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Classification, ecological differentiation, and conservation value of Pontic sandy grasslands in the Southern Buh River Basin (Ukraine)

Klassifikation, ökologische Differenzierung, und Schutzwürdigkeit pontischer Sandgrasländer im Einzugsgebiet des Südlichen Bug (Ukraine)

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Abstract

The Southern Buh River is one of the biggest Ukrainian rivers with diverse landscapes and flora. However, plot-based vegetation studies on sandy grasslands of the river basin are poorly available in literature sources and in the relevant phytosociological databases. This study aims to survey plant communities of sandy grasslands in the Southern Buh River Basin and reveal the main environmental factors determining their differentiation. The dataset, consisting of 105 relevés, was classified using unsupervised (modified TWINSPAN) and supervised classification (EUNIS-ESy, EuroVegChecklist). To explore the effect of the environmental variables on the floristic composition and vegetation clusters, I used CCA, DCA, and ANOVA. The current extent of sandy grasslands was assessed in relation to the total area of sand deposits through land-cover analyses. The classification resulted in eight main clusters, which were interpreted as following groups: open sandy grasslands of the *Festucion beckeri* alliance (*Centaureo savranicae-Festucetum beckeri* ass. nova, *Centaureo margaritalbae-Caricetum colchicae* ass. nova, and two informal communities), pioneer sandy vegetation of disturbed areas dominated by annual species (*Mollugo cerviana-Carex colchica* and *Secale sylvestre-Plantago arenaria* communities), and hemipsammophytic dry grasslands (*Convolvulus arvensis-Festuca stricta* subsp. *sulcata* and *Phleum phleoides-Stipa borysthenica* communities). According to the CCA analysis, the major variables determining the differentiation of communities were the organic carbon content of the soil, three bioclimatic parameters (minimum temperature of the coldest month, precipitation of the driest quarter, and precipitation of the coldest quarter) and disturbance including ploughing and intensive grazing. The land-cover analysis showed that sandy grasslands are distributed on 0.46% of the total sandy area. The described plant communities support the existence of several rare and endemic plant species and correspond to the habitat types protected by Resolution 4 of the Bern Convention and the European Red List of Habitats. However, their current extent compared to the total area of alluvial terraces in the study region reflects critically low preservation levels. These findings raise conservation concerns and thus call for future protection of sandy grassland in the Southern Buh River Valley. In consequence, I proposed the establishment of eight new nature conservation areas in the study area.

Keywords: CCA, DCA, *Festucion beckeri*, GIS, habitat, *Koelerio-Corynephoretea*, nature conservation, phytosociology, vegetation classification, vegetation survey

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Erweitere deutsche Zusammenfassung am Ende des Artikels

1. Introduction

Continental sandy vegetation of the class *Koelerio-Corynephoretea* is mainly distributed in Boreal, Pannonian and Pontic regions of Europe, where it occurs on fluvioglacial deposits, coastal dunes, and alluvial sands in river floodplains (MUCINA et al. 2016, TÖRÖK et al. 2018). Various studies describe its distribution, syntaxonomy, ecology, and conservation in Central and Northern Europe, the Pannonian region and the Balkans (e.g. KÖRMÖCZI 1989, DENGLER 1994, KRATZERT & DENGLER 1999, CSECSERITS & RÉDEI 2001, DENGLER 2001a, 2001c, MATUS et al. 2003, DENGLER 2004b, BIRÓ et al. 2008, ŠEFFEROVÁ STANOVÁ et al. 2008, KUZEMKO 2009, LAIME & TJARVE 2009, SCHWABE et al. 2013, ĆUK et al. 2019). Due to the major decline of continental sandy grasslands during the last decades, sandy grasslands are protected by Resolution 4 of the Bern Convention (COUNCIL OF EUROPE 2011), Annex I of the European Habitats Directive and the European Red List of Habitats (JANSSEN et al. 2016).

Pontic sandy vegetation of the alliance *Festucion beckeri* (*Koelerio-Corynephoretea*) is distributed from the Danubian delta in South-Western Ukraine in the west (KRAUSCH 1965, DUBYNA et al. 1996) to the Don River Basin and Orenburg Region in the steppic part of Russia in the east (DEMINA et al. 2012, DULEPOVA et al. 2018, PREISLEROVÁ et al. 2022). In Ukraine, it is distributed in the southern regions, including the steppe zone and the southern part of the forest-steppe zone. According to the geographical and climatic features, the associations of the *Festucion beckeri* in Southern Ukraine are rich in Pontic endemics and represent more unique communities, while northern sandy grasslands of the forest zone are very similar to those found in Central Europe belonging to the alliance *Koelerion glaucae* (KUZEMKO 2009). Nevertheless, the high-level syntaxonomical assignment of the Pontic *Festucion beckeri* and Pannonian *Festucion vaginatae* alliances remains controversial, including the possible recognition of the *Festucetea vaginatae* as a separate class independent of the *Koelerio-Corynephoretea* (DENGLER 2001a, 2003, CHYTRÝ 2007, SANDA et al. 2008, KUZEMKO 2009, MUCINA et al. 2016, DUBYNA et al. 2020).

In Ukraine, vegetation studies of pontic sandy grasslands based on the Braun-Blanquet approach were conducted on a local scale describing communities of the Dnipro River Basin (VICHEREK 1972, DIDUKH & KOROTCHENKO 1996, SHEVCHYK & SOLOMAKHA 1996, SHEVCHYK et al. 1996, BAIRAK 1998, UMANETS & SOLOMAKHA 1999b, GAIOVA 2015) and along the Black Sea coast (DUBYNA et al. 1995, 1996, UMANETS & SOLOMAKHA 1999a, DAVYDOVA 2019). More recently, studies on the national level (KUZEMKO 2009, DZIUBA & DUBYNA 2019, DUBYNA et al. 2020) summarized existing data on sandy vegetation from different regions of Ukraine.

However, there are still areas in Ukraine with lacking or insufficient data on sand vegetation, as in the Southern Buh River Basin case. Sandy deposits of erosion and accumulative origin occur in the floodplain areas of the Southern Buh Valley, and in the valleys of its tributary rivers – Inhul, Kodyma and Savranka. The flora of these sandy deposits was explored by numerous studies during the last century, e.g. by PACZOSKI (1917), KLOKOV (1935), SOBKO (1972), and KRYTSKA & DERKACH (1991), showing its unique features and high rate of endemism. However, the information about the vegetation was fragmentary and consisted mainly of descriptions of dominant species combinations. These studies also discuss nature conservation issues, such as the destruction of habitats of threatened endemic species in the lower reaches of the Southern Buh and Inhul rivers (KRYTSKA & DERKACH 1991). Until now, plot-based vegetation data on sandy grasslands of the Southern Buh River Basin were neither available in literature sources nor in the relevant phytosociological databases, such as the Ukrainian Grassland Database (KUZEMKO 2012), the Eastern European Steppe Database (VYNOKUROV et al. 2020), or the GrassPlot Database (BIURRUN et al. 2019).

The data presented here represent the first comprehensive study focusing on the sandy vegetation in the Southern Buh River Basin. The aims of this study are the following: to (1) classify the vegetation at the association/community level and discuss their syntaxonomical and habitat assignments, (2) find ecological factors that determine the differentiation of the surveyed plant communities, (3) evaluate the current extent of sandy vegetation in comparison to potentially suitable areas of sandy deposits, and to (4) discuss their conservation value and potential threats.

2. Study area

The study was conducted in the Southern Buh River Basin on alluvial sandy terraces. Sampled areas belong to the Mykolaiv and Odesa administrative regions in south-western Ukraine. The climate is humid continental in the north and semi-arid in the southern part of the region, with mean annual temperatures of 9.5 to 10.7 °C, January means of -2 to -5 °C and July means of +21 to +23 °C. Mean annual precipitation ranges from 400 to 550 mm, with lower values towards the south (RUDENKO 2007, KARGER et al. 2017, 2018).

Sandy deposits are distributed in floodplains of the Southern Buh Valley and tributary valleys of the Inhul, Kodyma and Savranka rivers (Fig. 1). The upper and middle reaches of the Southern Buh river are located on the border between the Podolian Plateau (placed to the west of Southern Buh river) and the Dnieper Upland (placed to the east of the river), while the lower reaches belong to the Black Sea Lowland (RUDENKO 2007). Within the upland region, Southern Buh and its left tributaries cross the Ukrainian shield, an old bedrock formation of granite, gneiss, quartzite, and other metamorphic rocks up to 3.5 billion years old (KOSTRYTSKYI 1956). Therefore, the floodplain is absent or underdeveloped in many places in the middle part of the river basin. However, alluvial sandy deposits occur along the riverbeds of the most prominent right tributaries Savranka and Kodyma and in adjacent parts of the Southern Buh River. According to the physiographic zoning of Ukraine (RUDENKO 2007), sandy deposits of the upland region are situated in the forest-steppe zone, whereas larger territories of alluvial sandy and sandy-loamy deposits of the lower reaches of the Southern Buh River and Inhul River are located within the Black Sea Lowland in the steppe zone. There, the geological substratum consists of sedimentary terrigenous-carbonate Miocene (Sarmatian) deposits, Neogene clay loams, and Quaternary alluvial deposits (TSYS 1962).

Nowadays, alluvial terraces of the Southern Buh River Basin are mainly transformed by anthropogenic activities, including forestation, ploughing, industrial and housing construction. The vegetation of natural and semi-natural sites predominantly consists of Pontic sandy dry grasslands, dominated by *Festuca beckeri*, *Stipa borysthenica*, and *Thymus pallasianus*. Typical species include many endemics, particularly of the Pontic region, e.g. *Goniolimon graminifolium*, *Senecio borysthenicus*, and *Tragopogon borysthenicus*. Additionally, local endemics of the Southern Buh River Basin occur. Among them, *Centaurea*

Fig. 1. Map of Ukraine with study area and sampling locations. The main rivers of the Pontic region of Ukraine and main tributaries of the Southern Buh River with well-developed sand deposits are highlighted. Basemap: boundaries of steppe and forest-steppe zone according to DIDUKH & SHELYAG-SOSONKO (2003); other borders (country border, river lines and water polygons) extracted from OpenStreetMap (openstreetmap.org).

