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Contribution to the knowledge of the non-calcareous grasslands of the Monti Sibillini National Park (central Italy): coenological structure, syntaxonomy, ecology, and floristic aspects

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Key words: arenaceous substrates, flora of conservation interest, grasslands, plant sociology.

Ključne besede: peščenjak, zavarovana flora, travišča, fitosociologija.

Abstract

This study provides the first contribution to the knowledge of the non-calcareous grasslands of the arenaceous sector of the Monti Sibillini National Park (central Italy). We conducted 55 relevés using the Braun-Blanquet phytosociological method and analysed the ecology of plant communities by Redundancy analysis using topographic variables and Ellenberg Indicator Values as predictors. We identified nine plant communities, belonging to four classes. Communities of *Calluno-Ulicetea* and *Nardetea strictae* were found on acidic soils at higher elevations, those of *Festuco-Brometea* were mainly associated with steeper south-facing slopes, while *Molinio-Arrhenatheretea* communities were associated with low altitudes and gentle slopes, semi-flat lands, and high soil nutrient and moisture values. We recorded a total of 410 taxa at the species and subspecies level, representing about 20% of the flora of the Monti Sibillini National Park. Some of these are of high conservation interest, e.g. *Calluna vulgaris*, *Genista sagittalis*, *Juncus capitatus*, and *Ophioglossum vulgatum*. Eight species are new to the flora of Sibillini National Park.

Izvleček

Članek predstavlja prve prispevke k poznavanju travišč na nekarbonatni podlagi na peščenjaku v Narodnem parku Monti Sibillini (srednja Italija). Naredili smo 55 popisov z Braun-Blanquetovo metodo in analizirali ekologijo rastlinskih združb z analizo renundance (RDA) z uporabo topografskih spremenljivk in Ellenbergovih indikatorskih vrednosti kot neodvisnih spremenljivk. Identificirali smo devet rastlinskih združb, ki jih uvrščamo v štiri razrede. Združbe iz razredov *Calluno-Ulicetea* in *Nardetea strictae* smo našli na kislih tleh na višjih nadmorskih višinah, tiste iz razreda *Festuco-Brometea* pa na strmih južnih pobočjih, medtem ko se združbe iz razreda *Molinio-Arrhenatheretea* pojavljajo v nižinah na blagih naklonih, bolj ali manj ravnih površinah, na tleh z večjo vsebnostjo hranil in vlažnostjo. Zabeležili smo 410 taksonov (vrst in podvrst), ki predstavljajo 20% flore Narodnega parka Monti Sibillini. Nekateri so pomembni z vidika ohranjanja, kot npr. *Calluna vulgaris*, *Genista sagittalis*, *Juncus capitatus* in *Ophioglossum vulgatum*. Osem vrst je v flori Narodnega parka Monti Sibillini zabeleženih prvič.

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Introduction

In the Apennine mountains (central Italy), semi-natural grasslands extend over vast areas representing an important cultural heritage (Antrop, 2004), and a biotope of high conservation interest (Sebastià et al., 2008). Most of these communities are protected habitat types included in the 92/43/EEC Directive and play a key role in the conservation of Italian endangered fauna and flora. These communities are threatened by land abandonment, management changes and rapid dynamic processes (Mazzoleni et al., 2004; Falcucci et al., 2007). Therefore, the conservation of this valuable natural heritage is of great importance (Bricca et al., 2020). For this purpose, knowledge of floristic composition, distribution, dynamics, and biodiversity is a fundamental first step (Gigante et al., 2016). However, not all the ecological and geographical features of the Apennine grasslands are yet well known and described, especially the semi-natural, non-calcareous grasslands, which are likely to represent an important biodiversity hotspot, as most of the Apennine chains are mainly composed of limestones.

The "Monti Sibillini" National Park is the northernmost National Park of central Italy and hosts more than 2,000 vascular plant species on about 70,000 hectares (Ballelli et al., 2010). From a geological point of view, it could be divided into two main parts: the larger part is composed of limestone rocks (about the 90% of the protected area) and a smaller part is formed by arenaceous and marly-arenaceous substrates, often covered by acid or sub-acid soils (less than 5% of the protected area). Composition patterns of pastures and meadows besides their classification are poorly studied in the Park and no studies have been performed on arenaceous substrates. On calcareous substrates and lacustrine/marsh deposits a pioneer work by Cortini Pedrotti et al. (1973) addressed the pastures and meadows of Pian Grande di Castelluccio di Norcia, followed by studies on Pian Perduto di Gualdo (Pedrotti & Cortini Pedrotti, 1982), Marcite di Norcia (Orsomando & Pedrotti, 1982), Ragnolo (Francalancia et al., 1981; Catorci et al., 2007), steppe grasslands dominated by *Stipa dasyvagynata* subsp. *apenninicola* and *Stipa capillata* in the Norcia basin (Ballelli et al., 2006), pastures of the Ambro Valley (Catorci et al., 2008), and alpine and subalpine grasslands of the mountain tops (Costanzo et al., 2009).

Regarding arenaceous substrates of Monti della Laga (the nearest conspicuous arenaceous rock complex), Pedrotti (1982) collected relevés on some acidophilous plant communities (*Vaccinio-Hypericetum richeri*, *Brachypodio-Festucetum spadiceae*, *Poo violaceae-Nardetum*, *Carici-Elynetum bellardii*). Di Pietro et al. (2001) described a new association of the *Linario-Festucion dimorphae*; Allegrezza et al. (2007) reported in Valle della Corte some associations never before indicated in the Monti della Laga. Di Pietro (2007) published a contribution on the beech forests. Finally, Allegrezza et al. (2013) published a paper on the vegetation of Piè Vettore, in the middle between the two geological systems, including new mountain grassland associations.

No complete floristic checklist has yet been published on the Monti Sibillini National Park. The most conspicuous contributions refer to Ballelli et al. (2005), who published the data of the *Herbarium* Vittorio Marchesoni, kept at the *Herbarium Universitatis Camerinensis* (CAME), including 1281 taxa at the species and subspecies level, and Ballelli et al. (2010), who collected references to 1920 taxa. Other floristic records referred to the flora of the Monti della Laga, but outside our study area are from Tondi (2000), Bartolucci et al. (2012), Ballelli & Allegrezza (2016), and Conti & Bartolucci (2016).

The aim of this study was to provide the first contribution to the knowledge of the non-calcareous grasslands of the arenaceous sector of the Monti Sibillini National Park.

Our specific research aims were: i) to assess the floristic relevance of these grasslands for the Monti Sibillini National Park; ii) to identify the herbaceous plant communities from a phytosociological point of view; iii) to describe the ecology of the different vegetation types using the Ellenberg Indicator Values (EIVs) and topographic data; iv) to identify the main environmental drivers of species composition.

Materials and methods

Study area

The study area is a hilly and low-montane area (500–1494 m a.s.l.) that extends at the foot of the south-eastern side of the Sibillini Mountains ridge (whose peaks generally exceed 2,000 m a.s.l.), in the central-western sector of the Province of Ascoli Piceno (Marche region, Italy). It is largely part ofthe Monti Sibillini National Park (Figure 1).

The bedrock consists of arenaceous substrates (Laga Formation) and arenaceous-pelithic deposits, with thick, poorly permeable, arenaceous banks forming the top of the hills (Centamore et al., 1991). The landforms consist of deep valleys, delimited by very steep slopes, and flat areas or not very steep slopes in the summit areas or adjacent to the limestone outcrops. Where sandstones outcrop, they give rise to very harsh landforms, while where the sandstones alternate with pelites, asymmetric landforms develop. In particular, where the arenaceous layers have opposite orientation to the slope inclination, slopes

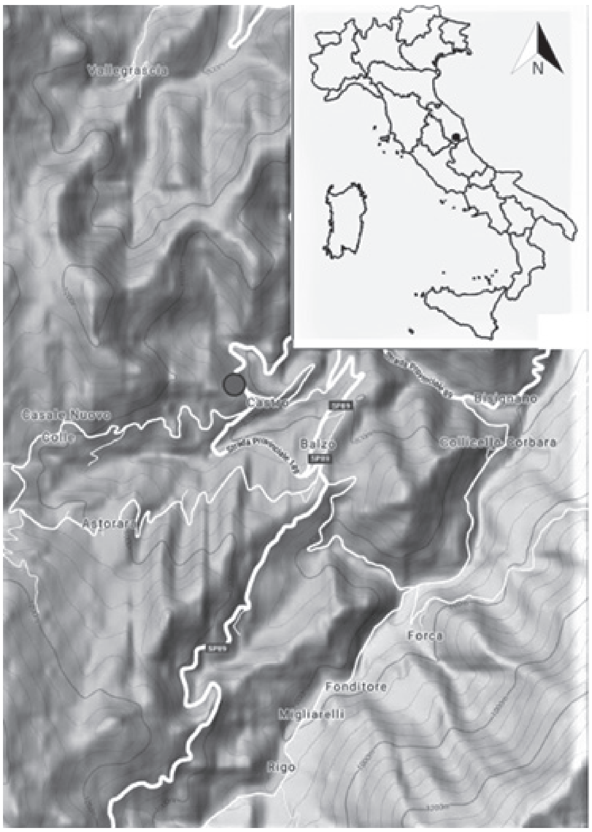

Figure1: Location of the study area (central Italy).
Slika 1: Preučevano območje (srednja Italija).

are very steep and sometimes interrupted by significant rocky cliffs. In contrast, slopes are quite gentle when the arenaceous layers are oriented in the same direction as the slope and are generally thicker (Centamore et al., 1991). Semi-flat areas correspond to basins covered by debris, often next to the geological division between calcareous and arenaceous outcrops. Soils are characterized by high desaturation, low active calcium content, pH less than 6, sandy, sandy loam or sandy clay loam texture and moderate to medium depth (ASSAM, 2006).

The mean annual temperature is 11.1 °C, the mean annual precipitation is 1,217 mm, the mean monthly temperature is below 10 °C for 6 months, and the summer drought stress (Mitrakos, 1980) is absent (data from the Montemonaco thermo-pluviometric station, 987 m a.s.l., 1950–2000; Amici & Spina, 2000). According to Pesaresi et al. (2017), the area belongs to the sub-Mediterranean bioclimatic variant of the temperate macro-bioclimate, with a weak Submediterraneity index, within the upper meso-temperate and lower supra-temperate bioclimatic belts, with lower and upper humid ombrotypes.

The vegetation mosaic of the study area is mostly characterized by forests dominated by *Ostrya carpinifolia, Quercus pubescens* and/or *Quercus cerris* below 900–1000 m a.s.l. and by *Fagus sylvatica* above this altitude (see Catorci et al., 2008). Forests generally cover the moderate to very steep slopes and the top of the hills. Pastures are generally distributed in the moderate to steep slopes, with the exception of the mowed meadows that characterize the semi-flat lands as well as croplands.

In the last decades, the area has been subject to an abandonment trend, which led to a very strong expansion of woodlands and a reduction of agricultural land and low productive pastures such as those the facing south (Brachetti et al., 2012).

Data collection

We conducted 55 phytosociological relevés (late May-July 2015) using the Braun-Blanquet phytosociological method (Braun-Blanquet, 1964), which implies a preferential sampling of vegetation units. We sampled grasslands (pastures and meadows) and a dwarf-shrub community occurring in patches inside pastures. The area of the plots ranged from 3 m² (dwarf shrub community) to 200 m² (dry grassland communities). For each relevé, we recorded the following data: locality (i.e., the locality closest to the plot, indicated on a topographic map), altitude (m a.s.l., measured using a digital GPS altimeter – 1-m resolution), slope aspect (azimuth degrees, measured using a compass – 1-degree resolution), slope angle (vertical degrees, measured using a clinometer – 1-degree resolution), total vegetation cover (%), and cover-abundance values of the species, the latter assigned using the Braun-Blanquet scale (Braun-Blanquet, 1964). The species nomenclature followed Bartolucci et al. (2018a, 2018b, 2018c, 2019a, 2019b).

We assigned to each species the Ellenberg Indicator Values (EIVs; Ellenberg et al., 1991) for light intensity (L), air temperature (T), continentality (C), soil moisture (M) and soil nutrients (N), adapted to Italian flora (Pignatti et al., 2005; Guarino et al., 2012). The use of EIVs (Ellenberg, 1974; Ellenberg, 1996; Ellenberg et al., 1992) allows a better understanding of the relations between species composition and ecological factors and has proven useful in analysing the drivers of vegetation change across environmental and management gradients (e.g., Schaffers & Sykora, 2000; Wamelink et al., 2002; Klaus et al., 2012), especially when they are used for comparisons on a local scale, within homogeneous bioclimatic and biogeographic contexts (Godefroid & Dana, 2007).

To characterize the study area from a floristic perspective, we integrated the list of species recorded in the phytosociological survey with those found in the areas surrounding the plots. Moreover, the floristic records come from the V. Marchesoni *Herbarium* (Ballelli et al., 2005) and the S. Ballelli *Herbarium* (unpublished data) stored in the *Herbarium Universitatis Camerinensis* (CAME), as well as from the data sheet of the floristic area of the Marche region "99. Santa Maria in Pantano" (Regione Marche, 2014).

Data analysis

To characterize the floristic value of the studied grasslands, we calculated the chorological spectrum of the floristic list obtained following the chorological indications reported in Pignatti (2017a, 2017b, 2018, 2019). We grouped species into eight main components: Mediterranean, European, Eurasian, Boreal, Endemic, Atlantic, wide-distribution, and undefined distribution. Finally, we extracted from the list the taxa at the species and subspecies level that are considered rare in the Marche region, are included in Italian Red-list, are relevant from a biogeographical point of view (endemic, circumboreal or at the extreme border of their distribution range), or are new to the flora of the Monti Sibillini National Park.

We transformed Braun-Blanquet cover-abundance classes to percentages using the average cover values of Braun-Blanquet classes: + (< 1%), 0.5 %; 1 (1–5%), 3%; 2 (5–25%), 15%; 3 (25–50%), 37.5%; 4 (50–75%), 62.5%; 5 (75–100%), 87.5%. To r values (rare species) we attributed 0.1%.

