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Electronic Appendix 1. Data sources.

Data obtained from the European Vegetation Archive:
(The number of plots included in the final *Brachypodietalia* dataset is given in brackets.)

00-RU-006 Database of non-forest vegetation of the Southern Urals (176 plots)
Custodian: Sergey Yamalov, Deputy Custodian: Mariya Lebedeva

EU-00–002 Nordic-Baltic Grassland Vegetation Database (NBGVD) (184 plots)
Custodian: Jürgen Dengler, Deputy Custodian: Łukasz Kozub

EU-00–013 Balkan Dry Grasslands Database (901 plots)
Custodian: Kiril Vassilev, Deputy Custodian: Armin Macanović

EU-00–019 Balkan Vegetation Database (8 plots)
Custodian: Kiril Vassilev, Deputy Custodian: Hristo Pedashenko

EU-AT-001 Austrian Vegetation Database (1206 plots)
Custodian: Wolfgang Willner, Deputy Custodian: Christian Berg

EU-BG-001 Bulgarian Vegetation Database (178 plots)
Custodian: Iva Apostolova, Deputy Custodian: Desislava Sopotlieva

EU-CZ-001 Czech National Phytosociological Database (1995 plots)
Custodian: Milan Chytrý, Deputy Custodian: Ilona Knollová

EU-DE-001 VegMV (336 plots)
Custodian: Florian Jansen, Deputy Custodian: Christian Berg

EU-DE-013 VegetWeb (60 plots)
Custodian: Jörg Ewald, Deputy Custodian: Martin Kleikamp

EU-DE-014 GVRD Vegetation Reference Database Halle (6111 plots)
Custodian: Ute Jandt, Deputy Custodian: Helge Bruelheide

EU-HR-001 Phytosociological Database of Non-Forest Vegetation in Croatia (193 plots)
Custodian: Zvjezdana Stančić

EU-HR-002 Croatian Vegetation Database (112 plots)
Custodian: Željko Škvorc, Deputy Custodian: Daniel Krstonošić

EU-HU-003 CoenoDat Hungarian Phytosociological Database (44 plots)
Custodian: János Csiky, Deputy Custodian: Zoltán Botta-Dukát

EU-PL-001 Polish Vegetation Database (563 plots)
Custodian: Zygmunt Kącki, Deputy Custodian: Grzegorz Swacha

EU-RO-008 Romanian Grassland Database (474 plots)
Custodian: Eszter Ruprecht, Deputy Custodian: Kiril Vassilev

EU-RS-002 Vegetation Database Grassland Vegetation of Serbia (499 plots)
Custodian: Svetlana Aćić, Deputy Custodian: Zora Dajić Stevanović

EU-RS-003 Database of Forest Vegetation in Republic of Serbia & EU-RS-004 Vegetation Database of Northern Part of Serbia (AP Vojvodina) (77 plots)
Custodian: Mirjana Krstivojević Ćuk

EU-SI-001 Vegetation Database of Slovenia (328 plots)
Custodian: Urban Šilc

EU-SK-001 Slovak Vegetation Database (276 plots)
Custodian: Milan Valachovič, Deputy Custodian: Jozef Šibík

EU-UA-001 Ukrainian Grassland Database (234 plots)
Custodian: Anna Kuzemko, Deputy Custodian: Yulia Vashenyak

EU-UA-006 Vegetation database of Ukraine and adjacent parts of Russia (2 plots)
Custodian: Viktor Onyshchenko, Deputy Custodian: Vitaliy Kolomiychuk

EU-RU-XXX Vegetation database of steppe vegetation of Rostov Region (53 plots)
Custodian: Olga Demina

Additional data:

- Attila Lengyel (49 plots from Hungary)
- Eszter Illyés † (317 plots from Hungary) (also used in Willner et al. 2017a)
- Jan Roleček (42 plots from Germany, Slovakia, Ukraine and Romania)
- Thomas Becker (389 plots from Germany and Romania)
- Yuri Semenishchenkov (114 plots from Bryansk region in Russia) (also used in Willner et al. 2017a)

Computerised phytosociological tables from the following published sources:

Averinova E. A. (2010): Sintaksonomiya stepey Tul'skoy oblasti [Syntaxonomy of the steppes of the Tula region]. – Vestnik Bryanskogo gos. un-ta, 2010, no. 4: 73–81.

Averinova E. A. (2011): Kal'tsefitnaya rastitel'nost' prirodnogo parka “Roven'skiy” (Belgorodskaya oblast') [Calciphytic vegetation of the natural park “Rovenky” (Belgorod region)]. – Vestnik Bryanskogo gos. un-ta, 2011, no. 4: 60–65.

Averinova E. A. (2014): Soobshchestva s kopeechnikom krupnotsvetkovym (*Hedysarum grandiflorum* Pall.) na territorii Srednerusskoy vozvyshennosti [Communities with *Hedysarum grandiflorum* Pall. in the territory of the Central Russian Upland]. – Byulleten' Bryanskogo otdeleniya RBO 1(3): 37–47.

Averinova E. A. & Ivenkova I. M. (2011): Travyanaya rastitel'nost' pamyatnika prirody “Balka Neprets” (Orlovskaya oblast') [Herbaceous vegetation of the nature monument “Balka Neprets” (Orel region)]. – Vestnik Bryanskogo gos. un-ta, 2011. no. 4: 66–71.

Poluyanov A. V. & Averinova E. A. (2012): Travyanaya rastitel'nost' Kurskoi oblasti (sintaksonomiya i voprosy okhrany) [Herbaceous vegetation of the Kursk region (syntaxonomy and conservation issues)]. – Kurskii Gosudarstvennyi Universitet, Kursk.

Zolotukhin N. I. et al. (2015): Kovyli i kovyl'nyye stepi Belgorodskoy, Kurskoy, Orlovskoy oblastey: kadastr svedeniy, voprosy okhrany [Feather grass steppes of Belgorod, Kursk, Orel regions: cadastre of information, conservation issues]. – 487 pp., Kursk.

Electronic Appendix 2. List of aggregated species. Species concepts and nomenclature follow Euro+Med PlantBase (www.emplantbase.org). Note that only species (most likely) present in the dataset are listed.

Achillea millefolium agg.: *A. aspleniifolia, A. carpatica, A. collina, A. distans, A. macrophylla, A. millefolium, A. pannonica, A. pratensis, A. roseoalba, A. setacea, A. stepposa, A. styriaca*
Alchemilla spec. div.: all species of the genus *Alchemilla*
Anthoxanthum odoratum agg.: *A. alpinum, A. odoratum*
Arabis hirsuta agg.: *A. hirsuta, A. planisiliqua, A. sagittata, A. sudetica*
Arenaria serpyllifolia agg.: *A. leptoclados, A. serpyllifolia, A. uralensis*
Brachypodium pinnatum agg.: *B. pinnatum, B. rupestre*
Camelina sativa agg.: *C. microcarpa, C. satica*
Campanula rotundifolia agg.: *C. carnica, C. kladniana, C. rotundifolia, C. scheuchzeri*
Cardamine pratensis agg.: *C. dentata, C. matthioli, C. pratensis*
Carex muricata agg.: *C. divulsa, C. muricata, C. spicata*
Carlina vulgaris agg.: *C. biebersteinii, C. vulgaris*
Centaurea jacea agg.: *C. jacea, C. macroptilon, C. subjacea*
Dianthus carthusianorum agg.: *D. carthusianorum, D. giganteiformis, D. pontederae*
Erysimum hieraciifolium agg.: *E. hieraciifolium, E. hungaricum, E. marschallianum*
Euphrasia nemorosa agg.: *E. coerulea, E. micrantha, E. nemorosa*
Euphrasia rostkoviana agg.: *E. kerneri, E. picta, E. rostkoviana*
Euphrasia stricta agg.: *E. pectinata, E. slovaca, E. stricta*
Festuca dalmatica agg.: *F. dalmatica, F. stojanovii*
Festuca ovina agg.: *F. filiformis, F. ovina* (incl. *F. guestfalica*)
Festuca pallens agg.: *F. csikhegyensis, F. pallens*
Festuca rubra agg.: *F. heteromalla, F. nigrescens, F. rubra*
Festuca valesiaca agg.: *F. valesiaca, F. rupicola* (= *F. stricta* subsp. *sulcata* sensu Euro+Med PlantBase)
Galium mollugo agg.: *G. album, G. mollugo*
Hylotelephium maximum agg.: *H. maximum, H. telephium, H. vulgare*
Koeleria pyramidata agg.: *K. eriostachya, K. macrantha, K. pyramidata*
Leucanthemum vulgare agg.: *L. ircutianum, L. vulgare*
Lotus corniculatus agg.: *L. alpicola, L. alpinus, L. borbasii, L. corniculatus, L. ucrainicus*
Luzula campestris agg.: *L. campestris, L. divulgata, L. multiflora, L. pallescens*
Minuartia verna agg.: *M. glaucina, M. verna*
Molinia caerulea agg.: *M. arundinacea, M. caerulea*
Myosotis sylvatica agg.: *M. stenophylla, M. sylvatica*
Odontites vulgaris agg.: *O. vernus, O. vulgaris*
Oenothera biennis agg.: *O. biennis, O. rubricaulis* etc.
Ornithogalum pyrenaicum agg: *O. pyrenaicum, O. sphaerocarpum*
Papaver dubium agg.: *P. dubium, P. lecoqii, P. laevigatum*
Phleum pratense agg.: *P. nodosum, P. pratense*
Pimpinella saxifraga agg.: *P. alpina, P. nigra, P. saxifraga*
Poa pratensis agg.: *P. angustifolia, P. pratensis*
Polygala amara agg.: *P. amara, P. amarella*
Polygonum aviculare agg.: *P. arenastum, P. aviculare, P. rurivagum*
Potentilla collina agg.: *P. collina, P. thyrsiflora*
Potentilla incana agg.: *P. incana, P. tommasiniana*
Potentilla verna agg.: *P. pusilla, P. tabernaemontani* (= *P. verna* nom. cons.)
Ranunculus acris agg.: *R. acris, R. strigulosus*
Ranunculus auricomus agg.: *R. auricomus, R. cassubicus* etc. (= "*R. auricomus* coll." sensu Euro+Med PlantBase)
Rubus fruticosus agg.: all species of *Rubus* subg. *Rubus*
Satureja montana agg.: *S. montana, S. subspicata, S. kitaibelii*
Scabiosa columbaria agg.: *S. cinerea, S. columbaria, S. lucida, S. triandra*
Scleranthus annuus agg.: *S. annuus, S. polycarpos, S. uncinatus, S. verticillatus*
Seseli elatum agg.: *S. austriacum, S. kochii, S. osseum*
Sesleria caerulea agg.: *S. caerulea, S. uliginosa*
Silene otites agg.: *S. baschkirorum, S. borysthenica, S. cyri, S. densiflora, S. donetzica, S. exaltata, S. hellmannii, S. media, S. otites, S. wolgensis*
Thymus pannonicus agg.: *T. kosteleckyanus* (incl. *T. pulegioides* subsp. *pannonicus*), *T. odoratissimus*
Veronica chamaedrys agg.: *V. chamaedrys, V. vindobonensis*
Vicia cracca agg.: *V. cracca, V. tenuifolia*

Electronic Appendix 3. Classification into phytosociological orders.

To check if the diagnostic species of the orders established by Willner et al. (2017) are also valid for the new, geographically enlarged dataset, we did a TWINSPAN classification of the whole *Festuco-Brometea* dataset using WinTWINS 2.3 (Hill & Šmilauer 2005). Cut levels of pseudospecies were 0, 5 and 25% cover. Species with less than five occurences were excluded. Since the program is limited to a maximum of 25,000 relevés, we made a random selection from the countries with the highest number of plots (Germany, Czech Republic, Austria). For the other countries, all relevés were selected, resulting in a dataset of 24,727 relevés (Table A3.1).

Table A3.1. Number of relevés per country used in the TWINSPAN classification of the whole *Festuco-Brometea* dataset.

Country	No. of relevés
AT	2000
BG	3323
CZ	2058
DE	3015
HR	579
HU	1282
PL	805
RO	2673
RU	2319
SK	1626
SL	395
RS	3139
UA	1513

The orders *Stipo-Festucetalia pallentis*, *Brachypodietalia pinnati* (= *Brometalia erecti*) and *Festucetalia valesiacae* corresponded to the TWINSPAN groups 00, 01 and 1, respectively (Table A3.2). Group 1 also included Balkanic rocky steppes (*Halacsyetalia sendtneri*), Eastern European desert steppes (*Tanaceto achilleifolii-Stipetalia lessingianae*) and Eastern European petrophytic steppes (*Thymo cretacei-Hyssopetalia cretacei*). A preliminary inspection of the lower division levels suggested that the latter orders account for ca. 25% of the relevés in group 1, but since our aim was to identify the relevés belonging to the *Brachypodietalia pinnati*, we did not separate them from the *Festucetalia valesiacae*.

Table A3.2. Excerpt from the TWINSPAN table of the whole *Festuco-Brometea* dataset. Only a small selection of diagnostic species is shown. Values are percentage constancy.

Twinspan cluster	**00**	**01**	**1**
Number of relevés	3054	11931	9742
Festuca pallens agg.	46	2	3
Carex humilis	67	19	13
Teucrium montanum	47	8	11
Anthericum ramosum	42	13	3
Seseli elatum agg.	29	2	3
Briza media	4	39	1
Brachypodium pinnatum agg.	10	45	3
Plantago media	5	48	16
Dactylis glomerata	1	33	8
Knautia arvensis	2	31	6
Lotus corniculatus agg.	12	51	18
Pimpinella saxifraga agg.	15	43	6
Trifolium montanum	2	30	5
Eryngium campestre	5	19	60
Bothriochloa ischaemum	6	8	46
Astragalus onobrychis	2	5	22
Stipa capillata	7	6	30
Salvia nemorosa	1	4	18
Stipa lessingiana	1	1	8

Most of the previously established diagnostic species were reproduced, i.e. they reached again a phi value > 0.2 or a constancy ratio > 2 or both (see Willner et al. 2017). However, a few species did not reach the fidelity threshold anymore. On the other hand, some species not considered as diagnostic in the previous paper (mostly because they had a very low constancy) reached the threshold of both fidelity measures.

To account for the strong over-representation of Central Europe in the dataset, we also calculated the fidelity of the species to the orders using only the relevés from Eastern Europe. Species absent or extremly rare in Central Europe but meeting the criteria for diagnostic species in Eastern Europe, were added to the list of diagnostic species.

Dealpine species (*Carduus defloratus, Phyteuma orbiculare, Sesleria caerulea, S. rigida, S. sadlerana*) were not considered as diagnostic for the *Stipo-Festucetalia pallentis* because they also occur in rather mesic semi-dry grasslands. *Festuca valesiaca* agg. is considered as diagnostic for the *Festucetalia valesiacae*.

Thus, we considered the following species as diagnostic for the three orders:

Stipo-Festucetalia pallentis

Allium lusitanicum
Alyssum montanum
Anthericum ramosum
Arabidopsis arenosa
Asplenium ruta-muraria
Asplenium trichomanes
Biscutella laevigata
Carex humilis
Clinopodium alpinum
Cyanus triumfettii
Dianthus plumarius
Dianthus praecox
Draba lasiocarpa
Erysimum odoratum
Erysimum witmannii
Festuca pallens agg.
Fumana procumbens
Galium anisophyllon
Galium austriacum
Genista pilosa
Globularia bisnagarica
Globularia cordifolia
Helianthemum canum
Helictotrichon decorum
Hieracium bupleuroides
Hornungia petraea
Inula ensifolia
Jovibarba globifera
Kernera saxatilis
Leontodon incanus
Linum tenuifolium
Minuartia laricifolia
Minuartia setacea
Paronychia cephalotes
Poa badensis
Polygala amara agg.
Polygonatum odoratum
Primula auricula
Pulsatilla halleri
Saxifraga paniculata
Scorzonera austriaca
Sedum album
Seseli elatum agg.
Seseli leucospermum
Stipa eriocaulis

Teucrium montanum
Thesium alpinum
Thymus comosus
Thymus praecox
Thymus pulcherrimus
Vincetoxicum hirundinaria

Brachypodietalia pinnati
Agrostis capillaris
Alchemilla spec. div.
Anthoxanthum odoratum agg.
Arrhenatherum elatius
Astragalus danicus
Avenula pubescens
Brachypodium pinnatum agg.
Briza media
Campanula glomerata
Campanula patula
Carex caryophyllea
Carex filiformis
Carex flacca
Carex michelii
Carex montana
Carlina acaulis
Carlina vulgaris agg.
Centaurea jacea agg.
Centaurea scabiosa
Cerastium fontanum
Cirsium acaulon
Cirsium pannonicum
Clinopodium vulgare
Colchicum autumnale
Cruciata glabra
Dactylis glomerata
Danthonia alpina
Daucus carota
Euphorbia verrucosa
Festuca rubra agg.
Filipendula vulgaris
Fragaria viridis
Galium boreale
Galium verum
Gymnadenia conopsea
Helictochloa pratensis
Hypochaeris maculata
Inula salicina
Knautia arvensis
Lathyrus pratensis
Leontodon hispidus
Leucanthemum vulgare agg.
Linum catharticum
Lotus corniculatus agg.
Luzula campestris agg.
Medicago lupulina
Onobrychis viciifolia
Ononis spinosa
Phlomis tuberosa
Pimpinella saxifraga agg.
Plantago media
Polygala comosa
Polygala major
Polygala vulgaris

Potentilla erecta
Primula veris
Prunella grandiflora
Prunella laciniata
Prunella vulgaris
Ranunculus acris agg.
Ranunculus bulbosus
Ranunculus polyanthemos
Rhinanthus minor
Rumex acetosa
Salvia pratensis
Schedonorus pratensis
Seseli annuum
Stachys officinalis
Stellaria graminea
Taraxacum sect. *Taraxacum*
Thymus longicaulis
Thymus pulegioides
Tragopogon pratensis
Trifolium medium
Trifolium montanum
Trifolium pratense
Trisetum flavescens
Veratrum nigrum
Veronica chamaedrys agg.
Vicia cracca agg.
Viola hirta

Festucetalia valesiacae
Achillea nobilis
Agropyron cristatum
Ajuga chamaepitys
Artemisia austriaca
Astragalus austriacus
Astragalus onobrychis
Bothriochloa ischaemum
Bromus squarrosus
Chondrilla juncea
Cleistogenes serotina
Convolvulus cantabrica
Cynodon dactylon
Eryngium campestre
Erysimum diffusum
Euphorbia nicaeensis
Festuca valesiaca agg.
Galatella villosa
Galium humifusum
Galium octonarium
Hypericum rumeliacum
Iris pumila
Koeleria nitidula
Linaria genistifolia
Linum austriacum
Marrubium peregrinum
Medicago minima
Orlaya grandiflora
Phlomis herba-venti subsp. *pungens*
Poa bulbosa
Salvia nemorosa
Salvia nutans
Seseli tortuosum
Sideritis montana

Stipa capillata
Stipa lessingiana
Taraxacum serotinum
Teucrium polium
Trifolium arvense
Verbascum phoeniceum
Viola ambigua
Xeranthemum annuum

Electronic Appendix 5. Expert system for the alliances.

