Tuexenia 43: 159–182. Göttingen 2023.
doi: 10.14471/2023.43.010, available online at www.tuexenia.de

Classification of dry grasslands of the Berda River Valley (Ukraine)

Klassikation von Trockenrasen des Berda-Flusstals (Ukraine)

Denys Vynokurov[1, 2], Igor Goncharenko[3], Dariia Borovyk[1, 4] & Olena Bronskova[5]

[1]M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine, Department of Geobotany and Ecology, 01601, Kyiv, Ukraine; [2]Department of Plant Biology and Ecology, University of the Basque Country (UPV/EHU), P.O. Box 644, 48080 Bilbao, Spain; [3]Institute for Evolutionary Ecology, National Academy of Sciences of Ukraine, Lebedeva 37, 03143, Kyiv, Ukraine; [4]Department of Botany and Zoology, Faculty of Science, Masaryk University, Kotlářská 267/2, 611 37 Brno, Czech Republic; [5]National Nature Park "Meotyda", Mariupol, Ukraine
**Corresponding author, e-mail: denys.vynokurov@gmail.com*

Abstract

The river Berda is located in southern Ukraine, within the steppe zone. This territory stands as a biologically diverse hotspot amidst the agricultural landscapes, where the entirety of the river's watershed has been subjected to plowing, while within the confines of the valley, remnants of natural vegetation have persisted. We collected 60 vegetation plots of dry grassland vegetation from the Berda River Valley and some of its tributaries recording all vascular plant species together with some structural and environmental parameters. In order to classify the relevés, we performed a Distance-Ranked Sorting Assembling (DRSA) analysis. It resulted in five clusters, different in terms of their floristic composition, physiognomy and environmental parameters. They also corresponded to the commonly used vegetation typology in Ukraine: granite rocky steppe (cluster 1), forb-bunchgrass steppe (clusters 2 and 4), bunchgrass steppe (cluster 3) and shrub-steppe (cluster 5). We suggest to interpret them within two classes: granite rocky steppes belonging to the class *Sedo-Scleranthetea*, and all other clusters to the *Festuco-Brometea* vegetation class. All five clusters, obtained as a result of the analysis, we interpret as association-level syntaxonomical units, as they show strong ecological and physiognomic differentiation. Granite rocky steppes of the Berda River Valley belong to the association *Ephedro distachyae-Stipetum graniticolae*, and to the alliance *Poo bulbosae-Stipion graniticolae*. The other associations we assigned to the alliance *Stipo lessingianae-Salvion nutantis*, which comprises the zonal steppe vegetation of the steppe zone in Eastern Europe. We included forb-bunchgrass steppes on the slopes of the valley into the association *Stipo lessingianae-Salvietum nutantis* and forb-bunchgrass steppes dominated by *Stipa capillata* on the flat areas into the *Eryngium campestre-Stipa capillata* community. Bunchgrass steppes, which mostly occur in the southern part of the river valley, were classified within the association *Ephedro distachyae-Stipetum capillatae*. Shrub-steppe communities were assigned to the association *Vinco herbaceae-Caraganetum fruticis*. In total, we propose a classification scheme of the steppe vegetation of the Berda River Valley which consists of five associations, belonging to two alliances, two orders and two classes. Considering the large-scale war taking place in the study area since 2022, this survey might be used as a documentation of the original state of steppe communities and as a baseline for their restoration after the military activities finish.

Manuscript received 09 April 2023, accepted 10 September 2023
Published online 22 December 2023
Co-ordinating Editor: Jürgen Dengler

Keywords: bunchgrass steppe, Distance-Ranked Sorting Assembling (DRSA) analysis, dry grassland, *Festucetalia valesiacae*, *Festuco-Brometea*, forb-bunchgrass steppe, granite rocky steppe, *Sedo-Scleranthetea*, shrub-steppe

Erweiterte deutsche Zusammenfassung am Ende des Artikels

1. Introduction

Steppes and steppe-like grasslands are one of the most threatened vegetation types in Europe (Török et al. 2016). Compared to the potential distribution area of steppes according to the climatic zonation, their current distribution is much less mainly due to agricultural intensification (Wesche et al. 2016). For example, in Ukraine, steppes historically covered approximately 40% of the territory of the country, but today steppe remnants exist only on 1% of this territory (Dembicz et al. 2016). In Ukraine, apart from the protected areas, natural steppes mostly survived along the river valleys where the arable farming was not possible. Because of the strong decline of steppe grasslands in recent decades, many of them are listed as priority habitat types in the Habitats Directive of the European Union (Willner et al. 2017). Therefore, studying the remnants of the steppe vegetation on the local scale, especially in the non-explored regions, may help to understand the patterns of the distribution of steppes, their ecological preferences and the suitable management regimes.

The Berda River Valley is one of such non-explored regions lying in the steppe zone of southern Ukraine. The study of the flora and vegetation of this region began at the end of the 19th – beginning of the 20th century. The first studies were mostly focused on studying the floristic peculiarities of the region (Verzhbitskiy 1892, Markovskii 1905, Shyrjaev 1912, Yanata 1926). In 1920s and 1930s, studies became more related to geobotany, with some characteristics of different vegetation types (Klokov & Lavrenko 1924, Klokov 1927, Kleopov 1928, 1929, Kotov & Karnaukh 1940). Some investigations were devoted to the vegetation of steppes and granitic outcrops of the reserve Kamyani Mohyly (“Stone tombs”), following its creation in 1927 in the valley of Karatysh River, a tributary of the Berda River (Kuznetsova 1956, Bilyk & Panova 1959, Panova 1976, Tkachenko & Genov 1992, Lysenko 2008). Botanical studies in the Berda River Valley itself were not common. During the last decades, several papers dedicated to the conservation of its vegetation were published (Vakarenko et al. 1996, 2000, Kolomiychuk 2003).

So far, there were only a few synthesis surveys dedicated to the syntaxonomy of the vegetation of the Azov Sea coastal zone, which includes the estuary of Berda river (Tyshchenko 1999, 2006, Kolomiychuk & Vynokurov 2016). However, the syntaxonomy of the vegetation of the Berda River Valley and its tributaries was not yet studied. Thus, our main aim was to explore the syntaxonomical diversity of the steppe vegetation of this poorly-studied territory. The collected data could be used in the future for refining the syntaxonomy of Ukraine and for monitoring of this threatened ecosystem type, expecially considering the current military activities taking place in this region.

2. Study area

2.1 Topography and geomorphology

The Berda River Valley is situated in south-eastern Ukraine, within the Zaporizhzhia and Donetsk regions, “Pryazovia” historical region. The river originates on the southern slopes of the main watershed ridge of the Azov Upland. Its upper and middle course runs within the upland, and the lower course submeridionally crosses the narrow Azov Lowland and flows into the Sea of Azov. The length of the river is 130 km, and the catchment area is 1720 km^2.

The Azov Upland is the eastern protrusion of the Ukrainian Crystalline Shield with a maximum height above sea level of 324 m. It is a denudational, ancient morphostructure composed of highly dislocated metamorphic and igneous rocks of the Archaean-Proterozoic age, mainly of the granitoid series (DATSENKO et al. 2014). Sometimes the crystalline rocks are exposed and the river valleys in the area of the Azov Upland may have a canyon-like appearance, a fast current and intensive erosion activity. In the lower part of the river Berda, after the river reaches the Azov lowland, the landscape changes to a slightly fragmented loess lowland sloping to the south, with southern low-humus chernozems (RUDENKO 2007). The current in this part of the river is slow, meanders and oxbows are formed, and in some places, there are marshy areas (NEPSHA 2012) with solonetz and solonchak floodplains (RUDENKO 2007).

In the end, the Azov lowland breaks off with a steep ledge (10–50 m) to the Sea of Azov. On the western side of the mouth of the river, an accumulative sea spit of 23 km length was formed during the last few thousand years. It is made of marine sediments, mostly sand and shells (NEPSHA 2013, TYSHCHENKO 2006). The mouth of the Berda forms a wide, shallow estuary (Solodkyi [“Sweet”] Estuary). In the upper part, it is dryer and covered with halophilic vegetation, and in the lower part, it is almost completely occupied by reedbeds. The estuary is separated from the sea by a narrow sandbank.

According to the physical and geographical zoning (RUDENKO 2007), the research area is located in the Chernihiv-Roziv and Andriiv-Volodar districts of the Pryazovia Upland region, and the bottom part is situated within the Primorsk-Berdyansk district of the Western Pryazovia Upland region.

2.2 Soils

The granitoid rocks of the Ukrainian Crystalline Shield are covered by the widespread deposits of the Pliocene red clay formation of wind-blown origin and Quaternary loess formation. The dominant soil-forming formation is loess. It is mainly composed of heavy loam and light clay rich in carbonate compounds (DATSENKO et al. 2014). Most of the surface of the studied area is covered with chernozem soils. They are heterogeneous and change depending on the terrain, climatic conditions and vegetation (DATSENKO et al. 2014). In the northern part of the study region, the soils (except for the river bed and its floodplain) are represented by ordinary low-humus chernozems, which were formed in the past under the forb-bunchgrass vegetation (RUDENKO 2007). These chernozems have a significant supply of nutrients, favourable water and physical properties, therefore they are the most fertile soils (DATSENKO et al. 2014). Southern low-humus chernozems are located to the south of the zone of ordinary chernozems. They were formed in drier conditions and under sparser steppe vegetation. Compared to ordinary chernozems, in southern low-humus chernozems, the humus horizon, as well as the entire profile, is much shallower. Southern chernozems have a sufficient amount of nutrients but are characterized by a significant lack of moisture (DATSENKO et al. 2014). Alluvial deposits are spread along the river valleys, and deluvial deposits are spread along the bottoms of the streams and gullies, on which meadow-floodplain and meadow-chernozem soils are formed, often in the complex with the saltmarshes (RUDENKO 2007).

2.3 Climate

According to the Köppen classification, the research area belongs to the Dfa zone with a hot summer continental climate (BECK et al. 2018). Bioclimatically, this corresponds to the subbiome grass-steppe (6b) of the biome of steppe (LOIDI et al. 2022). This is a typical steppe climate with pronounced arid dry wind phenomena. Summer here is dry and hot, and winter is snowless, wet and with frequent thaws. The weather on the coast is partially moderated by the sea influence. The average temperature in July varies from +22 to 23.5 °C in different parts of the valley, and in January – from 3 to -5.5 °C (ZUZUK 1997).

The annual amount of precipitation is about 400–450 mm in the Azov Lowland and 450–500 mm in the Azov Upland (DATSENKO et al. 2014). The maximum amount of precipitation falls in the summer-autumn period, and the minimum is in the winter-spring period (MIKOLASKOVA 2009). In summer, potential evaporation here very high, up to 890 mm (NEPSHA 2012). The least amount of precipitation falls in March-April (23–35 mm). Then its increase continues until July. In August and September, the amount of precipitation decreases again, and this continues until December, although there are exceptions in some years. The summer period is characterized by showers, which are one of the causes of linear erosion and surface washing. The snow cover is established in the late December and descends in early March. Often, especially in the south of the territory of the Northern Azov region, winters have little or no snow at all. This leads to the development of wind erosion (DATSENKO et al. 2014). Spring lasts from the middle of March to the beginning of May and is characterized by an intense increase in heat, as a result of which the phenological phases of many plants pass very quickly (TYSHCHENKO 2006).

2.4 Vegetation

According to the geobotanical zoning of Ukraine, the Berda River Valley lies within the Pontic province, Chornomoria-Azov steppe subprovince. The major part of the river belongs to the geobotanical “stripe” of forb-bunchgrass steppes (Zhdaniv district, Volodarskyi rayon). The lower course lies within the “stripe” of bunchgrass steppes (Kakhovka-Molochansk-Berdiansk district, Novovasylivskyi rayon) (BARBARYCH 1977). The *stripe* of forb-bunchgrass steppes (or forb-fescue-feathergrass steppes) differs by the presence of a higher number and cover of forbs. Northwards, it is replaced by the forest-steppe zone with dominating meadow steppe vegetation, which does not occur in the Berda River Valley. On the contrary, the *stripe* of bunchgrass steppes (or fescue-feathergrass steppes) is situated more to the south in drier climatic conditions. It differs by the presence of steppe communities with less participation of forbs and more abundant narrow-leaved turf grasses (BARBARYCH 1973). Among the zonal steppes, different edaphic dry grasslands can be found (LAVRENKO et al. 1991). The only edaphic variety of steppes occurring in the Berda basin is rocky (petrophytic) steppe on granite outcrops. In addition, one more type of steppe

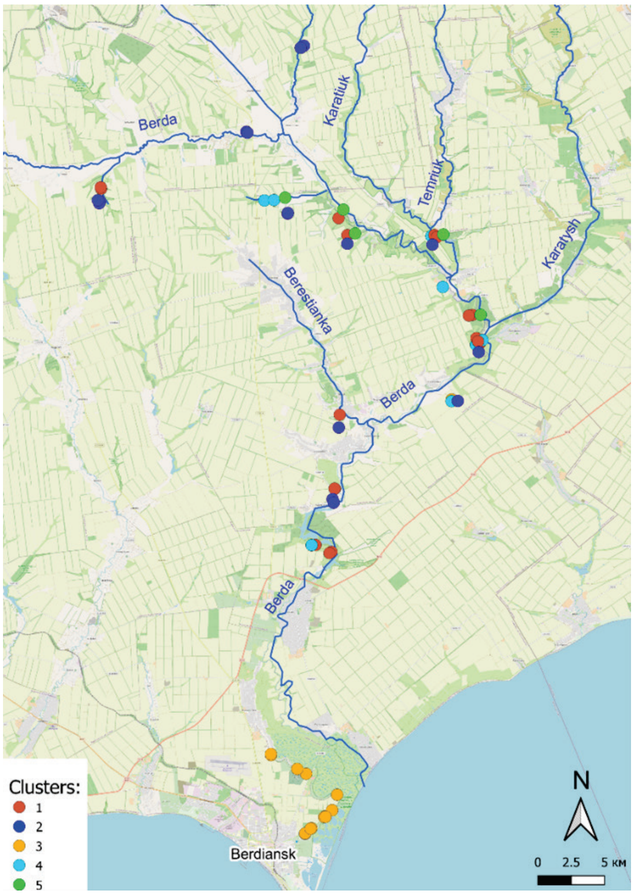

Fig. 1. Map of the study area with sampling localities coloured according to the results of the analysis (explanation in section 4b). Quelle: Basemap © OpenStreetMap contributors 2023.

Abb. 1. Karte des Untersuchungsgebiets mit entsprechend den Analyseergebnissen eingefärbten Lokalitäten (Erläuterung in Abschnitt 4b).

vegetation is traditionally recognized in Ukrainian phytosociological typology: shrub steppes (BARBARYCH 1973). It is recognized by the presence of low steppic shrubs, e.g. *Caragana frutex*, *Caragana scythica*, *Calophaca wolgarica*, *Spiraea hypericifolia* etc.

Besides the steppes, other vegetation types occur in the Berda River Valley. The natural forest-shrub vegetation is represented mainly in the northern part, by the small floodplain forest patches of *Salix ×fragilis*, *Populus alba*, *Ulmus* spp. along the river and temperate deciduous shrubs with *Acer tataricum*, *Crataegus monogyna*, *Prunus spinosa* subsp. *Dasyphylla*, *Pyrus communis*, *Rhamnus cathartica*, and *Rosa canina*. Also, there are widespread forest plantations of *Acer negundo*, *Elaeagnus angustifolia*, *Gleditsia triacanthos*, *Lonicera tatarica*, *Pinus sylvestris*, and *Robinia pseudoacacia*. Saline grasslands are represented in the floodplain of the river. Depending on the level of salinity, they vary from subsaline meadows with *Schedonorus arundinaceus* to salt steppes with *Puccinellia distans*. In habitats with the highest level of salinity, the vegetation is solonchak with *Salicornia europaea*, *Halocnemum strobilaceum*, *Suaeda prostrata* etc. (DATSENKO et al. 2014). Other types of natural vegetation are not so common: aquatic and wetland in the river itself and along its banks, chasmophytic on screes, hay meadows and pastures in the floodplain on the places with minimal salinity.

Several important nature protected areas are located in the basin of the river Berda. First of all, it is a section of the Ukrainian Steppe Nature Reserve “Kamyani Mohyly” (with an area of 389 ha), the “Polovetsky Steppe” section of the National Nature Park “Meotida” (2001 ha), a landscape reserve of national importance “Zaplava Richky Berda” (1117 ha), which is a part of the National Nature Park “Priazovsky”, landscape reserve of national importance “Kruchi” (172 ha), natural monument of national importance “Granite Rocks” (15 ha). There are also 44 nature conservation territories of local importance with a total area of 3,438 ha.

3. Material and methods

3.1 Data collection

In May 2018, we sampled 60 vegetation plots following the Braun-Blanquet approach (DENGLER et al. 2008) of 16 m^2 (4 m × 4 m, measured in the field) in the dry grasslands of the Berda River Valley and some of its tributaries (Fig. 1–2). We recorded all vascular plant species, their cover, and, additionally, some environmental and structural characteristics: latitude, longitude, altitude, aspect, inclination, total vegetation cover, herb layer cover, shrub layer cover, moss layer cover, lichen layer cover (Supplement S1). The relevés were made in homogeneous conditions in the different types of steppes and steppe-like grasslands: forb-bunchgrass steppe, bunchgrass steppe, rocky steppe on granite outcrops, shrub-steppe with low shrubs of *Caragana* species (*C. scythica*, *C. frutex*). The relevés are stored in the Eastern European Steppe Database (GIVD ID EU-00-030) (VYNOKUROV et al. 2020).

Species names of vascular plants are given according to the Nomenclatural checklist of vascular plants of Ukraine (MOSYAKIN & FEDORONCHUK 1999). Species life forms were taken from the Ukrainian plant trait database UkrTrait v.1.0 (Vynokurov et al., under development). We follow MUCINA et al. (2016) for the names and authors of higher syntaxa unless mentioned otherwise.

