Prilozi poznavanju flore Hrvatske

Picrido hieracioidis-Cirsietum candelabri Jasprica *et al*. 2015 - a ruderal association new to Croatia

original scientific paper

Nenad Jasprica (Institute for Marine and Coastal Research, University of Dubrovnik, P.O. Box 83, HR-20000 Dubrovnik, Croatia; nenad.jasprica@unidu.hr; corresponding author)
Milenko Milović ("Antun Vrančić" Grammar School, Put Gimnazije 64, HR-22000 Šibenik, Croatia; milenko.milovic@si.t-com.hr)
Marija Pandža ("Murterski škoji" Primary School, Put škole 10, HR-22243 Murter, Croatia; marija.pandza@si.t-com-hr)

Sažetak

Cilj istraživanja jest po prvi put u Hrvatskoj opisati i klasificirati sastojinu u kojoj dominira vrsta *Cirsium candelabrum* Griseb. (Asteraceae). Sastojina je istraživana u Dalmaciji 2015. te uključena u novopredloženu asocijaciju *Picrido hieracioidis-Cirsietum candelabri* Jasprica, Milović & Pandža 2015. Svrstana je unutar vegetacijske sveze *Dauco carotae-Melilotion albi*, reda *Onopordetalia acanthii* i razreda *Artemisietea vulgaris*. Asocijacija je razvijena uzduž cesta, najčešće na odlagalištima građevinskog otpada, a zauzima sunčana i ekstremno suha staništa. U radu je diskutiran odnos novopredložene asocijacije s asocijacijom *Cirsietum candelabri* Matvejeva *ex* Čarni, Kostadinovski & Matevski 2001 iz Makedonije te Bosne i Hercegovine.

Ključne riječi: fitocenologija, sintaksonomija, ruderalna staništa, *Artemisietea vulgaris*, nova asocijacija

Abstract

The aim of this study is to describe and classify the stands with a predominance of *Cirsium candelabrum* Griseb. (Asteraceae) for the first time in Croatia. The stands were investigated in south Croatian region of Dalmatia in 2015. In this study, the *Picrido hieracioidis-Cirsietum candelabri* Jasprica, Milović & Pandža 2015 is described and proposed as a new association, belonging to the *Dauco carotae-Melilotion albi* alliance, the *Onopordetalia acanthii* order and the *Artemisietea vulgaris* class. This association is developed along roadsides mostly on freshly filled deposits of construction waste. It occupies intensively sunny and extremely dry habitats. The syntaxonomy of the association is discussed and some comparison with the *Cirsietum candelabri* Matvejeva *ex* Čarni, Kostadinovski & Matevski 2001 association from Republic of Macedonia and Bosnia and Herzegovina is made.

Keywords: phytosociology, syntaxonomy, ruderal habitats, *Artemisietea vulgaris*, new association

Introduction

Cirsium candelabrum Griseb. (Asteraceae) is a biennial hemicryptophyte scapose plant endemic to the Balkans. According to Flora Europaea, it occurs in Albania, Bulgaria, Greece, Romania and ex-Yugoslav countries (Werner 1976). More precisely, it has been found in Bosnia and Herzegovina, Montenegro, Serbia and Macedonia (Hayek 1931, Greuter 2006), Slovenia (Grošelj 2012) and Kosovo (Prodanović et al. 2008). More recently, it has been recorded in the European part of Turkey (Yıldız et al. 2009).

In Croatia, this species has been found for the first time in the southern part of the country (Dalmatia) in 2008 (Nikolić 2015). The taxon is considered to has been introduced into Croatia during the motorway construction project of the last decade when it became established (Milović et al. 2014). In this area it was mostly found along the roadsides on the intensively sunny and extremely dry, freshly filled deposits of construction waste. In general, beside roadsides, *C. candelabrum* mostly grows within the ruderal habitats in urban and suburban areas (Gajić 1975, Petronić & Pavlović 2006, Prodanović et al. 2008, Jovanović et al. 2013). Additionally, it was also found in Montenegrin wetland

(Bubanja 2013), Greek mountain coniferous forest (Bergmeier 2002) or in inland sand dune communities dominated by *Artemisia campestris* (Pirini et al. 2006).

However, the phytosociology of the *Cirsium candelabrum* stands has only been studied in Republic of Macedonia (Matvejeva 1982, Čarni et al. 2001) and Bosnia and Herzegovina (Petronić & Pavlović 2006). In fact, Matvejeva (1982) described the *Cirsietum candelabri* association for the first time in Macedonia and subordinated it to the *Onopordion acanthii* alliance (*Onopordetalia acanthii*, *Artemisietea vulgaris*). More recently, Čarni et al. (2001) have adjusted nomenclature of the *Cirsietum candelabri* association according to the second edition of the Code of the Phytosociological Nomenclature (Barkman et al. 1986). In addition, the *Cirsietum candelabri* association was also reported from Bosnia and Herzegovina with the same syntaxonomic position (Petronić & Pavlović 2006). On the contrary, again in Bosnia and Herzegovina, Redžić et al. (2011) included the *Cirsium candelabrum* stands from the Prenj and Čvrsnica mountains in the *Cirsion candelabri* alliance, but it has not been published effectively. However, the *Cirsion candelabri* alliance is considered as synonym of the *Onopordion acanthii* alliance (Schaminée et al. 2012).