Note: This expert system does not include the definition of the order *Brachypodietalia pinnati*. It can only be applied to relevés which have already been classified to the order, e.g. by using an expert system based on the diagnostic species given in Appendix 3. For the syntax used in the definitions see Appendix S2 in Landucci et al. (2015).

Species groups:

#TC Dif-Mesobromion
Festuca ovina agg.
Potentilla verna agg.
Gentianella germanica

#TC Arm-elong-Grp
Armeria maritima
Myosotis stricta
Jasione montana
Agrostis vinealis
Cerastium semidecandrum
Silene viscaria
Helichrysum arenarium

#TC Arm-elong-Grp2
Festuca ovina agg.
Armeria maritima
Myosotis stricta
Jasione montana
Agrostis vinealis
Cerastium semidecandrum
Silene viscaria
Helichrysum arenarium

#TC Fest-val-Grp
Festuca valesiaca agg.
Veronica spicata
Astragalus onobrychis
Euphorbia nicaeensis

#TC Artem-camp-Grp
Artemisia campestris
Centaurea stoebe
Potentilla argentea
Rumex acetosella
Festuca stricta subsp. *trachyphylla*

#TC Scab-ochr-Grp
Scabiosa ochroleuca
Potentilla incana agg.
Adonis vernalis
Elytrigia intermedia
Campanula sibirica
Inula ensifolia
Carex michelii
Bromopsis riparia
Nonea pulla
Stipa pennata
Phlomis tuberosa
Stipa tirsa
Veronica prostrata
Stipa capillata

Cytisus ruthenicus
Iris aphylla
Salvia nutans
Arenaria procera
Veratrum nigrum
Dracocephalum ruyschiana
Euphorbia subtilis
Euphorbia semivillosa
Pulmonaria mollis
Lathyrus pannonicus
Pontechium maculatum
Pedicularis kaufmannii
Helictochloa hookeri subsp. *schelliana*
Linum nervosum
Polygala major
Viola ambigua
Cirsium pannonicum
Knautia drymeia
Sesleria heuflerana
Sesleria latifolia

#TC Dant-alp-Grp
Danthonia alpina
Chrysopogon gryllus

#TC Scorz-vill-Grp
Scorzonera villosa
Eryngium amethystinum
Koeleria lobata
Bupleurum gussonei
Carlina corymbosa
Helichrysum italicum
Leucanthemum platylepis
Ferulago campestris
Knautia illyrica

#TC Rhin-rum-Grp
Rhinanthus rumelicus
Moenchia mantica
Trifolium incarnatum
Trifolium strictum
Pilosella pavichii
Dianthus cruentus
Dianthus giganteus
Silene sendtneri
Pedicularis heterodonta
Knautia dinarica
Campanula sparsa
Cynosurus echinatus
Plantago subulata

#TC Ranu-bulb-Grp
Ranunculus bulbosus
Bromopsis erecta
Carlina acaulis
Cirsium acaulon
Polygala amara agg.

#TC Car-flac-Grp
Carex flacca
Euphorbia verrucosa
Buphthalmum salicifolium

Rhinanthus glacialis
Gentianella ciliata
Gentianella germanica
Ophrys insectifera

Group definitions:

5 aMe Mesobromion erecti
<#TC Dif-Mesobromion GR 00> NOT (<#TC Fest-val-Grp GR Festuca ovina agg.> OR (<#TC Arm-elong-Grp GR 01> OR (<#TC Artem-camp-Grp GR 01> OR (<#TC Scab-ochr-Grp GR 00> OR (<#TC Dant-alp-Grp GR 00> OR (<#TC Scorz-vill-Grp GR 00> OR (<#TC Rhin-rum-Grp GR 00> OR (<Cruciata glabra GR 00> OR <Thymus longicaulis GR 00>))))))))

5 aKP Koelerio-Phleion
(<#TC Arm-elong-Grp2 GR #TC Scab-ochr-Grp> AND (<#TC Arm-elong-Grp GR 01> OR <#TC Artem-camp-Grp GR 01>)) NOT (<#TC Dant-alp-Grp GR 00> OR (<#TC Scorz-vill-Grp GR 00> OR (<#TC Rhin-rum-Grp GR 00> OR (<#TC Car-flac-Grp GR 01> OR (<Bromopsis erecta GR 01> OR (<Brachypodium pinnatum agg. GR 05> OR <Carex montana GR 00>))))))

5 aCB Cirsio-Brachypodion
(<#TC Fest-val-Grp GR Festuca ovina agg.> OR <#TC Scab-ochr-Grp GR 01>) NOT (<#TC Arm-elong-Grp2 GR #TC Scab-ochr-Grp> OR (<#TC Scorz-vill-Grp GR #TC Scab-ochr-Grp> OR (<#TC Scorz-vill-Grp GR #TC Rhin-rum-Grp> OR ((<#TC Dant-alp-Grp | #TC Rhin-rum-Grp GR 01> AND <#TC Dant-alp-Grp | #TC Rhin-rum-Grp GR #TC Scab-ochr-Grp>) AND <#TC Dant-alp-Grp | #TC Rhin-rum-Grp GR #TC Ranu-bulb-Grp>))))

5 aSv Scorzonerion villosae
(<#TC Scorz-vill-Grp GR #TC Scab-ochr-Grp> AND <#TC Scorz-vill-Grp GR #TC Rhin-rum-Grp>) NOT (<Helictochloa pratensis GR 00> OR (<Phleum phleoides GR 00> OR <Poa molinerii GR 00>))

5 aCD Chrysopogono-Danthonion
((<#TC Dant-alp-Grp | #TC Rhin-rum-Grp GR 01> AND <#TC Dant-alp-Grp | #TC Rhin-rum-Grp GR #TC Scab-ochr-Grp>) AND <#TC Dant-alp-Grp | #TC Rhin-rum-Grp GR #TC Ranu-bulb-Grp>) NOT (<#TC Scorz-vill-Grp GR #TC Scab-ochr-Grp> OR (<#TC Scorz-vill-Grp GR #TC Rhin-rum-Grp> OR (<Festuca ovina agg. GR 00> OR <#TC Car-flac-Grp GR 00>)))

Electronic Appendix 7. Extended descriptions and distribution maps of the associations belonging to the alliances *Mesobromion* and *Cirsio-Brachypodion*.

The maps show the geographical distribution of the plots assigned to the associations by the expert systems given in Appendix 8 and 9. The synoptic table is provided in Appendix 6.

Alliance *Mesobromion erecti* (Br.-Bl. & Moor 1938) Oberd. 1957 nom. cons. propos.
Syn.: *Bromion erecti* Koch 1926 sensu orig.

Association group M1: impoverished semi-dry grasslands of northwestern Central Europe

(a) ***Solidagini-Helictotrichetum pratensis*** Willems et al. 1981

This association mainly occurs in NE Germany close to the Baltic Sea. The plots from other regions assigned to this unit might be impoverished forms of the *Gentiano-Koelerietum*. The unit is only negatively differentiated from the following associations. The soils are usually slightly acidic.

A potential nomenclatural problem is the fact that, in the original diagnosis of the association (N Jutland), *Koeleria pyramidata* is present, which is used as negative diagnostic species in our formal definition of the association. However, if *Koeleria pyramidata* is not considered a negative diagnostic species, much more relevés from NW Germany traditionally classified as *Gentiano-Koelerietum* are included in this unit.

According to Dengler (2004), the *Solidagini-Helictotrichetum* belongs to the Nordic alliance *Filipendulo-Helictotrichion*, but as no data from Northern Europe were included in the present study, we preliminarily included this association in the *Mesobromion*.

Fig. A7.1. – *Solidagini-Helictotrichetum*.

Association group M2: semi-dry grasslands of the lowlands of western Central Europe

(b) ***Gentiano-Koelerietum*** Knapp ex Bornkamm 1960
Syn.: *Carlino acaulis-Brometum* Oberd. 1957 p.p., *Euphorbio-Brachypodietum* Bornkamm 1960, *Avenulo pratensis-Koelerietum* Bassler et al. 2003 [syntax. syn.]

This is the most widespread type of semi-dry grasslands in Germany. It also occurs in the Czech and Austrian part of the Bohemian Massif, where it occupies cooler and slightly acidic sites not suitable for *Cirsio-Brachypodion* communities. In western Germany, it can be found on a broad range of soil types, which correspond to different subassociations.

The delimitation between *Gentiano-Koelerietum* and *Mesobrometum* remains dubious. In the phytosociological literature, these two associations are either regarded as geographical vicariants or as grassland types with different management regime (*Gentiano-Koelerietum*: pastures, *Mesobrometum*: meadows) or both (Oberdorfer & Korneck 1978). The first concept can clearly be rejected, as both units have more or less the same distribution,

and including additional diagnostic species in the definitions does not change this pattern. The second concept is probably valid to some degree, as *Bromopsis erecta* is particularly sensitive to frequent grazing (Ellenberg & Leuschner 2010). However, we were not able to find other differential species of sufficient constancy supporting these two units besides *Bromopsis erecta*. Therefore, it is unlikely that the *Gentiano-Koelerietum* fulfills our criteria for an association (see Methods in the main text). It should probably be considered as variant of the *Mesobrometum*. Chytrý (2007) included both units in the "*Carlino acaulis-Brometum*".

Nomenclatural remark: The name *Carlino acaulis-Brometum* Oberd. 1957 should not be used for this unit, because at least part of its original diagnosis belongs to the *Gentiano vernae-Brometum*. However, there seems to be no lectotypification of this name so far. The name *Gentiano-Koelerietum* Knapp ex Bornkamm 1960 is probably illegitimate because Bornkamm uses most of the time the form *Gentiano-Koelerietum boreoatlanticum*.

Fig. A7.2. – *Gentiano-Koelerietum.*

(c) ***Mesobrometum erecti*** Scherrer ex Koch 1926
Syn.: *Onobrychido viciifoliae-Brometum* Müller 1966

As stated above, this association is mainly differentiated from the *Gentiano-Koelerietum* by the dominance of *Bromopsis erecta*. Some other species might be regarded as differential species (*Onobrychis viciifolia*, *Orchis militaris*, *Euphorbia verrucosa*), but as they have a very low constancy in *Bromopsis erecta* grasslands, we did not use them in the formal definition of this unit.

Fig. A7.3. – *Mesobrometum erecti*.

(d) ***Polygalo amarae-Seslerietum*** Tx. (1937) 1955

Mesic *Sesleria caerulea* grasslands on steep slopes of the German lower mountain ranges except the southernmost part where it is replaced by the *Koelerio-Seslerietum*. The few occurrences in the Jura Mountains are probably misclassifications and should be regarded as impoverished forms of the *Koelerio-Seslerietum*.

Nomenclatural remark: The name is validly published in Tüxen (1955) because the author clearly states in the introduction that names in brackets (in this case *Mesobrometum seslerio-polygaletosum*) refer to his work from 1937, for which a full bibliographic reference is provided.

Fig. A7.4. – *Polygalo amarae-Seslerietum*.

Association group M3: pre-alpine semi-dry grasslands of western Central Europe

(e) ***Gentiano vernae-Brometum*** Kuhn ex Oberd. 1957
Syn.: *Carlino acaulis-Brometum* Oberd. 1957 p.p., *Astrantio majoris-Brometum* Machold 1996 [syntax. syn.]

This association includes the *Bromopsis erecta* meadows in the higher parts of the SW German Jura Mountains (Schwäbische Alb) and adjacent regions. It is very rich in orchids. The unit is well differentiated against the *Mesobrometum* by the presence of several pre-alpine species. Therefore, it clearly fulfils our criteria for an association. Some relevés from the SW Bohemian Massif were assigned to this unit as well.

The *Astrantio majoris-Brometum*, described from W Austria, is preliminarily included here as a special geographical variant, but its syntaxonomic status needs further studies. In particular, a comparison with the *Bromopsis erecta* meadows of Switzerland would be important.

Fig. A7.5. – *Gentiano vernae-Brometum*.

(f) ***Carlino-Caricetum sempervirentis*** Lutz & Paul 1947

Semi-dry grasslands of the Bavarian Alps and their foreland as well as adjacent parts of Austria. The unit is differentiated by the presence of several *Seslerion caeruleae* and *Molinion* species, which give this association a rather unique floristic character. In the southwestern corner of the German Jura Mountains, it forms transitions with the following association.

Fig. A7.6. – *Carlino-Caricetum sempervirentis*.

(g) ***Koelerio-Seslerietum*** Oberd. 1957 nom. invers.

Mesic *Sesleria caerulea* grasslands of the SW German Jura Mountains. They have many diagnostic species in common with the *Gentiano vernae-Brometum*, and the most important difference is the dominance of *Sesleria caerulea*. The community mainly occurs on steep north-facing slopes (Oberdorfer & Korneck 1978).

Fig. A7.7. – *Koelerio-Seslerietum*.

Alliance *Cirsio-Brachypodion pinnati* Hadač & Klika in Kilka & Hadač 1944
Syn.: *Festucion valesiacae* auct. p.p. [typo excl.], *Danthonio-Stipion stenophyllae* Soó 1949 p.p. [typo excl.], *Agrostio vinealis-Avenulion schellianae* Royer 1991 [syntax. syn.], *Fragario viridis-Trifolion montani* Korotchenko & Didukh 1997 [syntax. syn.], *Scabioso ochroleucae-Poion angustifoliae* Bulokhov 2001 [syntax. syn.], *Adonido vernalis-Stipion tirsae* Didukh in Didukh & Mucina 2014 [syntax. syn.]

Association group C1: dry meadow steppes of Central Europe

This association group is differentiated from the following one by numerous species indicating dry soil conditions. Most of the differential species have their optimum either in true steppes of the *Festucetalia valesiacae* or in rocky steppes of the *Stipo-Festucetalia pallentis*.

(1) ***Adonido-Brachypodietum*** (Libbert 1933) Krausch 1961

Distributed in the plains of NE Germany and Poland. *Festuca stricta* subsp. *sulcata* is replaced by *F. stricta* subsp. *trachyphylla* (= *F. brevipila*). Species of sandy grasslands have a higher constancy than in other associations of the alliance. Otherwise, the association is only negatively differentiated against the following ones. The occurrence of this association in the Czech Republic and S Poland is doubtful and needs further evaluation. The plots from these regions might be misclassified (see also the chapter on "geographically vicariant associations and the limits of formal definitions" in the Discussion in the main text).

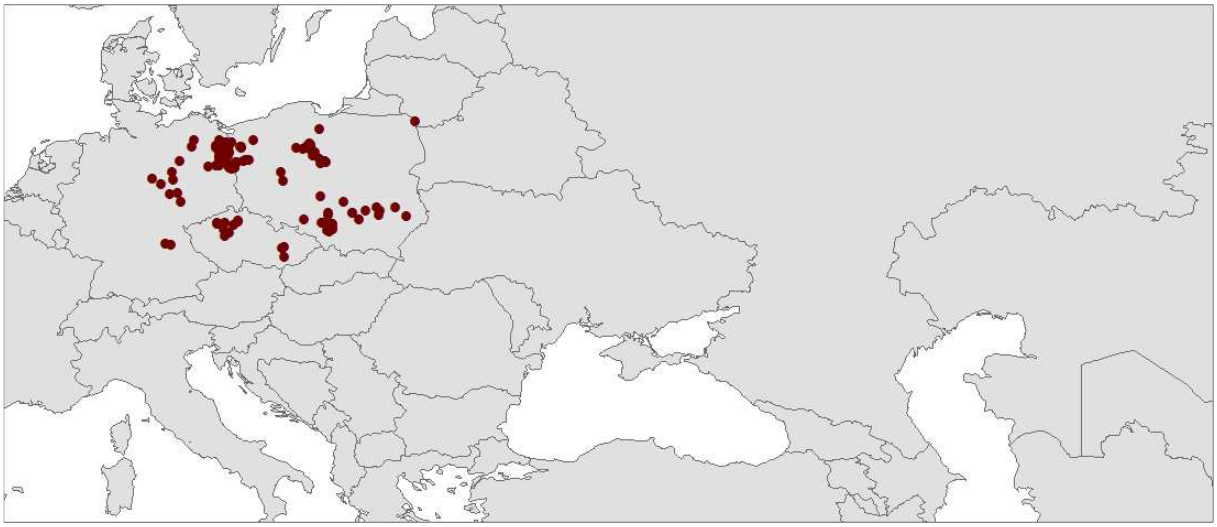

Fig. A7.8. – *Adonido-Brachypodietum*.

(2) ***Scabioso ochroleucae-Brachypodietum*** Klika 1933
Syn.: *Scorzonero hispanicae-Brachypodietum* Gauckler 1957 [syntax. syn.], *Festuco rupicolae-Brachypodietum* Mahn 1965 [syntax. syn.], *Sanguisorbo minoris-Brometum* Illyés et al. 2009 p.p. [typo excl.]

Mainly distributed in Central and SE Germany and in the Czech Republic. The occurrences in the Pannonian region, SE Poland and Ukraine might be considered as impoverished stands of the *Inuletum ensifoliae* and *Polygalo majoris-Brachypodietum* (but see Discussion in the main text). Except for the presence of *Cirsium acaulon*, the *Scabioso ochroleucae-Brachypodietum* is only negatively differentiated against these units, while it is positively differentiated against the *Adonido-Brachypodietum* by the presence of *Festuca stricta* subsp. *sulcata*, *Teucrium chamaedrys*, *Thymus praecox* and others.

The ***Asperulo tinctoriae-Brachypodietum rupestre*** Franz 1993, described from Carinthia (S Austria), was also assigned to the *Scabioso ochroleucae-Brachypodietum*, since we were not able to establish a separate formal definition for this unit. However, the semi-dry grasslands of Carinthia are mostly dominated by *Brachypodium rupestre* while the *Scabioso ochroleucae-Brachypodietum* is dominated by *Brachypodium pinnatum* sensu stricto. Due to the inconsistent determination of these two species, we had to combine them as *Brachypodium pinnatum* agg. in our analysis. The status of the *Asperulo tinctoriae-Brachypodietum rupestre* remains to be clarified in future studies which address the diagnostic value of *Brachypodium rupestre* and include more data from the Inner Alps.