To classify the plant communities, we performed cluster analysis on the Hellinger-transformed "relevé-by-species cover (percentage)" matrix, using the complete link algorithm, based on Euclidean distance. To describe plant communities based on their coenological composition, we grouped species within each cluster following the most accepted phytosociological placement of each species at the class rank (Biondi & Blasi, 2015; Mucina et al., 2016). Then, we grouped species of different classes based on their ecological affinity (e.g., we grouped species of *Festuco-Brometea*, *Festuco-Ononidetea,* etc.). For each plant community, we summed the average percent cover values of the Braun-Blanquet classes of species belonging to each phytosociological class or group of classes considered and calculated the percentage contribution of each species group to the total vegetation cover (sum of species cover values in all the relevés of each cluster).

For the syntaxonomic classification of the vegetation types, we referred to Biondi & Blasi (2015) and Mucina et al. (2016). The nomenclature of suballiances, alliances and higher syntaxonomic ranks was drawn from Biondi et al. (2005), Biondi & Blasi (2015), Mucina et al. (2016). For nomenclature at the association level, we mainly referred to Pedrotti (1976), Biondi & Ballelli (1995), Allegrezza & Biondi (2011), and Biondi & Galdenzi (2012).

Moreover, we identified constant, dominant, and diagnostic species for each group. We considered as "constant" those species whose frequency within each group is higher than 40% (Poldini & Sburlino, 2005) and as "dominant" those species (sensu Mucina et al., 1993) that occur in at least 60% of the relevès of a given group with a mean cover value higher than 25%. To identify the diagnostic species of each plant community resulting from the cluster analysis, we performed an indicator species analysis (ISA; Dufrene & Legendre, 1997). This method combines information on the abundance of species in a group and the occurrence of that species in a given group (McCune & Grace, 2002). An indicator value (IV_{ij}) for species i in group j. is obtained as the product of relative abundance (mean abundance of species i within group j divided by the sum of the mean abundance of species i in all groups) and relative frequency (number of samples in group j occupied by species i divided by the total number of samples in group j), and ranges from 0 to 1 (Dufrêne & Legendre, 1997). We tested the statistical significance ($P < 0.05$) of the observed maximum IVs using permutation tests with 1,000 runs, and discarded species whose component of relative abundance was less than 0.6 or whose component of relative frequency was less than 0.25 (De Caceres et al., 2012).

To characterize the environmental conditions of the plant communities, we calculated descriptive statistics of EIVs and environmental characteristics for each main group highlighted by the cluster analysis. To calculate the EIVs at plot level we made the modification of the equation described by Garnier et al. (2004) and we multiplied the "relevé-by-species presence/absence" matrix by the "species x EIVs" matrix obtaining the "relevé-by-EIVs" matrix as follows:

$$CM_{EIV} = \sum_{i=1}^{S} p_i x_i$$

where CM is the community-unweighted mean value of a given EIV (i.e. the mean values of EIV at relevé level), p_i is the relative cover of species i (i=1,2, …, S), and x_i is the value of EIV for species i. In case of presence/absence species values, as for our case, $p_i = 1/N$ for all N species in the sampling site. EIVs at the relevé level reflect the site conditions better than the EIVs at species level because the occurrence of a species in a relevé may deviate from its optimum due to ecological tolerance (Kowarik & Seidling, 1989).

To investigate the effect of the topographic variables on species composition, we performed a redundancy analysis (RDA) by using as dependent variables the "relevé-by-species cover (percentage)" matrix after Hellinger transformation and elevation, slope, and aspect as predictors. Prior to this analysis, aspect values were converted from the compass scale 0–360 to a linear scale (0–180), with northern aspect (the shadiest) receiving a value approaching 0 and southern aspect (the sunniest) receiving a value approaching 180 (Warren, 2008). The significance of the RDA model and each predictor was tested using permutation tests (999 iterations). Then, we used CM_{EIVs} as "supplementary" variables to highlight the ecological gradients depicted by RDA axes 1 and 2. Since dependent variables (i.e., species cover) and predictors (i.e., CM_{EIVs}) are not independent, the results may inflate Type I error. To avoid such effect, we used the approach based on permutation model described by Zelený & Schaffers (2012). We shuffled species identity 999 times in the EIVs matrix (i.e., we randomly assigned the EIVs across the species) and compared the observed coefficient of determination (obs. R^2) of each of the linear regressions between each CM_{EIV} and the ordination axes to a null distribution of 999 expected coefficients of determination (exp. R^2). The linear regressions were not due to the chance and not affected by error Type I only if the obs. R^2 was significantly higher than the exp. R^2 based on a one-tailed t-test (α=0.05).

Statistical analyses were performed using R software version 3.5.3 (R Foundation for Statistical Computing, Vienna, Austria, http://www.R-project.org). To perform cluster analysis, we used the *hclust* function (stats package, version 3.0.2) and the *vegdist* function (vegan package, version 2.4-3). The ISA was performed using the *multipatt* function (indicspecies package, version 1.7.9). To perform the Hellinger transformation, we used the *decostand* function of vegan. RDA was performed using the *rda* function, scaling = 2 (vegan package). The significance of the first RDA model for each predictor and the RDA axes were tested using the *anova.cca* function (vegan package). To compare the observed and expected R^2 in the second RDA, we used the *envifit.iv* function provided by Zelený & Schaffers (2012), which could be run in R version 3.3.2.

Results

Floristic characterization

We recorded a total of 410 taxa at the species and subspecies level, namely about 20% of the flora of the Monti Sibillini National Park (see Ballelli et al., 2010). Eight species were new for the National Park.

Achillea tomentosa L., *Calluna vulgaris* (L.) Hull and *Genista sagittalis* L. are among the taxa of highest conservation interest (Table S1). The most represented chorological groups were Mediterranean (135 taxa, 32.9%), Eurasian (115; 28.0%), and European (58; 14.1%), followed by taxa with a wide distribution (44; 10.7%), boreal (27; 6.6%), endemic (17; 4.1%), and Atlantic (6; 1.5%). The number of taxa with undetermined distribution was 8 (2%) (Table S2).

Phytosociological and ecological characterization of plant communities

The cluster analysis of the phytosociological relevés separated three main groups (Figure 2).

Cluster A (Table 1) grouped dwarf shrub and herbaceous communities growing at higher altitudes (Table S3). It was dominated by species of classes *Festuco-Brometea, Festuco hystricis-Ononidetea striatae*, and *Elyno-Seslerietea* (32.0%) and class *Nardetea* (28.3%) (Table 2). The constant species were fewer than in the other clusters; the most frequent were *Nardus stricta, Brachypodium rupestre, Luzula multiflora* subsp. *multiflora*, *Helianthemum nummularium* subsp. *obscurum*, and *Cruciata glabra* (Table S4). *Nardus scricta*, *Luzula multiflora* subsp. *multiflora*, *Genista sagittalis*, *Thesium linophyllon*, *Brachypodium rupestre*, *Trifolium montanum* subsp. *rupestre*, and *Cruciata glabra*, were the main indicator species (Table S5). Cluster A was divided into two sub-clusters (Figure 2, Table 1) dominated by *Calluna vulgaris* (A_1) and *Nardus stricta* (A_2). In the first sub-cluster, the highest cover value was due to the *Calluno-Ulicetea* species (87.5%); in the second, *Festuco-Brometea*, *Festuco-Ononidetea*, *Elyno-Seslerietea*, and *Nardetea* species were the most abundant (67% in total) (Table 2).

Cluster B (Table 3) included herbaceous communities characterized by lower altitude (748 m a.s.l.), steeper (19.4°) and south-facing slopes (139°) (Table S3). It was dominated by species of the classes *Festuco-Brometea, Festuco hystricis-Ononidetea striatae*, and *Elyno-Seslerietea* (50.6%), with a conspicuous contribution of species of the class *Nardetea* (33.1%) (Table 2). The most abundant species were *Bromopsis erecta* and *Achillea tomentosa*. The most frequent constant species were *Bromopsis erecta*, *Achillea tomentosa, Dactylis glomerata*, *Plantago lanceolata*, *Hypericum perforatum*, *Linum usitatissimum* subsp. *angustifolium*, *Lysimachia arvensis, Artemisia alba*, *Vulpia myuros*, *Trifolium scabrum*, *T. campestre*, *Poterium sanguisorba* subsp. *balearicum* (Table S4). The main indicator species were *Achillea tomentosa*, *Lysimachia arvensis*, *Vulpia myuros*, *Artemisia alba*, *Asperula purpurea*, *Sedum sexangulare*, *Poterium sanguisorba* subsp. *balearicum*, *Trifolium scabrum*, and *Hypericum perforatum* (Table S5). Cluster B was divided into three sub-clusters (Figure 2,

Figure 2: Dendrogram obtained from the cluster analysis of the "relevés-by-species" matrix.

Slika 2: Dendrogram, narejen s klastersko analizo matrike "popisi x vrste".

A. Group of plant communities of classes *Calluno-Ulicetea and Nardetea strictae*: A_1. *Calluna vulgaris* community; A_2. *Campanulo micranthae-Nardetum strictae*. B. Group of plant communities of class *Festuco-Brometea*: B_1. *Achillea tomentosa* and *Trigonella sulcata* community; B_2. *Bromopsis erecta* and *Achillea tomentosa* community with *Brachypodium distachyon*. B_3. *Bromopsis erecta* and *Achillea tomentosa* community. C. Group of plant communities of the class *Molinio-Arrhenatheretea*. C_1 *Mentho longifoliae-Juncetum inflexi* and *Deschampsio-Caricetum distantis*; C_2. *Colchico lusitani-Cynosuretum cristati*; C_3. *Ranunculo neapolitani-Arrhenatheretum elatioris ranunculetosum neapolitani*.

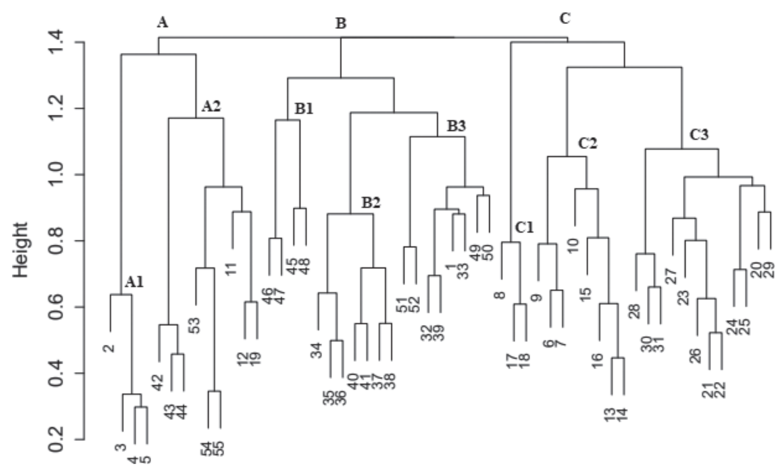

Table 3) dominated by *Achillea tomentosa* and *Trigonella sulcata* (B_1), *Bromopsis erecta* and *Achillea tomentosa* (B_3), *Bromopsis erecta* and *Achillea tomentosa* with *Brachypodium distachyon* (B_2). The community of sub-cluster B_1 develops on gentle slopes at the top of thick arenaceous banks with shallow soils and outcropping rocks. Sub-clusters B_2 and B_3 communities develop on arenaceous-pelithic substrates and deeper soils, the former at lower mean altitudes (mean value: 630 m) and on south-facing slopes, the latter at higher mean elevations (ca. 870 m), on less strictly south-facing slopes. Among the three sub-clusters, sub-cluster B_1 had the lowest percentage of *Festuco-Brometea*, *Festuco-Ononidetea* and *Elyno-Seslerietea* species; sub-cluster B_2 had the highest abundance of therophytic/chamaephytic xerophilous species; sub-cluster B_3 had the highest percentage of *Festuco-Brometea*, *Festuco-Ononidetea*, and *Elyno-Seslerietea* and *Molinio-Arrhenatheretea* species, and the lowest abundance of therophytic/chamaephytic xerophilous species (Table 2).

Cluster C (Table 4) included herbaceous communities that developed on semi-flat (5°), west and east-facing slopes (79°) (Table S3). The cluster was dominated by species of class *Molinio-Arrhenatheretea* (72.4%, Table 2). Among the constant species, we found *Anthoxanthum odoratum*, *Arrhenatherum elatius*, *Dactylis glomerata* subsp. *glomerata, Holcus lanatus*, *Rumex acetosa, Trifolium pratense* subsp. *pratense*, and *Linum usitatissimum* subsp. *angustifolium* (Table S4). The main indicator species were *Trifolium pratense*, *Holcus lanatus*, *Lotus corniculatus*, *Arrhenaterum elatius*, *Lolium perenne*, and *Poa trivialis* (Table S5).

Cluster C was divided into four sub-clusters (Figure 2, Table 4) dominated by *Juncus inflexus* or *Deschampsia cespitosa* (C_1), *Cynosurus cristatus* (C_2), and *Arrhenatherum elatius* (C_3). Sub-cluster C_1 had the highest percentages (95%) of *Molinio-Arrhenatheretea* species, while cluster C_3 had the highest value of companion species (Table 2).