The aim of this paper is to contribute to the knowledge of the phytosociology of *C. candelabrum* in Croatia, and (ii) highlight the affinities and differences with the related stands reported from Bosnia and Herzegovina and Macedonia.

Study area

The study area belongs to the Dinaric karstic region. It is located in south Croatia and is confined by coordinates 43°35'20" to 43°36'30" N and 16°34'50" to 17°10'30" E (UTM XJ, XH) (Fig. 1). The *Cirsium candelabrum* vegetation type occurs mainly in areas where the substrate is rocky and the slope is low or medium.

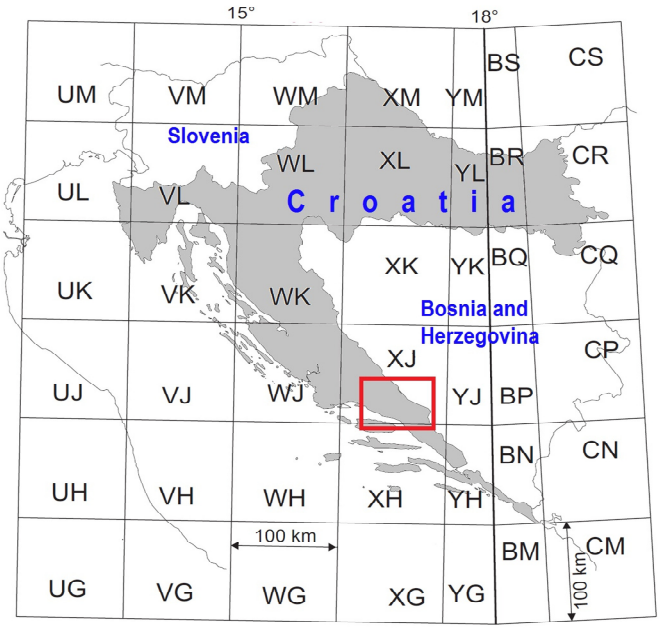

Figure 1. Geographical position of the study area.

The geological substrate is calcareous. Carbonate soils are developed on this geological substrate. Sub-Mediterranean rocky meadows (the *Scorzoneretalia villosae* order, *sensu* Terzi 2015) are developed on these shallow calcareous soils, while low forests of oriental hornbeam (*Carpinus orientalis* Mill.) are common on the cambric soils. In fact, stands with *Carpinus orientalis* (i.e., *Querco pubescenti-Carpinetum orientalis*) represent zonal vegetation in the area within the sub-Mediterranean vegetational zone of the *Ostryo carpinifoliae-Carpinion orientalis* alliance.

The climate of the area is sub-mediterranean, with a dry period during the summer and with harsh winter (Zaninović 1995). In the region of the town of Imotski, situated at an altitude of 400 m, the mean annual air temperature ranges between 13°C and 14°C (Zaninović et al. 2008). Average annual precipitation is 1065 mm yr^{-1} (Zaninović 1995). According to Köppen's climate classification Imotski lies within the Cfa climate zone (Köppen & Geiger 1954).

Material and methods

In August 2015, 10 phytocoenological relevés were conducted in the *Cirsium candelabrum* vegetation type in Croatia, in accord with the Braun-Blanquet method (Braun-Blanquet 1964, Dierschke 1994). Species cover abundance was recorded using the 7-grade scale of Braun-Blanquet. The plot size used to sample vegetation was established such as to represent full floristic composition, depending on plant density and homogeneity of vegetation cover. In each relevé the geographi-

cal coordinates, slope, exposition, altitude and total vegetation cover were recorded. Most of the plot-sizes were set at 30-32 m^2, and every effort was made to achieve high ecological and physiognomic homogeneity within each plot (Moravec et al. 1994). These values are clearly higher than those proposed for synanthropic vegetation by Chytrý & Otýpková (2003).

In Table 1, for each taxon frequencies are given as percentages (%). Place and date of relevés are listed in Appendix 1.

Taxonomic nomenclature follows the Flora Croatica Database (Nikolić 2015). Syntaxonomical nomenclature refers to Biondi et al. (2014). The system of characterizing species and the nomenclature of higher taxa were derived from Čarni et al. (2001), Šilc (2002), Šilc & Košir (2006), Láníková (2009), Terzi (2015), etc. Syntaxonomic units mentioned in the text and Table 1, but not in the scheme, are listed in Appendix 2.