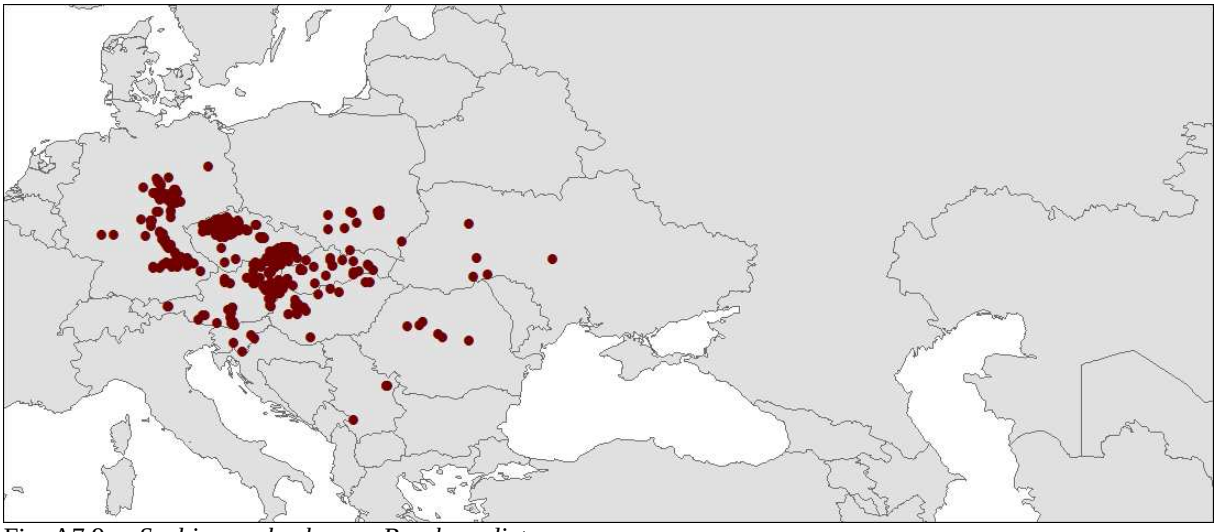
Fig. A7.9. – *Scabioso ochroleucae-Brachypodietum.*

(3) ***Astragalo onobrychidis-Brometum*** Br.-Bl. 1950

Semi-dry grasslands of the inner valleys of the Eastern Alps (Tirol, Unter-Engadin). Braun-Blanquet (1961) included this association in the alliance *Stipo-Poion xerophilae*, a rather heterogeneous unit which comprises rocky grasslands, typical grass steppes and semi-dry grasslands. According to the type relevé, the *Astragalo onobrychidis-Brometum* clearly belongs to the *Cirsio-Brachypodion*. Only very few relevés of this unit were included in our dataset.

Nomenclatural remark: This association is the type of the name *Stipo-Poion xerophilae* Br.-Bl. & Tx. ex Br.-Bl. 1950 nom. illeg., which in turn is the type of the name *Festucetalia valesiacae* Br.-Bl. & Tx. ex Br.-Bl. 1950 nom. cons. propos. (Terzi et al. 2017). By contrast, the legitimate name *Stipo-Poion xerophilae* Br.-Bl. & Richard 1950 is based on a different type which does not belong to the *Cirsio-Brachypodion* (Terzi et al. 2016). To prevent further confusion, a different conserved type should be chosen for the order name *Festucetalia valesiacae* (a procedure that is proposed for the next edition of the International Code of Phytosociological Nomenclature).


Fig. A7.10. – *Astragalo onobrychidis-Brometum.*

(4) ***Inuletum ensifoliae*** Kozłowska 1928
Syn.: *Thalictro-Salvietum pratensis* Medwecka-Kornaś 1959 [syntax. syn.]

This association is positively differentiated against the *Scabioso ochroleucae-Brachypodietum* (by the presence of *Inula ensifolia, Linum flavum, Campanula sibirica* and others) and negatively against the *Polygalo majoris-Brachypodietum* (by the absence of *Dorycnium pentaphyllum, Polygala major, Bupleurum falcatum* and others).

So far, it has only been reported from SE Poland. The occurrences in the Czech Republic and E Austria should probably be considered as impoverished forms of the *Polygalo majoris-Brachypodietum* (see also Discussion in the main text). The occurrences in Slovakia and Ukraine need further evaluation. The points in Romania and N Serbia are clearly misclassifications.

The ***Seslerio uliginosae-Scorzoneretum purpureae*** Kozłowska 1928, also described from SE Poland, was only represented by a single relevé in our dataset. Its status could not be evaluated, so we did not include it in our expert system.

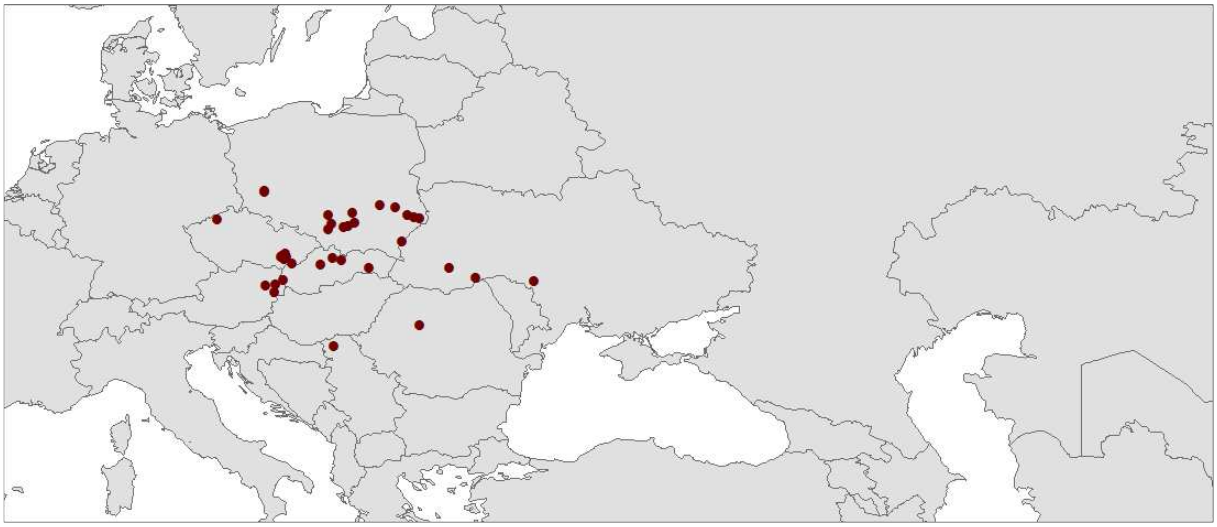

Fig. A7.11. – *Inuletum ensifoliae.*

(5) ***Polygalo majoris-Brachypodietum*** Wagner 1941
Syn.: *Carici humilis-Brachypodietum* Soó 1949 [syntax. syn.], *Danthonio-Brachypodietum* Soó 1949 nom. inval. p.p., *Onobrychido arenariae-Brachypodietum* Eijsink et al. 1978 [syntax. syn.], *Sanguisorbo minoris-Brometum* Illyés et al. 2009 [syntax. syn.], *Cirsium furiens-Brachypodium pinnatum* comm. Dengler et al. 2012

This unit includes the meadow steppes on limestone and other calcareous bedrocks in the Pannonian Basin and Transylvania, perhaps also in W Ukraine. In the margin of the Pannonian region it also occurs on loess, while in the loess hills of the central Basin it is replaced by the following association. Depending on the management, the community can be dominated either by *Brachypodium pinnatum* or by *Bromopsis erecta*. Stands dominated by *Bromopsis erecta* were described as *Sanguisorbo minoris-Brometum* by Illyés et al. (2009). However, the relative cover of these grasses can change quite fast within a few years. Moreover, *Bromopsis erecta* has a relatively high cover in the original diagnosis of the *Polygalo majoris-Brachypodietum*.

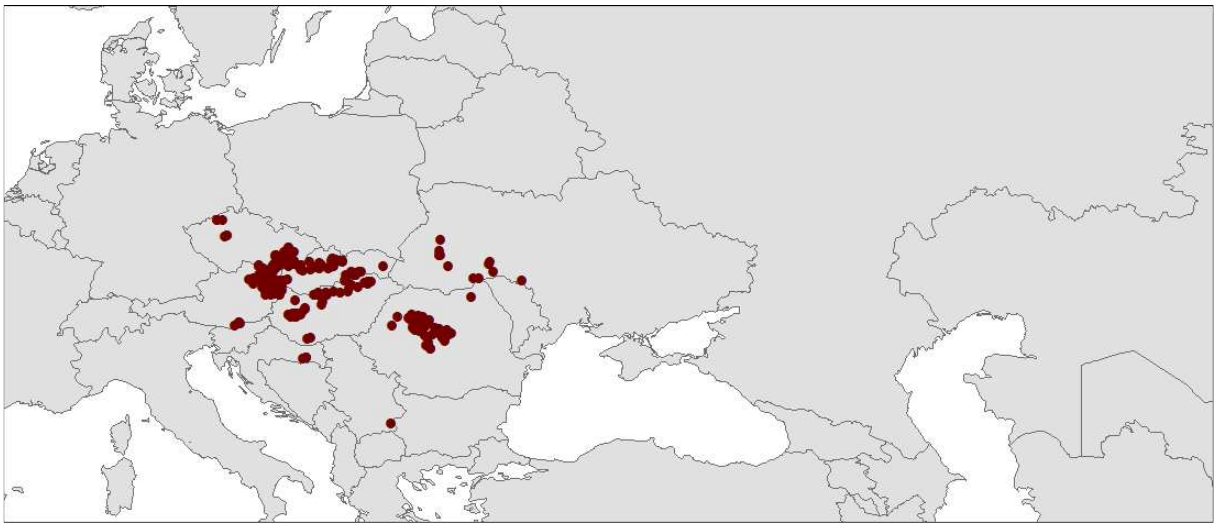

Fig. A7.12. – *Polygalo majoris-Brachypodietum.*

(6) ***Euphorbio pannonicae-Brachypodietum*** Horváth 2010

Meadow steppes on the loess hills of the Pannonian Basin. The unit is differentiated from the *Polygalo majoris-Brachypodietum* by the presence of several loess specialists such as *Euphorbia nicaeensis*, *Cytisus austriacus* and *Viola ambigua*. The dominant grass is usually *Brachypodium pinnatum*, while *Bromopsis erecta* is rather rare. The association has only been known from Hungary so far, but seems to be present also in S Moravia, E Austria and N Serbia, perhaps also in N Bohemia, Transylvania and W Ukraine. In Serbia, the unit was described as subassociation *Andropogono-Euphorbietum pannonicae brachypodietosum pinnati* (Bogojević 1968).

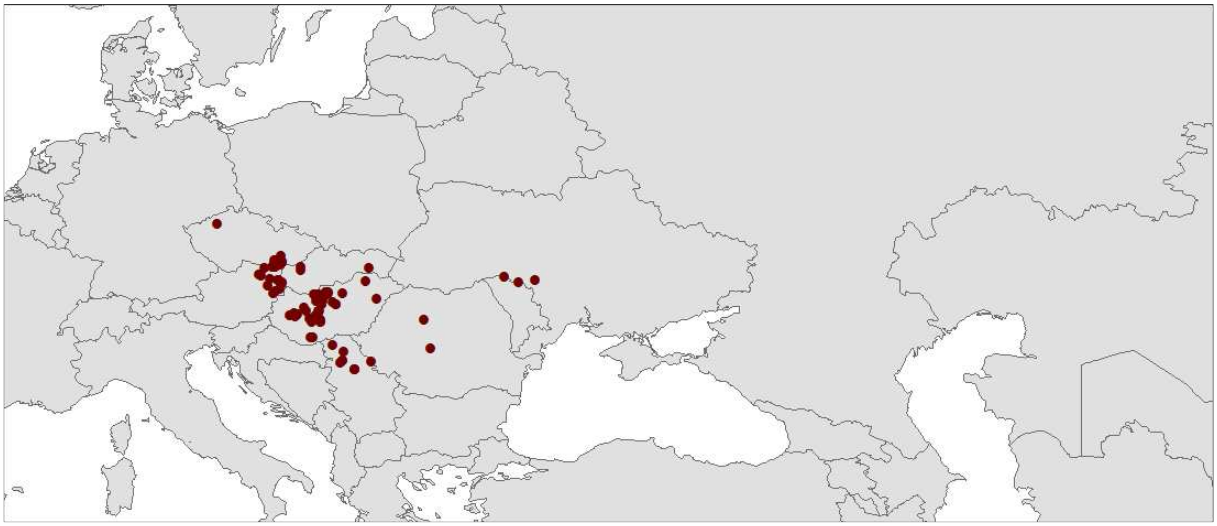

Fig. A7.13. – *Euphorbio pannonicae-Brachypodietum*.

(7) ***Cirsio pannonici-Seslerietum caeruleae*** Klika 1933

This association includes meso-xeric *Sesleria caerulea* grasslands on steep slopes at low altitudes north of the Alps. It is the eastern continuation of the *Polygalo-Seslerietum* of the *Mesobromion* (see above). It has only been reported from Bohemia so far, where it is mostly developed on Cretaceous marl. However, following our alliance concept, some meso-xeric *Sesleria caerulea* grasslands of Central Germany fall within the *Cirsio pannonici-Seslerietum*. The point in S Poland is a misclassification, probably due to the merging of *Sesleria caerulea* and *S. uliginosa*.

Nomenclatural remark: Despite being one of the most atypical examples of the *Cirsio-Brachypodion*, this association is the nomenclatural type of the alliance name.

Fig. A7.14. – *Cirsio pannonici-Seslerietum*.

(8) ***Orchido militaris-Seslerietum heufleranae*** Dengler et al. 2012

Meso-xeric *Sesleria heuflerana* grasslands on steep, usually north-facing slopes in Transylvania, E Slovakia and W Ukraine.

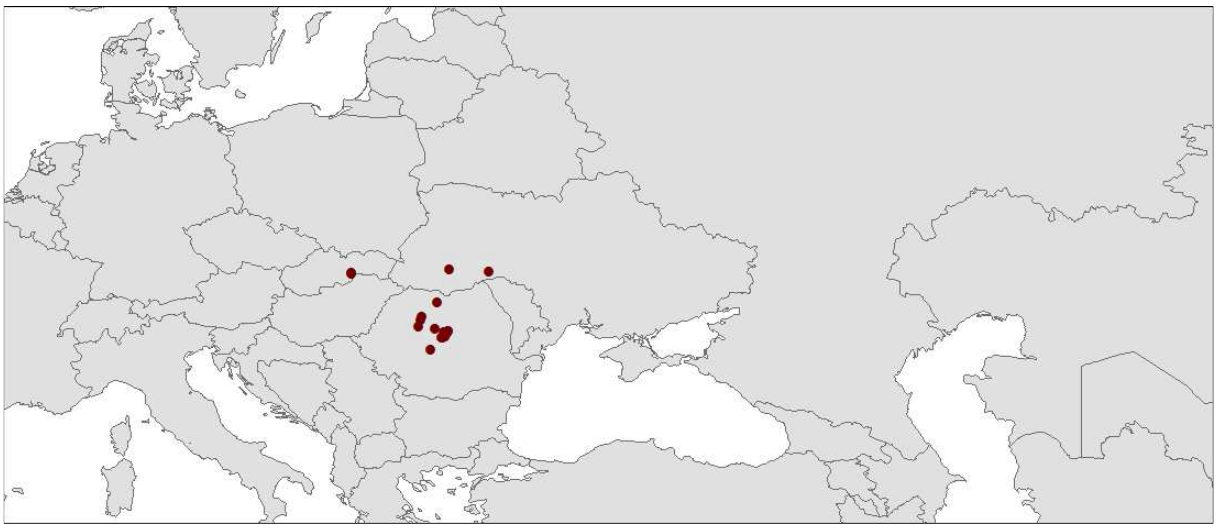

Fig. A7.15. – *Orchido militaris-Seslerietum heuflerianae*.

(9) ***Genisto-Stipetum tirsae*** Korneck 1974

Stipa tirsa grasslands in western Germany, with very few localities within a small area. Floristically quite different from all other communities dominated by this species.

(10) ***Stipetum tirsae*** Meusel 1938
Syn.: *Inulo hirtae-Stipetum tirsae* Borhidi 1996 [syntax. syn.], *Peucedano cervariae-Stipetum tirsae* Borhidi 2012 [syntax. syn.]

Stipa tirsa grasslands of Central Germany, N Bohemia, S Moravia, N Hungary, W Transylvania and Serbia. Despite considerable differences in the species combination, these grasslands have probably enough in common to be united in one association. The unit was not reproduced by the TWINSPAN classification of the whole *Brachypodietalia* dataset, but consistently appeared as a separate cluster in TWINSPAN classifications of geographically restricted datasets.

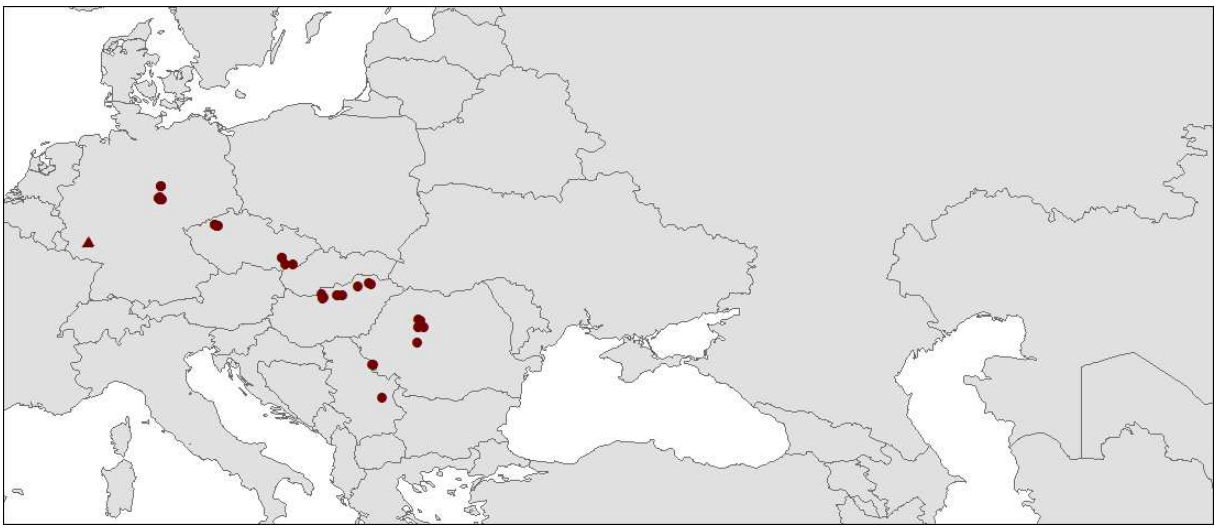

Fig. A7.16. – *Genisto-Stipetum tirsae* (triangle), *Stipetum tirsae* (circles).