Environmental drivers of plant community distribution and composition

Altitude, aspect, and slope significantly explained the variance of the species data set (*adj.* R^2 = 0.19; p = 0.001), both considered together and individually (p = 0.001). The first two RDA axes explained the 13% and the 9% of the variance (R^2; p = 0.001). As regards EIVs, we found a significant relation of the species data set with light intensity (R^2 =80%; p = 0.001), air temperature (R^2 =88%; p = 0.001), soil moisture (R^2 =63%; p = 0.004), soil nutri-

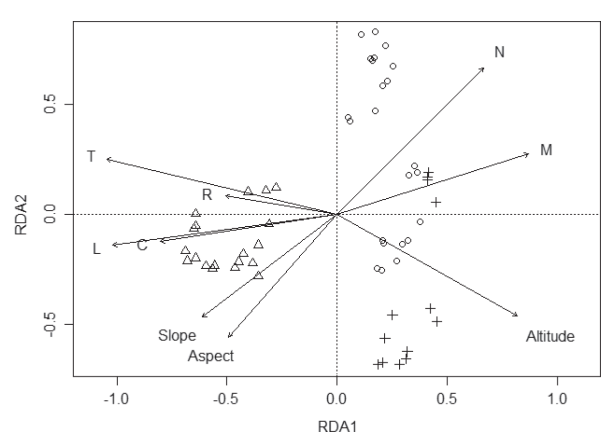

Figure 3: Redundancy analysis (RDA) ordination graph showing the effect of topographic variables on the species cover values (crosses – cluster A; triangles – cluster B; and circles – cluster C). Supplementary vectors related to light intensity (L), air temperature (T), Continentality (C), soil moisture (M), soil reaction (R) and soil nutrients (N) are projected onto ordination diagrams.

Slika 3: Ordinacijski graf, narejen z analizo renundance (RDA), kaže pomen topografskih spremenljivk na pokrovnost vrst (križci – klaster A; trikotniki – klaster B; in krožci – klaster C). Dodatni vektorji za svetlobo (L), temperature zraka (T), celinskost (C), vlažnost tal (M), reakcijo tal (R) in hranila v tleh (N) so pasivno projicirani na ordinacijski diagram.

ents (R^2 =67%; p = 0.001), and continentality (R^2 =50%; p = 0.024). *Nardus stricta* and *Calluna vulgaris*-dominated communities (cluster A) were related to the highest elevations, acidic soils with lower air temperature. The *Arrhenatherum elatius*-dominated communities (cluster C) and the *Bromopsis erecta*-dominated communities (cluster B) were associated with lower elevations (Figure 3). The former was related to flat and semi-flat lands and north-facing slopes, particularly nutrient-rich and moist soils and lower light intensity and air temperature and higher soil nutrients and moisture; the latter was associated with the opposite conditions, i.e., very steep south-facing slopes, higher light intensity and air temperature, and lower soil nutrients and moisture (Figure 3).

Discussion

Floristic assessment of grasslands

The floristic research on the grassland communities that develop on non-carbonatic substrates of the Monti Sibillini National Park allowed to highlight the relevance of the study area due to the presence of taxa of high conservation interest, such as *Achillea tomentosa* (*lg.* Marchesoni, in Ballelli et al., 2005), *Astrantia major* subsp. *involucrata* (*lg.* Ricci, in Paolucci, 1890, *lg.* Marchesoni, in Ballelli et al., 2005), *Cardamine apennina* (*lg.* Marchesoni, in Lihova' et al., 2004; Ballelli et al., 2005), *Carum carvi* (*lg.* Marchesoni, in Ballelli et al., 2005), *Crepis aurea* subsp. *glabrescens* (*lg.* Marchesoni, in Ballelli et al., 2005), *Genista sagittalis* subsp. *sagittalis* (Ballelli et al., 2005; Ballelli et al., 2010), *Gentiana dinarica* (*lg.* Marchesoni, in Ballelli et al. 2005), *Traunsteinera globosa* (*lg.* Marchesoni, in Marchesoni, 1959; Ballelli et al., 2005), *Vaccinium myrtillus* (*lg.* Marchesoni, in Marchesoni, 1959; Ballelli et al., 2005), *Erica scoparia* subsp. *scoparia* (Brilli-Cattarini & Ballelli, 1979), *Serapias lingua* (Bertoloni, 1833-54; Servilli & Dell'Orsoc, 2000; *lg.* Marchesoni, in Ballelli et al., 2005; Benigni et al., 2011), *Astragalus danicus* (Ballelli, 2003, *lg.* Marchesoni, in Ballelli et al., 2005), *Carex leporina* (*lg.* V. Marchesoni, in Ballelli et al., 2005), *Dichoropetalum carvifolium-chabraei* (Bertoloni, 1837; Sanguinetti, 1852-67; Caruel, 1888; Paolucci, 1890; Ballelli & Francalancia, 1995), *Juncus capitatus* (*lg.* Marzialetti, in Paolucci, 1890), *Oxytropis pilosa* subsp. *caputoi* (Brilli-Cattarini & al., 2001, *lg.* V. Marchesoni in Ballelli et al., 2005), *Sanguisorba officinalis* (*lg.* V. Marchesoni, in Ballelli et al., 2005), and *Viola canina* subsp. *canina* (sub *V. canina* subsp. *ruppii*, *lg.* V. Marchesoni, in Ballelli et al., 2005).

At the edge of the forest, on the western side of Mount Oialona, there is a small population of *Calluna vulgaris* (Brilli-Cattarini & Ballelli, 1979) linked to acidic or calcareous strongly decalcified soils. The Mount Oialona is the southernmost site of its distribution range in Italy.

The botanical relevance in the study area is also due to the presence of a ditch, which hosts some rare or uncommon species in the Marche region, such as *Carex panicea* (Brilli-Cattarini & Ballelli, 1979) and *Equisetum palustre*. Other noteworthy species are *Hordeum secalinum, Carex distans, C. pallescens, Ophioglossum vulgatum*, and *Parnassia palustris*. In particular, *Ophioglossum vulgatum* is a rare circumboreal species, growing in humid meadows and underwoods, especially in periodically flooded places (Ballelli et al., 2005; Ballelli et al., 2010).

A total of eight new plant species were discovered that have not been previously reported by other authors for the Sibillini National Park. Specifically, the new species are: *Jacobaea erucifolia s.l.*, *Diplotaxis muralis*, *Myagrum perfoliatum*, *Silene vulgaris* subsp. *tenoreana*, *Onobrychis caput-galli*, *Misopates orontium*, *Potentilla pedata*, and *Thymelaea passerina*.

Phytosociological and ecological interpretation of plant communities

The phytosociological interpretation of plant communities highlighted by cluster analysis (Figure 2) led to the identication of nine communities, which were classified in four phytosociological classes, as highlighted in the following syntaxonomic scheme.

CALLUNO VULGARIS-ULICETEA MINORIS Br.-Bl. & Tüxen ex Klika in Klika & Hadač 1944
VACCINIO MYRTILLI-GENISTETALIA PILOSAE Schubert ex Passarge 1964
Genisto pilosae-Vaccinion uliginosi Br.-Bl. 1926
Calluna vulgaris community

NARDETEA STRICTAE Rivas Goday in Rivas Goday & Rivas-Martínez 1963
NARDETALIA STRICTAE Oberdorfer ex Preising 1949
Ranunculo pollinensis-Nardion strictae Bonin 1972
Campanulo micranthae-Nardetum strictae Biondi & Galdenzi 2012 nardetosum strictae

FESTUCO VALESIACAE-BROMETEA ERECTI Br.-Bl. & Tüxen ex Soó 1947
PHLEO AMBIGUI-BROMETALIA ERECTI Biondi, Allegrezza, Blasi & Galdenzi in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Vagge & Blasi 2014
Achillea tomentosa and *Trigonella sulcata* community
Bromopsis erecta and *Achillea tomentosa* community
Bromopsis erecta and *Achillea tomentosa* community with *Brachypodium distachyon*

MOLINIO-ARRHENATHERETEA Tüxen 1937
TRIFOLIO-HORDEETALIA Horvatić 1963
Ranunculion velutini Pedrotti 1978
Deschampsio-Caricetum distantis Pedrotti 1976
TRIFOLIO REPENTIS-PHLEETALIA PRATENSIS Passarge 1969
Cynosurion cristati Tüxen 1947
Colchico lusitani-Cynosuretum cristati Biondi & Ballelli 1995
ARRHENATHERETALIA ELATIORIS Tüxen 1931
Ranunculo neapolitani-Arrhentatherion elatioris Allegrezza & Biondi 2011
Ranunculo neapolitani-Arrhentatheretum elatioris Allegrezza & Biondi 2011
ranunculetosum neapolitani Allegrezza & Biondi 2011
POTENTILLO-POLYGONETALIA AVICULARIS Tüxen 1947
Mentho longifoliae-Juncion inflexi T. Müller et Görs ex de Foucault 2009
Mentho longifoliae-Juncetum inflexi Lohmeyer ex Oberdorfer 1957

The communities of cluster A, assigned to the *Nardetea strictae* and *Calluno-Ulicetea* classes, were the most acidophilous and were found at higher elevations. The values of light intensity, air temperature, soil nitrogen, and soil moisture were intermediate between the grasslands of clusters B and C. The communities of cluster B, classified as *Festuco-Brometea* class, were found on steeper, south-facing slopes and had higher values for light intensity and air temperature and lower values for soil nutrients and moisture. The grassland communities of cluster C, attributed to the *Molinio-Arrhenatheretea* class, were clearly associated with altitude and slope (mainly low altitudes and gentle slopes or semi-flat lands), and high soil nutrient and moisture values.

Group of acidophilous communities of the mountain belt, characterized by *Calluna vulgaris* or *Nardus stricta* (cluster A, Table 1)

Calluna vulgaris community (cluster A, Table 1, rel. 1–4)

Species-poor community of acidophilous shrublands at 1100–1150 m a.s.l., physiognomically characterized by *Calluna vulgaris*, with *Vaccinium myrtillus*. The occurrence of *C. vulgaris*, *V. myrtillus*, and *Erica scoparia* subsp. *scoparia*, justifies a classification of the community in the *Genisto pilosae-Vaccinion uliginosi* alliance (order *Vaccinio myrtilli-Genistetalia pilosae*, class *Calluno-Ulicetea*). However, due to the small number of species and the small surface area occupied, there are no elements to describe a new association or identify an oldest one.

This community differs from the *Danthonio-Callunetum* association described by Pedrotti (1982) in the basin of Lake Trasimeno and from the *Tuberario lignosae-Callunetum* (Pedrotti, 1982) by the absence of *Genista germanica, G. pilosa*, *Cytisus scoparius*, and *Danthonia decumbens* and of Mediterranean species, and by the presence of *Vaccinium myrtillus*.

This community is in serial contact with the beech forests of the *Solidagini-Fagetum sylvaticae* association (see Catorci et al., 2008).

Campanulo micranthae-Nardetum strictae Biondi et Galdenzi 2012 (cluster A, Table 1, rel. 5–13)

Community of acidophilous mountain grasslands with dense swards, widespread in slightly to moderately steep areas located on the top of the highest hills with acid soils due to the occurence of sandstone banks. Physiognomically it is characterized by *Nardus stricta*, with elements of the *Ranunculo-Nardion* alliance, *Nardetalia strictae* order, and *Nardetea strictae* class, such as *Potentilla rigoana*, *P. erecta*, *Ranunculus pollinensis*, *R. apenninus*, and *Avenella flexuosa*. The presence of species *Campanula micrantha*, *Silene ciliata* subsp. *graefferi*, *Luzula multiflora*, *Agrostis capillaris*, and *Cynosurus cristatus* indicates that the community fits the *Campanulo-micranthae-Nardetum strictae* association. This association was described by Biondi & Galdenzi (2012) in the nearby Montagna dei Fiori (Marche).

This association is in serial contact with the beech forests of the association *Solidagini-Fagetum sylvaticae* (see Catorci et al., 2008).

Group of plant communities of the *Festuco-Brometea* class, characterized by *Achillea tomentosa* (cluster B, Table 3)

On the arenaceous and arenaceous-pelithic substrates up to 1000 m a.s.l., we found a group of three plant communities characterized by *Achillea tomentosa*, following an aridity gradient, from the open-turf community of the shallow arenaceous soils to the closed-turf community of deeper soils on arenaceous-pelithic substrates. Probably, these plant communities can be interpreted as facets of an association developed on a broader geographical range and ecological conditions, which should be investigated in more detail and in larger areas. For this reason, we preferred to avoid syntaxonomic classification at the level of association and the alliance.

Achillea tomentosa and *Trigonella sulcata* community (cluster B, Table 3, rel. 1–4)

An open-turf community that occurs on shallow soils with outcropping arenaceous rocks, on gentle slopes that tend to be north-facing, at 700–750 m. The total vegetation cover is approximately 80%. It is physiognomically characterized by *Achillea tomentosa* and a group of therophytes and chamaephytes such as *Trigonella sulcata*, *Petrorhagia saxifraga*, *Arenaria leptoclados*, *Trifolium angustifolium* subsp. *angustifolium*, *T. arvense*, *Ononis reclinata*, *Sabulina mediterranea*, *S. tenuifolia*, *Micromeria graeca*, *Linum strictum*, and *Teucrium capitatum* subsp. *capitatum*. Despite the presence of a conspicuous set of species from *Stipo-Trachynietea*, *Helianthemetea guttati*, and *Sedo-Scleranthetea*, the structure of the community is dominated by species from class *Festuco-Brometea* such as *Bromopsis erecta*, *Phleum hirsutum* subsp. *ambiguum*, *Brachypodium rupestre*, *Achillea tomentosa*, and *Asperula purpurea*, leading us to classify this community within the class *Festuco-Brometea*.

This community is in serial contact with the hop-hornbeam and turkey oak woodlands of the *Aceri obtusati-Quercetum cerridis* association (Catorci et al., 2008).

***Bromopsis erecta* and *Achillea tomentosa* community (cluster B, Table 3, rel. 12–19)**

Community of south-facing slopes, which develops at 650–1000 m on arenaceous-pelithic substrates with deeper soils. It is physiognomically characterized by *Bromopsis erecta* and *Achillea tomentosa* with, in suborder, *Carex caryophyllea*, *Thymus moesiacus*, *Linum catharticum*, and *Sedum sexangulare*. The prevalence of the species of *Festuco-Brometea* justifies the classification of this community in the class *Festuco-Brometea*.

The *Bromopsis erecta* and *Achillea tomentosa* community is in serial contact with the beech forests of the *Erico arboreae-Quercetum pubescentis quercetosum cerridis* subassociation (Catorci et al., 2008).