Biological form was verified in the field and denoted according to categories reported in Pignatti (1982), these being based on the classification of Raunkiaer (1934). Regarding chorological form, reference was also made to Jasprica et al. (2014, 2015), as well as to the monographs used for taxonomic nomenclature. The abbreviations of life- and chorological forms are given in Table 1, before each species name. The abbreviations of life-forms are as follows: P – Phanerophytes, Ch – Chamaephytes, H – Hemicryptophytes, G – Geophytes, T – Therophytes. Abbreviations of chorological forms are as follows: CM – Circum-Mediterranean, WM – West Mediterranean, EM – East Mediterranean, ISE – Illyrian-South European, IAE – Illyrian-Adriatic endemics, IAP – Illyrian-Apennine, MA – Mediterranean-Atlantic, EUM – European Mediterranean, SEM – South European-Mediterranean, SEP –South European-Pontic, EA – Eurasian, COSM - Cosmopolitan, EUR – European, CHO – Circum-Holarctic, EEUP – East European-Pontic, CUAD – Cultivated and adventive plants, SEE – Southeast European.

Statistical analysis

In order to obtain more complete information about Croatian *Cirsium candelabrum* stands, we compared our relevés with the *Cirsietum candelabri* association from Macedonia (10 relevés) and Bosnia and Herzegovina (five relevés) (Matvejeva 1982, Petronić & Pavlović 2006). Altogether, the matrix consists of 125 species × 25 samples (relevés). Braun-Blanquet (1964) values were transformed according to van der Maarel (1979). Taxa occurring in only one relevé were omitted before the analyses. The cluster analysis using the Bray-Curtis similarity index and the group-average sorting method were done. For these purposes the PC-ORD ver. 5 and PRIMERv6 software packages (McCune & Mefford 2006, Clarke & Gorley 2006) were used.

Results

Hierarchical classification identified two broad groups of significantly different the *Cirsium candelabrum* assemblages in the Balkans (Fig. 2).

This allowed us to propose new association *Picrido hieracioidis-Cirsietum candelabri* Jasprica, Milović & Pandža 2015 (holotypus Tab. 1 rel. 4). The syntaxonomic scheme of the association is:

ARTEMISIETEA VULGARIS Lohmeyer, Preising & Tüxen *ex* von Rochow 1951
+*Onopordetalia acanthii* Braun-Blanquet & Tüxen *ex* Klika in Klika & Hadač 1944
**Dauco carotae-Melilotion albi* Görs *ex* Rostański & Gutte 1971

Picrido hieracioidis-Cirsietum candelabri* Jasprica, Milović & Pandža 2015, *ass. nova hoc loco

This association is developed along roadsides in south Croatia (Figs. 3 and 4). It occupies intensively sunny and extremely dry habitats, mostly on freshly filled deposits of construction waste. The habitats are also exposed to disturbances. The stands are generally small (<100 m^2), but when the association attains optimal development in August the habitus of the dominant species make them particularly visible. The association is found at altitudes between 308 and 800 m on carbonaceous substrata. It generally occurs with various expositions (S, SW, NW) and inclinations (5-45°), but most of the stands were found on level surface areas. The vascular plant cover varies from 40% to 90%. Altogether, the association had 122 taxa. The number of taxa in the relevés was between 21 and 50 (average 31.4). Among those, 102 were companions.

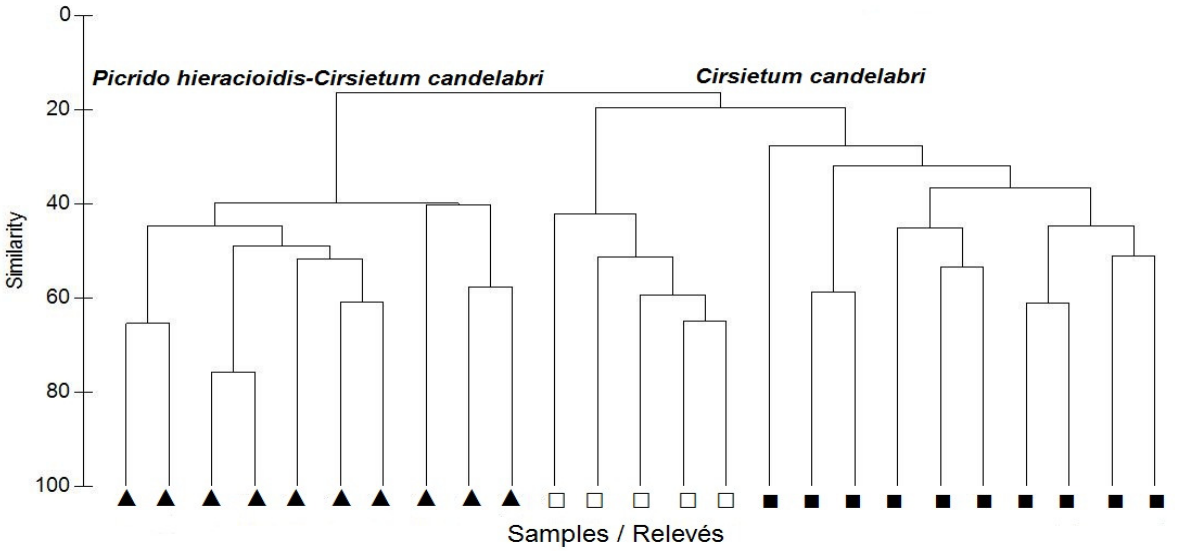

Figure 2. Dendrogram of the relevés. *Picrido hieracioidis-Cirsietum candelabri*: Croatia (▲), *Cirsietum candelabri*: Bosnia and Herzegovina (□) and Macedonia (■).