Abb. 1. Karte der Ukraine mit den Untersuchungsflächen. Die wichtigsten Flüsse im pontischen Teil der Ukraine mit signifikanten Sandablagerungen sind namentlich hervorgehoben. Die Abgrenzung der Steppen- und Waldsteppenregion in der Karte basieren auf DIDUKH & SHELYAG-SOSONKO (2003), während alles anderen geografischen Entitäten aus OpenStreetMap (openstreeetmap.org) stammen.

margaritacea, *C. margaritalba*, and C. *protomargaritacea* are endemic to the lower reaches of the Southern Buh River and Inhul River (KRYTSKA & DERKACH 1991), and *C. savranica* is endemic to the Savranka and the Kodyma rivers (SOBKO 1972).

3. Methods

3.1 Vegetation data

Dry grasslands were sampled between 2018 and 2020 in 105 plots placed on alluvial sands in the Southern Buh River Basin (Southern Buh, Inhul, Kodyma, and Savranka river valleys). Plots of 10 m^2 size were located across the study region within homogeneous stands to cover the range of different natural and semi-natural dry grassland types on sandy soils. While sampling, wet and mesic grasslands, as well as highly transformed ruderal habitats, were discarded. However, some of the sampled locations were influenced by anthropogenic disturbances, such as intensive grazing and past ploughing.

All relevés used in this article are stored in the Ukrainian Grasslands Database (KUZEMKO 2012). Some specimens of vascular plants and all bryophytes and lichens were collected for later identification and then stored in the National Herbarium of Ukraine in Kyiv (KW, including bryological collection KW-B), the herbarium of Masaryk University in Brno (BRNU) and the lichenological herbarium of

Table 1. Important differences between sources of taxonomical nomenclature and additions (*ad hoc* aggregates) used for the vegetation data. Followed cheklists: EURO+MED (2006+) for vascular plants – E+M; BOIKO (2014) for bryophytes; INDEX FUNGORUM (2022) for lichens. UA (Ukrainian) CheckList: MOSYAKIN & FEDORONCHUK (1999) for vascular plants. Species listed in Red Data Book of Ukraine (DIDUKH 2009) – RDU; species listed in regional red lists of Mykolaiv and Odesa regions (ANDRIIENKO & PEREGRYM 2012) – RDM and RDO, respectively.

Tabelle 1. Abweichende taxonomische Auffassungen sowie zusätzliche Aggregate in der vorliegenden Arbeit im Vergleich zu den im Allgemeinen angewendeten Checklisten (siehe englischsprachige Legende).

Taxon in paper	Followed checklist	UA CheckList	Comment
Agropyron cristatum	*Agropyron cristatum*	*Agropyron lavrenkoanum*	*A. lavrenkoanum* is diagnostic species of sandy syntaxa (DZIUBA & DUBYNA 2019) in Ukraine, which I treated as synonym of *A. cristatum* following E+M
Allium saxatile	*Allium saxatile*	*Allium savranicum*	*A. savranicum* is an endemic species of alluvial sandy vegetation (RDU), which I treated as synonim of *A. saxatile* following E+M
Artemisia marschalliana	*Artemisia campestris* subsp. *inodora*	*Artemisia marschalliana*	Taxon name from UA CheckList (MOSYAKIN & FEDORONCHUK 1999) is followed in this paper
Cerastium gracile	*Cerastium gracile*	*Cerastium pseudobulgaricum*, *C. schmalhausenii*	*C. schmalhausenii* is a local endemic species (RDO), closely related to *C. pseudobulgaricum*; I treated both species as synonym of *C. gracile* following E+M
Cetraria aculeata	*Cetraria aculeata*	*Cetraria steppae*	*C. steppae* is a rare lichen species (RDU), which is treated as synonim of *C. aculeata* (NADYEINA et al. 2013)
Helichrysum arenarium	*Helichrysum arenarium*	*Helichrysum arenarium*, *H. corymbiforme*	*H. corymbiforme* (= *H. arenarium* subsp. *ponticum*) is diagnostic species of sandy syntaxa (DZIUBA & DUBYNA 2019) in Ukraine, but I did not find any differences from *H. arenarium*
Jurinea longifolia	*Jurinea longifolia*	*Jurinea longifolia*, *J. paczoskiana*	*J. paczoskiana* is a rare endemic species of alluvial sandy vegetation (RDM), which I treated as synonym of *J. longifolia* following E+M
Salvia nemorosa	*Salvia nemorosa* subsp. *nemorosa*, *S. nemorosa* subsp. *tesquicola*	*Salvia illuminata*, *S. nemorosa*, *S. tesquicola*	Polymorphic and hardly distinguishable subspecies (species according to the Ukrainian checklist) were treated as *S. nemorosa*
Lomelosia argentea	*Lomelosia argentea*	*Scabiosa ucranica*	*S. ucranica* is diagnostic species of sandy syntaxa (DZIUBA & DUBYNA 2019) in Ukraine, which I treated as synonym of *Lomelosia argentea* following E+M
Syntrichia ruralis agg.	*Syntrichia ruralis*, *S. ruraliformis*	as followed	*Ad hoc* aggregate
Thymus ×dimorphus	–	*Thymus ×dimorphus*	Hybrid taxon (NACHICHKO et al. 2019), not listed in E+M
Tragopogon floccosus	*Tragopogon floccosus*	*Tragopogon savranicus*	*T. savranicus* is a local endemic species of Kodymo-Savranian sands in Ukraine (RDO), which I treated as synonim of *T. floccosus* following E+M
Veronica verna agg.	*Veronica dillenii*, *V. verna*	as followed	*Ad hoc* aggregate
Viola tricolor agg.	*Viola arvensis*, *V. hymettia*, *V. tricolor*	*Viola arvensis*, *V. lavrenkoana*, *V. tricolor*	*Ad hoc* aggregate

Kherson State University (KHER). The nomenclature follows the EURO+MED (2006+) for vascular plants, BOIKO (2014) for bryophytes and INDEX FUNGORUM (2022) for lichens. To facilitate the link between the Euro+Med taxonomy and the Ukrainian Prodrome (DUBYNA et al. 2019), the Red Data Book of Ukraine, and regional red lists, a taxonomical crosswalk for the diagnostic species of high-level syntaxa of sandy vegetation and those of conservation concern is provided in Table 1. For seven taxon names used in this paper, I refrained from following the given checklists but followed Ukrainian CheckList (MOSYAKIN & FEDORONCHUK 1999) or *ad hoc* aggregates.

To assess the conservation value of communities, I calculated the number of vascular plant species with conservation values per plot, based on the Red Data Book of Ukraine (DIDUKH 2009) and the lists of regionally rare plants of Mykolaiv and Odesa regions (ANDRIIENKO & PEREGRYM 2012).

3.2 Environmental variables

In each plot, I visually estimated the cover of the shrubs, herbs, cryptogams and litter, and recorded coordinates, altitude (using GPS of Google Pixel 3 smartphone), aspect (compass), and slope (inclinemeter). The microrelief was measured as the maximum vertical distance from the lowest and highest point in the plot. I classified present land use into main categories referring to "grazing intensity" (0 = not grazed; 1 = low; 2 = medium; 3 = high) and "ploughing intensity", expressed by the time elapsed after the last ploughing (0 = not ploughed; 1 = old ploughing (more than ~5 years ago); 2 = relatively recent ploughing (~3–5 years ago); 3 = recent ploughing, less than 3 years ago) based on visible signs in the plots and/or knowledge of the sites (personal communication with local people, data from forestry departments). Additionally, the total disturbance (hereafter disturbance) was calculated as the sum of grazing and ploughing intensity described above.

Soil samples (n = 88) were taken from the uppermost 10 cm in three to five random locations within the plot. Soil pH was measured electrometrically in a suspension of 5 ml soil with 25 ml deionised water (pH_{water}) or potassium chloride water solution (pH_{KCl}). Also, C_{org} content (Tyurin method, using 0.4 N potassium dichromate solution), N content (alkaline hydrolysed nitrogen according to Cornfield), and CO_2 content (acidimetric titration of a carbonate) were determined for each sample (KYRYLCHUK & BONISHKO 2011). Bioclimatic data (19 variables) for each plot location were extracted from the CHELSA database (KARGER et al. 2017, 2018).

3.3 Data processing and analysis

The relevés were stored in a TURBOVEG 2 database (HENNEKENS & SCHAMINÉE 2001) and analysed them using JUICE 7.1 (TICHÝ 2002) and R (R CORE TEAM 2022). For the numerical analysis, all plant records determined at the genus level and non-native shrub and tree species were excluded from the dataset.

The dataset, consisting of 105 relevés, was classified with modified TWINSPAN (ROLEČEK et al. 2009) with three pseudospecies cut levels (0%, 5%, 15%), four relevés as the minimum group size for division, and total inertia as the cluster heterogeneity measure. I examined partitions with up to 15 clusters. The partition with eight clusters showed the best results according to plant-compositional patterns and ecological interpretability. I used vascular-plant data for the numerical classification and added non-vascular taxa *post hoc* to characterise the obtained clusters.

The diagnostic species of clusters were determined based on the phi coefficient as a fidelity measure with equalisation of cluster sizes according to TICHÝ & CHYTRÝ (2006) with a fidelity threshold of 0.25 for diagnostic species and 0.5 for highly diagnostic species, excluding species with non-significant occurrence concentration within a cluster based on Fisher's exact test ($p \geq 0.05$) (CHYTRÝ et al. 2002). Constant species were defined as those with constancy (occurrence frequency) > 35% (highly constant: > 60%), and dominant species as those with cover > 15% in > 10% of relevés (highly dominant: in > 25% of relevés). Species names in the lists are arranged alphabetically.

Canonical correspondence analysis (CCA; package *vegan*; OKSANEN et al. 2017) was performed to test the effect of environmental variables on the floristic composition. I eliminated the highly correlated environmental variables using the Pearson correlation coefficient ($r \geq 0.9$; *alookr* package) prior to the CCA. Parameters directly derived from the plant community were excluded from CCA to avoid circular reasoning. To visualise the floristic similarity and variation patterns of clusters, I calculated a Detrended Correspondence Analysis (DCA; package *vegan*; OKSANEN et al. 2017) with log (x + 1)-transformed percentage cover values. The species with the best environmental fit (*envfit* function, *vegan* package), vectors of selected environmental variables (most significant according to the CCA), and community parameters (vegetation cover, number of species) were displayed in the ordination space. To explore the environmental features of the vegetation communities, I also calculated ANOVA p-values for all community parameters, soil parameters, selected bioclimatic variables, and management and disturbance values at the level of obtained clusters.