Association group C2: mesic meadow steppes of Central Europe

This association group is differentiated from the previous one by a large group of species indicating rather mesic and partly also slightly acidic soil conditions. Among the diagnostic species are several ones with an optimum in the *Molinio-Arrhenatheretea* or the *Nardetea*, but also species which are frequent in forests.

(11) ***Festuco rupicolae-Brometum*** Zielonkowski 1973
Syn.: *Sieglingio-Brachypodietum* Zielonkowski 1973 [syntax. syn.], *Onobrychido viciifoliae-Brometum* auct. [typo excl.], *Cirsio pannonici-Brometum* Steinbuch 1995 nom. inval., *Salvio verticillatae-Festucetum rupicolae* Ujházy et al. 2007 [syntax. syn.], *Filipendulo-Brometum* Hundt & Hübl ex Willner 2013 [syntax. syn.]

This is the most abundant unit of the association group. It is mainly negatively differentiated against the following units. At its western border, the association comes into direct contact with the *Mesobromion*, and many authors have classified it into the latter alliance. However, due the presence of *Festuca stricta* subsp. *sulcata* instead of *F. guestfalica* these grasslands are firmly placed within the *Cirsio-Brachypodion*. The dominant grass is usually *Bromopsis erecta*, but *Brachypodium pinnatum* or *Festuca stricta* subsp. *sulcata* can also reach high cover. The association has a very large distribution area, but further splitting seems not possible due to the low constancy of the potential geographical differential species. However, compared to previous classifications, where this unit was often included in the *Onobrychido viciifoliae-Brometum* (= *Mesobrometum*) (e.g., Mucina & Kolbek 1993, Kaligarič & Škornik 2002, Hegedüšová Vantarová & Škodová 2014), the distribution area has been considerably reduced.

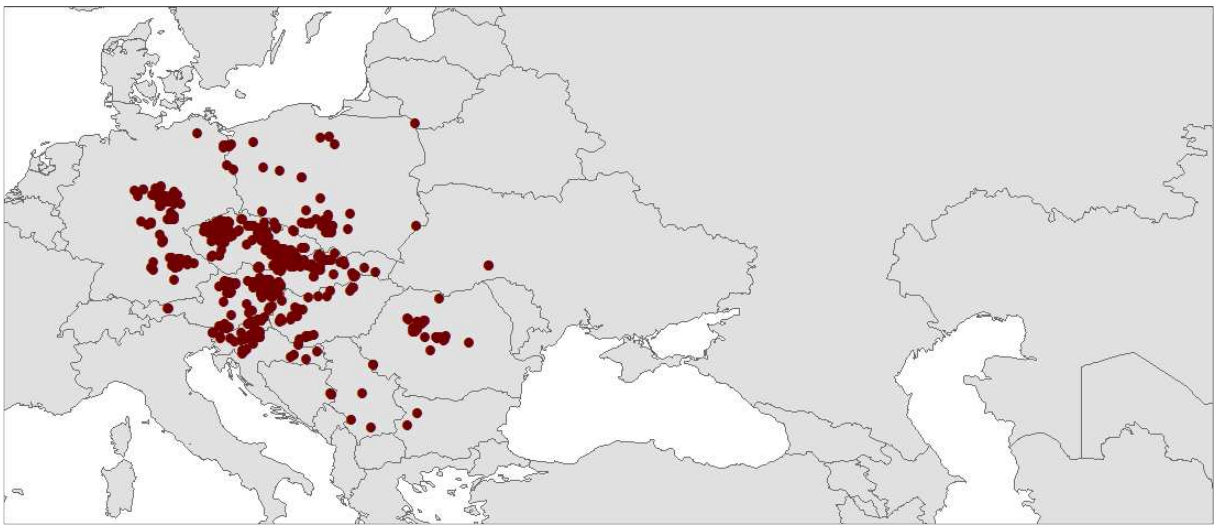

Fig. A7.17. – *Festuco rupicolae-Brometum*.

(12) ***Brachypodio-Molinietum*** Klika 1939
Syn.: *Festuco sulcatae-Brachypodietum* Soó 1927, *Pediculari-Caricetum montanae* Soó 1948 [syntax. syn.], *Trifolio medii-Brachypodietum* Illyés et al. 2009 [syntax. syn.]

Very species rich grasslands of the Carpathians, mainly developed on flysch substrate. The community is characterised by a unique combination of species with very different ecological optima. The highest diagnostic values have species of slightly acidic and intermittently moist soils (e.g. *Carex montana*, *Galium boreale*, *Potentilla alba*). The unit shows a considerable floristic variability within its distribution range, but these differences are not sufficient to split it into two or more vicariant associations. The association has been included in the *Mesobromion* in some surveys (Chytrý 2007, Hegedüšová Vantarová & Škodová 2014), but according to our alliance concept, it is clearly accommodated in the *Cirsio-Brachypodietum*. The *Brachypodio-Molinietum* can even be regarded as one of the core units of this alliance as it has more species in common with the meadow steppes of Eastern Europe than any other grassland in Central Europe (see also Roleček et al. 2014).

The plots assigned to this association outside the Carpathians might be considered as misclassified. The *Euphorbio verrucosae-Caricetum montanae* of the Eastern Alps (ass. 15) is quite similar to the *Brachypodio-Molinietum*, but sufficiently different to be considered as a separate association. However, some stands at the eastern margin of the Alps are transitional between the two associations.

Nomenclatural remark: The oldest valid name for this association seems to be *Festuco sulcatae-Brachypodietum* Soó 1927, a name which has never been used except in Dengler et al. (2012). However, according to the 4th edition of the ICPN (Theurillat et al., in prep.), this name would become illegitimate because *Festuca sulcata* is not a correct species name, and correction of the name is not possible as it would create a younger homonym to the *Festuco rupicolae-Brachypodietum* Mahn 1965.

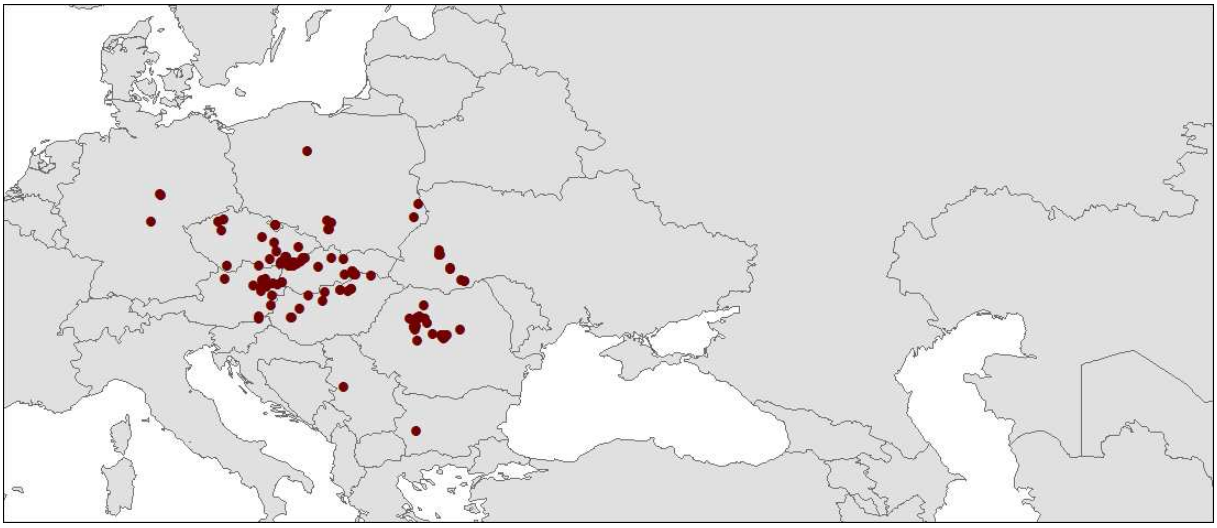

Fig. A7.18. – *Brachypodio-Molinietum*.

(13) ***Colchico autumnalis-Festucetum rupicolae*** Lengyel et al. 2016
Syn.: *Hypochoerido-Festucetum rupicolae* Steinbuch 1995 nom. inval.

Moderately acidic grasslands dominated by *Festuca stricta* subsp. *sulcata*. The differential species are from the *Violion caninae*. The distribution center of this association is located in SE Austria, NE Slovenia and SW Hungary, but it seems to be present also in Germany, the Czech Republic, Slovakia and Romania. Further evaluation of these new locations are necessary. The presence of *Moenchia mantica* in the core area indicates a floristic relationship towards the *Chrysopogono-Danthonion*. The association was included in the *Mesobromion* by Steinbuch (1995) and Škornik (2003) (under the name *Hypochoerido-Festucetum rupicolae*) and in the *Cynosurion* by Lengyel et al. (2016).

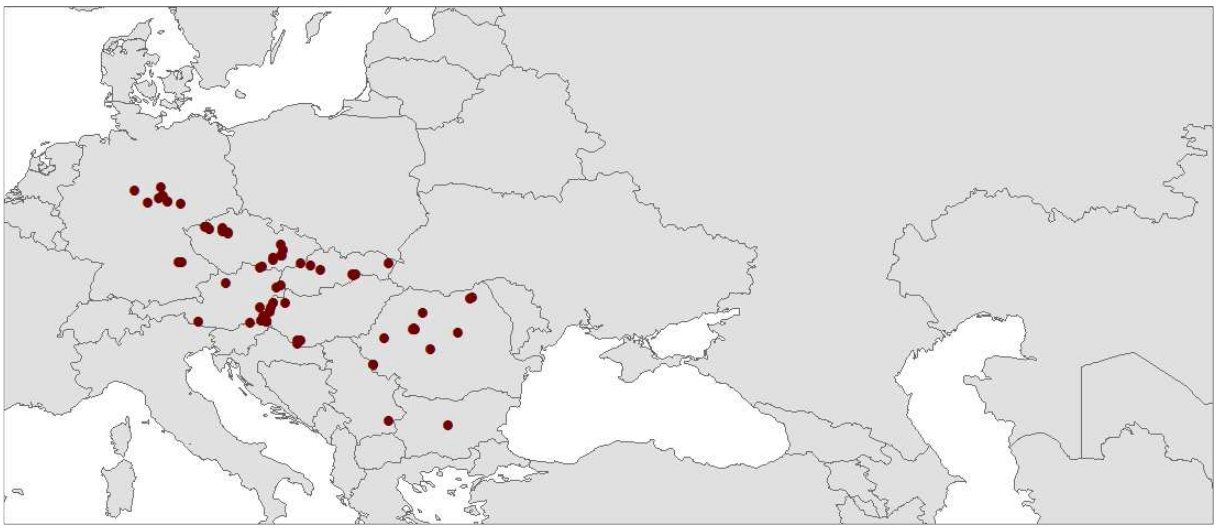

Fig. A7.19. – *Colchico-Festucetum rupicolae*.

Association group C3: pre-alpine semi-dry grasslands of eastern Central Europe

This group is the eastern continuation of association group M3. The common feature of these two groups is the presence of many *Elyno-Seslerietea* species, indicating the close proximity of alpine grasslands. Indeed, the grasslands of the *Festuco-Brometea* and *Elyno-Seslerietea* are connected by a floristic continuum, and the delimitation between the two classes along the altitudinal gradient is often not trivial. Another important differential species of this group is *Knautia drymeia*, which is also common in forests. In the NW Dinaric Mountains, additional diagnostic species with typical "illyric" distribution enter these grasslands. Towards the south, the association group is adjacent to the *Scorzonerion villosae*. The *Cirsio-Brachypodion* character species *Cirsium pannonicum* has its optimum in this group.

The associations of this group have traditionally been assigned to the *Mesobromion* (Mucina & Kolbek 1993, Kaligarič & Škornik 2002). Indeed, the number of *Cirsio-Brachypodion* species is relatively low, but both *Festuca stricta* subsp. *sulcata* and *Cirsium pannonicum* have a high constancy. If *Knautia drymeia* is considered as *Cirsio-Brachypodion* species, too – which makes more sense from a biogeographical point of view than considering it as a *Mesobromion* species – the inclusion of this unit in the *Cirsio-Brachypodion* is well established. However, as discussed in the main text, the association group should probably be merged with the suballiance *Hypochoeridenion maculatae*, which is currently included in the *Scorzonerion villosae*.

(14) ***Bromo-Plantaginetum*** Horvat et al. 1974

This association includes the species-rich calciphytic semi-dry grasslands of Slovenia and Croatia. It has the same distribution range as the *Bromo-Danthonietum* (see below) but differs from the latter by the presence of several rocky grassland species (e.g. *Carex humilis, Anthericum ramosum*) and the absence of species typical for more mesic or slightly acidic stands, such as *Danthonia alpina, Trisetum flavescens, Polygala vulgaris* and others.

Fig. A7.20. – *Bromo-Plantaginetum*.

(15) ***Euphorbio verrucosae-Caricetum montanae*** Karrer 1985

This association has a similar species composition as the *Brachypodio-Molinietum*. However, the floristic link to Eastern Europe is much weaker, while several pre-alpine species have a high constancy. Moreover, the dominant species in this unit is *Bromopsis erecta* while the *Brachypodio-Molinietum* is usually dominated by *Brachypodium pinnatum*. The *Euphorbio-Caricetum* is distributed on loamy, often intermittently moist soils in the NE Alps of Lower and Upper Austria. The occurrences in the SE Alps need further evaluation. The two relevés from the W Carpathians should be regarded as misclassified and included in the *Brachypodio-Molinietum*.


Fig. A7.21. – *Euphorbio verrucosae-Caricetum montanae*.

(16) ***Bromo-Danthonietum*** Šugar 1973

Species-rich semi-dry grasslands on slightly acidic soils in Slovenia and Croatia. See *Bromo-Plantaginetum* for further information.


Fig. A7.22. – *Bromo-Danthonietum*.

(17) ***"Sesleria caerulea* community SK"**
(18) ***"Sesleria caerulea* community AT"**

These two provisional units comprise the meso-xeric *Sesleria caerulea* grasslands of the Western Carpathians and of the Eastern Alps, respectively. In contrast to the meso-xeric *Sesleria caerulea* grasslands of the lower mountain ranges of Central Europe (see associations d, g and 7), the status of the *Sesleria*-dominated semi-dry grasslands of the Alps and Carpathians is rather unclear. Their delimitation towards *Sesleria caerulea* grasslands on shallow soils, belonging to the *Stipo-Festucetalia pallentis*, on the one hand, and alpine *Sesleria caerulea* grasslands of the *Elyno-Seslerietea* on the other hand, needs further evaluation.

Fig. A7.23. – "*Sesleria caeruleae* community SK" (triangles), "*Sesleria caeruleae* community AT" (circles).

(19) ***Carici albae-Brometum monocladi*** Ujházy et al. 2007
(20) **"*Carex alba-Bromus erectus*-community"**

The grasslands with *Carex alba* and *Bromopsis pannonica* subsp. *monoclada* in the Western Carpathians were described as *Carici albae-Brometum monocladi*. In the course of establishing a formal definition for this association, we realized that similar grasslands are present in the Eastern Alps, but with *Bromopsis erecta* as the co-dominant species. To highlight the existence of this peculiar grassland type, we provisionally accepted it as a separate unit, but obviously its status needs further evaluation.

Fig. A7.24. – *Carici albae-Brometum monocladi* (triangles), "*Carex alba-Bromus erectus*-community" (circles).

Association group C4: western Balkanic meadow steppes

This group is located between the previous and the following association group. The number of *Cirsio-Brachypodion* species is rather low, while some diagnostic species of the *Chrysopogono-Danthonion* reach a high constancy. However, due to the dominance of *Bromopsis erecta*, these grasslands were assigned to the *Cirsio-Brachypodion*.

(21) ***Carici montanae-Brometum*** Kojić ex Aćić et al. 2014

Bromopsis erecta grasslands growing on limestone in the mountains of Serbia.

(22) "***Brometum erecti* SRB**"

A second type of *Bromopsis erecta* grasslands in Serbia, distributed in higher altitudes (1200–1500 m a.s.l.) and clearly differentiated from the former one. We are not aware of a legitimate name for this association.

Fig. A7.25. – *Carici montanae-Brometum* (cricles), "*Brometum erecti* SRB" (triangles).

Association group C5: eastern Balkanic meadow steppes

This group is clearly differentiated from the meadow steppes of both Central and Eastern Europe. It should probably be considered as a separate suballiance.

(23) ***Hieracio pilosellae-Festucetum dalmaticae*** Vassilev et al. 2012

This and the following association have been only known from W Bulgaria, but they seem to occur also in SE Serbia. *Festuca stricta* subsp. *sulcata* is replaced by *F. dalmatica*, and *Bromopsis erecta* is replaced by *B. riparia*. The single relevé from N Romania must be considered as misclassification.

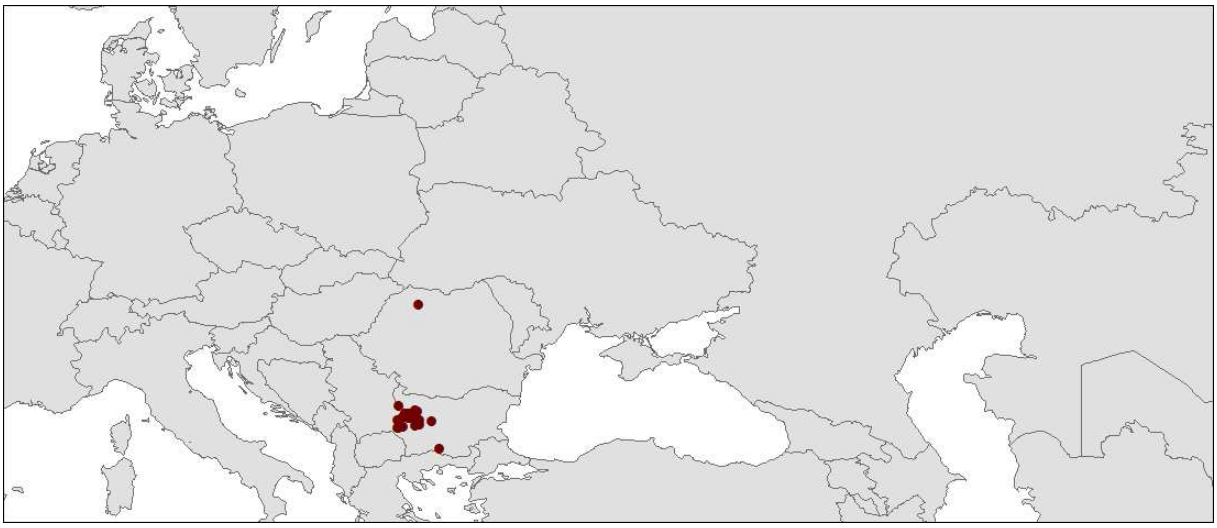

Fig. A7.26. – *Hieracio pilosellae-Festucetum dalmaticae*.

