

Two new montane grassland communities from the SE Alps (N Slovenia)

Igor Dakskobler^{1,*} & Andrej Seliškar²

Key words: montane grasslands, phytosociology, synsystematics, *Gladiolus palustris*, Karavanke, Kamnik Alps, Natura 2000, Slovenia.

Ključne besede: gorska travišča, fitocenologija, sinsistematika, *Gladiolus palustris*, Karavanke, Kamniške Alpe, Natura 2000, Slovenija.

Abstract

On very steep dolomite slopes in the western foothills of the Kamnik Alps (Ravni hrib, Javorov vrh, Zaplata, Kriška gora) and southwestern Karavanke Mountains (Dobrča) we conducted a phytosociological study into montane grasslands (former hay meadows, partly pastures) where *Gladiolus palustris*, a species of European conservation concern, also occasionally occurs. They were compared with similar montane grasslands (former hay meadows) on sunny slopes of the Stol ridge above Breginj in the southwestern foothills of the Julian Alps. Based on this comparison we described three new syntaxa: *Centaureo julici-Laserpitietum sileris gladioletosum palustris*, *Festuco amethystinae-Seslerietum calcariae* and *Pediculari julici-Bromopsietum transilvanicae*. Both new associations are classified into the alliance *Caricion austroalpinae* and treated as a long-term successional stage in the belt of altimontane beech forests from the association *Ranunculo plataniifolii-Fagetum*.

Izveček

Na strmih dolomitnih pobočjih v zahodnem prigorju Kamniških Alp (Ravni hrib, Javorov vrh, Zaplata, Kriška gora) in jugozahodnih Karavank (Dobrča) smo fitocenološko preučili gorska travišča (nekdanje senožeti, deloma pašnike), v katerih ponekod raste tudi evropsko varstveno pomembna vrsta *Gladiolus palustris*. Primerjali smo jih s podobnimi montanskimi travišči (nekdanjimi senožetmi) na prisojnih pobočjih Stolovega grebena nad Breginjem v jugozahodnem prigorju Julijskih Alp. Na podlagi te primerjave smo opisali tri nove sintaksone: *Centaureo julici-Laserpitietum sileris gladioletosum palustris*, *Festuco amethystinae-Seslerietum calcariae* in *Pediculari julici-Bromopsietum transilvanicae*. Obe novi asociaciji uvrščamo v zvezo *Caricion austroalpinae* in ju obravnavamo kot dolgotrajen sukcesijski stadij v pasu altimontanskih bukovih gozdov iz asociacije *Ranunculo plataniifolii-Fagetum*.

Received: 6. 3. 2015

Revision received: 21. 8. 2015

Accepted: 25. 8. 2015

1 Institute of Biology, Scientific Research Centre of the Slovenian Academy of Sciences and Arts, Regional unit Tolmin, Brunov drevored 13, SI-5220 Tolmin, and Biotechnical Faculty of the University in Ljubljana, Department of Forestry and Renewable Forest Resources, Večna pot 83, SI-1000 Ljubljana.
E-mail: Igor.Dakskobler@zrc-sazu.si

* Corresponding author

2 Grobeljska cesta 6 b, SI-1234 Mengeš. E-mail: ase@siol.com

Introduction

Several years ago (Dakskobler 2003, Dakskobler et al. 2007, Dakskobler & Poldini 2012) we described the species composition of former montane hay meadows in the southern Julian Alps classified into the association *Centaureo julici-Laserpitietum sileris*. In the western Karavanke Mts. and in the Kamnik Alps, the association *Pediculari julici-Brometum erecti* Seliškar 1993 nom. prov. (Seliškar 1993:13–14, 1996: 103–104) was, until now only provisionally, described in the same (montane-altimontane) elevation belt (from 900 m to the timberline). In terms of its species composition, its stands are transitional between the communities of the classes *Festuco-Brometea* and *Elyno-Seslerietea*. In the summer of 2014, while we were mapping the former hay meadows and pastures under Kriška gora (the Kamnik Alps), we inventoried another type of a similar montane grassland in which, however, we did not observe the taxon *Bromus erectus* agg.; instead, the grasses were dominated by *Sesleria caerulea* subsp. *calcaria* and *Festuca amethystina*. In the same year we inventoried also former hay meadows with *Gladiolus palustris* under the peak Musc (Mali Muzec) in the Stol ridge (southwestern Julian Alps). We therefore compared the relevés of the association *Pediculari julici-Brometum erecti* with the relevés of the grasslands under Kriška gora and Musc and used these comparisons as the basis for this paper.

Methods

Phytosociological records of (alti)montane meadows were made according to the standard Central-European method (Braun-Blanquet 1964) and entered into the FloVegSi database (Seliškar et al. 1993). We transformed the combined cover-abundance values with numerical values (1–9) according to van der Maarel (1979). Numerical comparisons were performed with the SYN-TAX 2000 program package (Podani 2001). The relevés were compared by means of “(unweighted) average linkage method” – UPGMA, using Wishart’s similarity ratio. The nomenclature source for the names of vascular plants is the Mala flora Slovenije (Martinčič et al. 2007), Martinčič (2003) for the names of mosses and Šilc & Čarni (2012) for the names of syntaxa. In the classification of species into phytosociological groups (groups of diagnostic species) we mainly refer to the Flora alpina (Aeschmann et al. 2004a, b, c). Geographic coordinates of relevés are determined according to the Slovenian geographic coordinate system D 48 (5th zone) on the Bessel ellipsoid and with Gauss-Krüger projection.

Short ecological description of the study area

A shared characteristic of the study areas, southern slopes of the Stol ridge (Figure 1), Kriška gora (Figure 2), Dobrča (Figure 3) and Zaplata, Javorov vrh and Ravni hrib (Figure 4) is similar geological bedrock – dolomite or dolomitised limestone (Buser 2009). The slopes are therefore very steep and the soil shallow. The differences in the amount of precipitation between the southwestern Julian Alps and the southern foothills of the Karavanke and the Kamnik Alps are considerable. The mean annual precipitation volume in the SW Julian Alps exceeds 2500 mm,

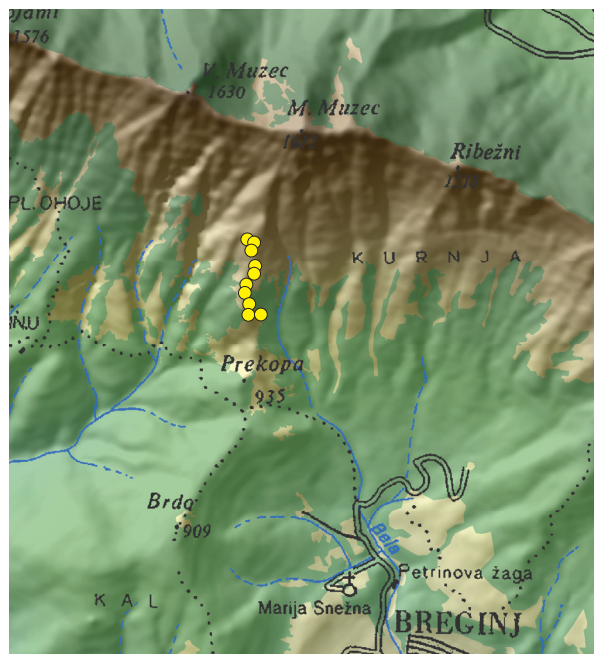
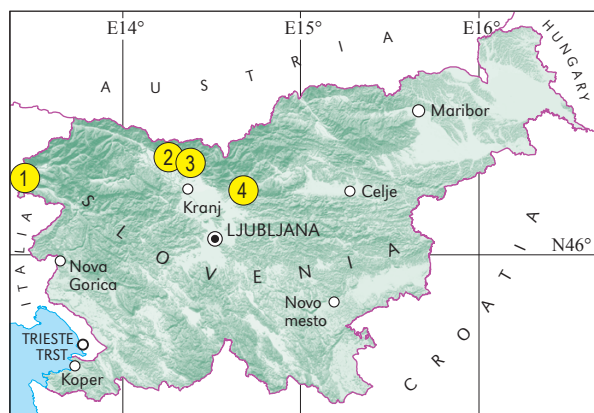


Figure 1: Approximate localities of researched grasslands under the peak Musc (Mali Muzec) in the Stol ridge.

Slika 1: Približna lokacija popisanih travišč pod Muzcem (Malim Muzcem) v Stolovem pogorju.

while the mean annual precipitation volume in the latter two locations stays below 2000 mm (Zupančič 1998). The mean annual temperature in the study areas is similar at around 4–6 °C (Cegnar 1998). Due to the sunny aspect and considerable slope snow melts early or slides

down the slope. While the hay meadows under the Stol ridge have been abandoned for a long time and completely left to natural succession, the grasslands under Kriška gora and on Zaplata are partly used as pastures, mainly for small ruminants.

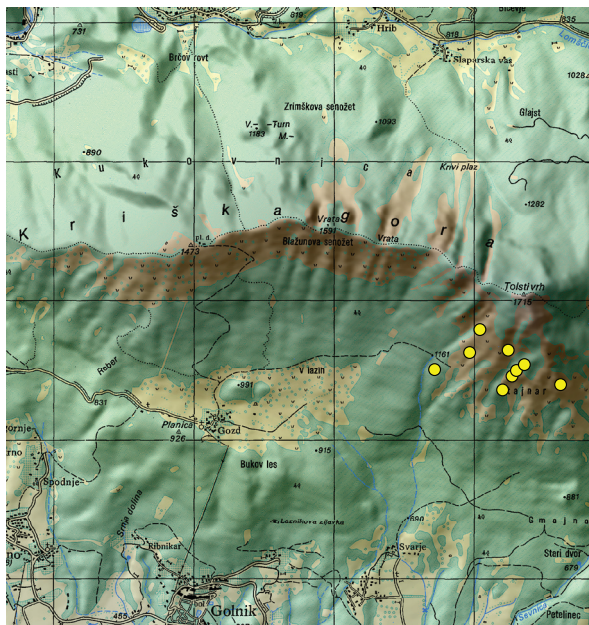


Figure 2: Approximate localities of researched grasslands under the peak Tolsti vrh in the Kriška gora ridge.