3.4 Syntaxonomical and habitat assignments

To assign the vegetation clusters to previously described phytosociological units, I compared the characteristic species and other community attributes with literature sources. If such an assignment at the association level was not possible, I described a new association or used an informal community name for the cluster. In particular, new associations were described following the International Code of Phytosociological Nomenclature (THEURILLAT et al. 2021) and just in those cases when relevés of one cluster represented a homogeneous group with clear diagnostic species and sufficient geographical distribution coverage (compared to the total potential distribution of the vegetation type). In other cases and for the higher-level syntaxa, I assume that the description of new syntaxonomic units should be done as a result of a more comprehensive revision of sandy grasslands. For a derivative community, I used a definition of derivative community in natural ecosystems (SCHAMINÉE & STORTELDER 1996).

For the habitat classification and verification of the high-level syntaxonomical assignments, I applied the expert systems EUNIS-ESy (CHYTRÝ et al. 2020, version 2021-06-01) and EuroVeg-Checklist (MUCINA et al. 2016, version 2014-01-08) via JUICE 7.1 (TICHÝ 2002).

3.5 Land-cover analysis

A land-cover analysis was conducted using QGIS 3.16 (https://qgis.org). As a present-day land-cover information, I considered 11 land-cover categories within each of the five areas making up the study region: Inhul, Kodyma, Savranka river valleys, Southern Buh River Valley in the forest-steppe zone, and Southern Buh River Valley in the steppe zone (Table 4). In particular, I used manual vectorization based on high-resolution orthophotos supplemented by land-use data from Ukrainian cadastre maps (available as WMS service via https://map.land.gov.ua/). Land-cover categories were defined related to the European CORINE Land Cover classification system (CLC; available via https://land.copernicus.eu/). Subsequently, I supplemented and adjusted land-cover data by field mapping of sandy areas in natural or near-natural conditions using the NextGIS program (https://nextgis.com). Additionally, the total initial area of sandy deposits (sandy soils and sandy loam soils) was estimated using soil mapping data implemented in the Ukrainian cadastre maps.

4. Results

4.1 Clusters

The eight groups obtained by the modified TWINSPAN analysis (Fig. 2), differed in the characteristics of environmental variables, regional biogeographical patterns, disturbance history, and land use.

Clusters A1 and A2 were separated by species typical of loamy xeric grasslands. They represent transitional types of grasslands on sandy-loamy soils. Cluster A1 differs by the presence of synanthropic species, while cluster A2 is rich in xerophilous species typical of bounding steppe vegetation.

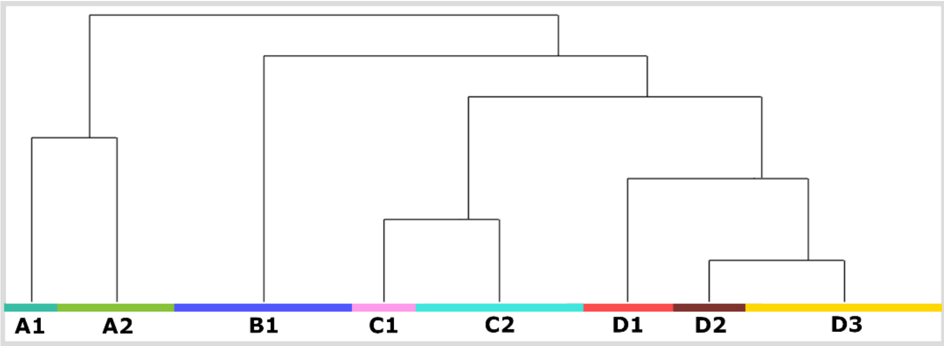

Fig. 2. Dendrogram based on the modified TWINSPAN classification. Clusters: A1 – *Convolvulus arvensis-Festuca stricta* subsp. *sulcata* community (6 relevés); A2 – *Phleum phleoides-Stipa borysthenica* community (13 relevés); B1 – *Centaureo savranicae-Festucetum beckeri* (18 relevés); C1 – *Mollugo cerviana-Carex colchica* community (7 relevés); C2 – *Secale sylvestre-Plantago arenaria* community (17 relevés); D1 – *Centaurea protomargaritacea-Calamagrostis epigejos* derivative community (12 relevés); D2 – *Seseli tortuosum-Cynodon dactylon* community (9 relevés); D3 – *Centaureo margaritalbae-Caricetum colchicae* (23 relevés).

Abb. 2. Dendrogramm basierend auf der modifizierten TWINSPAN-Klassifikation. Für die Namen der Einheiten und die Anzahl der zugeordneten Aufnahmen sei auf die englischsprachige Legende verwiesen.

Clusters B, C, and D represent grasslands occurring on sandy soil with lower humus content. Group B1 is a homogeneous cluster of sandy dry grasslands in the forest-steppe zone well-separated by floristic composition and its geographic restriction to the northern part of the Southern Buh River Basin. The rest number of relevés (groups C and D) represents the main type of open sandy grasslands in the steppe zone and pioneer vegetation of disturbed sands. They contain characteristic species of the southern Pontic sands. Clusters C1 and C2 refer to annual-dominated sandy grasslands and represent two stages of succession following disturbance, such as intensive grazing and ploughing for forestation. Clusters D1, D2, and D3 include open perennial-dominated sandy grasslands restricted to the southern part of the Southern Buh River Basin. Among them, clusters D1 and D2 represent communities which occur in more intensively used (e.g. grazed) areas than cluster D3.

4.2 Description of the communities

(Table 2; full table in Supplement E1, E2)

In the following paragraphs, community descriptions include information about characteristic species with highly diagnostic, highly constant and highly dominant species indicated in bold. Additionally, I discuss further floristic details, the ecology and distribution of the communities. The syntaxonomical interpretation of each cluster is given with notes on high-level assignment and relationships to syntaxa described from adjacent regions.

Cluster A1. ***Convolvulus arvensis-Festuca stricta*** **subsp.** ***sulcata community***

Number of relevés: 6

Diagnostic species: *Achillea pannonica*, *Arenaria serpyllifolia*, *Berteroa incana*, *Carex hirta*, *Chondrilla juncea*, ***Convolvulus arvensis***, ***Echium vulgare***, ***Elytrigia repens***, *Eryngium campestre*, ***Festuca stricta*** **subsp.** ***sulcata***, *Galium verum*, ***Lactuca serriola***, *Medicago falcata*, ***Poa angustifolia***, *Potentilla argentea*, *Trifolium arvense*, *Veronica prostrata*, *Vicia hisuta*, ***V. villosa***.

Constant species: *Achillea pannonica*, ***Arenaria serpyllifolia***, ***Artemisia marschalliana***, *Berteroa incana*, *Brachythecium albicans* (bryophyte, hereafter as "B"), ***Chondrilla juncea***, ***Convolvulus arvensis***, ***Echium vulgare***, ***Elytrigia repens***, *Eryngium campestre*, ***Festuca stricta*** **subsp.** ***sulcata***, *Silene borysthenica*, ***Poa angustifolia***, ***Potentilla argentea***, *Seseli tortuosum*, *Syntrichia ruralis* agg. (B), *Tragopogon floccosus*, ***Trifolium arvense***, *Veronica verna* agg., *Vicia hisuta*, ***V. villosa***.

Dominant species: *Calamagrostis epigejos* subsp. *epigejos*, *Carex hirta*, ***Festuca stricta*** **subsp.** ***sulcata***, ***Poa angustifolia***, *Syntrichia ruralis* agg. (B).

This cluster consists of six floristically heterogeneous relevés. It differs from other communities by the presence of generalist species of meso-xeric and synanthropic habitats, such as *Convolvulus arvensis*, *Echium vulgare*, *Poa angustifolia* and *Vicia hirsuta*. Typical psammophilous species (e.g. *Silene borysthenica*, *Tragopogon floccosus*) are also, but only with low cover and constancy. Among all clusters, the cover of the herb (mean: 74%) and litter layer (mean: 68%) are highest, while the cryptogamic layer has a relatively low cover (mean: 15%) and consists of few species (mean richness: 2). This community predominantly represents floodplain pastures on sandy-loamy soils located in the south of the forest-steppe zone (Kodyma and Savranka rivers) and to a lesser extent in the steppe zone (Inhul River).

Syntaxonomy: I could not assign this small heterogeneous group of relevés to one of the previously described associations and thus, treat this cluster as an informal. Based on the characteristic species, the meso-xeric cluster A1 represents a transition between the classes *Festuco-Brometea* and *Artemisietea vulgaris*, and might be placed in the alliance *Convolvulo arvensis-Agropyrion repentis* s.l., incl. *Rubo caesii-Calamagrostion epigeji* (DENGLER 2001b, 2004, MUCINA et al. 2016).

Cluster A2. ***Phleum phleoides-Stipa borysthenica*** **community**

Number of relevés: 13

Diagnostic species: *Achillea ochroleuca*, *Allium guttatum,* ***Botriochloa ischaemum***, *Carex supina*, ***Cleistogenes serotina*** **subsp.** ***bulgarica***, *Euphorbia agraria*, ***Eryngium campestre***, *Festuca valesiaca*, *Hieracium umbellatum*, *Hylotelephium maximum* subsp. *maximum*, *Hypericum perforatum*, ***Galium ruthenicum***, *Gypsophila paniculata*, *Iris pumila*, ***Koeleria macrantha***, ***Phleum phleoides***, *Poa angustifolia*, *Potentilla recta*, *Pulsatilla pratensis*, ***Salvia nemorosa***, *Stachys recta*, ***Stipa borysthenica***, ***S. capillata***, *Thesium ramosum*, *Thymus ×dimorphus*, *Verbascum phoeniceum*, *Veronica barrelieri*, *Weissia longifolia* (B).

Constant species: *Arenaria serpyllifolia*, ***Artemisia marschalliana***, *Astragalus varius*, *Carex colchica*, *Cleistogenes serotina* subsp. *bulgarica*, *Euphorbia seguieriana*, ***Eryngium campestre***, *Festuca valesiaca*, *Galium ruthenicum*, ***Gypsophila paniculata***, ***Poa angustifolia***, ***P. bulbosa***, ***Phleum phleoides***, *Potentilla argentea*, ***Rumex acetosella***, ***Lomelosia argentea***, *Seseli tortuosum*, ***Stipa borysthenica***, ***Syntrichia ruralis*** **agg. (B)**, ***Trifolium arvense***, *Veronica verna* agg.

