

EFFECT OF MANAGEMENT MODIFICATION ON THE COENOLOGICAL COMPOSITION OF THE NORTH ADRIATIC PASTORAL LANDSCAPE (ČIĆARIJA, CROATIA)

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Abstract

The research aim was to assess the dynamics of the North Adriatic pastoral landscape (Čićarija, Croatia) with regard to the coenological composition of grassland communities, and, more specifically, to: i) assess the current grassland mosaic from a coenological viewpoint; ii) assess the effects of management abandonment on grassland species composition, also taking into account, as a basis for comparison, data on pastoral communities collected in the past decades. To achieve the research aims, 73 phytosociological relevés were carried out; for each of them field data (altitude, aspect, slope, landform) and information on grassland management were collected. Multivariate analysis of phytosociological relevés led to the identification of four vegetation types (*Danthonio-Scorzoneretum villosae*, *Carici humilis-Centaureetum rupestris*, *Brachypodium rupestre*-dominated stands, and *Anthoxantho-Brometum erecti*), which were linked to landform and to grassland management. Comparison in terms of social behaviour type composition of the grassland communities surveyed in the present study with the ones surveyed in the past decades, highlighted that the current management (grassland abandonment, as well as low intensity grazing and not periodic mowing) is leading to a percentage loss of pasture and meadow characteristic species, in favour of successional and ruderal ones.

Key words: grasslands, North Adriatic, management, phytosociology, social behaviour type.

Izvlaček

Namen raziskave je bil ovrednotiti dinamiko severnojadranske pašniške krajine (Čićarija, Hrvaška) predvsem cenološke sestavo travniških združb. Posebej smo želeli ugotoviti: i) trenutno travniški mozaik s cenološkega vidika, ii) spremembe opuščanja gospodarjenja na vrstno sestavo travnikov s primerjavo podatkov o pašnikih, pridobljenih v preteklih desetletjih. Naredili smo 73 fitocenoloških popisov in za vsakega od njih smo pridobili podatke o višini, legi, nagibu, krajinski obliki in informacijo o gospodarjenju. Z multivariatnimi analizami smo ugotovili štiri vegetacijske tipe (*Danthonio-Scorzoneretum villosae*, *Carici humilis-Centaureetum rupestris*, združbo z dominantno vrsto *Brachypodium rupestre* in *Anthoxantho-Brometum erecti*), ki smo jih povezali s krajinsko obliko in načinom gospodarjenja. Primerjava sestave zgradbe travniških združb glede na sinsociološko pripadnost vrst med današnjimi in starejšimi popisi je pokazala, da trenutni način gospodarjenja (opuščanje gospodarjenja, nizka intenziteta paše in le občasna košnja) vodi v izgubo značilnih vrst pašnikov in travnikov na račun vrst razvitejših sukcesijskih stadijev in vrst ruderalnih rastišč.

Ključne besede: travniki, severni Jadran, gospodarjenje, fitocenologija, fitosociološka pripadnost vrst.

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1. INTRODUCTION

European semi-natural calcareous grasslands, species-rich ecosystems, have been considered priority habitats by the European Union (92/43/EEC Directive) and judged worthy of conservation (Pärtel et al. 1999, Norderhaug et al. 2000, Myklestad and Sætersdal 2004, Klimek et al. 2006). Throughout Europe, owing to their low agricultural productivity (Willems 1990, van Dijk 1991), these managed pastures are in strong decline and threatened by abandonment (Luick 1998, Zervas 1998, Dullinger et al. 2003, Sebastià et al. 2008). This trend has been also observed in the North Adriatic pastoral landscape (Kaligarič et al. 2006) and on the Čičarija mountainous plateau as well (Vitasović Kosić 2011, Vitasović Kosić et al. 2011).

Thus, the understanding of change due to abandonment or management modification is a key factor for biodiversity conservation. Indeed, it is known that grassland management acts as a driving force in plant community diversity (Milchunas & Lauenroth 1993, Biondini et al. 1998, Collins et al. 1998, MacDonald et al. 2000, Adler et al. 2001, Bullock et al. 2001, Kahmen et al. 2002, Wilson et al. 2003, Frank 2005, Altesor et al. 2006, de Bello et al. 2006, 2007, Catorci et al. 2011). However, the use of simple measurements of species richness to understand plant community shifts due to management modification can lead to misleading conclusions for conservation aims (Campetella et al. 2004). The analysis of plant communities phytosociological composition, instead, has proven useful in understanding ecosystem dynamics and properties (Scheiner 1992, Borhidi 1995, Díaz et al. 2001, Decocq et al. 2004). This approach provides information on the mechanisms underlying species assemblages (Kolasa & Rollo 1991, Alard & Poudevigne 2000), allows a better understanding of the relationship between environmental features and plant diversity (Díaz & Cabido 1997, Lavorel et al. 1997, McIntyre et al. 1999, Pillar 1999, Hunt et al. 2004), and permits modelling floristic and vegetation shifting due to changes in management type or in disturbance intensity (Kelly 1996, Noble & Gitay 1996, Hobbs 1997, Kleyer 1999). Thus, the assessment of plant communities' coenological composition may provide useful information for the improvement of grassland management practices, according to the principles of adaptive management (Holling 1978).

Our research aim was to assess the dynamics of the North Adriatic pastoral landscape with regard to the coenological composition of grassland communities, using social behaviour types analysis, in consideration of the ongoing process of abandonment of management activities. Hence, the specific research goals were to: i) assess the current grassland mosaic from a coenological viewpoint; ii) assess the effects of management abandonment on grassland species composition, also taking into account, as a basis for comparison, data on pastoral communities collected in the past decades.

2. MATERIALS AND METHODS

2.1 STUDY AREA

The study area (about 1,000 ha) is located to the north of the Istrian Peninsula, on the Čičarija mountainous plateau (45° 29' 56" – 45° 30' 00" N, 13° 59' 54" – 14° 00' 29" E), ranging from 250–300 to 850–900 m a.s.l., and it is proposed as a Special Protection Area (SPA) of the Natura 2000 network (92/43/EEC Directive) as an important site for habitat 62A0 and bird species conservation. The climate is transitional between mediterranean and continental pre-Alpine, with cool, rainy winters and long, dry summers (Poldini 1989). The mean annual temperature is 12.6 °C, the coldest in February (0–2 °C) and the warmest in July or August (18–22 °C). Precipitation is about 1500 mm/year, most of which falls in autumn; a less pronounced secondary peak occurs as spring turns to summer. From a bioclimatic viewpoint, the study area belongs to the sub-mediterranean belt (Kaligarič 1997) and the epi-mediterranean zone of the mediterranean-mountain vegetation belt (Čarni 2003). The territory is characterised by karstic phenomena (dolines, caves, *etc.*); the bedrock consists of limestone; soils are generally brown, shallow and clast-rich. Pastures are for the most part undergrazed because of the low density of grazers (sheep) or abandoned; meadows are not regularly mown, are abandoned or, in some cases, derive from seeded forage meadows that have been abandoned (Vitasović Kosić et al. 2011).

The pastoral landscape is characterized by pastures and meadows, referred to the *Scorzoneretalia villosae* order (*Festuco-Brometea* class) and *Arrhenatheretalia elatioris* order (*Molinio-Arrhenatheretea* class), respectively.

2.2 DATA COLLECTION

Data collection was planned according to a stratified sampling method in order to sample all the topographic conditions, related to altitude, aspect, slope and landform, and all types of grassland use (mowing, grazing, mowing abandonment, and grazing abandonment).

During 2009, 73 relevés were carried out using the Braun-Blanquet method (1964) in 10 × 10 m plots (100 m²). Field data (altitude, aspect, slope, landform) and information on grassland management were collected for each plot.

Phytosociological papers which report data collected during the past decades on grasslands of the study area and neighbouring territories (Poldini 1980, 1985, 1989, Poldini & Oriolo 1994, Kaligarič & Poldini 1997) were consulted.

Species were grouped in social behaviour types (SBTs) (Borhidi 1995, Bartha et al. 2008, Catorci et al. 2011a). SBTs aggregate species with similar preferences for the associated habitats, *i.e.* based on their coenological role, that is the role that a plant species plays in the community (Borhidi 1995) considering species in regard to their autoecology, morphology and physiological performances (Alard & Poudevigne 2000). Species SBTs were assessed in accordance with Mucina et al. (1993), Biondi et al. (2001, 2005), Aeschimann et al. (2004), and Čarni et al. (2005), following the most accepted phytosociological placement of each species: pasture species (characteristic of *Festuco-Brometea*, *Tuberarietea guttatae*, and *Sedo-Scleranthetea* classes); meadow species (characteristic of *Molinio-Arrhenatheretea* class); successional and ruderal species (characteristic of *Trifolio-Geranietea*, *Rhamno-Prunetea*, *Quercu-Fagetea*, *Artemisietea vulgaris*, and *Stellarietea mediae* classes).

2.3 DATA ELABORATION

Phytosociological relevés were submitted to cluster analysis using the *Complete link* algorithm (Orloci 1978), based on chord distance. To this purpose Braun-Blanquet values were transformed according to the van der Maarel scale (1979). For the syntaxonomical placement of the grassland types, local phytosociological studies (Poldini 1980, 1985, 1989, Poldini & Oriolo 1994, Kaligarič & Poldini 1997) were consulted. The species nomenclature followed the Flora Croatica Database (Nikolić 2011) and Flora d'Italia (Pignatti 1982).

A synoptic table was made to compare the current coenological composition of *syntaxa* emerging from the phytosociological interpretation of Čičarija grassland communities, with one of the same *syntaxa* identified in the North Adriatic pastoral landscape by other authors during the past decades (Poldini 1989, Kaligarič & Poldini 1997). The SBT frequency distribution of each relevé group reported in the synoptic table was calculated.

Cluster analysis was performed using SYN-TAX 2000 software (Podani 2001).

3. RESULTS

3.1 PHYTOSOCIOLOGICAL ANALYSIS

The multivariate analysis of phytosociological relevés (Figure 1) shows a separation into two main clusters (I and II), the latter divided into two subclusters (IIa, IIb).

Cluster I aggregates relevés ranging from 200–250 to 650–700 (888) m a.s.l., spread on flat or slightly concave surfaces, on the transition belt between slopes and flat lands, with quite deep soils (Table 1). The assessment of floristic and ecological features allows this community to be referred to the *Danthonio-Scorzoneretum villosae* association (*Scorzonerion villosae* alliance). Such grasslands are mainly managed as hay meadows.

Cluster IIa includes relevés ranging from 500–550 to 700–750 (852) m a.s.l., spread on flat or slightly convex relief tops and on slightly or moderately steep slopes, with shallow soils and outcropping rock (Table 2). The assessment of floristic and ecological features enables such a community to be referred to the *Carici humilis-Centaureetum rupestris* association (*Saturejion subspicatae* alliance). Group IIa is further separated, at a lower dissimilarity level, into two subgroups (IIa¹, IIa²), the former referred to grazed pastures, the latter to ungrazed and unmown grasslands, which are referred to a variant differentiated by *Brachypodium rupestre*.

Cluster IIb aggregates relevés spread generally on flat lands, on the bottom of depressions between relief tops, with deep clayey soils, between 500–550 and 700–750 m a.s.l. (Table 3). From a phytosociological viewpoint they are referred to *Anthoxantho-Brometum erecti* (*Arrhenatherion elatioris* alliance). This type of grassland, once used as pasture and hay meadow, at present is mostly unmanaged.

