	.	.	.	.	10
<i>Betonica officinalis</i>	E1	.	.	.	7	10	<i>Pinus sylvestris</i>	E3	.	.	.	.	10
<i>Quercus robur</i>	E2	.	.	.	7	.	<i>Dryopteris dilatata</i>	E1	.	.	.	.	10
QF Quercu-Fagetea							RP Rhamno-Prunetea						
<i>Carex digitata</i>	E1	91	85	87	100	90	<i>Ligustrum vulgare</i>	E2a	52	80	27	7	20
<i>Acer campestre</i>	E3	78	75	46	40	30	<i>Crataegus monogyna</i>	E3	4	20	.	.	.
<i>Acer campestre</i>	E2	30	45	13	27	20	<i>Crataegus monogyna</i>	E2	48	50	47	53	50
<i>Acer campestre</i>	E1	57	85	20	7	20	<i>Rubus ulmifolius</i>	E2a	13	30	.	.	50
<i>Crataegus laevigata</i>	E2	70	80	93	87	60	<i>Ficus carica</i>	E2b	9	.	.	.	.
<i>Hedera helix</i>	E3a	57	70	40	47	80	<i>Cornus sanguinea</i>	E2b	4	25	.	.	.
<i>Hedera helix</i>	E1	70	90	30	80	90	<i>Cornus sanguinea</i>	E2a	.	30	27	.	10
<i>Anemone nemorosa</i>	E1	65	50	73	93	100	<i>Euonymus europaea</i>	E2	4	20	.	.	50
<i>Melica uniflora</i>	E1	52	0	27	7	10	<i>Prunus spinosa</i>	E2	4	5	.	.	.
<i>Clematis vitalba</i>	E3a	9	20	.	.	.	<i>Juniperus communis</i>	E2	.	5	40	.	.
<i>Clematis vitalba</i>	E2	30	20	47	53	40	<i>Rosa arvensis</i>	E2	.	.	40	13	10
<i>Corylus avellana</i>	E3a	.	5	.	.	.	<i>Viburnum lantana</i>	E2	.	.	.	7	.
<i>Corylus avellana</i>	E2	26	70	.	40	90	TG Trifolio-Geranietea						
<i>Quercus petraea</i>	E3	22	50	47	.	70	<i>Viola hirta</i>	E1	22	25	.	.	.
<i>Quercus petraea</i>	E2	.	5	.	.	10	<i>Fragaria moschata</i>	E1	13	.	.	.	.
<i>Quercus petraea</i>	E1	17	45	13	.	50	<i>Vincetoxicum hirsutiflorum</i>	E1	4	30	33	7	.

Successive number (Zaporedna številka)	1	2	3	4	5
Number of relevé (Število popisov)	23	19	15	15	10
<i>Viola odorata</i>	E1	4	.	20	.
<i>Clinopodium vulgare</i>	E1	4	.	.	.
<i>Campanula rapunculoides</i>	E1	.	10	.	10
EA Epilobietea angustifolii					
<i>Stachys sylvatica</i>	E1	13	5	.	.
<i>Robinia pseudoacacia</i>	E3b	4	20	.	7 50
<i>Robinia pseudoacacia</i>	E2	9	.	.	13 40
<i>Geum urbanum</i>	E1	4	5	.	.
<i>Erigeron annuus</i>	E1	4	.	.	.
<i>Hypericum hirsutum</i>	E1	4	.	.	.
<i>Torilis japonica</i>	E1	4	.	.	.
<i>Fragaria vesca</i>	E1	.	20	.	7 .
<i>Eupatorium cannabinum</i>	E1	.	5	.	7 .
<i>Arctium nemorosum</i>	E1	.	5	.	.
<i>Lamium maculatum</i>	E1	.	5	.	.
<i>Calamintha sylvatica</i>	E1	.	.	.	7 10
<i>Spiraea japonica</i>	E2	.	.	.	40
<i>Galeopsis pubescens</i>	E1	.	.	.	10
<i>Galeopsis speciosa</i>	E1	.	.	.	10
FB Festuco-Brometea					
<i>Chamaecytisus hirsutus</i>	E2b	.	5	.	.
<i>Brachypodium rupestre</i>	E1	.	5	.	.
MA Molinio-Arrhenatheretea					
<i>Ajuga reptans</i>	E1	65	80	47	. 10
<i>Veronica chamaedrys</i>	E1	17	10	47	. .
<i>Prunella vulgaris</i>	E1	.	5	.	.
<i>Ranunculus repens</i>	E1	.	5	.	.
<i>Colchicum autumnale</i>	E1	.	.	.	13 10
AT Asplenietea trichomanis					
<i>Polypodium vulgare</i>	E1	13	5	27	27 20
<i>Asplenium trichomanes</i>	E1	4	5	.	7 10
ML Mosses (Mahovi)					
<i>Isoetes macrospora</i>	E0	70	15	27	40 30
<i>Fissidens taxifolius</i>	E0	65	55	93	87 30
<i>Ctenidium molluscum</i>	E0	39	5	20	13 10
<i>Anomodon attenuatus</i>	E0	35	10	27	7 .
<i>Brachythecium velutinum</i>	E0	26	20	47	33 60
<i>Eurhynchium striatum</i>	E0	26	15	40	13 10
<i>Plagiomnium undulatum</i>	E0	22	35	13	. .
<i>Atrichum undulatum</i>	E0	22	20	27	27 40
<i>Hypnum cupressiforme</i>	E0	22	.	80	20 .