Dominant species: ***Festuca valesiaca***, ***Stipa borysthenica***, *S. capillata.*

This community occurs in the steppe zone on slopes of river valleys and small gullies, shortly above the upper (non-flooded) alluvial terraces, on sandy-loamy soils with a relatively high humus content (C_{org}: 1.3%). Compared to all other clusters, cluster A2 has the highest total species richness (mean: 31). The herb layer is closed (mean: 69%) and dominated by the grasses *Festuca valesiaca*, *Stipa borysthenica*, and *S. capillata*. Among the characteristic herbaceous species *Galium ruthenicum*, *Phleum phleoides*, *Pulsatilla pratensis*, and *Lomelosia argentea* are the most dominant. Numerous generalist species of loamy dry grasslands, e.g. *Bothriochloa ischaemum*, *Carex supina*, *Hypericum perforatum*, *Potentilla recta*, *Salvia nemorosa*, *Stachys recta*, and *Verbascum phoeniceum* occur. Additionally, psammophilous and acidophilous species, such as *Astragalus varius*, *Carex colchica*, *Rumex acetosella*, and *Trifolium arvense*, are constant. The cryptogamic layer has a low cover (mean: 7%) and typically consists of *Rhynchostegium megapolitanum*, *Syntrichia ruralis* agg., and *Weissia longifolia*.

Syntaxonomy: Based on the floristic composition and physiognomy, this community reflects hemipsammophytic xeric steppes – a transitional type from zonal steppes (*Festuco-Brometea*) to sandy grasslands (*Koelerio-Corynephoretea canescentis*). Some heterogeneity of the species composition between individual relevés reflects different stages of succession (overgrowing of sands with loamy grassland species) and corresponds to the content of organic carbon in the soil, which varies from 0.62% to 1.69%. Most relevés of this cluster correspond to communities reported from Ukraine with the provisional name *Stipo borysthenicae-Phleetum phleoidis* ass. prov. (VYNOKUROV 2016) and presumably represent a new association or a new alliance of xeric hemipsammophytic steppes in the Pontic Region (see discussion in Section 5.1.3). Nevertheless, further studies are needed to better describe the floristic pattern and ecology of this community including data from the wider region and comparisons to related communities of the classes *Festuco-Brometea* and *Koelerio-Corynephoretea canescentis.*

Cluster B1. *Centaureo savranicae-Festucetum beckeri* ass. nova hoc loco

Number of relevés: 18

Diagnostic species: ***Asperula graveolens***, *Brachythecium albicans* (B), ***Centaurea savranica***, *Cladonia rei* (L), *Crepis ramosissima*, *Cytisus ruthenicus*, ***Festuca beckeri***, *Koeleria glauca* subsp. *glauca*, *Polytrichum piliferum* (B), *Potentilla incana*, *Silene borysthenica*, *Thymus pallasianus*, ***Tragopogon floccosus***, *Veronica verna* agg., *Viola tricolor* agg.

Constant species: *Anisantha tectorum*, *Anthemis ruthenica*, ***Artemisia marschalliana***, *Brachythecium albicans* (B), ***Carex colchica***, *Centaurea savranica*, *Ceratodon purpureus* (B), *Cladonia rei* (L), *Euphorbia seguieriana*, ***Festuca beckeri***, ***Poa bulbosa***, ***Silene borysthenica***, ***Syntrichia ruralis* agg. (B)**, ***Thymus pallasianus***, ***Tragopogon floccosus***, *Trifolium arvense*, *Viola tricolor* agg., ***Veronica verna* agg**.

Dominant species: *Ceratodon purpureus* (B), ***Festuca beckeri, Syntrichia ruralis* agg. (B),** *Thymus pallasianus.*

This cluster comprises dry grasslands on alluvial sands in the northern part of the study area, i.e. in the forest-steppe zone, in the Kodyma and Savranka river valleys and adjacent areas of the Southern Buh River Valley. The herb layer is relatively open (mean: 47%) and dominated mainly by *Festuca beckeri*. The most frequent species are *Carex colchica*, *Euphorbia seguieriana*, *Silene borysthenica*, *Thymus pallasianus*. Diagnostic species include psammophilous species such as *Asperula graveolens*, *Cytisus ruthenicus*, *Koeleria glauca* subsp. *glauca*, and *Tragopogon floccosus*, as well as *Centaurea savranica* – a regional endemic of sandy soils with a narrow distribution range. The cryptogamic layer is well-developed with a high cover (mean: 50%) and diversity (mean: 4 species). It is typically formed from numerous lichens of the genus *Cladonia* (*C. fimbriata*, *C. foliacea*, *C. furcata*, *C. pyxidata*, *C. rangiformis*, *C. rei*) and the mosses *Brachythecium albicans*, *Ceratodon purpureus*, *Polytrichum piliferum*, and *Syntrichia ruralis* agg. The soils have a slightly lower pH than all other communities (mean: 6.6) and a low humus content (C_{org}: 0.8%).

Syntaxonomy: This vegetation unit with clear floristical and regional differentiation is not represented in the literature. Therefore, I describe it as a new association:

***Centaureo savranicae-Festucetum beckeri* ass. nova hoc loco**; Holotypus: Supplement E2, relevé 32 of this paper (Ukraine, Odesa Region, Savran urban-type settlement, Savranka River Valley, sandy grassland, 48.12008° N, 30.07238° E; Field ID = BS1948-1, 20.07.2019, relevé by Dariia Shyriaieva & Denys Vynokurov): *Agropyron cristatum* 0.5%, *Arenaria procera* subsp. *pubescens* 1%, *Artemisia marschalliana* 4%, *Asperula graveolens* 2%, *Brachythecium albicans* (B) 0.1%, *Carex colchica* 0.3%, *Centaurea savranica* 0.5%, *Chondrilla juncea* 0.1%, *Cladonia fimbriata* (L) 3%, *C. subulata* (L) 0.1%, *Festuca beckeri* 25%, *Silene borysthenica* 1%, *Syntrichia ruralis* agg. (B) 52%, *Thymus pallasianus* 7%, *Tragopogon floccosus* 0.5%, *Veronica verna* agg. 0.1%.

The species composition and structure of these communities are similar to the *Centaureo borysthenicae-Festucetum beckeri* distributed in forest-steppe zone in the Dnipro River Basin (VICHEREK 1972). Differences between them are in the vicariant species among diagnostic species, e.g. *Centaurea savranica* vs. *C. borysthenica*, *Tragopogon floccosus* vs. *T. ucrainicus* in the Southern Buh River Basin and Dnipro River Basin, respectively.

Cluster C1. *Mollugo cerviana-Carex colchica* community

Number of relevés: 7

Diagnostic species: *Bassia laniflora*, *Carex colchica*, ***Eragrostis minor***, ***Mollugo cerviana***, *Plantago arenaria*, *Portulaca oleracea*.

Constant species: ***Bassia laniflora***, ***Carex colchica***, *Cynodon dactylon*, ***Eragrostis minor***, ***Mollugo cerviana***, ***Plantago arenaria***, ***Poa bulbosa***, *Portulaca oleracea*, ***Syntrichia ruralis* agg. (B)**, *Tribulus terrestris*.

Dominant species: *Bryum argenteum* (B), ***Carex colchica***, *Plantago arenaria*, ***Syntrichia ruralis* agg. (B)**, *Tribulus terrestris*, *Thymus pallasianus*.

This community consists of species poor (mean: 10 species) stands with an open herb layer (mean: 27%), with numerous pioneer and herbaceous annuals such as *Mollugo cerviana*, *Eragrostis minor*, *Portulaca oleracea*, and *Tribulus terrestris*. Perennial herbs are represented by a few psammophilous species; *Carex colchica* is often dominating. The cryptogam layer has a low species diversity (mean: 1 species) and a moderately low cover (22%); it usually consists of *Syntrichia ruralis* agg., rarely also of *Bryum argenteum* or *Cetraria aculeata*. The community represents the first stages of succession after intensive anthropogenic disturbance and occurs in stands, which are recently ploughed or intensively grazed.

Table 2. Shortened synoptic table with diagnostic species for each cluster and with other common species. The values in the table are species percentage constancies. Shaded species are ranked by decreasing fidelity to individual communities: Dark shading is used for *phi* ≥ 0.5 and light shading for 0.5 > *phi* ≥ 0.25. Letters in the column on the left of the species names: "V" – vascular plant, "B" – bryophyte, "L" – lichen. The full version of the table with individual relevés and complete species lists is available in Supplement E2.

Tabelle 2. Gekürzte Stetigkeitstabelle mit diagnostischen Arten für die Gesellschaften sowie weiteren häufigen Arten. Die Zahlen sind prozentuale Stetigkeiten. Die diagnostischen Arten der Gesellschaften sind grau hervorgehoben (*phi* ≥ 0,5: dunkelgrau, 0,5 > *phi* ≥ 0,25: hellgrau) und nach abfallendem phi-Wert sortiert. "V" – Gefäßpflanze, "B" – Moos, "L" – Flechte. Die vollständige Version dieser Tabelle mit den Einzelaufnahmen und allen Arten ist als elektronischer Anhang E2 verfügbar.