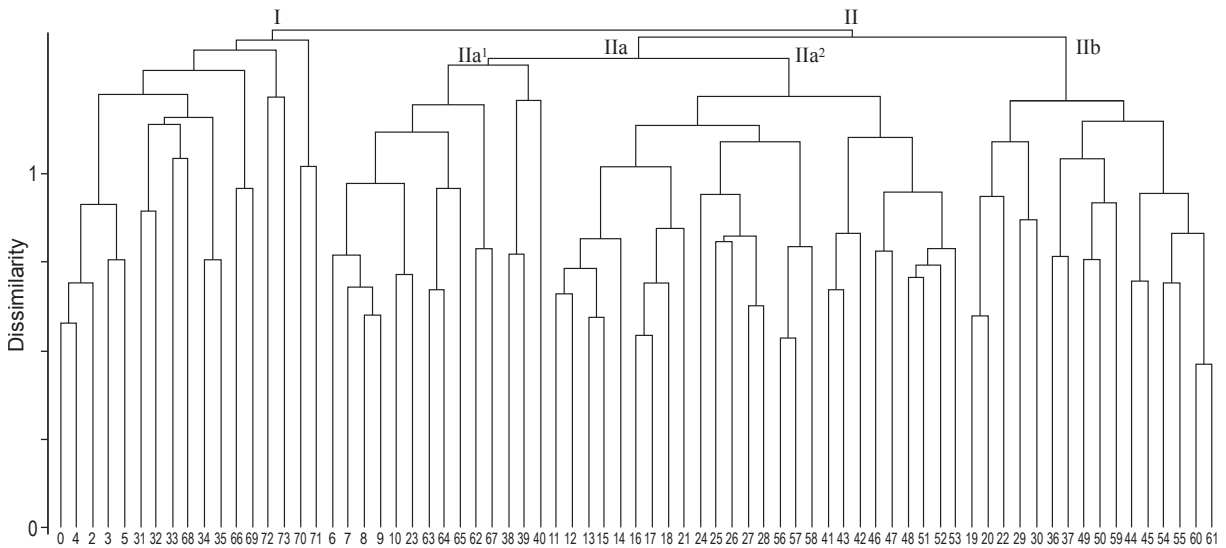


Figure 1: Dendrogram of phytosociological relevés (I – *Danthonio-Scorzoneretum villosae*; IIa¹ – *Carici humilis-Centaureetum rupestris*; IIa² – *Carici humilis-Centaureetum rupestris Brachypodium rupestre* variant; IIb – *Anthoxantho-Brometum erecti* Poldini 1980).

Slika 1: Dendrogram fitocenoloških popisova (I – *Danthonio-Scorzoneretum villosae*; IIa¹ – *Carici humilis-Centaureetum rupestris*; IIa² – *Carici humilis-Centaureetum rupestris Brachypodium rupestre* varianta; IIb – *Anthoxantho-Brometum erecti* Poldini 1980).

The synoptic table (Table 4) shows the comparison of phytosociological composition between the above mentioned groups and the respective *syntaxa* drawn from the literature (Poldini 1989, Kaligarič & Poldini 1997).

3.2 SOCIAL BEHAVIOUR TYPES COMPOSITION

Table 5 shows the percentage frequency distribution of social behaviour types in each group of relevés reported in the synoptic table (Table 4). With regard to *Danthonio-Scorzoneretum villosae*, relevés from Čičarija grasslands, compared with Kaligarič & Poldini’s (1997) ones (Table 5, columns 1 and 2), show a lower frequency of pasture species and a higher occurrence of successional and ruderal elements (mostly from fringe habitats and fallow fields, mainly belonging to *Trifolio-Geranietea* and *Artemisietea vulgaris* classes). Similar differences have been observed also in *Carici humilis-Centaureetum rupestris* (Table 5, columns 3, 4, and 5). Social behaviour types variations are particularly pronounced in abandoned grasslands (cluster IIa²), because of the higher percentage of successional and ruderal species, mostly due to herbaceous and woody fringe species (*Trifolio-Geranietea* and *Rhamno-*

Prunetea classes), and to nitrophilous elements (*Artemisietea vulgaris* class). With regard to *Anthoxantho-Brometum erecti* (Table 5, columns 6 and 7), Čičarija grasslands have a higher percentage value of successional and ruderal species (in particular belonging to *Trifolio-Geranietea*, *Artemisietea vulgaris*, and *Rhamno-Prunetea* classes), and a lower value of meadow elements, compared with Poldini’s (1989) relevés, while the frequency of pasture species is constant.

4. DISCUSSION

From the comparison of the relevé groups emerging from multivariate analysis (Figure 1) and of the collected field data (Tables 1–3), it can be observed that relevés segregation into clusters at the highest dissimilarity level is linked to landform, which, in turn, affects soil characteristics. These findings are consistent with plant communities distribution modeling, proposed by Vitanzi et al. (2009), and with Poldini’s (1989) description of grassland communities’ distribution in relation to landforms. Clusters segregation into subclusters at a lower dissimilarity level mostly depends on grassland use/non-use.

Comparing species composition of the above mentioned *syntaxa* of grassland communities,

sampled in the study area, with the ones reported in previous studies (Table 4), it can be argued that, at present, all the plant communities have a relatively high percentage of successional species (mostly herbaceous and shrubby fringe) (Table 5). This is due to grassland abandonment, as observed also by Catorci et al. (2011b) in the Apennines, and, probably, to the low intensity use of the whole pastoral system. More particularly, cluster I (Figure 1) groups relevés in which, apart from the elements of *Scorzonerion villosae* alliance and of the upper syntaxonomic units, a considerable number of meadow, successional and ruderal elements (transgressive species from *Molinio-Arrhenatheretea*, *Trifolio-Geranietea*, and *Artemisietea vulgaris* classes) occur. In cluster IIa, successional and ruderal species (belonging to *Trifolio-Geranietea*, *Rhamno-Prunetea*, and *Artemisietea vulgaris* classes) are associated with the typical species composition of *Saturejion subspicatae* alliance and of the upper units. Such elements are more frequent in abandoned pastures (subcluster IIa²) than in the ones subjected to a low disturbance intensity (subcluster IIa¹). Cluster IIb aggregates relevés characterized by the typical elements of meadows (*Molinio-Arrhenatheretea* class) and by a conspicuous number of pasture species (*Festuco-Brometea* class) and of successional and ruderal species (*Trifolio-Geranietea*, *Rhamno-Prunetea*, and *Artemisietea vulgaris* classes). Despite their floristic similarity, mainly due to the dominance of the *Molinio-Arrhenatheretea* species set, these relevés have a heterogeneous composition, probably because of the different origin of these grasslands. As a matter of fact, they derive from recolonisation processes of abandoned seeded meadows by *Molinio-Arrhenatheretea* species or, conversely, they are the result of the abandonment of *Arrhenatherum elatius*-dominated meadows. The lower frequency of meadow species in this group than in Poldini's (1989) relevés, in favour of successional and ruderal ones, can be explained by considering that, in accordance with Catorci & Gatti (2010), the occurrence of the *Molinio-Arrhenatheretea* class characteristic species set is linked to the contemporary presence of mowing, high soil nitrogen content, and high soil Available Water Capacity, so that the abandonment of mowing and/or fertilization cause the loss of *Molinio-Arrhenatheretea* species.

Moreover, the occurrence of *Brachypodium rupestre* in Čićarija unmanaged grassland communities (Tables 2 and 3) is consistent with several

studies, which emphasize the role of *B. pinnatum* and *B. rupestre* in the invasion of unmanaged grasslands, through processes of competition, and the related conservation problems (During & Willems 1984, Bobbink & Willems 1987). The reduction in grazing pressure, for instance, was primarily referred as a cause of the spread of *B. pinnatum* in the United Kingdom (Wilson et al. 1995, Buckland et al. 2001) and of *B. rupestre* in the Apennines (Bonanomi & Allegranza 2004).

Table 6 shows schematically the types of land use (pasture, meadow), their relation with landforms, and the observed dynamic trends of Čićarija grassland *syntaxa*, and reports some hypotheses about their evolution in case of protracted abandonment.

5. CONCLUSIONS

The coenological analysis of Čićarija grasslands indicated that grassland abandonment, undergrazing and not periodic mowing (low disturbance) are leading to a coenological variation, which consists in a percentage loss of pasture and meadow characteristic species in ungrazed and unmown grasslands, respectively, in favour of successional and ruderal ones (Vitasović Kosić et al. 2011). More specifically, the analysis of SBT frequencies shifts highlighted that the current management is causing the homogenization of grassland communities coenological composition (Table 5). On the other hand, other studies indicate that intensive farming activities also cause landscape homogenization in central Europe (Poschlod & Wallis DeVries 2002, Robinson & Sutherland 2002, Benton et al. 2003, Tscharrntke et al. 2005). Thus actually, both high and low intensity use are liable to lead to a progressive homogenization of pastoral landscape.

However, as stated by Bakker (1998), differences in local grazing intensity may be very influential on plant communities' composition, at intermediate scales, while at small scales may cause the occurrence of micro-patterns, resulting in a system of pulsing patches. Moreover, it is known that dry grasslands on steep slopes or shallow soils are more resistant to vegetation change caused by abandonment than grasslands on flatter sites, hence they are more suitable to preserving plant biodiversity; on the contrary, mesophilous meadows are less resistant (Bennie et al. 2006), and hence they are more vulnerable

than pastures to the loss of species diversity because of management abandonment.

Such considerations suggest that pastures and meadows should be subjected to different types of regulation in order to preserve their diversity. In particular, a general low pressure of grazing can be maintained by means of grazing rotation, favouring the contemporary presence of ungrazed, undergrazed and moderately grazed pasture patches, while intensive grazing should be avoided because of the low resilience of dry pastures (Hirst et al. 2005). In pastures abandoned a long time ago, shrub clearing should be planned. In meadows, regular mowing should be maintained and incentivized; moreover, fertilization might be necessary, in specific cases, to improve productivity and preserve the meadow characteristic species set. Finally, the implementation of management plans for Čičarija grasslands will contribute to protecting one of the biodiversity hot spots in Europe, proposed as a Special Protection Area (SPA) of the Natura 2000 network, rich in endemisms, threatened plant species and floristic entities that reach in this area the edge of their range.

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8. APPENDIX

Localities, date of the relevés and accidental species

Table 1: *Danthonio-Scorzoneretum villosae* Ht. & H-ić (1956) 1958

Locality and date of the relevés: rel. 1–5 – Brest pod Učkom (15/06/2009); rel. 6–8 – Semić (08/07/2009); rel. 9 – Žbevnica (23/06/2009); rel. 10–11 – Semić, meadow (08/07/2009); rel. 12 – Slum, meadow (23/06/2009); rel. 13 – Slum, meadow (08/09/2009); rel. 14 – Gregurinčići, meadow (09/09/2009); rel. 15 – St. Grgur (10/09/2009); rel. 16 – Boljunski Katun, meadow (09/09/2009); rel. 17 – Trošti, meadow (09/09/2009).

Accidental species: rel. 4 – *Clematis vitalba*, +; rel. 6 – *Carduus pycnocephalus*, +; *Silene latifolia* subsp. *alba*, +; rel. 7 – *Rumex crispus*, +; *Erigeron annuus*, +; *Briza minor*, +; *Allium* sp., +; rel. 8 – *Juniperus communis*, +; *Pinus nigra*, +; rel. 10 – *Luzula multiflora*, +; rel. 11 – *Acinos arvensis*, +; rel. 12 – *Cerastium arvense* subsp. *strictum*, +; rel. 13 – *Carduus nutans*, 1; *Cirsium arvense*, +; rel. 15 – *Scolymus hispanicus*, 2.