Among companions, the taxa of *Festuco valesiacae-Brometea erecti*, *Stellarietea mediae*, *Querco roboris-Fagetea sylvaticae*, *Trifolio medii-Geranietea sanguinei*, *Quercetea ilicis*, *Asplenietea trichomanis*, *Molinio-Arrhenatheretea*, *Thlaspietea rotundifolii*, *Thero-Brachypodietea ramosi*, *Galio aparines-Urticetea dioicae*, *Agrostietea stoloniferae*, *Salicetea purpureae* and *Epilobietea angustifolii* classes are found. The highest number of companions (50 taxa) belonged to the *Festuco valesiacae-Brometea erecti* class followed by the *Stellarietea mediae* (18 taxa).

Figures 3-4. The *Picrido hieracioidis-Cirsietum candelabri* association in Croatia (Photos: N. Jasprica).

Altogether, six taxa displayed the greatest presence (100%). Character-species of the association are *Cirsium candelabrum* and *Picris hieracioides*. *Cirsium candelabrum* dominated. Among taxa of the *Dauco carotae-Melilotion albi* alliance and *Onopordetalia acanthii* order, *Daucus carota* and *Tussilago farfara* were an abundant and constant species. Among companions, *Sanguisorba minor* ssp. *muricata* and *Silene vulgaris* ssp. *angustifolia* appeared with high presence (90 and 100%) and low cover.

The analysis of plant life-forms showed that the association was dominated by hemicryptophytes (49.1%), followed by therophytes (25.4%) and chamaephytes (14.4%) (Tab. 2).

South European floral element (29.7%), followed by a considerable proportion of Mediterraneans (26.2%), mostly circum-Mediterranean plants, dominated in the association (Tab. 3).

Life forms	No. of taxa (%)
Hemicryptophytes (H)	58 (49.1)
Therophytes (T)	30 (25.4)
Chamaephytes (Ch)	17 (14.4)
Phanerophytes (P)	9 (7.7)
Geophytes (G)	4 (3.4)
Total taxa	118 (100)

Table 2. Life-form spectrum in the *Picrido hieracioidis-Cirsietum candelabri* association in Croatia.

Floral elements	No. of taxa (%)
South European	35 (29.7)
Mediterranean	31 (26.2)
Eurasian (EA)	23 (19.5)
Cosmopolitan (COSM)	18 (15.3)
European (EUR)	4 (3.4)
Circum-Holarctic (CHO)	2 (1.7)
East European-Pontic (EEUP)	2 (1.7)
Cultivated and adventive plants (CUAD)	2 (1.7)
Southeast European (SEE)	1 (0.8)
No. of taxa	118
(%)	(100)

Table 3. Floral elements in the *Picrido hieracioidis-Cirsietum candelabri* association in Croatia.

Discussion

The present investigation in south Croatia revealed the presence of *Cirsium candelabrum* stand which we included in new proposed the *Picrido hieracioidis-Cirsietum candelabri* association (Milović et al. 2014).

The floristic composition of the new association does markedly differ from the related *Cirsietum candelabri* association previously described in Macedonia (Matvejeva 1982) and Bosnia and Herzegovina (Petronić & Pavlović 2006). Alongside *C. candelabrum*, in our case, *Picris hieracioides*, *Daucus carota*, *Tussilago farfara*, *Sanguisorba minor* ssp. *muricata* and *Silene vulgaris* ssp. *angustifolia* had the highest cover and frequency. On the contrary, in Bosnia and Herzegovina these were *Trifolium repens*, *Trifolium pratense* and *Ranunculus repens*. In Macedonia, only *Cirsium acanthoides* appeared with relatively high frequency (IV), but with low cover.

Regarding the ecology, our results suggest that the *Picrido hieracioidis-Cirsietum candelabri* association occurs at the lowest altitudes than the *Cirsietum candelabri* association. In addition, it has higher number of taxa, while life-forms spectra did not show differences between two associations. Hemicryptophytes prevailed in both associations. In our case, this may be explained by the high percentage of the *Festuco valesiacae-Brometea erecti* taxa. Additionally, in our study, analysis of chorotypes showed a clear dominance of the taxa of South European and Mediterranean origin. These confirm the peculiarity of the surveyed area from the phytogeographic point of view.

On the other hand, relatively high percentages of Eurasian taxa and cosmopolitans, and the presence of a relatively low number of non-native plant taxa were common characteristics of both associations. Anyway, these taxa had a significant influence on the physiognomy of this type of ruderal habitat. A significantly contribution of Eurasian and cosmopolitan taxa has already been found for other ruderal communities in the area (cf. Pajazitaj 2009, Jarić et al. 2011, Jovanović et al. 2013).