(24) ***Galio lovcense-Artemisietum chamaemelifoliae*** Pedashenko et al. 2010

This unit is distributed in the same region as the former association, where it occupies deeper soils.

Fig. A7.27. – *Galio lovcense-Artemisietum chamaemelifoliae*.

(25) "***Seslerietum latifoliae***"

Meso-xeric *Sesleria latifolia* grasslands of western and central Bulgaria. The species combination of this unit is very similar to the *Galio lovcense-Artemisietum chamaemelifoliae*, and the main difference is the dominance of *Sesleria latifolia*. In analogy to the grasslands dominated by *Sesleria caerulea* and *S. heuflerana*, we provisionally accepted this unit as a separate association.

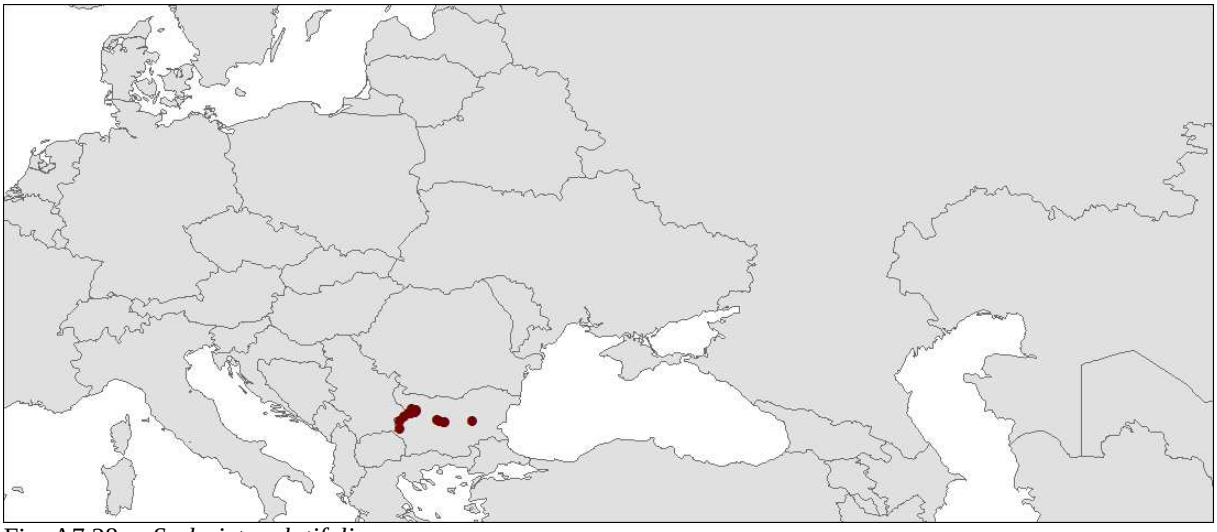

Fig. A7.28. – *Seslerietum latifoliae*.

Association group C6: meadow steppes of Crimea

(26) ***Adonido-Stipetum tirsae*** Didukh 2014

Stipa tirsa grasslands of eastern Crimea. Didukh & Mucina (2014) described a new alliance *Adonido-Stipion tirsae* for this association. For the reasons discussed in the main text, we prefer to include it as suballiance in the *Cirsio-Brachypodion*.

Fig. A7.29. – *Adonido-Stipetum tirsae*.

Association group C7: impoverished meadow steppes and steppe meadows of Eastern Europe

(27) ***Salvio pratensis-Poetum angustifoliae*** Korotchenko & Didukh 1997

This unit represents the core of the *Fragario viridis-Trifolion montani* described by Korotchenko & Didukh (1997). Many species typical for the Pannonian and the Eastern European meadow steppes are absent or very rare. The dominant grass species is usually *Poa angustifolia*. Our expert system assigned also plots far outside of Ukraine to this association. Whether this makes sense from an ecological point of view or should be regarded as misclassifications remains a question for future studies.

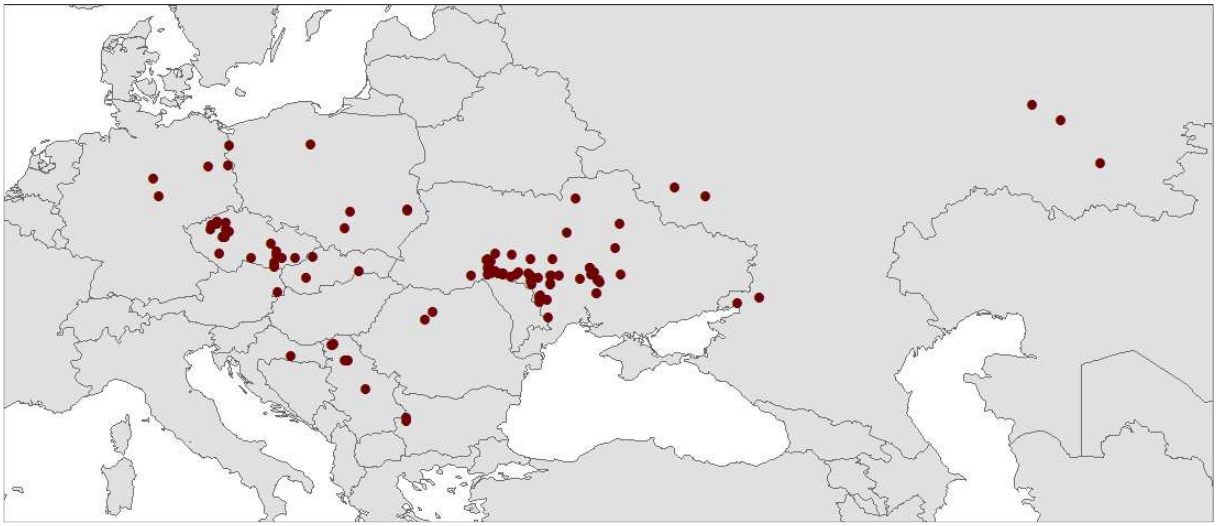

Fig. A7.30. – *Salvio pratensis-Poetum angustifoliae*.

(28) ***Artemisio campestris-Poetum angustifoliae*** Bulokhov 1990
Syn.: *Medicagini lupulinae-Poetum angustifoliae* Bulokhov 1990, *Agrimonio eupatoriae-Poetum angustifoliae* Bulokhov & Radchenko 1999, *Seseli annui-Poetum angustifoliae* Bulokhov & Radchenko 1999

This association is very similar to the previous unit and basically its north-eastern continuation. *Festuca valesiaca* agg., *Eryngium campestre* and some other species present in the *Salvio pratensis-Poetum angustifoliae* are absent, while *Artemisia campestris* and *Cytisus ruthenicus* are more frequent. This unit was described as separate alliance *Scabioso ochroleucae-Poion angustifoliae*, a solution preliminarily accepted in Willner et al. (2017). However, with the new data set it became clear that it is just an impoverished, marginal form of the *Cirsio-Brachypodion*. Several associations have been described within the *Scabioso ochroleucae-Poion angustifoliae*, but their status needs further evaluation, so we preferred to include them in this broadly defined unit for the purpose of this study.

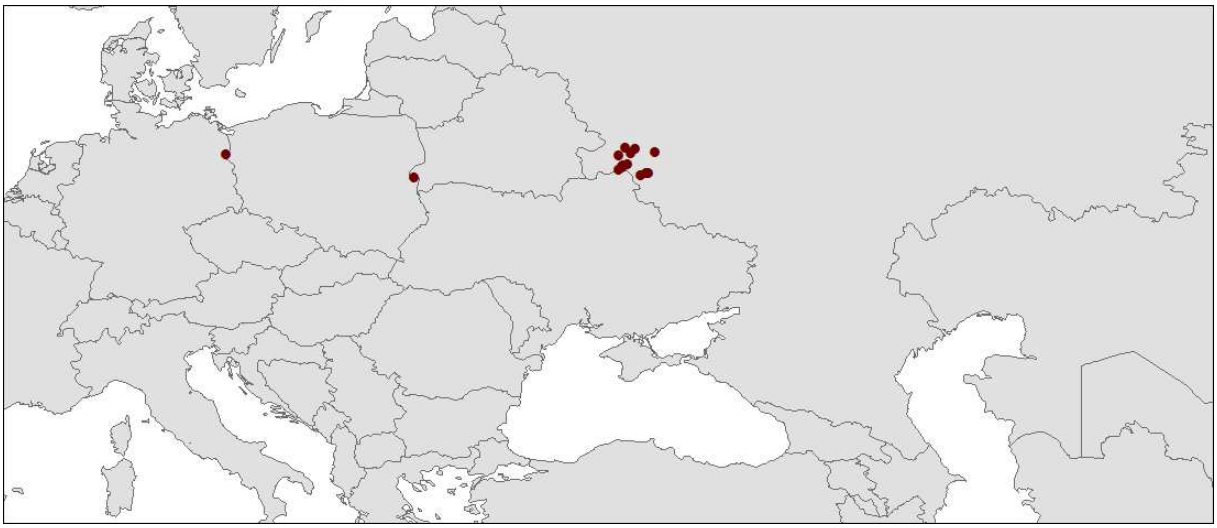

Fig. A7.31. – *Artemisio campestris-Poetum angustifoliae*.

Association group C8: calciphytic meadow steppes of Eastern Europe

This group includes meadow steppes on relatively shallow calcareous soils. It corresponds to the suballiance *Bupleuro falcati-Gypsophilenion altissimae* Averinova 2005.

(29) ***Asperulo cynanchicae-Onobrychidetum*** Averinova 2005

This association occurs on eroded slopes which are influenced by grazing (Poluyanov & Dorofejeva 2015). It is differentiated by several ruderal species such as *Echium vulgare, Daucus carota, Melilotus officinalis, Cynoglossum officinale, Poa compressa, Medicago lupulina, Lappula squarrosa* and *Brassica elongata* (= *Erucastrum armoracioides*).

Fig. A7.32. – *Asperulo cynanchicae-Onobrychidetum*.

(30) ***Astero amelli-Potentilletum humifusae*** Poluyanov 2012

Meadow steppes on shallow chernozem soils with admixture of carbonatic gravel. The sites are usually not grazed but regularly mown (Poluyanov & Dorofejeva 2015). Differential species within the association group are *Inula ensifolia, Aster amellus, Veronica incana, Orobanche alba, Astragalus onobrychis, Astragalus austriacus, Polygala nicaeensis* (incl. *P. cretacea*) and *Viola ambigua*.

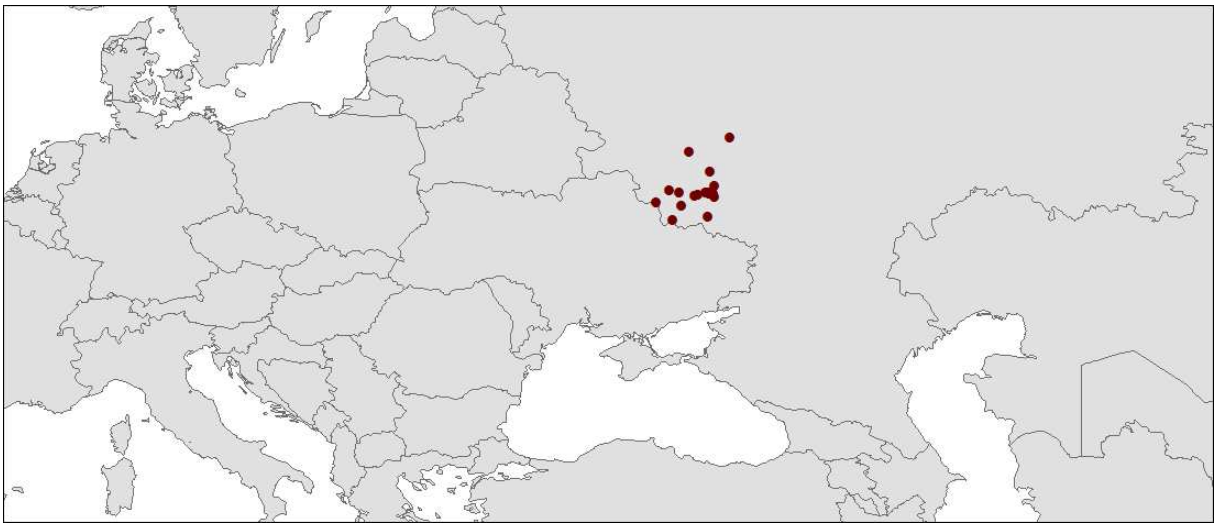

Fig. A7.33. – *Astero amelli-Potentilletum humifusae*.

(31) ***Gentiano cruciatae-Stipetum*** Averinova 2010 nom. prov.

This association was described from the Tula region by Averinova (2010), but it seems to be more widespread. It is only negatively differentiated against the previous two associations. The single plot from the S Urals should be considered as misclassified.

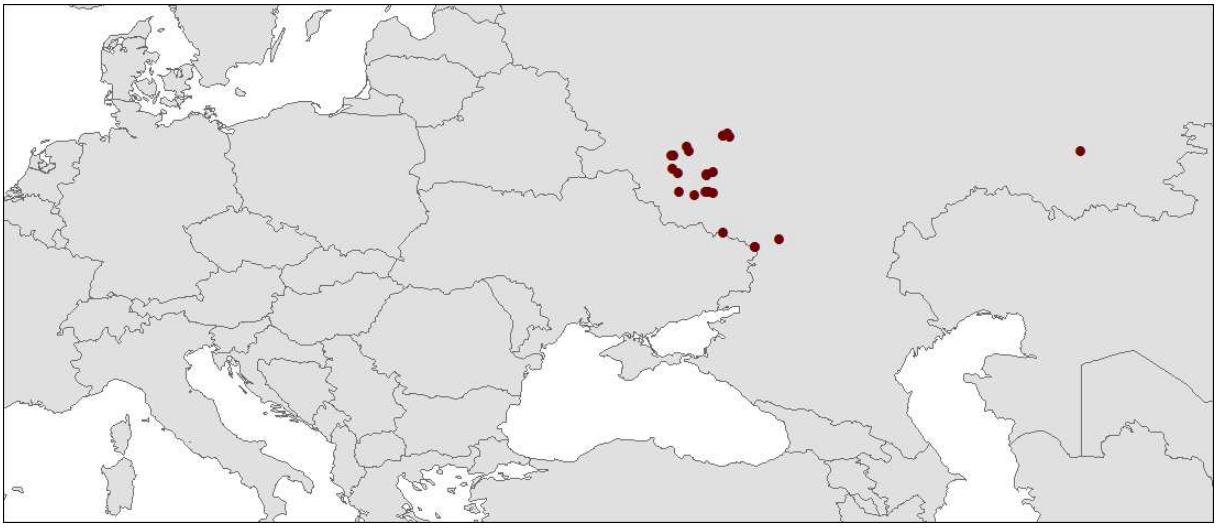

Fig. A7.34. – *Gentiano cruciatae-Stipetum.*

Association group C9: typical meadow steppes of Eastern Europe

This group includes the typical meadow steppes on chernozem soils.

(32) ***Veronico incanae-Inuletum ensifoliae*** Averinova 2010

This association is similar to the *Astero amelli-Potentilletum humifusae* (differential species: *Inula ensifolia, Aster amellus, Veronica incana*), but the diagnostic species of the *Bupleuro falcati-Gypsophilenion altissimae* are absent. It occupies southern slopes and places with eroded chernozem soils (Poluyanov & Dorofejeva 2015).

Fig. A7.35. – *Veronico incanae-Inuletum ensifoliae.*

(33) ***Vicio craccae-Centaureetum pseudophrygiae*** Poluyanov & Dorofejeva 2015 ass. prov.

This unit is found on northern slopes. It is differentiated by *Serratula tinctoria, Anthriscus sylvestris, Polygonum bistorta, Urtica dioica, Centaurea phrygia, Veronica spuria, Sanguisorba officinalis, Trifolium medium* and *Carex montana*. Poluyanov & Dorofejeva (2015) assigned this community to the *Geranion sanguinei*.

The single plot from the S Urals should be considered as misclassified.

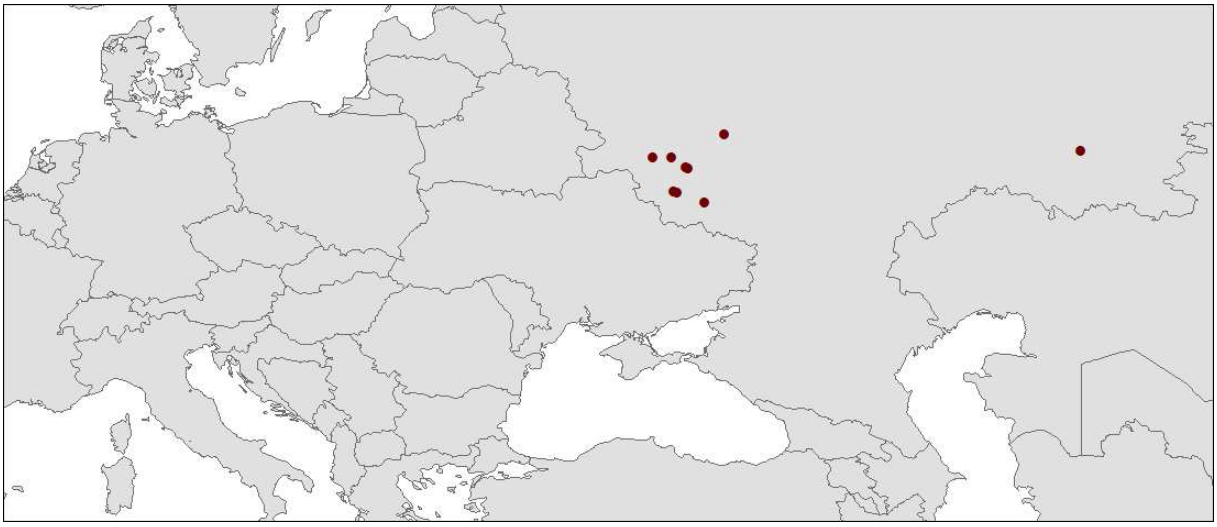

Fig. A7.36. – *Vicio craccae-Centauretum pseudophrygiae*.

(34) ***Stipo tirsae-Bromopsietum ripariae*** Averinova 2010 nom. cons. propos.
Syn.: *Agrostio vinealis-Avenuletum schellianae* Royer 1991

Meadow steppes on deep chernozem in flat watershed position ("plakor"). The locus classicus of this association is the famous Streletsky Steppe near Kursk. The stands have been used for hay making for many centuries, which is probably one of the reasons for their exceptional species richness. Without management, shrubs and trees encroach on the stands. Differential species against the previous two associations are *Pedicularis kaufmannii, Campanula patula, Briza media, Agrostis vinealis, Draba sibirica, Cerastium fontanum, Trifolium aureum, Rhinanthus angustifolius, Leontodon hispidus* and *Rumex acetosella*.