	Cluster code	**A1**	**A2**	**B1**	**C1**	**C2**	**D1**	**D2**	**D3**
	Number of releves	**6**	**13**	**18**	**7**	**17**	**12**	**9**	**23**
	***Convolvulus arvensis-Festuca stricta* subsp. *sulcata* community**								
V	*Convolvulus arvensis*	83	0	0	0	0	0	0	0
V	*Echium vulgare*	67	0	0	0	0	0	0	0
V	*Festuca stricta* subsp. *sulcata*	67	15	0	0	0	0	11	0
V	*Vicia villosa*	67	8	0	0	12	0	22	0
V	*Elytrigia repens*	67	8	0	0	6	0	33	0
V	*Galium verum*	33	0	0	0	0	0	0	0
V	*Lactuca serriola*	33	0	0	0	0	0	0	0
V	*Achillea pannonica*	50	0	17	0	6	0	0	0
V	*Vicia hirsuta*	50	8	0	0	0	8	0	9
V	*Carex hirta*	33	0	6	0	0	0	0	0
V	*Veronica prostrata*	33	8	0	0	0	0	0	0
V	*Potentilla argentea*	83	46	28	14	12	25	11	4
V	*Arenaria serpyllifolia*	83	54	11	14	12	8	22	26
V	*Trifolium arvense*	100	69	44	0	59	33	78	17
V	*Medicago falcata*	33	23	6	0	0	0	0	0
V	*Chondrilla juncea*	83	31	33	14	41	58	56	30
	***Phleum phleoides-Stipa borysthenica* community**								
V	*Phleum phleoides*	0	85	0	0	6	0	0	0
V	*Galium ruthenicum*	0	54	0	0	0	0	0	4
V	*Festuca valesiaca*	0	46	0	0	6	0	0	0
V	*Cleistogenes serotina* subsp. *bulgarica*	17	62	11	0	0	0	0	0
V	*Koeleria macrantha*	0	38	0	0	0	0	0	0
V	*Stipa borysthenica*	0	85	0	0	18	0	22	48
V	*Bothriochloa ischaemum*	0	38	0	0	6	0	0	0
V	*Eryngium campestre*	50	85	17	0	18	0	11	13
V	*Stipa capillata*	0	31	0	0	0	0	0	0
V	*Salvia nemorosa*	0	31	0	0	0	0	0	0
V	*Achillea ochroleuca*	0	31	0	0	0	0	0	4
V	*Hylotelephium maximum* subsp. *maximum*	0	23	0	0	0	0	0	0
V	*Veronica barrelieri*	0	23	0	0	0	0	0	0
V	*Pulsatilla pratensis*	0	23	0	0	0	0	0	0
V	*Allium guttatum*	0	23	0	0	0	0	0	0
V	*Verbascum phoeniceum*	17	38	6	0	0	0	0	0
V	*Bromus squarrosus* subsp. *squarrosus*	17	38	11	0	0	0	0	0
B	*Weissia longifolia*	0	31	0	0	0	0	11	4
V	*Sisymbrium polymorphum*	0	38	0	0	0	0	22	9
V	*Thesium ramosum*	0	15	0	0	0	0	0	0
V	*Potentilla recta*	0	15	0	0	0	0	0	0
V	*Hieracium umbellatum*	0	15	0	0	0	0	0	0
V	*Iris pumila*	0	15	0	0	0	0	0	0

	Cluster code	A1	A2	B1	C1	C2	D1	D2	D3
	Number of releves	**6**	**13**	**18**	**7**	**17**	**12**	**9**	**23**
V	*Thymus ×dimorphus*	0	15	0	0	0	0	0	0
V	*Euphorbia agraria*	0	15	0	0	0	0	0	0
V	*Carex supina*	0	15	0	0	0	0	0	0
V	*Stachys recta*	17	38	6	0	6	0	11	0
V	*Hypericum perforatum*	17	31	0	0	6	0	0	0
V	*Gypsophila paniculata*	17	69	11	0	41	0	44	57
V	*Echinops ritro*	0	15	0	0	0	0	0	4
B	*Ptychostomum capillare*	0	15	6	0	0	0	0	0
V	*Erysimum diffusum*	0	15	0	0	0	8	0	0
	Ass. *Centaureo savranicae-Festucetum beckeri*								
V	*Tragopogon floccosus*	33	0	89	0	6	0	0	0
V	*Festuca beckeri*	0	0	67	0	0	0	0	30
V	*Asperula graveolens*	0	0	28	0	0	0	0	0
V	*Centaurea savranica*	33	0	50	0	0	0	0	0
V	*Thymus pallasianus*	0	0	89	29	35	42	0	52
V	*Silene borysthenica*	50	0	83	0	41	0	33	26
V	*Veronica verna* agg.	33	62	89	0	12	8	67	30
V	*Viola tricolor* agg.	0	8	56	0	12	17	44	17
B	*Polytrichum piliferum*	0	0	17	0	0	0	0	4
V	*Crepis ramosissima*	0	0	11	0	0	0	0	0
V	*Koeleria glauca* subsp. *glauca*	0	0	11	0	0	0	0	0
V	*Cytisus ruthenicus*	0	0	11	0	0	0	0	0
V	*Potentilla incana*	0	15	22	0	0	0	0	0
L	*Cladonia rei*	0	23	50	0	0	8	33	30
B	*Brachythecium albicans*	50	23	44	0	6	8	11	4
	***Mollugo cerviana-Carex colchica* community**								
V	*Mollugo cerviana*	0	0	6	86	24	8	0	9
V	*Eragrostis minor*	0	0	11	71	18	0	11	13
V	*Portulaca oleracea*	0	0	6	43	18	0	0	0
V	*Carex colchica*	0	38	89	100	18	83	56	91
	***Secale sylvestre-Plantago arenaria* community**								
V	*Secale sylvestre*	0	0	39	0	71	17	11	39
V	*Erodium cicutarium*	0	0	0	0	18	0	0	0
V	*Cuscuta species*	0	0	11	0	29	0	0	4
V	*Tribulus terrestris*	0	0	0	43	47	25	11	4
V	*Chenopodium album*	17	0	11	0	24	0	0	0
	***Centaurea protomargaritacea-Calamagrostis epigejos* community**								
V	*Centaurea protomargaritacea*	0	0	0	0	12	67	0	17
V	*Calamagrostis epigejos* subsp. *epigejos*	17	8	22	0	0	83	0	22
V	*Centaurea odessana*	0	0	0	0	0	17	0	0
B	*Bryum argenteum*	0	0	0	14	0	25	0	0
V	*Filago arvensis*	0	23	6	29	18	58	22	22
V	*Heliotropium ellipticum*	0	0	0	0	6	17	0	0
	***Seseli tortuosum-Cynodon dactylon* community**								
V	*Tragopogon borystenicus*	17	0	0	0	24	0	67	35
V	*Seseli tortuosum*	50	46	11	0	6	0	89	48
V	*Cynodon dactylon*	17	0	11	43	12	0	67	4
V	*Verbascum species*	0	0	0	0	0	0	22	0
V	*Bassia sedoides*	0	0	0	0	0	0	22	0
V	*Melica transsilvanica* subsp. *transsilvanica*	17	15	6	0	0	0	44	0
V	*Centaurea margaritacea*	0	0	0	0	6	0	22	0
V	*Euphorbia seguieriana*	17	62	61	14	29	17	89	65
V	*Linaria genistifolia*	0	15	17	14	18	42	67	43

	Cluster code	A1	A2	B1	C1	C2	D1	D2	D3
	Number of releves	**6**	**13**	**18**	**7**	**17**	**12**	**9**	**23**
V	*Centaurea scabiosa* subsp. *adpressa*	0	15	0	0	0	0	22	0
V	*Androsace elongata*	33	38	0	0	6	0	44	9
V	*Polygonum patulum*	33	0	22	0	18	17	44	4
	Ass. *Centaureo margaritalbae-Caricetum colchicae*								
V	*Centaurea margaritalba*	0	0	0	0	0	0	11	52
V	*Cerastium gracile*	0	15	0	0	0	33	22	48
V	*Holosteum umbellatum*	17	23	33	0	35	8	22	61
V	*Valerianella carinata*	0	8	0	0	0	0	22	26
B	*Hypnum cupressiforme*	0	0	0	0	0	0	0	9
V	*Papaver laevigatum*	0	0	0	0	0	0	0	9
L	*Cladonia pyxidata*	0	0	6	0	0	0	0	17
V	*Odontarrhena tortuosa* subsp. *savranica*	0	0	17	29	29	8	11	43
	Species diagnostic for two clusters								
V	*Poa angustifolia*	83	69	11	0	0	0	11	9
V	*Berteroa incana*	50	0	6	0	0	0	33	0
V	*Lomelosia argentea*	33	54	0	0	24	0	22	65
V	*Plantago arenaria*	17	31	11	100	88	17	44	30
V	*Bassia laniflora*	0	0	39	71	88	8	11	26
V	*Anthemis ruthenica*	17	15	56	0	76	33	78	17
V	*Anisantha tectorum*	0	31	61	29	94	92	89	100
V	*Helichrysum arenarium*	0	15	17	14	47	92	22	91
V	*Cytisus borysthenicus*	0	15	0	0	0	58	11	52
V	*Koeleria glauca* subsp. *sabuletorum*	0	0	0	0	0	42	0	43
	Other species occurring in at least 20% of relevés								
V	*Artemisia marschalliana*	67	85	83	14	65	42	78	96
B	*Ceratodon purpureus*	17	38	61	0	6	58	44	65
B	*Bryum caespiticium*	0	15	6	14	6	42	22	39
B	*Syntrichia ruralis* agg.	50	69	83	71	94	42	89	96
V	*Pilosella echioides*	33	38	0	0	0	0	33	30
V	*Rumex acetosella*	33	54	11	0	18	42	44	30
V	*Artemisia austriaca*	17	15	28	0	6	0	11	0
V	*Jurinea cyanoides*	0	23	22	14	18	17	11	17
V	*Myosotis stricta*	17	23	28	0	6	8	33	22
V	*Erigeron canadensis*	17	0	33	29	24	25	22	9
V	*Astragalus varius*	17	38	11	29	41	8	11	35
V	*Arabidopsis thaliana*	33	38	11	0	18	17	44	0
V	*Senecio leucanthemifolius* subsp. *vernalis*	17	23	28	0	6	8	33	17
V	*Poa bulbosa*	33	69	78	71	82	67	56	61
V	*Cerastium semidecandrum*	17	31	22	0	41	42	33	30

Syntaxonomy: This community resembles the *Molluginetum cervianae* Borza 1963 in Romania within the *Bassio laniflorae-Bromion tectorum* alliance (SANDA et al. 2008). Nevertheless, pioneer sandy vegetation in the Pannonian region is significantly influenced by characteristic species of contiguous communities of the *Festucion vaginatae* alliance. Thus, the presence of differences in floristic composition between the *Mollugo cerviana-Carex colchica* and the *Molluginetum cervianae* should be verified using an extended dataset.

Cluster C2. *Secale sylvestre-Plantago arenaria* community

Number of relevés: 17

Diagnostic species: *Anisantha tectorum*, *Anthemis ruthenica*, ***Bassia laniflora***, *Chenopodium album*, *Erodium cicutarium*, *Plantago arenaria*, ***Secale sylvestre***, *Tribulus terrestris*.

Constant species: ***Anisantha tectorum***, ***Anthemis ruthenica***, *Artemisia marschalliana*, *Astragalus varius*, ***Bassia laniflora***, *Cerastium semidecandrum*, *Chondrilla juncea*, *Gypsophila paniculata*, *Helichrysum arenarium*, ***Plantago arenaria***, ***Poa bulbosa***, ***Secale sylvestre***, *Silene borysthenica*, ***Syntrichia ruralis* agg. (B)**, *Tribulus terrestris*, *Trifolium arvense*.