Slika 2: Približna lokacija popisanih travišč pod Tolstim vrhom v grebenu Kriške gore.

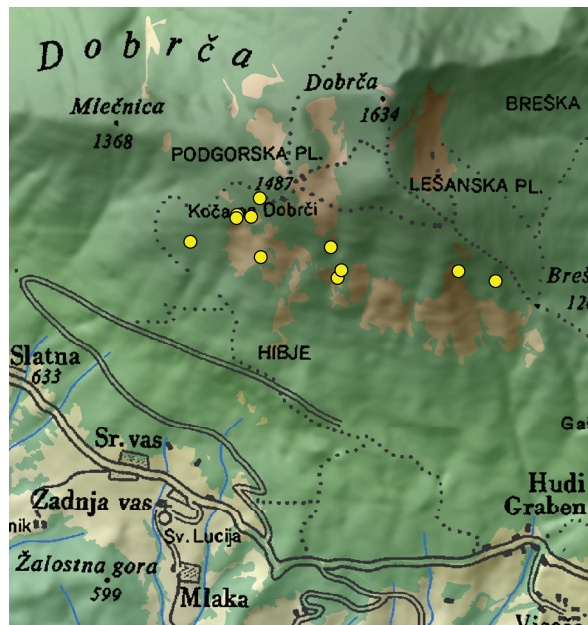


Figure 3: Approximate localities of researched grasslands under Dobrča in western Karavanke.

Slika 3: Približna lokacija popisanih travišč pod Dobrčo v zahodnih Karavankah.

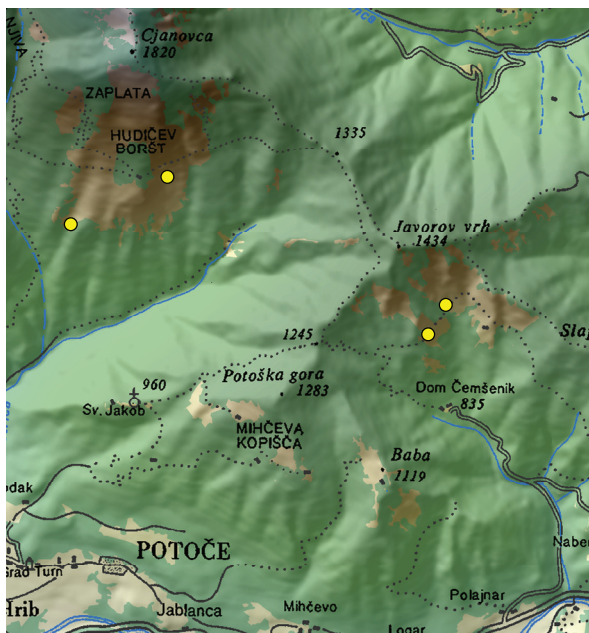
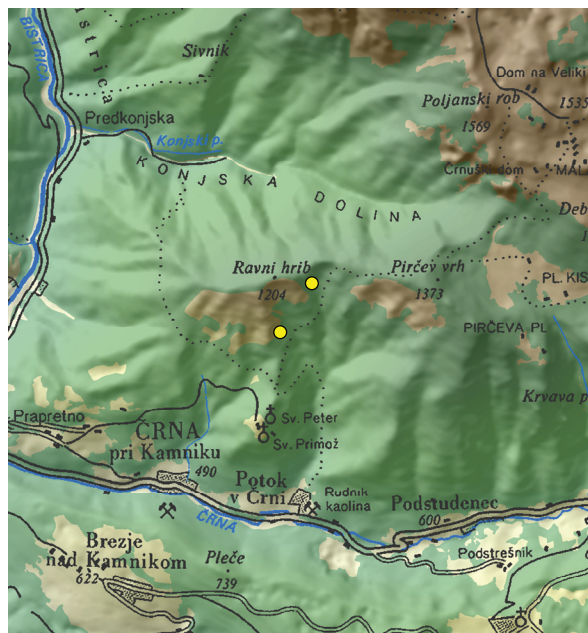


Figure 4: Approximate localities of researched grasslands under Zaplata, Javorov vrh and Ravni hrib in the Kamnik Alps.

Slika 4: Približna lokacija popisanih travišč pod Zaplato, Javorovim vrhom in Ravnim hribom v Kamniških Alpah.



Results and discussion

In Table 1 we arranged 36 relevés that were made in the elevation belt between 1000 m and 1400 m. When we compared them using hierarchical classification they grouped into four clusters (Figure 5):

- FaSa *Festuco amethystinae-Seslerietum calcariae*
- CjLsgl *Centaureo julici-Laserpitietum sileris gladioletosum palustris*
- PjBt *Pediculari julici-Bromopsietum transsilvanicae*
- LSass *Laserpitium siler* community (*Astrantio majoris-Laserpitietum sileris* nom. prov.)

The first group comprises relevés of grasslands from Kriška gora. The dominant species in these relevés is usually *Sesleria caerulea* subsp. *calcaria*, but *Festuca amethystina*, *Calamagrostis varia*, *Carex humilis*, *Erica carnea* and *Asperula tinctoria* also have high medium coverage. The most common among the species of thermophilous forest edges is *Geranium sanguineum*, while *Laserpitium siler* for now covers large areas only on several spots. These stands therefore cannot be classified into the as-

sociation *Centaureo julici-Laserpitietum sileris*, nor into the association *Pediculari julici-Brometum erecti*, because of the absence of the taxon *Bromus erectus* agg. They are characterised by species of the classes *Elyno-Seslerietea*, *Festuco-Brometea*, *Trifolio-Geranietea* and *Erico-Pinetea* (Table 2) and classified into the new association *Festuco amethystinae-Seslerietum calcariae*. Its nomenclature type, *holotypus*, is relevé No. 7 in Table 1. Diagnostic species of the association are *Sesleria caerulea* subsp. *calcaria*, *Festuca amethystina*, *Asperula tinctoria*, *Achillea distans*, *Orobanche alba*, *Euphrasia salisburgensis* and *Phleum hirsutum*. *Festuca amethystina* is a southeastern-European montane species, a character species of the alliance *Erico-Pinion* (Aeschimann et al. 2004b: 850). In Slovenia it is listed as rare on the Red List (Anonymous 2002). Jogan (2007: 857) mentions its occurrence in light, mainly pine forests on dry soil on calcareous bedrock, and Kriška gora, Vrtača, Črni graben and Zidani Most as its localities. Most of the data in the FloVegSi database are for the southern foothills of the western Karavanke (the Draga valley, Dobrča) and the Kamnik Alps (Kriška gora). Only individual localities are from other phytogeographical regions. We believe this species well characterises former sunny hay meadows on dolo-

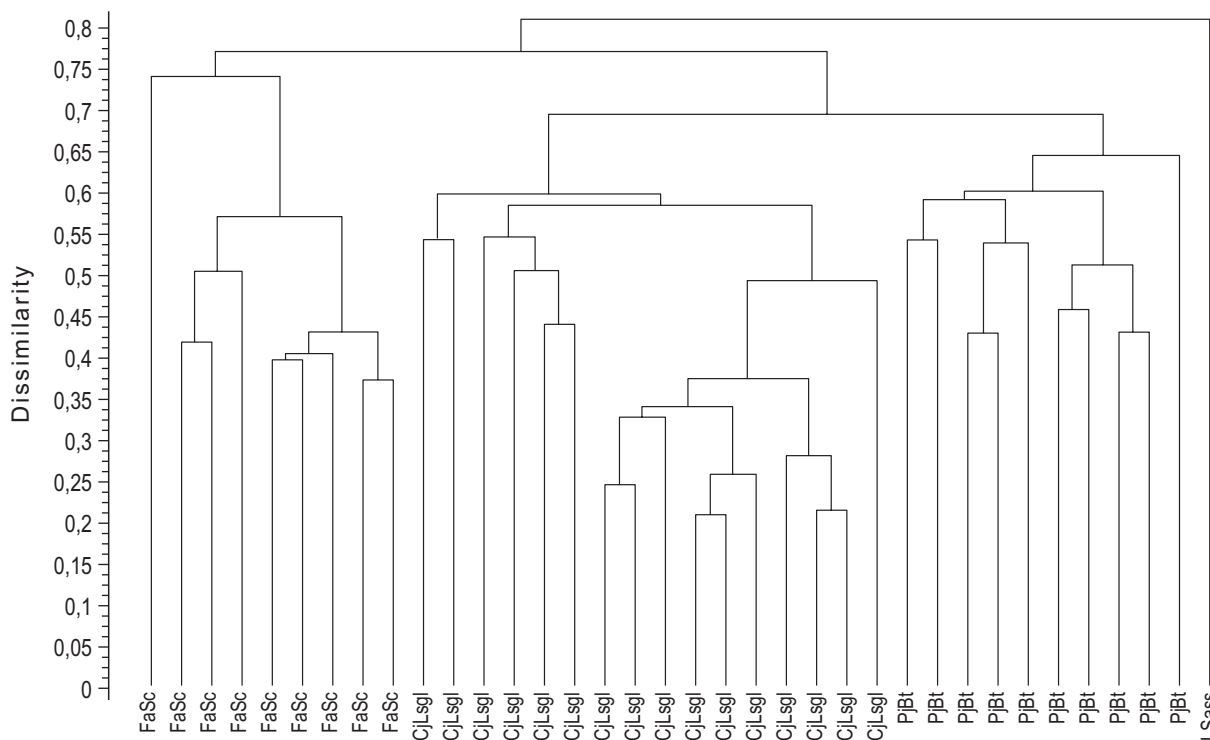


Figure 5: Dendrogram of relevés of altimontane grasslands in the Julian and Kamnik Alps and in the western Karavanke ridge (UPGMA, similarity ratio).