3.2 Data analysis

Vegetation classification was performed using the Distance-Ranked Sorting Assembling (DRSA) method (GONCHARENKO 2015). This method belongs to a subfamily of methods based on the kNN-clustering approach, or *k*-nearest neighbours (COVER & HART 1967). The choice of this method in vegetation science is particularly recommended in cases of high data continuity with indistinct cluster structure because it implements a noise-detection approach (DAVE 1991, GONCHARENKO 2016).

The Bray-Curtis distance matrix (BRAY & CURTIS 1957) was used for clustering relevés. The number of *k*-nearest neighbours considered in the knn-graph was set to 15. The clustering process initially allocated four clusters. Afterwards, we manually separated cluster 5 from cluster 4 based on a physiognomic criterion, i.e. when the shrub layer of *Caragana frutex* exceeded a cover of 40%, which allows this cluster to be regarded as shrub-steppe.

Next page (nächste Seite):

Abb. 2. Pflanzen und Gesellschaften des Berda-Flusstals. **a)** *Vincetoxicum fuscatum* (syn. *V. maeoticum* (Kleopow) Barbar.); **b)** *Ornithogalum pyrenaicum* (syn. *O. melancholicum* Klokov ex Krasnova); **c)** *Paronychia cephalotes*, **d)** *Astragalus cornutus*; **e)** Felsige Landschaft des Berda-Flusstals; **f)** Aspekt von *Pulsatilla pratensis*; **g)** Vegetationsaufnahme der erodierten Hänge mit *Bothriochloa ischaemum* von D. Borovyk und D. Vynokurov; **h)** O. Bronskov und E. Bronskova in einem Bestand von *Stipa pulcherrima* (Fotos: a, b, e, h: D. Vynokurov; c, d, f: D. Borovyk; g: O. Bronskova, alle Fotos 2018).

Fig. 2. Plants and communities of the Berda River Valley. **a)** *Vincetoxicum fuscatum* (syn. *V. maeoticum* (Kleopow) Barbar.); **b)** *Ornithogalum pyrenaicum* (syn. *O. melancholicum* Klokov ex Krasnova); **c)** *Paronychia cephalotes*, **d)** *Astragalus cornutus*; **e)** Rocky landscape of Berda River Valley; **f)** Aspect of *Pulsatilla pratensis*; **g)** Sampling the eroded slopes with *Bothriochloa ischaemum*, relevé by D. Borovyk and D. Vynokurov; **h)** O. Bronskov and E. Bronskova in a stand of *Stipa pulcherrima* (Photos: a, b, e, h: D. Vynokurov; c, d, f: D. Borovyk; g: O. Bronskova, all photos 2018).

The sorting of species, as well as the allocation of diagnostic species, was based on the concept of fidelity (BARKMAN 1989, CHYTRÝ et al. 2002, WILLNER 2006). As a species-to-cluster affinity measure the Ochiai index was used (GONCHARENKO & SENCHYLO 2020) with standardization to equal size of all groups. The threshold value for diagnostic species was set at 0.35, considering Fisher's exact test at $p < 0.05$. Diagnostic species with phidelity > 50 were considered as highly diagnostic.

After identifying syntaxa, the degree of their floristic similarity was assessed using hierarchical cluster analysis taking into account species constancy. The dendrogram was constructed using a flexible beta agglomeration approach with $\beta = -0.25$ (DUFRÊNE & LEGENDRE 1997).

For the environmental assessment, the phytoindication method was used (RAMENSKY et al. 1956, ELLENBERG et al. 1991, DIDUKH & PLYUTA 1994). The calculations were based on the $\log_2$ transformed weighted average, taking into account the projected coverage of species. Ecological scales adapted for the Ukrainian flora were used (DIDUKH 2011). All factors were unified to a 100-point scale for comparability (GONCHARENKO 2017). The variables used in the analysis were soil water regime, or moisture (Hd), soil reaction (Rc), salt regime (Sl), carbonate content in the soil (Ca), nitrogen content in the soil (Nt), thermoregime (Tm), continentality of the climate (Kn), humidity, or ombroregime (Om), cryoregime (Cr) and light value (Lc).

Non-metric multidimensional scaling (NMDS) was used for ordination (KRUSKAL 1964). Two axes were selected, and the model stress was 0.21. To interpret the ordination axes, the vectors of structural and ecological variables were projected into the ordination plane. The degree of their relation to the ordination axes was evaluated using the envit() function from the vegan package (OKSANEN et al. 2018). The metaMDS function from the same package was used for ordination, and we used the function agnes() from the built-in cluster library to construct the dendrogram of syntaxon similarity. The ANOVA test based on the built-in aov() function was used to assess differences between syntaxa regarding structural and environmental variables. All calculations were performed in the statistical environment R version 3.5.3 (R CORE TEAM 2023).

The map of the relevé distribution was made using QGIS3.22 (qgis.org).

4. Results

4.1 Cluster analysis

As a result of vegetation classification using the DRSA method, four clusters were obtained and one more cluster was separated manually due to its physiognomic difference (dominating low steppic shrubs), making in total five clusters (Fig. 3, Table 1). The first cluster corresponds to granite rocky steppe. Clusters 2 and 4 are grouped together and both represent forb-bunchgrass steppes: on slopes of the valley and on flat plain areas correspondingly. Third cluster corresponds to bunchgrass steppe in the southern part of the study area. The fifth cluster represents shrub-steppe communities with *Caragana frutex*. A synoptic table and an ordered table of relevés of the vegetation of Berda River Valley are given in the Supplements S1 and E1. As shown on the similarity dendrogram (Fig. 3), the cluster 1 is more distinct from the rest of clusters based on the floristic composition.

4.2 Description of clusters

Cluster 1. Granite rocky steppe

Group 1 is the most distinct compared to the rest and combines the steppe-like grasslands on granitic outcrops. These grasslands occur in places where the granite bedrock of the Ukrainian Crystalline Shield is exposed on the valley's slopes (Fig. 4a). One of the most

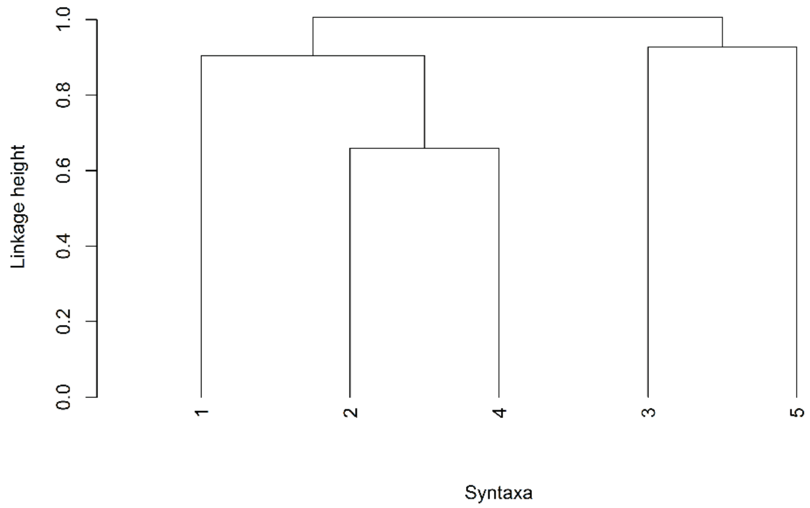

Fig. 3. Dendrogram of similarity of vegetation clusters in the Berda River Valley (flexible beta hierarchical algorithm, Bray-Curtis distance matrix). Numbers of clusters correspond to those given in Table 1 and the Results text. Numbers in brackets indicate the number of plots in the cluster.

Abb. 3. Dendrogramm der Ähnlichkeit von Vegetationsclustern im Berda-Flusstal (flexibler hierarchischer Beta-Algorithmus, Bray-Curtis-Distanzmatrix). Die Anzahl der Cluster entspricht den Angaben in Tabelle 1 und dem Text des Ergebnisteils. Die Zahlen in Klammern geben die Anzahl der Vegetationsaufnahmen im Cluster an.

in some sources with *S. borysthenica* or *S. pennata* (GONZALO et al. 2013, EURO+MED 2006+), but distinctively associated with the granite outcrops in the steppe zone of Ukraine (DIDUKH 2009, KUZEMKO et al. 2020). The other common dominant species in these communities is *Poa bulbosa*, whereas the other species rarely become the dominants. Some of the remarkable diagnostic species are: *Pulsatilla pratensis*, *Stipa graniticola*, *Cerastium pseudobulgaricum*, *Poa bulbosa*, *Artemisia marschalliana*, *Jurinea granitica*, *Trifolium arvense*, *Thymus ×dimorphus*, *Helichrysum arenarium*, *Rumex acetosella*, *Eremogone biebersteinii* (ordered by decreasing Ochiai index).

Cluster 2. *Stipa lessingiana* forb-bunchgrass steppe

The true steppe vegetation, often called in the literature "forb-bunchgrass steppes", is classified into cluster 2 (Fig. 4c–d). Generally, dominant species are grasses (*Botriochloa ischaemum*, *Stipa capillata*, *S. lessingiana*) with higher cover and number of forbs in comparison to bunchgrass steppes (e.g., *Salvia nutans*, *Galatella villosa*, *Linum czerniaevii*, *Astragalus ucrainicus*, *Teucrium polium*, *Salvia nutans*, *Stachys recta*, *Potentilla astracanica*, etc.). These communities occur usually on deeper soils, however, might grow on shallow ones on the granitic bedrock. Sometimes the soils are eroded which leads to the prevalence of *Botriochloa ischaemum* and a lower number of forbs and a lower number of species in the community. In the Berda River Valley, they occupy generally more gentle

Table 1. Shortened synoptic table with diagnostic species for each cluster. Numbers represent percentage frequencies, superscripts fidelity (Ochiai index). Species are sorted by their fidelities. Diagnostic species are marked grey (light-grey are the species with low diagnostic value (< 50) and dark-grey are the species with high diagnostic value). For the full version of the table see the Supplement E1.

Tabelle 1. Gekürzte Übersichtstabelle mit diagnostischen Arten für jeden Cluster. Die Zahlen stellen prozentuale Häufigkeiten dar, hochgestellte die Treue (Ochiai-Index). Die Arten sind nach ihrer Treue sortiert. Diagnostische Arten sind grau markiert (hellgrau sind die Arten mit niedrigem diagnostischem Wert (< 50) und dunkelgrau sind die Arten mit hohem diagnostischem Wert). Die vollständige Version der Tabelle findet sich im Anhang E1.

Cluster number	**1**	**2**	**3**	**4**	**5**
Number of releves	**17**	**16**	**14**	**8**	**5**
Ephedro distachyae-Stipetum graniticolae achilleetosum leptophylae					
Stipa graniticola	65^{80}	0^{---}	0^{---}	0^{---}	0^{---}
Pulsatilla pratensis	65^{80}	0^{---}	0^{---}	0^{---}	0^{---}
Pilosella echioides	88^{77}	19^{---}	0^{---}	25^{---}	0^{---}
Myosotis micrantha	76^{73}	0^{---}	0^{---}	13^{---}	20^{---}
Sedum acre	53^{73}	0^{---}	0^{---}	0^{---}	0^{---}
Cerastium pseudobulgaricum	53^{73}	0^{---}	0^{---}	0^{---}	0^{---}
Erophila verna	65^{71}	6^{---}	0^{---}	13^{---}	0^{---}
Poa bulbosa	94^{69}	31^{---}	50^{---}	13^{---}	0^{---}
Trifolium arvense	47^{69}	0^{---}	0^{---}	0^{---}	0^{---}
Jurinea granitica	76^{68}	38^{---}	0^{---}	13^{---}	0^{---}
Artemisia marschalliana	88^{66}	31^{---}	0^{---}	38^{---}	20^{---}
Helichrysum arenarium	47^{61}	13^{---}	0^{---}	0^{---}	0^{---}
Rumex acetosella	35^{59}	0^{---}	0^{---}	0^{---}	0^{---}
Holosteum umbellatum	88^{55}	63^{---}	79^{---}	25^{---}	0^{---}
Veronica dillenii	29^{54}	0^{---}	0^{---}	0^{---}	0^{---}
Hylotelephium polonicum	29^{54}	0^{---}	0^{---}	0^{---}	0^{---}
Carex supina	29^{54}	0^{---}	0^{---}	0^{---}	0^{---}
Chondrilla juncea	41^{53}	6^{---}	0^{---}	13^{---}	0^{---}
Anthemis ruthenica	35^{51}	0^{---}	0^{---}	13^{---}	0^{---}
Alyssum desertorum	65^{51}	56^{---}	43^{---}	0^{---}	0^{---}
Veronica arvensis	35^{50}	0^{---}	14^{---}	0^{---}	0^{---}
Eremogone biebersteinii	29^{49}	0^{---}	7^{---}	0^{---}	0^{---}
Phleum phleoides	24^{49}	0^{---}	0^{---}	0^{---}	0^{---}
Alyssum hirsutum	41^{48}	19^{---}	14^{---}	0^{---}	0^{---}
Achillea leptophylla	41^{46}	19^{---}	0^{---}	0^{---}	20^{---}
Asperula graniticola	35^{45}	25^{---}	0^{---}	0^{---}	0^{---}
Euphorbia seguieriana	65^{44}	44^{---}	7^{---}	63^{---}	40^{---}
Tragopogon major	18^{42}	0^{---}	0^{---}	0^{---}	0^{---}
Herniaria glabra	18^{42}	0^{---}	0^{---}	0^{---}	0^{---}
Gagea bohemica	18^{42}	0^{---}	0^{---}	0^{---}	0^{---}
Linaria genistifolia	24^{39}	0^{---}	0^{---}	13^{---}	0^{---}
Galium verum	35^{38}	6^{---}	14^{---}	13^{---}	20^{---}
Stipo lessingianae-Salvietum nutantis					
Linum czernjajevii	0^{---}	63^{79}	0^{---}	0^{---}	0^{---}
Astragalus ucrainicus	18^{---}	94^{66}	43^{---}	25^{---}	20^{---}
Silene bupleuroides	6^{---}	44^{62}	0^{---}	0^{---}	0^{---}
Viola ambigua	0^{---}	44^{58}	0^{---}	13^{---}	0^{---}
Senecio erucifolius	0^{---}	50^{58}	0^{---}	25^{---}	0^{---}
Teucrium polium	18^{---}	88^{57}	57^{---}	50^{---}	20^{---}
Haplophyllum suaveolens	0^{---}	31^{56}	0^{---}	0^{---}	0^{---}
Thesium arvense	6^{---}	63^{55}	21^{---}	38^{---}	0^{---}
Stachys recta	41^{---}	88^{55}	29^{---}	38^{---}	60^{---}

Cluster number	1	2	3	4	5
Number of releves	**17**	**16**	**14**	**8**	**5**
Ajuga chia	6^{---}	50^{53}	7^{---}	25^{---}	0^{---}
Euphorbia stepposa	6^{---}	56^{53}	0^{---}	50^{---}	0^{---}
Botriochloa ischaemum	12^{---}	44^{53}	0^{---}	13^{---}	0^{---}
Alyssum calycinum	6^{---}	50^{53}	21^{---}	13^{---}	0^{---}
Achillea nobilis	0^{---}	25^{50}	0^{---}	0^{---}	0^{---}
Ornithogalum kochii	0^{---}	25^{50}	0^{---}	0^{---}	0^{---}
Securigera varia	0^{---}	63^{47}	43^{---}	50^{---}	20^{---}
Oxytropis pilosa	6^{---}	38^{45}	0^{---}	25^{---}	0^{---}
Plantago media	0^{---}	25^{44}	7^{---}	0^{---}	0^{---}
Convolvulus arvensis	12^{---}	56^{43}	14^{---}	50^{---}	40^{---}
Linum austriacum	6^{---}	50^{41}	36^{---}	38^{---}	20^{---}
Ephedro distachyae-Stipetum capillatae					
Galium octonarium	0^{---}	6^{---}	71^{81}	0^{---}	0^{---}
Lamium amplexicaule	12^{---}	6^{---}	86^{77}	0^{---}	20^{---}
Nepeta parviflora	0^{---}	0^{---}	50^{71}	0^{---}	0^{---}
Veronica persica	0^{---}	0^{---}	50^{71}	0^{---}	0^{---}
Nigella arvensis	6^{---}	6^{---}	57^{69}	0^{---}	0^{---}
Thlaspi perfoliatum	0^{---}	13^{---}	50^{63}	0^{---}	0^{---}
Agropyron pectinatum	0^{---}	0^{---}	36^{60}	0^{---}	0^{---}
Seseli tortuosum	6^{---}	25^{---}	64^{59}	25^{---}	0^{---}
Senecio vernalis	65^{---}	25^{---}	86^{58}	0^{---}	40^{---}
Lappula patula	0^{---}	6^{---}	36^{55}	0^{---}	0^{---}
Amygdalus nana	0^{---}	0^{---}	29^{53}	0^{---}	0^{---}
Caragana scythica	0^{---}	0^{---}	29^{53}	0^{---}	0^{---}
Otites dolichocarpus	0^{---}	0^{---}	29^{53}	0^{---}	0^{---}
Ornithogalum melancholicum	0^{---}	0^{---}	29^{53}	0^{---}	0^{---}
Veronica praecox	6^{---}	6^{---}	36^{52}	0^{---}	0^{---}
Phlomis pungens	0^{---}	6^{---}	36^{48}	13^{---}	0^{---}
Cerastium ucrainicum	24^{---}	0^{---}	36^{46}	0^{---}	0^{---}
Lycopsis orientalis	0^{---}	0^{---}	21^{46}	0^{---}	0^{---}
Veronica austriaca	0^{---}	0^{---}	21^{46}	0^{---}	0^{---}
Crupina vulgaris	0^{---}	0^{---}	21^{46}	0^{---}	0^{---}
Galatella villosa	0^{---}	19^{---}	36^{44}	13^{---}	0^{---}
Elytrigia repens	0^{---}	25^{---}	57^{41}	50^{---}	60^{---}
Lactuca serriola	6^{---}	0^{---}	21^{41}	0^{---}	0^{---}
Vincetoxicum fuscatum	0^{---}	6^{---}	29^{39}	0^{---}	20^{---}
Marrubium praecox	0^{---}	13^{---}	36^{36}	13^{---}	40^{---}
***Eryngium campestre-Stipa capillata* community**					
Eryngium campestre	41^{---}	56^{---}	36^{---}	100^{61}	40^{---}
Senecio jacobaea	0^{---}	19^{---}	7^{---}	50^{57}	0^{---}
Stipa capillata	6^{---}	38^{---}	50^{---}	88^{56}	60^{---}
Medicago lupulina	0^{---}	0^{---}	0^{---}	25^{50}	0^{---}
Stipa ucrainica	0^{---}	0^{---}	0^{---}	25^{50}	0^{---}
Galium humifusum	0^{---}	0^{---}	0^{---}	25^{50}	0^{---}
Asperula cynanchica	0^{---}	25^{---}	0^{---}	38^{47}	0^{---}
Taraxacum erythrospermum	6^{---}	0^{---}	0^{---}	25^{45}	0^{---}
Taraxacum serotinum	0^{---}	6^{---}	0^{---}	25^{45}	0^{---}
Vinco herbaceae-Caraganetum fruticis					
Thalictrum minus	0^{---}	6^{---}	36^{---}	13^{---}	100^{80}
Caragana frutex	24^{---}	13^{---}	29^{---}	25^{---}	100^{73}
Verbascum blattaria	0^{---}	0^{---}	0^{---}	0^{---}	40^{63}
Echinops sphaerocephalus	0^{---}	0^{---}	0^{---}	0^{---}	40^{63}
Cynoglossum officinale	0^{---}	0^{---}	0^{---}	13^{---}	40^{55}
Asparagus officinalis	0^{---}	0^{---}	14^{---}	0^{---}	40^{54}
Potentilla argentea	35^{---}	6^{---}	0^{---}	25^{---}	60^{53}