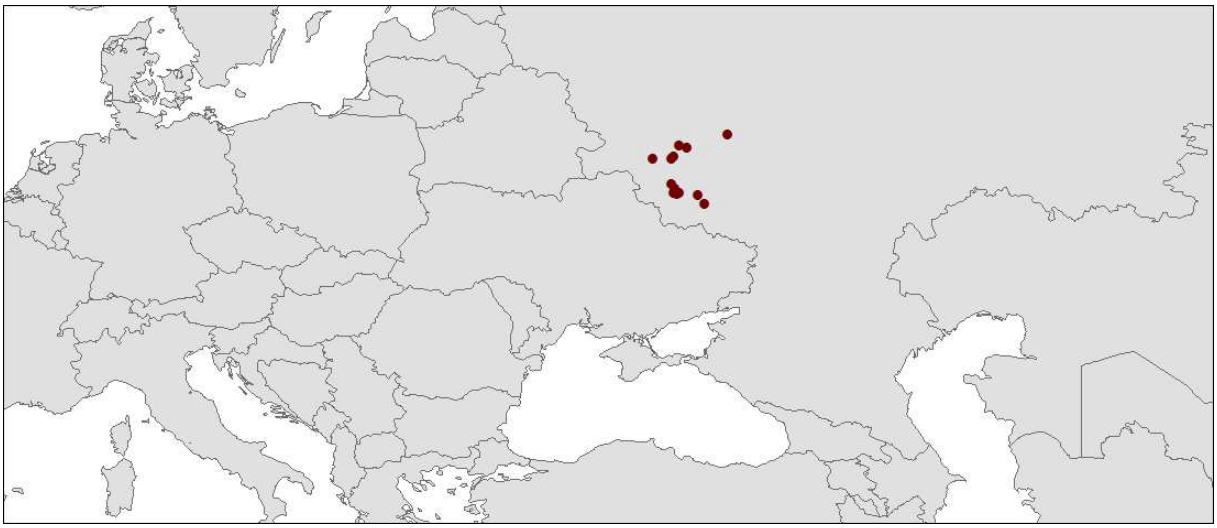

Fig. A7.37. – *Stipo tirsae-Bromopsietum ripariae.*

(35) ***Poo angustifoliae-Stipetum pennatae*** Yamalov et al. 2013
Syn.: *Leucanthemo vulgaris-Stipetum pennatae* Yamalov et al. 2013 [syntax. syn.]

Meadow steppes of the Southern Ural (Bashkortostan) and adjacent regions. The species composition is similar to the previous association, but *Bromopsis riparia*, *Stipa tirsa* and some other species are almost completely absent. The single plot from western Russia assigned to this association must be considered as misclassified.

Fig. A7.38. – *Poo angustifoliae-Stipetum pennatae*.

Association group C10: southern meadow steppes of Eastern Europe

This group comprises the meadow steppes along the southern margin of the forest steppe zone. They are well differentiated by species with an optimum in true steppes and by the absence of more mesophilous species.

(36) ***Serratulo radiatae-Stipetum pennatae*** Vynokurov 2014

Meadow steppes of the northernmost part of the true steppe zone of Ukraine dominated by *Stipa dasyphylla, S. pennata* and *S. tirsa*. This association was described from the Ingul River valley (Vynokurov 2014).

Fig. A7.39. – *Serratulo radiatae-Stipetum pennatae*.

(37) ***Trifolio alpestris-Stipetum tirsae*** Demina 2012

This association is mainly documented from the northern Rostov region. Its locus classicus is the “Don Reserve”, where it occupies the upper parts of the ridges. The community is developed on typical and southern chernozem (Demina 2015).

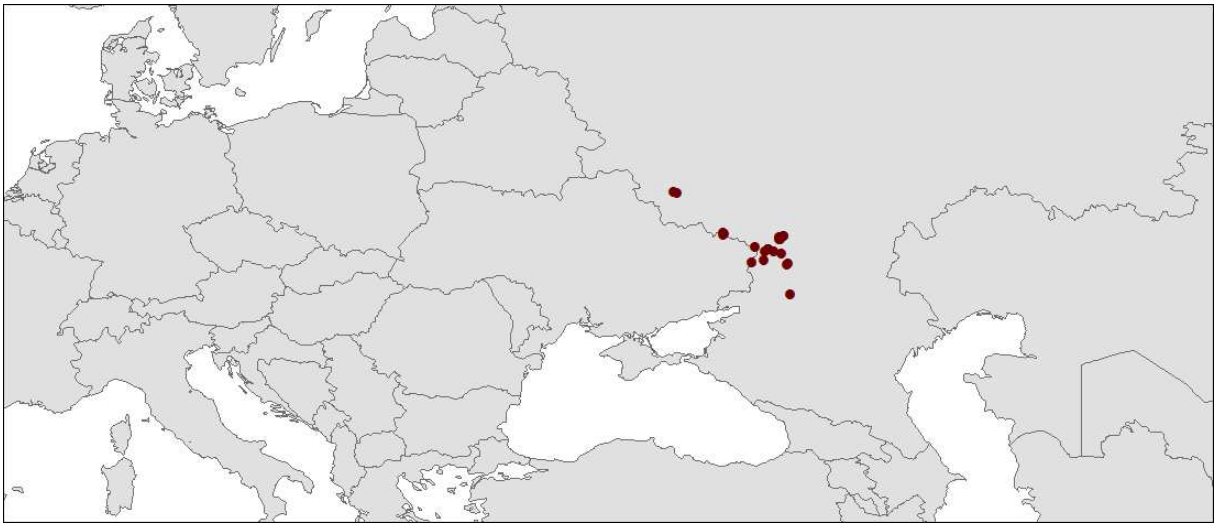

Fig. A7.40. – *Trifolio alpestris-Stipetum tirsae*.

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Electronic Appendix 8. Expert system for the associations of the alliance *Mesobromion erecti*.

Note: This expert system does not include the definition of the alliance. It can only be applied to relevés which have already been classified to the alliance by using the expert system given in Appendix 5. For the syntax used in the definitions see Appendix S2 in Landucci et al. (2015).

Species groups:

#TC Carex-semp-Grp
Carex sempervirens
Gentiana clusii
Linum viscosum
Polygonum viviparum

#TC Buph-sal-Grp1
Buphthalmum salicifolium
Rhinanthus glacialis
Astrantia major
Platanthera bifolia
Gymnadenia odoratissima
Crepis alpestris
Gentiana verna

#TC Buph-sal-Grp2
Buphthalmum salicifolium
Rhinanthus glacialis
Astrantia major
Gymnadenia odoratissima
Phyteuma orbiculare
Polygala chamaebuxus
Knautia dipsacifolia
Allium carinatum
Gentiana verna
Muscari botryoides
Crepis alpestris

#TC Salv-prat-Grp
Salvia pratensis
Hippocrepis comosa
Teucrium chamaedrys
Gentianella germanica
Gentianella ciliata
Carex montana
Brachypodium pinnatum agg.
Bromopsis erecta
Koeleria pyramidata agg.
Sesleria caerulea agg.
Euphorbia verrucosa
Onobrychis viciifolia
Asperula cynanchica
Genista sagittalis
Carlina acaulis

Group definitions:

5 M-a Solidagini-Helictotrichetum
(((<Helictochloa pratensis GR 02> OR <Briza media GR 02>) OR <Festuca rubra agg. GR 02>) OR <Festuca ovina agg. GR 02>) NOT (<#TC Carex-semp-Grp GR 01> OR <#TC Salv-prat-Grp GR 01>)

5 M-b Gentiano-Koelerietum

<#TC Salv-prat-Grp GR 01> NOT (((< Sesleria caerulea agg. GR 05> OR <Bromopsis erecta GR 05>) OR <#TC Carex-semp-Grp GR 01>) OR <#TC Buph-sal-Grp2 GR 01>)

5 M-c Mesobrometum
(<#TC Salv-prat-Grp GR 01> AND <Bromopsis erecta GR 05>) NOT ((< Sesleria caerulea agg. GR 05> OR <#TC Carex-semp-Grp GR 01>) OR <#TC Buph-sal-Grp2 GR 01>)

5 M-d Polygalo amarae-Seslerietum
<Sesleria caerulea agg. GR 05> NOT (<#TC Buph-sal-Grp1 GR 01> OR <#TC Carex-semp-Grp GR 01>)

5 M-e Gentiano vernae-Brometum
(<#TC Salv-prat-Grp GR 01> AND <#TC Buph-sal-Grp2 GR 01>) NOT (< Sesleria caerulea agg. GR 05> OR <#TC Carex-semp-Grp GR 01>)

5 M-f Carlino-Caricetum sempervirentis
<#TC Carex-semp-Grp GR 01>

5 M-g Koelerio-Seslerietum
(<Sesleria caerulea agg. GR 05> AND <#TC Buph-sal-Grp1 GR 01>) NOT <#TC Carex-semp-Grp GR 01>

Electronic Appendix 9. Expert system for the associations of the alliance *Cirsio-Brachypodion pinnati*.

Note: This expert system does not include the definition of the alliance. It can only be applied to relevés which have already been classified to the alliance by using the expert system given in Appendix 5. For the syntax used in the definitions see Appendix S2 in Landucci et al. (2015).

Species groups:

#TC CB-West1
Bromopsis erecta
Helictochloa pratensis
Onobrychis viciifolia
Orchis militaris
Euphorbia verrucosa
Lembotropis nigricans
Trifolium rubens
Dianthus carthusianorum agg.
Ranunculus bulbosus
Carlina acaulis
Cirsium pannonicum
Sesleria caerulea agg.
Bromopsis pannonica
Sesleria heuflerana
Salvia transsylvanica
Genista pilosa
Festuca stricta subsp. *trachyphylla*

#TC CB-West2
Thesium linophyllon
Linum catharticum
Sanguisorba minor
Scabiosa columbaria agg.
Euphorbia cyparissias
Teucrium chamaedrys
Polygala major
Bothriochloa ischaemum
Danthonia alpina

#TC CB-Balkan
Festuca dalmatica agg.
Leontodon crispus
Asperula purpurea
Cerastium banaticum
Galium rhodopeum
Artemisia chamaemelifolia
Sesleria latifolia

#TC CB-Crimea
Bromopsis cappadocica
Cerastium biebersteinii
Cruciata taurica
Asperula tenella
Thymus roegneri

#TC CB-East
Bromopsis riparia
Phlomis tuberosa
Veronica incana
Phlomis herba-venti subsp. *pungens*
Dianthus capitatus
Salvia nutans
Potentilla humifusa

Cirsium decussatum
Psephellus sumensis
Linum perenne
Gypsophila altissima
Polygala sibirica
Iris aphylla
Dracocephalum ruyschiana
Euphorbia subtilis
Euphorbia semivillosa
Delphinium cuneatum
Arenaria procera
Pedicularis kaufmannii
Draba sibirica
Helictochloa hookeri subsp. *schelliana*
Artemisia armeniaca
Galium octonarium
Stipa dasyphylla
Hieracium virosum
Verbascum marschallianum
Seseli tortuosum
Sisymbrium polymorphum
Jurinea cyanoides
Peucedanum ruthenicum
Salvia dumetorum
Potentilla thuringiaca
Artemisia sericea
Dracocephalum thymiflorum
Stipa zalesskii
Astragalus macropus
Rhaponticoides ruthenica
Lathyrus pisiformis
Trifolium lupinaster
Dianthus versicolor
Spiraea crenata

#TC Brach-Brom
Bromopsis erecta
Brachypodium pinnatum agg.

#TC CB-West-dry
Artemisia campestris
Potentilla incana agg.
Festuca stricta subsp. *trachyphylla*
Eryngium campestre
Cytisus ruthenicus
Campanula sibirica
Adonis vernalis
Carex humilis
Anthericum ramosum
Aster amellus
Elytrigia intermedia
Veronica spicata
Astragalus onobrychis
Inula ensifolia
Linum flavum
Carex michelii
Polygala major
Podospermum purpureum
Bupleurum falcatum
Linum tenuifolium
Globularia bisnagarica
Pulsatilla vulgaris

Teucrium montanum
Euphorbia nicaeensis
Cytisus austriacus
Viola ambigua
Taraxacum serotinum

#TC CB-West-mesic
Campanula patula
Colchicum autumnale
Trisetum flavescens
Lathyrus pratensis
Schedonorus pratensis
Festuca rubra agg.
Cerastium fontanum
Rumex acetosa
Veronica chamaedrys agg.
Ranunculus acris agg.
Holcus lanatus
Carex flacca
Potentilla erecta
Rhinanthus minor
Anthoxanthum odoratum agg.
Agrostis capillaris
Luzula campestris agg.
Danthonia decumbens
Anacamptis morio
Genista sagittalis
Carex montana
Molinia caerulea agg.
Potentilla alba
Viola canina
Trifolium rubens
Laserpitium latifolium
Inula salicina
Serratula tinctoria
Stellaria graminea
Sanguisorba officinalis
Lathyrus pannonicus
Danthonia alpina
Pontechium maculatum
Clematis recta
Fragaria moschata
Pulmonaria angustifolia
Pulmonaria mollis
Trifolium pannonicum
Trifolium ochroleucon
Veratrum nigrum
Knautia drymeia
Euphorbia verrucosa
Gentiana utriculosa
Ranunculus montanus

#TC NegDif-AdonBrach
Festuca valesiaca agg.
Sesleria caerulea agg.
Globularia bisnagarica
Teucrium montanum
Hippocrepis comosa
Thymus praecox
Teucrium chamaedrys
Bothriochloa ischaemum
Cytisus ruthenicus

Elytrigia intermedia
Festuca pallens agg.
Helictotrichon desertorum
Seseli elatum agg.
Thymus pannonicus agg.

#TC NegDif-AdonBrach-ScorzBrach-AstrBrom
Inula ensifolia
Linum flavum
Carex michelii
Cruciata glabra
Cirsium pannonicum
Polygala major
Astragalus monspessulanus
Cytisus albus
Melampyrum barbatum
Salvia austriaca
Thesium ramosum

#TC NegDif-AdonBrach-ScorzBrach
Astragalus onobrychis
Dorycnium pentaphyllum

#TC NegDif-AdonBrach-AstrBrom
Inula hirta
Pulsatilla vulgaris
Bupleurum falcatum
Linum tenuifolium

#TC Dianth-syl-Grp
Dianthus sylvestris
Onobrychis montana
Poa molinerii

#TC NegDif-Inul-ensi
Dorycnium pentaphyllum
Hypochaeris maculata
Stipa pennata
Genista tinctoria
Polygala major
Arenaria procera
Astragalus monspessulanus
Buphthalmum salicifolium
Coronilla coronata
Cyanus triumfettii
Cytisus albus
Cytisus hirsutus
Gentiana verna
Pulmonaria mollis
Pulsatilla montana
Salvia nutans
Salvia transsylvanica
Seseli pallasii
Sesleria caerulea agg.

#TC Bupl-falc-Grp
Bupleurum falcatum
Linum tenuifolium
Globularia bisnagarica
Pulsatilla vulgaris
Teucrium montanum
Onobrychis viciifolia

#TC Euph-pann-Grp
Euphorbia nicaeensis
Cytisus austriacus
Viola ambigua
Taraxacum serotinum

#TC Inul-ensi-Grp-Pann
Astragalus onobrychis
Campanula sibirica
Cytisus austriacus
Cytisus ratisbonensis
Inula ensifolia
Polygala major

#TC Gen-janu-Grp3
Asperula purpurea
Cirsium acaulon
Cytisus purpureus
Dianthus giganteus
Erica carnea
Euphorbia verrucosa
Genista januensis
Gentiana verna
Knautia purpurea
Linum viscosum
Primula acaulis
Rhinanthus glacialis
Thymus longicaulis

#TC Carex-mont-Grp
Carex montana
Potentilla alba
Molinia caerulea agg.
Trifolium rubens
Laserpitium latifolium
Inula salicina
Serratula tinctoria
Sanguisorba officinalis
Lathyrus pannonicus
Danthonia alpina
Pontechium maculatum
Clematis recta
Fragaria moschata
Pulmonaria angustifolia
Pulmonaria mollis
Trifolium pannonicum
Trifolium ochroleucon
Veratrum nigrum
Carex michelii
Galium boreale
Polygala major

#TC Knaut-drym-Grp
Knautia drymeia
Buphthalmum salicifolium
Euphorbia verrucosa
Rhinanthus glacialis
Allium carinatum
Linum viscosum
Leontodon incanus

#TC Gen-janu-Grp
Genista januensis
Veronica barrelieri

#TC Gen-janu-Grp2
Genista januensis
Veronica barrelieri
Gentiana utriculosa
Cirsium acaulon
Danthonia alpina
Genista sagittalis
Thymus longicaulis

#TC Gent-utric-Grp
Gentiana utriculosa
Carlina acanthifolia
Silene sendtneri
Ranunculus montanus

#TC Cerast-moes-Grp
Cerastium moesiacum
Seseli peucedanoides
Crepis conyzifolia
Campanula abietina
Centaurea orientalis
Centaurea kotschyana
Dianthus cruentus
Pedicularis heterodonta

#TC Colch-Fest
Danthonia decumbens
Potentilla erecta
Polygala vulgaris
Viola canina
Hypochaeris radicata
Dianthus deltoides
Dianthus armeria
Rumex acetosella
Moenchia mantica

#TC Car-alb-Brom
Carex alba
Carex filiformis
Carex montana
Buphthalmum salicifolium
Cirsium pannonicum
Inula salicina

#TC Gen-Stip-tirs
Genista pilosa
Festuca heteropachys
Arabidopsis thaliana

#TC Seslerietum-SK
Bromopsis pannonica
Gentiana cruciata
Centaurea phrygia
Cruciata glabra
Carum carvi
Potentilla heptaphylla
Carex filiformis

#TC Seslerietum-SK-AT
Carex montana
Molinia caerulea agg.
Buphthalmum salicifolium
Phyteuma orbiculare
Festuca amethystina
Carduus defloratus
Leontodon incanus
Allium carinatum
Rumex acetosa
Ranunculus acris agg.
Platanthera bifolia
Clinopodium alpinum
Carex panicea
Carex alba
Dorycnium pentaphyllum
Genista pilosa

#TC Seslerietum-AT
Stachys officinalis
Stachys alopecuros
Euphorbia verrucosa
Polygala chamaebuxus
Rhinanthus alectorolophus
Calamagrostis varia
Aquilegia atrata
Galium austriacum
Astrantia major

#TC Gal-rhod-Grp
Galium rhodopeum
Festuca rubra agg.
Potentilla alba
Inula salicina
Seseli peucedanoides
Artemisia chamaemelifolia
Veratrum nigrum
Cruciata glabra
Stachys officinalis

#TC NegDif-Hier-Fest
Salvia austriaca
Helleborus purpurascens
Cytisus albus

#TC Dif-Frag-Trif
Eryngium campestre
Thesium linophyllon
Linum catharticum
Sanguisorba minor
Euphorbia cyparissias
Teucrium chamaedrys
Bothriochloa ischaemum

#TC NegDif-Frag-Trif
Stipa pennata
Potentilla humifusa
Arenaria procera
Carex humilis
Pontechium maculatum
Salvia nutans
Iris aphylla

Astragalus danicus
Asperula tinctoria
Galium boreale
Anthericum ramosum
Cirsium decussatum
Psephellus sumensis
Linum perenne
Gypsophila altissima
Dracocephalum ruyschiana
Draba sibirica
Stipa tirsa

#TC Poa-ang-Grp
Poa pratensis agg.
Koeleria pyramidata agg.
Festuca valesiaca agg.