Slika 5: Dendrogram altimontanskih travnišč v Julijskih in Kamniških Alpah ter zahodnih Karavankah.

mite bedrock and shallow soils in the altimontane belt that are very slowly becoming overgrown. The differential species of the association is yet another southeastern-European montane species *Grafia golaka*. Considering its species composition (Tables 1 and 2) the new association could be classified into the class *Festuco-Brometea*, but with consideration of the composition of diagnostic and dominant species we find that it would be more suitable to classify these grasslands also into the alliance *Caricion austroalpinae* and class *Elyno-Seslerietea*. Somewhat similar grassland communities which include also *Sesleria caerulea* (*S. albicans*), *Molinia caerulea* subsp. *arundinacea*, *Carex humilis*, *Calamagrostis varia* and *Festuca amethystina* are in the Bavarian Alps classified into the association *Laserpitio-Seslerietum* Moor ex Béguin 1972 (Rösler 1997).

The second group of relevés consists of two sub-groups. The smaller one comprises relevés from Dobrča, Zaplata and Ravni hrib, i.e. from the western Karavanke and the Kamnik Alps, while the larger sub-group comprises relevés from the Stol ridge in the southwestern Julian Alps. These relevés can definitely be classified within the association *Centaureo julici-Laserpitietum sileris* as they are clearly a long-term stage with tall umbellifers, especially with *Laserpitium siler*, in the overgrowing of former hay meadows. Other diagnostic species of this association are also more or less present in these relevés. *Gladiolus palustris* is particularly interesting because it is the first time we have recorded it in the stands of this association (compare Dakskobler 2003, Dakskobler et al. 2007, Dakskobler & Poldini 2012). Relevés Nos. 10 to 25 in Table 1 are therefore classified into the new subassociation *-gladioletosum palustris*. Its differential species are *Gladiolus palustris* and *Grafia golaka*, the nomenclature type, *holotypus*, is relevé No. 22 in Table 1. Two variants are distinguished. Var. *Pedicularis julica* comprises the relevés from both the Kamnik Alps and western Karavanke, and var. *Carduus crassifolius* comprises relevés from the Julian Alps. Medium coverage of the taxon *Molinia caerulea* subsp. *arundinacea* is considerably higher in the latter variant. Somewhat similar communities with dominant *Molinia arundinacea* and often presence of *Gladiolus palustris* on intermittent moisture soils were described by Feoli Chieppella & Poldini (1994) in the southern foothills of the Friulian Alps (NE Italy) and classified into the association *Gladiolo palustris-Molinietum arundinaceae*.

The third group comprises the relevés from Dobrča in the western Karavanke and Ravni hrib in the Kamnik Alps which are clearly syndynamically related with the stands of the association *Centaureo julici-Laserpitietum sileris*, but are a younger development stage in the over-

growing of former hay meadows in which tall umbellifers have not yet established themselves. The dominant species of the herb layer is therefore still one of the grasses, namely from the aggregate *Bromus erectus* agg.; we determined it as *Bromopsis transsilvanica*. Also occurring is the species *Sesleria caerulea* subsp. *calcaria* and some other character species of subalpine-alpine grasslands in the Southeastern Alps, such as *Laserpitium peucedanoides*, *Allium ericetorum*, *Asperula aristata* and endemic *Allium kermesinum*. These stands are classified into the association *Pediculari julici-Bromopsietum transsilvanicae* Seliškar, which we typify in this paper. The nomenclature type of the new association, *holotypus*, is relevé No. 30 in Table 1. The character species of the association are *Bromopsis transsilvanica* and *Pedicularis elongata* subsp. *julica*, the differential species of the association is *Festuca amethystina*. The latter is characteristic for stands of a similar association *Festuco amethystinae-Seslerietum calcariae*, in which, however, we did not record *Bromopsis transsilvanica*. *Bromopsis transsilvanica* is a southeastern-European montane species that usually occurs in the montane and subalpine belts (Aeschimann et al. 2004b, Jogan 2007). The new association *Pediculari julici-Bromopsietum transsilvanicae* is classified into the alliance *Caricion austroalpinae* and class *Elyno-Seslerietea*. Such classification is justified by some of the previously listed diagnostic species of subalpine grasslands that are well represented in this association. In terms of proportion, the species from the class *Festuco-Brometea* prevail, but the species of the class *Trifolio-Geranietea* are also frequent (Table 2, column 3).

Relevé No. 36 in Table 1 that was made under Javorov vrh is obviously floristically different from all other relevés compared and cannot be classified into any of the listed associations. For the time being it is classified for its dominant species *Laserpitium siler* into the provisional tall herb association *Astrantio majoris-Laserpitietum sileris* nom. prov.

Conclusions

Phytosociological analysis of former montane hay meadows on steep, sunny dolomite slopes in the altimontane belt (1000 m to 1450 m) in the southwestern foothills of the Julian Alps, in the foothills of the western Karavanke and Kamnik Alps demonstrated certain differences in dominant species that are partly the result of ecological differences and partly of the past or existing use and stage in the successional sere. Based on these differences we described the following new syntaxa and classified them as follows:

Elyno-Seslerietea Br.-Bl. 1948

Seslerietalia albicantis Br.-Bl. in Br.-Bl. & Jenny 1926
corr. Oberd. 1983

Caricion austroalpinae Sutter 1962

Centaureo julici-Laserpitietum sileris Dakskobler in Dakskobler & Poldini 2012

-*gladioletosum palustris* subass. nov.

Festuco amethystinae-Seslerietum calcariae ass. nov.

Pediculari julici-Bromopsietum transsilvanicae
Seliškar in Dakskobler et Seliškar ass. nov.

As these hay meadows were cleared in the belt of altimontane beech forests they are gradually becoming overgrown, mainly with spruce (*Picea abies*), common juniper (*Juniperus communis*), hazel (*Corylus avellana*), in places with hop hornbeam (*Ostrya carpinifolia*) and Austrian pine (*Pinus nigra*), and at higher elevations also with dwarf pine (*Pinus mugo*). Overgrowing can be hindered by the grazing of small ruminants (at Kriška gora, Zaplata), occasional cutting of young trees (Zaplata) as well as by natural factors such as annual avalanches. These former hay meadows are still very species-rich and a site of some protected, rare or threatened species (Anonymous 2002, 2004) such as *Festuca amethystina*, *Gladiolus palustris*, *Gentiana clusii*, *Gymnadenia conopsea*, *G. odoratissima*, *Dianthus hyssopifolius*, *D. sylvestris*, *Traunsteinera globosa*, *Arctostaphylos uva-ursi*, *Helleborus niger*, *Convallaria majalis* and *Veratrum nigrum*. The most threatened among them is *Gladiolus palustris*, a species of European conservation concern. Its protection areas in Slovenia include Dobrča, Zaplata, Javorov vrh and Ravni hrib (Seliškar 2004). In this article, we propose grasslands under Musc (Mali Muzec) and Ribežni (Kurnja) in the Stol ridge in southwestern Julian Alps as a new protection area – see also Čušin (2006). We have not yet recorded *Gladiolus palustris* under Kriška gora, but its occurrence is possible also on these grasslands. At present, all examined grasslands are largely left to the natural, but very slow, overgrowing processes. Their former use, namely late annual manual mowing in July or August, which would serve best to preserve the species diversity of these meadows, is no longer commercially viable. While the grazing of small ruminants slows down the overgrowing process it can, especially if intensive (parts of Kriška gora), considerably impoverish the species composition and lead to ruderalisation of grass swards.

Acknowledgements

In our field work we were assisted by Branko Zupan and Vid Dakskobler (Kriška gora). Iztok Sajko prepared Figures 1, 2, 3 and 4 for print. Two anonymous reviewers helped us with valuable improvements and corrections. English translation by Andreja Šalamon Verbič.

Povzetek

Dve novi združbi gorskih travišč v Jugovzhodnih Alpah (severna Slovenija)

Fitocenološka analiza nekdanjih gorskih senožeti na strmih, prisojnih dolomitnih pobočjih v altimontanskem pasu (1000 m do 1450 m) v jugozahodnem prigorju Julijskih Alp, v prigorju zahodnih Karavank in Kamniških Alp, je pokazala na nekatere razlike v dominantnih vrstah, ki so deloma posledica ekoloških razlik, pretekle oz. še obstoječe rabe in stopnje v sukcesijskem nizu. Na podlagi teh razlik smo opisali naslednje nove sintaksone, ki jih uvrščamo, kot sledi:

Elyno-Seslerietea Br.-Bl. 1948

Seslerietalia albicantis Br.-Bl. in Br.-Bl. & Jenny 1926
corr. Oberd. 1983

Caricion austroalpinae Sutter 1962

Centaureo julici-Laserpitietum sileris Dakskobler in Dakskobler & Poldini 2012

-*gladioletosum palustris* subass. nov.

Festuco amethystinae-Seslerietum calcariae ass. nov.