***Bromopsis erecta* and *Achillea tomentosa* community with *Brachypodium distachyon* (cluster B, Table 3, rel. 5–11)**

Community of south-facing slopes, spreading at 500–750 m on arenaceous-pelithic substrates. It differs from the previous community by a group of therophytic species consisting of *Brachypodium distachyon*, *Briza minor*, *Gastridium ventricosum*, *Euphorbia exigua* subsp. *exigua*, *Crepis neglecta*, *Galium parisiense*, and *Helianthemum salicifolium*.

This community is in serial contact with the white oak woodlands of the *Erico arboreae-Quercetum pubescentis ericetosum arboreae* subassociation (Catorci et al., 2008).

Group of plant communities of the *Molinio-Arrhenatheretea* class, characterized by *Arrhenatherum elatius* and *Cynosurus cristatus* (cluster C, Table 4)

Mesophilous or hygrophilous grasslands with a dense sward, spreading on flat or semi-flat lands on alluvial substrates and detritic material, at the edge of ditches and depressions.

***Mentho longifoliae-Juncetum inflexi* Lohmeyer ex Oberdorfer 1957 (cluster A, Table 4, rel. 1).**

Species-poor sub-nitrophilous and sub-hygrophilous community dominated by *Juncus inflexus* subsp. *inflexus* and found along small ditches crossing grasslands dominated by the *Cynosurus cristatus*. *J. inflexus* is associated with species of the *Potentillo-Polygonetalia* order and *Molinio-Arrhenateretea* class, e.g. *Ranunculus repens*, *Carex hirta*, *Galium album* subsp. *album*, *Rumex acetosa*, *Lolium arundinaceum*, *Poa trivialis*, and *Lychnis flos-cuculi*. The species composition of the community allows us to classify it in the *Potentillo-Polygonetalia* order of the *Molinio-Arrhenateretea* class. Because of the dominance of the helophyte *Juncus inflexus* subsp. *inflexus* and the presence of *Mentha longifolia*, we assigned this community to the *Mentho longifoliae-Juncetum inflexi*, which occurs from northern Italy (e.g. Andreis et al., 1995; Tomasi & Caniglia, 2004) to central and southern Italy (e.g. Canullo et al., 1988; Pirone, 2000; Pirone et al., 2004). The species composition of this community differs from that of *Galio palustris-Juncetum inflexi*, described by Venanzoni & Gigante (2000), because of the absence of *Galium palustre* and *Scutellaria galericulata* and the prevalence of species of the *Molinio-Arrhenatheretea* class. It also differs from the *Carici otrubae-Juncetum inflexi* Minissale et Spampinato 1985 asssociation because *Carex otrubae*, characteristic of the association, is absent.

***Deschampsio-Caricetum distantis* Pedrotti 1976 (cluster C, Table 4, rel. 2–3)**

Thick-sward wet meadows, dominated by *Deschampsia cespitosa*, found in depressions that are flooded in early summer and moist by the end of summer. This community includes numerous elements of the *Molinio-Arrhenatetea* class (e.g. *Poa trivialis*, *Centaurea jacea* subsp. *jacea*, *Rumex acetosa* subsp. *acetosa*, and *Ranunculus acris*). The presence of *Lolium arundinaceum* subsp. *arundinaceum*, justifies the classification of the community in the *Ranunculion velutini* alliance of the order *Trifolio-Hordeetalia*. The occurrence of *Carex distans*, next to *Deschampsia cespitosa*, allows its assignment to the association *Deschampsio-Caricetum distantis*, described by Pedrotti (1976) in the Piani di Montelago (Marche). The association is endemic to the wet meadows of central and southern Italy (Pedrotti, 1975; Pedrotti, 1976; Canullo et al., 1988; Pedrotti et al., 1992; Pirone, 1997; Catorci & Orsomando, 2001; Tardella et al., 2002; Tardella & Di Agostino, 2020).

***Colchico lusitani-Cynosuretum cristati* Biondi et Ballelli 1995 (cluster C, Table 4, rel. 4–11)**

Community of mesophilous hay meadows with a dense sward, in areas covered by detritic material. It is physiognomically characterized by *Cynosurus cristatus* with numerous elements of the *Molinio-Arrhenatheretea* class.

The presence of *Lolium perenne*, *Bellis perennis*, *Phleum pratense* subsp. *pratense*, and *Trifolium repens* allows to classify this community in the order *Trifolio repentis-Phleetalia pratensis* and alliance *Cynosurion cristati*. More specifically, the community found in the study area fits with the *Colchico lusitani-Cynosuretum cristati* association, described by Biondi & Ballelli (1995) in the humid hay-meadows of the Coscerno-Civitella massif (Umbria) due to the occurrence of the characteristic species *Colchicum lusitanum*, *Achillea millefolium*, and *Tragopogon pratensis* subsp. *pratensis*, besides *Cynosurus cristatus*, and a conspicuous group of *Festuco-Brometea* species.

This community differs from the *Achilleo collinae-Cynosuretum cristati*, described by Biondi et al. (1989) for the arenaceous substrates in the district Monte Catria-Nerone by the absence of the characteristic species *Phleum pratense* subsp. *bertolonii* and *Lotus tenuis*, as well as most of the differential species of the association in comparison with the *Cynosurus cristatus*-dominated communities of the calcareous Apennine ridges (e.g. *Ononis spinosa*, *Scabiosa columbaria*, *Eryngium amethystinum*, *Ziziphora granatensis* subsp. *alpina*, *Clinopodium vulgare*, *Dorycnium pentaphyllum*, *Blackstonia perfoliata* and *Carthamus lanatus*). The community differs from the *Campanulo glomeratae-Cynosuretum cristati* association, described by Ubaldi et al. (1987) by the absence of *Campanula glomerata*, *Armeria canescens*, *Rumex acetosa*, *Taraxacum officinale*, *Geranium pyrenaicum*, *Cruciata laevipes*, *Helichtotrichon praetutianum*, *Scorzoneroides cichoraceus*, *Orchis mascula* and *Veronica serpyllifolia*.

This association is in serial contact with the beech forests of the association *Solidagini-Fagetum sylvaticae* (Catorci et al., 2008).

***Ranunculo neapolitani-Arrhenatheretum elatioris* Allegrezza et Biondi 2011 *ranunculetosum neapolitani* Allegrezza et Biondi 2011 (cluster C, Table 4, rel. 12–23)**

Community of mesophilous hay-meadows with a dense sward, spread on alluvial substrates, physiognomically characterized by *Arrhenatherum elatius*, with a dominance of species of the class *Molinio-Arrhenatheretea*. The occurrence of *Ranunculus neapolitanus*, *Pastinaca sativa* subsp. *urens*, and *Achillea collina* justifies a classification of the community in the *Ranunculo neapolitani-Arrhenatherion elatioris* alliance, while *Holcus lanatus* subsp. *lanatus, Tragopogon pratensis* subsp. *orientalis, Salvia pratensis*, *Trifolium campestre*, *Geranium dissectum*, *Galium mollugo*, *Trisetaria flavescens*, *Cynosurus cristatus*, and *Colchicum lusitanum* are characteristic taxa of the *Ranunculo neapolitani-Arrhenatheretum elatioris* association with the typical subassociation *ranunculetosum neapolitani*.

This community was described by Allegrezza & Biondi (2011), who referred to this subassociation the relevés carried out by Pedrotti (1963) and Venanzoni (1992) in the Nera and Velino basins.

This community is in serial contact with the forests of the *Aceri obtusati-Quercetum cerridis fagetosum sylvaticae* sub-association (Catorci et al., 2008).

Conclusion and conservation remarks

The study presented here has highlighted how the sectors of the Sibillini National Park with non-calcareous substrates are essential for the implementation of the biodiversity of the protected area. In fact, communities such as the arid ones with *Achillea tomentosa* or the formations dominated by *Arrhenatherum elatius* are not present on the carbonate mountains. The *Nardus stricta*-dominated grasslands are also extremely interesting, as they occur elsewhere only on small areas and probably with a partially different floristic composition. However, the general conservation status of such grasslands is rather low, at least as regards the *Nardus stricta* and the *Achillea tomentosa* vegetation types, which are no longer in agricultural land use and are therefore subject to species turnover and invasion by shrubs and pre-forest formations. Even the conservation status of the dwarf shurbland dominated by *Calluna vulgaris*, is very precarious, as they are fragmented formations rather than true heath formations. Finally, the contribution to the flora of the National Park is also relevant, as eight (8) new species have been discovered in addition to the approximately 2000 currently known (Ballelli et al., 2010).

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Appendix 1: Locality and data for each relevé

Table 1
Rel.1-2: Sommità Monte Oialona (AP), 25/05/2015; Rel. 3-4: Sommità dei prati di Santa Maria in Pantano (AP), 25/05/2015; Rel.5-7: Monte Ceresa (AP), 21/07/2015; Rel. 8-10: Passo Galluccio (AP), 28/05/2015; Rel.11-12: Santa Maria in Pantano (AP), 29/06/2015; Rel.13: Santa Maria in Pantano (AP), 01/07/2015.

Table 3
Rel.1-2: San Pietro d'Arli - Piana della Forcella (AP), 21/07/2015; Rel.3: Ponte d'Arli (AP), 21/07/2015; Rel.4: San Pietro d'Arli - Piana della Forcella (AP), 21/07/2015; Rel.5-7: Montemonaco (AP), 04/07/2015; Rel.8-9: Rascio di Montemonaco (AP), 04/07/2015; Rel.10-11: Montemonaco (AP), 04/07/2015; Rel.12-13: Bivio Monte Sibilla-Fraz. Collina (AP), 28/05/2015; Rel.14: Montemonaco, strada per Cese, 04/07/2015; Rel. 15: Colle Propezzano, 04/07/2015, Rel.16: Montemonaco (AP), 06/06/2015; Rel. 17: Santa Maria in Pantano, 04/07/2015; Rel.18: Pretattoni, vicino strada per Montefortino (FM), 28/05/2015; Rel.19: Montemonaco per Vallefiume (AP), 28/05/2015.

Table 4
Rel.1: Santa Maria in Pantano (AP), 29/06/2015; Rel.2-3: Santa Maria in Pantano (AP), 01/07/2015; Rel.4-7: Santa Maria in Pantano (AP), 29/06/2015; Rel.8-11: Santa Maria in Pantano (AP), 01/07/2015; Rel.12-14: Balzo di Montegallo (AP), 24/05/2015; Rel.15-21: Abetito-frazione di Montegallo (AP), 24/05/2015; Rel.22-23. Balzo di Montegallo (AP), 24/05/2015.

Supplementary material on-line

Table S1 – List of taxa of conservation interest in the study area.
Table S2 – Chorological spectrum of taxa at the species and subspecies level found in the study area.
Table S3 – Descriptive statistics.
Table S4 – List of constant species associated to each cluster of Figure 2.
Table S5 – List of the diagnostic species resulting from Indicator species analysis associated to each cluster of Figure 2.

Table 1: Dwarf shrub and herbaceous communities of the *Calluno-Ulicete*a and *Nardetea strictae* classes.
Tabela 1: Grmiščne in zeliščne združbe razredov *Calluno-Ulicetea* in *Nardetea strictae*.

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	Occurrences	Frequency
Relevé number in Figure 2	2	3	4	5	44	42	43	53	54	55	11	12	19		
Altitude (m a.s.l)	1120	1125	1127	1130	1375	1380	1380	1275	1195	1205	1210	1220	1180		
Aspect	0	0	45	45	90	180	180	135	135	135	112,5	180	0		
Slope (°)	1	1	5	5	35	25	1	10	25	25	5	22,5	5		
Surface (mq)	3	4	20	20	70	100	100	100	100	100	100	100	30		
Coverage (%)	100	100	98	98	100	100	100	100	100	100	100	100	100		
***Calluna vulgaris* community and higher syntaxa**															
Calluna vulgaris	3	4	4	4	.	.	.	.	.	.	.	.	.	4	30,8
Vaccinium myrtillus	1	1	+	+	.	.	.	.	.	.	.	.	.	4	30,8
Erica scoparia subsp. *scoparia*	2	.	1	.	.	.	.	.	.	.	.	.	.	2	15,4
Char. species of the *Campanulo micranthae-Nardetum strictae* ass. and *nardetosum strictae* subass.															
Nardus stricta	2	1	1	1	4	3	4	3	4	4	2	3	4	13	100,0
Luzula multiflora subsp. *multiflora*	.	.	.	.	+	+	+	1	2	2	1	1	+	9	69,2
Agrostis capillaris subsp. *capillaris*	.	.	.	.	2	2	1	+	.	.	.	1	1	6	46,2
Cynosurus cristatus	.	.	.	.	.	.	.	+	+	+	1	2	1	6	46,2
Campanula micrantha	.	.	.	.	2	1	1	+	.	.	.	.	.	4	30,8
Silene ciliata subsp. *graefferi*	.	.	.	.	.	+	.	.	.	.	.	.	.	1	7,7
Species of *Ranunculo pollinensis-Nardion strictae* all.															
Potentilla rigoana	.	.	.	.	+	1	1	+	+	+	.	.	.	6	46,2
Ranunculus pollinensis	.	.	.	.	.	.	.	1	+	+	+	+	.	5	38,5
Ranunculus apenninus	.	.	.	.	.	.	.	.	.	.	+	1	.	2	15,4
Species of *Nardetalia strictae* ord. and *Nardetea strictae* class															
Genista sagittalis	.	.	.	.	1	1	1	3	3	3	.	1	1	8	61,5
Festuca rubra group	.	.	.	.	.	2	.	2	3	3	+	2	1	7	53,8
Danthonia decumbens subsp. *decumbens*	.	.	.	.	2	1	1	.	.	.	1	1	1	6	46,2
Potentilla erecta	.	.	.	.	1	1	1	.	.	.	1	1	1	6	46,2
Polygala vulgaris	.	.	.	.	.	.	.	1	+	1	1	1	+	6	46,2
Viola canina	.	.	.	.	+	.	.	1	+	.	+	+	.	5	38,5
Rumex nebroides	.	.	.	.	+	+	+	.	.	.	.	.	.	3	23,1
Dianthus hyssopifolius	.	.	.	.	2	1	1	.	.	.	.	.	.	3	23,1
Avenella flexuosa subsp. *flexuosa*	.	.	.	.	+	+	+	.	.	.	.	.	.	3	23,1
Bellardiochloa variegata subsp. *variegata*	.	.	.	.	.	+	1	.	.	.	.	.	.	2	15,4
Carex pallescens	.	.	.	.	.	.	.	.	.	.	2	.	+	2	15,4
Luzula campestris subsp. *campestris*	.	.	.	.	.	.	.	.	.	.	.	+	.	1	7,7
Coeloglossum viride	.	.	.	.	.	.	.	+	.	.	.	.	.	1	7,7
Veronica officinalis	.	.	.	.	+	.	.	.	.	.	.	.	.	1	7,7
Poa alpina subsp. *alpina*	.	.	.	.	.	.	.	1	.	.	.	.	.	1	7,7
Species of *Festuco-Brometea* class															
Brachypodium rupestre	.	+	.	+	4	4	3	.	+	1	1	1	+	10	76,9
Helianthemum nummularium subsp. *obscurum*	.	.	.	.	2	2	2	+	2	2	+	1	1	9	69,2
Trifolium montanum subsp. *rupestre*	.	.	.	.	+	1	1	2	2	2	1	1	1	9	69,2
Bromopsis erecta subsp. *erecta*	.	.	.	.	+	1	1	3	3	3	2	.	+	8	61,5
Carex caryophyllea	.	.	.	.	+	.	+	+	1	1	1	1	1	8	61,5
Thesium linophyllon	.	.	.	.	+	+	+	1	.	1	+	+	+	8	61,5
Cerastium arvense subsp. *suffruticosum*	.	.	.	.	.	.	+	+	2	2	+	+	+	7	53,8
Briza media	.	.	.	.	.	.	+	+	+	+	+	1	+	7	53,8
Scabiosa columbaria	.	.	.	.	.	+	+	+	.	+	r	+	+	7	53,8
Knautia calycina	.	.	.	.	.	.	.	1	+	1	+	+	+	6	46,2
Campanula glomerata	.	.	.	.	+	+	1	.	+	+	r	.	.	6	46,2