Regarding syntaxonomy, we subordinated *Picrido hieracioidis-Cirsietum candelabri* to the *Dauco carotae-Melilotion albi* alliance, which includes associations of biennial and perennial species often forming the initial stage of succession on anthropogenic substrates (cf. Láníková 2009, Šilc & Čarni 2012, Biondi et al. 2014). They usually grow on dry and nutrient-poor soils that contain large amounts of bedrock fragments. By contrast, the *Cirsietum candelabri* association from Macedonia and Bosnia and Herzegovina has been classified in the *Onopordion acanthii* alliance (Matvejeva 1982, Petronić & Pavlović 2006, Čarni et al. 2001). In our case, the majority of taxa of the *Onopordion acanthii* alliance are missing (cf. Mucina 1981, 1982, 1993, Biondi et al. 2004, etc.). Additionally, associations of the *Dauco carotae-Melilotion albi* alliance are linked to anthropic environments developing as various more or less ephemeral stages and can evolve to the populations of the *Festuco*

valesiacae-Brometea erecti communities.

Similarly, in Italy, associations of the *Dauco carotae-Melilotion albi* alliance are also linked to the series of the *Carpinion* (=*Ostryo carpinifoliae-Carpinion orientalis*) alliance (Blasi 2010). Generally, associations of the *Dauco carotae-Melilotion albi* alliance originate by evolution from coenosis of *Stellarietea mediae*, i.e. the widely-distributed class of the annual ruderal communities (Taffetani et al. 2011). In our study, the proportion of characteristic taxa of *Stellarietea mediae* was also quite high. In the area, the *Picrido hieracioidis-Cirsietum candelabri* association can mediate with still poorly known association from Croatia – the *Dauco carotae-Picridetum hieracioidis* (Jasprica, unpubl. data), also included in the *Dauco carotae-Melilotion albi* alliance (Láníková 2009).

In summary, our findings contributed to a better understanding of the phytosociology and ecology of *Cirsium candelabrum* in Croatia and in the Balkans generally. The presence of the *Picrido hieracioidis-Cirsietum candelabri* association and its floristic structure are beneficial to richness of biological diversity and diversity of biotope in our country.

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Appendix 1. Place and date of the relevés:
All relevés were collected on August 8, 2015. Gauss-Krüger coordinates were used:

- Rel. 1. X=5627784, Y=4828571;
- Rel. 2. X=5627972, Y=4828968;
- Rel. 3. X=5656901, Y=4831766;
- Rel. 4. (*Holotypus) X=5660995, Y=4828286;
- Rel. 5. X=5660876, Y=4828175;
- Rel. 6. X=5662030, Y=4827260;
- Rel. 7. X=5662045, Y=4827253;
- Rel. 8. X=5662403, Y=4826913;
- Rel. 9. X=5670990, Y=4810227;
- Rel. 10. X=5676481, Y=4799641.

Appendix 2. Syntaxonomic units mentioned in the text and Table 1 (pages 10-12), but not in the scheme (in alphabetical order).

- *Agrostietea stoloniferae* Oberdorfer 1983
- *Asplenietea trichomanis* (Braun-Blanquet in Meier & Braun-Blanquet 1934) Oberdorfer 1977
- *Cirsietum candelabri* Matvejeva *ex* Čarni, Kostadinovski & Matevski 2001
- *Cirsion candelabri* Redžić, Barudanović, Trakić & Kulijer 2011
- *Dauco carotae-Picridetum hieracioidis* Görs *ex* Seybold & Müller 1972
- *Epilobietea angustifolii* Tüxen & Preising *ex* von Rochow 1951
- *Festuco valesiacae-Brometea erecti* Braun-Blanquet & Tüxen *ex* Braun-Blanquet 1949
- *Galio aparines-Urticetea dioicae* Passarge *ex* Kopecký 1969
- *Molinio-Arrhenatheretea* Tüxen 1937
- *Onopordion acanthii* Braun-Blanquet in Braun-Blanquet, Gajewski, Wraber & Walas 1936
- *Ostryo carpinifoliae-Carpinion orientalis* Horvat (1954) 1958
- *Quercetea ilicis* Braun-Blanquet in Braun-Blanquet, Roussine & Nègre 1952
- *Querco pubescenti-Carpinetum orientalis* Horvatić 1939
- *Querco roboris-Fagetea sylvaticae* Braun-Blanquet & Vlieger in Vlieger 1937
- *Salicetea purpureae* Moor 1958
- *Scorzoneretalia villosae* Kovačević 1959

- *Stellarietea mediae* Tüxen, Lohmeyer & Preising *ex* von Rochow 1951
- *Thero-Brachypodietea ramosi* Braun-Blanquet 1947
- *Thlaspietea rotundifolii* Braun-Blanquet 1948
- *Trifolio medii-Geranietea sanguinei* Müller 1962

Table 1. *Picrido hieracioidis-Cirsietum candelabri* Jasprica, Milović & Pandža 2015 (LF- Life form; FL - Floral element; * - holotypus).