species *Isopyrum thalictroides*, *Acer obtusatum*, *Carex pilosa*, *Melica uniflora* and *Salix caprea* are differential for the stands of the association *Anemone nemorosa-Carpinetum betuli*. There is evidently difference in ecology, while stands from the Slovenian part of Istria thrive on drier sites than stands near Pazin. In terms of species composition the studied stands therefore resemble the stands of the association *Ornithogalo-Carpinetum* more than the stands of the association *Anemone nemorosa-Carpinetum*, so we find the classification into the first association more appropriate. Its character and differential species *Ruscus aculeatus*, *Sesleria autumnalis*, *Crataegus laevigata*, *Ornithogalum pyrenaicum* are relatively frequent and we added also the species *Scilla bifolia*, *Arum italicum* and *Carpinus orientalis* to the differential combination. The latter

Successive number (Zaporedna številka)	1	2	3	4	5
Number of relevé (Število popisov)	23	19	15	15	10
<i>Anomodon viticulosus</i>	E0	17	15	.	.
<i>Plagiothecium denticulatum</i>	E0	17	.	47	80 10
<i>Brachythecium rutabulum</i>	E0	13	10	13	. .
<i>Neckera complanata</i>	E0	13	5	13	27 .
<i>Isoetes macrospora</i>	E0	13	.	67	40 .
<i>Thamnobryum alopecurum</i>	E0	9	20	.	. 10
<i>Fissidens dubius</i>	E0	9	.	.	. .
<i>Neckera crispa</i>	E0	9	.	13	7 20
<i>Plagiochila porelloides</i>	E0	9	.	.	13 10
<i>Schistidium apocarpum</i>	E0	9	.	.	20 10
<i>Hypnum cupressiforme</i> var. <i>filiforme</i>	E0	4	.	33	7 .
<i>Polytrichum formosum</i>	E0	4	.	.	13 50
<i>Metzgeria furcata</i>	E0	4	.	.	7 .
<i>Homalothecium lutescens</i>	E0	4	.	.	. .
<i>Homalothecium philippeanum</i>	E0	4	.	.	. .
<i>Mnium affine</i>	E0	4	.	.	. .
<i>Porella platyphylla</i>	E0	4	.	.	. .
<i>Thuidium tamariscinum</i>	E0	.	10	20	20 30
<i>Dicranum scoparium</i>	E0	.	5	.	. .
<i>Mnium</i> sp.	E0	.	5	.	. .
<i>Dicranella heteromalla</i>	E0	.	.	13	46 .
<i>Ulota crispa</i>	E0	.	.	13	. .
<i>Peltigera canina</i>	E0	.	.	13	. .
<i>Leucobryum glaucum</i>	E0	.	.	.	7 10
<i>Tortella tortuosa</i>	E0	.	.	.	7 .
<i>Bartramia pomiformis</i>	E0	.	.	.	7 .
<i>Conocephalum conicum</i>	E0	.	.	.	. 10