Cluster number	1	2	3	4	5
Number of releves	**17**	**16**	**14**	**8**	**5**
Diagnostic species for more than one cluster					
Thymus dimorphus	94^{61}	94^{61}	0^{---}	50^{---}	0^{---}
Koeleria cristata	82^{52}	81^{51}	29^{---}	63^{---}	0^{---}
Stipa lessingiana	0^{---}	44^{47}	43^{46}	0^{---}	0^{---}
Plantago lanceolata	0^{---}	56^{44}	0^{---}	88^{68}	20^{---}
Poa angustifolia	0^{---}	25^{---}	14^{---}	100^{65}	100^{65}

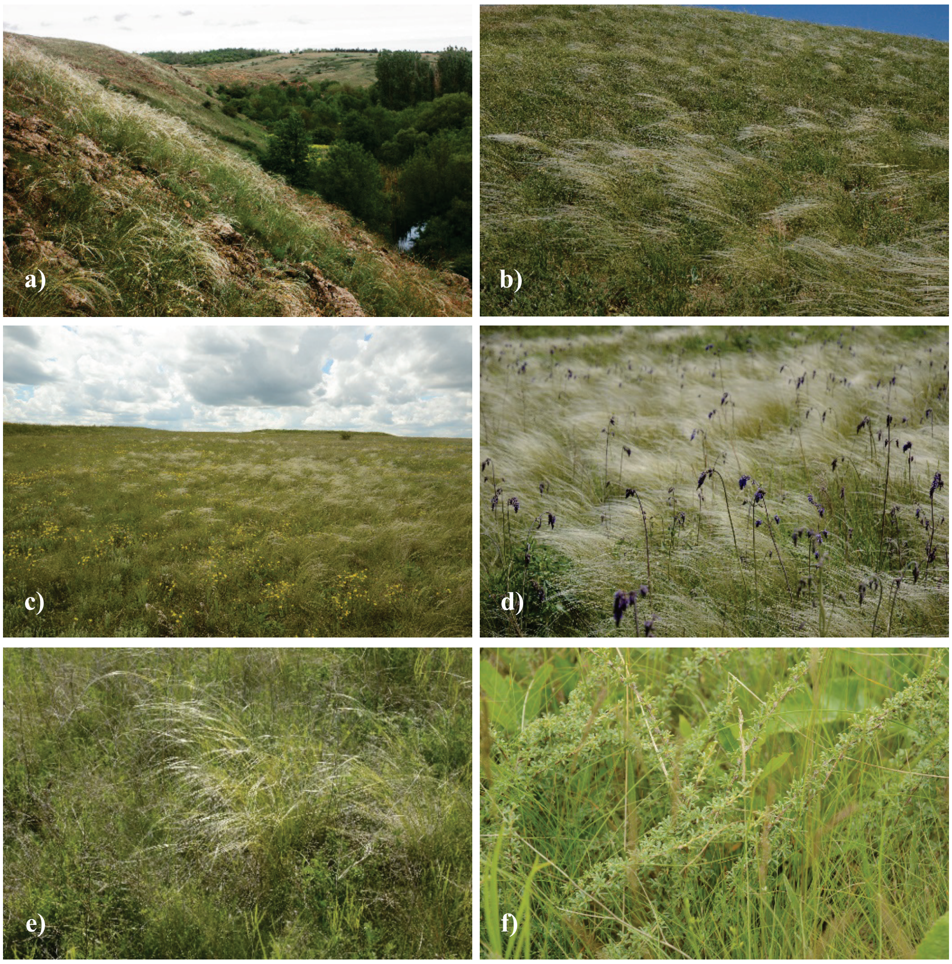

Fig. 4. Vegetation associations of the Berda River Valley. **a)** *Ephedro distachyae-Stipetum graniticolae*; **b)** *Ephedro distachyae-Stipetum capillatae*; **c–d)** *Stipo lessingianae-Salvietum nutantis*; **e)** *Eryngium campestre-Stipa capillata* community; **f)** *Vinco herbaceae-Caraganetum fruticis* (Photos: **a)** D. Vynokurov; **b–f)** D. Borovyk, all photos 2018).

Abb. 4. Assoziationen des Berda-Flusstals. **a)** *Ephedro distachyae-Stipetum graniticolae*; **b)** *Ephedro distachyae-Stipetum capillatae*; **c–d)** *Stipo lessingianae-Salvietum nutantis*; **e)** *Eryngium campestre-Stipa capillata*-Gesellschaft; **f)** *Vinco herbaceae-Caraganetum fruticis* (Fotos: **a)** D. Vynokurov; **b–f)** D. Borovyk, alle Fotos 2018).

slopes (mean 12.4º) and a higher herb layer cover in comparison to the previous community (mean 67%). Important diagnostic species in this group are: *Linum czernjajevii*, *Astragalus ucrainicus*, *Silene bupleuroides*, *Teucrium polium*, *Viola ambigua*, *Stachys recta*, *Thesium arvense*, *Ajuga chia*, *Euphorbia stepposa*.

Cluster 3. Bunchgrass steppe

Group 3 combines bunchgrass steppe communities in the southern part of the Berda River Valley. They occupy medium and steep slopes predominantly of the southern and eastern aspect (Fig. 4b). The common dominant species among the grasses are *Agropyron pectinatum*, *Bromopsis riparia*, *Stipa lessingiana* and *S. zalesskii*. The proportion of forbs is somewhat lower, some of the dominants are *Galatella villosa*, *Salvia nutans*, *Thalictrum minus* etc. The distribution of these communities coincides with the geobotanical zonation of Ukraine. The southern part of the Berda River Valley is situated within the bunchgrass stripe of the Ukrainian steppe zone and climatically differs from the rest by the higher temperatures. The rest of the study area lies within the forb-bunchgrass *stripe* of the steppe zone. This vegetation type differs from the other zonal steppe communities by the higher participation of therophytes and a smaller number of forbs (Fig. 5d). The moss and lichen layers are sparse or absent. Some of the remarkable diagnostic species are *Galium octonarium*, *Nepeta parviflora*, *Veronica persica*, *Seseli tortuosum*, *Phlomis pungens*.

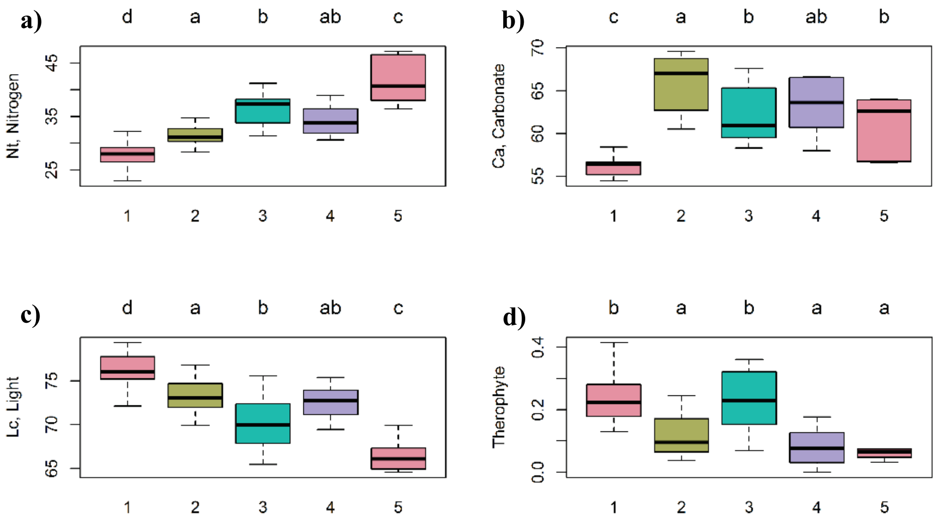

Fig. 5. Comparison the ecological indicator values **a)** Nitrogen content, **b)** carbonate content, **c)** light and participation of therophyte life forms **d)** among the five associations (community-weighted means).

Fig. 5. Comparison the ecological indicator values **a)** Nitrogen content, **b)** carbonate content, **c)** light and participation of therophyte life forms **d)** among the five associations (community-weighted means).

Cluster 4. *Stipa capillata* forb-bunchgrass steppe

The other community of true steppes is found on flat plain areas of the watershed of the river Berda and is classified in the fourth cluster (Fig. 4e). They are an example of steppes existed in the past before the ploughing, contrary to the other steppe types occurring on the slopes of the valley. The communities have higher herb layer cover (mean 84%), the lichen layer is usually not found in such communities et all. They could be found on flat areas and gentle slopes; the mean inclination of the sampled plots is 8.5º. Usually, these communities have a lower number of species than the other two zonal types and the steppes on granitic outcrops. Other characteristic features of this vegetation type are lower participation of therophytes, and higher of hemicryptophytes; the amount of early spring species is the lowest, and the amount of summer and autumn flowering species is the highest among the other steppe types. There are not so many diagnostic species found in this community: *Eryngium campestre*, *Senecio jacobaea*, *Stipa capillata*, *Medicago lupulina*, *Stipa ucrainica* and some others. The most common dominants are *Poa angustifolia*, *Stipa capillata*, *S. ucrainica*.

Cluster 5. Shrub-steppe with *Caragana frutex*

The last group was distinguished from the previous one by its physiognomy. The highly diagnostic species of this community are *Thalictrum minus*, *Caragana frutex*, *Verbascum blattaria*, *Echinops sphaerocephalus*, *Cynoglossum officinale*, *Asparagus officinalis*, *Potentilla argentea*. The floristic composition is poorer in comparison with the rest of the communities. But they are clearly distinguished by their appearance: the dominant species is a low shrub *Caragana frutex* (Fig. 4f). This community is in a stage of natural succession in the steppe zone. Usually, the steppe vegetation without any disturbance (grazing, fire, mowing, etc.) is encroached by low shrubs (e.g., in addition to the already mentioned, *Amygdalus nana*, *Caragana scythica*, *Spiraea hypericifolia* etc.), and later on by high shrubs (usually *Prunus spinosa*, and also by *Cerasus fruticosa*, *Rosa* ssp. etc.). Naturally, the cover of the herb layer is lower in comparison with the other vegetation groups, and the number of species is lower (18 species per 16 m^2 on average).

4.3 Relation to the environmental and structural parameters

Vegetation plots which were classified to cluster 1 and associated with the granitic outcrops, highly correlate with the parameter Lc (light) of the Ukrainian ecological indicator values (DIDUKH 2011), and negatively with Rc (soil reaction) and Ca (carbonate content in soil) (Fig. 6). The communities occur mostly on the medium and steep slopes (mean 20º) without preferences in the aspect. They are usually sparse (mean 45% of herb layer cover), with the highest participation of mosses (up to 20%, mean 9.5%) and lichens (up to 80% cover, mean 22%) among the sampled communities.

Communities belonging to cluster 3 (bunchgrass steppes) are the most thermophilous (higher values of BIO1). Due to the location near the Azov Sea coast, the temperature annual range (continentality) is lower than in the other places (Table 2). The participation of therophytes in these communities is quite high, like in the previous group, which can be explained by the adaptation to higher temperatures and drought. Also, together with the previous group, the communities of bunchgrass steppes tend to have a higher number of species in the vegetation plot record.

Table 2. Climatic, structural and ecological characteristics among the five clusters. The *p*-values and significance levels refer to ANOVAs (*** < 0.001, ** < 0.01, * < 0.05, . < 0.1, 1).

Tabelle 2. Klimatische, strukturelle und ökologische Merkmale der fünf Cluster. Die *p*-Werte und Signifikanzniveaus beziehen sich auf ANOVAs (*** < 0,001; ** < 0,01; * < 0,05; . < 0,1, 1).

Cluster number	**1**	**2**	**3**	**4**	**5**		
Number of relevés	**17**	**16**	**14**	**8**	**5**		
	Mean±Sd	**Mean±Sd**	**Mean±Sd**	**Mean±Sd**	**Mean±Sd**	***p* value**	**Signi-ficance**
Vegetation structure							
Cover vegetation total	49±16	67±16	62±13	84±11	34±5	<0.001	***
Cover shrub layer	not present	not present	not present	9±25	41±38	<0.001	***
Cover moss layer	9±7	4±4	2±2	5±7	3±4	0.001	**
Cover lichen layer	22±24	3±10	0±0	not present	not present	<0.001	***
Species richness	30.4±4.9	30.8±5.6	30.8±5.9	24.6±4.8	18.0±4.9	<0.001	***
Height, cm	39±12	54±20	40±20	48±32	54±2	0.006	**
Therophytes	0.23±0.07	0.12±0.07	0.23±0.09	0.08±0.06	0.09±0.08	<0.001	***
Geophytes	0.02±0.02	0.04±0.03	0.06±0.06	0.04±0.05	0.05±0.03	0.122	
Chamaephytes	0.05±0.04	0.09±0.03	0.08±0.05	0.05±0.04	0.01±0.02	<0.001	***
Hemicryptophytes	0.57±0.11	0.57±0.11	0.52±0.13	0.73±0.09	0.60±0.06	0.002	**
Forbs	0.44±0.08	0.55±0.10	0.47±0.14	0.55±0.10	0.46±0.12	0.033	*
Legumes	0.03±0.03	0.08±0.03	0.07±0.05	0.06±0.02	0.23±0.05	<0.001	***
Graminoids	0.34±0.17	0.33±0.12	0.36±0.12	0.33±0.13	0.29±0.13	0.898	
Climatic parameters							
Bio1	10.3±0.3	9.9±0.4	10.9±0.2	10.2±0.3	10.1±0.2	<0.001	***
Bio7	490±21	517±32	506±8	505±34	504±26	0.064	.
Bio12	320±5	324±5	302±5	322±5	325±2	<0.001	***
Topography							
Altitude, m	58±22	99±39	33±22	85±38	86±23	<0.001	***
Inclination	21±15	12±13	24±19	9±17	11±7	0.104	
Heat load index	0.54±0.11	0.62±0.04	0.57±0.15	0.62±0.12	0.62±0.06	0.163	
Ecological indicator values							
Hd, Moisture	24±1	26±1	25±3	26±1	29±1	<0.001	***
Rc, Soil reaction	57±2	65±2	65±2	65±3	65±2	<0.001	***
Sl, Salt regime	42±1	43±1	43±1	44±2	43±1	<0.001	***
Nt, Soil nitrogen	28±2	31±2	37±3	34±3	42±5	<0.001	***
Lc, Light value	76±2	73±2	70±3	73±2	67±2	<0.001	***
Ca, Carbonate content	56±2	66±3	62±3	63±3	61±4	<0.001	***
Tm, Thermoregime	65±2	66±1	67±2	64±2	63±1	<0.001	***
Kn, Continentality	51±2	50±1	51±3	51±2	50±2	0.661	
Om, Ombroregime	50±1	47±1	46±2	48±2	47±2	<0.001	***
Cr, Cryoregime	56±2	56±2	56±2	53±3	50±2	<0.001	***

Forb-bunchgrass steppes (clusters 2 and 4) occur in slightly more mesic conditions (Hd) and tend to have higher herb layer cover and higher mean plant height of the species. They differ by higher participation of hemicryptophytes and forbs in the communities. Also, they are related to the higher amount of Ca carbonates and higher pH (Fig. 6).

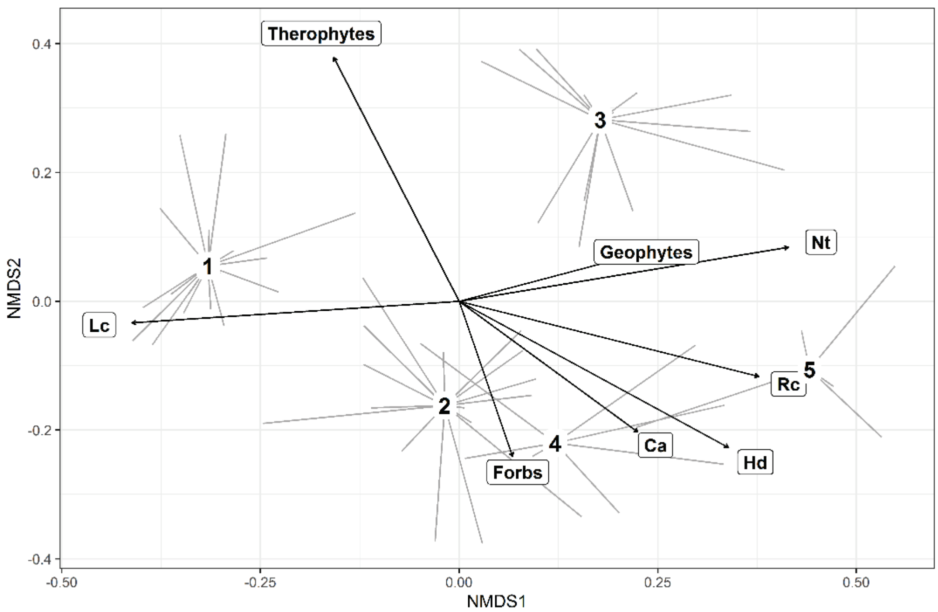

Fig. 6. NMDS ordination of all relevés. Lc: light, Ca: carbonate content in soil, Nt: Nitrogen content, Hd: humidity, Rc: soil reaction, Therophytes: participation of therophytes, Forbs: participation of forbs, Geophytes: participation of geothytes (community weighted means).