Pediculari julici-Bromopsietum transsilvanicae
Seliškar in Dakskobler et Seliškar ass. nov.

Ker so bile te senožeti izkrcene v pasu altimontanskih bukovih gozdov, se postopno zaraščajo, predvsem s smreko, z navadnim brinom, lesko, ponekod tudi s črnim gabrom, črnim borom in v višji nadmorski višini z rušjem. Zaraščanje ponekod zavira paša drobnice (Kriška gora, Zaplata), občasno sekanje mladih dreves (Zaplata), po naravni poti pa vsakoletni snežni plazovi. Te nekdanje senožeti so za zdaj vrstno zelo bogate in v njih uspevajo tudi nekatere zavarovane, redke ali varstveno ogrožene vrste (Anon. 2002, 2004), kot so *Festuca amethystina*, *Gladiolus palustris*, *Gentiana clusii*, *Gymnadenia conopsea*, *G. odoratissima*, *Dianthus hyssopifolius*, *Traunsteinera globosa*, *Dianthus sylvestris*, *Arctostaphylos uva-ursi*, *Helleborus niger*, *Convallaria majalis* in *Veratrum nigrum*. Med naštetimi je najbolj ogrožena evropsko varstveno pomembna vrsta *Gladiolus palustris*. Njena varstvena območja v Sloveniji so tudi Dobrča, Zaplata, Javorov vrh in Ravni hrib (Seliškar 2004), kot novo varstveno območje pa v tem članku predlagamo travišča pod Muscem (Malim Muzcem) in Ribežni (Kurnja) v Stolovem grebenu – glej tudi Čušin (2006). Pod Kriško goro močvirskega mečka za zdaj še nismo popisali, a je njegovo uspevanje tudi na teh traviščih mogoče. Za zdaj so vsa preučena travišča v glavnem prepuščena naravnim procesom zaraščanja, ki pa so počasni. Nekdanja raba, ki bi najbolj ohranjala vrstno pisanost teh travnikov, to

je vsakoletna pozna ročna košnja v juliju ali avgustu, ni več gospodarna. Paša drobnice zaraščanje zavira, vendar posebej, če je bolj intenzivna (deli Kriške gore), vrstno sestavo zelo siromaši in travno rušo ruderalizira.

References

- Aeschimann, D., Lauber, K., Moser, D. M. & Theurillat, J.-P. 2004 a: Flora alpina. Bd. 1: *Lycopodiaceae-Apiaceae*. Haupt Verlag, Bern, Stuttgart, Wien, 1159 pp.
- Aeschimann, D., Lauber, K., Moser, D. M. & Theurillat, J.-P. 2004 b: Flora alpina. Bd. 2: *Gentianaceae-Orchidaceae*. Haupt Verlag, Bern, Stuttgart, Wien, 1188 pp.
- Aeschimann, D., Lauber, K., Moser, D. M. & Theurillat, J.-P. 2004 c: Flora alpina. Bd. 3: Register. Haupt Verlag, Bern, Stuttgart, Wien, 322 pp.
- Anonymous 2002: Pravilnik o uvrstitvi ogroženih rastlinskih in živalskih vrst v rdeči seznam. Uradni list RS 82/2002.
- Anonymous 2004: Uredba o zavarovanih prosto živečih rastlinskih vrstah. Uradni list RS 46/2004.
- Braun-Blanquet, J. 1964: Pflanzensoziologie. Grundzüge der Vegetationskunde. 3. Auflage. Springer, Wien – New York, 865 pp.
- Buser, S. 2009: Geological map of Slovenia 1:250,000. Geološki zavod Slovenije, Ljubljana.
- Cegnar T. 1998: Temperatura zraka. In: Fridl, J., Kladnik, D., Orožen Adamič, M. & Perko, D. (eds.): Geografski atlas Slovenije. Država v prostoru in času. Državna založba Slovenije, Ljubljana, pp. 100–101.
- Čušin, B. 2006: Rastlinstvo Breginjskega kota. Založba ZRC, ZRC SAZU, Ljubljana, 198 pp.
- Dakskobler, I. 2003: Pioneer spruce stands above the actual (anthropogenic) upper forest line in the southern Julian Alps (an example from the upper Bača Valley). *Hacquetia* 2 (1): 19–37.
- Dakskobler, I., Vreš, B. & Anderle, B. 2007: Novelty of flora in the Slovenian part of the Julian Alps. *Razprave 4. razreda SAZU* 48 (2): 139–192.
- Dakskobler, I. & Poldini, L. 2012: Two new tall herb communities with the dominant *Laserpitium siler* and *Grafia golaka* from the SE Alps (NE Italy, W Slovenia). *Hacquetia* 11 (1): 47–89.
- Feoli Chiappella, L. & Poldini, L. 1994: Prati e pascoli del Friuli (NE Italia) su substrati basici. *Studia Geobotanica* 13 (1993): 3–140.
- Jogan, N. 2007: *Poaceae (Gramineae)* – trave. In: A. Martinčič (ed.): Mala flora Slovenije. Ključ za določanje praprotnic in semenk. Tehniška založba Slovenije, četrta, dopolnjena in spremenjena izdaja, Ljubljana. pp. 826–933.
- Maarel van der, E. 1979: Transformation of cover-abundance values in phytosociology and its effects on community similarity. *Vegetatio* 39 (2): 97–114.
- Martinčič, A. 2003: Seznam listnatih mahov (*Bryopsida*) Slovenije. *Hacquetia* (Ljubljana) 2 (1): 91–166.
- Martinčič, A., Wraber, T., Jogan, N., Podobnik, A., Turk, B., Vreš, B., Ravnik, V., Frajman, B., Sturgule Krajšek, S., Trčak, B., Bačič, T., Fischer, M. A., Eler, K. & Surina, B. 2007: Mala flora Slovenije. Ključ za določanje praprotnic in semenk. Četrta, dopolnjena in spremenjena izdaja. Tehniška založba Slovenije, Ljubljana, 967 pp.
- Podani, J. 2001: SYN-TAX 2000. Computer Programs for Data Analysis in Ecology and Systematics. User's Manual, Budapest, 53 pp.
- Rösler, S. 1997: Die Rasengesellschaften der Klasse *Seslerietea* in den Bayerischen Alpen und ihre Verzahnung mit dem *Carlino-Caricetum sempervirentis* (Klasse *Festuco-Brometea*). *Hoppea, Denkschr. Regensb. Bot. Ges.* 58: 5–215.
- Seliškar, A. 1993: Übersicht der Wiesenvegetation der Kamniško-Savinjske Alpen. In: Zupančič, M. (ed.): Flora in vegetacija Kamniško-Savinjskih Alp: referati = Flora und Vegetation der Kamniško-Savinjske Alpen: Referaten. Biološki inštitut ZRC SAZU, Ljubljana, pp. 9–16.
- Seliškar, A. 1996: Traviščna in močvirna vegetacija. In: Gregori, J. & al. (eds.): Narava Slovenije, stanje in perspektive. Društvo ekologov Slovenije, Ljubljana, pp. 99–106.
- Seliškar, A. 2004: *Gladiolus palustris* Gaudin – močvirski meček. In: Čušin, B. (ed.): Natura 2000 v Sloveniji – rastline, ZRC, ZRC SAZU, Ljubljana, pp. 97–101.
- Seliškar, T., Vreš, B. & Seliškar, A. 2003: FloVegSi 2.0. Računalniški program za urejanje in analizo bioloških podatkov. Biološki inštitut ZRC SAZU, Ljubljana.
- Šilc, U. & Čarni, A. 2012: Conspectus of vegetation syntaxa in Slovenia. *Hacquetia* 11 (1): 113–164.
- Zupančič, B. 1998: Padavine. In: Fridl, J., Kladnik, D., Orožen Adamič, M. & Perko, D. (eds.): Geografski atlas Slovenije. Država v prostoru in času. Državna založba Slovenije, Ljubljana, pp. 98–99.

Table 1: Altimontane grasslands with *Gladiolus palustris* – the Julian and Kamnik Alps, western Karavanke.

Tabela 1: Altimontanska travnišča z vrsto *Gladiolus palustris* – Julijske in Kamniške Alpe, zahodne Karavanke.

Number of relevé (Zaporedna številka popisa)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Database number of relevé (Delovna številka popisa)	132159	254015	254020	254019	254021	254025	254024	254022	254023	8016	8053	128516	8021	8045	8046
Author of relevé (Avtor popisa)	AS	ID	ID	ID	ID	ID	ID	ID	ID	AS	AS	AS	AS	AS	AS
Elevation in m (Nadomska višina v m)	1170	1360	1380	1280	1445	1320	1380	1430	1450	1100	1250	1000	1050	1350	1320
Aspect (Lega)	S	SSW	S	S	SW	SSW	S	S	SW	SE	S	E	S	S	S
Slope in degrees (Nagib v stopinjah)	40	40	40	35	35	35	35	35	35	50	40	40	45	40	40
Parent material (Matična podlaga)	A	D	D	D	D	D	D	D	D	A	D	D	D	D	D
Soil (Tla)	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re
Stoniness in % (Kamnitost v %)	.	10	5	.	.	.	.	5	.	.	.	.	.	.	.
Cover of shrub layer in % (Zastiranje grmovne plasti v %)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cover of herb layer in % (Zastiranje zeliščne plasti v %)	100	100	95	100	100	100	100	95	100	100	100	100	100	90	100
Number of species (Število vrst)	53	49	58	48	45	49	48	40	40	37	41	52	47	42	34
Relevé area (Velikost popisne ploskve)	m ²	50	20	20	20	20	20	20	20	25	25	50	50	25	25
Date of taking relevé (Datum popisa)		7/9/1981	8/18/2014	8/18/2014	8/18/2014	8/18/2014	8/18/2014	8/18/2014	8/18/2014	7/10/1984	7/30/1981	7/7/1981	8/11/1984	7/22/1982	7/22/1982
Locality (Nahajališče)		Kriška g. - Stajnar	Kriška g. - Stajnar	Kriška g. - Stajnar	Kriška g. - Stajnar	Kriška g. - Stajnar	Kriška g. - Stajnar	Kriška g. - Stajnar	Kriška g. - Stajnar	Javorov vrh	Zaplata - Cjanovca	Ravni hrib	Zaplata - Cjanovca	Dobrča	Dobrča
Quadrant (Kvadrant)		9652/3	9652/3	9652/3	9652/3	9652/3	9652/3	9652/3	9652/3	9652/4	9652/4	9753/2	9652/4	9651/2	9651/2
Coordinate GK Y (D-48)	m	450719	451276	451624	451208	451364	450971	451306	451248	451044	459285	457561	472298	443268	443458
Coordinate GK X (D-48)	m	5133510	5133463	5133401	5133364	5133546	5133632	5133502	5133649	5133798	5130726	5131767	5125680	5131454	5136810