Dominant species: *Artemisia marschalliana*, ***Bassia laniflora***, ***Plantago arenaria***, ***Secale sylvestre***, ***Syntrichia ruralis* agg. (B)**, *Trifolium arvense*.

Like the previous cluster, these communities represent a successional vegetation type of sandy grasslands. However, the community structure differs by a relatively closed herb layer (mean: 50%), higher species richness (mean: 19 species) and a notable predominance of annual psammophilous species (*Bassia laniflora*, *Plantago arenaria, Secale sylvestre*). Among the constant species, few perennial species, such as *Artemisia marschalliana*, *Astragalus varius*, *Helichrysum arenarium*, and *Silene borysthenica* occur with a low cover. The cryptogam layer is species poor (mean: 1 species) and usually consists of only one species – *Syntrichia ruralis* agg. This community represents the second stage of succession after intensive anthropogenic disturbance and usually occurs in stands ploughed a few years ago.

Syntaxonomy: This community is similar to the *Plantaginetum arenariae* (Buia et al. 1960) Popescu et Sanda 1987 in Romania (SANDA et al. 2008) within the alliance *Bassio laniflorae-Bromion tectorum*, but does not fully match its description: similar to the Pannonian association *Molluginetum cervianae* vs. community C1 of this study, the Pannonian pioneer vegetation of the *Plantaginetum arenariae* is significantly influenced by characteristic species of the *Festucion vaginatae* alliance.

Cluster D1. *Centaurea protomargaritacea-Calamagrostis epigejos* derivative community

Number of relevés: 12

Diagnostic species: *Bryum argenteum*, ***Calamagrostis epigejos* subsp. *epigejos***, *Centaurea odessana*, ***C. protomargaritacea***, *Cytisus borysthenicus*, *Filago arvensis*, *Helichrysum arenarium*, *Heliotropium ellipticum*, *Koeleria glauca* subsp. *sabuletorum*.

Constant species: ***Anisantha tectorum***, *Artemisia marschalliana*, *Bryum caespiticium* (B), ***Calamagrostis epigejos* subsp. *epigejos***, ***Carex colchica***, ***Centaurea protomargaritacea***, *Cerastium semidecandrum*, *Ceratodon purpureus* (B), *Chondrilla juncea*, *Cytisus borysthenicus*, *Filago arvensis*, ***Helichrysum arenarium***, *Koeleria glauca* subsp. *sabuletorum*, *Linaria genistifolia*, ***Poa bulbosa***, *Rumex acetosella*, *Syntrichia ruralis* agg. (B), *Thymus pallasianus*.

Dominant species: ***Calamagrostis epigejos* subsp. *epigejos***, *Carex colchica*, *Ceratodon purpureus* (B), *Syntrichia ruralis* agg. (B).

This community occurs in the very south of the study region on the sandy terrace of the Southern Buh River in the vicinity of Mykolaiv, namely "Halytsynivski pisky". In this sandy area, pine forests were planted during the last decades. A significant part of the forest plantations was destroyed by fires in recent years, and natural vegetation has partly grown back naturally. As a result, this community differs by the dominance of *Calamagrostis epigejos*, a relatively low species richness (mean: 18) and a sparse cryptogam layer

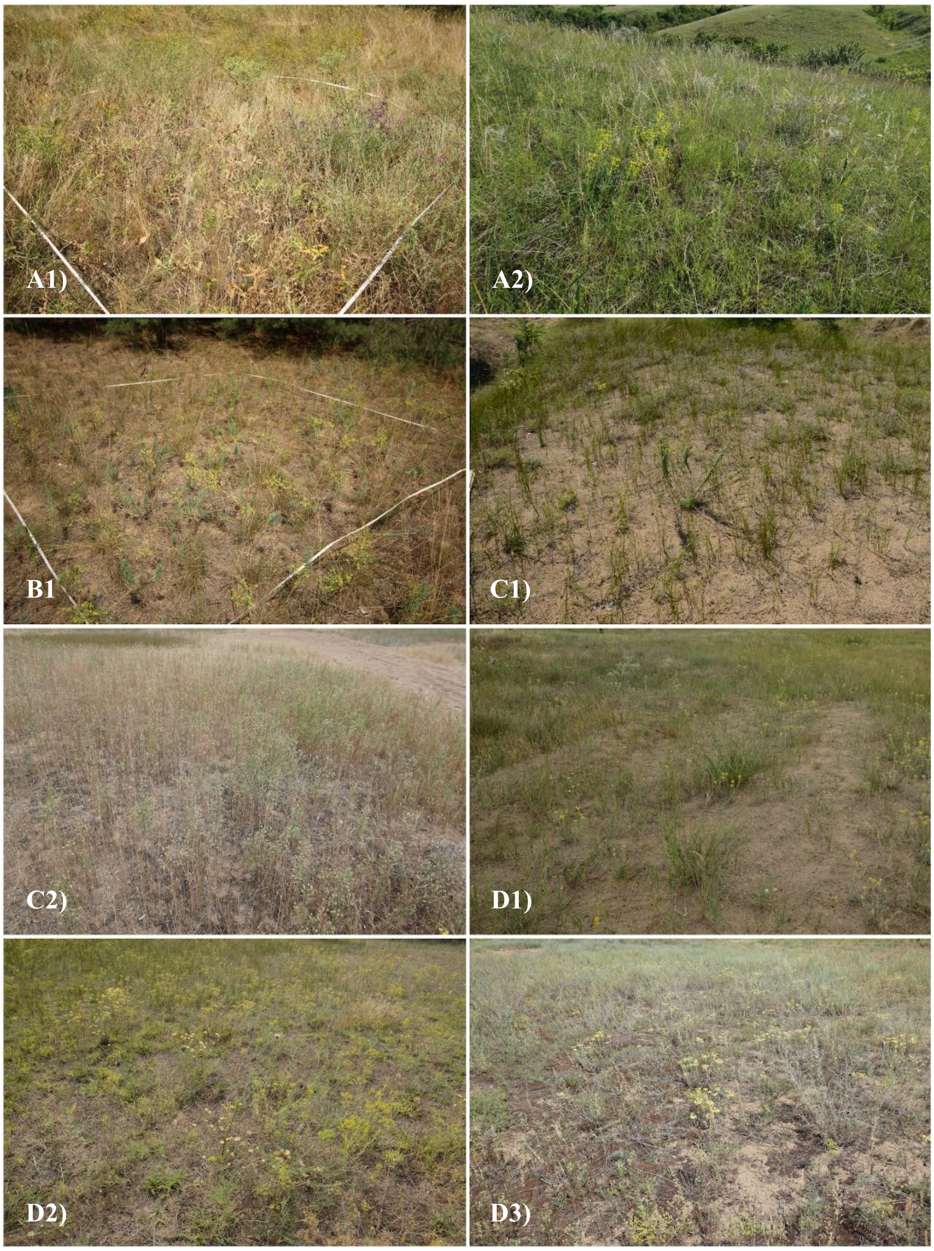

Fig. 3. The diversity of sandy vegetation in the Southern Buh River Basin. The names of vegetation units correspond to given in Section *Results*: A1 – *Convolvulus arvensis-Festuca stricta* subsp. *sulcata* hemipsammophytic community in Kodyma River Valley (forest-steppe zone); A2 –*Phleum phleoides-Stipa borysthenica* hemipsammophytic community in Southern Buh River Valley (steppe zone); B1 – *Centaureo savranicae-Festucetum beckeri* association in Savranka River Valley; C1 – *Mollugo cerviana-Carex colchica* community at disturbed sands, lower riches of Southern Buh River, near Balovne village; C2 – *Secale sylvestre-Plantago arenaria* community at the edge of artificial forest

(mean: 19%). Nevertheless, the characteristic types of this community are diagnostic for the *Festucion beckeri* alliance: *Carex colchica*, *Cytisus borysthenicus*, *Koeleria glauca* subsp. *sabuletorum*, etc. One of the diagnostic species, *Centaurea protomargaritacea*, is a local endemic of the "Halytsynivski pisky" area.

Syntaxonomy: Due to its restricted distribution within an intensively disturbed area, cluster D1 represents a derivative community of the *Festucion beckeri* alliance with the dominance of *Calamagrostis epigejos*, a diagnostic species of *Convolvulo arvensis-Agropyrion repentis* s.l. incl. *Rubo caesii-Calamagrostion epigeji* (DENGLER 2001b, 2004, MUCINA et al. 2016).

Clusters D2. *Seseli tortuosum-Cynodon dactylon* community

Number of relevés: 9

Diagnostic species: *Androsace elongata*, *Anthemis ruthenica*, *Bassia sedoides*, *Berteroa incana*, *Centaurea margaritacea*, *C. scabiosa* subsp. *adpressa*, *Cynodon dactylon*, *Melica transsilvanica* subsp. *transsilvanica*, *Polygonum patulum*, *Seseli tortuosum*, *Tragopogon borystenicus*.

Constant species: *Androsace elongata*, ***Anisantha tectorum***, ***Anthemis ruthenica***, *Arabidopsis thaliana*, ***Artemisia marschalliana***, *Carex colchica*, *Ceratodon purpureus* (B), *Chondrilla juncea*, ***Cynodon dactylon***, ***Euphorbia seguieriana***, *Gypsophila paniculata*, ***Linaria genistifolia***, *Melica transsilvanica* subsp. *transsilvanica*, *Plantago arenaria*, *Poa bulbosa*, *Polygonum patulum*, *Rumex acetosella*, ***Seseli tortuosum***, ***Syntrichia ruralis* agg. (B)**, ***Tragopogon borystenicus***, ***Trifolium arvense***, ***Veronica verna* agg.**, *Viola tricolor* agg.

Dominant species: *Artemisia marschalliana*, *Carex colchica*, ***Cynodon dactylon***, *Stipa borysthenica*, ***Syntrichia ruralis* agg. (B)**, *Trifolium arvense*.

This community is moderately species rich (mean: 25 species) and has a medium closed herb layer (mean: 53%). It is mainly dominated by *Cynodon dactylon*. Grazing tolerant and partly weedy species, such as *Anisantha tectorum*, *Anthemis ruthenica*, *Artemisia marschalliana*, *Berteroa incana*, and *Trifolium arvense*, are among the characteristic species. Stands of this community occur in the lower Southern Buh and Inhul rivers, on slightly alkaline (mean: 7.3) sandy soils, often with past and current moderate grazing.