Abb. 6. NMDS-Ordination aller Vegetationsaufnahmen. Lc: Licht, Ca: Karbonatgehalt im Boden, Nt: Stickstoffgehalt, Hd: Feuchtigkeit, Rc: Bodenreaktion, Therophyten: Beteiligung von Therophyten, Kräuter: Beteiligung von Kräutern, Geophyten: Beteiligung von Geophyten (gemeinschaftsgewichtete Mittel).

The most mesic communities are those belonging to cluster 5 (shrub-steppe). They have the highest values of the Hd ecological parameter. Naturally, they have higher participation of phanerophytes (shrubs) and the lowest amount of therophytes.
In the Table 2, these and some other parameters are listed, their mean values for each cluster and the standart deviation, as well as the results of the ANOVA.

5. Discussion

5.1 Syntaxonomic position of the distinguished vegetation types

The granite rocky grasslands within the steppe zone of Ukraine are classified as the alliance *Poo bulbosae-Stipion graniticolae* which was described from the Inhul River Valley (a tributary of the Southern Buh) in Central-Southern Ukraine, Mykolaiv region (VYNOKUROV 2014a). Originally it was subordinated to the *Festuco-Brometea* (order *Festucetalia valesiaceae*) as a transitional unit to the *Sedo-Scleranthetea*. Later on, in the EuroVegChecklist (MUCINA et al. 2016), it was transferred to the class *Sedo-Scleranthetea*. Considering the strong distinction from the other vegetation units shown in our analysis (Fig. 3), in the current regional study we follow this solution and also subordinate it to *Sedo-Scleranthetea* class. However, taking into account the strong floristic relatedness to the

Festuco-Brometea vegetation class, this solution might be reviewed in the further larger-scale analysis. There are several arguments in favor of including this unit in the *Sedo-Scleranthetea*. These communities have a sparse cover of the herb layer but a high cover of the cryptogam layer (lichens up to 80%, and mosses up to 20%), and they occur only on granitic outcrops. Many of constant species are widely distributed across Europe and considered to be diagnostic for this vegetation class: *Artemisia marschalliana* (*A. campestris* s. l.), *Rumex acetosella*, *Sedum acre*, *Trifolium arvense*, *Veronica dillenii* etc. In case of supporting the taxonomic revision of *Stipa graniticola* and considering it as a synonym of *S. borysthenica* (see above), one of the dominant species of these communities would also be a common dominant species of the class *Koelerio-Corynephoretea canescentis* in Ukraine associated with sandy grasslands and hemipsammophytic steppes (SHYRIAIEVA 2022). However, there is also a significant number of species that is more associated with the *Festuco-Brometea*: *Astragalus ucrainicus*, *Botriochloa ischaemum*, *Carex supina*, *Eremogone biebersteinii*, *Euphorbia seguieriana*, *Teucrium polium* etc. In case of including this unit in the latter class, it would become an analogue of the alliances *Alysso-Festucion pallentis* and *Asplenio-Festucion pallentis* from the Central Europe.

The petrophytic communities on granitic outcrops in the Berda River Valley closely correspond to the association *Ephedro distachyae-Stipetum graniticolae* with some regional unique features. In comparison to similar communities in the basin of the Southern Buh River, the floristic composition is slightly different. In the Berda River Valley the species *Achillea leptophylla*, *Jurinea granitica*, *Asperula graniticola* have a high constancy, whereas in the basin of Southern Buh River these species are absent or occur with lower frequency. On the contrary, in the basin of Southern Buh River there are such species as *Achillea ochroleuca*, *Minuartia setacea*, *Seseli pallasii*, which were not recorded in the vegetation plots of the Berda River Valley. Considering these floristic differences, we describe a new syntaxon on the level of subassociation:

***Ephedro distachyae-Stipetum graniticolae achilleetosum leptophylae* subass. nov. hoc loco**

Granite rocky steppes, dry grasslands on silicious outcrops of the Azov Upland. Communities are distributed on the slopes of Berda River Valley and its tributaries.

Holotypus hoc loco: relevé 2 in Supplement S1 (this paper); Ukraine, Donetsk Region, Mariupol District, vicinity of Zakharivka village, right slope of Karatiuk river, 47.16766 N 36.96337 E, altitude: 81 m a.s.l., aspect: 45°, inclination: 20°, 19.05.2018, authors of the relevé: D. Borovyk & D. Vynokurov.

Diagnostic species: *Achillea leptophylla*, *Jurinea granitica*, *Pulsatilla pratensis*, *Stipa graniticola*.

The rest of the clusters comprise steppe vegetation on deeper soils and are considered to be within the class *Festuco-Brometea*. It was suggested to classify true steppe vegetation of Eastern Europe in the order *Galatello villosae-Stipetalia lessingianae* (VYNOKUROV 2021) but without a proper comparison and justification. Thus, we follow EuroVegChecklist (MUCINA et al. 2016) and consider the true steppe vegetation in the order *Festucetalia valesiacae*.

On the level of alliances, we classify the rest of the clusters within *Stipo lessingianae-Salvion nutantis* which was described in Ukraine in the Inhul River Valley (VYNOKUROV 2014b). The alliance is not recognized in the EuroVegChecklist (MUCINA et al. 2016) and is considered as a synonym of *Stipion lessingianae* Soó 1947, which was described from

Transsylvania. However, in the comprehensive work of WILLNER et al. (2017), the vegetation plots belonging to *Stipion lessingianae* from Transsylvania were classified within the group of *Festucion valesiacae* Klika 1931. Thus, we consider our true steppe vegetation within the alliance *Stipo lessingianae-Salvion nutantis*. Another possible solution for the part of our plots in the southern part of the Berda River could be the alliance *Tanaceto millefolii-Galatellion villosae* Vynokurov in Kolomiychuk et Vynokurov 2016 which was proposed for the southern bunchgrass steppes of Ukraine (KOLOMIYCHUK & VYNOKUROV 2016). But in our syntaxonomical scheme, the southern bunchgrass steppes (cluster 3) are not as different from forb-bunchgrass steppes to consider them in the other alliance.

Within this alliance, at the association level, we found the corresponding names to 3 out of 4 clusters. The forb-bunchgrass communities can be interpreted as *Stipo lessingianae-Salvietum nutantis*, which is the type of alliance *Stipo lessingianae-Salvion nutantis*. Although it was described from the other region (the central-southern part of Ukraine, Kirovograd Region, within the steppe zone), it nevertheless shows quite similar species composition to the forb-bunchgrass communities from the Berda River Valley. We propose to unite the bunchgrass steppic grasslands into the association *Ephedro distachyae-Stipetum capillatae*, which was described in the same region (Zaporizhzhia region, steppe slope to Molochny estuary). We unite the shrub-steppe communities into the association *Vinco herbaceae-Caraganetum fruticis*. This association was described from the forest-steppe zone of Ukraine, Kharkiv Region but floristically is quite similar to the communities from the Berda River Valley.

For the *Stipa capillata* forb-bunchgrass steppe communities (cluster 4), we could not find any association name. Considering the recommendation 7A of the ICPN (THEURILLAT et al. 2020), stating that at least 10 vegetation relevés are recommended to describe a new association, we treat this cluster for the time being as an informal community of association rank: *Eryngium campestre-Stipa capillata* community. Its status might be changed after the proper investigation and comparison with plots from other bordering regions.

5.2 Syntaxonomic scheme

Summarizing, the steppe vegetation in the Berda River Valley could be classified within 4 associations and one community, 2 alliances, 2 orders and 2 classes:

Sedo-Scleranthetea Br.-Bl. 1955

Sedo-Scleranthetalia Br.-Bl. 1955

Poo bulbosae-Stipion graniticolae Vynokurov 2014

1. *Ephedro distachyae-Stipetum graniticolae* Vynokurov 2014 *achilleetosum leptophylae* subass. nov. (this paper)

Festuco-Brometea Br.-Bl. et Tx. ex Soó 1947

Festucetalia valesiacae Soó 1947
(or *Galatello villosae-Stipetalia lessingianae* Vynokurov 2021)

Stipo lessingianae-Salvion nutantis Vynokurov 2014

2. *Stipo lessingianae-Salvietum nutantis* Vynokurov 2014
3. *Ephedro distachyae-Stipetum capillatae* Kolomiychuk et Vynokurov 2016
4. *Eryngium campestre-Stipa capillata* community
5. *Vinco herbaceae-Caraganetum fruticis* Korotchenko et Didukh 1997

5.3 Threats and conservation

The dry grasslands of the Berda River Valley and its tributaries are showing high conservation value as they are the remnants of the vast areas covered with steppe vegetation before the agricultural exploration of this area. Thus, many species are rare and protected on the national or regional levels. There are 12 species recorded in the relevés which are listed in the Red Data Book of Ukraine (DIDUKH 2009): *Astragalus odessanus*, *Caragana scythica*, *Elytrigia stipifolia*, *Hyacinthella pallasiana*, *Pulsatilla pratensis*, *Stipa capillata*, *S. graniticola*, *S. lessingiana*, *S. pulcherrima*, *S. ucrainica*, *S. zalesskii*, *Tulipa graniticola*. Besides them, among the species not recorded in our relevés are threatened *Achillea glaberrima*, *Centaurea pseudoleucolepis*, *Crambe tataria*, *Echium russicum*, *Paeonia tenuifolia*, included in the Revised Annex I of Resolution 6 (COUNCIL OF EUROPE 1998) of the Bern Convention listing the species requiring specific habitat conservation measures (year of revision 2011) (KLOKOV 1927, PANOVA 1967, VAKARENKO et al. 1996, ZUBTSOVA 2010).

Among the most common threats, we can mention lack of management in some localities, which leads to encroachment of the steppe communities by low steppic shrubs (mostly of *Caragana frutex*), which are successionally followed by the communities of *Crataego-Prunetea* vegetation class (FITSAILO 2006). On the other hand, in some areas, especially those closer to bigger settlements, we observed heavily overgrazed areas. The overgrazing in this region, especially on slopes of the valleys, leads to intensification of soil erosion and expanding of *Botriochloa ischaemum* communities (DIDUKH 2020), and shrinking the areas covered with species which do not tolerate intense grazing (e.g. those protected according to Red Data Book of Ukraine and some others).

Lastly, since the full-scale war in Ukraine began in 2022, the new modern threats affected natural ecosystems in the region, including steppe vegetation and other vegetation types. Among them, there are direct destructions of vegetation cover due to military activities, large-scale chemical and physical pollution, mining of territories, changes in land use and land management. We believe that our data on the vegetation of the Berda River Valley, as well as other biodiversity surveys of the region (e.g. SKOBEL et al. 2023), will become a baseline inventory for evaluating the war impact and will be used for the planning of vegetation restoration after the war finishes.

Erweiterte deutsche Zusammenfassung

Einleitung – In der Südukraine hat das großflächige Pflügen weite Gebiete beeinträchtigt, darunter auch die gesamten Wassereinzugsgebiete von Flüssen. Dennoch dominieren gelegentlich natürliche Steppenrasen die Hänge von Flusstälern und schaffen einzigartige und biologisch vielfältige Hotspots innerhalb der Agrarlandschaft. Ein solcher Hotspot ist der Fluss Berda, der in der Steppenzone in der südlichen Region der Ukraine liegt. Bisher gab es nur wenige Syntheseuntersuchungen zur Syntaxonomie der Vegetation der Küstenzone des Asowschen Meeres, zu der auch die Mündung des Flusses Berda gehört (TYSHCHENKO 1999, 2006, KOLOMIYCHUK & VYNOKUROV 2016). Die Syntaxonomie der Steppenvegetation im Berda-Flusstal und seinen Nebenflüssen ist jedoch noch weitgehend unerforscht. Daher bestand unser Hauptziel darin, die syntaxonomische Vielfalt der Steppenvegetation in diesem wenig untersuchten Gebiet zu untersuchen.

Untersuchungsgebiet – Das Berda-Flusstal liegt im Südosten der Ukraine, insbesondere in den Regionen Saporischschja und Donezk. Der Großteil der Böden im Untersuchungsgebiet besteht aus Tschernosemen, die heterogen sind und je nach Gelände, klimatischen Bedingungen und Vegetation variieren. Nach der Köppen-Klassifikation liegt das Untersuchungsgebiet in der Dfa-Zone, die im Sommer durch ein heißes Kontinentalklima gekennzeichnet ist. Die natürliche Vegetation in dieser Region besteht überwiegend aus Steppen. Traditionell werden innerhalb der Steppenzone in der Region des Berda-Flusses zwei Unterzonen unterschieden: Kräuter-Horstgras-Steppen (oder Kräuer-Schwingel-Federgras-Steppen) und Horstgras-Steppen (oder Schwingel-Federgras-Steppen).

Material und Methoden – Wir beprobten 60 Vegetationsplots von 16 m^2 (4 m × 4 m, gemessen im Feld) nach dem Braun-Blanquet-Ansatz im trockenen Grasland des Berda-Flusstals und einiger seiner Nebenflüsse (Abb. 1 und 2). Wir erfassten alle Gefäßpflanzenarten, ihren Deckungsgrad und zusätzlich einige Umwelt- und Strukturmerkmale: Breitengrad, Längengrad, Höhe, Expostion, Neigung, Gesamtvegetationsbedeckung, Bedeckung der Strauchschicht, Krautschicht, Moosschicht und Flechtenschicht (Beilage S1). Die Klassifizierung der Vegetation erfolgte mit der Methode des Distance-Ranked Sorting Assembling (DRSA) (GONCHARENKO 2015), die zu einer Unterfamilie von Methoden gehört, die auf dem kNN-Clustering-Ansatz basieren. Für die Clusterung von Relevanzen wurde die Bray-Curtis-Distanzmatrix verwendet.

Ergebnisse – Der Clustering-Prozess wies zunächst vier Cluster zu. Anschließend trennten wir Cluster 5 manuell von Cluster 4 anhand eines physiognomischen Kriteriums, d. h. wenn die Strauchschicht von *Caragana frutex* eine Bedeckung von 40 % überschritt. Der erste Cluster entspricht der Granitfelsensteppe. Die Cluster 2 und 4 sind zusammengefasst und stellen jeweils Staudengrassteppen dar, und zwar an den Talhängen bzw. auf flachen Ebenen. Der dritte Cluster entspricht der Horstgrassteppe im südlichen Teil des Untersuchungsgebiets. Der fünfte Cluster repräsentiert Strauchsteppengemeinschaften mit *Caragana frutex*. Eine Übersichtstabelle und eine geordnete Übersichtstabelle der Vegetation des Berda-Flusstals finden sich in den Beilage S1 und Anhang E1.

Diskussion und Schlussfolgerungen – Wir schlagen vor, die Trockenrasen des Berda-Flusstals in zwei Klassen einzuteilen: Granitfelssteppen (Cluster 1), die zur Klasse *Sedo-Scleranthetea* gehören, und alle anderen Cluster, die der Klasse *Festuco-Brometea* angehören. Alle fünf als Ergebnis der Analyse erhaltenen Cluster interpretieren wir als syntaxonomische Einheiten auf Assoziationsebene, da sie eine starke ökologische und physiognomische Differenzierung aufweisen. Granitfelssteppen des Berda-Flusstals gehören zur Assoziation *Ephedro distachyae-Stipetum graniticolae* und zum Verband *Poo bulbosae-Stipion graniticolae*. Die anderen Assoziationen ordneten wir dem Verband *Stipo lessingianae-Salvion nutantis* zu, der die zonale Steppenvegetation der Steppenzone in Osteuropa umfasst. Wir haben Kräuter-Horstgrassteppen an den Talhängen in die Assoziation *Stipo lessingianae-Salvietum nutantis* und Kräuter-Horstgrassteppen, die auf den flachen Flächen von *Stipa capillata* dominiert werden, in die *Eryngium campestre-Stipa capillata*-Gesellschaft aufgenommen. Horstgrassteppen, die überwiegend im südlichen Teil des Flusstals vorkommen, wurden in die Assoziation *Ephedro distachyae-Stipetum capillatae* eingeordnet. Strauchsteppen-Gesellschaften wurden der Assoziation *Vinco herbaceae-Caraganetum fruticis* zugeordnet. Insgesamt schlagen wir ein Klassifikationsschema der Steppenvegetation des Berda-Flusstals vor, das aus fünf Assoziationen besteht, die zwei Verbänden, zwei Ordnungen und zwei Klassen angehören.

Acknowledgements

The field work was supported by the Ukrainan Nature Conservation Group (UNCG). The authors are grateful to Olexandr Bronskov for participating in the field work sampling, and Denis Davydov for the help in plant determination. The work of D.B. was supported by the Visegrad Fund (scholarship #52211389) during the manuscript writing. Last but not least, we are sincerely grateful to the Armed Forces of Ukraine and all Ukrainians for their courage and resistance.

Author contributions

Vegetation plots were recorded by D.V, D.B, O.B; O.G. and D.V. ran the analysis and performed the evaluation of the results; D.V. led the writing; all authors participated in writing and revising the manuscript and approved the final version.

ORCID iDs

Dariia Borovyk https://orcid.org/0000-0001-7140-7201
Olena Bronskova https://orcid.org/0000-0002-7762-7229
Igor Goncharenko https://orcid.org/0000-0001-5239-3270
Denys Vynokurov https://orcid.org/0000-0001-7003-6680

Supplements

Supplement S1. Vegetation table of the authors' relevés.