Legend - Legenda

1 *Ornithogalo-Fagetum* var. geogr. *Helleborus istriacus fraxinetosum orni*, Istria, this article

2 *Ornithogalo-Carpinetum* var. geogr. *Helleborus istriacus*, Istria, this article

3 *Sesleria autumnalis-Fagetum* var. geogr. *Sorbus domestica*, Istria (Dakskobler 1996a)

4 *Ornithogalo-Carpinetum* var. geogr. *Anemone trifolia fraxinetosum orni*, Goriška Brda (Dakskobler 1996b)

5 *Ornithogalo-Fagetum* var. geogr. *Anemone trifolia*, Vipava Valley, Goriška Brda (Dakskobler, unpublished)

two in particular have not yet been reported for the stands of other forms of the association *Ornithogalo-Carpinetum*. The studied stands are classified into the new subassociation *-seslerietosum autumnalis* subass. nova. Its nomenclature type, *holotypus*, is relevé 33 in Table 1. Its differential species are *Sesleria autumnalis*, *Tamus communis*, *Lathyrus venetus* and *Carpinus orientalis*. The new subassociation characterises common hornbeam sites in the warm and relatively dry climate, that differs from the climate in which the stands of other forms of this association occur. Their stands can be subdivided into three variants: var. *Quercus petraea*, on more acidophilous sites, with often dominant sessile oak in the tree layer; differential species is also *Galium laevigatum*, var. *Arum maculatum*, on more mesophilous sites (differential species is also *Allium ur-*

Table 3: Phytosociological groups in the syntaxa *Ornithogalo-Fagetum*, *Ornithogalo-Carpinetum* and *Seslerio-Fagetum*; SW and W Slovenia**Preglednica 3:** Fitocenološke skupine v sintaksonih *Ornithogalo-Fagetum*, *Ornithogalo-Carpinetum*, *Seslerio-Fagetum*, jugozahodna in zahodna Slovenija

Successive number (Zaporedna številka)	1	2	3	4	5
Number of relevé (Število popisov)	23	19	15	15	10
Sign for syntaxa (Oznaka sintaksnov)	OF-I	OC-I	SE-I	OF-Op	OF-Vd
<i>Aremonio-Fagion</i>	2	0,9	0,8	5,5	5,4
<i>Erythronio-Carpinion</i>	4,5	6,4	3,5	6	5,8
<i>Tilio-Acerion</i>	2,4	1,7	2,3	7,3	7,9
<i>Alnion incanae</i>	1,1	1,6	0,4	0,5	1,5
<i>Fagetalia sylvaticae</i>	30	23	20	30	28
<i>Quercetalia pubescenti-petraeae</i> (inc. <i>Quercetea ilicis</i>)	18	24	25	15	9,7
<i>Quercetalia roboris</i>	4,1	2	9,1	6,8	3,3
<i>Quercu-Fagetea</i>	18	24	15	13	19
<i>Vaccinio-Piceetea</i>	1,3	0,7	3,6	3,7	4,6
<i>Rhamno-Prunetea</i>	3,1	5,8	3,8	1,4	3,7
<i>Trifolio-Geranietea</i> (inc. <i>Festuco-Brometea</i>)	1,1	1,6	0,7	0,5	0,2
<i>Epilobietea angustifolii</i>	1	1,4	0	0,7	3,1
<i>Molinio-Arrhenatheretea</i>	1,8	2,2	2	0,2	0,4
<i>Asplenietea trichomanis</i>	0,4	0,2	0,6	0,6	0,6
Mosses (Mahovi)	10	5,3	13	9,5	6,6
Total (Skupaj)	100	100	100	100	100

Legend - Legenda

1 *Ornithogalo-Fagetum* var. geogr. *Helleborus istriacus fraxinetosum orni*, Istria, this article

2 *Ornithogalo-Carpinetum* var. geogr. *Helleborus istriacus*, Istria, this article

3 *Seslerio autumnalis-Fagetum* var. geogr. *Sorbus domestica*, Istria (Dakskobler 1996a)

4 *Ornithogalo-Carpinetum* var. geogr. *Anemone trifolia fraxinetosum orni*, Goriška Brda (Dakskobler 1996b)

5 *Ornithogalo-Fagetum* var. geogr. *Anemone trifolia*, Vipava Valley, Goriška Brda (Dakskobler, unpublished)

sinum) and var. *Prunus avium*, as a more pioneer form (differential species are also *Viola hirta* and *Vincetoxicum hirundinaria*).