Syntaxonomy: This community overlaps in distribution and species composition with the clusters D1 and D3; the differences between them are caused by differences in land use. Due to its transitional nature, I treated this cluster as an informal community *Seseli tortuosum-Cynodon dactylon*.

Previous page (vorherige Seite):

plantation, ploughed few years ago; D1 – *Centaurea protomargaritacea-Calamagrostis epigejos* derivative community in the sandy area "Halytsynivski pisky", lower reaches of Southern Buh River, recovery of sandy vegetation after unsuccessful forest plantation and burning; D2 – *Seseli tortuosum-Cynodon dactylon* community in lower reaches of Inhul river, pasture, near Mishkovo-Pohorilove village; D3 – *Centaureo margaritalbae-Caricetum colchicae* association in Southern Buh River Valley, near Nova Odesa city (Photos: A1, B1: D. Vynokurov, 2019; A2: D. Shyriaieva, 2020, C1–C2, D1–D3: D. Shyriaieva, 2019).

Abb. 3. Diversität der Sandvegetation im Tal des Südlichen Bug. Für die Namen der Gesellschaften und ihre geografische Herkunft sei auf die englischsprachige Legende verwiesen.

Clusters D3. *Centaureo margaritalbae-Caricetum colchicae* ass. nova hoc loco

Number of relevés: 23

Diagnostic species: *Anisantha tectorum*, ***Centaurea margaritalba***, *Cerastium gracile*, *Cladonia pyxidata* (L), *Cytisus borysthenicus*, *Helichrysum arenarium*, *Holosteum umbellatum*, *Hypnum cupressiforme* (B), *Koeleria glauca* subsp. *sabuletorum*, *Odontarrhena tortuosa* subsp. *savranica*, *Papaver laevigatum*, *Lomelosia argentea*, *Valerianella carinata*.

Constant species: ***Anisantha tectorum***, ***Artemisia marschalliana***, ***Carex colchica***, ***Centaurea margaritalba***, *Cerastium gracile*, ***Ceratodon purpureus* (B)**, *Chondrilla juncea*, *Cytisus borysthenicus*, ***Euphorbia seguieriana***, *Gypsophila paniculata*, ***Helichrysum arenarium***, *Holosteum umbellatum*, *Koeleria glauca* subsp. *sabuletorum*, *Linaria genistifolia*, *Odontarrhena tortuosa* subsp. *savranica*, *Poa bulbosa*, ***Lomelosia argentea***, *Seseli tortuosum*, *Stipa borysthenica*, ***Syntrichia ruralis* agg. (B)**, *Thymus pallasianus*.

Dominant species: *Carex colchica*, ***Ceratodon purpureus*** (B), *Festuca beckeri*, ***Stipa borysthenica***, ***Syntrichia ruralis* agg.** (B).

This community has a well-developed cryptogam layer (mean cover: 53%, mean species number: 4) and a relatively sparse herb layer with a dominance of perennial herbs (mean: 43%). Diagnostic species are psammophilous herbs and grasses (*Cytisus borysthenicus*, *Helichrysum arenarium*, *Koeleria glauca* subsp. *sabuletorum*, *Odontarrhena tortuosa* subsp. *savranica*) including *Centaurea margaritalba*, whose range coincides with that of the association described here. Among the dominant species, *Carex colchica* and *Stipa borysthenica* are constant species in the herb layer, while *Ceratodon purpureus* and *Syntrichia ruralis* agg. dominate in cryptogam layer.

Syntaxonomy: Since there is no matching syntaxon in the available literature, I describe it as a new association:

***Centaureo margaritalbae-Caricetum colchicae* ass. nova hoc loco**; Holotypus: Supplement E2, relevé 94 of this paper (Ukraine, Mykolaiv Region, Mykolaiv distr., near Kovalivka village; Southern Buh River Valley, 47.30737° N, 31.71814° E; Field ID = SB18172, 31.07.2018, relevé by Dariia Shyriaieva): *Allium saxatile* 1%, *Alyssum* cf. *turkestanicum/ minutum* 0.01%, *Anisantha tectorum* 1%, *Artemisia marschalliana* 2%, *Bryum caespiticium* (B) 3%, *Carex colchica* 2%, *Centaurea margaritalba* 2%, *Cerastium gracile* 0.01%, *C. semidecandrum* 0.01%, *Ceratodon purpureus* (B) 17%, *Cladonia fimbriata* (L) 5%, *C. rei* (L) 3%, *Cytisus borysthenicus* 0.5%, *Festuca beckeri* 5%, *Galium ruthenicum* 4%, *Helichrysum arenarium* 0.2%, *Holosteum umbellatum* 0.01%, *Hypnum cupressiforme* (B) 0.1%, *Koeleria glauca* subsp. *sabuletorum* 1%, *Pilosella echioides* 0.5%, *Rhynchostegium megapolitanum* (B) 1%, *Poa bulbosa* 2%, *Seseli tortuosum* 0.3%, *Stipa borysthenica* 25%, *Syntrichia ruralis* agg. (B) 8%, *Thymus pallasianus* 8%.

This association is similar to the *Centaureo brevicipitis-Festucetum beckeri* of the Lower Dnipro Region (VICHEREK 1972). However, among the characteristic species of these associations, there are vicariant species such as the endemic *Centaurea margarita-alba* and *C. breviceps* or *Thymus pallasianus* and *T. borysthenicus* replacing each other in Lower Southern Buh and Lower Dnipro, respectively. Sandy grasslands of the Dnipro region are generally richer in psammophilous species as those from the Southern Buh valley. Among these species *Agropyron dasyanthum*, *Scorzonera ensifolia*, and *Spergularia morrisonii* occur in Lower Dnipro sandy areas. The lower diversity of sandy flora in the Southern Buh region could be explained by the close proximity to the edge of the distribution range of *Festucion beckeri* vegetation and by the fragmentation of sandy habitats.

Fig. 4. Endemic knapweeds (*Centaurea* L.), which are diagnostic for the described vegetation units. **a–c)** Pearl knapweeds with scarious involucral bracts (section *Pseudophalolepis*, *C. margaritacea* agg.): **a)** *C. margaritacea*; **b)** *C. margaritalba*; **c)** *C. protomargaritacea*; d) Savranian knapweed *C. savranica* (*C. arenaria* aggr.) (Photos: a–c: D. Shyriaieva, 2018; d: D. Davydov, 2015).

Abb. 4. Endemische Flockenblumen (*Centaurea* L.), welche diagnostisch für die beschriebenen Vegetationseinheiten sind. Ihre Namen können der englischsprachigen Legende entnommen werden.

4.3 Proposed syntaxonomical scheme

Here, I propose the syntaxonomical scheme discussed in sections 4.2 and 5.1. Unclear assignments and missing syntaxonomical allocations are marked with "?", while alternative options of high-level assignments for transitional hemipsammophytic communities are separated by the term "OR".

Class *Koelerio-Corynephoretea canescentis* Klika in Klika et Novak 1941
Order *Festucetalia vaginatae* Soo 1957
Alliance *Festucion beckeri* Vicherek 1972
B1 *Centaureo savranicae-Festucetum beckeri* Shyriaieva 2022
D3 *Centaureo margaritalbae-Caricetum colchicae* Shyriaieva 2022
D1 *Centaurea protomargaritacea-Calamagrostis epigejos* derivative community
D2 *Seseli tortuosum-Cynodon dactylon* community

Alliance ? annual-dominated sandy grasslands of (Pontic region) OR (Central European, Pannonian and Pontic regions) (see discussion in Section 5.1.2)
C1 *Mollugo cerviana-Carex colchica* community
C2 *Secale sylvestre-Plantago arenaria* community

Class ? *Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947
Order ? *Festucetalia valesiacae* Soó 1947
Alliance ? *Festucion valesiacae* Klika 1931 OR possibly a new alliance representing closed xeric hemipsammophytic grasslands on sandy-loamy soils in Pontic region (see discussion in Section 5.1.3)
A2 *Phleum phleoides-Stipa borysthenica* community

Class ? transition between the *Festuco-Brometea* and *Artemisietea vulgaris*
Alliance ? *Convolvulo arvensis-Agropyrion repentis* s.l. (incl. *Rubo caesii-Calamagrostion epigeji*)
A1 *Convolvulus arvensis-Festuca stricta* subsp. *sulcata* community

4.4 Envinronmental variables and geographical patterns

According to the CCA, the constrained axes accounted for 32.2% of the variation in the data (Total Inertia = 9.18; Eigenvalues for first two axes: axis 1 = 0.50, axis 2 = 0.32). Six environmental factors were the main significant explanatory variables shaping plant-compositional patterns of sandy grasslands in the Southern Buh River Valley: content of organic carbon in the soil ($p = 0.003$); disturbance ($p < 0.001$); selected bioclimatic parameters: bio06 – minimum temperature of coldest month ($p < 0.001$), bio14 – precipitation of driest month ($p < 0.001$); bio17 – precipitation of driest quarter ($p < 0.001$), bio19 – precipitation of coldest quarter ($p < 0.001$) (displayed in Fig. 5). Results of the ANOVAs calculated for environmental factors in relation to the six clusters slightly differed in their *p*-values for two variables when derived from the CCA; disturbance appeared to be non-significant and soil nitrogen content (N) was significant ($p = 0.001$) (Table 3).

According to the DCA ordination diagrams (Fig. 5) and distribution (Fig. 6), the communities are mainly differentiated by local environmental factors, while others are linked to macro-climatic variables. The hemipsammophytic vegetation of clusters A1 and A2 (*Convolvulus arvensis-Festuca stricta* subsp. *sulcata*, *Phleum phleoides-Stipa borysthenica*) is separated from the other clusters along the first DCA axis (Fig. 5) with higher values for organic carbon content, herb layer cover and total species richness, and low levels of disturbance. In contrast, the annual-dominated vegetation of clusters C1 and C2 (*Mollugo cerviana-Carex colchica* and *Secale sylvestre-Plantago arenaria* communities) is characterized by highest disturbance levels. The *Centaurea protomargaritacea-Calamagrostis epigejos* derivative community (D1) is separated from other perennial-dominated open sandy grasslands (clusters B1, D2, D3) along the vector of the minimum temperature of the coldest month, corresponding to their small-scaled occurrence in the most southern part of the study region. Separation of distributed in the north forest-steppe clusters A1 and B1 (*Convolvulus arvensis-Festuca stricta* subsp. *sulcata* and *Centaureo savranicae-Festucetum beckeri*) from all other occurring in the south steppe clusters is noticeable along the third DCA axis and relates to the precipitation of the driest month, the driest quarter, and the coldest quarter, respectively.