Beilage S1. Vegetationstabelle der Aufnahmen der Autorinnen und Autoren.

Additional supporting information may be found in the online version of this article.

Zusätzliche unterstützende Information ist in der Online-Version dieses Artikels zu finden.

Supplement E1. Synoptic table (percentage frequency and fidelity in the superscript) of the main vegetation units of the Berda River Valley and its tributaries.

Anhang E1. Übersichtstabelle (prozentuale Häufigkeit und Treue im hochgestellten Index) der Hauptvegetationseinheiten des Berda-Flusstals und seiner Nebenflüsse.

References

BARBARYCH, A.I. (Ed.) (1973): Vegetation of the Ukrainian SSR: steppes, rocky outcrops, sands (Roslynnist' URSR: stepy, kam'yanysti vidslonennia, pisky) [in Ukrainian]. – Naukova Dumka, Kyiv: 428 pp.

BARBARYCH, A.I. (Ed.) (1977): Geobotanichne rayonuvannia Ukrains'koi SSR (Geobotanical zoning of Ukrainian SSR) [in Ukrainian]. – Naukova Dumka, Kyiv: 304 pp.

BARKMAN, J. (1989): Fidelity and character-species, a critical evaluation. – Vegetatio 85: 105–116.

BECK, H.E., ZIMMERMANN, N.E., MCVICAR, T.R., VERGOPOLAN, N., BERG, A. & WOOD, E.F. (2018): Present and future Köppen-Geiger climate classification maps at 1-km resolution. – Sci. Data 5: 180214. https://doi.org/10.1038/sdata.2018.214

BILYK, H.I. & PANOVA, L.S. (1959): Roslynni kompleksy zapovidnyka "Kamyani Mohyly" (Vegetation complexes of the reserve "Kamyani Mohyly") [in Ukrainian]. – Ukr. Bot. J. 16(6): 40–48.

BRAY, J.R. & CURTIS, J.T. (1957): An ordination of the upland forest communities of southern Wisconsin. – Ecol. Monogr. 27: 326–349.

CHYTRÝ, M., TICHÝ, L., HOLT, J. & BOTTA-DUKÁT, Z. (2002): Determination of diagnostic species with statistical fidelity measures. – J. Veg. Sci. 13: 79–90. https://doi.org/10.1111/j.1654-1103.2002.tb02025.x

COVER, T. & HART, P. (1967): Nearest neighbour pattern classification. – IEEE Trans. Inf. Theory 13(1): 21–27.

COUNCIL OF EUROPE (1998): Revised Annex I of Resolution 6 (1998) of the Bern Convention listing the species requiring specific habitat conservation measures (year of revision 2011). – Council of Europe. – URL: https://rm.coe.int/1680746347 [accessed 2023-02-01].

DATSENKO, L.M. (Ed.) (2014): Pivnichno-Zakhidne Pryazovia: geologia, geomorfologia, geoloho-geomorfologichni procesy, geoecologichnyi stan (North-Western Pryazovia: geology, geomorphology, geological and geomorphological processes, geoecological stage) [in Ukrainian]. – Vydavnytstvo MDPU im. B. Khmelnytsknoho, Melitopol: 308 pp.

DAVE, R.N. (1991): Characterization and detection of noise in clustering. – Pattern Recognit. Lett. 12(11): 657–664.

DEMBICZ, I., MOYSIYENKO, I.I., SHAPOSHNIKOVA, A., VYNOKUROV, D., KOZUB, Ł. & SUDNIK-WÓJCIKOWSKA, B. (2016): Isolation and patch size drive specialist plant species density within steppe islands: a case study of kurgans in southern Ukraine. – Biodivers. Conserv. 25: 2289–2307. https://doi.org/10.1007/s10531-016-1077-y

DENGLER, J., CHYTRÝ, M. & EWALD, J. (2008): Phytosociology. – In: JØRGENSEN, S.E. & FATH, B.D. (Eds.): Encyclopedia of ecology: 2767–2779. Elsevier B.V.

DIDUKH, Y.P. (2011): The ecological scales for the species of Ukrainian flora and their use in synphytoindication. – Phytosociocentre, Kyiv: 176 pp.

DIDUKH, Y.P. (Ed.) (2009): Plant world Chervona knyha Ukrainy. Roslynnyi svit (Red Data Book of Ukraine) [in Ukrainian]. – Globalkonsalting, Kyiv: 900 pp.

DIDUKH, Y.P. (Ed.) (2020): Biotopy stepovoi zony Ukrainy (Biotopes of Steppe zone of Ukraine) [in Ukrainian]. – DrukART, Kyiv-Chernivtsi: 392 pp.

DIDUKH, Y.P. & PLYUTA, P.G. (1994): Phytoindication of ecological factors. – Naukova dumka, Kyiv: 280 pp.

DUFRÊNE, M. & LEGENDRE, P. (1997): Species assemblages and indicator species: the need for a flexible asymmetrical approach. – Ecol. Mongr. 67: 345–366.

ELLENBERG, H., WEBER, H.E., DÜLL, R., WIRTH, V., WERNER, W. & PAULISEN, D. (1991): Zeigerwerte von Pflanzen in Mitteleuropa. – Verlag Erich Goltze KG, Göttingen: 248 pp.

EURO+MED (2006+): Euro+Med PlantBase – the information resource for Euro-Mediterranean plant diversity. – URL: http://europlusmed.org [accessed 31.03.2023].

FITSAILO, T.V. (2006): Syntaxonomia chaharnykovoi roslynnosti (klas *Rhamno-Prunetea* Rivas Goday et Carb. 1961) viddilennia "Kamiani mohyly" Ukrainskoho Stepovogo Pryrodnoho Zapovidnyka (Syntaxonomy of shrub vegetation [class *Rhamno-Prunetea* Rivas Goday et Carb. 1961] in the section of the Ukrainian Steppe Nature Reserve "Kamyani Mogyly") [in Ukrainian]. – News Biosphere Reserve "Askania Nova" 8: 49–59.

GONCHARENKO, I.V. (2015): Metod "sortuyuchoi" klasteryzatsii (DRSA) dlia klasyfikatsii roslynnosti (A method of "sorting" clustering (DRSA) for the classification of plant communities) [In Ukrainian]. – Reports of the National Academy of Sciences of Ukraine (9): 129–136.

GONCHARENKO, I.V. (2016): Zastosuvannia metodu DRSA – neparametrychnoho klasternoho analizu v klasyfikatsii roslynnosti (An application of the DRSA method, a nonparametric cluster analysis, in vegetation classification) [in Ukrainian]. – Ukr. Bot. J. 73(6): 568–578.

GONCHARENKO, I.V. (2017): Fitoindykatsiia antropohennoho navantazhennia (Phytoindication of anthropogenic factor) [in Ukrainian]. – Serednyak T.K., Dnipro: 127 pp.

GONCHARENKO, I.V. & SENCHYLO, O.O. (2020): The study of fidelity measures in the context of using them as a threshold criterion in the allocation of diagnostic species. – Ecologica Montenegrina 30: 28–36.

GONZALO, R., AEDO, C. & GARCÍA, M.Á. (2013): Taxonomic revision of the Eurasian *Stipa* Subsections *Stipa* and *Tirsae* (*Poaceae*). – Syst. Bot. 38: 344–378. https://doi.org/10.1600/036364413X666615

KLEOPOV, Y.D. (1928): Stepy Nadozivs'koi krystalichnoi smuhy (Steppes of the Nadozivs'ka crystalline stripe) [in Ukrainian]. – Okhorona pam'iatok pryrody na Ukraini 2: 61–67.

KLEOPOV, Y.D. (1929): Roslynnist' Stalins'koi okruhy (The vegetation of Stalino district [in Ukrainian]. – Materialy doslidzhen' gruntiv Ukrainy 4: 56–62.

KLOKOV, M.V. (1927): Kamyani Mohyly. Zahal'nyi nacherk roslynnosti (Kamyani Mohyly. General description of vegetation) [in Ukrainian]. – Okhorona pam'iatok pryrody na Ukraini 1: 3–8.

KLOKOV, M.V. & LAVRENKO, YE.M. (1924): Botaniko-geografichni doslidy na pivdennomu skhodi Ukrainy za ostanni roky (The vegetation of Donbas [botanical-geographical explorations in the region of Southeastern Ukraine during the last years]) [in Ukrainian]. – Chervonyi shliakh 8–9: 193–212.

KOLOMIYCHUK, V.P. (2003): Locus classicus *Ornithogalum melancholicum* Klokov ex A. Krasnova ta pytannia yoho okhorony (Locus classicus *Ornithogalum melancholicum* Klokov ex A. Krasnova and issues of its protection) [in Ukrainian]. – Ukr. Bot. J. 60(2): 189–191.

KOLOMIYCHUK, V. & VYNOKUROV, D. (2016): Syntaxonomy of the *Festuco-Brometea* class vegetation of the Azov sea coastal zone. – Hacquetia 15: 79–104. https://doi.org/10.1515/hacq-2016-0018

KOTOV, M.K. & KARNAUKH, Y.D. (1940): Roslynnist' zapovidnykiv Stalins'koi oblasti (The vegetation of the reserves in Stalino oblast) [in Ukrainian]. – Botanichny Zhurnal AN URSR 3–4(1): 34–47.

KRUSKAL, J.B. (1964): Multidimensional scaling by optimizing goodness of fit to a nonmetric hypothesis. – Psychometrika 29: 1–27.

KUZEMKO, A., VYNOKUROV, D. & SHYRIAIEVA, D. (2020): Distribution of species of the genus *Stipa* in Ukraine according to phytosociological databases. – Plant Introd. 87–88: 87–103. https://doi.org/10.46341/PI2020037

KUZNETSOVA, G.O. (1956): Zapovidnyk Kamyani Mohyly (Kamyani Mohyly Reserve) [in Ukrainian]. – Ukr. Bot. J. 13(2): 31–43.

LAVRENKO, E.M., KARAMYSHEVA, Z.V. & NIKULINA, R.I. (1991): Stepi Evrazii (Steppes of Eurazia) [in Russian]. – Nauka, Leningrad: 146 pp.

LOIDI, J., NAVARRO-SÁNCHEZ, G. & VYNOKUROV, D. (2022): Climatic definitions of the world's terrestrial biomes. – Veg. Classif. Surv. 3: 231–271.

LYSENKO, H.M. (2008): Monitoryng fitosystem petrofitnoho stepu "Kamyani Mohyly" (Monitoring of phytosystems of petrophytic steppe in "Kamyani Mohyly") [in Ukrainian]. – Chornomorski Bot. J. 4(1): 89–97.

MARKOVSKII, A. (1905): Geobotanicheskoye opisaniye Mariupol'skogo uiezda (Geobotanical description of the Mariupol district) [in Russian]. – Izv. Mosk. S-h. Inst. 11: 348–454.

MIKOLASKOVA, K. (2009): Continental and oceanic precipitation régime in Europe. – Cent. Eur. J. Geosci. 1: 176–182.

MOSYAKIN, S.L. & FEDORONCHUK, M.M. (1999): Vascular plants of Ukraine. A nomenclatural checklist. – Specialized printing house of scientific journals of the NAS of Ukraine, Kyiv: 345 pp.

MUCINA, L., BÜLTMANN, H., DIERßEN, K. … TICHÝ, L. (2016): Vegetation of Europe: hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities. – Appl. Veg. Sci. 19, Suppl. 1: 3–264. https://doi.org/10.1111/avsc.12257

NEPSHA, O.V. (2012): Hidrolohichni osoblyvosti richok Pivdenno-Zakhidnoho Pryazovia (Hydrological peculiarities of the rivers of Norh-Western Pryazovia) [in Ukrainian]. – Proceedings of the conference "Ekolohichnyi shliakh u maibutnie" (Uman', 29–30March 2012). – Naukovyi Svit, Kyiv: 95–96.

NEPSHA, O.V. (2013): Pro budovu kis Pivnichnoho Pryazovia (About structure of spits of North Pryazovia) [in Ukrainian]. – Geologichnyi J. 3: 44–50.

OKSANEN, J., BLANCHET, F.G., FRIENDLY, M. ... WAGNER, H. (2018): Vegan: Community Ecology Package. R package version 2.4-6. – URL: https://CRAN.R-project.org/package=vegan [accessed 2022-09-21].

PANOVA, L.S. (1967): Roslynnist' granitovykh vidslonen' zapovidnyka "Kamyani Mohyly" (Vegetation of the granitic outcrops of the reserve "Kamyani Mohyly") [in Ukrainian]. – Ukr. Bot. J. 24(2): 67–21.

R CORE TEAM (2023): R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. – URL https://www.R-project.org/.

RAMENSKY, L.G., TSATSENKIN, I.A., CHIZHIKOV, O.N. & ANTIPIN, N.A. (1956): Ecological assessment of forage land by vegetation. – Selhozgiz, Moskva: 472 pp.

RUDENKO, L.G. (Ed.) (2007): Natsionalyi atlas Ukrainy (National Atlas of Ukraine) [in Ukrainian]. – Kartografia, Kyiv: 440 pp.

SHYRIAIEVA, D. (2022): Classification, ecological differentiation, and conservation value of Pontic sandy grasslands in the Southern Buh River Basin (Ukraine). – Tuexenia 42: 57–94. https://doi.org/10.14471/2022.42.008

SHYRJAEV, G.K. (1912): K flore granitov vostoka Tavricheskoy gubernii (To the granite flora of the east of the Tauride province) [in Russian]. – Trudy Kharvovskogo Obshestva Ispytateley Prirody 14: 1–13.

SKOBEL, N., BOROVYK, D., VYNOKUROV, D. … DEMBICZ, I. (2023): Biodiversity surveys of grassland and coastal habitats in 2021 as a documentation of pre-war status in southern Ukraine. – Biodiv. Data J. 11: e99605. https://doi.org/10.3897/BDJ.11.e99605

THEURILLAT, J-P., WILLNER, W., FERNÁNDEZ-GONZÁLEZ, F., BÜLTMANN, H., ČARNI, A., GIGANTE, D., MUCINA, L. & WEBER, H. (2020): International Code of Phytosociological Nomenclature. 4th ed. – Appl. Veg. Sci. 24: e12491. https://doi.org/10.1111/avsc.12491

TKACHENKO, V.S. & GENOV, A.P. (1992): Ekologo-henetychny riad roslynnosti zapovidnyka “Kamyani mohyly” (Donetska oblast) (Ecological and genetic series of vegetation in the reserve “Kamyani Mohyly” [Donets oblast]) [in Ukrainian]. – Ukr. Bot. J. 49(4): 19–24.

TÖRÖK, P., AMBARLI, D., KAMP, J., WESCHE, K. & DENGLER, J. (2016): Step(pe) up! Raising the profile of the Palaearctic natural grasslands. – Biodivers. Conserv. 25: 2187–2195. https://doi.org/10.1007/s10531-016-1187-6

TYSHCHENKO, O.V. (1999): Roslynnist Berdianskoi kosy (Zaporizka oblast) ta osoblyvosti ii dynamiky (The vegetation of the Berdiansk Sea Spit [Zaporizhzhia Region] and peculiarities of its dynamism) [in Ukrainian]. – Ukr. Phytosoc. Coll. Ser A 3(14): 36–57.

TYSHCHENKO, O.V. (2006): Roslynnist prymorskykh kis pivnichnogo uzberezhzhia Azovskoho moria (The vegetation of the sea spits of the Northern coast of the Sea of Azov) [in Ukrainian]. – Fitosociotsentr, Kyiv: 156 pp.

VAKARENKO, L.P., MOSYAKIN, S.L. & HENOV, A.P. (2000): Naukove obgruntuvannia stvorennia mizhrehional’noho landshaftnoho parku “Nadberdiansky Step” (Pivnichne Pryazovia) (Scientific substantiation of the need to create an interregional landscape park “Nadberdiansky Step” [Northern Pryazovia]) [in Ukrainian]. – Zapovidna sprava v Ukraini 6: 17–27.

VAKARENKO, L.P., MOVCHAN, YA.I. & TURUTA, O.Y. (1996): Roslynni rarytety serednioi techii r. Berdy (Plant rarities of the middle course of the Berda River) [in Ukrainian]. – Ukr. Bot. J. 53: 598–603.

VERZHBITSKIY, O.L. (1892): Zametki o flore orkestnostey g. Mariupolia (Notes on flora in outskirts of Mariupol) [in Russian]. – In: Mariupol i yego okrestnosti (Mariupol and its outskirts) [in Russian]. – Tipo-Litografia A.A. Frantova, Mariupol: 454–456.

VYNOKUROV, D. (2021): New and validated names of some syntaxa of the *Festuco-Brometea* class vegetation from Eastern Europe. – Chornomorski Bot. J. 17: 76–80.

VYNOKUROV, D.S. (2014a): Syntaxonomy of xerothermic vegetation of the Ingul river valley (class *Festuco-Brometea*). Part 1. Petrophytic steppe vegetation. – Ukr. Bot. J. 71: 148–160.

VYNOKUROV, D.S. (2014b): Syntaxonomy of xerothermic vegetation of the river Ingul valley (class *Festuco-Brometea*). Part 2. Meadow, shrub and true steppe vegetation. – Ukr. Bot. J. 71: 537–548.

VYNOKUROV, D., DIDUKH, Y., KRASOVA, O., LYSENKO, H., GONCHARENKO, I., DMYTRASH-VATSEBA, I., CHUSOVA, O., SHYRIAIEVA, D., KOLOMIYCHUK, V. & MOYSIYENKO, I. (2020): Eastern European Steppe Database. – Veg. Classif. Surv. 1: 149–150.