Diagnostic species of the association *Festuco amethystinae-Seslerietum calcariae*

ES <i>Sesleria caerulea</i> subsp. <i>calcaria</i>	E1	+	4	3	3	4	4	4	4	4	1	+	+	+	2	+
EP <i>Festuca amethystina</i>	E1	1	1	1	1	1	1	1	1	1	.	.	.	.	.	+
FB <i>Asperula tinctoria</i>	E1	+	+	+	.	+	+	+	.	+	.	.	.	.	.	.
EP <i>Calamagrostis varia</i>	E1	2	2	+	2	3	2	1	1	1	.	.	.	.	.	.
TG <i>Achillea distans</i>	E1	.	+	.	+	+	.	+	+	+	.	.	.	.	.	.
FB <i>Orobanche alba</i>	E1	.	+	.	+	.	+	+	+	.	.	.	.	.	.	.
ES <i>Euphrasia salisburgensis</i>	E1	.	+	+	.	.	+	.	.	+	.	.	.	.	.	.
ES <i>Phleum hirsutum</i>	E1	+	.	.	.	.	.	.	+	1	.	.	.	.	.	.

Diagnostic species of the subassociation *Centaureo julici-Laserpitietum sileris gladietosum palustris*

TG <i>Laserpitium siler</i>	E1	.	2	4	1	.	.	.	.	.	3	3	4	4	3	4
Mo <i>Gladiolus palustris</i>	E1	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+
TG <i>Lilium carnioolicum</i>	E1	.	+	+	.	.	.	.	+	.	.	.	.	+	.	.
ES <i>Laserpitium peucedanoides</i>	E1	+	.	.	.	.	+	.	.	.	+	1	.	.	.	.
ES <i>Carduus crassifolius</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ES <i>Serratula tinctoria</i> subsp. <i>macrocephala</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ES <i>Centaurea haynaldii</i> subsp. <i>julica</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ES <i>Gentiana lutea</i> subsp. <i>symphyandra</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
TG <i>Laserpitium latifolium</i>	E1	.	.	.	.	.	.	.	.	.	.	1	.	+	.	.

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
5127279	5127335	5127387	5127435	5127526	5127490	5127661	5127604	5127648	5127281	5137088	5136961	5136814	5136933	5137183	5137098	5137082	5136881	5136776	5126005	5130920
378210	378214	378189	378195	378243	378240	378212	378225	378238	378272	442208	441898	442669	442616	442253	442136	442133	442258	442650	472508	459402
9746/2	9746/2	9746/2	9746/2	9746/2	9746/2	9746/2	9746/2	9746/2	9746/2	9651/1	9651/1	9651/2	9651/2	9651/1	9651/1	9651/1	9651/1	9651/2	9753/2	9652/4
Muzec - Prekopa	Muzec - Prekopa	Muzec-Boban	Muzec - Prekopa	Muzec - Prekopa	Muzec - Prekopa	Muzec - Prekopa	Muzec - Planjca	Muzec - Planjca	Muzec - Boban	Dobrča	Dobrča	Dobrča	Dobrča	Dobrča	Dobrča	Dobrča	Dobrča	Dobrča	Ravni hrib	Javorov vrh
7/19/2014	7/19/2014	8/2/2014	7/19/2014	7/19/2014	7/19/2014	7/19/2014	8/2/2014	8/2/2014	8/2/2014	6/30/1982	8/12/1984	7/22/1982	7/22/1982	6/30/1982	6/30/1982	7/2/1981	7/2/1981	7/2/1981	8/7/1984	7/10/1984
1035	1060	1080	1095	1145	1120	1210	1180	1210	1005	1357	1200	1317	1370	1440	1330	1320	1270	1250	1100	1100
SE	SE	SW	SW	SE	SE	SW	SW	SWW	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
15	30	25	25	35	30	20	35	30	30	45	45	50	40	40	45	45	40	45	45	45
D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re	Re
.	.	.	.	.	5	10	.	.	10	.	.	.	.	.	.	.	.	.	.	.
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
39	36	29	37	35	44	43	43	39	39	45	45	48	47	43	62	45	46	49	58	33
20	20	20	20	20	20	20	20	20	20	25	25	25	25	25	25	50	25	50	25	25
7/19/2014	7/19/2014	8/2/2014	7/19/2014	7/19/2014	7/19/2014	7/19/2014	8/2/2014	8/2/2014	8/2/2014	6/30/1982	8/12/1984	7/22/1982	7/22/1982	6/30/1982	6/30/1982	7/2/1981	7/2/1981	7/2/1981	8/7/1984	7/10/1984
Muzec - Prekopa	Muzec - Prekopa	Muzec-Boban	Muzec - Prekopa	Muzec - Prekopa	Muzec - Prekopa	Muzec - Prekopa	Muzec - Planjca	Muzec - Planjca	Muzec - Boban	Dobrča	Dobrča	Dobrča	Dobrča	Dobrča	Dobrča	Dobrča	Dobrča	Dobrča	Ravni hrib	Javorov vrh
9746/2	9746/2	9746/2	9746/2	9746/2	9746/2	9746/2	9746/2	9746/2	9746/2	9651/1	9651/1	9651/2	9651/2	9651/1	9651/1	9651/1	9651/1	9651/2	9753/2	9652/4
378210	378214	378189	378195	378243	378240	378212	378225	378238	378272	442208	441898	442669	442616	442253	442136	442133	442258	442650	472508	459402
Pr. 1-9	Pr. 10-25	Pr. 26-36	Pr.-Total	Fr.-Total																
9	16	10	35	97																
9	1	7	17	47																
7	0	5	12	33																
9	0	0	9	25																
6	0	0	6	17																
5	0	0	5	14																
4	0	0	4	11																
3	0	0	3	8																
3	16	4	23	64																
0	16	3	19	53																
3	8	6	17	47																
2	3	5	10	28																
0	9	0	9	25																
0	6	0	6	17																
0	5	0	5	14																
0	4	0	4	11																
0	2	1	3	8																