In terms of phytogeography these stands are classified into the geographical variant var. geogr. *Helleborus istriacus* var. geogr. nova (the nomenclature type is the same relevé as the nomenclature type of the new subassociation). This geographical variant was already discussed in a previous paper (Dakskobler, 2016), but was not typified at the time.

4 CONCLUSIONS**4 ZAKLJUČKI**

Mesophilous beech and common hornbeam forests are very rare in Slovenian Istria, where they mainly

occupy small areas. The common hornbeam community is often only a stage of degradation on former beech sites. The current occurrence of beech stands and numerous species characteristic for its communities (such as *Erythronium dens-canis*, *Cyclamen purpurascens*, *Mecurialis perennis*, *Euphorbia amygdaloides*, *Lilium martagon*, *Allium ursinum*, *Salvia glutinosa*, *Pulmonaria officinalis*, *Dryopteris filix-mas*, *Polystichum aculeatum* and other), mainly in the catchment area of the Dragonja, partly also the Rižana and Malinska, indirectly indicates previously definitely more abundant presence of beech in this area, something that has been reported also by palynologists (Culiberg, 1995, Šercelj, 1996), dendrologists and geneticists (Brus, 2010). It is the responsibility of the forestry profession to preserve these stands through adequate management and to allow beech to regenerate and develop new generations. Istrian forests with their diversity of tree species (economically interesting are the minority species *Sorbus domestica* and *S. torminalis*) and the diversity of their sites, which is due to the vicinity of the Adriatic Sea, pose a unique challenge that should be given much more attention both in terms of research as well as silviculture and forest management. Their role as biotopes is also significant, given that they serve as sites of several protected species (Anon., 2004): *Ruscus aculeatus*, *R. hypoglossum*, *Cyclamen purpurascens*, *Galanthus nivalis*, *Erythronium dens-canis*, *Helleborus odoratus* subsp. *istriacus*, *Lilium martagon*, *Neottia nidus-avis*, *Ilex aquifolium*, *Orchis purpurea*, *O. mascula* subsp. *speciosa*, *Cephalanthera longifolia*, *Platanthera bifolia*, *P. chlorantha* as well as several species that are rare either in Slovenia or Istria (*Luzula forsteri*, *Orthilia secunda*).

5 POVZETEK**5 SUMMARY**

Fitocenološka analiza kolinsko-submontanskih bukovih in belogabrovih sestojev v flišnem delu slovenske Istre s hierarhično klasifikacijo je pokazala, da lahko razlikujemo dve asociaciji *Ornithogalo-Fagetum* in *Ornithogalo-Carpinetum*, pri čemer so sestoji druge asociacije pogosto le degradacijski stadij prve. Mezofilni bukovi sestoji v Istri so v primerjavi s podobnimi gričevnimi in podgorskimi sestoji na flišni in mešani flišno-apnenčasti matični podlagi drugod v submediteranskem in predalpsko-submediteranskem delu Slovenije vrstno revnejši.

V njih so redka ali sploh ne uspevajo nekatere diagnosticne vrste zvez *Erythronio-Carpinion* in *Aremonio-Fagion* (*Helleborus odoratus* subsp. *odoratus*, *Lamium orvala*, *Hacquetia epipactis*, *Euphorbia carniolica*), prav