WESCHE, K., AMBARLI, D., KAMP, J., TÖRÖK, P., TREIBER, J. & DENGLER, J. (2016): The Palaearctic steppe biome: a new synthesis. – Biodivers. Conserv. 25: 2197–2231. https://doi.org/10.1007/s10531-016-1214-7

WILLNER W. (2006): The association concept revisited. – Phytocoenologia 36: 67–76. https://doi.org/10.1127/0340-269X/2006/0036-0067

WILLNER, W., KUZEMKO, A., DENGLER, J. … JANIŠOVÁ, M. (2017): A higher-level classification of the Pannonian and western Pontic steppe grasslands (Central and Eastern Europe). – Appl. Veg. Sci. 20: 143–158. https://doi.org/10.1111/avsc.12265

YANATA, O. (1926): Spysok nairidshykh I naytsikavishykh roslyn Berdianshchyny, zibranykh 1912-ho (List of the rarest and most interesting plants of the Berdyansk region, collected in 1912) [in Ukrainian]. – Ukr. Bot. J. 3: 53–60.

ZUBTSOVA, T.V. (2010): *Echium russicum* (Syniak ruskyi). – In: Chervona knyha Donetskoi oblasti: roslynnyi svit (roslyny, scho pidliagayut okhoroni v Donetskii oblasti) (Red Data Book of the Donetsk Oblast: plant world [protected plants of the Donetsk Oblast]) [in Ukrainian]. – Novaya pechat, Donetsk: P. 110.

ZUZUK, F.V. (Ed.) (1997): Atlas Zaporizkoi oblasti (Atlas of Zaporizhzhia Oblast) [in Ukrainian]. – Ukrgeodezkartografia, Kyiv: 48 pp.

Supplement S1. Vegetation table of the authors' relevés.

Beilage S1. Vegetationstabelle der Aufnahmen der Autorinnen und Autoren.

Table number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Field form ID	42	5	3	56	54	44	25	24	52	19	11	18	47	60	55	46	43	27	6	2	16	7	50	9	14	59	51	48	49	8	13	10	30	33	37	35	36	38	32	39	57	34	31	28	41	40	58	1	23	53	12	45	29	21	26	15	22	20	17	4
Aspect (degrees)	45	45	360	45	NA	23	360	90	338	90	158	360	90	113	360	135	180	90	338	68	225	158	90	45	90	-1	68	90	45	45	68	293	338	180	90	180	180	180	68	360	90	135	68	-1	90	315	180	23	-1	45	315	45	180	45	45	360	23	90	180	360
Inclination (degrees)	0	20	20	0	20	7	30	45	15	53	30	20	30	17	8	30	5	5	12	10	50	20	6	9	7	0	13	1	1	15	10	35	5	25	65	20	25	8	15	65	20	10	15	0	10	30	23	3	0	5	2	1	2	5	50	20	5	5	15	10
Cover herb layer (%)	50	70	70	40	30	60	30	40	70	40	40	50	35	50	75	25	65	90	70	80	50	65	85	40	80	55	60	80	80	50	80	40	70	50	40	60	65	60	65	85	50	50	75	80	60	75	50	80	90	85	95	95	80	85	60	30	40	40	30	30
Cover shrub layer (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	0	0	0	0	0	70	0	0	75	60
Cover mosses (%)	20	7	1	15	10	20	2	7	10	20	10	15	5	5	0	7	7	1	2	10	0	2	5	0	5	12	3	3	1	7	0	5	5	1	1	7	0	0	1	5	7	0	1	1	1	1	1	20	1	10	0	5	1	0	1	10	0	0	2	5
Cover lichens (%)	80	3	60	20	5	60	3	7	40	20	30	10	2	12	25	3	1	0	0	0	0	0	0	1	0	5	0	0	0	40	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Longitude	36.86012	36.96337	36.96101	37.00389	36.9982	36.84452	37.00594	37.00217	36.63387	36.86708	36.63428	36.87572	36.86311	36.8682	36.99477	36.86351	36.85812	36.98395	36.83307	36.95916	36.87568	36.82984	36.63239	36.77765	36.81731	37.00447	36.63107	36.86119	36.86231	36.77668	36.81708	36.63322	36.86729	36.83426	36.85302	36.84045	36.85424	36.86075	36.80076	36.86562	36.83966	36.83422	36.80083	36.97797	36.82658	36.83523	36.85423	36.958	37.00175	36.80371	36.79437	36.84064	36.97785	36.96924	37.00814	36.8063	36.99805	36.8635	36.87492	36.96147
Latitude	46.95699	47.16766	47.16905	47.09796	47.11567	46.96161	47.09718	47.10014	47.20099	47.18035	47.20003	47.16906	46.99944	47.04888	47.11524	46.99929	46.95616	47.06472	47.30196	47.16926	47.16988	47.30061	47.19694	47.24404	47.19042	47.09744	47.199	46.99891	46.99659	47.24466	47.19004	47.19844	47.04691	46.76757	46.7788	46.77127	46.77933	46.78341	46.82118	46.79384	46.77099	46.76781	46.82047	47.05906	46.81119	46.80795	46.77896	47.16838	47.09572	47.19244	47.19219	46.96149	47.05797	47.13432	47.09884	47.19311	47.1148	47.18514	47.16918	47.16853
Altitude (m)	25	81	73	61	54	24	66	49	164	90	162	96	44	56	69	41	34	71	160	73	95	161	179	122	126	60	182	58	53	122	127	173	63	19	23	27	24	9	36	23	28	29	39	104	33	34	16	80	77	126	142	35	104	74	40	117	56	85	98	74
Cluster number	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	5	5	5	5	5
Ephedro distachyae-Stipetum graniticolae achilleetosum leptophylae																																																												
Stipa graniticola	20	30	30	5	.	30	15	20	30	20	20	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pulsatilla pratensis	0.1	5	0.5	.	0.1	5	0.5	.	15	1	0.5	0.5	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pilosella echioides	0.1	1	0.1	1	0.5	1	0.1	1	0.5	.	0.2	0.5	0.1	0.5	1	0.1	.	.	.	.	.	.	.	.	.	0.5	.	.	0.1	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	1	.	.	.	.	.	.
Myosotis micrantha	0.1	0.1	0.1	0.2	0.1	.	.	0.1	0.1	0.1	.	0.1	0.1	0.5	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	0.1
Sedum acre	0.5	1	0.5	0.1	.	0.1	.	0.1	.	.	0.2	5	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium pseudobulgaricum	1	0.1	0.5	0.5	.	.	.	.	.	0.5	.	.	0.1	1	0.5	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erophila verna	0.1	0.1	0.1	0.1	.	0.1	0.1	0.1	0.1	0.1	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.
Poa bulbosa	10	10	10	2	0.2	10	5	7	3	.	7	7	5	1	2	10	10	.	.	1	.	.	0.1	.	.	.	.	.	.	10	.	5	1	.	5	.	5	1	5	.	.	1	0.5	.	.	.	1	3	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium arvense	3	0.1	0.1	.	3	0.1	.	.	.	.	.	.	.	1	2	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Jurinea granitica	0.5	3	0.1	4	2	0.5	1	3	2	1	0.5	0.3	.	.	.	.	1	.	0.1	.	.	.	.	2	.	.	0.5	.	.	5	0.2	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.
Artemisia marschalliana	5	0.1	3	2	2	7	0.5	1	3	2	2	5	0.3	5	.	.	1	.	.	.	.	.	.	.	.	.	.	0.1	0.2	0.5	.	1	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	2	.	.	.	.	0.5	.	.	.	.	.	0.5
Helichrysum arenarium	.	0.1	0.1	1	1	0.1	0.1	.	0.1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex acetosella	0.1	.	0.5	.	2	.	0.1	0.5	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Holosteum umbellatum	0.1	0.1	0.1	0.1	0.2	0.1	0.5	0.1	0.1	0.1	0.1	.	0.1	0.5	0.1	0.1	.	.	0.1	0.1	.	0.1	.	.	0.1	0.5	0.1	.	0.1	0.1	.	0.1	0.1	0.1	.	.	0.1	0.1	0.1	0.1	.	0.1	0.1	0.1	0.1	0.1	0.1	0.3	.	.	.	.	0.1	.	.	.	.	.	.	.
Veronica dillenii	0.1	.	.	.	0.1	.	.	.	0.5	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hylotelephium polonicum	0.1	.	.	.	.	.	0.1	0.1	.	0.1	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex supina	1	0.1	.	2	.	5	.	.	.	.	.	.	.	.	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chondrilla juncea	0.1	.	.	0.1	0.2	.	0.1	.	.	.	.	.	.	0.1	.	0.5	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.
Anthemis ruthenica	0.5	0.1	.	.	0.1	.	.	.	.	.	.	.	.	0.5	1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.
Alyssum desertorum	0.1	0.1	0.1	0.2	1	.	0.1	0.1	.	0.5	0.1	.	.	1	.	.	0.1	.	.	.	.	0.1	0.1	.	.	0.1	0.1	0.1	0.1	0.1	.	0.1	0.1	0.1	0.1	0.1	.	.	.	.	.	0.1	0.5	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.
Veronica arvensis	0.1	.	.	.	.	0.1	.	.	.	.	.	.	0.1	.	0.1	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eremogone biebersteinii	.	0.1	0.5	.	.	.	.	.	0.5	1	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Phleum phleoides	0.1	.	.	.	.	.	.	.	0.3	.	.	0.5	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alyssum hirsutum	.	.	.	.	.	.	0.1	0.1	.	.	0.1	0.3	0.1	.	0.5	.	0.1	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	0.5	0.1	.	0.1	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Achillea leptophylla	.	1	.	1	1	.	0.1	0.1	.	1	.	.	.	5	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	0.5	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5
Asperula graniticola	.	0.1	.	.	0.2	.	0.5	0.1	.	.	0.3	.	.	.	.	0.1	.	.	.	.	.	.	1	.	0.2	0.5	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia seguieriana	0.5	0.5	1	0.5	0.5	.	0.1	.	0.2	.	0.1	0.3	.	.	0.1	.	0.5	0.1	.	.	.	0.5	.	.	.	0.5	.	1	0.1	.	0.2	.	0.1	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	2	.	2	0.5	0.5	.	.	0.1	.	.	0.1	.	0.5
Tragopogon major	.	.	.	.	.	.	.	.	.	.	0.1	.	0.5	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Herniaria glabra	0.1	.	.	0.5	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gagea bohemica	.	.	0.1	.	.	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linaria genistifolia	0.1	0.1	.	.	.	.	.	.	.	.	.	.	0.5	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.
Galium verum	0.5	.	.	.	.	0.5	0.5	0.5	0.1	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	.	.	.	.	.	.	.	0.1	.	.	.	.	0.2	.	.
Stipo lessingianae-Salvietum nutantis																																																												
Linum czernjajevii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	5	.	1	0.5	1	2	.	4	4	.	0.1	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Astragalus ucrainicus	.	0.5	.	2	.	.	.	.	.	.	.	0.5	.	.	.	.	.	0.5	1	0.5	0.1	0.2	3	0.1	2	1	2	0.1	1	1	0.5	.	0.1	0.2	0.2	.	.	.	0.5	.	.	0.5	1	.	0.5	.	.	0.5	.	.	.	.	.	0.1	.	.	.	.	.	0.5
Silene bupleuroides	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	0.5	0.1	0.1	0.2	.	0.2	0.1	.	.	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Viola ambigua	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.5	.	0.1	0.1	0.1	0.1	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.
Senecio erucifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	0.5	0.1	0.1	.	.	0.1	.	.	0.1	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	0.1	.	.	.	.	.	.
Teucrium polium	0.5	.	.	.	.	.	.	.	0.1	.	0.2	.	.	.	.	.	.	0.1	0.5	1	0.2	0.1	4	0.2	0.5	1	2	0.3	0.1	.	0.5	.	0.5	0.2	.	0.5	0.5	1	0.1	.	0.5	0.1	0.5	.	.	.	.	0.2	.	2	.	.	.	1	0.1	.	.	.	0.1	.
Haplophyllum suaveolens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	.	0.1	.	.	.	0.2	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thesium arvense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	0.2	0.5	.	0.1	0.2	0.1	.	.	0.3	0.2	.	0.1	.	0.1	.	0.2	.	.	.	.	.	.	.	.	.	0.1	0.1	.	.	0.3	.	0.1	0.2	.	.	.	.	.	.	.	.	.
Stachys recta	0.1	.	.	0.5	.	.	.	0.3	.	0.1	0.5	.	0.1	.	.	0.2	.	1	0.5	0.2	0.1	0.5	0.2	0.1	3	0.5	0.5	0.1	.	0.3	1	0.1	.	.	0.2	.	.	.	.	.	1	.	0.5	.	.	0.1	.	.	.	4	.	0.3	0.1	.	.	1	.	.	0.5	1
Ajuga chia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	.	0.1	0.1	.	.	.	0.5	0.1	.	0.1	.	.	.	0.1	1	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.5	.	.	.	.	.	.	.
Euphorbia stepposa	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.2	1	0.1	.	1	0.3	0.1	1	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	2	.	.	0.1	0.1	.	.	.	.	.
Botriochloa ischaemum	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	20	0.1	.	.	40	.	.	.	.	1	.	60	10	.	70	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.
Alyssum calycinum	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	0.1	.	0.5	.	0.1	0.2	.	0.1	.	.	0.1	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	0.1	0.1	0.1	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.
Achillea nobilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	0.1	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ornithogalum kochii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	.	0.1	.	.	.	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Securigera varia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	0.1	.	0.5	.	.	0.1	0.5	.	0.1	.	.	0.3	0.1	0.1	.	0.1	.	.	.	.	0.1	0.1	0.1	.	0.1	0.1	.	.	0.1	.	5	.	0.1	0.1	.	.	.	.	.	0.5	.
Oxytropis pilosa	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	0.5	0.1	.	0.1	1	0.5	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.5	.	.	.	.	.	.	.	.	.
Plantago media	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	0.1	.	0.5	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Convolvulus arvensis	.	.	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	0.1	0.5	0.1	0.1	.	0.1	0.1	0.5	.	.	0.1	.	0.1	.	.	0.1	.	.	.	0.1	.	.	.	.	.	.	.	.	.	1	.	1	.	0.1	.	.	0.3	0.5	.	.	.	1
Linum austriacum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	.	0.1	0.1	.	0.2	.	0.5	.	0.5	.	.	0.1	0.1	.	.	0.5	.	0.1	.	0.1	.	0.5	.	0.1	.	.	.	.	.	0.1	.	.	0.1	0.1	.	.	.	.	.	.	0.1	.
Ephedro distachyae-Stipetum capillatae																																																												
Galium octonarium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.1	0.3	0.5	0.2	0.5	0.5	0.2	.	0.1	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lamium amplexicaule	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	0.2	0.1	0.1	0.1	0.5	0.1	.	0.1	.	0.1	0.1	0.1	0.1	.	.	.	.	.	.	.	.	.	.	0.1	.	.
Nepeta parviflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	5	.	0.5	.	.	.	0.5	.	1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.
Veronica persica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	0.1	0.1	0.1	0.2	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Nigella arvensis	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.1	0.1	.	.	.	.	0.1	0.5	0.1	0.1	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thlaspi perfoliatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Agropyron pectinatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	7	.	.	.	0.3	30	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
Seseli tortuosum	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	0.1	.	0.5	.	0.1	.	.	.	.	.	0.1	.	.	.	.	.	1	.	0.5	.	0.5	.	0.3	.	0.5	0.5	0.1	0.5	0.5	.	.	.	.	.	.	0.5	0.1	.	.	.	.	.	.
Senecio vernalis	0.1	.	.	.	.	0.1	0.1	.	0.1	0.1	0.1	0.1	1	0.5	.	0.1	0.5	.	.	.	0.1	.	.	.	.	.	.	0.1	0.1	0.1	.	.	.	0.1	0.5	0.1	0.5	0.1	.	0.5	1	1	0.5	0.1	0.1	.	0.2	.	.	.	.	.	.	.	.	.	.	0.5	0.1	.
Lappula patula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	0.1	0.5	0.1	0.5	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Amygdalus nana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	8	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Caragana scythica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	5	.	.	15	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.
Otites dolichocarpus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	0.5	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ornithogalum melancholicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	0.5	.	.	.	0.1	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.
Veronica praecox	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	0.1	.	.	.	0.1	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.
Phlomis pungens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	3	.	7	0.1	1	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.
Cerastium ucrainicum	.	.	0.5	.	0.3	0.5	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	0.1	.	0.1	.	.	.	.	0.5	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lycopsis orientalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	0.1	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.
Veronica austriaca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	0.5	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crupina vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	0.1	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galatella villosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	50	.	.	.	7	.	.	.	.	.	.	.	.	.	0.1	.	5	.	.	.	1	10	30	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.
Elytrigia repens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.1	1	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	1	0.1	.	0.5	0.1	0.5	0.1	.	10	.	.	.	3	1	5	.	.	3	.	0.5	.	0.1	0.1
Lactuca serriola	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vincetoxicum fuscatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	0.1	0.2	.	.	1	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.
Marrubium praecox	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	.	.	.	1	.	.	.	0.2	0.1	.	.	.	.	.	.	.	1	.	.	.	.	.	0.1	0.3	.
Eryngium campestre-Stipa capillata community																																																												
Eryngium campestre	.	.	0.1	0.5	.	0.5	.	.	.	.	0.5	0.3	.	.	5	.	0.1	.	3	.	0.3	1	0.2	0.1	0.5	.	.	0.1	5	.	.	.	0.5	.	.	0.5	.	.	0.1	.	.	.	1	0.1	0.1	.	.	1	5	0.5	0.1	0.1	0.1	1	0.1	.	0.1	.	.	0.5
Senecio jacobaea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.3	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	0.2	3	.	.	0.1	.	0.1	.	.	.	.	.
Stipa capillata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.	.	1	.	.	1	.	15	.	1	.	50	.	.	.	30	20	.	1	5	5	.	.	15	3	.	.	.	.	5	1	20	5	60	60	.	5	5	.	0.5	.	2	0.5
Medicago lupulina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.
Stipa ucrainica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30	.	25	.	.	.	.	.	.	.	.	.	.
Galium humifusum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	0.2	.	.	.	.	.	.	.	.	.	.	.
Asperula cynanchica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	.	0.1	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.5	.	.	0.1	.	.	.	.	.	.
Taraxacum erythrospermum	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.
Taraxacum serotinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	0.3	.	.	.	.	.	.
Vinco herbaceae-Caraganetum fruticis																																																												
Thalictrum minus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	7	8	.	.	0.5	.	10	.	.	.	.	.	.	.	.	0.1	7	0.5	10	5	0.5
Caragana frutex	.	.	0.1	.	.	0.1	.	.	.	.	.	.	.	.	0.1	.	1	.	.	1	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	7	.	5	0.1	.	.	.	.	.	0.2	.	.	0.1	70	80	80	75	60
Verbascum blattaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.3	.	.	.
Echinops sphaerocephalus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.
Cynoglossum officinale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	0.1
Asparagus officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	0.5	.
Potentilla argentea	0.1	.	0.5	.	.	.	.	.	1	0.2	.	.	.	0.5	0.1	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.1	.	.	.	.	.	.	0.1	.	0.5	.	0.3
Diagnostic species for more than one cluster																																																												
Thymus dimorphus	1	3	3	3	3	0.5	3	2	0.5	3	3	0.5	2	7	.	7	1	.	0.5	1	0.5	0.3	0.2	1	2	1	3	0.2	0.1	3	5	25	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.5	0.1	.	.	0.5	.	.	.	.	.	.
Koeleria cristata	1	0.1	0.1	7	2	1	1	1	1	1	.	1	.	2	2	1	.	1	0.5	.	.	0.1	0.1	.	0.1	2	1	1	1	3	0.1	3	0.1	.	.	.	.	.	0.1	.	.	.	0.5	1	0.1	.	.	5	2	1	.	.	.	3	0.5	.	.	.	.	.
Stipa lessingiana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	35	8	40	.	.	.	3	40	.	.	.	.	30	1	.	.	.	.	30	.	12	5	.	.	.	2	.	5	.	15	.	.	.	.	.	.	.	.	.	.	.	.	.
Plantago lanceolata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.5	.	.	0.1	0.1	0.1	.	0.5	1	0.1	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	0.2	0.1	0.5	0.1	0.1	0.1	.	.	.	.	.	0.5
Poa angustifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	1	.	3	10	0.1	0.1	5	0.3	0.5	7	10	30	20	0.5	0.5
Other species																																																												
Acer tataricum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Achillea millefolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	0.5
Achillea pannonica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.
Achillea setacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.1	.	.	.	0.1	.	.	.	.	0.1	.	.	.	0.5	.	.	.	.	.	.	.
Acinos arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ajuga genevensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	0.3	.
Ajuga laxmannii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Allium flavescens	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	0.1	.	0.1	.	.	.	.	0.1	0.5	.	.	0.5	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Allium paczoskianum	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Allium sp.	.	.	.	0.1	.	.	.	.	0.1	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alyssum tortuosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anchusa procera	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Androsace elongata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anisantha sterilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anisantha tectorum	.	.	.	.	0.5	.	.	.	.	.	.	.	0.1	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthriscus cerefolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arabidopsis sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arabis auriculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.
Arenaria leptoclados	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arenaria uralensis	0.1	0.1	.	0.5	0.5	0.1	.	0.1	0.3	.	0.1	0.1	0.1	1	.	0.1	0.5	0.1	0.5	0.1	.	0.1	0.5	.	0.5	0.5	.	0.1	0.1	0.5	.	.	0.1	0.1	0.1	0.1	0.1	0.5	.	0.1	.	0.1	0.1	0.1	.	0.5	0.5	0.2	0.1	.	.	.	0.1	.	.	.	.	.	.	.
Artemisia absinthium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.
Artemisia austriaca	.	0.1	.	.	1	.	.	.	.	.	.	.	.	3	.	.	0.1	0.1	.	2	.	0.3	.	.	0.2	.	.	.	0.5	0.2	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	0.5	0.2	2	1	.	.	.	.	.	.	.	.	.
Asperula montana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Continued on back page