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13		
Galium verum	.	.	.	.	+	.	.	+	.	.	1	+	+	5	38,5
Phyteuma orbiculare	.	.	.	.	.	.	.	1	+	+	.	+	+	5	38,5
Thymus moesiacus	.	.	.	.	.	.	.	+	1	2	+	.	.	4	30,8
Ranunculus polyanthemophyllus	.	.	.	.	.	.	.	1	+	+	.	.	+	4	30,8
Linum catharticum subsp. *catharticum*	.	.	.	.	.	.	.	+	.	.	+	+	+	4	30,8
Viola eugeniae	.	.	.	.	.	.	.	+	+	+	.	.	+	4	30,8
Ornithogalum comosum	.	.	.	.	.	.	.	r	+	+	+	.	.	4	30,8
Centaurea jacea subsp. *gaudinii*	.	.	.	.	.	.	.	+	.	.	2	.	1	3	23,1
Podospermum purpureum	.	.	.	.	.	.	.	2	1	+	.	.	.	3	23,1
Festuca circummediterranea	.	.	.	.	1	1	+	.	.	.	.	.	.	3	23,1
Senecio scopolii subsp. *floccosus*	.	.	.	.	.	1	1	.	+	.	.	.	.	3	23,1
Hippocrepis comosa subsp. *comosa*	.	.	.	.	.	.	.	+	1	+	.	.	.	3	23,1
Anacamptis morio	.	.	.	.	.	.	.	+	+	+	.	.	.	3	23,1
Centaurea triumfettii	.	.	.	.	.	+	.	.	+	+	.	.	.	3	23,1
Dianthus carthusianorum	.	.	.	.	.	.	.	+	+	+	.	.	.	3	23,1
Muscari neglectum	.	.	.	.	.	.	.	+	+	+	.	.	.	3	23,1
Poterium sanguisorba subsp. *balearicum*	.	.	.	.	.	.	.	+	+	+	.	.	.	3	23,1
Thymus longicaulis subsp. *longicaulis*	.	.	.	.	+	+	+	.	.	.	.	.	.	3	23,1
Saxifraga bulbifera	.	.	.	.	.	.	.	.	+	+	r	.	.	3	23,1
Festuca inops	.	.	.	.	2	.	2	.	.	.	.	.	.	2	15,4
Astragalus danicus	.	.	.	.	.	.	.	.	1	+	.	.	.	2	15,4
Trifolium ochroleucon	.	.	.	.	.	.	.	.	.	.	.	1	+	2	15,4
Dactylorhiza sambucina	.	.	.	.	.	.	.	+	.	+	.	.	.	2	15,4
Eryngium amethystinum	.	.	.	.	.	.	.	+	+	.	.	.	.	2	15,4
Koeleria splendens	.	.	.	.	.	.	.	.	+	+	.	.	.	2	15,4
Carlina acanthifolia	.	.	.	.	.	+	.	r	.	.	.	.	.	2	15,4
Crocus neglectus	.	.	.	.	.	.	.	r	+	.	.	.	.	2	15,4
Pentanema hirtum	.	.	.	.	.	.	.	.	r	+	.	.	.	2	15,4
Allium sphaerocephalon	.	.	.	.	.	.	.	.	.	.	+	.	.	1	7,7
Bupleurum falcatum subsp. *cernuum*	.	.	.	.	.	+	.	.	.	.	.	.	.	1	7,7
Carex flacca subsp. *erythrostachys*	.	.	.	.	.	.	.	.	.	.	+	.	.	1	7,7
Euphrasia stricta	.	.	.	.	.	.	.	.	.	.	.	.	+	1	7,7
Filipendula vulgaris	.	.	.	.	.	.	.	.	.	.	+	.	.	1	7,7
Gentiana verna	.	.	.	.	.	.	.	.	.	+	.	.	.	1	7,7
Ononis spinosa	.	.	.	.	.	.	.	.	.	.	.	+	.	1	7,7
Salvia pratensis	.	.	.	.	.	.	.	.	+	.	.	.	.	1	7,7
Neotinea ustulata	.	.	.	.	.	.	.	.	.	.	r	.	.	1	7,7
Neottia ovata	.	.	.	.	.	.	.	r	.	.	.	.	.	1	7,7
Prunella laciniata	.	.	.	.	.	.	.	.	.	r	.	.	.	1	7,7
Anthillis vulneraria subsp.*rubriflora*	.	.	.	.	.	.	.	.	.	r	.	.	.	1	7,7
Ingr. species from *Molinio-Arrhenatheretea* class															
Leontodon hispidus	.	.	.	.	+	+	.	2	2	2	1	1	1	8	61,5
Dactylis glomerata subsp. *glomerata*	.	1	+	+	.	+	+	+	+	.	.	.	.	7	53,8
Anthoxanthum odoratum	.	.	.	.	+	.	.	2	1	2	1	1	+	7	53,8
Trifolium pratense subsp. *pratense*	.	.	.	.	.	+	+	+	1	2	.	1	1	7	53,8
Tragopogon pratensis	.	.	.	.	.	.	+	+	+	+	+	+	+	7	53,8
Holcus lanatus subsp. *lanatus*	.	.	.	.	.	.	.	+	+	+	1	2	2	6	46,2
Rumex acetosa subsp. *acetosa*	.	.	.	.	.	.	.	1	1	+	1	1	1	6	46,2
Lotus corniculatus	.	.	.	.	+	.	+	+	+	+	+	.	.	6	46,2
Plantago lanceolata	.	.	.	.	.	.	.	+	+	+	+	+	+	6	46,2
Gymnadenia conopsea	.	.	.	.	.	.	.	+	.	+	+	+	+	5	38,5
Ranunculus acris	.	.	.	.	+	+	+	.	.	.	r	.	+	5	38,5

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13		
Narcissus poëticus	.	.	.	.	.	.	.	+	+	+	+	.	.	4	30,8
Rhinanthus alectorolophus	.	.	.	.	.	.	.	2	.	.	.	1	1	3	23,1
Carex distans	.	.	.	.	.	.	.	.	.	.	+	+	.	2	15,4
Cerastium holosteoides	.	.	.	.	.	.	.	.	+	+	.	.	.	2	15,4
Plantago media	.	.	.	.	.	+	.	.	.	+	.	.	.	2	15,4
Carex hirta	.	.	.	.	.	.	.	.	.	.	1	.	.	1	7,7
Centaurea nigrescens	.	.	.	.	.	.	.	.	.	.	.	1	.	1	7,7
Lathyrus pratensis	.	.	.	.	.	.	.	.	.	.	1	.	.	1	7,7
Primula veris subsp. *columnae*	.	.	.	.	.	.	.	1	.	.	.	.	.	1	7,7
Rhinanthus minor	.	.	.	.	.	.	.	.	.	.	.	.	1	1	7,7
Achillea millefolium	.	.	.	.	.	+	.	.	.	.	.	.	.	1	7,7
Colchicum lusitanum	.	.	.	.	.	.	.	.	.	.	.	+	.	1	7,7
Daucus carota	.	.	.	.	.	.	.	.	.	.	.	+	.	1	7,7
Leucanthemum vulgare subsp. *vulgare*	.	.	.	.	.	.	.	.	.	.	.	+	.	1	7,7
Lolium arundinaceum subsp. *arundinaceum*	.	.	.	.	.	.	.	.	.	.	+	.	.	1	7,7
Lychnis flos-cuculi subsp. *flos-cuculi*	.	.	.	.	.	.	.	.	.	.	+	.	.	1	7,7
Onobrychis viciifolia	.	.	.	.	.	.	.	.	.	+	.	.	.	1	7,7
Pedicularis hoermanniana	.	.	.	.	.	.	.	+	.	.	.	.	.	1	7,7
Poa trivialis	.	.	.	.	.	.	.	.	.	.	+	.	.	1	7,7
Trifolium dubium	.	.	.	.	.	.	.	.	.	.	+	.	.	1	7,7
Ingr. species from *Elyno-Seslerietea* class															
Galium anisophyllon	.	.	.	.	.	.	.	1	+	+	+	1	+	6	46,2
Carlina acaulis subsp. *caulescens*	.	.	.	.	+	+	+	+	+	+	.	.	.	6	46,2
Helictochloa praetutiana subsp. *praetutiana*	.	.	.	.	.	.	.	1	1	1	+	+	.	5	38,5
Senecio apenninus	.	.	.	.	.	+	+	2	1	.	.	.	.	4	30,8
Carex macrolepis	.	.	.	.	.	.	.	+	.	.	.	.	.	1	7,7
Gentiana utriculosa	.	.	.	.	.	.	.	+	.	.	.	.	.	1	7,7
Gentiana lutea	.	.	.	.	.	.	.	r	.	.	.	.	.	1	7,7
Companion species															
Cruciata glabra	.	.	.	.	1	1	1	1	1	1	+	+	1	9	69,2
Alchemilla sp.	.	.	.	.	.	+	+	1	+	+	1	.	+	7	53,8
Trifolium alpestre	.	.	.	.	+	1	1	1	+	.	.	+	.	6	46,2
Betonica officinalis	.	.	.	.	+	.	.	r	r	+	.	+	+	6	46,2
Asphodelus macrocarpus subsp. *macrocarpus*	.	.	.	.	2	3	3	.	+	.	+	.	.	5	38,5
Genista tinctoria	.	.	.	.	.	+	.	+	.	.	1	2	1	5	38,5
Veronica chamaedrys	.	.	.	.	+	+	+	+	+	.	.	.	.	5	38,5
Campanula rapunculus	.	.	.	.	.	.	.	+	+	+	.	+	+	5	38,5
Oreoselinum nigrum	.	+	.	.	.	.	.	3	+	.	+	.	.	4	30,8
Grafia golaka	+	+	.	.	.	.	.	.	.	.	+	.	2	4	30,8
Arabis hirsuta	.	.	.	.	.	+	+	+	.	+	.	.	.	4	30,8
Scorzoneroides cichoriacea	.	.	.	.	.	.	.	+	+	+	.	.	+	4	30,8
Pilosella officinarum	.	.	.	.	.	.	.	.	r	+	.	+	+	4	30,8
Silene nutans	.	.	.	.	.	.	.	r	+	1	.	.	.	3	23,1
Ajuga reptans	.	.	.	.	.	.	.	+	+	+	.	.	.	3	23,1
Silene italica	.	.	.	.	+	+	+	.	.	.	.	.	.	3	23,1
Galium mollugo	.	.	.	.	+	+	.	.	r	.	.	.	.	3	23,1
Laserpitium latifolium	.	.	.	.	.	.	.	r	.	.	+	+	.	3	23,1
Bistorta vivipara	.	.	.	.	.	+	+	.	.	.	.	.	.	2	15,4
Cirsium lobelii	.	.	.	.	+	.	+	.	.	.	.	.	.	2	15,4
Dichoropetalum carvifolium-chabraei	.	.	.	.	+	+	.	.	.	.	.	.	.	2	15,4
Malva alcea	.	.	.	.	.	+	+	.	.	.	.	.	.	2	15,4
Populus tremula	+	+	.	.	.	.	.	.	.	.	.	.	.	2	15,4

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13		
Pteridium aquilinum subsp. *aquilinum*	.	.	.	+	.	.	.	.	+	.	.	.	.	2	15,4
Fagus sylvatica subsp. *sylvatica*	.	.	r	+	.	.	.	.	.	.	.	.	.	2	15,4
Myosotis graui	.	.	.	.	.	.	.	.	r	+	.	.	.	2	15,4
Platanthera bifolia	.	.	.	.	.	.	.	.	.	.	r	.	+	2	15,4
Thalictrum aquilegiifolium subsp. *aquilegiifolium*	.	.	.	.	+	.	.	r	.	.	.	.	.	2	15,4
Potentilla pedata	r	.	.	r	.	.	.	.	.	.	.	.	.	2	15,4
Cytisus hirsutus	.	.	+	+	.	.	.	.	.	.	.	.	.	2	15,4
Cephalanthera longifolia	.	.	.	.	.	.	.	1	.	.	.	.	.	1	7,7
Anemonoides ranunculoides	.	.	.	.	.	.	.	.	.	+	.	.	.	1	7,7
Castanea sativa	.	.	.	+	.	.	.	.	.	.	.	.	.	1	7,7
Dactylorhiza maculata subsp. *fuchsii*	.	.	.	.	.	.	.	+	.	.	.	.	.	1	7,7
Fragaria vesca subsp. *vesca*	.	.	.	.	.	.	+	.	.	.	.	.	.	1	7,7
Geranium sanguineum	.	.	.	.	+	.	.	.	.	.	.	.	.	1	7,7
Geum urbanum	.	.	.	.	+	.	.	.	.	.	.	.	.	1	7,7
Juniperus communis	.	.	+	.	.	.	.	.	.	.	.	.	.	1	7,7
Pyrus communis subsp. *pyraster*	.	.	.	+	.	.	.	.	.	.	.	.	.	1	7,7
Quercus pubescens	.	.	.	+	.	.	.	.	.	.	.	.	.	1	7,7
Rosa arvensis	.	.	.	.	+	.	.	.	.	.	.	.	.	1	7,7
Vicia cracca	.	.	.	.	.	.	.	.	.	.	+	.	.	1	7,7
Vicia sativa	.	.	.	.	.	.	.	.	+	.	.	.	.	1	7,7
Malva moschata	.	.	.	.	.	.	.	r	.	.	.	.	.	1	7,7
Orobanche gracilis	.	.	.	.	.	.	.	.	.	.	r	.	.	1	7,7
Trifolium scabrum	.	.	.	.	.	.	.	.	+	.	.	.	.	1	7,7

Table 2: Percent cover values of species grouped in phytosociological classes inside relevés clusters and sub-clusters highlighted by cluster analysis. Cluster/sub-cluster IDs refer to Figure 2.