tako nekatere vrste reda *Fagetalia sylvaticae* (*Fraxinus excelsior*, *Daphne mezereum*, *Galeobdolon flavidum*, *Asarum europaeum* subsp. *caucasicum*, *Prenanthes purpurea*) in razredov *Quercus-Fagetea* (*Veratrum nigrum*, *Vinca minor*, *Hepatica nobilis*) in *Vaccinio-Piceetea* (*Aposeris foetida*, *Veronica urticifolia*, *Maianthemum bifolium*, *Luzula pilosa*). V istrskih mezofilnih bukovih sestojih so pogostejše nekatere diagnostične vrste reda *Quercetalia pubescenti-petraeae* (*Quercus cerris*, *Sorbus torminalis*, *Heleborus odorus* subsp. *istriacus*). Floristične posebnosti, ki sta v drugih do zdaj opisanih oblikah te asociacije zelo redki, sta vrsti *Arum italicum* in *Asparagus acutifolius*. V preučeni sestoji še vedno uspeva večina diagnostičnih vrst asociacije *Ornithogalo pyrenaici-Fagetum*, najredkejši med njimi sta vrsti *Ornithogalum pyrenaicum* in *Crocus vernus* subsp. *vernus*. Uvrščamo jih v geografsko varianto *Ornithogalo pyrenaici-Fagetum* var. geogr. *Helleborus istriacus* (Dakskobler, 2006), na rangu subasociacije pa v njeno suho obliko *-fraxinetosum orni* Dakskobler 1996. Vrste *Carex sylvatica*, *Carex pilosa* in *Dryopteris filix-mas* so dobre razlikovalnice istrske oblike asociacije *Ornithogalo-Fagetum* nasproti floristično precej podobnim stičnim sestojem asociacije *Sesleria autumnalis-Fagetum*. Uvrstitev teh sestojev v srednjeevropsko asociacijo *Carici pilosae-Fagetum* (omenjajo jo v hrvaškem delu Istre) ni ustrezna, saj v novejšem času sestoj te asociacije obravnavajo v okviru asociacije *Cephalanthera longifoliae-Fagetum*, katere sestoji pa prevladujejo v subpanonskem delu Hrvaške.

Sestoj s prevladujočim belim gabrom smo na podlagi primerjave z vrstno sestavo podobnih sestojev belega gabra v dolinah Branice in Raše (subasociacija *Ornithogalo-Carpinetum betuli lamietosum orvalae*) in sestojev asociacije *Anemone nemorosae-Carpinetum* iz hrvaškega dela Istre (okolica Pazina) uvrstili v novo subasociacijo *Ornithogalo-Carpinetum betuli seslerietosum autumnalis*. Njene razlikovalnice so vrste *Sesleria autumnalis*, *Tamus communis*, *Lathyrus venetus* in *Carpinus orientalis*. Od sestojev asociacije *Anemone-Carpinetum* se razlikujejo po bistveno večji prisotnosti naslednjih predvsem toploljubnih vrst *Ornithogalum pyrenaicum*, *Fraxinus ornus*, *Cornus mas*, *Sesleria autumnalis*, *Tamus communis*, *Asparagus acutifolius*, *Lathyrus venetus*, *Carpinus orientalis*, *Castanea sativa*, *Quercus petraeae* in *Ajuga reptans*, medtem ko so vrste *Isopyrum thalictroides*, *Acer obtusatum*, *Carex pilosa*, *Melica uniflora* in *Salix caprea* razlikovalne za belogabrovo združbo iz hrvaškega dela Istre.

Nova subasociacija označuje belogabrova rastišča v toplem in razmeroma suhem podnebju, drugačnem od podnebja, v katerem uspevajo sestoji drugih oblik

te asociacije. Razlikujemo tri variante: na nekoliko bolj kislih tleh varianto z gradnom (var. *Quercus petraea*, razlikovalnica je tudi vrsta *Galium laevigatum*), bolj vlagoljubno obliko var. *Arum maculatum* (razlikovalnica je tudi vrsta *Allium ursinum*) in bolj pionirsko obliko, var. *Prunus avium* (razlikovalnici sta tudi vrsti *Viola hirta* in *Vincetoxicum hirundinaria*). V fitogeografskem smislu te sestoj uvrščamo v geografsko varianto var. geogr. *Helleborus istriacus*.