Table 2: *Carici humilis-Centaureetum rupestris* Ht. 1931

Brachypodium rupestre variant (rell. 15–40)
Locality and date of the relevés: rel. 1 – Brest pod Učkom (15/06/2009); rel. 2–4 – Slum, near Genetic center (15/06/2009); rel. 5 – Slum, pasture on the hill (15/06/2009); rel. 6 – Jelovice, pasture on the hill (17/06/2009); rel. 7–8 – Slum, near Genetic center (23/06/2009); rel. 9 – Slum, near Genetic center (08/09/2009); rel. 10 – Žbevnica (10/07/2009); rel. 11 – Žbevnica (23/06/2009); rel. 12–13 – Brgudac-Lanišće (08/07/2009); rel. 14 – Lanišće, abandoned pasture (08/07/2009); rel. 15–19 – Jelovice (16/06/2009); rel. 20–21 – Vodice (16/06/2009); rel. 22 – Vodice, abandoned pasture (16/06/2009); rel. 23 – Jelovice, abandoned pasture in the village (17/06/2009); rel. 24 – Jelovice, abandoned grassland (17/06/2009); rel. 25 – Jelovice, abandoned pasture, dolines (17/06/2009); rel. 26 – Jelovice, abandoned pasture (17/06/2009); rel. 27 – Jelovice, dolines, succession with *Laserpitium siler* (17/06/2009); rel. 28

– Jelovice, dolines, succession (17/06/2009); rel. 29 – Jelovice-Vodice, main road (17/06/2009); rel. 30 – Jelovice-Vodice, main road, 1 km further than rel. 29 (17/06/2009); rel. 31 – Dane-Brest under Žbevnica (10/07/2009); rel. 32 – Vodice, pasture (08/07/2009); rel. 33 – Vodice, pasture (08/07/2009); rel. 34 – Vodice, pasture (08/07/2009); rel. 35 – Lanišće, abandoned pasture (09/07/2009); rel. 36–37 – Račja vas, abandoned grassland (09/07/2009); rel. 38–39 – Račja vas-Rašpor, abandoned pasture (09/07/2009); rel. 40 – Rašpor-Trstenik (09/07/2009).

Accidental species: rel. 5 – *Viola odorata*, +; rel. 6 – *Viola odorata*, +; rel. 7 – *Cerastium arvense* subsp. *strictum*, +; *Carduus nutans*, +; rel. 8 – *Cerastium arvense* subsp. *strictum*, +; rel. 9 – *Dorycnium hirsutum*, +; rel. 12 – *Daucus carota*, +; rel. 15 – *Cirsium arvense*, +; *Poa bulbosa*, +; rel. 16 – *Rhinanthus glacialis*, +; rel. 17 – *Sorbus aucuparia*, +; *Cirsium arvense*, +; rel. 18 – *Sorbus aucuparia*, +; *Poa bulbosa*, +; rel. 22 – *Rhamnus saxatilis*, +; rel. 23 – *Rhamnus saxatilis*, +; *Ajuga reptans*, +; *Convolvulus arvensis*, +; rel. 25, 28 – *Verbascum pulverulentum*, +; rel. 29 – *Cytisus nigricans*, +; *Potentilla reptans*, +; *Thlaspi perfoliatum*, +; *Gentiana lutea* subsp. *symphyandra*, +; rel. 30 – *Potentilla reptans*, +; *Gentiana lutea* subsp. *symphyandra*, +; rel. 31 – *Cytisus nigricans*, +; *Acinos arvensis*, +; rel. 32 – *Silene latifolia* subsp. *alba*, +; rel. 33 – *Silene latifolia* subsp. *alba*, +; *Clematis vitalba*, +; rel. 34 – *Acer campestre*, +; *Scolymus hispanicus*, +; *Pastinaca sativa*, +; rel. 35 – *Quercus cerris*, +; rel. 36 – *Apera spica-venti*, +; rel. 37 – *Acer campestre*, +; *Fraxinus excelsior*, +; rel. 38 – *Fraxinus excelsior*, +; *Rhinanthus glacialis*, +; *Vicia villosa*, +; rel. 39 – *Daucus carota*, +; rel. 40 – *Apera spica-venti*, +; *Thlaspi perfoliatum*, +.

rel. 12 – Vodice-Dane, abandoned pasture (09/07/2009); rel. 13 – Jelovice, abandoned pasture (10/07/2009); rel. 14 – Jelovice, wetter meadow (10/07/2009); rel. 15 – Klenovščak, abandoned meadow, dolines (10/07/2009); rel. 16 – Klenovščak, dolines (10/07/2009).

Accidental species: rel. 1 – *Cornus mas*, +; *Rhamnus saxatilis*, +; *Stachys recta*, +; rel. 2 – *Gentiana lutea* subsp. *symphyandra*, +; *Inula ensifolia*, +; rel. 3 – *Echium vulgare*, +; *Crepis sancta*, +; *Linum narbonense*, +; *Dianthus sanguineus*, +; *Linum tenuifolium*, +; *Hieracium bahuinii*, +; *Peucedanum cervaria*, +; *Calamintha menthifolia*, +; rel. 4 – *Silene vulgaris*, +; *Lilium bulbiferum*, +; *Allium* sp., +; rel. 5 – *Luzula multiflora*, +; *Pinus nigra*, +; rel. 6 – *Carduus pycnocephalus*, +; *Picris hieracioides*, +; rel. 7 – *Cichorium intybus*, +; *Clematis vitalba*, +; rel. 8 – *Knautia purpurea*, +; rel. 9 – *Dianthus monspessulanum*, +; rel. 10 – *Paeonia mascula*, +; *Leucanthemum vulgare*, +; rel. 12 – *Aristolochia clematidis*, +; *Prunus spinosa*, 1; *Rhamnus fallax*, +; rel. 13 – *Plantago holostium*, +; *Laserpitium siler*, +; rel. 14 – *Campanula pyramidalis*, +; *Pseudolysimachion spicatum* subsp. *barrelieri*, +; rel. 15 – *Potentilla reptans*, +; rel. 16 – *Allium sphaerocephalon*, +.

Table 3: *Anthoxantho-Brometum erecti* Poldini 1980

Locality and date of the relevés: rel. 1 – Vodice, abandoned meadow, karst field (16/06/2009); rel. 2 – Vodice, abandoned meadow (16/06/2009); rel. 3 – Jelovice, meadow (17/06/2009); rel. 4 – Dane, abandoned meadow (17/06/2009); rel. 5 – Dane, abandoned pasture (17/06/2009); rel. 6 – Brgudac, abandoned meadow, village (08/07/2009); rel. 7 – Brgudac, abandoned meadow (08/07/2009); rel. 8 – Račja vas, meadow along the main road (09/07/2009); rel. 9 – Račja vas, abandoned pasture, near the cemetery (09/07/2009); rel. 10 – Klenovščak, meadow along the road (09/07/2009); rel. 11 – Vodice-Dane, abandoned meadow (09/07/2009);

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Table 1: *Danthonio-Scorzoneretum villosae* Horvat & Horvatić in Horvatić 1958.

Tabela 1: *Danthonio-Scorzoneretum villosae* Horvat & Horvatić in Horvatić 1958.

Relevé no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Relevé no. in Figure 1	1	4	2	3	5	31	32	33	68	34	35	66	69	72	73	70	71
Altitude (m a.s.l.)	661	661	661	661	660	522	516	527	888	521	531	493	493	256	256	233	661
Slope (°)	0	0	0	0	0	7	10	0	10	0	0	3	3	0	0	0	0
Aspect	0	0	0	0	0	E	E	0	NW	0	0	SSW	W	0	0	0	0
Relevé area (m ²)	100	100	100	100	100	100	100	100	25	100	100	25	100	100	100	100	100
Cover (%)	100	100	100	100	100	90	97	100	100	100	100	100	100	100	90	98	100
Landform	flat	flat	flat	flat	flat	concave slope	concave slope	flat	concave slope	flat	flat	flat	flat	flat	flat	flat	flat
Grassland management	mowing	mowing	mowing	mowing	mowing	grazing	grazing	mowing abandon.	grazing abandon.	mowing	grazing	mowing	mowing	mowing	grazing abandon.	mowing	mowing

Characteristic and differential species of *Danthonio-Scorzoneretum villosae* association

<i>Plantago media</i>	+	+	+	1	+	2	1	.	.	1	+	1	2	.	.	.	+	12	71
<i>Ononis spinosa</i> subsp. <i>antiquorum</i>	2	+	2	+	.	3	2	+	1	.	.	.	.	.	.	.	+	9	53
<i>Lathyrus latifolius</i>	.	.	+	.	+	.	+	+	.	+	+	.	.	1	.	.	.	7	41
<i>Trifolium rubens</i>	.	+	.	.	+	+	+	+	.	+	.	.	.	.	.	.	.	6	35
<i>Serratula lycopifolia</i>	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	2	12
<i>Carex flacca</i> s.l.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	6
<i>Danthonia alpina</i>	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	6

Characteristic species of *Scorzonerion villosae* alliance

<i>Knautia illyrica</i>	1	1	1	2	+	+	.	+	+	2	+	2	.	.	.	.	.	11	65
<i>Leucanthemum liburnicum</i>	2	+	+	+	+	.	.	.	+	+	+	3	+	.	.	.	.	10	59
<i>Medicago falcata</i>	.	.	.	.	.	+	+	1	+	1	.	+	.	+	.	.	.	7	41
<i>Melampyrum barbatum</i> subsp. <i>carstiense</i>	1	+	1	1	+	.	.	.	.	.	.	.	.	.	.	.	.	5	29
<i>Prunella laciniata</i>	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	+	4	24
<i>Daucus carota</i>	.	.	.	.	.	.	.	.	.	.	.	+	2	1	.	.	1	4	24
<i>Ranunculus bulbosus</i>	.	.	.	.	.	.	.	.	+	.	.	1	.	.	.	.	.	2	12
<i>Hypochaeris maculata</i>	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<i>Rhinanthus freynii</i>	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	6
<i>Dorycnium herbaceum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	6

Characteristic and differential species of *Scorzoneretalia villosae* order

<i>Salvia pratensis</i>	1	1	2	1	1	2	1	+	+	2	1	.	2	1	+	1	1	16	94
<i>Festuca rupicola</i>	+	1	+	+	2	2	1	.	+	+	1	.	.	.	.	.	.	10	59
<i>Chrysopogon gryllus</i>	.	.	.	.	.	1	+	2	4	1	3	.	.	.	+	4	1	9	53
<i>Koeleria splendens</i>	+	+	.	.	+	+	+	1	.	3	2	.	.	.	.	2	.	9	53
<i>Bromus condensatus</i>	2	1	1	3	3	2	.	1	2	.	.	+	.	.	.	.	.	9	53
<i>Scorzonera villosa</i>	3	2	4	1	1	.	.	.	.	2	+	.	.	.	.	.	.	7	41
<i>Polygala nicaeensis</i>	1	+	+	+	+	.	.	+	+	.	.	.	.	.	.	.	.	7	41
<i>Lotus corniculatus</i> subsp. <i>hirsutus</i>	1	+	+	+	+	.	.	.	.	+	+	.	.	.	.	.	.	7	41
<i>Globularia punctata</i>	1	+	.	.	+	.	.	.	.	+	+	.	.	.	.	+	.	6	35
<i>Thymus longicaulis</i>	+	+	+	.	+	.	.	.	.	+	.	.	.	.	.	.	.	5	29
<i>Cirsium acaule</i>	1	+	+	.	2	.	.	.	.	.	.	.	.	.	.	.	.	4	24
<i>Pseudolysimachion spicatum</i> subsp. <i>barrelieri</i>	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	1	.	3	18
<i>Galium lucidum</i>	.	.	.	.	.	+	.	1	.	.	.	.	.	2	.	.	.	3	18
<i>Inula hirta</i>	.	.	.	.	+	.	.	+	.	.	.	.	+	.	.	.	.	3	18
<i>Centaurea rupestris</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	3	18
<i>Stachys subcrenata</i>	.	+	.	2	+	.	.	.	.	.	.	.	.	.	.	.	.	3	18
<i>Carex humilis</i>	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	1	.	3	18
<i>Muscari botryoides</i>	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	2	12