Tabela 2: Pokrovnost v odstotkih vrst združenih po fitocenoloških razredih v klastrih in podklastrih. Klastri in podklastri so enaki kot prikazani v sliki 2.

Cluster / sub-cluster ID	FB-FO-ES	MA	NS	CU	LS-ST-H-OR-SS	Companion species
A	32,0	18,8	28,3	10,3	0,3	10,3
A1	0,3	0,0	8,4	87,5	1,4	2,4
A2	36,2	21,3	30,9	0,0	0,1	11,3
B	50,5	6,6	0,0	0,0	33,1	9,7
B1	41,1	6,6	0,0	0,0	36,5	15,1
B2	49,1	4,5	0,0	0,0	37,7	8,7
B3	56,7	8,2	0,0	0,0	27,5	7,5
C	14,2	72,4	0,9	0,0	2,7	9,8
C1	0,3	95,1	2,7	0,0	0,9	1,0
C2	25,1	67,3	1,5	0,0	2,6	3,5
C3	7,4	72,2	0,0	0,0	3,2	17,2

CU – *Calluno-Ulicetea;* ES – *Elyno-Seslerietea*; FB – *Festuco-Brometea*; FO – *Festuco hystricis-Ononidetea striatae*; H – *Helianthemetea guttati*; LS – *Lygeo sparti-Stipetea tenacissimae*; MA – *Molino-Arrhenatheretea*; NS – *Nardetea strictae*; OR – *Ononido-Rosmarinetea*, SS – *Sedo-Scleranthetea*; ST – *Stipo-Trachynietea*.

Table 3: Herbaceous communities of the *Festuco-Brometea* class.
Tabela 3: Zeliščne združbe razreda *Festuco-Brometea*.

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Occurrences	Frequency
Relevé number in Figure 2	46	47	45	48	34	35	36	40	41	37	38	51	52	32	39	1	33	49	50		
Altitude (m a.s.l.)	710	700	700	730	520	540	580	700	740	660	680	980	985	800	950	900	800	640	913		
Aspect	90	112,5	90	45	180	180	180	180	90	180	180	135	22,5	180	180	180	180	135	135		
Slope (°)	2	2	20	10	20	20	20	30	35	20	10	25	25	15	35	30	5	25	20		
Surface (mq)	50	50	50	60	200	200	200	200	200	200	200	100	100	200	200	200	200	50	100		
Coverage (%)	70	90	80	80	95	90	90	90	95	95	95	95	85	90	98	100	90	80	90		
***Achillea tomentosa* and *Trigonella sulcata* community**																					
Brachypodium rupestre	2	2	+	1	+	.	.	+	+	+	.	+	+	+	+	1	1	.	.	14	73,7
Ajuga chamaepitys	2	1	1	+	.	+	+	.	+	+	.	r	.	+	+	+	+	.	.	13	68,4
Petrorhagia saxifraga	2	+	2	2	.	.	1	+	+	.	.	+	+	+	1	.	.	.	+	12	63,2
Sabulina mediterranea	+	+	1	1	.	.	.	+	+	.	.	r	1	+	+	.	+	.	.	11	57,9
Trigonella sulcata	1	1	2	3	.	.	.	+	+	.	.	1	.	.	1	+	.	1	.	10	52,6
Odontites luteus	+	+	+	1	+	.	.	.	+	.	.	.	.	+	+	.	+	r	.	10	52,6
Allium sphaerocephalon	+	+	1	2	.	.	.	.	1	+	+	.	r	.	1	.	.	.	.	9	47,4
Trifolium angustifolium subsp. *angustifolium*	1	2	+	.	+	.	+	.	.	+	+	.	.	.	.	.	+	.	.	8	42,1
Arenaria leptoclados subsp. *leptoclados*	1	1	+	2	.	.	.	.	.	.	.	+	.	.	+	.	.	+	.	7	36,8
Ononis reclinata	1	1	1	+	.	.	.	.	.	.	.	.	.	1	+	.	.	r	.	7	36,8
Phleum hirsutum subsp. *ambiguum*	1	1	+	1	.	.	.	.	.	.	.	1	+	.	+	.	.	.	.	7	36,8
Sabulina tenuifolia	+	+	+	+	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	7	36,8
Galium corrudifolium	+	.	1	+	.	.	.	.	.	.	.	+	+	+	.	+	.	.	.	7	36,8
Micromeria graeca	+	+	+	1	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	6	31,6
Trifolium arvense	+	3	1	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	5	26,3
Sixalix atropurpurea	2	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	5	26,3
Linum strictum	+	+	+	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	5	26,3
Chondrilla juncea	+	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	21,1
Teucrium capitatum subsp. *capitatum*	1	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	4	21,1
Carduus nutans	+	+	+	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	4	21,1
Daucus carota	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	4	21,1
Avena barbata	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	15,8
Centaurea deusta	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	15,8
Dactylorhiza sambucina	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	15,8
Stachys recta	.	.	+	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	10,5
Veronica orsiniana	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	10,5

***Bromopsis erecta* and *Achillea tomentosa* community**																					
Bromopsis erecta subsp. *erecta*	+	1	1	3	1	1	1	3	3	3	3	2	3	3	4	4	3	3	3	19	100,0
Achillea tomentosa	2	3	2	1	2	2	2	1	1	2	2	2	2	1	+	1	2	2	2	19	100,0
Carex caryophyllea	+	.	+	.	1	1	1	1	1	2	1	1	1	+	.	1	+	.	1	15	78,9
Sedum sexangulare	.	.	.	.	+	+	1	+	1	+	+	3	1	1	1	1	.	1	1	14	73,7
Linum catharticum	.	.	.	.	+	1	.	.	+	1	.	+	+	1	+	+	1	+	+	12	63,2
Thymus moesiacus	.	.	.	.	1	1	.	+	.	+	1	1	1	.	.	1	2	1	1	11	57,9
Bromopsis erecta* and *Achillea tomentosa* community with *Brachypodium distachyon																					
Brachypodium distachyon	.	.	.	.	3	3	3	2	2	2	3	.	.	.	1	.	.	.	.	8	42,1
Euphorbia exigua subsp. *exigua*	.	.	.	.	+	1	1	+	+	+	1	.	.	.	.	.	.	.	.	7	36,8
Briza minor	.	.	.	.	+	+	+	1	.	1	+	.	.	.	.	+	.	.	.	7	36,8
Gastridium ventricosum	.	.	.	.	+	+	1	1	+	+	+	.	.	.	.	.	.	.	.	7	36,8
Crepis neglecta	.	.	.	.	1	+	+	+	.	1	.	.	.	.	.	1	.	.	.	6	31,6
Galium parisiense	.	.	.	.	+	.	+	1	+	+	.	.	.	.	.	.	.	.	.	5	26,3
Helianthemum salicifolium	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Species of phytosociological class of *Festuco-Brometea*																					
Poterium sanguisorba subsp. *balearicum*	+	1	1	1	2	.	1	2	1	1	2	1	1	1	2	+	1	.	1	17	89,5
Artemisia alba	.	+	+	+	1	1	+	2	2	+	2	1	.	1	2	1	.	2	+	16	84,2
Trifolium campestre	1	1	.	+	1	1	1	2	1	1	1	2	1	+	.	1	+	.	+	16	84,2
Helianthemum nummularium subsp. *obscurum*	.	.	+	1	1	1	1	.	.	1	+	+	1	1	+	+	1	2	+	15	78,9
Asperula purpurea	1	.	2	1	2	.	.	+	+	.	+	1	1	1	1	r	1	+	.	14	73,7
Eryngium amethystinum	+	.	+	+	+	+	+	.	+	.	+	+	1	+	+	2	+	.	.	14	73,7
Teucrium chamaedrys	.	.	+	1	+	.	+	1	+	.	.	+	+	.	1	1	+	2	1	13	68,4
Cerastium arvense subsp. *suffruticosum*	.	.	+	1	.	.	.	+	+	.	.	1	1	+	+	.	+	+	r	11	57,9
Muscari neglectum	.	.	+	+	.	.	.	+	+	+	+	1	1	+	+	.	.	.	+	11	57,9
Allium vineale	.	.	.	.	1	1	1	+	+	1	1	.	.	+	+	.	+	.	.	10	52,6
Anacamptis coriophora	.	.	.	.	+	+	+	+	+	+	+	.	.	.	+	r	.	.	.	9	47,4
Anacamptis pyramidalis	.	.	.	.	.	.	.	.	+	+	+	1	1	+	.	r	+	.	.	8	42,1
Hippocrepis comosa subsp. *comosa*	.	.	.	.	1	.	.	.	+	.	.	+	1	.	.	1	.	2	+	7	36,8
Medicago falcata subsp. *falcata*	.	2	.	1	.	.	+	.	.	.	+	.	.	+	+	.	+	.	.	7	36,8
Dianthus longicaulis	.	.	+	+	.	.	.	+	+	.	.	.	.	1	+	.	+	.	.	7	36,8
Ononis spinosa	.	.	.	.	+	.	.	+	.	.	+	+	+	+	+	.	.	.	.	7	36,8
Ophrys holosericea subsp. *holosericea*	.	.	.	.	+	+	.	.	+	.	.	+	+	.	+	r	.	.	.	7	36,8
Anthillis vulneraria subsp. *rubriflora*	.	.	+	.	.	.	.	.	.	.	.	2	+	.	+	+	+	.	+	7	36,8
Prunella laciniata	.	.	.	.	+	.	.	1	+	1	1	.	.	.	.	.	+	.	.	6	31,6
Neottia ovata	.	.	.	.	+	+	1	.	.	+	1	.	.	.	+	.	.	.	.	6	31,6
Carex flacca subsp. *erythrostachys*	.	.	.	.	.	.	.	+	+	+	.	.	1	.	.	+	.	+	.	6	31,6

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
Muscari comosum	.	.	.	.	.	.	.	+	.	.	+	.	.	+	+	r	.	.	1	6	31,6
Polygala nicaeensis	.	.	.	.	+	+	.	.	.	.	.	.	.	.	+	r	+	+	.	6	31,6
Koeleria splendens	.	.	.	.	.	.	.	+	+	.	.	.	2	.	+	.	+	.	.	5	26,3
Pilosella piloselloides	.	.	.	.	+	+	+	.	.	.	+	.	.	.	.	1	.	.	.	5	26,3
Centaurea jacea subsp. *gaudinii*	.	.	+	.	+	.	.	.	.	.	.	.	r	.	.	+	1	.	.	5	26,3
Globularia bisnagarica	.	.	.	.	+	+	.	+	1	.	.	.	.	.	.	r	.	.	.	5	26,3
Bupleurum baldense	.	.	+	+	.	.	.	.	.	.	.	.	r	+	+	.	.	.	.	5	26,3
Euphrasia stricta	.	.	.	.	+	+	.	.	+	.	+	r	.	.	.	.	.	.	.	5	26,3
Festuca circummediterranea	.	.	.	+	.	.	.	.	.	.	.	.	1	.	.	1	1	.	.	4	21,1
Anacamptis morio	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	+	+	4	21,1
Valerianella sp.	.	.	.	.	.	.	.	1	.	.	.	r	.	.	.	r	.	.	+	4	21,1
Clinopodium nepeta	+	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	4	21,1
Linum tenuifolium	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	+	+	.	4	21,1
Thymus longicaulis subsp. *longicaulis*	.	.	+	+	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	4	21,1
Leontodon rosanoi	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	3	15,8
Ononis pusilla subsp. *pusilla*	.	.	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	15,8
Scabiosa columbaria	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	1	.	.	3	15,8
Bromus hordeaceus	.	+	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	3	15,8
Ophrys funerea	.	.	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	r	.	3	15,8
Centaurea ambigua	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	2	10,5
Centaurium erythraea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	2	10,5
Melica ciliata	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	10,5
Ophrys bertolonii	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	2	10,5
Sabulina verna	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	2	10,5
Briza media	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.	.	.	.	.	2	10,5
Neotinea tridentata	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	r	.	.	.	2	10,5
Trifolium incarnatum subsp. *molinerii*	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	r	2	10,5
Astragalus monspessulanus	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	2	10,5
Leontodon crispus	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	2	10,5
Oxytropis pilosa subsp. *caputoi*	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Festuca inops	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	5,3
Globularia meridionalis	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	5,3
Helianthemum oelandicum subsp. *incanum*	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	5,3
Medicago lupulina	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Orchis anthropophora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	5,3
Ornithogalum comosum	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3