Number of relevé (Zaporedna številka popisa)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Diagnostic species of the association <i>Pediculari julici-Bromopsietum transsilvanicae</i>																
FB	<i>Bromopsis transsilvanica</i>	E1	.	.	.	.	.	.	.	.	.	.	+	.	1	+
ES	<i>Pedicularis elongata</i> subsp. <i>julica</i>	E1	.	.	.	.	.	.	.	.	+	+	.	.	+	+
CA	<i>Caricion austroalpinae</i>															
	<i>Allium ericetorum</i>	E1	.	.	1	1	1	1	1	1	.	+	.	.	+	.
	<i>Asperula aristata</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	+	+
	<i>Allium kermesinum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	.
	<i>Festuca calva</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.
	<i>Ranunculus hybridus</i>	E1	.	.	.	.	.	.	.	.	.	+	.	.	.	.
ES	<i>Elyno-Seslerietea</i>															
	<i>Phyteuma orbiculare</i>	E1	+	.	.	+	+	.	.	.	1	+	.	+	+	.
	<i>Betonica alopecurus</i>	E1	.	1	.	1	.	1	1	+	+	1	.	.	+	1
	<i>Carex sempervirens</i>	E1	+	.	.	.	.	.	1	+	2	.	.	+	.	.
	<i>Thymus praecox</i> subsp. <i>polytrichus</i>	E1	+	+	.	1	1	2	1	+	2	.	.	.	+	.
	<i>Helictotrichon parlatorei</i>	E1	1	1	+	.	+	2	2	2	1	.	+	.	.	.
	<i>Acinos alpinus</i>	E1	.	+	.	.	+	.	.	+	.	.	+	.	.	.
	<i>Scabiosa triandra</i>	E1	+	.	.	.	.	.	.	.	.	+	.	.	1	+
	<i>Campanula witasekiana</i>	E1	.	.	.	.	+	+	+	+	.	.	.	.	.	.
	<i>Leucanthemum heterophyllum</i> (<i>L. maximum</i> s. lat.)	E1	.	.	.	.	.	.	.	.	.	+	.	.	.	+
	<i>Scabiosa lucida</i> subsp. <i>stricta</i>	E1	.	.	+	+	+	+	+	+	.	.	.	.	.	.
	<i>Globularia cordifolia</i>	E1	.	.	+	.	.	.	.	.	.	.	.	.	.	.
	<i>Campanula thyrsoides</i>	E1	.	+	+	.	.	.	.	.	.	.	+	.	.	.
	<i>Rhinanthus glacialis</i>	E1	.	.	+	.	.	.	.	.	.	.	.	+	+	+
	<i>Ranunculus montanus</i>	E1	.	.	.	.	.	+	+	+	.	.	.	.	.	.
	<i>Gentiana clusii</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Gentiana utriculosa</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.
	<i>Orobanche reticulata</i>	E1	.	r	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Carduus defloratus</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Polygonum viviparum</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Astrantia bavarica</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Carex mucronata</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Helianthemum alpestre</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Heliosperma alpestre</i>	E1	.	.	.	.	.	+	.	.	.	.	.	.	.	.
	<i>Polygala alpestris</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Thesium alpinum</i>	E1	.	.	.	.	.	+	.	.	.	.	.	.	.	.
	<i>Thesium pyrenaicum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	.
FB	<i>Festuco-Brometea</i>															
	<i>Helianthemum nummularium</i> s. lat. (inc. <i>H. grandiflorum</i>)	E1	1	+	1	+	1	+	1	1	2	.	1	1	1	.
	<i>Buphthalmum salicifolium</i>	E1	+	1	+	1	1	1	1	+	.	1	1	1	+	+
	<i>Carex humilis</i>	E1	+	3	3	2	2	2	2	.	1	1	.	2	1	1
	<i>Prunella grandiflora</i>	E1	1	+	+	+	+	+	1	.	.	.	+	+	1	+
	<i>Inula hirta</i>	E1	.	+	1	1	+	+	+	+	.	+	.	+	.	+
	<i>Galium lucidum</i>	E1	1	1	+	1	1	1	1	1	1	+	.	+	+	+
	<i>Galium verum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	+	+
	<i>Gymnadenia conopsea</i>	E1	1	.	1	.	.	.	.	.	.	1	+	1	+	+
	<i>Centaurea scabiosa</i> subsp. <i>fritschii</i>	E1	.	.	1	1	.	.	.	.	.	+	+	+	+	+
	<i>Carlina acaulis</i>	E1	.	.	+	.	+	+	+	+	+	+	+	+	.	.
	<i>Koeleria pyramidata</i>	E1	+	+	+	.	+	+	1	2	1	.	.	+	.	+
	<i>Teucrium montanum</i>	E1	.	+	1	.	.	.	.	.	.	.	.	+	+	+
	<i>Dianthus hyssopifolius</i>	E1	.	1	1	1	1	1	.	1	1	.	.	.	1	+
	<i>Cirsium erisithales</i>	E1	1	+	+	2	1	.	1	+	+	1	.	.	.	.
	<i>Stachys recta</i> s. lat.	E1	+	+	+	.	.	.	.	.	.	.	+	1	.	1
	<i>Trifolium montanum</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Briza media</i>	E1	+	.	.	.	+	2	1	1	1	.	.	+	.	.

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Pr. 1-9	Pr. 10-25	Pr. 26-36	Pr.-Total	Fr.-Total
2	2	1	1	+	1	1	1	+	.	1	1	3	3	2	2	2	2	1	2	.	0	12	10	22	61
.	+	.	+	1	+	+	+	+	.	.	0	4	7	11	31
.	.	+	+	+	1	+	+	+	+	+	+	+	.	.	.	7	6	8	21	58
.	.	.	+	+	+	+	+	+	+	.	+	+	+	.	0	9	3	12	33
.	1	.	0	1	1	2	6
.	0	1	0	1	3
.	0	1	0	1	3
+	+	+	+	+	+	+	.	+	+	+	+	+	+	+	+	+	.	+	+	+	3	13	10	26	72
.	.	+	1	1	1	1	1	1	+	1	1	1	1	.	.	.	.	1	.	6	11	5	22	61
.	1	1	+	.	.	+	1	1	.	+	.	+	.	+	2	+	.	+	+	3	8	7	18	50	
.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	.	+	8	1	5	14	39
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	8	1	3	12	33
.	.	.	.	.	.	.	.	.	.	+	+	.	+	+	+	+	+	+	.	3	1	7	11	31
.	.	.	.	.	.	.	.	.	.	+	.	.	+	1	1	1	+	+	.	1	3	7	11	31
.	.	+	+	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	4	5	0	9	25
.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	+	+	+	+	.	0	2	7	9	25
.	.	.	.	.	.	.	+	1	+	.	.	.	.	.	.	.	.	.	.	5	3	0	8	22
.	.	.	.	.	+	.	.	.	.	.	+	+	+	.	.	.	.	.	.	1	1	3	5	14
.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	0	4	11
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3	0	4	11
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	0	0	3	8
.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	0	1	1	2	6
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	0	1	1	2	6
.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	0	2	6
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0	0	1	3
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0	0	1	3
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	1	1	3
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	1	1	3
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0	0	1	3
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	1	1	3
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0	0	1	3
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	1	0	1	3
+	+	+	+	1	+	1	1	+	.	+	1	+	+	1	1	1	1	+	1	.	9	12	10	31	86
.	.	.	+	1	+	+	+	+	+	+	+	1	1	+	+	+	+	+	+	8	13	10	31	86	
1	2	.	2	2	2	2	1	1	1	+	1	1	1	1	1	.	.	+	1	.	8	14	8	30	83
.	.	+	+	+	.	1	.	+	.	.	+	+	1	.	1	+	+	+	+	7	10	8	25	69	
+	.	+	1	+	+	+	+	.	+	+	1	+	+	.	1	1	+	.	.	7	11	7	25	69	
.	.	.	.	.	.	.	.	.	.	.	1	1	1	+	+	1	1	+	+	9	4	10	23	64
1	+	+	1	1	1	1	+	+	+	+	1	+	1	+	1	+	+	+	1	.	0	14	10	24	67
.	+	+	+	+	.	.	+	+	.	.	+	+	+	1	+	1	+	+	.	2	12	8	22	61	
+	+	+	.	.	+	+	.	.	1	+	1	1	.	.	+	.	1	1	+	2	12	7	21	58	
.	.	.	.	.	.	+	+	+	.	.	1	.	+	+	1	.	+	+	+	6	7	7	20	56
.	.	.	.	.	.	+	.	.	.	1	.	+	1	+	+	.	+	+	+	8	3	8	19	53
+	+	+	+	1	+	.	+	.	+	.	+	+	+	.	.	.	.	.	+	2	12	4	18	50
.	.	.	+	1	1	+	+	+	.	.	.	.	+	.	.	.	.	.	.	7	9	1	17	47
.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	+	+	.	+	1	8	3	5	16	44
.	.	.	.	.	+	.	.	.	+	.	+	+	+	1	1	1	1	.	.	3	6	8	17	47
1	+	+	+	.	+	.	.	+	.	1	+	.	.	.	1	.	.	+	+	2	6	5	13	36	
.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	+	+	.	6	1	5	12	33