Relevé no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Pres.	Fr. %
<i>Centaurea cristata</i> subsp. <i>tommasinii</i>	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	2	12
<i>Centaurea triumfettii</i> subsp. <i>adscendens</i>	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	2	12
<i>Leontodon crispus</i>	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	2	12
<i>Buphthalmum salicifolium</i>	.	.	.	.	.	.	.	1	.	.	+	.	.	.	.	.	.	2	12
<i>Potentilla alba</i>	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	2	12
<i>Gentiana tergestina</i>	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<i>Potentilla tommasiniana</i>	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<i>Centaurea bracteata</i>	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	6
<i>Carlina acaulis</i>	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	6
<i>Genista sylvestris</i>	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	6
<i>Narcissus radiflorus</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	6
<i>Inula ensifolia</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	6
<i>Potentilla australis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	6
<i>Allium senescens</i> subsp. <i>montanum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	6
<i>Euphorbia nicaeensis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	6
<i>Asperula cynanchica</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	6
Characteristic species of Festuco-Brometea class																			
<i>Scabiosa triandra</i>	1	+	+	+	+	.	.	.	+	+	+	.	+	1	.	.	1	11	65
<i>Anthyllis vulneraria</i>	+	1	+	+	+	+	.	.	+	+	+	.	.	.	.	.	.	9	53
<i>Medicago lupulina</i> s.l.	+	+	.	+	+	+	+	+	+	+	+	.	1	+	.	.	9	53	
<i>Hippocrepis comosa</i>	.	+	.	+	+	+	.	.	+	+	+	.	.	.	.	.	+	8	47
<i>Filipendula vulgaris</i>	+	+	.	1	1	.	.	+	1	1	1	.	.	.	.	.	.	8	47
<i>Briza media</i>	1	+	+	+	1	.	.	1	+	+	.	.	.	.	.	.	.	8	47
<i>Trifolium campestre</i>	+	+	+	+	+	.	.	.	+	.	.	+	.	.	.	.	.	7	41
<i>Vicia cracca</i>	+	.	.	+	1	.	.	+	.	.	.	.	+	+	.	.	.	6	35
<i>Bromus erectus</i>	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	3	3	5	29
<i>Lotus corniculatus</i>	.	.	.	.	.	.	+	.	+	.	.	+	.	1	.	.	+	5	29
<i>Onobrychis vicifolia</i>	3	2	3	+	1	.	.	.	.	.	.	.	.	.	.	.	.	5	29
<i>Thymus pulegioides</i>	.	.	.	.	.	1	+	.	.	2	.	.	.	.	.	1	+	5	29
<i>Teucrium chamaedrys</i>	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	+	+	5	29
<i>Sanguisorba minor</i> subsp. <i>muricata</i>	.	.	+	.	+	.	+	.	.	+	.	.	.	.	.	1	.	5	29
<i>Brachypodium rupestre</i>	.	.	.	+	.	1	+	.	+	.	.	.	.	.	.	.	.	4	24
<i>Tragopogon pratensis</i>	.	.	.	.	.	+	.	+	.	+	1	.	.	.	.	.	.	4	24
<i>Orchis morio</i>	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	3	18
<i>Satureja montana</i> subsp. <i>montana</i>	.	.	.	.	.	+	.	.	.	+	.	+	.	.	.	.	.	3	18
<i>Polygala vulgaris</i>	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	3	18
<i>Galium verum</i>	.	.	.	.	.	.	.	.	+	.	.	2	2	.	.	.	.	3	18
<i>Eryngium amethystinum</i>	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	3	18
<i>Euphorbia cyparissias</i>	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	2	12
<i>Orchis militaris</i>	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	2	12
<i>Galium corrudifolium</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	2	12
<i>Festuca valesiaca</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	3	2	12
<i>Potentilla heptaphylla</i>	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<i>Trifolium montanum</i>	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	6
<i>Linum catharticum</i>	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	6
<i>Knautia purpurea</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	6
<i>Asperula aristata</i> s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	6
Transgressive species from Molinio-Arrhenatheretea class																			
<i>Plantago lanceolata</i>	+	+	+	1	.	1	+	+	+	+	+	+	2	+	.	.	+	14	82
<i>Achillea millefolium</i>	+	.	.	2	+	2	2	+	+	+	+	+	.	+	+	.	+	13	76
<i>Trifolium pratense</i> subsp. <i>pratense</i>	3	1	+	+	3	.	2	.	+	1	+	1	1	.	.	.	.	11	65
<i>Poa pratensis</i>	+	+	.	+	+	+	+	1	1	.	.	1	.	.	.	.	.	9	53
<i>Prunella vulgaris</i>	.	.	.	.	.	.	+	+	.	.	.	.	+	+	.	.	+	5	29
<i>Trisetum flavescens</i>	+	1	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	5	29
<i>Dactylis glomerata</i> subsp. <i>glomerata</i>	.	.	.	.	.	.	1	1	1	.	.	+	.	4	.	.	.	5	29
<i>Centaurea jacea</i>	.	.	.	.	.	.	.	.	+	.	.	.	+	3	+	.	.	4	24
<i>Trifolium repens</i> subsp. <i>repens</i>	.	.	.	.	.	.	2	.	.	1	.	+	.	.	.	.	.	3	18
<i>Arrhenatherum elatius</i> subsp. <i>elatius</i>	.	.	.	.	.	.	.	1	.	.	.	4	2	.	.	.	.	3	18

Relevé no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Pres.	Fr. %
<i>Plantago major</i>	.	.	+	+	2	12
<i>Lathyrus pratensis</i>	.	.	.	+	+	2	12
<i>Crepis biennis</i>	+	.	.	+	2	12
<i>Colchicum autumnale</i>	.	.	.	+	1	6
<i>Tragopogon orientalis</i>	1	.	.	.	.	.	.	.	.	.	1	6
<i>Holcus lanatus</i>	+	1	6
<i>Tragopogon porrifolius</i>	+	1	6
<i>Plantago altissima</i>	+	.	.	.	1	6
<i>Betonica officinalis</i> subsp. <i>serotina</i>	+	.	1	6
<i>Anthoxanthum odoratum</i>	1	.	.	.	.	.	.	.	.	1	6
<i>Stellaria graminea</i>	+	1	6
Transgressive species from <i>Trifolio-Geranietea sanguinei</i> class																			
<i>Trifolium alpestre</i>	1	1	2	+	+	.	.	1	.	1	+	.	.	.	.	.	.	8	47
<i>Inula salicina</i>	1	1	+	1	1	.	.	+	+	.	.	.	.	+	.	.	.	8	47
<i>Chamaecytisus hirsutus</i>	1	+	+	.	.	+	+	+	.	.	.	.	.	.	.	.	.	6	35
<i>Campanula rapunculus</i>	+	.	.	1	.	.	+	.	.	+	.	.	.	.	.	.	.	4	24
<i>Lilium bulbiferum</i>	.	.	.	+	+	2	12
<i>Scorzonera hispanica</i>	+	+	2	12
<i>Peucedanum oreoselinum</i>	+	.	.	+	.	.	.	2	12
<i>Orobanche lutea</i>	.	.	+	1	6
<i>Geranium sanguineum</i>	+	1	6
<i>Seseli libanotis</i>	+	1	6
<i>Peucedanum cervaria</i>	+	1	6
<i>Dictamnus albus</i>	+	1	6
<i>Knautia drymeia</i>	+	1	6
Companions																			
<i>Medicago sativa</i>	+	+	.	+	+	.	+	1	3	.	.	.	+	8	47
<i>Helianthemum salicifolium</i>	.	1	.	+	+	+	.	+	1	.	.	.	.	.	.	+	.	7	41
<i>Dactylis glomerata</i> subsp. <i>hispanica</i>	2	+	+	+	1	.	.	.	+	.	.	.	.	.	+	.	.	7	41
<i>Picris hieracioides</i>	.	+	.	+	+	+	+	.	.	+	6	35
<i>Sedum acre</i>	+	+	.	.	+	+	4	24
<i>Dorycnium hirsutum</i>	.	+	1	+	.	.	.	.	.	.	.	.	.	.	.	+	.	4	24
<i>Carex</i> sp.	+	+	.	1	.	.	.	.	.	.	+	.	.	.	.	.	.	4	24
<i>Convolvulus arvensis</i>	+	1	.	.	.	.	+	3	18
<i>Pastinaca sativa</i>	+	+	+	.	.	.	3	18
<i>Galium mollugo</i>	+	.	.	+	+	3	18
<i>Crepis sancta</i>	+	+	1	.	.	.	.	.	.	.	.	.	3	18
<i>Rosa canina</i>	+	+	+	3	18
<i>Calamagrostis arundinacea</i>	.	+	.	+	2	.	.	.	.	.	.	.	.	.	.	.	.	3	18
<i>Cichorium intybus</i>	+	+	2	12
<i>Senecio erucifolius</i>	+	+	2	12
<i>Elymus repens</i>	+	.	.	+	.	.	2	12
<i>Vicia angustifolia</i>	+	.	.	+	2	12
<i>Vicia sativa</i>	+	+	2	12
<i>Rubus caesius</i>	+	.	+	2	12
<i>Quercus cerris</i>	+	.	+	2	12
<i>Stellaria holostea</i>	+	+	2	12
<i>Petrorhagia saxifraga</i>	+	.	+	2	12
<i>Aira elegantissima</i>	+	+	2	12
<i>Filago vulgaris</i>	1	1	.	2	12
<i>Dorycnium pentaphyllum</i>	1	.	.	+	.	.	.	.	.	.	2	12
<i>Danthonia decumbens</i>	.	.	+	+	2	12
<i>Euphorbia palustris</i>	.	.	.	+	+	2	12
<i>Helleborus multifidus</i> subsp. <i>istriacus</i>	+	+	2	12
<i>Hypericum hirsutum</i>	.	+	.	+	2	12
<i>Poa bulbosa</i>	+	+	2	12
Accidental species	0	0	0	1	0	2	4	2	0	1	1	1	2	0	1	0	0		

Table 3: Anthoxantho-Brometum erecti Poldini 1980.
Tabela 3: Anthoxantho-Brometum erecti Poldini 1980.