Pentanema montanum	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Plantago sempervirens	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Salvia pratensis	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Saxifraga bulbifera	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	5,3
Sesleria nitida	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	5,3
Neotinea ustulata	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	1	5,3
Seseli tommasinii	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	1	5,3
Species of *Stipo-Trachynietea distachyae* and *Helianthemetea guttati* classes																					
Vulpia myuros subsp. *myuros*	+	.	1	1	1	1	1	+	+	1	1	+	.	1	+	+	+	1	2	17	89,5
Trifolium scabrum	1	2	2	+	2	2	2	+	1	.	1	1	+	2	+	.	1	.	r	16	84,2
Catapodium rigidum	+	.	+	1	.	.	+	+	+	.	.	r	+	+	+	.	+	r	+	13	68,4
Briza maxima	.	+	+	.	+	+	+	+	.	.	.	3	r	1	+	1	.	.	3	12	63,2
Cynosurus echinatus	+	1	.	.	.	+	+	+	.	+	.	+	+	+	.	.	+	.	+	11	57,9
Linum corymbulosum	.	+	.	.	1	2	2	1	1	2	2	.	.	+	.	.	+	.	.	10	52,6
Aira elegantissima subsp. *elegantissima*	.	1	.	.	+	+	+	.	.	+	+	3	1	+	.	.	.	.	1	10	52,6
Sherardia arvensis	.	.	.	.	.	+	.	+	.	.	.	+	+	.	+	r	.	+	+	8	42,1
Poa bulbosa subsp. *bulbosa*	.	.	.	1	.	.	.	.	.	.	.	.	1	+	+	.	+	2	1	7	36,8
Fumana procumbens	.	.	.	+	.	.	.	.	+	.	.	.	.	+	+	r	1	+	.	7	36,8
Medicago minima	.	.	.	.	.	+	.	.	+	.	.	+	+	+	.	1	.	r	.	7	36,8
Stachys romana	.	.	+	.	+	.	+	.	+	+	.	.	.	+	+	.	.	.	.	7	36,8
Serapias lingua	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	r	.	.	2	5	26,3
Tuberaria guttata	.	.	.	1	.	.	.	.	.	.	.	.	.	+	+	.	.	.	1	4	21,1
Filago pyramidata	+	+	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	4	21,1
Onobrychis caput-galli	.	.	+	.	.	.	+	.	.	.	.	.	.	+	.	.	.	1	.	4	21,1
Arenaria serpyllifolia subsp. *serpyllifolia*	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	+	4	21,1
Coronilla scorpioides	.	.	+	.	.	.	.	.	+	.	.	+	.	.	.	r	.	.	.	4	21,1
Avellinia festucoides	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	3	15,8
Galium divaricatum	+	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	3	15,8
Silene gallica	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	r	.	.	.	2	10,5
Bombycilaena erecta	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	2	10,5
Cerastium brachypetalum subsp. *roeseri*	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	2	10,5
Logfia gallica	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	10,5
Myosotis ramosissima subsp. *ramosissima*	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	+	2	10,5
Saxifraga tridactylites	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.	.	.	.	.	2	10,5
Aira caryophyllea	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Hornungia petraea subsp. *petraea*	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	5,3
Lathyrus sphaericus	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	5,3

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
Lysimachia linum-stellatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	5,3
Trifolium stellatum	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Linum trigynum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	1	5,3
Ornithopus compressus	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Xeranthemum inapertum	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	1	5,3
Species of *Ononido-Rosmarinetea* class																					
Cistus creticus subsp. *eriocephalus*	+	+	.	1	.	.	.	+	.	.	.	.	.	1	1	+	+	2	1	10	52,6
Carlina corymbosa	+	+	1	+	.	+	+	1	1	.	.	.	.	.	+	.	+	.	.	10	52,6
Helichrysum italicum	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	3	15,8
Cistus salviifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	5,3
Thesium humile	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	5,3
Species of *Sedo-Scleranthetea* class																					
Petrorhagia prolifera	+	1	.	.	.	.	+	.	.	.	.	.	+	.	.	.	1	.	+	6	31,6
Petrosedum rupestre	.	.	+	.	.	.	.	.	.	.	.	.	.	+	1	.	.	+	1	5	26,3
Ziziphora acinos	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	3	15,8
Arabidopsis thaliana	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	2	10,5
Sedum album	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	2	10,5
Aethionema saxatile	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Sedum hispanicum	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Draba verna	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	1	5,3
Species of *Molinio-Arrhenatheretea* class																					
Dactylis glomerata subsp. *glomerata*	+	2	+	+	+	+	+	+	+	1	1	+	+	+	+	1	+	1	+	19	100,0
Plantago lanceolata	1	1	+	.	+	+	+	+	+	+	+	+	+	+	+	1	+	.	+	17	89,5
Blackstonia perfoliata	.	.	.	.	1	1	.	+	1	+	1	+	+	+	+	+	+	+	.	13	68,4
Lotus corniculatus	.	.	+	1	+	.	.	.	.	+	+	+	1	+	+	+	+	.	1	12	63,2
Onobrychis viciifolia	.	.	.	+	+	.	+	.	.	+	+	1	+	+	+	1	1	.	.	11	57,9
Rhinanthus minor	.	.	.	.	.	+	.	+	+	+	+	2	2	.	.	2	.	r	+	10	52,6
Agrostis capillaris subsp. *capillaris*	1	2	+	.	1	1	+	+	+	2	1	.	.	.	.	.	.	.	.	10	52,6
Anthoxanthum odoratum	.	.	+	.	.	.	.	+	.	.	.	+	+	+	.	2	+	.	+	8	42,1
Festuca rubra group	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	+	.	+	.	4	21,1
Gymnadenia conopsea	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	r	.	.	r	4	21,1
Holcus lanatus subsp. *lanatus*	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	r	3	15,8
Tragopogon pratensis	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	3	15,8
Achillea millefolium	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	10,5
Lolium pratense	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Colchicum lusitanum	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	5,3

Leontodon hispidus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	5,3
Leucanthemum vulgare subsp. *vulgare*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	5,3
Luzula multiflora subsp. *multiflora*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	5,3
Poa pratensis subsp. *pratensis*	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Veronica serpyllifolia	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Hypochaeris radicata	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	1	5,3
Companion species																					
Lysimachia arvensis subsp. *arvensis*	+	1	+	.	+	1	1	+	1	+	+	+	+	+	+	.	1	r	r	17	89,5
Hypericum perforatum	+	1	.	.	1	1	1	1	1	1	1	+	.	+	+	+	+	r	+	16	84,2
Linum usitatissimum subsp. *angustifolium*	+	1	+	.	1	.	1	+	+	+	.	3	2	+	+	+	+	+	+	16	84,2
Bothriochloa ischaemum	+	1	+	+	1	1	1	+	+	+	+	.	.	.	+	.	+	.	.	13	68,4
Vicia bithynica	.	.	.	.	+	+	+	1	+	1	1	+	.	.	+	1	.	.	r	11	57,9
Ziziphora granatensis subsp. *alpina*	1	.	+	.	.	+	1	+	.	.	.	1	1	.	.	.	.	.	.	7	36,8
Centaurium pulchellum subsp. *pulchellum*	.	.	.	.	+	1	1	+	.	+	.	.	.	+	+	.	.	.	.	7	36,8
Erigeron annuus	.	.	.	.	.	+	+	1	+	+	+	.	.	.	.	.	.	r	.	7	36,8
Euphorbia peplus	+	+	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.	.	.	6	31,6
Lathyrus clymenum	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	+	+	.	1	5	26,3
Cota tinctoria subsp. *tinctoria*	1	2	.	.	.	.	.	.	.	.	.	.	r	.	+	.	+	.	.	5	26,3
Poa compressa	+	+	.	.	.	.	.	+	.	.	.	r	.	.	.	.	+	.	.	5	26,3
Veronica arvensis	.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.	+	4	21,1
Urospermum dalechampii	.	.	.	.	+	.	+	.	.	.	+	.	.	.	+	.	.	.	.	4	21,1
Cynodon dactylon	.	+	.	.	+	.	+	.	.	.	.	.	.	.	.	.	+	.	.	4	21,1
Geranium columbinum	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	3	15,8
Cuscuta epithymum	.	.	.	+	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	3	15,8
Pilosella officinarum	.	.	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	3	15,8
Parentucellia latifolia	.	.	.	+	.	.	.	.	.	.	.	.	r	.	.	.	+	.	.	3	15,8
Orobanche gracilis	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	r	.	.	+	3	15,8
Malva setigera	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	+	.	.	.	3	15,8
Silene vulgaris subsp. *tenoreana*	+	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	3	15,8
Reichardia picroides	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	3	15,8
Echium vulgare subsp. *vulgare*	+	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	3	15,8
Erica arborea	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	3	15,8
Thymelaea passerina	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	10,5
Potentilla pedata	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	2	10,5
Picris hieracioides	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	10,5
Sonchus asper	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	10,5
Origanum vulgare	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	10,5

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
Crepis setosa	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	2	10,5
Myagrum perfoliatum	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	10,5
Festuca sp.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Hieracium sp.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	5,3
Limodorum abortivum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	5,3
Setaria sp.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Spartium junceum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	5,3
Sagina sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	1	5,3
Diplotaxis muralis	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	5,3
Diplotaxis tenuifolia	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Juncus bufonius	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	5,3
Juncus capitatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	5,3
Cytisus hirsutus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	5,3
Lotus dorycnium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	5,3
Campanula rapunculus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	1	5,3
Misopates orontium	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Anisantha sterilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	1	5,3
Erodium malacoides	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	5,3
Triticum neglectum	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	5,3
Crepis vesicaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	1	5,3
Astragalus sesameus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	5,3
Elymus repens subsp. *repens*	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Linaria vulgaris subsp. *vulgaris*	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Reseda lutea subsp. *lutea*	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Delphinium consolida	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5,3
Chaenorhinum minus	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	5,3

Table 4: Herbaceous communities of the *Molinio-Arrhenatheretea* class.
Tabela 4: Zeliščne združbe razreda *Molinio-Arrhenatheretea.*

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Occurrences	Frequency
Relevé number in Figure 2	8	17	18	6	9	7	10	16	15	13	14	28	30	31	20	23	26	21	22	24	25	27	29		
Altitude (m a.s.l)	1170	1170	1170	1170	1170	1160	1180	1180	1160	1150	1165	886	862	872	795	781	745	781	778	778	773	882	882		
Aspect	90	0	90	180	90	180	112,5	67,5	180	90	112,5	90	90	180	0	0	67,5	0	22,5	0	0	90	90		
Slope (°)	1	2,5	1,5	1	1	2	6	17,5	5	5	2	8	10	8	1,5	6	2	2,5	5,5	5	3	10	15		
Surface (mq)	15	20	30	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		
Coverage (%)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		
Species of the *Mentho-Juncetum inflexi* ass.																									
Mentha longifolia	+	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	+	+	1	1	1	+	.	9	39,1
Juncus inflexus subsp. *inflexus*	3	2	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	17,4
Species of the *Mentho-Juncion inflexi* all. and *Potentillo-Polygonetalia* ord.																									
Carex hirta	1	.	.	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	17,4
Galium album	1	.	.	.	+	.	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	17,4
Ranunculus repens	2	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	13,0
Charact. and diff. species of the *Deschampsio-Caricetum distantis* ass. and higher syntaxa																									
Lolium arundinaceum subsp. *arundinaceum*	+	.	1	1	2	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	6	26,1
Deschampsia cespitosa	2	4	4	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	21,7
Carex distans	.	+	.	.	+	.	.	.	.	.	.	+	+	1	.	.	.	.	.	.	.	.	.	5	21,7
Charact. and diff. of the *Colchico lusitani-Cynosuretum cristati* ass.																									
Cynosurus cristatus	+	.	.	2	2	2	1	2	4	3	4	1	1	1	+	1	.	1	.	.	.	1	1	17	73,9
Tragopogon pratensis subsp. *pratensis*	.	.	.	.	.	+	+	+	+	+	+	1	1	1	+	1	1	1	1	+	+	+	.	17	73,9
Achillea millefolium	+	.	.	.	.	+	+	.	+	+	+	.	+	.	.	1	+	.	.	+	+	1	1	13	56,5
Colchicum lusitanum	.	.	.	+	1	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	+	9	39,1
Sp. of the *Cynosurion cristati* all. and *Trifolio repentis-Phleetalia pratensis* ord.																									
Lolium perenne	.	.	.	1	1	1	1	+	1	1	+	+	1	1	1	+	.	+	.	.	.	+	.	15	65,2
Bellis perennis	.	.	.	+	+	+	+	.	+	.	.	.	1	+	1	+	+	+	+	.	+	1	.	14	60,9
Scorzoneroides autumnalis	.	+	.	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	17,4
Trifolium repens	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	.	.	.	.	.	.	.	.	2	8,7
Phleum pratense subsp. *pratense*	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	4,3
Charact. and diff. species of the *Ranunculo neapolitani-Arrhenatheretum elatioris* ass. and the *ranunculetosum neapolitani* subass.																									
Holcus lanatus subsp. *lanatus*	1	+	+	.	1	1	1	2	1	1	1	.	2	1	3	2	3	3	2	1	+	1	1	21	91,3
Salvia pratensis	.	.	.	.	.	+	1	1	+	1	1	+	+	.	.	+	+	+	.	.	.	+	+	13	56,5
Trifolium campestre	.	.	.	.	.	.	.	+	1	1	1	.	.	1	+	+	1	+	+	1	+	.	+	13	56,5
Galium mollugo	.	.	.	.	.	.	.	.	.	.	.	1	2	1	+	+	.	+	+	+	2	1	1	11	47,8
Trisetaria flavescens subsp. *flavescens*	.	.	.	.	.	.	.	.	1	+	1	2	2	1	.	.	.	.	.	.	.	1	.	7	30,4
Tragopogon pratensis subsp. *orientalis*	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	+	.	.	.	.	.	+	5	21,7
Geranium dissectum	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	4,3