		No. of relevés	1	2	3	4*	5	6	7	8	9	10	
		No. of taxa	41	24	33	50	26	30	27	37	21	25	
LF	FE	Altitude (m a.s.l.)	310	308	800	717	725	730	730	717	560	620	
		Slope (°)	.	.	.	45	.	5	5	35	.	40	Fr.
		Aspect	.	.	.	S	.	NW	NW	SW	.	S	
		Vascular plant cover (%)	60	60	40	90	70	90	60	80	80	70	
		Plot size (m^2)	32	32	32	30	30	30	20	100	40	30	%
		Char. Ass.											
H	ISE	*Cirsium candelabrum* Griseb.	1	2	3	4	1	4	2	4	4	4	100
H	EA	*Picris hieracioides* L.	1	+	+	1	1	1	1	1	1	+	100
		Dauco carotae-Melilotion albi											
H	COSM	*Daucus carota* L.	1	1	.	1	+	+	+	1	+	+	90
H	COSM	*Cichorium intybus* L.	+	+	+	.	.	.	.	.	+	.	40
H	EUR	*Echium vulgare* L.	.	.	.	.	1	.	.	+	+	+	40
T	EA	*Melilotus albus* Medik.	.	+	.	+	+	.	.	.	.	.	30
H	COSM	*Reseda lutea* L.	.	.	.	+	.	+	.	.	.	.	20
H	EM	*Melilotus officinalis* (L.) Lam.	.	.	.	.	+	.	.	+	.	.	20
H	EEP	*Isatis tinctoria* L.	.	.	.	.	.	.	.	.	+	+	20
		Onopordetalia acanthii, Artemisietea vulgaris											
G	EA	*Tussilago farfara* L.	2	2	.	+	+	3	2	+	1	+	90
T	SEM	*Crepis foetida* L.	1	+	+	.	+	.	.	1	.	.	50
H	EA	*Chondrilla juncea* L.	1	+	.	.	.	.	.	.	.	+	30
H	COSM	*Diplotaxis tenuifolia* (L.) DC.	.	+	.	+	.	.	.	+	.	.	30
Ch	IAE	*Haplophyllum patavinum* (L.) G.Don	.	.	.	+	.	.	+	+	.	.	30
H	CM	*Dittrichia viscosa* (L.) Greuter	+	3	.	.	.	.	.	.	.	.	20
T	CUAD	*Ambrosia artemisiifolia* L.	.	.	1	+	.	.	.	.	.	.	20
H	CM	*Foeniculum vulgare* Mill.	r	.	.	.	.	.	.	.	.	.	10
H	CM	*Picnomon acarna* (L.) Cass.	+	.	.	.	.	.	.	.	.	.	10
H	EA	*Silene latifolia* Poir. ssp. *alba* (Mill.) Greuter et Bourdet	.	.	.	r	.	.	.	.	.	.	10
G	COSM	*Elymus repens* (L.) Gould	.	.	.	2	.	.	.	.	.	.	10
		Companions											
		Festuco valesiacae-Brometea erecti											
H	SEM	*Sanguisorba minor* Scop. ssp. *muricata* Briq.	+	+	1	+	+	+	+	+	+	+	100
H	SEP	*Lactuca viminea* (L.) J. Presl & C. Presl	+	+	.	r	.	+	+	1	1	+	80
H	EA	*Melica ciliata* L.	.	+	.	.	+	+	+	+	1	+	70
H	IAE	*Centaurea spinosociliata* Seenus ssp. *cristata* (Bertol.) Dostál	.	.	.	+	+	+	+	1	+	+	70
H	SEM	*Galium corrudifolium* Vill.	+	.	+	.	+	1	.	+	.	+	60
H	SEM	*Hypericum perforatum* L.	.	+	+	+	.	+	+	.	.	+	60
Ch	WM	*Dorycnium pentaphyllum* Scop.	.	.	r	1	+	+	+	.	.	+	60
T	COSM	*Medicago lupulina* L.	r	.	+	+	+	+	.	.	.	.	50
H	SEM	*Asperula aristata* L.f. ssp. *scabra* (J.Presl et C.Presl) Nyman	.	.	1	+	.	+	+	+	.	.	50
H	EA	*Campanula sibirica* L.	.	.	+	+	+	.	.	+	+	.	50
Ch	SEP	*Linum tenuifolium* L.	.	.	.	+	+	+	+	+	.	.	50
H	EA	*Carlina vulgaris* L.	.	.	.	+	+	+	+	+	.	.	50
Ch	SEM	*Fumana procumbens* (Dunal) Gren. et Godr.	r	.	+	.	.	+	+	.	.	.	40
T	EA	*Arenaria leptoclados* (Reichenb.) Guss.	.	r	.	+	+	.	.	+	.	.	40
H	COSM	*Arabis hirsuta* (L.) Scop.	.	+	+	.	.	.	.	+	.	.	30
H	COSM	*Lotus corniculatus* L. ssp. *hirsutus* Rothm.	.	.	+	.	.	+	.	+	.	.	30
Ch	IAE	*Satureja subspicata* Vis.	.	.	+	.	.	+	+	.	.	.	30