Relevé no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Relevé no. in Figure 1	19	20	22	29	30	36	37	49	50	59	44	45	54	55	60	61	
Altitude (m a.s.l.)	614	613	610	530	530	733	728	596	696	612	589	596	648	652	673	673	
Slope (°)	0	0	0	0	0	0	0	0	0	0	5	16	22	0	0	0	
Aspect	0	0	0	0	0	0	0	0	0	0	S	SE	NW	0	0	0	
Relevé area (m ²)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
Cover (%)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
Landform		flat	flat	flat	flat	flat	flat	flat	flat	flat	flat	concave slope	convex slope	convex slope	flat	flat	flat
Land use management		mowing abandonment	mowing abandonment	mowing	mowing abandonment	grazing abandonment	mowing abandonment	mowing abandonment	mowing	grazing abandonment	mowing	mowing abandonment	grazing abandonment	grazing abandonment	mowing	mowing abandonment	mowing abandonment

Characteristic and differential species of Anthoxantho-Brometum erecti

<i>Knautia illyrica</i>	2	2	+	+	+	+	+	+	+	+	+	+	1	+	1	1	16	100
<i>Galium verum</i>	1	+	+	1	2	+	1	.	.	+	1	1	+	+	+	1	14	88
<i>Festuca valesiaca</i>	.	.	.	.	.	+	1	1	1	+	1	1	1	2	1	1	11	69
<i>Sanguisorba minor</i> subsp. <i>muricata</i>	.	.	.	.	+	.	.	.	+	.	.	.	+	+	+	.	6	38
<i>Rhinanthus minor</i>	.	.	.	.	.	+	+	.	.	+	.	.	.	2	+	+	6	38
<i>Trifolium campestre</i>	+	1	+	.	.	.	.	+	.	.	.	.	.	.	.	.	4	25

Characteristic species of Arrhenatherion elatioris alliance and upper units

<i>Dactylis glomerata</i> subsp. <i>glomerata</i>	1	1	1	+	+	1	+	+	1	+	+	+	1	+	+	1	16	100
<i>Arrhenatherum elatius</i> subsp. <i>elatius</i>	2	3	3	1	1	2	3	1	+	+	1	1	.	.	+	+	14	88
<i>Poa pratensis</i>	.	1	1	.	+	1	2	+	+	+	+	1	+	+	+	+	14	88
<i>Trifolium repens</i> subsp. <i>repens</i>	1	+	2	+	.	.	1	+	.	1	.	.	.	.	.	.	7	44
<i>Anthoxanthum odoratum</i>	3	1	+	+	.	.	.	1	+	.	.	+	.	.	.	.	7	44
<i>Achillea millefolium</i>	.	+	+	.	.	.	1	.	.	+	.	.	.	+	+	+	7	44
<i>Betonica officinalis</i> subsp. <i>serotina</i>	+	+	+	.	.	+	.	.	.	.	.	.	+	+	.	.	6	38
<i>Trisetum flavescens</i>	.	.	.	+	.	.	+	1	+	1	.	.	.	.	.	.	5	31
<i>Trifolium pratense</i> subsp. <i>pratense</i>	1	1	3	.	.	.	1	.	.	1	.	.	.	.	.	.	5	31
<i>Prunella vulgaris</i>	.	+	+	.	.	.	.	.	.	.	.	.	.	.	+	+	4	25
<i>Rumex acetosa</i>	.	.	+	+	.	.	.	.	.	+	+	.	.	.	.	.	4	25
<i>Holcus lanatus</i>	+	+	+	.	.	.	.	.	.	1	.	.	.	.	.	.	4	25
<i>Plantago lanceolata</i>	+	.	1	.	.	+	+	.	.	.	.	.	.	.	.	.	4	25
<i>Colchicum autumnale</i>	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	2	13
<i>Gentiana pneumonanthe</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	2	13
<i>Tragopogon orientalis</i>	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	2	13
<i>Plantago major</i>	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	2	13
<i>Taraxacum officinale</i>	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	2	13
<i>Ranunculus acris</i>	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<i>Stellaria graminea</i>	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<i>Cerastium fontanum</i>	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	6
<i>Thalictrum simplex</i> subsp. <i>galioides</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	6

Transgressive species from Scorzoneretalia villosae order and Festuco-Brometea class

<i>Festuca rupicola</i>	2	2	+	1	+	+	1	1	1	+	1	1	1	2	1	1	16	100
<i>Salvia pratensis</i>	1	2	+	+	+	+	+	+	+	+	+	+	1	1	1	1	16	100
<i>Briza media</i>	1	1	+	+	+	+	+	+	+	+	+	+	+	1	+	+	16	100
<i>Medicago falcata</i>	+	+	+	+	+	1	2	1	+	1	1	1	1	1	+	1	16	100
<i>Brachypodium rupestre</i>	1	1	1	4	3	.	.	+	1	+	2	1	2	1	1	2	14	88
<i>Plantago media</i>	+	+	1	.	+	.	+	+	+	+	+	+	.	+	+	+	13	81

Relevé no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Pres.	Fr. %
<i>Filipendula vulgaris</i>	+	+	.	.	.	+	+	+	+	+	1	+	1	1	+	+	13	81
<i>Scorzonera villosa</i>	+	.	+	.	+	3	+	.	2	+	1	+	2	1	2	2	13	81
<i>Bromus erectus</i>	2	3	1	.	.	.	.	3	3	3	1	2	2	3	2	2	12	75
<i>Galium lucidum</i>	+	+	.	1	.	+	+	.	.	+	1	1	1	+	+	+	12	75
<i>Centaurea bracteata</i>	.	+	.	.	.	2	3	1	1	3	.	+	+	+	+	1	11	69
<i>Medicago lupulina</i> s.l.	1	1	1	1	.	.	+	+	+	+	.	.	.	+	+	+	11	69
<i>Polygala nicaeensis</i>	.	+	.	+	+	.	.	+	+	.	+	+	+	+	+	+	11	69
<i>Koeleria macrantha</i>	.	.	.	.	.	+	+	+	+	+	1	1	+	1	+	+	11	69
<i>Scabiosa triandra</i>	1	2	+	.	.	+	+	+	+	.	.	.	.	+	+	1	10	63
<i>Lotus corniculatus</i>	.	.	.	+	+	+	+	1	+	1	+	+	.	.	.	.	9	56
<i>Hypericum perforatum</i>	.	.	1	.	.	+	+	+	+	+	.	+	.	.	+	+	9	56
<i>Leucanthemum liburnicum</i>	+	+	+	.	.	.	.	+	.	.	.	+	.	+	+	+	8	50
<i>Carduus collinus</i>	1	+	+	.	.	.	.	.	+	.	.	.	+	+	+	+	8	50
<i>Lotus corniculatus</i> subsp. <i>hirsutus</i>	+	+	+	.	.	.	.	.	.	.	.	.	+	+	+	+	7	44
<i>Asperula aristata</i> s.l.	.	.	.	.	.	.	.	.	+	.	+	+	+	+	+	+	7	44
<i>Anthyllis vulneraria</i>	.	.	+	.	+	.	.	+	.	.	.	.	+	+	+	+	7	44
<i>Tragopogon pratensis</i>	.	.	.	+	+	+	+	+	+	+	.	.	.	.	.	.	7	44
<i>Buphthalmum salicifolium</i>	.	.	+	.	+	.	.	+	.	+	.	.	.	+	1	1	7	44
<i>Euphorbia verrucosa</i>	.	.	1	.	.	.	.	.	+	.	+	+	+	+	.	.	6	38
<i>Globularia punctata</i>	+	.	.	.	+	.	.	.	.	.	.	.	+	+	+	+	6	38
<i>Hippocrepis comosa</i>	+	.	.	.	+	.	.	.	.	.	.	.	+	+	+	+	6	38
<i>Genista sylvestris</i>	.	.	+	.	.	.	.	.	.	.	.	.	+	+	+	+	5	31
<i>Centaurea triumfettii</i> subsp. <i>adscendens</i>	.	.	.	.	+	.	.	+	.	.	+	.	+	+	.	.	5	31
<i>Stachys subcrenata</i>	.	.	.	.	.	.	.	+	.	.	+	.	+	.	+	+	5	31
<i>Carex humilis</i>	.	.	.	.	.	.	.	.	.	.	2	.	1	+	+	+	5	31
<i>Thymus longicaulis</i>	.	.	+	.	+	.	.	.	.	.	.	.	+	+	.	+	5	31
<i>Gentiana cruciata</i>	+	+	.	+	.	+	.	+	.	.	.	.	.	.	.	.	5	31
<i>Koeleria splendens</i>	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	5	31
<i>Trifolium montanum</i>	.	.	.	.	.	.	.	.	.	1	.	.	+	+	+	+	5	31
<i>Euphorbia cyparissias</i>	.	.	.	.	.	.	.	.	+	.	+	+	+	+	.	.	5	31
<i>Thymus pulegioides</i>	+	+	.	.	+	.	.	.	.	.	+	.	.	.	.	+	5	31
<i>Dianthus balbisii</i> subsp. <i>liburnicus</i>	.	.	.	.	.	.	.	.	.	+	.	.	+	+	+	+	5	31
<i>Daucus carota</i>	.	.	+	.	.	.	.	+	.	+	.	.	.	+	.	.	4	25
<i>Ononis spinosa</i> subsp. <i>antiquorum</i>	.	.	.	.	.	.	.	+	.	.	.	+	.	.	1	+	4	25
<i>Rhinanthus freynii</i>	.	.	.	.	.	.	.	.	.	1	.	.	.	1	1	+	4	25
<i>Centaurea weldeniana</i>	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	4	25
<i>Danthonia alpina</i>	.	.	.	.	+	.	.	.	.	1	.	.	.	.	+	+	4	25
<i>Eryngium amethystinum</i>	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	+	4	25
<i>Teucrium chamaedrys</i>	.	.	+	.	.	+	+	.	.	.	.	.	+	.	.	.	4	25
<i>Orchis militaris</i>	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	+	4	25
<i>Vicia cracca</i>	.	.	.	+	+	+	.	.	.	1	.	.	.	.	.	.	4	25
<i>Arabis hirsuta</i>	.	+	+	.	.	.	.	.	.	.	.	.	.	.	+	+	4	25
<i>Galium corrudifolium</i>	2	2	.	1	+	.	.	.	.	.	.	.	.	.	.	.	4	25
<i>Sesleria juncifolia</i>	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	3	19
<i>Bromus condensatus</i>	.	.	3	1	1	.	.	.	.	.	.	.	.	.	.	.	3	19
<i>Tragopogon dubius</i>	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	3	19
<i>Allium carinatum</i>	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+	3	19
<i>Prunella laciniata</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	2	13
<i>Hypochaeris maculata</i>	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	2	13
<i>Carex flacca</i> s.l.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	2	13
<i>Inula hirta</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	2	13
<i>Leontodon crispus</i>	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	2	13
<i>Scorzonera austriaca</i>	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	2	13
<i>Teucrium montanum</i>	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	2	13
<i>Genista sericea</i>	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	2	13