Fortsetzung auf der Rückseite

Table number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Cluster number	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	5	5	5	5	5
Other species (continued)																																																												
Astragalus austriacus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.
Astragalus odessanus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Astragalus onobrychis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	0.2	.	0.5	.	.	.	0.5	.	0.3	.	.	.	.	.	.	0.5	.	.	.	5	.	1	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.
Astragalus pallescens	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Astragalus sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.
Asyneuma canescens	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Atriplex tatarica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bellevalia sarmatica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.
Bromopsis inermis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	0.5	.	0.5	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1
Bromopsis riparia	1	.	.	1	.	1	.	.	0.2	0.1	3	.	.	0.5	0.5	.	.	1	12	1	.	1	3	1	.	3	4	.	0.5	.	.	.	.	.	1	.	1	.	1	7	.	.	10	0.5	3	.	.	0.2	.	.	.	.	0.3	0.5	.	.	0.1	.	.	0.5
Bromus squarrosus	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	1	.	0.1	.	0.5	.	.	.	1	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.
Buglossoides arvensis	.	.	.	.	.	.	.	.	0.1	.	.	.	.	0.1	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.1	.	0.1	.	.	.	0.2	.	0.1	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.
Calamagrostis epigeios	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Camelina microcarpa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	0.1	.	.	.	.	.	0.1	.	0.1	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Capsella bursa-pastoris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carduus acanthoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex praecox	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	5	.	.	.	.
Centaurea apiculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea diffusa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea orientalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.
Centaurea ruthenica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea sp.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea stoebe	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.
Centaurea substituta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.
Cephalaria uralensis	.	.	.	.	.	0.1	0.3	0.1	.	0.3	.	.	.	.	.	.	.	.	.	0.5	.	.	.	0.5	.	.	4	.	.	.	.	0.1	.	.	.	0.1	.	.	0.1	.	2	.	.	.	0.1	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium perfoliatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium sp.	.	.	.	.	.	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cichorium intybus	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cirsium ukranicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.
Cleistogenes bulgarica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Convolvulus lineatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crataegus sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crepis tectorum	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cuscuta sp.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cynanchum acutum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.
Descurainia sophia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	0.1	.
Draba nemorosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Elytrigia intermedia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Elytrigia scythica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.
Elytrigia stipifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ephedra distachya	0.1	.	1	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	10	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.
Equisetum ramosissimum	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erysimum diffusum	.	.	.	.	.	.	1	0.5	.	0.5	.	0.1	0.1	.	.	.	.	0.1	0.1	0.5	.	.	.	.	.	.	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.1	.
Erysimum repandum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.
Euphorbia leptocaula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia stricta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Falcaria vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	0.5	.	0.1	0.1	.	.	.	.	.	.	.	0.1	.	.	.	0.1	.	.	.	0.5	0.1	0.1	.	.	.	0.1	0.1	0.1	.	.	.	0.5	0.1	0.1	.	0.1	0.1	0.1	0.5	0.3	0.1	.
Fallopia convolvulus	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.
Filago arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fumaria schleicheri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.
Gagea sp.	.	.	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gagea ucrainica	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium aparine	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	0.1	.	.	0.1	.	.	.	.	0.1	5	.	.
Galium mollugo	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Galium semiamictum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Galium sp.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium spurium	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.
Genista tinctoria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Glaucium corniculatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Goniolimon tataricum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Herniaria besseri	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hieracium virosum	.	.	.	.	.	.	0.1	0.1	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.
Hyacinthella pallasiana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hyacinthella sp.	.	.	.	.	.	0.1	.	.	0.1	.	.	.	.	.	0.5	.	0.5	.	.	.	.	0.1	.	.	.	.	0.5	.	.	0.1	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypericum perforatum	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	1	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.
Hypericum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.
Inula oculus-christi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Iris pumila	0.5	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	0.2	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Jurinea arachnoidea	.	.	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Jurinea multiflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Kochia prostrata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Lagoseris sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leontodon biscutellifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Limonium bungei	.	.	.	0.5	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Limonium platyphyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linaria biebersteinii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	.	.	.	.	.	.	0.1	.
Linaria maeotica	.	.	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lycium barbarum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lycopsis sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Melica chrysolepis	.	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Melica transsilvanica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Melilotus officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	.	0.5	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	0.1	.	.	.	.	.	.	.
Meniocus linifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Myosotis arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.
Nonea rossica	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Odontites luteus	.	.	.	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	0.3	.	.	.	0.1	0.1	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	0.1	.	.	.	.	.	.
Onobrychis arenaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Otites artemisetorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Otites chersonensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.
Otites hellmannii	.	.	.	0.5	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Papaver stevenianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Papaver strigosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Paronychia cephalotes	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Phlomis tuberosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.5	.	.	.	.	0.2	.	.	.	.	.	1	.	.	.	.	.	.	.	20
Picris hieracioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	0.1	.	.	.	.	0.1	.	.
Pilosella officinarum	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pimpinella titanophila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Plantago urvillei	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	2	0.5	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	0.1
Poa compressa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla astracanica	0.1	5	1	0.5	.	1	0.1	.	.	.	.	1	0.5	2	.	.	10	0.5	0.1	1	.	0.5	.	0.1	.	.	1	.	0.5	0.5	0.1	.	0.5	.	.	.	.	0.3	0.5	.	.	.	.	0.1	0.1	0.1	.	0.3	.	0.5	.	.	.	.	.	.	.	.	.	0.1
Potentilla humifusa	.	0.1	0.1	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	0.3	0.1	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	0.1
Potentilla recta	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	0.5	.	.	.
Potentilla semilaciniosa	.	.	.	.	2	.	.	.	.	0.5	0.1	.	.	.	0.2	.	.	.	.	.	.	.	.	.	0.5	0.5	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	1	.	.	.	.	.	.
Prunus spinosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pterotheca sancta	.	.	0.1	.	.	.	.	.	.	.	0.1	.	.	0.1	.	.	0.1	.	.	.	.	0.2	.	.	0.1	.	.	0.1	.	0.1	.	0.1	0.1	0.1	.	.	.	.	.	.	.	0.1	.	0.1	.	.	.	0.1	.	0.1	.	0.1	0.1	.	.	.	.	.	.	.
Ranunculus illyricus	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus oxyspermus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Reseda lutea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rindera tetraspis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	8	.	.	.	.	.	.	.	.	.	.	.	.	.
Rosa sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex acetosa	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Salvia aethiopis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.
Salvia nutans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25	0.1	7	.	7	3	0.1	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	7	.	.	.	7	10	3	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.5	.
Salvia verticillata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scorzonera mollis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Senecio grandidentatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.
Sideritis montana	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene supina	.	.	.	.	.	.	.	.	.	.	.	0.1	0.5	.	.	0.5	.	.	.	.	1	.	.	.	.	.	.	.	0.1	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Sisymbrium loeselii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sisymbrium officinale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.
Sisymbrium polymorphum	.	.	0.1	0.1	0.1	.	.	.	0.1	.	0.1	.	.	.	.	.	.	0.1	.	0.2	.	.	1	.	0.1	0.2	0.1	.	.	0.1	.	.	.	.	.	0.1	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	0.1
Stipa pulcherrima	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30	.	.	.	.	.	.	20	.	.	.	.	.	.	.	.	40	.	.	.	.	.	.	.
Stipa zalesskii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tanacetum millefolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thymus marschallianus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trigonella monspeliaca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tulipa graniticola	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valeriana tuberosa	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valerianella costata	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Verbascum austriacum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Verbascum lychnitis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.
Verbascum orientale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Verbascum phoeniceum	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Veronica jacquinii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Veronica spicata	.	.	.	.	.	0.1	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Veronica triphyllos	.	.	.	0.5	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Veronica verna	.	.	0.1	.	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.
Vicia cracca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia hirsuta	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.
Vicia tenuifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vinca herbacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Viola arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Viola hirta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.
Viola sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.
Viola tricolor	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Xeranthemum annum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	0.1	0.1	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Supplement E1. Synoptic table (percentage frequency and fidelity in the superscript) of the main vegetation units of the Berda River Valley and its tributaries. Species are sorted by the decreasing fidelity (Ochiai index), the threshold for the diagnostic species is 35 (marked grey), the threshold for the highly diagnostic species is 50 (makred dark-grey).

Anhang E1. Übersichtstabelle (prozentuale Häufigkeit und Treue im hochgestellten Index) der Hauptvegetationseinheiten des Berda-Flusstals und seiner Nebenflüsse. Die Arten sind nach abnehmender Treue (Ochiai-Index) sortiert. Der Schwellenwert für die diagnostischen Arten liegt bei 35 (grau markiert), der Schwellenwert für die hochdiagnostischen Arten bei 50 (dunkelgrau markiert).