Ch	SEM	*Satureja montana* L.	.	.	.	+	.	.	+	.	.	+	30
Ch	SEM	*Teucrium montanum* L.	.	.	.	.	.	+	+	+	.	.	30
Ch	CM	*Ononis antiquorum* (L.) Arcang.	+	.	+	.	.	.	.	.	.	.	20
T	SEP	*Bromus squarrosus* L.	.	r	.	.	+	.	.	.	.	.	20
H	SEM	*Medicago prostrata* Jacq.	.	.	.	+	.	.	.	+	.	.	20
T	SEM	*Acinos arvensis* (Lam.) Dandy	.	.	.	.	+	.	.	+	.	.	20
H	SEM	*Paronychia kapela* (Hacq.) A. Kerner	.	.	.	.	.	+	+	.	.	.	20
Ch	SEM	*Aethionema saxatile* (L.) R.Br.	.	.	.	.	.	+	+	.	.	.	20
Ch	CM	*Euphorbia spinosa* L.	+	.	.	.	.	.	.	.	.	.	10
Ch	CM	*Helichrysum italicum* (Roth) G. Don	+	.	.	.	.	.	.	.	.	.	10
H	SEE	*Stachys thirkei* K.Koch	+	.	.	.	.	.	.	.	.	.	10
H	IAE	*Astragalus muelleri* Steud. et Hochst.	r	.	.	.	.	.	.	.	.	.	10
Ch	WM	*Argyrolobium zanonii* (Turra) P.W. Ball	r	.	.	.	.	.	.	.	.	.	10
H	SEM	*Ononis pusilla* L.	r	.	.	.	.	.	.	.	.	.	10
T	EA	*Petrorhagia prolifera* (L.) P.W.Ball ex Heywood	.	+	.	.	.	.	.	.	.	.	10
H	SEM	*Petrorhagia saxifraga* (L.) Link	.	r	.	.	.	.	.	.	.	.	10
Ch	IAE	*Genista sylvestris* Scop. ssp. *dalmatica* (Bartl.) H.Lindb.	.	.	+	.	.	.	.	.	.	.	10
H	IAE	*Seseli montanum* L. ssp. *tommassinii* (Rchb. F.) Arcang.	.	.	+	.	.	.	.	.	.	.	10
H	EA	*Scabiosa triandra* L.	.	.	.	1	.	.	.	.	.	.	10
H	EEP	*Centaurea weldeniana* Rchb.	.	.	.	+	.	.	.	.	.	.	10
H	SEM	*Bromus erectus* Huds.	.	.	.	+	.	.	.	.	.	.	10
H	EA	*Euphorbia cyparissias* L.	.	.	.	+	.	.	.	.	.	.	10
T	MA	*Desmazeria rigida* (L.) Tutin	.	.	.	+	.	.	.	.	.	.	10
H	IAP	*Centaurea rupestris* L.	.	.	.	r	.	.	.	.	.	.	10
H	SEP	*Stachys recta* L.	.	.	.	r	.	.	.	.	.	.	10
H	CM	*Plantago holosteum* Scop.	.	.	.	r	.	.	.	.	.	.	10
Ch	SEM	*Sedum sexangulare* L.	.	.	.	r	.	.	.	.	.	.	10
H	EUM	*Anthyllis vulneraria* L.	.	.	.	.	+	.	.	.	.	.	10
Ch	SEM	*Helianthemum oelandicum* (L.) DC. ssp. *italicum* (L.) Font Quer et I	.	.	.	.	.	r	.	.	.	.	10
Ch	SEP	*Teucrium chamaedrys* L.	.	.	.	.	.	.	.	+	.	.	10
H	SEM	*Hippocrepis comosa* L.	.	.	.	.	.	.	.	+	.	.	10
Ch	SEM	*Helianthemum nummularium* (L.) Mill.	.	.	.	.	.	.	.	+	.	.	10
T	CM	*Trifolium scabrum* L.	.	.	.	.	.	.	.	.	+	.	10
		Stellarietea mediae											
H	SEM	*Silene vulgaris* (Moench) Garcke ssp. *angustifolia* Hayek	+	+	+	+	+	+	+	+	.	+	90
H	COSM	*Lactuca serriola* L.	.	.	r	+	.	.	.	+	.	.	30
T	EA	*Setaria viridis* (L.) P.Beauv.	1	.	+	.	.	.	.	.	.	.	20
T	CHO	*Fallopia convolvulus* (L.) Á.Löve	+	.	.	+	.	.	.	.	.	.	20
T	COSM	*Bromus sterilis* L.	.	.	.	+	.	.	.	.	+	.	20
T	COSM	*Digitaria sanguinalis* (L.) Scop.	+	.	.	.	.	.	.	.	.	.	10
G	COSM	*Cynodon dactylon* (L.) Pers.	+	.	.	.	.	.	.	.	.	.	10
T	COSM	*Erodium cicutarium* (L.) L'Hér.	r	.	.	.	.	.	.	.	.	.	10
T	COSM	*Polygonum aviculare* L.	r	.	.	.	.	.	.	.	.	.	10
T	EA	*Solanum villosum* Mill. ssp. *alatum* (Moench) Dostál	r	.	.	.	.	.	.	.	.	.	10
T	EA	*Polycnemum majus* A. Braun	r	.	.	.	.	.	.	.	.	.	10
T	SEP	*Avena barbata* Pott ex Link	.	+	.	.	.	.	.	.	.	.	10
T	SEM	*Reseda phyteuma* L.	.	.	+	.	.	.	.	.	.	.	10
T	SEM	*Crepis pulchra* L.	.	.	+	.	.	.	.	.	.	.	10
T	SEM	*Geranium purpureum* Vill.	.	.	.	+	.	.	.	.	.	.	10
T	COSM	*Atriplex patula* L.	.	.	.	+	.	.	.	.	.	.	10
T	EA	*Cirsium arvense* (L.) Scop.	.	.	.	+	.	.	.	.	.	.	10
T	CUAD	*Conyza canadensis* (L.) Cronquist	.	.	.	r	.	.	.	.	.	.	10
		Querco roboris-Fagetea sylvaticae											
P	EUR	*Clematis vitalba* L.	.	.	+	.	1	+	+	+	+	1	70
P	EM	*Coronilla emerus* L. ssp. *emeroides* Boiss. et Spruner	.	.	.	.	.	+	.	+	+	+	40
P	COSM	*Ulmus minor* Miller, juv.	.	.	.	+	.	+	.	+	.	.	30
H	ISE	*Sesleria autumnalis* (Scop.) F.W. Schultz	.	.	+	.	.	.	+	.	.	.	20
P	CM	*Colutea arborescens* L.	.	.	.	.	.	.	.	.	+	+	20