Relevé no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Pres.	Fr.%
<i>Centaurea rupestris</i>	+	1	.	.	2	13
<i>Dianthus sylvestris</i> subsp. <i>tergestinus</i>	+	+	2	13
<i>Orchis morio</i>	.	.	+	+	.	2	13
<i>Ferulago galbanifera</i>	1	.	.	.	.	.	.	.	+	.	2	13
<i>Asphodelus albus</i>	+	.	.	.	+	.	.	.	2	13
<i>Thalictrum minus</i>	+	+	.	.	2	13
<i>Prunella grandiflora</i>	+	+	2	13
Ingressive species from <i>Trifolio-Geranietea sanguinei</i> class																		
<i>Lathyrus latifolius</i>	+	1	+	+	+	+	+	+	.	.	.	.	8	50
<i>Knautia drymeia</i>	+	+	.	+	+	1	+	1	1	8	50
<i>Campanula rapunculus</i>	+	+	.	.	+	+	.	.	+	+	+	7	44
<i>Scorzonera hispanica</i>	+	.	+	+	+	+	+	+	7	44
<i>Orobanche lutea</i>	.	.	+	.	+	+	.	.	.	+	+	5	31
<i>Trifolium alpestre</i>	+	.	+	1	.	1	1	.	.	.	.	5	31
<i>Agrimonia eupatoria</i>	+	.	+	.	.	+	+	4	25
<i>Coronilla coronata</i>	+	.	.	+	+	.	.	3	19
<i>Veronica jacquinii</i>	.	.	+	+	+	3	19
<i>Seseli libanotis</i>	+	+	.	+	3	19
<i>Trifolium rubens</i>	+	+	.	2	13
<i>Valeriana wallrothii</i>	.	+	.	.	+	2	13
<i>Veronica chamaedrys</i>	.	.	.	+	+	2	13
<i>Serratula lycopifolia</i>	+	+	2	13
<i>Anthericum ramosum</i> s.l.	+	+	.	.	.	2	13
<i>Polygonatum odoratum</i>	+	+	2	13
<i>Chamaecytisus hirsutus</i>	+	+	.	.	2	13
<i>Viola hirta</i>	+	+	.	.	2	13
Companions																		
<i>Elymus repens</i>	+	1	+	.	+	+	1	2	+	+	+	+	11	69
<i>Sedum acre</i>	.	2	+	.	+	+	+	.	.	.	.	.	.	+	+	.	8	50
<i>Dorycnium pentaphyllum</i>	+	+	.	.	+	+	+	+	6	38
<i>Pastinaca sativa</i>	.	.	.	1	.	.	+	+	.	+	.	.	.	.	.	.	4	25
<i>Picris echioides</i>	+	.	+	+	+	4	25
<i>Vicia villosa</i>	+	+	1	+	.	.	.	.	.	.	.	4	25
<i>Briza minor</i>	+	+	+	+	4	25
<i>Crataegus monogyna</i>	+	.	.	+	+	+	4	25
<i>Prunus mahaleb</i>	+	+	.	.	.	+	+	4	25
<i>Rubus caesius</i>	.	.	+	+	.	.	+	.	.	+	4	25
<i>Plantago argentea</i>	1	.	.	.	1	+	+	4	25
<i>Ajuga reptans</i>	+	+	+	3	19
<i>Erigeron annuus</i>	.	+	+	.	.	.	+	3	19
<i>Petrorhagia saxifraga</i>	.	.	.	+	.	+	+	3	19
<i>Pyrus pyraeaster</i>	.	+	+	+	3	19
<i>Calamagrostis varia</i>	2	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	3	19
<i>Rhinanthus glacialis</i>	.	+	+	.	.	.	+	3	19
<i>Medicago sativa</i>	.	.	+	1	.	.	.	.	.	+	.	.	.	.	.	.	3	19
<i>Helleborus multifidus</i> subsp. <i>istriacus</i>	+	.	+	.	.	+	3	19
<i>Senecio erucifolius</i>	+	+	.	.	2	13
<i>Cirsium arvense</i>	+	+	2	13
<i>Convolvulus arvensis</i>	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	+	2	13
<i>Silene latifolia</i> subsp. <i>alba</i>	+	+	2	13
<i>Rumex crispus</i>	+	+	2	13
<i>Galium mollugo</i>	+	+	2	13
<i>Juniperus communis</i>	.	.	.	+	+	2	13
<i>Acer campestre</i>	+	.	+	2	13
<i>Fraxinus excelsior</i>	+	+	2	13

Relevé no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Pres. Fr. %
<i>Fraxinus ornus</i>	.	.	+	+	2 13
<i>Cytisus nigricans</i>	+	.	.	1	.	.	2 13
<i>Allium roseum</i>	+	.	.	+	.	.	.	2 13
<i>Genista sagittalis</i> s.l.	+	+	.	.	2 13
<i>Luzula luzuloides</i>	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2 13
<i>Viola odorata</i>	+	+	2 13
<i>Carex</i> sp.	.	.	.	+	+	2 13
<i>Hypericum tetrapterum</i>	+	+	.	.	2 13
<i>Trifolium alpinum</i>	.	.	+	+	2 13
Accidental	3	2	8	3	2	3	2	1	1	2	0	3	2	2	1	1	

Table 4: Synoptic table of Čićarija grassland vegetation, compared with phytosociological tables from Istria and surrounding territories, based on data collected in the past decades [column 1: cluster I, table 2 – *Danthonio-Scorzoneretum villosae* Horvat & Horvatić in Horvatić 1958 (present study); column 2: *Danthonio-Scorzoneretum villosae* Horvat & Horvatić in Horvatić 1958 (rel. 44–48, Table 1 in Kaligarić & Poldini 1997); column 3: subcluster IIa¹, Table 3 – *Carici humilis-Centaureetum rupestris* Horvat 1931 (present study); column 4: subcluster IIa², Table 3 – *Carici humilis-Centaureetum rupestris* Horvat 1931 *Brachypodium rupestre* variant (present study); column 5: *Carici humilis-Centaureetum rupestris* Horvat 1931 (rel. 41–50, Table 2 in Kaligarić & Poldini 1997); column 6: subcluster IIb, table 4 – *Anthoxantho-Brometum erecti* Poldini 1980 (present study); column 7: *Anthoxantho-Brometum erecti* Poldini 1980 [sub *Arrhenatheretum elatioris* sensu Poldini non Br.-Bl. 1925 *brometosum erecti* (rel. 13–33, Table 56 in Poldini 1989)].

Tabela 4: Sinoptična tabela vegetacije travnikov v Čićariji in primerjava s fitocenološkim gradivom iz Istre in sosednjih območij [stolpec 1: klaster I, tabela 2 – *Danthonio-Scorzoneretum villosae* Horvat & Horvatić in Horvatić 1958 (ta članek); stolpec 2: *Danthonio-Scorzoneretum villosae* Horvat & Horvatić in Horvatić 1958 (popisi 44–48, tabela 1 v Kaligarić & Poldini 1997); stolpec 3: subklaster IIa¹, tabela 3 – *Carici humilis-Centaureetum rupestris* Horvat 1931 (ta članek); stolpec 4: subklaster IIa², tabela 3 – *Carici humilis-Centaureetum rupestris* Horvat 1931 *Brachypodium rupestre* varianta (ta članek); stolpec 5: *Carici humilis-Centaureetum rupestris* Horvat 1931 (popisi 41–50, tabela 2 v Kaligarić & Poldini 1997); stolpec 6: subklaster IIb, tabela 4 – *Anthoxantho-Brometum erecti* Poldini 1980 (ta članek); stolpec 7: *Anthoxantho-Brometum erecti* Poldini 1980 [sub *Arrhenatheretum elatioris* sensu Poldini non Br.-Bl. 1925 *brometosum erecti* (popisi 13–33, tabela 56 v Poldini 1989)].

Column no.	1	2	3	4	5	6	7
No. of relevés	17	5	14	26	10	16	21

Characteristic species of *Scorzonerion villosae* alliance

<i>Knautia illyrica</i>	IV	III	II	V	I	V	.
<i>Leucanthemum liburnicum</i>	III	V	I	II	I	III	.
<i>Daucus carota</i>	II	.	I	I	.	II	IV
<i>Rhinanthus freynii</i>	I	II	.	I	.	II	I
<i>Medicago falcata</i>	III	.	I	IV	.	V	II
<i>Ferulago galbanifera</i>	.	V	II	I	.	I	I
<i>Hypochaeris maculata</i>	I	II	.	I	.	I	.
<i>Dianthus sanguineus</i>	.	II	I	I	.	I	.
<i>Ranunculus bulbosus</i>	I	I	.	.	.	.	IV
<i>Dorycnium herbaceum</i>	I	.	I	.	.	.	I
<i>Prunella laciniata</i>	II	.	.	I	.	I	.
<i>Melampyrum barbatum</i> subsp. <i>carstiense</i>	II	.	.	I	.	.	.

Characteristic and differential species of *Saturejienion subspicatae* suballiance and *Saturejion subspicatae* alliance

<i>Centaurea rupestris</i>	I	III	V	V	IV	I	.
<i>Carex humilis</i>	I	III	V	III	V	II	.

No. of relevés	17	5	14	26	10	16	21
<i>Bromus condensatus</i>	III	.	IV	III	.	I	.
<i>Stachys subcrenata</i>	I	.	IV	IV	.	II	.
<i>Dorycnium germanicum</i>	.	IV	IV	I	IV	.	.
<i>Euphorbia verrucosa</i>	.	IV	I	IV	.	II	.
<i>Teucrium montanum</i>	.	.	IV	IV	V	I	.
<i>Scorzonera austriaca</i>	.	.	III	III	II	I	.
<i>Muscari botryoides</i>	I	.	II	.	I	.	.
<i>Gentiana tergestina</i>	I	.	.	I	I	.	.
<i>Centaurea cristata</i> subsp. <i>tommasinii</i>	I	.	.	I	I	.	.
<i>Stipa pennata</i> subsp. <i>eriocaulis</i>	.	.	IV	II	II	.	.
<i>Satureja montana</i> subsp. <i>subspicata</i>	.	.	IV	I	I	.	.
<i>Dianthus sylvestris</i> subsp. <i>tergestinus</i>	.	.	II	II	.	I	.
<i>Seseli elatum</i> subsp. <i>gouanii</i>	.	.	I	I	.	.	.
<i>Globularia cordifolia</i>	.	.	III	.	.	.	.
<i>Crepis chondrilloides</i>	.	.	I	.	.	.	.
<i>Euphrasia illyrica</i>	.	.	.	.	I	.	.
Characteristic species of <i>Scorzoneretalia villosae</i> order							
<i>Scorzonera villosa</i>	III	V	IV	V	III	V	I
<i>Festuca rupicola</i>	III	III	II	IV	IV	V	II
<i>Polygala nicaeensis</i>	III	III	III	IV	II	IV	III
<i>Salvia pratensis</i>	V	V	IV	V	II	V	V
<i>Lotus corniculatus</i> subsp. <i>hirsutus</i>	III	V	I	V	II	III	.
<i>Globularia punctata</i>	II	V	V	III	IV	II	.
<i>Thymus longicaulis</i>	II	III	I	III	IV	II	.
<i>Galium lucidum</i>	I	IV	I	III	II	IV	.
<i>Centaurea triumfettii</i> subsp. <i>adscendens</i>	I	I	I	III	I	II	.
<i>Leontodon crispus</i>	I	II	II	I	II	I	.
<i>Genista sylvestris</i>	I	II	III	IV	III	II	.
<i>Lathyrus latifolius</i>	III	II	I	I	.	III	I
<i>Centaurea weldeniana</i>	.	II	I	I	II	II	II
<i>Pseudolysimachion spicatum</i> subsp. <i>barrelieri</i>	I	I	I	I	.	I	.
<i>Euphorbia nicaeensis</i>	I	II	IV	II	IV	.	.
<i>Asperula cynanchica</i>	I	I	III	I	III	.	.
<i>Koeleria splendens</i>	III	.	III	III	IV	II	.
<i>Inula hirta</i>	I	.	IV	II	I	I	.
<i>Plantago holostium</i>	.	IV	III	III	III	I	.
<i>Chrysopogon gryllus</i>	III	IV	I	.	I	.	.
<i>Danthonia alpina</i>	I	II	.	II	.	II	.
<i>Potentilla tommasiniana</i>	I	I	.	I	III	.	.
<i>Cirsium acaule</i>	II	.	I	I	II	.	.
<i>Centaurea bracteata</i>	I	.	III	III	.	IV	.
<i>Inula ensifolia</i>	I	.	II	II	.	I	.
<i>Allium senescens</i> subsp. <i>montanum</i>	I	.	II	I	I	.	.
<i>Bupthalmum salicifolium</i>	I	.	I	IV	.	III	.
<i>Betonica officinalis</i> subsp. <i>serotina</i>	I	I	III	III	IV	II	.
<i>Genista sericea</i>	.	.	I	II	II	I	.
<i>Narcissus radiflorus</i>	I	.	III	I	.	.	.
<i>Potentilla alba</i>	I	.	I	I	.	.	.
<i>Serratula lycopifolia</i>	I	.	.	I	.	I	.
<i>Linum narbonense</i>	.	.	II	I	.	I	.
<i>Gentiana cruciata</i>	.	.	I	II	.	II	.