Cluster number	**1**	**2**	**3**	**4**	**5**
Number of releves	**17**	**16**	**14**	**8**	**5**
Ephedro distachyae-Stipetum graniticolae achilleetosum leptophylae					
Stipa graniticola	65^{80}	0 ---	0 ---	0 ---	0 ---
Pulsatilla pratensis	65^{80}	0 ---	0 ---	0 ---	0 ---
Pilosella echioides	88^{77}	19 ---	0 ---	25 ---	0 ---
Myosotis micrantha	76^{73}	0 ---	0 ---	13 ---	20 ---
Sedum acre	53^{73}	0 ---	0 ---	0 ---	0 ---
Cerastium pseudobulgaricum	53^{73}	0 ---	0 ---	0 ---	0 ---
Erophila verna	65^{71}	6 ---	0 ---	13 ---	0 ---
Poa bulbosa	94^{69}	31 ---	50 ---	13 ---	0 ---
Trifolium arvense	47^{69}	0 ---	0 ---	0 ---	0 ---
Jurinea granitica	76^{68}	38 ---	0 ---	13 ---	0 ---
Artemisia marschalliana	88^{66}	31 ---	0 ---	38 ---	20 ---
Helichrysum arenarium	47^{61}	13 ---	0 ---	0 ---	0 ---
Rumex acetosella	35^{59}	0 ---	0 ---	0 ---	0 ---
Holosteum umbellatum	88^{55}	63 ---	79 ---	25 ---	0 ---
Veronica dillenii	29^{54}	0 ---	0 ---	0 ---	0 ---
Hylotelephium polonicum	29^{54}	0 ---	0 ---	0 ---	0 ---
Carex supina	29^{54}	0 ---	0 ---	0 ---	0 ---
Chondrilla juncea	41^{53}	6 ---	0 ---	13 ---	0 ---
Anthemis ruthenica	35^{51}	0 ---	0 ---	13 ---	0 ---
Alyssum desertorum	65^{51}	56 ---	43 ---	0 ---	0 ---
Veronica arvensis	35^{50}	0 ---	14 ---	0 ---	0 ---
Eremogone biebersteinii	29^{49}	0 ---	7 ---	0 ---	0 ---
Phleum phleoides	24^{49}	0 ---	0 ---	0 ---	0 ---
Alyssum hirsutum	41^{48}	19 ---	14 ---	0 ---	0 ---
Achillea leptophylla	41^{46}	19 ---	0 ---	0 ---	20 ---
Asperula graniticola	35^{45}	25 ---	0 ---	0 ---	0 ---
Euphorbia seguieriana	65^{44}	44 ---	7 ---	63 ---	40 ---
Tragopogon major	18^{42}	0 ---	0 ---	0 ---	0 ---
Herniaria glabra	18^{42}	0 ---	0 ---	0 ---	0 ---
Gagea bohemica	18^{42}	0 ---	0 ---	0 ---	0 ---
Linaria genistifolia	24^{39}	0 ---	0 ---	13 ---	0 ---
Galium verum	35^{38}	6 ---	14 ---	13 ---	20 ---
Stipo lessingianae-Salvietum nutantis					
Linum czernjajevii	0 ---	63^{79}	0 ---	0 ---	0 ---
Astragalus ucrainicus	18 ---	94^{66}	43 ---	25 ---	20 ---
Silene bupleuroides	6 ---	44^{62}	0 ---	0 ---	0 ---
Viola ambigua	0 ---	44^{58}	0 ---	13 ---	0 ---
Senecio erucifolius	0 ---	50^{58}	0 ---	25 ---	0 ---
Teucrium polium	18 ---	88^{57}	57 ---	50 ---	20 ---
Haplophyllum suaveolens	0 ---	31^{56}	0 ---	0 ---	0 ---
Thesium arvense	6 ---	63^{55}	21 ---	38 ---	0 ---
Stachys recta	41 ---	88^{55}	29 ---	38 ---	60 ---
Ajuga chia	6 ---	50^{53}	7 ---	25 ---	0 ---
Euphorbia stepposa	6 ---	56^{53}	0 ---	50 ---	0 ---
Botriochloa ischaemum	12 ---	44^{53}	0 ---	13 ---	0 ---
Alyssum calycinum	6 ---	50^{53}	21 ---	13 ---	0 ---
Achillea nobilis	0 ---	25^{50}	0 ---	0 ---	0 ---
Ornithogalum kochii	0 ---	25^{50}	0 ---	0 ---	0 ---
Securigera varia	0 ---	63^{47}	43 ---	50 ---	20 ---
Oxytropis pilosa	6 ---	38^{45}	0 ---	25 ---	0 ---
Plantago media	0 ---	25^{44}	7 ---	0 ---	0 ---
Convolvulus arvensis	12 ---	56^{43}	14 ---	50 ---	40 ---
Linum austriacum	6 ---	50^{41}	36 ---	38 ---	20 ---
Ephedro distachyae-Stipetum capillatae					
Galium octonarium	0 ---	6 ---	71^{81}	0 ---	0 ---
Lamium amplexicaule	12 ---	6 ---	86^{77}	0 ---	20 ---
Nepeta parviflora	0 ---	0 ---	50^{71}	0 ---	0 ---
Veronica persica	0 ---	0 ---	50^{71}	0 ---	0 ---
Nigella arvensis	6 ---	6 ---	57^{69}	0 ---	0 ---
Thlaspi perfoliatum	0 ---	13 ---	50^{63}	0 ---	0 ---
Agropyron pectinatum	0 ---	0 ---	36^{60}	0 ---	0 ---
Seseli tortuosum	6 ---	25 ---	64^{59}	25 ---	0 ---
Senecio vernalis	65 ---	25 ---	86^{58}	0 ---	40 ---
Lappula patula	0 ---	6 ---	36^{55}	0 ---	0 ---
Amygdalus nana	0 ---	0 ---	29^{53}	0 ---	0 ---
Caragana scythica	0 ---	0 ---	29^{53}	0 ---	0 ---
Otites dolichocarpus	0 ---	0 ---	29^{53}	0 ---	0 ---
Ornithogalum melancholicum	0 ---	0 ---	29^{53}	0 ---	0 ---
Veronica praecox	6 ---	6 ---	36^{52}	0 ---	0 ---
Phlomis pungens	0 ---	6 ---	36^{48}	13 ---	0 ---
Cerastium ucrainicum	24 ---	0 ---	36^{46}	0 ---	0 ---
Lycopsis orientalis	0 ---	0 ---	21^{46}	0 ---	0 ---
Veronica austriaca	0 ---	0 ---	21^{46}	0 ---	0 ---
Crupina vulgaris	0 ---	0 ---	21^{46}	0 ---	0 ---
Galatella villosa	0 ---	19 ---	36^{44}	13 ---	0 ---
Elytrigia repens	0 ---	25 ---	57^{41}	50 ---	60 ---
Lactuca serriola	6 ---	0 ---	21^{41}	0 ---	0 ---
Vincetoxicum fuscatum	0 ---	6 ---	29^{39}	0 ---	20 ---
Marrubium praecox	0 ---	13 ---	36^{36}	13 ---	40 ---
***Eryngium campestre-Stipa capillata* community**					
Eryngium campestre	41 ---	56 ---	36 ---	100^{61}	40 ---
Senecio jacobaea	0 ---	19 ---	7 ---	50^{57}	0 ---
Stipa capillata	6 ---	38 ---	50 ---	88^{56}	60 ---
Medicago lupulina	0 ---	0 ---	0 ---	25^{50}	0 ---
Stipa ucrainica	0 ---	0 ---	0 ---	25^{50}	0 ---
Galium humifusum	0 ---	0 ---	0 ---	25^{50}	0 ---
Asperula cynanchica	0 ---	25 ---	0 ---	38^{47}	0 ---
Taraxacum erythrospermum	6 ---	0 ---	0 ---	25^{45}	0 ---
Taraxacum serotinum	0 ---	6 ---	0 ---	25^{45}	0 ---
Vinco herbaceae-Caraganetum fruticis					
Thalictrum minus	0 ---	6 ---	36 ---	13 ---	100^{80}
Caragana frutex	24 ---	13 ---	29 ---	25 ---	100^{73}
Verbascum blattaria	0 ---	0 ---	0 ---	0 ---	40^{63}
Echinops sphaerocephalus	0 ---	0 ---	0 ---	0 ---	40^{63}
Cynoglossum officinale	0 ---	0 ---	0 ---	13 ---	40^{55}
Asparagus officinalis	0 ---	0 ---	14 ---	0 ---	40^{54}
Potentilla argentea	35 ---	6 ---	0 ---	25 ---	60^{53}
Diagnostic species for more than one cluster					
Thymus dimorphus	94^{61}	94^{61}	0 ---	50 ---	0 ---
Koeleria cristata	82^{52}	81^{51}	29 ---	63 ---	0 ---
Stipa lessingiana	0 ---	44^{47}	43^{46}	0 ---	0 ---
Plantago lanceolata	0 ---	56^{44}	0 ---	88^{68}	20 ---
Poa angustifolia	0 ---	25 ---	14 ---	100^{65}	100^{65}
Other species					
Acer tataricum	0 ---	6 ---	0 ---	0 ---	0 ---
Achillea millefolium	0 ---	0 ---	0 ---	13 ---	20 ---
Achillea pannonica	0 ---	0 ---	0 ---	0 ---	20 ---
Achillea setacea	0 ---	13 ---	21 ---	25 ---	0 ---
Acinos arvensis	0 ---	6 ---	7 ---	0 ---	0 ---
Ajuga genevensis	0 ---	0 ---	0 ---	13 ---	20 ---
Ajuga laxmannii	0 ---	0 ---	7 ---	0 ---	0 ---
Allium flavescens	18 ---	25 ---	0 ---	0 ---	0 ---
Allium paczoskianum	6 ---	0 ---	7 ---	0 ---	0 ---
Allium sp.	18 ---	6 ---	0 ---	0 ---	0 ---
Alyssum tortuosum	6 ---	0 ---	0 ---	0 ---	0 ---
Anchusa procera	0 ---	0 ---	7 ---	0 ---	0 ---
Androsace elongata	0 ---	0 ---	7 ---	0 ---	0 ---
Anisantha sterilis	0 ---	0 ---	7 ---	0 ---	0 ---
Anisantha tectorum	18 ---	6 ---	7 ---	0 ---	0 ---
Anthriscus cerefolium	0 ---	0 ---	7 ---	0 ---	0 ---
Arabidopsis sp.	0 ---	6 ---	0 ---	0 ---	0 ---
Arabis auriculata	0 ---	0 ---	14 ---	0 ---	0 ---
Arenaria leptoclados	12 ---	0 ---	0 ---	0 ---	0 ---
Arenaria uralensis	76 ---	69 ---	79 ---	38 ---	0 ---
Artemisia absinthium	0 ---	0 ---	0 ---	13 ---	0 ---
Artemisia austriaca	24 ---	38 ---	7 ---	50 ---	0 ---
Asperula montana	0 ---	0 ---	14 ---	0 ---	0 ---
Astragalus austriacus	0 ---	6 ---	0 ---	13 ---	0 ---
Astragalus odessanus	0 ---	0 ---	14 ---	0 ---	0 ---
Astragalus onobrychis	6 ---	25 ---	21 ---	13 ---	0 ---
Astragalus pallescens	6 ---	0 ---	0 ---	0 ---	0 ---
Astragalus sp.	0 ---	0 ---	7 ---	13 ---	0 ---
Asyneuma canescens	6 ---	0 ---	0 ---	0 ---	0 ---
Atriplex tatarica	0 ---	0 ---	7 ---	0 ---	0 ---
Bellevalia sarmatica	0 ---	13 ---	14 ---	0 ---	0 ---
Bromopsis inermis	0 ---	6 ---	21 ---	0 ---	20 ---
Bromopsis riparia	47 ---	56 ---	50 ---	38 ---	40 ---
Bromus squarrosus	12 ---	6 ---	29 ---	13 ---	0 ---

Cluster number	**1**	**2**	**3**	**4**	**5**
Number of releves	**17**	**16**	**14**	**8**	**5**
Other species (continued)					
Buglossoides arvensis	12 ---	19 ---	29 ---	0 ---	40 ---
Calamagrostis epigeios	0 ---	6 ---	0 ---	0 ---	0 ---
Camelina microcarpa	6 ---	19 ---	29 ---	0 ---	0 ---
Capsella bursa-pastoris	0 ---	0 ---	14 ---	0 ---	0 ---
Carduus acanthoides	0 ---	0 ---	14 ---	0 ---	0 ---
Carex praecox	0 ---	0 ---	0 ---	13 ---	20 ---
Centaurea apiculata	0 ---	6 ---	0 ---	0 ---	0 ---
Centaurea diffusa	0 ---	6 ---	0 ---	0 ---	0 ---
Centaurea orientalis	0 ---	0 ---	0 ---	13 ---	0 ---
Centaurea ruthenica	0 ---	0 ---	7 ---	0 ---	0 ---
Centaurea sp.	6 ---	0 ---	0 ---	0 ---	0 ---
Centaurea stoebe	6 ---	6 ---	0 ---	13 ---	0 ---
Centaurea substituta	0 ---	0 ---	0 ---	13 ---	0 ---
Cephalaria uralensis	24 ---	25 ---	29 ---	13 ---	0 ---
Cerastium perfoliatum	0 ---	0 ---	14 ---	0 ---	0 ---
Cerastium sp.	12 ---	0 ---	14 ---	0 ---	0 ---
Cichorium intybus	6 ---	6 ---	0 ---	0 ---	0 ---
Cirsium ukranicum	0 ---	0 ---	0 ---	0 ---	20 ---
Cleistogenes bulgarica	0 ---	6 ---	0 ---	0 ---	0 ---
Convolvulus lineatus	0 ---	6 ---	7 ---	0 ---	0 ---
Crataegus sp.	0 ---	0 ---	7 ---	0 ---	0 ---
Crepis tectorum	12 ---	0 ---	0 ---	0 ---	0 ---
Cuscuta sp.	6 ---	0 ---	0 ---	13 ---	0 ---
Cynanchum acutum	0 ---	0 ---	7 ---	0 ---	0 ---
Descurainia sophia	0 ---	0 ---	0 ---	13 ---	20 ---
Draba nemorosa	0 ---	0 ---	14 ---	0 ---	0 ---
Elytrigia intermedia	0 ---	0 ---	7 ---	0 ---	0 ---
Elytrigia scythica	0 ---	0 ---	0 ---	13 ---	0 ---
Elytrigia stipifolia	0 ---	6 ---	0 ---	0 ---	0 ---
Ephedra distachya	18 ---	13 ---	21 ---	0 ---	0 ---
Equisetum ramosissimum	6 ---	0 ---	0 ---	0 ---	0 ---
Erysimum diffusum	29 ---	31 ---	0 ---	13 ---	20 ---
Erysimum repandum	0 ---	0 ---	0 ---	13 ---	0 ---
Euphorbia leptocaula	0 ---	0 ---	7 ---	0 ---	0 ---
Euphorbia sp.	0 ---	0 ---	7 ---	0 ---	0 ---
Euphorbia stricta	0 ---	0 ---	7 ---	0 ---	0 ---
Falcaria vulgaris	12 ---	25 ---	50 ---	63 ---	80 ---
Fallopia convolvulus	6 ---	0 ---	0 ---	0 ---	20 ---
Filago arvensis	12 ---	0 ---	0 ---	0 ---	0 ---
Fumaria schleicheri	0 ---	0 ---	14 ---	0 ---	20 ---
Gagea sp.	12 ---	13 ---	0 ---	0 ---	0 ---
Gagea ucrainica	6 ---	0 ---	0 ---	0 ---	0 ---
Galium aparine	6 ---	0 ---	7 ---	25 ---	40 ---
Galium mollugo	0 ---	0 ---	0 ---	13 ---	0 ---
Galium semiamictum	0 ---	0 ---	0 ---	13 ---	0 ---
Galium sp.	6 ---	0 ---	0 ---	0 ---	0 ---
Galium spurium	6 ---	13 ---	7 ---	0 ---	20 ---
Genista tinctoria	0 ---	0 ---	14 ---	0 ---	0 ---
Glaucium corniculatum	0 ---	0 ---	7 ---	0 ---	0 ---
Goniolimon tataricum	0 ---	0 ---	7 ---	0 ---	0 ---
Herniaria besseri	6 ---	0 ---	0 ---	0 ---	0 ---
Hieracium virosum	18 ---	0 ---	0 ---	13 ---	0 ---
Hyacinthella pallasiana	0 ---	6 ---	0 ---	0 ---	0 ---
Hyacinthella sp.	24 ---	25 ---	0 ---	0 ---	0 ---
Hypericum perforatum	6 ---	25 ---	7 ---	0 ---	20 ---
Hypericum sp.	0 ---	0 ---	0 ---	13 ---	0 ---
Inula oculus-christi	0 ---	0 ---	7 ---	0 ---	0 ---
Iris pumila	18 ---	13 ---	14 ---	0 ---	0 ---
Jurinea arachnoidea	12 ---	6 ---	7 ---	0 ---	0 ---
Jurinea multiflora	0 ---	0 ---	7 ---	0 ---	0 ---
Kochia prostrata	0 ---	0 ---	7 ---	13 ---	0 ---
Lagoseris sp.	6 ---	0 ---	0 ---	0 ---	0 ---
Leontodon biscutellifolius	0 ---	13 ---	0 ---	0 ---	0 ---
Limonium bungei	12 ---	0 ---	0 ---	0 ---	0 ---
Limonium platyphyllum	0 ---	0 ---	7 ---	0 ---	0 ---
Linaria biebersteinii	0 ---	13 ---	0 ---	25 ---	20 ---
Linaria maeotica	12 ---	0 ---	0 ---	0 ---	0 ---
Lycium barbarum	0 ---	0 ---	7 ---	0 ---	0 ---
Lycopsis sp.	0 ---	0 ---	7 ---	0 ---	0 ---
Melica chrysolepis	6 ---	0 ---	0 ---	0 ---	0 ---
Melica transsilvanica	0 ---	0 ---	7 ---	0 ---	0 ---
Melilotus officinalis	0 ---	19 ---	0 ---	25 ---	0 ---
Meniocus linifolius	0 ---	13 ---	7 ---	0 ---	0 ---
Myosotis arvensis	0 ---	0 ---	7 ---	0 ---	20 ---
Nonea rossica	6 ---	0 ---	0 ---	0 ---	0 ---
Odontites luteus	12 ---	25 ---	0 ---	25 ---	0 ---
Onobrychis arenaria	0 ---	13 ---	0 ---	0 ---	0 ---
Otites artemisetorum	0 ---	0 ---	14 ---	0 ---	0 ---
Otites chersonensis	0 ---	0 ---	7 ---	13 ---	0 ---
Otites hellmannii	12 ---	0 ---	0 ---	0 ---	0 ---
Papaver stevenianum	0 ---	0 ---	14 ---	0 ---	0 ---
Papaver strigosum	0 ---	0 ---	7 ---	0 ---	0 ---
Paronychia cephalotes	6 ---	6 ---	0 ---	0 ---	0 ---
Phlomis tuberosa	0 ---	0 ---	21 ---	13 ---	20 ---
Picris hieracioides	0 ---	0 ---	14 ---	13 ---	20 ---
Pilosella officinarum	6 ---	0 ---	0 ---	0 ---	0 ---
Pimpinella titanophila	6 ---	19 ---	0 ---	0 ---	0 ---
Plantago urvillei	0 ---	6 ---	21 ---	13 ---	20 ---
Poa compressa	0 ---	6 ---	7 ---	0 ---	0 ---
Poa sp.	0 ---	0 ---	7 ---	0 ---	0 ---
Potentilla astracanica	59 ---	63 ---	36 ---	25 ---	20 ---
Potentilla humifusa	18 ---	13 ---	21 ---	13 ---	20 ---
Potentilla recta	6 ---	6 ---	7 ---	13 ---	20 ---
Potentilla semilaciniosa	24 ---	19 ---	0 ---	25 ---	0 ---
Prunus spinosa	0 ---	6 ---	14 ---	0 ---	0 ---
Pterotheca sancta	24 ---	38 ---	21 ---	50 ---	0 ---
Ranunculus illyricus	12 ---	0 ---	7 ---	0 ---	0 ---
Ranunculus oxyspermus	0 ---	0 ---	14 ---	0 ---	0 ---
Reseda lutea	0 ---	6 ---	0 ---	0 ---	0 ---
Rindera tetraspis	0 ---	0 ---	14 ---	0 ---	0 ---
Rosa sp.	0 ---	0 ---	7 ---	0 ---	0 ---
Rumex acetosa	6 ---	0 ---	0 ---	0 ---	0 ---
Salvia aethiopis	0 ---	6 ---	0 ---	13 ---	0 ---
Salvia nutans	0 ---	38 ---	36 ---	13 ---	20 ---
Salvia verticillata	0 ---	13 ---	0 ---	0 ---	0 ---
Scorzonera mollis	6 ---	6 ---	0 ---	0 ---	0 ---
Senecio grandidentatus	0 ---	0 ---	0 ---	13 ---	0 ---
Sideritis montana	6 ---	0 ---	0 ---	0 ---	0 ---
Silene supina	18 ---	19 ---	0 ---	13 ---	0 ---
Sisymbrium loeselii	0 ---	6 ---	7 ---	0 ---	0 ---
Sisymbrium officinale	0 ---	0 ---	0 ---	0 ---	20 ---
Sisymbrium polymorphum	29 ---	44 ---	14 ---	13 ---	20 ---
Stipa pulcherrima	0 ---	0 ---	14 ---	13 ---	0 ---
Stipa zalesskii	0 ---	0 ---	14 ---	0 ---	0 ---
Tanacetum millefolium	0 ---	0 ---	14 ---	0 ---	0 ---
Thymus marschallianus	0 ---	0 ---	7 ---	0 ---	0 ---
Trigonella monspeliaca	6 ---	0 ---	0 ---	0 ---	0 ---
Tulipa graniticola	6 ---	0 ---	0 ---	0 ---	0 ---
Valeriana tuberosa	6 ---	0 ---	7 ---	0 ---	0 ---
Valerianella costata	6 ---	0 ---	0 ---	0 ---	0 ---
Verbascum austriacum	0 ---	6 ---	0 ---	0 ---	0 ---
Verbascum lychnitis	0 ---	0 ---	0 ---	13 ---	0 ---
Verbascum orientale	0 ---	0 ---	14 ---	0 ---	0 ---
Verbascum phoeniceum	12 ---	0 ---	0 ---	0 ---	0 ---
Veronica jacquinii	0 ---	0 ---	7 ---	0 ---	0 ---
Veronica spicata	12 ---	13 ---	7 ---	0 ---	0 ---
Veronica triphyllos	12 ---	0 ---	7 ---	0 ---	0 ---
Veronica verna	18 ---	0 ---	7 ---	13 ---	0 ---
Vicia cracca	0 ---	0 ---	7 ---	0 ---	0 ---
Vicia hirsuta	6 ---	0 ---	0 ---	0 ---	0 ---
Vicia sp.	0 ---	0 ---	0 ---	13 ---	0 ---
Vicia tenuifolia	0 ---	0 ---	7 ---	0 ---	0 ---
Vinca herbacea	0 ---	0 ---	14 ---	0 ---	0 ---
Viola arvensis	6 ---	0 ---	14 ---	0 ---	0 ---
Viola hirta	0 ---	0 ---	0 ---	0 ---	20 ---
Viola sp.	0 ---	0 ---	14 ---	0 ---	0 ---
Viola tricolor	12 ---	6 ---	0 ---	0 ---	0 ---
Xeranthemum annum	6 ---	19 ---	0 ---	0 ---	0 ---