Zdajšnje uspevanje bukovih sestojev in številnih za njene združbe značilnih vrst (na primer *Erythronium dens-canis*, *Cyclamen purpurascens*, *Mecurialis perennis*, *Euphorbia amygdaloides*, *Lilium martagon*, *Allium ursinum*, *Salvia glutinosa*, *Pulmonaria officinalis*, *Dryopteris filix-mas*, *Polystichum aculeatum* in drugih) predvsem v povodju Dragonje, deloma tudi Rižane in Malinske, je posreden dokaz za nekoč zagotovo večjo razširjenost bukve v tem prostoru, ki jo nakazujejo spoznanja palinologov, dendrologov in genetikov. Naloga gozdarske stroke je, da te sestoj s primernim gospodarjenjem ohranja in omogoča bukvi pomlajevanje in razvoj novih generacij. Istrski gozdovi so po raznolikosti drevesnih vrst (med njimi sta tudi gospodarsko zanimiva skorš, *Sorbus domestica* in brek, *S. torminalis*) in tudi po raznolikosti rastišč zaradi neposredne bližine Jadranskega morja svojevrsten izziv, ki bi mu morali tako v raziskovalnem kot praktično gozdnogojitvenem delu posvetiti precej več pozornosti kot doslej. Pomembna je tudi njihova biotopska vloga, saj so rastišča nekaterih zavarovanih vrst (*Ruscus aculeatus*, *R. hypoglossum*, *Cyclamen purpurascens*, *Galanthus nivalis*, *Erythronium dens-canis*, *Helleborus odorus* subsp. *istriacus*, *Lilium martagon*, *Neottia nidus-avis*, *Ilex aquifolium*, *Orchis purpurea*, *O. mascula* subsp. *speciosa*, *Cephalanthera longifolia*, *Platanthera bifolia*, *P. chlorantha*) in nekaterih v Sloveniji ali v Istri redkih vrst (*Luzula forsteri*, *Orthilia secunda*).

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7 REFERENCES

7 LITERATURA

- Anonymous 2004. Uredba o zavarovanih prosto živečih rastlinskih vrstah. Ljubljana, Uradni list RS 46/2004.
 Braun-Blanquet J. 1964. Pflanzensoziologie. Grundzüge der Vegetationskunde. 3. Auf., Wien-New York, Springer Verlag: 865 p.