No. of relevés	17	5	14	26	10	16	21
<i>Carlina acaulis</i>	I	.	.	I	.	.	.
<i>Potentilla australis</i>	I	.	I	.	.	.	.
<i>Ruta graveolens</i>	.	.	I	I	.	.	.
<i>Cytisus pseudoprocumbens</i>	.	II	.	.	.	.	.
<i>Ruta divaricata</i>	.	.	.	.	I	.	.
Characteristic species of <i>Festuco-Brometea</i> class							
<i>Plantago media</i>	IV	V	I	III	III	V	V
<i>Bromus erectus</i>	II	V	I	III	V	IV	IV
<i>Filipendula vulgaris</i>	III	V	V	V	I	V	.
<i>Hippocrepis comosa</i>	III	III	II	III	I	II	.
<i>Teucrium chamaedryx</i>	II	I	IV	IV	IV	II	.
<i>Briza media</i>	III	II	.	IV	I	V	III
<i>Sanguisorba minor</i>	II	III	I	II	.	II	V
<i>Eryngium amethystinum</i>	I	III	IV	IV	V	II	.
<i>Euphorbia cyparissias</i>	I	I	IV	IV	IV	II	.
<i>Trifolium montanum</i>	I	V	II	I	.	II	.
<i>Carex flacca</i> s.l.	I	.	I	I	I	I	.
<i>Anthyllis vulneraria</i>	III	.	IV	V	.	III	II
<i>Lotus corniculatus</i>	II	.	III	II	.	III	V
<i>Galium verum</i>	I	.	.	III	I	V	III
<i>Festuca valesiaca</i>	I	I	I	IV	.	IV	IV
<i>Brachypodium rupestre</i>	I	III	I	.	I	.	.
<i>Medicago lupulina</i>	III	.	.	I	.	IV	V
<i>Trifolium campestre</i>	III	.	.	I	.	II	III
<i>Scabiosa triandra</i>	IV	III	I	II	III	IV	II
<i>Tragopogon pratensis</i>	II	.	III	I	.	III	.
<i>Thymus pulegioides</i>	II	.	I	I	.	II	III
<i>Galium corrudifolium</i>	I	.	IV	IV	.	II	.
<i>Brachypodium pinnatum</i>	I	.	I	V	.	V	.
<i>Orchis militaris</i>	I	.	I	II	.	II	.
<i>Thalictrum minus</i>	.	.	III	V	II	I	.
<i>Allium sphaerocephalon</i>	.	.	I	I	III	I	.
<i>Linum tenuifolium</i>	.	.	I	I	III	I	.
<i>Hypericum perforatum</i>	.	.	I	I	I	III	.
<i>Plantago argentea</i>	.	.	I	I	I	II	.
<i>Carduus collinus</i>	.	.	II	IV	.	III	I
<i>Linum catharticum</i>	I	II	I	.	.	.	.
<i>Vicia cracca</i>	II	.	.	.	.	II	I
<i>Potentilla heptaphylla</i>	I	.	II	II	.	.	.
<i>Satureja montana</i> subsp. <i>montana</i>	I	.	II	II	.	.	.
<i>Asperula aristata</i> s.l.	I	.	.	III	.	III	.
<i>Knautia purpurea</i>	I	.	.	I	.	I	.
<i>Orchis morio</i>	I	.	.	I	.	I	.
<i>Satureja montana</i> subsp. <i>variegata</i>	.	I	II	.	IV	.	.
<i>Achillea collina</i>	.	I	.	.	I	.	IV
<i>Koeleria pyramidata</i>	.	I	II	I	.	.	.
<i>Trinia glauca</i>	.	II	II	.	II	.	.
<i>Sanguisorba minor</i> subsp. <i>muricata</i>	.	.	I	II	IV	.	.
<i>Jurinea mollis</i>	.	.	III	I	II	.	.
<i>Sesleria juncifolia</i>	.	.	III	III	.	I	.
<i>Stachys recta</i>	.	.	.	I	I	I	.

No. of relevés	17	5	14	26	10	16	21
<i>Allium carinatum</i>	.	.	.	I	I	I	.
<i>Leucanthemum vulgare</i>	.	.	.	I	.	I	V
<i>Ononis spinosa</i> subsp. <i>antiquorum</i>	III	.	.	.	.	II	.
<i>Anthyllis vulneraria</i> subsp. <i>poliphylla</i>	.	IV	.	.	III	.	.
<i>Helianthemum ovatum</i>	.	IV	.	.	II	.	.
<i>Carex caryophyllea</i>	.	III	.	.	I	.	.
<i>Pulsatilla montana</i>	.	II	.	.	II	.	.
<i>Hieracium pilosella</i>	.	II	.	.	I	.	.
<i>Leontodon hispidus</i>	.	I	.	.	.	.	V
<i>Anthyllis montana</i> subsp. <i>jacquinii</i>	.	.	II	III	.	.	.
<i>Melica ciliata</i>	.	.	IV	I	.	.	.
<i>Senecio scopolii</i>	.	.	I	III	.	.	.
<i>Cuscuta epithymum</i>	.	.	I	I	.	.	.
<i>Phyteuma orbiculare</i>	.	.	I	I	.	.	.
<i>Salvia sclarea</i>	.	.	I	I	.	.	.
<i>Senecio doronicum</i>	.	.	I	I	.	.	.
<i>Arabis hirsuta</i>	.	.	II	.	.	II	.
<i>Dianthus monspessulanus</i>	.	.	I	.	.	I	.
<i>Koeleria macrantha</i>	.	.	.	III	.	IV	.
<i>Dianthus balbisii</i> subsp. <i>liburnicus</i>	.	.	.	I	.	II	.
<i>Hieracium bauhinii</i>	.	.	.	I	.	I	.
<i>Asphodelus albus</i>	.	.	.	I	.	I	.
<i>Prunella grandiflora</i>	.	.	.	I	.	I	.
<i>Silene vulgaris</i>	.	.	.	I	.	I	.
<i>Tragopogon dubius</i>	.	.	.	I	.	I	.
<i>Onobrychis viciifolia</i>	II	.	.	.	.	.	.
<i>Polygala vulgaris</i>	I	.	.	.	.	.	.
<i>Carex montana</i>	.	I	.	.	.	.	.
<i>Onobrychis arenaria</i>	.	I	.	.	.	.	.
<i>Orchis ustulata</i>	.	I	.	.	.	.	.
<i>Festuca rubra</i>	.	.	II	.	.	.	.
<i>Globularia meridionalis</i>	.	.	.	I	.	.	.
<i>Asperula purpurea</i>	IV	.	.
<i>Medicago prostrata</i>	III	.	.
<i>Agropyron intermedium</i>	II	.	.
<i>Thesium divaricatum</i>	II	.	.
<i>Hieracium piloselloides</i>	II	.	.
<i>Campanula glomerata</i>	I	.	.
<i>Hyssopus officinalis</i> subsp. <i>aristatus</i>	I	.	.
<i>Avenula pubescens</i>	III
<i>Cerastium tenoreanum</i>	II
<i>Pimpinella saxifraga</i>	II
Characteristic species of <i>Arrhenatherion</i> alliance, <i>Arrhenatheretalia</i> order and <i>Molinio-Arrhenatheretea</i> class							
<i>Plantago lanceolata</i>	V	I	II	II	.	II	V
<i>Dactylis glomerata</i>	II	II	I	III	.	V	IV
<i>Anthoxanthum odoratum</i>	I	III	I	I	.	III	V
<i>Trifolium pratense</i> subsp. <i>pratense</i>	IV	III	.	.	.	II	V
<i>Poa pratensis</i>	III	.	.	II	.	V	V
<i>Arrhenatherum elatius</i> subsp. <i>elatius</i>	I	.	.	I	.	V	V
<i>Trisetum flavescens</i>	II	.	.	I	.	II	III
<i>Rhinanthus minor</i>	.	I	.	I	.	II	II

No. of relevés	17	5	14	26	10	16	21
<i>Achillea millefolium</i>	IV	.	.	II	.	III	.
<i>Prunella vulgaris</i>	II	.	.	I	.	II	.
<i>Trifolium repens</i>	I	.	.	I	.	III	.
<i>Colchicum autumnale</i>	I	.	.	I	.	I	.
<i>Tragopogon orientalis</i>	I	.	.	I	.	I	.
<i>Holcus lanatus</i>	I	.	.	.	.	II	I
<i>Cerastium fontanum</i>	.	.	I	.	.	I	IV
<i>Ranunculus acris</i>	.	.	.	I	.	I	I
<i>Stellaria graminea</i>	I	.	.	I	.	I	.
<i>Plantago major</i>	I	.	.	.	.	I	.
<i>Lathyrus pratensis</i>	I	.	.	.	.	.	III
<i>Tragopogon porrifolius</i>	I	.	.	I	.	.	.
<i>Plantago altissima</i>	I	.	.	I	.	.	.
<i>Senecio jacobaea</i>	.	II	.	.	II	.	.
<i>Gentiana pneumonanthe</i>	.	.	.	I	.	I	.
<i>Thalictrum simplex</i> subsp. <i>galioides</i>	.	.	.	I	.	I	.
<i>Rumex acetosa</i>	.	.	.	.	.	II	III
<i>Taraxacum officinale</i>	.	.	.	.	.	I	IV
<i>Centaurea jacea</i>	II	.	.	.	.	.	.
<i>Crepis biennis</i>	I	.	.	.	.	.	.
<i>Genista tinctoria</i>	.	I	.	.	.	.	.
<i>Lolium perenne</i>	.	.	.	.	.	.	IV
<i>Galium album</i>	.	.	.	.	.	.	III
<i>Festuca pratensis</i>	.	.	.	.	.	.	I
<i>Bellis perennis</i>	.	.	.	.	.	.	I
Companions							
<i>Trifolium rubens</i>	II	II	II	II	.	I	II
<i>Luzula multiflora</i>	I	I	.	.	.	I	II
<i>Trifolium alpestre</i>	III	.	II	IV	.	II	.
<i>Picris hieracioides</i>	II	.	II	I	.	I	.
<i>Chamaecytisus hirsutus</i>	II	.	II	II	.	I	.
<i>Sedum acre</i>	II	.	I	III	.	III	.
<i>Scorzonera hispanica</i>	I	.	I	II	.	III	.
<i>Seseli libanotis</i>	I	.	I	II	.	I	.
<i>Orobanche lutea</i>	I	.	I	II	.	II	.
<i>Dorycnium pentaphyllum</i>	I	.	II	III	.	II	.
<i>Knautia drymeia</i>	I	.	III	III	.	III	.
<i>Helleborus multifidus</i> subsp. <i>istriacus</i>	I	.	III	II	.	I	.
<i>Pinus nigra</i>	I	.	II	III	.	I	.
<i>Elymus repens</i>	I	.	II	II	.	IV	.
<i>Juniperus communis</i>	I	.	II	II	.	I	.
<i>Allium species</i>	I	.	I	I	.	I	.
<i>Petrorhagia saxifraga</i>	I	.	I	I	.	I	.
<i>Peucedanum oreoselinum</i>	I	.	I	I	.	.	II
<i>Pastinaca sativa</i>	I	.	.	I	.	II	I
<i>Rhinanthus glacialis</i>	.	I	.	I	I	I	.
<i>Anthericum ramosum</i>	.	.	II	II	I	I	.
<i>Viola hirta</i>	.	.	.	I	I	I	II
<i>Inula salicina</i>	III	.	I	I	.	.	.
<i>Helianthemum salicifolium</i>	III	.	I	I	.	.	.
<i>Geranium sanguineum</i>	I	.	I	I	.	.	.