Number of relevé (Zaporedna številka popisa)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Peucedanum oreoselinum</i>	E1	+	.	.	.	.	.	.	.	+	.	+	+	.	+
<i>Coronilla vaginalis</i>	E1	.	+	+	.	.	+	.	.	.	.	.	.	.	+
<i>Euphorbia cyparissias</i>	E1	.	.	+	+	.	1	.	.	.	.	1	.	.	.
<i>Teucrium chamaedrys</i>	E1	.	1	+	1	.	+	.	.	.	.	.	+	+	1
<i>Euphorbia verrucosa</i>	E1	.	.	.	.	.	.	.	.	+	.	.	+	+	.
<i>Hypochoeris maculata</i>	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Anthyllis vulneraria</i> s. lat.	E1	.	.	+	.	.	.	+	.	.	.	+	+	+	.
<i>Linum viscosum</i>	E1	.	.	+	.	.	.	.	.	.	+	+	+	.	.
<i>Allium carinatum</i> subsp. <i>carinatum</i>	E1	.	+	.	1	.	+	.	.	.	.	+	.	.	.
<i>Brachypodium rupestre</i>	E1	.	.	.	1	+	.	+	.	1	.	.	+	.	.
<i>Asperula cynanchica</i>	E1	.	.	.	.	.	.	.	.	.	+	+	.	.	+
<i>Cirsium pannonicum</i>	E1	.	.	.	.	.	.	.	.	.	.	+	.	+	.
<i>Linum catharticum</i>	E1	.	.	+	.	.	.	.	+	.	.	.	.	+	.
<i>Campanula glomerata</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Salvia pratensis</i>	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Scabiosa columbaria</i>	E1	.	.	.	.	.	.	.	.	.	.	1	+	.	.
<i>Centaurea triumfettii</i>	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	.
<i>Genista tinctoria</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hippocrepis comosa</i>	E1	.	+	+	.	.	+	.	.	.	.	.	.	.	.
<i>Plantago media</i>	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Orobanche vulgaris</i>	E1	+	.	+	.	.	.	+	.	.	.	.	.	.	.
<i>Dorycnium germanicum</i>	E1	.	.	.	.	.	.	.	.	.	.	1	.	1	.
<i>Pimpinella saxifraga</i>	E1	.	.	.	.	+	1	.	+	.	.	.	.	.	.
<i>Festuca rupicola</i>	E1	+	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Galium purpureum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Orobanche gracilis</i>	E1	.	.	.	.	.	+	+	.	.	.	.	.	.	.
<i>Thymus pulegioides</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Achillea pannonica</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Campanula rotundifolia</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Centaurea bracteata</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cirsium x linkianum</i>	E1	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Festuca ovina</i> agg.	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Orchis</i> sp.	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polygala comosa</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ranunculus polyanthemus</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Thesium linophyllum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PaT <i>Poo alpinae-Trisetalia</i>															
<i>Astrantia major</i>	E1	1	.	.	+	.	.	+	.	.	1	1	.	.	.
<i>Traunsteinera globosa</i>	E1	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Trollius europaeus</i>	E1	.	.	.	.	.	.	+	.	+	.	.	.	.	.
<i>Ranunculus nemorosus</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Campanula scheuchzeri</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pimpinella major</i> subsp. <i>rubra</i>	E1	.	.	.	.	1	.	.	.	.	.	.	.	.	.
MA <i>Molinio-Arrhenatheretea</i>															
<i>Lotus corniculatus</i> s. lat.	E1	+	.	+	.	.	.	.	+	+	+	1	+	+	.
<i>Dactylis glomerata</i>	E1	+	.	.	.	+	+	.	+	.	.	.	.	.	.
<i>Centaurea jacea</i>	E1	.	.	.	.	.	.	.	.	.	+	.	+	.	.
<i>Lathyrus pratensis</i>	E1	+	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Vicia cracca</i>	E1	+	+	.	+	.	.	.	.	.	.	.	.	.	.
<i>Leucanthemum ircutianum</i>	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Ranunculus acris</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Trifolium pratense</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Festuca rubra</i>	E1	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Heracleum sphondylium</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Pr. 1-9	Pr. 10-25	Pr. 26-36	Pr.-Total	Fr.-Total
+	1	1	.	+	+	.	.	.	.	+	1	.	1	6	5	12	33
.	.	+	+	+	+	+	+	+	+	.	.	.	3	3	6	12	33
.	+	+	+	+	1	+	1	.	.	3	3	5	11	31
.	+	1	+	1	+	.	.	.	1	.	4	3	4	11	31
.	+	1	+	+	+	.	.	.	.	+	+	0	3	7	10	28
+	r	.	+	.	+	.	.	.	+	+	+	.	.	.	+	.	.	.	+	.	0	6	4	10	28
.	.	.	+	.	.	.	+	+	.	.	.	+	+	+	2	4	3	9	25
.	.	.	+	+	.	.	+	+	+	1	8	0	9	25
+	+	.	.	.	+	+	.	3	4	1	8	22
.	1	.	.	.	.	.	.	.	.	+	+	4	1	3	8	22
.	1	1	.	+	.	.	0	3	3	6	17
.	+	1	.	+	.	.	.	.	.	1	.	0	2	4	6	17
.	+	1	.	.	.	.	.	+	.	2	2	2	6	17
.	.	.	.	+	.	.	+	.	.	.	+	+	+	0	2	3	5	14
.	+	+	.	.	.	+	.	.	+	.	.	0	1	4	5	14
.	+	+	+	.	0	2	3	5	14
.	.	.	.	+	.	.	.	+	+	0	3	1	4	11
+	.	+	+	.	+	0	4	0	4	11
.	+	3	1	0	4	11
.	+	.	.	+	.	.	.	+	.	0	1	3	4	11
.	3	0	0	3	8
.	+	.	0	2	1	3	8
.	3	0	0	3	8
.	2	0	0	2	6
+	+	0	2	0	2	6
.	2	0	0	2	6
.	+	.	+	0	1	1	2	6
.	1	0	0	1	3
.	+	.	0	0	1	1	3
.	0	1	0	1	3
.	1	0	0	1	3
.	+	0	0	1	1	3
.	+	0	0	1	1	3
.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	1	0	1	3
.	+	+	.	.	.	+	.	+	+	+	1	3	2	7	12	33
.	.	.	+	.	+	+	+	.	.	+	.	+	.	.	+	1	4	3	8	22
.	2	0	0	2	6
.	+	.	.	+	.	.	0	0	2	2	6
.	1	0	0	1	3
.	1	0	0	1	3
+	+	.	.	.	+	+	+	+	+	+	+	1	.	+	+	+	3	8	10	21	58
.	4	0	0	4	11
.	+	+	.	.	0	2	2	4	11
.	+	2	0	1	3	8
.	3	0	0	3	8
.	+	+	.	0	1	2	3	8
.	+	1	0	1	2	6
.	1	0	0	1	3
.	1	0	0	1	3
.	+	0	0	1	1	3

Number of relevé (Zaporedna številka popisa)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
	<i>Leontodon hispidus</i> subsp. <i>hispidus</i>	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	.
CU	Calluno-Ulicetea																
	<i>Potentilla erecta</i>	E1	+	.	.	+	+	1	1	+	+	1	+	.	+	.	
	<i>Polygala vulgaris</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	+
	<i>Anthoxanthum odoratum</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Calluna vulgaris</i>	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	.
	<i>Carex pilulifera</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	.
	<i>Genista germanica</i>	E1	.	.	+	.	.	.	.	.	.	.	.	.	.	.
	<i>Lathyrus linifolius</i>	E1	.	.	.	.	.	.	+	.	.	.	.	.	.	.
	<i>Viola canina</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
MuA	Mulgedio-Aconitetea																
	<i>Veratrum album</i>	E1	.	.	.	.	+	.	+	.	+	.	.	.	.	.
	<i>Aconitum lycoctonum</i> s. lat.	E1	.	.	.	.	.	.	.	+	+	.	.	.	.	.
	<i>Hypericum maculatum</i>	E1	.	.	.	.	.	.	.	+	+	.	.	.	.	.
	<i>Silene vulgaris</i> subsp. <i>antelopum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.
BA	Betulo-Alnetea viridis																
	<i>Salix appendiculata</i>	E2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Salix glabra</i>	E2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.
TG	Trifolio-Geranietea																
	<i>Anthericum ramosum</i>	E1	.	+	1	2	.	.	1	.	.	1	1	1	1	+	1
	<i>Thalictrum minus</i>	E1	+	+	+	+	.	+	.	.	.	+	1	+	+	+	+
	<i>Polygonatum odoratum</i>	E1	.	+	+	+	.	.	.	.	.	.	+	1	+	+	+
	<i>Geranium sanguineum</i>	E1	2	1	+	+	r	1	1	1	.	.	.	+	.	1	.
	<i>Vincetoxicum hirundinaria</i>	E1	.	.	.	2	.	.	.	.	.	1	.	+	.	1	+
	<i>Thesium bavarum</i>	E1	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+
	<i>Silene nutans</i>	E1	.	+	.	.	.	.	.	+	.	.	+	.	.	+	+
	<i>Grafia golaka</i>	E1	.	+	.	1	1	.	1	.	.	.	.	.	.	.	.
	<i>Iris graminea</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Origanum vulgare</i>	E1	.	1	.	+	+	+	.	.	.	.	.	.	.	.	.
	<i>Verbascum lanatum</i>	E1	.	.	.	+	+	+	.	1	+	.	.	.	.	.	.
	<i>Valeriana nemorensis</i>	E1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Libanotis sibirica</i> subsp. <i>montana</i>	E1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
	<i>Viola hirta</i>	E1	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.
	<i>Trifolium rubens</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Hypericum perforatum</i>	E1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Lembotrops nigricans</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
	<i>Trifolium alpestre</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Verbascum austriacum</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
RP	Rhamno-Prunetea																
	<i>Juniperus communis</i>	E2a	.	+	+	+	+	.	.	.	+	r	.	.	.	.	.
	<i>Rosa canina</i>	E2a	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
TG	Thlaspietea rotundifolii																
	<i>Biscutella laevigata</i>	E1	+	.	.	+	+	.	+	+	.	+	.	.	+	+	+
	<i>Campanula cespitosa</i>	E1	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Hieracium porrifolium</i>	E1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
AT	Asplenietea trichomanis																
	<i>Dianthus sylvestris</i>	E1	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.
	<i>Erysimum sylvestre</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Saxifraga crustata</i>	E1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Silene hayekiana</i>	E1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Valeriana saxatilis</i>	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
EP	Erico-Pinetea																
	<i>Molinia caerulea</i> subsp. <i>arundinacea</i>	E1	.	.	.	1	.	+	+	.	.	2	2	+	1	+	1
	<i>Erica carnea</i>	E1	.	3	3	1	2	3	+	+	3	+	.	+	1	.	.

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Pr. 1-9	Pr. 10-25	Pr. 26-36	Pr.-Total	Fr.-Total	
.	0	1	0	1	3
+	+	1	1	+	+	+	1	1	1	+	.	.	.	+	1	.	1	1	+	+	.	7	13	7	27	75
.	+	+	.	.	.	0	2	2	4	11
.	1	0	0	1	3
.	0	1	0	1	3
.	0	1	0	1	3
.	1	0	0	1	3
.	1	0	0	1	3
.	+	.	.	0	0	1	1	3
.	1	3	0	1	4	11
.	+	2	0	1	3	8
.	2	0	0	2	6
.	+	0	1	1	2	6
.	+	+	+	0	3	0	3	8
.	+	0	1	0	1	3
3	3	3	3	2	2	2	2	2	3	+	1	1	1	+	1	1	1	+	+	.	4	16	10	30	83	
+	1	.	.	+	+	+	.	+	1	+	1	+	+	+	.	+	+	+	+	.	5	13	9	27	75	
1	1	2	1	1	1	1	1	1	1	+	1	1	+	.	.	1	+	+	+	+	3	15	9	27	75	
.	1	.	1	+	.	+	1	+	.	+	.	8	2	7	17	47	
1	+	.	.	.	+	+	+	.	+	+	.	+	.	.	+	+	.	.	.	1	1	10	5	16	44	
+	.	.	+	+	.	+	+	.	.	+	+	+	.	.	+	+	.	.	+	.	0	7	6	13	36	
.	+	+	.	+	+	+	+	.	.	2	4	5	11	31	
r	+	1	2	2	.	.	.	.	.	.	.	.	.	.	.	.	4	5	0	9	25	
1	.	.	+	.	.	2	+	1	.	.	.	.	.	.	+	.	+	.	.	+	0	5	3	8	22
.	+	4	1	0	5	14	
.	5	0	0	5	14	
.	+	+	2	0	3	3	8	
.	+	0	2	1	3	8	
+	2	1	0	3	8	
+	+	0	2	0	2	6	
.	1	0	0	1	3	
.	0	1	0	1	3	
.	0	1	0	1	3	
.	1	0	0	1	3	
+	+	+	1	.	.	+	.	.	.	.	.	.	.	.	5	5	1	11	31	
.	0	1	0	1	3	
+	+	1	+	.	+	.	+	+	+	1	+	5	5	9	19	53	
.	2	0	0	2	6	
.	1	0	0	1	3	
.	+	1	.	+	.	0	2	3	5	14	
.	0	0	1	1	3	
.	1	0	0	1	3	
.	1	0	0	1	3	
.	0	1	0	1	3	
5	4	3	4	4	4	4	3	4	5	3	2	.	.	1	+	+	+	4	.	+	3	16	8	27	75	
1	1	2	1	+	+	.	1	+	1	.	+	1	.	.	1	2	+	.	.	.	8	12	5	25	69	