P	SEM	*Fraxinus ornus* L., juv.	.	.	r	.	.	.	.	.	.	.	10
P	ISE	*Frangula rupestris* (Scop.) Schur, juv.	.	.	.	.	.	.	.	.	+	.	10
		Thlaspietea rotundifolii											
H	SEM	*Scrophularia canina* L.	+	+	1	1	+	.	.	+	.	.	60
T	IAP	*Chaenorhinum minus* (L.) Lange ssp. *litorale* (Willd.) Hayek	r	+	.	.	.	.	+	.	+	.	40
T	EUR	*Chaenorhinum minus* (L.) Lange ssp. *minus*	.	.	+	.	.	+	+	.	.	.	30
T	EUM	*Galeopsis angustifolia* Hoffm.	.	.	.	.	.	.	+	.	.	.	10
		Quercetea ilicis											
P	MA	*Rubus ulmifolius* Schott	1	.	.	.	.	.	.	+	+	1	40
P	CM	*Clematis flammula* L.	+	.	.	.	.	.	.	.	.	.	10
G	CM	*Arum italicum* Mill.	.	.	.	.	.	.	.	.	.	+	10
		Trifolio medii-Geranietea sanguinei											
H	SEM	*Arabis turrita* L.	.	.	.	+	.	+	.	+	.	.	30
H	SEP	*Inula conyza* DC.	.	.	.	.	+	.	.	.	+	+	30
H	EA	*Cruciata glabra* (L.) Ehrend.	.	.	.	+	.	.	.	.	.	.	10
		Molinio-Arrhenatheretea											
H	EA	*Dactylis glomerata* L. ssp. *glomerata*	.	.	+	+	.	.	.	.	.	+	30
H	COSM	*Plantago lanceolata* L.	+	.	.	.	+	.	.	.	.	.	20
H	EA	*Cirsium vulgare* (Savi) Ten.	.	+	+	.	.	.	.	.	.	.	20
H	EA	*Trifolium pratense* L.	.	.	.	.	.	+	+	.	.	.	20
H	EUR	*Lolium perenne* L.	+	.	.	.	.	.	.	.	.	.	10
T	SEM	*Euphorbia falcata* L.	.	.	r	.	.	.	.	.	.	.	10
H	SEM	*Plantago altissima* L.	.	.	.	r	.	.	.	.	.	.	10
		Asplenietea trichomanis											
H	IAE	*Campanula pyramidalis* L.	.	.	.	.	.	.	.	+	.	+	20
		Thero-Brachypodietea ramosi											
H	CM	*Bituminaria bituminosa* (L.) Stirton	+	.	.	.	.	.	.	.	.	.	10
H	WM	*Helictotrichon convolutum* (C.Presl) Henrard.	.	.	.	.	.	.	.	+	.	.	10
		Agrostietea stoloniferae											
H	COSM	*Plantago major* L. ssp. *intermedia* (Gilib.) Lange	.	.	+	.	.	.	.	.	.	.	10
		Galio aparines-Urticetea dioicae											
T	EA	*Cruciata laevipes* Opiz.	.	.	.	+	.	.	.	.	.	.	10
		Salicetea purpureae											
P	EA	*Salix purpurea* L.	.	.	.	+	.	.	.	.	.	.	10
		Epilobietea angustifolii											
H	CHO	*Epilobium angustifolium* L.	.	.	.	.	.	.	.	.	.	+	10
		Others											
		Pastinaca sp.	+	.	.	.	.	.	.	.	.	.	10
		Vicia sp.	+	.	.	.	.	.	.	.	.	.	10
		Medicago sp.	r	.	.	.	.	.	.	.	.	.	10
		Koeleria sp.	.	.	.	+	.	.	.	.	.	.	10

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