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Charact. and diff. species of the *Ranunculo neapolitani-Arrhenatherion elatioris* all.																									
Arrhenatherum elatius subsp. *elatius*	.	.	.	.	.	.	.	.	+	+	+	2	3	3	4	3	4	4	5	4	3	3	3	15	65,2
Ranunculus neapolitanus	.	.	.	.	.	.	.	.	1	.	1	2	1	1	1	1	1	2	2	1	+	1	2	14	60,9
Centaurea nigrescens	+	.	.	2	1	1	1	+	1	+	1	.	.	.	.	.	.	.	.	.	.	.	.	9	39,1
Pastinaca sativa subsp. *urens*	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	1	+	1	.	.	+	8	34,8
Achillea collina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	4,3
Species of the *Molinio-Arrhenatheretea* class																									
Dactylis glomerata subsp. *glomerata*	+	.	1	2	+	2	+	.	+	+	1	1	2	1	2	+	+	+	1	1	+	+	+	21	91,3
Trifolium pratense subsp. *pratense*	.	.	+	2	2	3	1	2	1	2	2	1	2	1	2	1	1	2	2	1	+	1	.	20	87,0
Anthoxanthum odoratum	+	.	+	2	2	2	2	2	2	2	2	1	1	1	+	.	2	2	1	.	+	1	1	20	87,0
Rumex acetosa subsp. *acetosa*	+	+	1	+	+	+	r	+	+	+	+	.	.	+	.	1	1	1	+	+	+	+	1	20	87,0
Lotus corniculatus	+	.	.	2	1	2	2	1	2	2	1	1	1	1	.	+	.	2	.	+	1	2	+	18	78,3
Daucus carota	.	.	.	.	.	r	+	+	+	+	1	+	+	+	+	+	1	+	.	+	+	+	+	17	73,9
Poa trivialis	1	+	3	.	1	1	1	.	.	1	.	.	.	.	3	+	1	+	1	1	+	.	1	15	65,2
Rhinanthus minor	.	.	.	2	+	2	+	.	1	+	+	.	+	+	.	2	2	.	.	+	+	1	1	15	65,2
Plantago lanceolata	.	.	.	+	.	.	+	+	+	+	.	.	+	+	+	+	1	1	1	+	.	1	+	15	65,2
Onobrychis viciifolia	.	.	.	.	.	+	2	2	1	3	3	.	1	+	.	1	.	+	+	.	+	2	.	13	56,5
Lathyrus pratensis	1	1	1	.	.	.	+	.	+	.	+	.	+	+	+	+	.	.	.	1	2	+	.	13	56,5
Leucanthemum vulgare subsp. *vulgare*	.	.	.	1	+	+	r	.	+	+	+	1	1	1	.	.	.	.	.	.	.	1	+	12	52,2
Leontodon hispidus	.	.	.	.	+	+	+	1	1	1	1	+	+	.	.	.	+	.	.	.	+	.	+	12	52,2
Trifolium dubium	.	.	.	+	.	+	+	+	+	+	+	+	+	+	.	+	.	.	.	.	.	+	.	12	52,2
Poa pratensis subsp. *pratensis*	1	+	.	.	.	.	.	.	.	.	1	2	+	+	2	1	.	.	.	.	1	.	2	10	43,5
Prunella vulgaris subsp. *vulgaris*	.	.	.	1	+	1	.	1	1	1	+	.	+	.	.	.	.	.	.	.	.	.	.	8	34,8
Lychnis flos-cuculi subsp. *flos-cuculi*	+	+	+	.	+	+	+	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	+	8	34,8
Rhinanthus alectorolophus	.	.	.	.	.	.	1	2	1	2	2	.	.	.	.	.	.	2	1	.	.	.	.	7	30,4
Ranunculus bulbosus	.	.	.	+	1	1	+	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	7	30,4
Agrostis capillaris subsp. *capillaris*	.	.	.	1	1	2	2	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	6	26,1
Ranunculus acris	+	+	1	1	1	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	6	26,1
Luzula multiflora subsp. *multiflora*	.	.	.	+	.	+	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	1	6	26,1
Cerastium holosteoides	.	+	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+	+	6	26,1
Picris hieracioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	+	+	.	.	.	5	21,7
Potentilla reptans	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	+	.	.	.	.	+	.	5	21,7
Festuca gr. rubra	.	.	.	2	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	4	17,4
Equisetum palustre	+	.	.	2	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	17,4
Valeriana officinalis	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	4	17,4
Crepis biennis	.	.	.	.	.	.	.	.	.	+	+	.	+	+	.	.	.	.	.	.	.	.	.	4	17,4

Hordeum secalinum	.	.	.	1	2	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	13,0
Centaurea jacea subsp. *jacea*	.	1	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	13,0
Carum carvi	.	.	.	r	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	13,0
Ophioglossum vulgatum	.	.	.	r	+	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	13,0
Sanguisorba officinalis	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	8,7
Pimpinella major	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	2	8,7
Tragopogon porrifolius	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	2	8,7
Hypericum tetrapterum	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	8,7
Gymnadenia conopsea	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	8,7
Lolium pratense	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	4,3
Carex panicea	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	4,3
Hypochaeris radicata	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	4,3
Plantago media	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	4,3
Ranunculus tuberosus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	4,3
Ingr. species from *Festuco-Brometea* class																									
Briza media	.	.	+	3	1	1	1	1	+	1	1	1	1	2	.	+	.	.	.	.	+	+	+	16	69,6
Bromus hordeaceus	.	.	.	.	1	.	1	.	1	1	1	.	+	.	+	+	+	+	+	+	.	+	+	14	60,9
Medicago lupulina	.	.	.	.	.	1	1	.	+	1	+	1	1	1	+	1	.	.	.	+	+	1	.	13	56,5
Cerastium arvense subsp. *suffruticosum*	.	.	.	+	+	+	+	+	+	+	+	.	.	.	.	.	+	.	+	+	.	+	+	13	56,5
Polygala nicaeensis	.	.	.	+	+	.	+	.	+	+	1	.	+	.	.	+	+	+	.	.	+	.	.	11	47,8
Carex caryophyllea	.	.	.	1	1	1	.	+	1	1	+	+	.	+	.	.	.	.	.	.	.	.	+	10	43,5
Bromopsis erecta subsp. *erecta*	.	.	.	1	.	.	2	2	.	2	2	+	.	2	.	.	.	.	.	+	.	.	2	9	39,1
Brachypodium rupestre	.	.	.	.	.	1	1	1	2	1	1	+	+	.	.	.	.	.	.	+	.	.	.	9	39,1
Galium verum	.	.	.	+	+	1	1	+	+	+	1	.	+	.	.	.	.	.	.	.	.	.	.	9	39,1
Poterium sanguisorba subsp. *balearicum*	.	.	.	.	.	.	+	+	1	1	1	.	.	.	.	+	.	.	+	+	+	.	.	9	39,1
Luzula campestris subsp. *campestris*	.	.	.	+	1	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	+	9	39,1
Saxifraga bulbifera	.	.	.	.	r	+	r	r	.	r	.	.	.	.	.	.	+	.	.	.	+	+	+	9	39,1
Allium vineale	.	.	.	+	+	1	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	8	34,8
Trifolium montanum subsp. *rupestre*	.	.	.	+	+	+	.	+	2	.	+	.	.	.	.	.	.	.	.	.	.	.	+	7	30,4
Linum catharticum	.	.	.	+	.	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	7	30,4
Valerianella sp.	.	.	.	.	.	+	+	+	+	+	.	.	.	+	.	.	+	.	.	.	.	.	.	7	30,4
Trifolium ochroleucon	.	.	.	1	.	+	2	1	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	6	26,1
Carex flacca subsp. *erythrostachys*	+	.	.	+	.	.	.	+	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	6	26,1
Euphrasia stricta	.	.	.	+	r	+	+	+	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	6	26,1
Trifolium incarnatum subsp. *molinerii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	+	+	1	.	.	.	+	5	21,7
Centaurea jacea subsp. *gaudinii*	.	.	.	.	.	.	.	.	.	.	.	+	+	1	.	.	+	.	.	.	.	+	.	5	21,7
Festuca inops	.	.	.	.	.	.	.	2	2	1	2	.	.	.	.	.	.	.	.	.	.	.	.	4	17,4

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Knautia calycina	.	.	.	.	.	.	+	1	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.	4	17,4
Ornithogalum comosum	.	.	.	+	r	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	17,4
Potentilla rigoana	.	.	.	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	13,0
Muscari neglectum	.	.	.	.	.	.	.	+	.	r	.	.	.	.	.	.	.	.	.	.	.	.	+	3	13,0
Helianthemum nummularium subsp. *obscurum*	.	.	.	.	.	.	.	2	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	2	8,7
Dactylorhiza sambucina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	2	8,7
Scorzonera austriaca	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	2	8,7
Anacamptis coriophora	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.	2	8,7
Anacamptis pyramidalis	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.	2	8,7
Neotinea ustulata	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	8,7
Allium sphaerocephalon	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	4,3
Centaurea ambigua	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	4,3
Cynoglottis barrelieri subsp. *barrelieri*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	4,3
Gentiana verna	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	4,3
Neottia ovata	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	4,3
Orchis anthropophora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	4,3
Pentanema salicinum	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	4,3
Companion species																									
Linum usitatissimum subsp. *angustifolium*	.	.	.	+	+	+	1	+	1	1	1	+	1	+	+	2	1	1	1	+	.	+	+	19	82,6
Sherardia arvensis	.	.	.	.	.	+	+	+	+	+	+	.	+	1	.	+	+	.	+	.	.	.	+	12	52,2
Campanula rapunculus	.	.	.	.	.	+	+	+	+	+	r	.	.	+	.	.	+	+	.	.	+	.	.	10	43,5
Veronica chamaedrys	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	+	1	1	1	9	39,1
Vicia cracca	.	.	.	.	.	.	+	+	.	.	+	.	+	.	+	.	.	.	.	+	+	1	+	9	39,1
Taraxacum erythrospermum	.	.	.	.	.	.	.	.	.	.	.	1	+	+	2	+	.	+	+	.	.	.	+	8	34,8
Cruciata glabra	.	.	.	+	+	+	+	+	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	8	34,8
Veronica arvensis	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	+	+	.	+	+	.	+	.	8	34,8
Vicia bithynica	.	.	.	+	r	+	1	.	1	.	1	.	.	.	+	.	.	.	.	.	.	.	1	8	34,8
Medicago sativa	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	1	1	1	.	+	.	+	7	30,4
Vicia sativa	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	+	+	+	1	1	.	.	7	30,4
Scorzoneroides cichoriacea	.	.	.	1	.	+	1	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	7	30,4
Convolvulus arvensis	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	+	.	+	.	+	1	.	7	30,4
Crepis vesicaria	.	.	.	.	.	.	.	.	.	.	.	+	1	+	+	+	+	.	+	.	.	.	.	7	30,4
Geranium molle	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	1	1	+	.	.	+	6	26,1
Cruciata laevipes	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	+	+	6	26,1
Rubus caesius	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	1	.	.	1	2	.	.	5	21,7
Geranium pyrenaicum subsp. *pyrenaicum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	1	.	+	+	5	21,7

Artemisia verlotiorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	1	.	+	.	5	21,7
Orobanche gracilis	.	.	.	.	.	.	r	r	.	r	r	.	+	.	.	.	.	.	.	.	.	.	.	5	21,7
Cynosurus echinatus	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	+	.	.	+	+	5	21,7
Carex pallescens	1	+	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	21,7
Myosotis arvensis subsp. *arvensis*	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	+	.	+	.	4	17,4
Danthonia alpina	.	.	.	+	+	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	17,4
Clinopodium vulgare	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	+	.	3	13,0
Juncus articulatus subsp. *articulatus*	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	13,0
Cuscuta epithymum	.	.	.	.	.	.	.	.	+	r	r	.	.	.	.	.	.	.	.	.	.	.	.	3	13,0
Dactylorhiza maculata subsp. *fuchsii*	r	.	.	.	.	.	.	r	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	3	13,0
Equisetum telmateia	.	.	.	.	.	.	.	r	+	r	.	.	.	.	.	.	.	.	.	.	.	.	.	3	13,0
Helictochloa praetutiana subsp. *praetutiana*	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	3	13,0
Geranium columbinum	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	3	13,0
Potentilla erecta	1	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	13,0
Clematis vitalba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	2	8,7
Cirsium arvense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	2	8,7
Eupatorium cannabinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	2	8,7
Solidago virgaurea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	2	8,7
Thalictrum aquilegiifolium subsp. *aquilegiifolium*	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	2	8,7
Bunium bulbocastanum	.	.	.	.	.	r	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	2	8,7
Galium anisophyllon	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	8,7
Veronica persica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	2	8,7
Anisantha sterilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	2	8,7
Aira elegantissima subsp. *elegantissima*	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	8,7
Briza maxima	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	2	8,7
Aira caryophyllea	.	.	.	.	.	.	.	.	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.	2	8,7
Chaerophyllum temulum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	4,3
Holcus mollis subsp. *mollis*	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	4,3
Alchemilla sp.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	4,3
Cardamine hirsuta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	4,3
Carex sylvatica	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	4,3
Equisetum arvense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	4,3
Galium palustre	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	4,3
Jacobaea erucifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	4,3
Orchis purpurea	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	4,3
Ornithogalum divergens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	4,3
Sonchus asper	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	4,3

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Vicia peregrina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	4,3
Leucanthemum adustum subsp. *adustum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	4,3
Lathyrus clymenum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	4,3
Hypericum perforatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	4,3
Silene vulgaris subsp. *tenoreana*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	4,3
Drabella muralis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	4,3
Myosotis ramosissima subsp. *ramosissima*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	4,3
Poa bulbosa subsp. *bulbosa*	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	4,3
Serapias lingua	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	4,3
Trifolium nigrescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	4,3
Vulpia myuros subsp. *myuros*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	4,3
Danthonia decumbens subsp. *decumbens*	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	4,3
Carex leporina	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	4,3