Number of relevé (Zaporedna številka popisa)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Chamaecytisus purpureus</i>	E1	.	+	+	+	.	.	+	.	.	.	.	1	+	+
<i>Chamaecytisus hirsutus</i>	E1	+	.	+	.	+	.	.	.	1	+	.	.	.	.
<i>Peucedanum austriacum</i>	E1	.	+	.	+	1	+	1	+	+	.	.	+	.	.
<i>Aquilegia nigricans</i>	E1	+	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Leontodon incanus</i>	E1	.	.	.	.	.	.	.	.	.	.	+	+	.	.
<i>Aster amellus</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polygala chamaebuxus</i>	E1	.	.	+	.	.	1	.	.	.	.	.	.	.	.
<i>Gymnadenia odoratissima</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Crepis slovenica</i>	E1	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Genista januensis</i>	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Rhamnus saxatilis</i>	E2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Arctostaphylos uva-ursi</i>	E1	.	.	1	.	.	.	.	.	.	.	.	.	.	.
<i>Pinus mugo</i>	E2a	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Rubus saxatilis</i>	E1	.	.	.	.	+	.	.	.	.	.	.	.	.	.
VP Vaccinio-Piceetea															
<i>Picea abies</i>	E1	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Aposeris foetida</i>	E1	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Calamagrostis arundinacea</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
AF Aremonio-Fagion, Erythronio-Carpinion															
EC <i>Helleborus odoratus</i>	E1	+	.	.	+	1	1	1	1	1	.	+	.	.	.
<i>Cyclamen purpurascens</i>	E1	.	.	1	1	1	+	1	1	1	.	+	.	.	+
<i>Knautia drymeia</i>	E1	+	.	.	.	+	.	+	+	+	.	.	.	.	.
<i>Anemone trifolia</i>	E1	.	.	.	.	.	.	.	.	.	+	+	.	.	.
EC <i>Primula vulgaris</i>	E1	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Helleborus niger</i>	E1	.	.	.	+	.	.	1	.	.	.	.	.	.	.
<i>Euphorbia carniolica</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
QP Quercetalia pubescenti-petraeae															
<i>Carex flacca</i>	E1	+	.	+	.	.	+	+	.	.	.	+	.	+	.
<i>Mercurialis ovata</i>	E1	+	.	.	.	.	.	.	.	1	+	.	+	+	.
<i>Convallaria majalis</i>	E1	+	.	.	.	+	.	.	.	.	+	+	+	.	.
<i>Melittis melissophyllum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ostrya carpinifolia</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Tanacetum corymbosum</i> s. lat.	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sorbus aria</i>	E2a	.	.	+	+	.	.	.	.	.	.	.	.	.	.
QF Quercu-Fagetea															
<i>Cruciata glabra</i>	E1	+	.	.	+	.	.	+	+	+	.	.	.	.	.
<i>Platanthera bifolia</i>	E1	.	.	+	.	.	.	.	.	.	+	.	.	.	.
<i>Veratrum nigrum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Corylus avellana</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Serratula tinctoria</i> subsp. <i>tinctoria</i>	E1	.	.	.	.	+	+	1	.	.	.	.	.	.	.
FS <i>Mercurialis perennis</i>	E1	.	.	.	.	+	+	.	.	.	.	.	.	.	.
<i>Carex montana</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carex digitata</i>	E1	.	.	.	.	.	.	.	+	.	.	.	.	.	.
O Other species (Druge vrste)															
AV <i>Cirsium eriophorum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
EA <i>Fragaria vesca</i>	E1	.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Trifolium</i> sp.	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	.
M Mosses (Mahovi)															
<i>Musci</i>	E0	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Tortella tortuosa</i>	E0	.	+	.	.	.	.	.	.	.	.	.	.	.	.

Legend - Legenda

AS Andrej Seliškar D Dolomite – dolomit
 ID Igor Dakskobler Gr Gravel – grušč
 A Limestone – apnenec Re Rendzina – rendzina

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Pr. 1-9	Pr. 10-25	Pr. 26-36	Pr.-Total	Fr.-Total
+	+	+	+	+	+	1	.	+	1	1	.	1	2	+	.	.	.	.	.	.	4	12	4	20	56
+	+	+	.	+	+	+	+	+	1	+	1	2	+	.	3	10	5	18	50
.	+	+	7	1	2	10	28
.	+	+	.	.	+	.	1	1	4	6	17
.	+	+	+	.	.	.	+	.	0	3	3	6	17
1	+	.	.	.	+	.	+	.	+	0	5	0	5	14
.	+	+	.	2	0	2	4	11
.	+	+	.	.	0	1	2	3	8
.	+	1	0	1	2	6
.	+	.	0	1	1	2	6
.	+	0	0	2	2	6
.	1	0	0	1	3
.	1	0	0	1	3
.	1	0	0	1	3
.	+	+	+	1	2	1	4	11
.	+	1	0	1	2	6
.	+	.	0	0	1	1	3
.	+	.	+	.	+	+	+	+	+	.	.	7	1	7	15	42
.	+	.	.	.	+	.	.	.	+	.	.	+	+	.	.	7	3	4	14	39
.	+	+	+	1	+	.	.	+	5	0	6	11	31
.	+	+	.	.	0	2	2	4	11
.	+	+	1	0	2	3	8
.	2	0	0	2	6
.	2	.	.	.	.	0	0	1	1	3
.	+	.	.	+	1	.	1	.	.	.	.	.	+	.	.	+	.	.	.	+	4	6	3	13	36
.	1	+	.	.	1	+	+	1	+	.	1	1	4	8	13	36
+	+	1	.	1	.	+	.	.	.	.	.	+	.	.	.	.	2	7	2	11	31
.	+	.	+	+	.	.	+	0	0	4	4	11
.	.	.	.	+	+	.	+	0	3	0	3	8
.	+	+	+	0	2	1	3	8
.	2	0	0	2	6
.	5	0	1	6	17
.	+	.	.	.	+	1	1	2	4	11
.	.	.	+	.	+	+	+	0	4	0	4	11
.	+	.	+	+	0	3	0	3	8
.	3	0	0	3	8
.	2	0	0	2	6
.	1	0	0	1	3
.	1	0	0	1	3
.	+	0	0	1	1	3
.	1	0	0	1	3
.	0	1	0	1	3
.	1	0	0	1	3

Table 2: Phytosociological structure of altimontane grasslands with *Gladiolus palustris* – the Julian and Kamnik Alps, western Karavanke (relative frequencies).

Tabela 2: Fitosociološka sestava altimontanskih travišč z vrsto *Gladiolus palustris* – Julijske in Kamniške Alpe, zahodne Karavanke (relativne frekvence).

Successive number (Zaporedna številka)	1	2	3
Number of relevés (Število popisov)	10	16	11
Sign for syntaxa (Oznaka sintaksonov)	FaSc	CjLsg	PjBe
<i>Caricion austroalpinae</i>	2,1	5,3	4,9
<i>Elyno-Seslerietea</i>	15,8	14,0	14,0
<i>Festuco-Brometea</i>	33,3	36,1	40,6
<i>Molinion caeruleae</i>	0,0	2,5	0,4
<i>Poo alpinae-Trisetetalia</i>	2,1	0,1	2,3
<i>Molinio-Arrhenatheretea</i>	4,2	1,9	2,7
<i>Calluno-Ulicetea</i>	2,5	2,7	1,9
<i>Mulgedio-Aconitetea</i>	1,5	0,2	0,0
<i>Betulo-Alnetea viridis</i>	0,0	0,6	0,0
<i>Trifolio-Geranietea</i>	12,0	17,4	13,0
<i>Rhamno-Prunetea</i>	1,1	0,1	0,2
<i>Thlaspietea rotundifolii</i>	1,9	0,8	1,6
<i>Asplenietea trichomanis</i>	0,4	0,5	0,8
<i>Erico-Pinetea</i>	11,4	9,9	9,3
<i>Vaccinio-Piceetea</i>	0,4	0,3	0,4
<i>Aremonio-Fagion, Erythronio-Carpinion</i>	5,1	0,1	4,1
<i>Quercetalia pubescenti-petraeae</i>	2,5	3,5	2,9
<i>Quercu-Fagetea</i>	3,2	1,3	0,6
Other species (Druge vrste)	0,4	0,2	0,2
Mosses (Mahovi)	0,2	0,2	0,0
Total (Skupaj)	100,0	100,0	100,0