#TC NegDif-Frag-Trif2
Brachypodium pinnatum agg.
Danthonia alpina
Chrysopogon gryllus
Briza media
Carex caryophyllea
Trisetum flavescens
Carex flacca
Allium lusitanicum
Anacamptis morio
Anthyllis vulneraria
Astragalus danicus
Carex filiformis
Carex michelii
Cirsium acaulon
Clematis recta
Colchicum autumnale
Crepis praemorsa
Cruciata glabra
Cyanus triumfettii
Cytisus ratisbonensis
Danthonia decumbens
Dorycnium pentaphyllum
Ferulago sylvatica
Fragaria moschata
Galium glaucum
Genista sagittalis
Globularia bisnagarica
Gymnadenia conopsea
Helianthemum nummularium
Helictochloa praeusta
Hippocrepis comosa
Inula ensifolia
Inula hirta
Knautia drymeia
Laserpitium latifolium
Lathyrus latifolius
Linum flavum
Linum tenuifolium
Melica ciliata
Molinia caerulea agg.
Polygala major
Potentilla alba
Potentilla erecta
Primula veris

Pulmonaria angustifolia
Pulmonaria mollis
Pulsatilla vulgaris
Scorzonera hispanica
Serratula tinctoria
Tragopogon pratensis
Trifolium pannonicum

#TC Dif-Kursk
Carex michelii
Potentilla alba
Lathyrus pannonicus
Veratrum nigrum
Delphinium cuneatum
Anthericum ramosum
Cirsium decussatum
Psephellus sumensis

#TC Dif-Kursk-Ural
Rumex acetosa
Stellaria graminea
Campanula persicifolia
Dracocephalum ruyschiana
Bunias orientalis
Euphorbia semivillosa
Draba sibirica
Astragalus danicus
Asperula tinctoria
Galium boreale

#TC Dif-Rostov
Pilosella echioides
Galium octonarium
Stipa dasyphylla
Artemisia austriaca
Artemisia pontica
Hieracium virosum
Eryngium campestre
Phlomis herba-venti subsp. *pungens*
Verbascum marschallianum
Seseli tortuosum
Sisymbrium polymorphum
Prunus tenella
Jurinea cyanoides
Peucedanum ruthenicum
Euphorbia nicaeensis

#TC NegDif-Rostov
Astragalus danicus
Teucrium chamaedrys
Cirsium eriophorum
Cytisus albus
Milium vernale
Helictotrichon desertorum
Rhaponticoides ruthenica
Artemisia sericea
Onosma simplicissima
Artemisia latifolia
Astragalus macropus
Astragalus wolgensis

#TC Dif-Ural

Salvia dumetorum
Potentilla thuringiaca
Artemisia sericea
Dracocephalum thymiflorum
Helictotrichon desertorum
Helictochloa hookeri subsp. *schelliana*
Lathyrus pisiformis
Trifolium lupinaster
Dianthus versicolor

#TC NegDif-Ural
Ajuga genevensis
Anthericum ramosum
Asperula cynanchica
Bromopsis riparia
Bupleurum falcatum
Carex humilis
Cirsium decussatum
Elytrigia intermedia
Inula ensifolia
Iris aphylla
Linum perenne
Pontechium maculatum
Psephellus sumensis
Salvia nemorosa
Salvia nutans
Salvia pratensis
Stipa tirsa
Trifolium alpestre
Veratrum nigrum
Veronica incana

#TC Gyps-alt-Grp
Gypsophila altissima
Hypericum elegans
Helianthemum nummularium
Polygala sibirica
Centaurea stoebe

#TC Ech-vul-Grp-RU
Echium vulgare
Daucus carota
Melilotus officinalis
Cynoglossum officinale
Potentilla incana agg.
Poa compressa
Medicago lupulina
Lappula squarrosa
Brassica elongata

#TC Eryng-plan-Grp
Eryngium planum
Malva thuringiaca
Pilosella bauhini
Stipa capillata
Echinops ritro
Achillea nobilis
Linum flavum
Seseli annuum

#TC Inul-ensi-Grp-RU
Inula ensifolia

Aster amellus
Veronica incana
Orobanche alba
Astragalus onobrychis
Astragalus austriacus
Polygala nicaeensis
Viola ambigua

#TC Stipa-tirsa-Grp-RU
Stipa tirsa
Potentilla alba
Stachys officinalis
Dracocephalum ruyschiana
Rumex acetosa
Veratrum nigrum
Klasea lycopifolia
Lathyrus pannonicus
Bunias orientalis
Primula veris
Stellaria graminea
Campanula persicifolia
Arrhenatherum elatius
Peucedanum oreoselinum
Euphorbia semivillosa
Nepeta nuda

#TC Serr-tinct-Grp-RU
Serratula tinctoria
Anthriscus sylvestris
Bistorta officinalis
Urtica dioica
Centaurea phrygia
Veronica spuria
Sanguisorba officinalis
Trifolium medium
Carex montana

#TC Ped-kauf-Grp
Pedicularis kaufmannii
Campanula patula
Briza media
Agrostis vinealis
Draba sibirica
Cerastium fontanum
Trifolium aureum
Rhinanthus angustifolius
Leontodon hispidus
Rumex acetosella

#TC Spir-hyp-Grp
Spiraea hypericifolia
Asyneuma canescens
Teucrium polium
Milium vernale

Group definitions:

5 CB-01 Adonido-Brachypodietum
((<#TC CB-West1 | #TC CB-West2 GE #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-dry GE #TC CB-West-mesic>) NOT (<#TC NegDif-AdonBrach GR 00> OR (<#TC NegDif-AdonBrach-ScorzBrach GR 00> OR (<#TC NegDif-AdonBrach-ScorzBrach-AstrBrom GR 00> OR

(<#TC NegDif-AdonBrach-AstrBrom GR 00> OR (<#TC Euph-pann-Grp GR 00> OR (<#TC CB-Balkan GR 00> OR (<#TC CB-Crimea GR 00> OR (<Sesleria heuflerana GR 00> OR (<Bromopsis pannonica GR 00> OR <Stipa tirsa GR 00>)))))))))

5 CB-02 Scabioso ochroleucae-Brachypodietum
(((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-dry GE #TC CB-West-mesic>) AND <#TC NegDif-AdonBrach | #TC NegDif-AdonBrach-AstrBrom GR 00>) NOT (<#TC Dianth-syl-Grp GR 00> OR (<#TC NegDif-AdonBrach-ScorzBrach GR 00> OR (<#TC NegDif-AdonBrach-ScorzBrach-AstrBrom GR 00> OR (<#TC Euph-pann-Grp GR 00> OR (<Campanula sibirica GR 00> OR (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC CB-Crimea GR 00> OR (<Sesleria caerulea agg. GR 05> OR (<Sesleria heuflerana GR 00> OR (<Bromopsis pannonica GR 00> OR <Stipa tirsa GR 05>)))))))))

5 CB-03 Astragalo onobrychidis-Brometum
((((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-dry GE #TC CB-West-mesic>) AND <#TC NegDif-AdonBrach | #TC NegDif-AdonBrach-ScorzBrach GR 00>) AND <#TC Dianth-syl-Grp GR 00>) NOT (<#TC NegDif-AdonBrach-ScorzBrach-AstrBrom GR 00> OR (<#TC NegDif-AdonBrach-AstrBrom GR 00> OR (<#TC Euph-pann-Grp GR 00> OR (<Eryngium campestre GR 00> OR (<Scabiosa ochroleuca GR 00> OR (<Campanula sibirica GR 00> OR (<Cirsium acaulon GR 00> OR (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC CB-Crimea GR 01> OR (<Sesleria caerulea agg. GR 05> OR (<Sesleria heuflerana GR 00> OR (<Bromopsis pannonica GR 00> OR <Stipa tirsa GR 00>)))))))))))

5 CB-04 Inuletum ensifoliae
(((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-dry GE #TC CB-West-mesic>) AND <#TC NegDif-AdonBrach-ScorzBrach-AstrBrom GR 00>) NOT (<#TC Dianth-syl-Grp GR 00> OR (<Cirsium acaulon GR 00> OR (<#TC NegDif-Inul-ensi GR 00> OR (<#TC Bupl-falc-Grp GR 00> OR (<#TC Euph-pann-Grp GR 00> OR (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC CB-Crimea GR 00> OR (<Sesleria caerulea agg. GR 05> OR (<Sesleria heuflerana GR 05> OR (<Bromopsis pannonica GR 05> OR <Stipa tirsa GR 05>)))))))))

5 CB-05 Polygalo majoris-Brachypodietum
((((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-dry GE #TC CB-West-mesic>) AND <#TC NegDif-AdonBrach-ScorzBrach | #TC NegDif-AdonBrach-ScorzBrach-AstrBrom GR 00>) AND <#TC Bupl-falc-Grp | #TC NegDif-Inul-ensi GR 00>) NOT (<#TC Gen-janu-Grp3 GR #TC Inul-ensi-Grp-Pann> OR (<#TC Dianth-syl-Grp GR 00> OR (<Cirsium acaulon GR 00> OR (<#TC Euph-pann-Grp GR #TC Bupl-falc-Grp> OR (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC CB-Crimea GR 01> OR (<Sesleria caerulea agg. GR 05> OR (<Sesleria heuflerana GR 05> OR (<Bromopsis pannonica GR 05> OR <Stipa tirsa GR 05>)))))))))

5 CB-06 Euphorbio pannonicae-Brachypodietum
(((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-dry GE #TC CB-West-mesic>) AND <#TC Euph-pann-Grp GR #TC Bupl-falc-Grp>) NOT (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC CB-Crimea GR 01> OR (<Sesleria caerulea agg. GR 00> OR (<Sesleria heuflerana GR 05> OR (<Bromopsis pannonica GR 05> OR <Stipa tirsa GR 05>)))))

5 CB-07 Cirsio pannonici-Seslerietum caeruleae
<Sesleria caerulea agg. GR 05> NOT (<#TC Seslerietum-SK-AT GR 00> OR <#TC Seslerietum-AT GR 00>)

5 CB-08 Orchido militaris-Seslerietum heufleranae
<Sesleria heuflerana GR 05>

5 CB-09 Genisto-Stipetum tirsae
((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <Stipa tirsa GR 05>) AND <#TC Gen-Stip-tirs GR 00>) NOT <#TC CB-Crimea GR 00>

5 CB-10 Stipetum tirsae
(<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <Stipa tirsa GR 05>) NOT (<#TC CB-Crimea GR 00> OR <#TC Gen-Stip-tirs GR 00>) NOT <#TC Spir-hyp-Grp GR 01>

5 CB-11 Festuco rupicolae-Brometum

((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-mesic GR #TC CB-West-dry>) NOT (<#TC Carex-mont-Grp GR 03> OR ((<Festuca valesiaca agg. GR #TC Brach-Brom> AND <#TC Colch-Fest GR #TC Carex-mont-Grp>) OR ((<#TC Knaut-drym-Grp GR 01> AND <#TC Gen-janu-Grp2 GR 01>) OR (<#TC Gent-utric-Grp GR 01> OR (<#TC Cerast-moes-Grp GR 01> OR (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC CB-Crimea GR 01> OR (<Carex alba GR 01> OR (<Sesleria caerulea agg. GR 05> OR (<Sesleria heuflerana GR 05> OR (<Bromopsis pannonica GR 05> OR <Stipa tirsa GR 05>)))))))))))

5 CB-12 Brachypodio-Molinietum
((((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-mesic GR #TC CB-West-dry>) AND <#TC Carex-mont-Grp GR 03>) AND <#TC Carex-mont-Grp GR #TC Colch-Fest>) NOT (<#TC Knaut-drym-Grp GR 00> OR (<#TC Gen-janu-Grp GR 01> OR (<#TC Gent-utric-Grp GR 01> OR (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC CB-Crimea GR 01> OR (<Carex alba GR 01> OR (<Sesleria caerulea agg. GR 05> OR (<Sesleria heuflerana GR 05> OR (<Bromopsis pannonica GR 05> OR <Stipa tirsa GR 05>)))))))))

5 CB-13 Colchico autumnalis-Festucetum rupicolae
((((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-mesic GR #TC CB-West-dry>) AND <Festuca valesiaca agg. GR #TC Brach-Brom>) AND <#TC Colch-Fest GR #TC Carex-mont-Grp>) NOT (<Carex montana GR 05> OR (<#TC Gen-janu-Grp GR 00> OR (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC CB-Crimea GR 00> OR (<Sesleria caerulea agg. GR 00> OR (<Sesleria heuflerana GR 00> OR (<Bromopsis pannonica GR 00> OR <Stipa tirsa GR 00>)))))))

5 CB-14 Bromo-Plantaginetum
(((((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-dry GE #TC CB-West-mesic>) AND <#TC NegDif-AdonBrach-ScorzBrach | #TC NegDif-AdonBrach-ScorzBrach-AstrBrom GR 00>) AND <#TC Bupl-falc-Grp | #TC NegDif-Inul-ensi GR 00>) AND <#TC Gen-janu-Grp3 GR #TC Inul-ensi-Grp-Pann>) NOT (<#TC Dianth-syl-Grp GR 00> OR (<Cirsium acaulon GR 00> OR (<Phleum phleoides GR 00> OR (<#TC Euph-pann-Grp GR #TC Bupl-falc-Grp> OR (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC CB-Crimea GR 01> OR (<Sesleria caerulea agg. GR 05> OR (<Sesleria heuflerana GR 05> OR (<Bromopsis pannonica GR 05> OR <Stipa tirsa GR 05>)))))))))

5 CB-15 Euphorbio verrucosae-Caricetum montanae
(((((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-mesic GR #TC CB-West-dry>) AND <#TC Carex-mont-Grp GR 03>) AND <#TC Carex-mont-Grp GR #TC Colch-Fest>) AND <#TC Knaut-drym-Grp GR 00>) NOT (<#TC Gen-janu-Grp2 GR 01> OR (<#TC Gent-utric-Grp GR 01> OR (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC CB-Crimea GR 00> OR (<Astragalus danicus GR 00> OR (<Carex alba GR 01> OR (<Sesleria caerulea agg. GR 05> OR (<Sesleria heuflerana GR 00> OR (<Bromopsis pannonica GR 00> OR <Stipa tirsa GR 00>)))))))))

5 CB-16 Bromo-Danthonietum
((((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-mesic GR #TC CB-West-dry>) AND <#TC Knaut-drym-Grp GR 00>) AND <#TC Gen-janu-Grp2 GR 01>) NOT (<Carex alba GR 00> OR (<Carduus defloratus GR 00> OR (<Artemisia campestris GR 00> OR (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC CB-Crimea GR 00> OR (<Sesleria caerulea agg. GR 00> OR (<Sesleria heuflerana GR 05> OR (<Bromopsis pannonica GR 05> OR <Stipa tirsa GR 05>)))))))

5 CB-17 Sesleria caerulea community SK
((<Sesleria caerulea agg. GR 05> AND <#TC Seslerietum-SK-AT GR 00>) AND <#TC Seslerietum-SK GR #TC Seslerietum-AT>) NOT <Cirsium acaulon GR 00>

5 CB-18 Sesleria caerulea community AT
((<Sesleria caerulea agg. GR 05> AND <#TC Seslerietum-SK-AT GR 00>) AND <#TC Seslerietum-AT GR #TC Seslerietum-SK>) NOT <Cirsium acaulon GR 00>

5 CB-19 Carici albae-Brometum monocladi
(<Bromopsis pannonica GR 01> AND <#TC Car-alb-Brom GR 01>) NOT <Sesleria caerulea agg. GR 05>

5 CB-20 Carex alba-Bromus erectus-community

((<Bromopsis erecta GR 01> AND <Carex alba GR 01>) AND <#TC Knaut-drym-Grp GR 01>) NOT <Sesleria caerulea agg. GR 05>

5 CB-21 Carici montanae-Brometum
(((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-mesic GR #TC CB-West-dry>) AND <#TC Gent-utric-Grp GR 00>) NOT (<#TC Cerast-moes-Grp GR 01> OR (<Carex flacca GR 00> OR (<Potentilla erecta GR 00> OR (<#TC Knaut-drym-Grp GR 00> OR (<#TC Gen-janu-Grp GR 00> OR (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC CB-Crimea GR 01> OR (<Sesleria caerulea agg. GR 05> OR (<Sesleria heuflerana GR 05> OR (<Bromopsis pannonica GR 05> OR <Stipa tirsa GR 05>)))))))))

5 CB-22 Brometum erecti SRB
((((<#TC CB-West1 | #TC CB-West2 GR #TC CB-East> AND <#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00>) AND <#TC CB-West-mesic GR #TC CB-West-dry>) AND <#TC Gent-utric-Grp GR 00>) AND <#TC Cerast-moes-Grp GR 01>) NOT (<Carex flacca GR 00> OR (<Potentilla erecta GR 00> OR (<#TC Knaut-drym-Grp GR 00> OR (<#TC Gen-janu-Grp GR 00> OR (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC CB-Crimea GR 01> OR (<Sesleria caerulea agg. GR 05> OR (<Sesleria heuflerana GR 05> OR (<Bromopsis pannonica GR 05> OR <Stipa tirsa GR 05>)))))))))

5 CB-23 Hieracio pilosaellae-Festucetum dalmaticae
<#TC CB-Balkan GR #TC CB-West1> NOT (<#TC NegDif-Hier-Fest GR 00> OR (<#TC Gal-rhod-Grp GR 02> OR (<Stipa tirsa GR 00> OR <Sesleria latifolia GR 05>)))