No. of relevés	17	5	14	26	10	16	21
<i>Dictamnus albus</i>	I	.	I	I	.	.	.
<i>Rosa canina</i>	I	.	III	III	.	.	.
<i>Campanula rapunculus</i>	II	.	.	I	.	III	.
<i>Peucedanum cervaria</i>	I	.	.	II	.	I	.
<i>Briza minor</i>	I	.	.	I	.	II	.
<i>Lilium bulbiferum</i>	I	.	.	I	.	I	.
<i>Silene latifolia</i> subsp. <i>alba</i>	I	.	.	I	.	I	.
<i>Senecio erucifolius</i>	I	.	.	I	.	I	.
<i>Convolvulus arvensis</i>	I	.	.	I	.	I	.
<i>Cirsium arvense</i>	I	.	.	I	.	I	.
<i>Clematis vitalba</i>	I	.	.	I	.	I	.
<i>Rubus caesius</i>	I	.	.	I	.	II	.
<i>Medicago sativa</i>	III	.	.	.	.	I	I
<i>Tragopogon tommasinii</i>	.	II	.	.	I	.	II
<i>Serratula radiata</i>	.	.	I	I	I	.	.
<i>Prunus mahaleb</i>	.	.	II	III	.	II	.
<i>Laserpitium siler</i>	.	.	II	III	.	I	.
<i>Cornus mas</i>	.	.	I	II	.	I	.
<i>Crataegus monogyna</i>	.	.	I	I	.	II	.
<i>Polygonatum odoratum</i>	.	.	I	I	.	I	.
<i>Fraxinus ornus</i>	.	.	I	I	.	I	.
<i>Campanula pyramidalis</i>	.	.	I	I	.	I	.
<i>Ajuga reptans</i>	.	.	.	I	.	I	II
<i>Dorycnium hirsutum</i>	II	.	I	.	.	.	.
<i>Carduus nutans</i>	I	.	I	.	.	.	.
<i>Cerastium arvense</i> subsp. <i>strictum</i>	I	.	I	.	.	.	.
<i>Dactylis glomerata</i> subsp. <i>hispanica</i>	III	.	.	II	.	.	.
<i>Scolymus hispanicus</i>	I	.	.	I	.	.	.
<i>Acinos arvensis</i>	I	.	.	I	.	.	.
<i>Poa bulbosa</i>	I	.	.	I	.	.	.
<i>Quercus cerris</i>	I	.	.	I	.	.	.
<i>Carex species</i>	II	.	.	.	.	I	.
<i>Cichorium intybus</i>	I	.	.	.	.	I	.
<i>Galium mollugo</i>	I	.	.	.	.	I	.
<i>Erigeron annuus</i>	I	.	.	.	.	I	.
<i>Rumex crispus</i>	I	.	.	.	.	I	.
<i>Carduus pycnocephalus</i>	I	.	.	.	.	I	.
<i>Crepis sancta</i>	I	.	.	.	.	I	.
<i>Vicia angustifolia</i>	I	.	.	.	.	.	III
<i>Bothriochloa ischaemon</i>	.	I	.	.	II	.	.
<i>Verbascum blattaria</i>	.	.	II	I	.	.	.
<i>Bunium alpinum</i> subsp. <i>montanum</i>	.	.	I	II	.	.	.
<i>Vincetoxicum hirundinaria</i>	.	.	I	II	.	.	.
<i>Euphorbia characias</i> subsp. <i>wulfenii</i>	.	.	I	I	.	.	.
<i>Inula spiraeifolia</i>	.	.	I	I	.	.	.
<i>Viola odorata</i>	.	.	I	.	.	I	.
<i>Rhamnus fallax</i>	.	.	.	II	.	I	.
<i>Trifolium alpinum</i>	.	.	.	II	.	I	.
<i>Agrimonia eupatoria</i>	.	.	.	I	.	II	.
<i>Vicia villosa</i>	.	.	.	I	.	II	.
<i>Allium roseum</i>	.	.	.	I	.	I	.

No. of relevés	17	5	14	26	10	16	21
<i>Veronica jacquinii</i>	.	.	.	I	.	I	.
<i>Genista sagittalis</i>	.	.	.	I	.	I	.
<i>Gentiana lutea</i> subsp. <i>symphyandra</i>	.	.	.	I	.	I	.
<i>Cytisus nigricans</i>	.	.	.	I	.	I	.
<i>Coronilla coronata</i>	.	.	.	I	.	I	.
<i>Aristolochia clematitidis</i>	.	.	.	I	.	I	.
<i>Echium vulgare</i>	.	.	.	I	.	I	.
<i>Rhamnus saxatilis</i>	.	.	.	I	.	I	.
<i>Acer campestre</i>	.	.	.	I	.	I	.
<i>Valeriana wallrothii</i>	.	.	.	I	.	I	.
<i>Calamintha menthifolia</i>	.	.	.	I	.	I	.
<i>Fragaria vesca</i>	.	.	.	I	.	I	.
<i>Fraxinus excelsior</i>	.	.	.	I	.	I	.
<i>Prunus spinosa</i>	.	.	.	I	.	I	.
<i>Paeonia mascula</i>	.	.	.	I	.	I	.
<i>Potentilla reptans</i>	.	.	.	I	.	I	.
<i>Veronica chamaedrys</i>	I	II
<i>Euphorbia palustris</i>	I	.	.	.	.	.	.
<i>Danthonia decumbens</i>	I	.	.	.	.	.	.
<i>Filago vulgaris</i>	I	.	.	.	.	.	.
<i>Aira elegantissima</i>	I	.	.	.	.	.	.
<i>Stellaria holostea</i>	I	.	.	.	.	.	.
<i>Calamagrostis arundinacea</i>	I	.	.	.	.	.	.
<i>Hypericum hirsutum</i>	I	.	.	.	.	.	.
<i>Vicia sativa</i>	I	.	.	.	.	.	.
<i>Chamaespartium sagittale</i>	.	III	.	.	.	.	.
<i>Festuca tenuifolia</i>	.	I	.	.	.	.	.
<i>Potentilla recta</i>	.	I	.	.	.	.	.
<i>Calamintha nepeta</i>	.	.	I	.	.	.	.
<i>Verbascum chaixii</i>	.	.	.	I	.	.	.
<i>Silene italica</i>	.	.	.	I	.	.	.
<i>Lotus angustissimus</i>	.	.	.	I	.	.	.
<i>Apera spica-venti</i>	.	.	.	I	.	.	.
<i>Salix caprea</i>	.	.	.	I	.	.	.
<i>Sorbus aucuparia</i>	.	.	.	I	.	.	.
<i>Thlaspi perfoliatum</i>	.	.	.	I	.	.	.
<i>Verbascum pulverulentum</i>	.	.	.	I	.	.	.
<i>Juniperus oxycedrus</i> subsp. <i>macrocarpa</i>	.	.	.	I	.	.	.
<i>Frangula rupestris</i>	II	.	.
<i>Bupleurum veronense</i>	I	.	.
<i>Artemisia alba</i>	I	.	.
<i>Fumana procumbens</i>	I	.	.
<i>Viola rupestris</i>	I	.	.
<i>Picris echioides</i>	II	.
<i>Luzula luzuloides</i>	I	.
<i>Calamagrostis varia</i>	I	.
<i>Hypericum tetrapterum</i>	I	.
<i>Pyrus communis</i>	I	.
<i>Crepis taraxacifolia</i>	III
<i>Veronica arvensis</i>	III
<i>Myosotis arvensis</i>	II

No. of relevés	17	5	14	26	10	16	21
<i>Coronilla varia</i>	.	.	.	.	.	.	II
<i>Sedum sexangulare</i>	.	.	.	.	.	.	II
<i>Cerastium glutinosum</i>	.	.	.	.	.	.	II
<i>Bromus hordeaceus</i>	.	.	.	.	.	.	I
<i>Centaurea vochinensis</i>	.	.	.	.	.	.	I

Table 5: Social behaviour type composition (in %) of Čičarija grassland *syntaxa*, compared with the one of the same *syntaxa*, surveyed in the past decades in Istria and surrounding territories. Column numbers are the same as reported in Table 4.

Tabela 5: Sestava zgradbe travniških združb glede na sinsociološko pripadnost vrst (v %) travniških sintaksonov Čičarije. Primerjava popisnega gradiva s popisi narejenimi v preteklih desetletjih in iz sosednjih območij. Številke stolpcov so enake kot v Tabeli 4.

Social behaviour type	1	2	3	4	5	6	7
Pasture	57.1	82.7	71.2	57.1	90.7	50.0	50.0
Meadow	11.2	9.3	3.4	8.2	1.2	10.6	25.0
Successional and ruderal	29.8	8.0	23.3	33.3	8.1	36.2	25.0
Other	1.9	0.0	2.1	1.4	0.0	3.2	0.0

Table 6: Management type, landform, and dynamic state related to use/non-use, of the identified grassland *syntaxa*. Possible trends in case of protracted abandonment are also shown.

Tabela 6: Način gospodarjenja, krajinska oblika in dinamično stanje glede na status uporabe/neuporabe v ugotovljenih travniških sintaksonih. Nakazani so možni trendi v primeru nadaljnega opuščanja.

Management type	Pasture	Meadow	
Landform	Flat or slightly convex relief tops, slightly or moderately steep slopes, with shallow soils and outcropping rock	Flat or slightly concave surfaces, at the transition between slopes and flat lands, with quite deep soils	Flat lands, bottom of depressions between relief tops, with deep soils
Use	<i>Carici humilis-Centaureetum rupestris</i>	<i>Danthonio-Scorzoneretum villosae</i>	<i>Arrhenatheretum elatioris</i> "typicum"
Abandonment	<i>Brachypodium rupestre</i> variant	<i>Brachypodium rupestre</i> variant ?	<i>Anthoxantho-Brometum erecti</i>
Protracted abandonment	<i>Brachypodium rupestre</i> community ?	<i>Brachypodium rupestre</i> community ?	Nitrophilous tall herbs community ?