- Brus R. 2010. Growing evidence for the existence of glacial refugia of European beech (*Fagus sylvatica* L.) in the south-eastern Alps and north-western Dinaric Alps. *Periodicum biologorum*, 112, 3: 239–246.
- Buser S. 2009. Geološka karta Slovenije 1: 250.000. Geological map of Slovenia 1:250,000. Ljubljana, Geološki zavod Slovenije.
- Cegnar T. 1998. Temperatura zraka. In: Fridl J., Kladnik D., Orožen Adamič M., Perko D. (eds.): Geografski atlas Slovenije. Država v prostoru in času. Ljubljana, Državna založba Slovenije: 100–101.
- Culiberg M. 1995. Dezertifikacija in reforestacija slovenskega Krasa. Poročilo o raziskovanju paleolitika, neolitika in enolitika v Sloveniji (Ljubljana), 22 (1994): 201–217.
- Dakskobler I. 1996a. Združba *Sesleria autumnalis-Fagetum* (Ht.) M. Wraber ex Borhidi 1963 v Koprskem gričevju. *Annales*, Ser. hist. nat., 9: 181–200.
- Dakskobler I. 1996b. Bukovi gozdovi Srednjega Posočja. *Scopolia*, 35: 1–78.
- Dakskobler I. 2006. Prispevek k poznavanju gozdne vegetacije Krasa (jugozahodna Slovenija). *Annales*, Ser. hist. nat. 16, 1: 57–76.
- Dakskobler I. 2013. Phytosociological characteristics of beech forests in the colline belt of the sub-Mediterranean region of Slovenia. *Hrvatska misao* (Sarajevo), 17 (1) / 13 (61) nova serija sv. 46: 173–189.
- Dakskobler I. 2015. Nekateri posebnosti flore in vegetacije severozahodnega dela Banjšic (zahodna Slovenija). *Folia biologica et geologica*, 56, 3: 25–36.
- Dakskobler I. 2016. Phytosociological analysis of riverine forests in the Vipava and Reka Valleys (southwestern Slovenia). *Folia biologica et geologica*, 57, 1: 5–61.
- Lovrenčak F. 1998. Prsti. In: Fridl J., Kladnik D., Orožen Adamič M., Perko D. (eds.): Geografski atlas Slovenije. Država v prostoru in času. Ljubljana, Državna založba Slovenije: 114–115.
- Maarel van der E. 1979. Transformation of cover-abundance values in phytosociology and its effects on community similarity. *Vegetatio* 39, 2: 97–114.
- Marinček L., Papež J., Dakskobler I., Zupančič M. 1990. *Ornithogalo pyrenaici-Fagetum* ass. nova, nova združba bukovih gozdov v Sloveniji. *Scopolia*, 22: 1–22.
- Martinčič A. 2003. Seznam listnatih mahov (Bryopsida) Slovenije. *Hacquetia*, 2, 1: 91–166.
- Martinčič A. 2011. Seznam jetrenjakov (Marchanthiophyta) in rogovnjakov (Anthocerotophyta) Slovenije. Annotated Checklist of Slovenian Liverworts (Marchanthiophyta) and Hornworts (Anthocerotophyta). *Scopolia*, 72: 1–38.
- Martinčič A., Wraber T., Jogan N., Podobnik A., Turk B., Vreš B., Ravnik V., Frajman B., Strgulc Krajšek S., Trčak B., Bačič T., Fischer M. A., Eler K., Surina B. 2007. Mala flora Slovenije. Ključ za določanje praprotnic in semenk. Četrta, dopolnjena in spremenjena izdaja. Ljubljana, Tehniška založba Slovenije: 967 p.
- Pleničar M., Polšak, A., Šikić D. 1973. Osnovna geološka karta 1: 100 000. Tolmač listov L 33–88 Trst. Zvezni geološki zavod, Beograd: 68 p.
- Podani J. 2001. SYN-TAX 2000. Computer Programs for Data Analysis in Ecology and Systematics. User's Manual, Budapest: 53 p.
- Sadar Z., Dakskobler I. 2015. Bukev (*Fagus sylvatica*) v jugozahodnem delu Slovenske Istre – nahajališča in fitocenološka oznaka rastišč. *Gozdarski vestnik*, 73, 5–6: 259–271.
- Seliškar T., Vreš B., Seliškar A. 2003. FloVegSi 2.0. Računalniški program za urejanje in analizo bioloških podatkov. Ljubljana, Biološki inštitut ZRC SAZU.
- Šercelj A. 1996. Začetki in razvoj gozdov v Sloveniji. Slovenska akademija znanosti in umetnosti. Razred za naravoslovne vede, Dela (Opera) 35, 1–142.
- Šilc U., Čarni A. 2012. Conspectus of vegetation syntaxa in Slovenia. *Hacquetia* (Ljubljana) 11, 1: 113–164.
- Stepančič D. 1974. Tla na eocenskem flišu Šavrinskega gričevja. Disertacija, Biotehniška fakulteta, Ljubljana: 103 p.
- Trinajstić I. 1994. Mezofilna šuma običnog graba (*As. Anemone-Carpinetum betuli* Trinajstić 1964) u Istri. *Šumarski list*, 118, 3–4: 81–84.
- Trinajstić I. 2008. Biljne zajednice Republike Hrvatske. Plant communities of Croatia. Akademija šumarskih znanosti, Zagreb: 179 p.
- Urbančič M., Simončič P., Prus T., Kutnar L. 2005. Atlas gozdnih tal. Ljubljana, Zveza gozdarskih društev Slovenije, Gozdarski vestnik & Gozdarski inštitut Slovenije: 100 p.
- Vukelić J. 2012. Šumska vegetacija Hrvatske. Sveučilište u Zagrebu, Šumarski fakultet, Državni zavod za zaštitu prirode. Zagreb: 403 p.
- Weber, H. E., Moravec, J., Theurillat, J.-P. 2000. International Code of Phytosociological Nomenclature. 3rd. Edition. *J. Veg. Sci.* 11, 5: 739–766.
- Zupančič B. 1998. Padavine. In: Fridl J., Kladnik D., Orožen Adamič M., Perko D. (eds.): Geografski atlas Slovenije. Država v prostoru in času. Ljubljana, Državna založba Slovenije: 98–99.