5 CB-24 Galio lovcense-Artemisietum chamaemelifoliae
(<#TC CB-Balkan GR #TC CB-West1> AND <#TC Gal-rhod-Grp GR 02>) NOT (<Stipa tirsa GR 00> OR <Sesleria latifolia GR 05>)

5 CB-25 Seslerietum latifoliae
<Sesleria latifolia GR 05>

5 CB-26 Adonido-Stipetum tirsae
<#TC CB-Crimea GR 00> AND <Stipa tirsa GR 05>

5 CB-27 Salvio pratensis-Poetum angustifoliae
<#TC Poa-ang-Grp GR 01> NOT (<#TC NegDif-Frag-Trif GR #TC Dif-Frag-Trif> OR (<#TC Dif-Ural GE #TC NegDif-Ural> OR (<#TC CB-West1 GR 00> OR (<#TC CB-West1 | #TC NegDif-Frag-Trif2 GR 00> OR (<#TC CB-Balkan GR #TC CB-West1> OR (<#TC Dianth-syl-Grp GR 00> OR (<#TC Knaut-drym-Grp GR 00> OR (<Cirsium acaulon GR 00> OR (<Stipa tirsa GR 00> OR (<Stipa dasyphylla GR 00> OR <Stipa pennata GR 05>)))))))))

5 CB-28 Artemisio campestris-Poetum angustifoliae
<Poa pratensis agg. GR 01> NOT (<Festuca valesiaca agg. GR 00> OR (<Stipa tirsa GR 00> OR (<Brachypodium pinnatum agg. GR 00> OR (<Stipa pennata GR 00> OR (<#TC CB-East GR 00> OR (<#TC CB-West1 GR 00> OR (<#TC CB-West2 GR 00> OR (<#TC CB-Balkan GR 00> OR <#TC CB-Crimea GR 00>)))))))

5 CB-29 Asperulo cynanchicae-Onobrychidetum
((((<#TC CB-East GR #TC CB-West1 | #TC CB-West2> AND <#TC NegDif-Ural GR #TC Dif-Ural>) AND <#TC NegDif-Frag-Trif GR #TC Dif-Frag-Trif>) AND <#TC Gyps-alt-Grp | #TC Eryng-plan-Grp GE #TC Stipa-tirsa-Grp-RU>) AND <#TC Ech-vul-Grp-RU GR 01>) NOT (<Stipa tirsa GR 00> OR (<Stipa dasyphylla GR 00> OR (<Stipa pennata GR 05> OR (<#TC CB-Balkan GR #TC CB-West1> OR <#TC CB-Crimea GR 00>))))

5 CB-30 Astero amelli-Potentilletum humifusae
((((<#TC CB-East GR #TC CB-West1 | #TC CB-West2> AND <#TC NegDif-Ural GR #TC Dif-Ural>) AND <#TC NegDif-Frag-Trif GR #TC Dif-Frag-Trif>) AND <#TC Gyps-alt-Grp | #TC Eryng-plan-Grp GE #TC Stipa-tirsa-Grp-RU>) AND <#TC Inul-ensi-Grp-RU GR 01>) NOT (<Stipa tirsa GR 00> OR (<Stipa dasyphylla GR 00> OR (<#TC Ech-vul-Grp-RU GR 01> OR (<#TC CB-Balkan GR #TC CB-West1> OR <#TC CB-Crimea GR 00>))))

5 CB-31 Gentiano cruciatae-Stipetum

(((<#TC CB-East GR #TC CB-West1 | #TC CB-West2> AND <#TC NegDif-Ural GR #TC Dif-Ural>) AND <#TC NegDif-Frag-Trif GR #TC Dif-Frag-Trif>) AND <#TC Gyps-alt-Grp | #TC Eryng-plan-Grp GE #TC Stipa-tirsa-Grp-RU>) NOT (<Stipa tirsa GR 00> OR (<Stipa dasyphylla GR 00> OR (<#TC Inul-ensi-Grp-RU GR 01> OR (<#TC Ech-vul-Grp-RU GR 01> OR (<#TC CB-Balkan GR #TC CB-West1> OR <#TC CB-Crimea GR 00>)))))

5 CB-32 Veronico incanae-Inuletum ensifoliae
((((((<#TC CB-East GR #TC CB-West1 | #TC CB-West2> AND <#TC NegDif-Ural GR #TC Dif-Ural>) AND <#TC NegDif-Frag-Trif GR #TC Dif-Frag-Trif>) AND <#TC Dif-Kursk | #TC Dif-Kursk-Ural GR #TC Dif-Rostov>) AND <#TC Stipa-tirsa-Grp-RU GR #TC Gyps-alt-Grp | #TC Eryng-plan-Grp>) AND <#TC Inul-ensi-Grp-RU GR #TC Serr-tinct-Grp-RU>) AND <#TC Inul-ensi-Grp-RU GR #TC Ped-kauf-Grp>) NOT (<Galium glaucum GR 00> OR (<Pulsatilla montana GR 00> OR (<#TC CB-Balkan GR #TC CB-West1> OR <#TC CB-Crimea GR 00>)))

5 CB-33 Vicio craccae-Centaureetum pseudophrygiae
(((((<#TC CB-East GR #TC CB-West1 | #TC CB-West2> AND <#TC NegDif-Ural GR #TC Dif-Ural>) AND <#TC NegDif-Frag-Trif GR #TC Dif-Frag-Trif>) AND <#TC Dif-Kursk | #TC Dif-Kursk-Ural GR #TC Dif-Rostov>) AND <#TC Stipa-tirsa-Grp-RU GR #TC Gyps-alt-Grp | #TC Eryng-plan-Grp>) AND <#TC Serr-tinct-Grp-RU GR #TC Ped-kauf-Grp>) NOT (<Galium glaucum GR 00> OR (<Pulsatilla montana GR 00> OR (<#TC Inul-ensi-Grp-RU GR #TC Serr-tinct-Grp-RU> OR (<#TC Inul-ensi-Grp-RU GR #TC Ped-kauf-Grp> OR (<#TC CB-Balkan GR #TC CB-West1> OR <#TC CB-Crimea GR 00>)))))

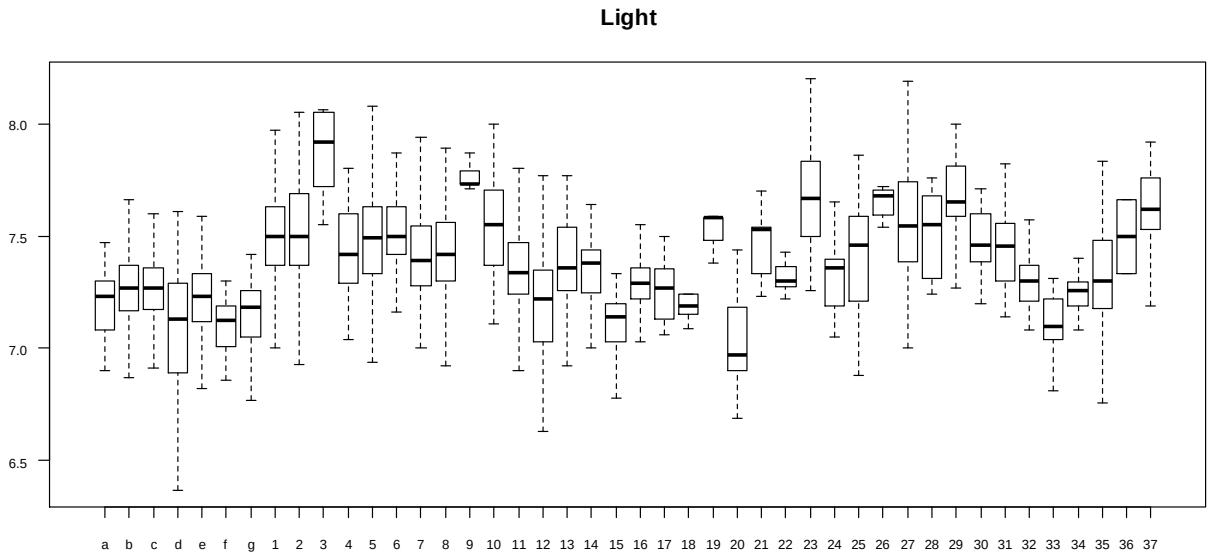
5 CB-34 Stipo tirsae-Bromopsietum ripariae
(((((<#TC CB-East GR #TC CB-West1 | #TC CB-West2> AND <#TC NegDif-Ural GR #TC Dif-Ural>) AND <#TC NegDif-Frag-Trif GR #TC Dif-Frag-Trif>) AND <#TC Dif-Kursk | #TC Dif-Kursk-Ural GR #TC Dif-Rostov>) AND <#TC Stipa-tirsa-Grp-RU GR #TC Gyps-alt-Grp | #TC Eryng-plan-Grp>) AND <#TC Ped-kauf-Grp GE #TC Serr-tinct-Grp-RU>) NOT (<#TC Inul-ensi-Grp-RU GR #TC Serr-tinct-Grp-RU> OR (<#TC Inul-ensi-Grp-RU GR #TC Ped-kauf-Grp> OR (<#TC CB-Balkan GR #TC CB-West1> OR <#TC CB-Crimea GR 00>)))

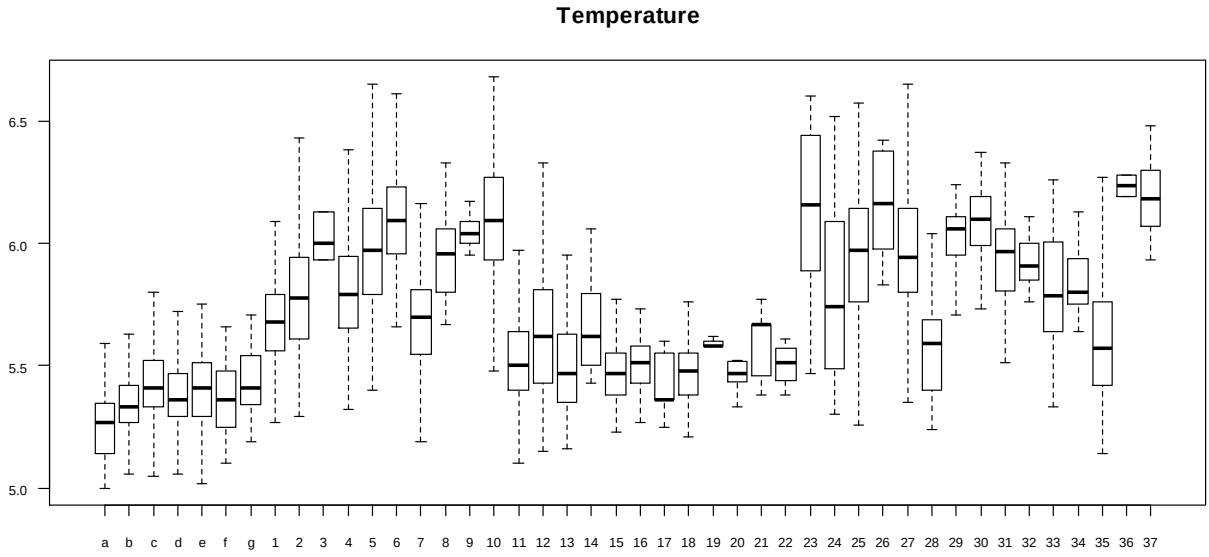
5 CB-35 Poo angustifoliae-Stipetum pennatae
(<#TC CB-East GR #TC CB-West1 | #TC CB-West2> AND <#TC Dif-Ural GE #TC NegDif-Ural>) NOT (<Anthericum ramosum GR 00> OR (<Salvia pratensis GR 00> OR (<#TC Dif-Rostov GR #TC Dif-Ural | #TC Dif-Kursk-Ural> OR (<#TC CB-Balkan GR #TC CB-West1> OR <#TC CB-Crimea GR 00>))))

5 CB-36 Serratulo radiatae-Stipetum pennatae
(<Stipa pennata GR 05> OR <Stipa tirsa GR 05>) AND <#TC Spir-hyp-Grp GR 01> NOT <#TC CB-Crimea GR 00>

5 CB-37 Trifolio alpestris-Stipetum tirsae
((((<#TC CB-East GR #TC CB-West1 | #TC CB-West2> AND <#TC NegDif-Ural GR #TC Dif-Ural>) AND <#TC Dif-Rostov GR #TC Dif-Kursk | #TC Dif-Kursk-Ural>) AND <#TC Dif-Rostov GR #TC Dif-Ural>) AND (<Stipa tirsa GR 00> OR <Stipa dasyphylla GR 00>)) NOT (<#TC NegDif-Rostov GR 00> OR (<#TC CB-Balkan GR #TC CB-West1> OR <#TC CB-Crimea GR 00>))

Electronic Appendix 11. Comparison of the associations of the alliances *Mesobromion* (a–g) and *Cirsio-Brachypodion* (1–37) in terms of Borhidi Indicator Values, calculated as unweighted average for each relevé. Boxes represent the interquartile range, the horizontal line inside the boxes is the median. Outliers are not shown. Letters and numbers of associations correspond to those used in the Results.





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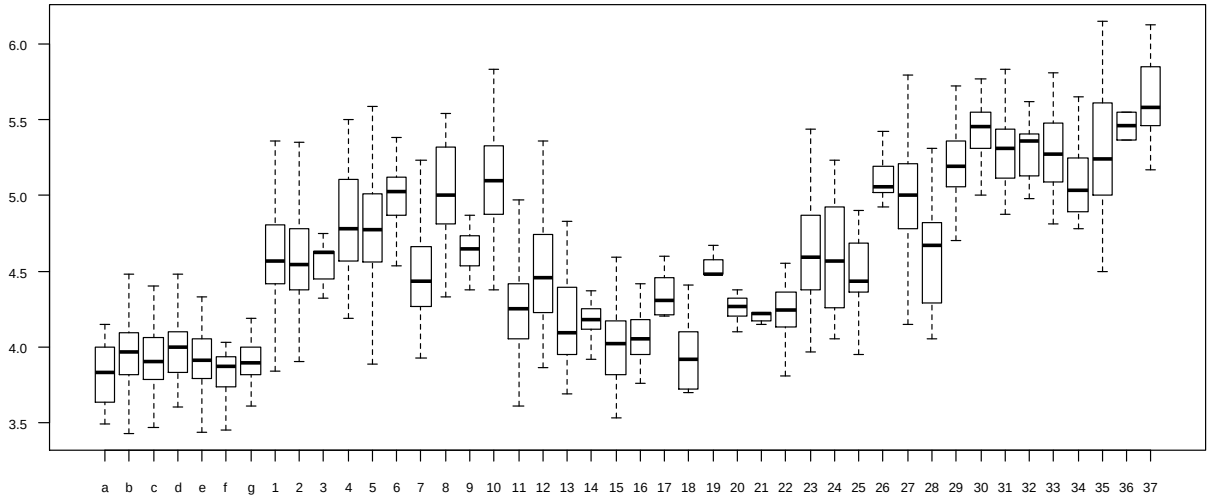
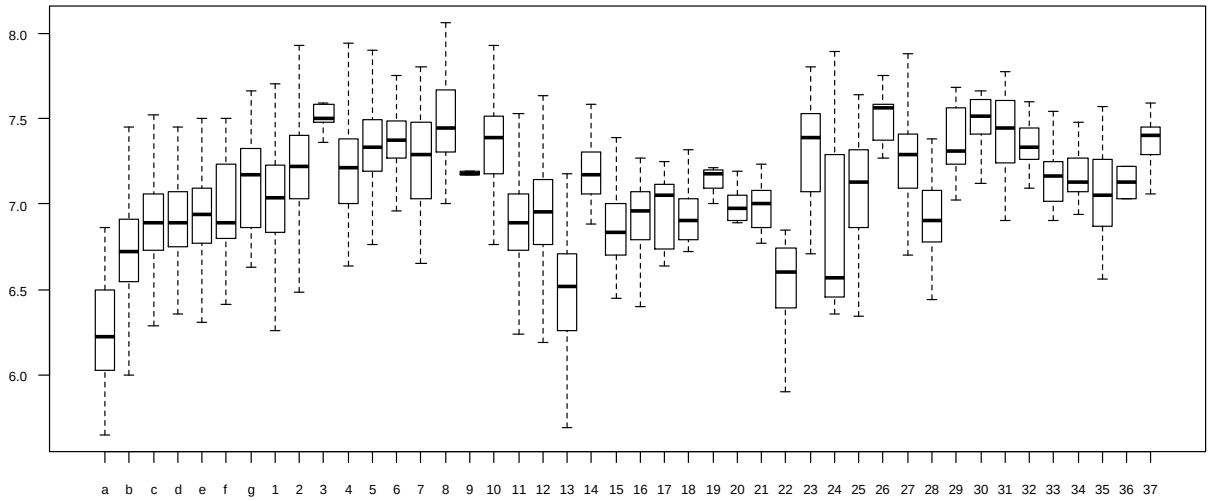
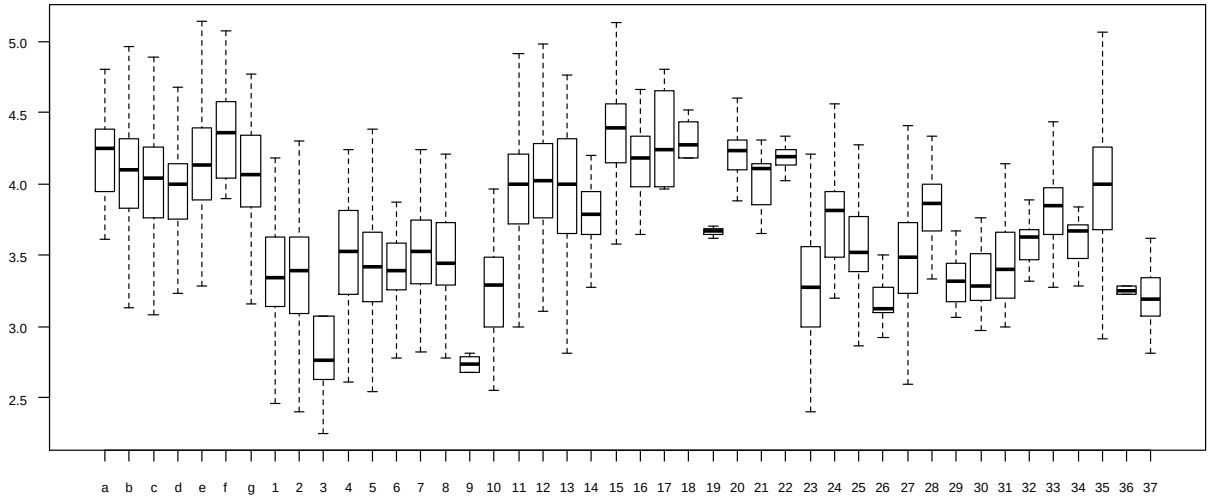


Soil reaction



Soil moisture



Nutrients