4.5 Expert systems

Using the EuroVegChecklist expert system, the dataset was largely classified within the classes *Koelerio-Corynephoretea* (COR: 86 relevés) and *Festuco-Brometea* (FES: 13), while a few relevés were assigned to classes *Sedo-Scleranthetea* (SED: 3), *Molinio-Arrhenatheretea* (MOL: 1), *Artemisietea vulgaris* (ART: 1) and *Digitario sanguinalis-Eragrostietea minoris* (DIG: 1). In particular, for the individual clusters: A1 – FES (3), ART (1), MOL (1), SED (1); A2 – FES (10), COR (3); B1 – COR (17), SED (1); C1 – COR (5), DIG (1), SED (1). All relevés of clusters C2, D1, D2, D3 were classified as *Koelerio-Corynephoretea* (61). In addition, all relevés of cluster A1 were characterised by notable participation of the diagnostic species of *Artemisietea vulgaris*, and relevés of cluster A1 – by the constant presence of species diagnostic of *Koelerio-Corynephoretea*.

Using the EUNIS-ESy, most relevés were classified as R11 Pannonian and Pontic sandy steppe (49 relevés) or just to the superior category R Grasslands (43), while some others were identified as R1B Continental dry grassland (9), V Man-made habitats (3), and V38

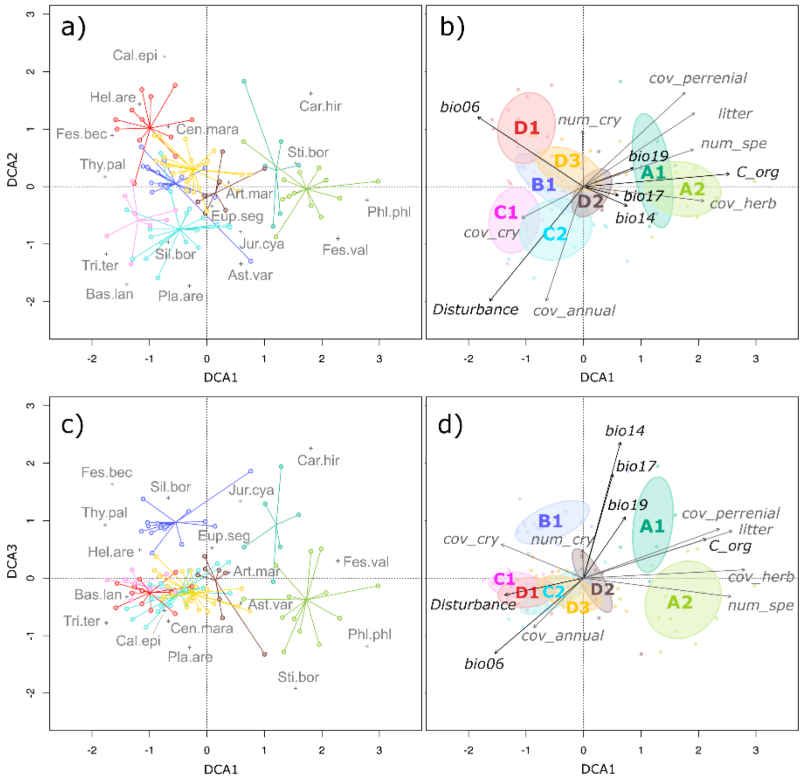

Fig. 5. DCA ordination diagrams (Total Inertia = 9.18; Eigenvalues: axis 1 = 0.59, axis 2 = 0.41; Axis lengths: axis 1 = 4.71, axis 2 = 3.42, axis 3 = 3.27): **a)** spider-plot of the communities and species with best environmental fit (axes DCA1, DCA2); **b)** ellipses showing communities (SD, conf. 0.5) and fitted vectors (axes DCA1, DCA2). Vectors of community parameters (grey color): total number of species (num_spe), number of cryptogams (num_cry); covers of herbs (cov_herb), cryptogams (cov_cry), annuals (cov_annual), and perennials (cov_perennial); cover of litter (litter). Vectors of selected environmental factors (only selected by CCA factors are shown) (black): organic carbon content (C_org); total disturbance (Disturbance); bioclimatic variables bio06, bio14, bio17, bio19; **c)** the same as a, but axes DCA1 and DCA3; **d)** the same as b, but axes DCA1 and DCA3.
The colours and codes of the communities: **A1** (dark green) – *Convolvulus arvensis-Festuca stricta* subsp. *sulcata* community; **A2** (light green) – *Phleum phleoides-Stipa borysthenica* community; **B1** (dark blue) – *Centaureo savranicae-Festucetum beckeri*, **C1** (pink) – *Mollugo cerviana-Carex colchica* community; **C2** (light blue) – *Secale sylvestre-Plantago arenaria* community; **D1** (red) – *Centaurea protomargaritacea-Calamagrostis epigejos* derivative community; **D2** (brown) – *Seseli tortuosum-Cynodon dactylon* community; **D3** (yellow) – *Centaureo margaritalbae-Caricetum colchicae*.

Abb. 5. DCA-Ordinationsdiagramme. **a)** Spinnenplot der Gesellschaften und Arten mit den höchsten Korrelationen zu den Achsen DCA1 und DCA2; **b)** Ellipsen der Gesellschaften mit korrelierten Vektoren: Gesellschaftsattribute (grau): Gesamtartenreichtum (num_spe), Artenreichtum von Nichtgefäßpflanzen (num_cry); Krautschichtdeckung (cov_herb), Deckung von Nichtgefäßpflanzen (cov_cry), Deckung von einjährigen Gefäßpflanzen (cov_annual), Deckung von ausdauernden Gefäßpflanzen (cov_perennial), Streudeckung (litter). Umweltvariablen, die in der CCA signifikant waren (schwarz): organischer Kohlenstoffgehalt (C_org), Gesamtstörungsintensität (Disturbance), bioklimatische Variablen bio06, bio14, bio17, bio19. **c)** und **d)** analog zu a) und b) für die Achsen DCA1 und DCA3. Die Kürzel und Namen der Gesellschaften können der englischsprachigen Legende entnommen werden.

Table 3. Community attributes, environmental factors and selected bioclimatic variables of the seven clusters. Mean values and standard deviation values are given. The *p* -values were calculated using ANOVA at the cluster level.

Tabelle 3. Gesellschaftseigenschaften, Umweltfaktoren und ausgewählte bioklimatische Variablen der sieben Cluster. Angegeben sind Mittelwerte und Standardabweichungen. Die *p* -Werte wurden durch ANOVA auf der Cluster-Ebene kalkuliert.

Cluster	**A1**	**A2**	**B1**	**C1**	**C2**	**D1**	**D2**	**D3**	***p* -value**	**signif.**
Number of relevés	6	13	18	7	17	12	9	23		
Community attributes										
Species richness in 10 m^2	26.0 ± 2.8	30.9 ± 7.3	22.7 ± 8.2	11.4 ± 4.0	19.5 ± 6.3	17.6 ± 3.7	25.3 ± 5.7	24.8 ± 4.7	0.28	
Species richness of vascular plants in 10 m^2	23.6 ± 1.9	27.6 ± 7.2	19.1 ± 8.5	10.3 ± 3.2	18.2 ± 6.2	15.3 ± 4.5	22.2 ± 5.7	20.8 ± 4.1	0.14	
Species richness of non-vascular taxa in 10 m^2	2.3 ± 1.2	3.3 ± 2.6	3.6 ± 1.7	1.1 ± 1.1	1.2 ± 0.6	2.3 ± 1.8	3.1 ± 2.2	4.0 ± 2.4	0.22	
Cover of vegetation total (%)	79 ± 10	73 ± 9	74 ± 18	45 ± 13	70 ± 18	52 ± 16	69 ± 12	78 ± 9	0.98	
Cover of herb layer (%)	74 ± 9	69 ± 9	47 ± 13	27 ± 11	50 ± 13	38 ± 14	55 ± 11	48 ± 11	0.002	**
Cover of annual herbs (%)	4 ± 2	4 ± 3	5 ± 5	13 ± 11	41 ± 16	5 ± 6	14 ± 17	8 ± 5	0.21	***
Cover of perennial herbs (%)	73 ± 10	66 ± 9	43 ± 14	19 ± 6	15 ± 9	36 ± 13	46 ± 16	43 ± 10	0.002	**
Cover of cryptogam layer (%)	15 ± 29	7 ± 6	50 ± 32	22 ± 21	37 ± 25	19 ± 22	23 ± 15	53 ± 19	0.002	**
Cover of litter (%)	68 ± 8	63 ± 16	35 ± 24	5 ± 4	14 ± 17	18 ± 13	38 ± 27	29 ± 12	< 0.001	***
Soil parameters										
pH (H_2O)	7.2 ± 0.3	7.2 ± 0.6	6.6 ± 0.7	7 ± 0.2	7 ± 0.5	7 ± 0.7	7.3 ± 0.5	7 ± 0.5	0.6	
pH (KCl)	6.4 ± 0.4	6.2 ± 0.6	5.6 ± 0.7	6.1 ± 0.2	6.1 ± 0.5	6 ± 0.6	6.2 ± 0.6	6.1 ± 0.5	0.3	
Organic Carbon (%)	1.5 ± 0.3	1.3 ± 0.3	0.8 ± 0.3	0.4 ± 0.1	0.9 ± 0.4	0.6 ± 0.3	0.9 ± 0.2	0.8 ± 0.4	0.003	**
N (mg/100 g)	16 ± 6	13 ± 5	11 ± 6	7 ± 3	9 ± 2	7 ± 2	13 ± 6	9 ± 4	0.001	**
$CaCO_3$ (%)	2.5 ± 0.9	3.3 ± 1.1	3.5 ± 1.1	3.3 ± 0.5	3.3 ± 0.8	2.8 ± 1.2	3.6 ± 0.8	3.6 ± 1.3	0.33	
Selected bioclimatic variables										
Annual mean temperature (°C)	9.9 ± 0.4	10 ± 0.2	9.7 ± 0.1	10.5 ± 0.2	10.3 ± 0.3	10.7 ± 0.1	10.3 ± 0.1	10.4 ± 0.2	< 0.001	***
Annual precipitation (mm)	470 ± 66	458 ± 43	512 ± 25	432 ± 12	431 ± 20	408 ± 4	433 ± 17	437 ± 17	< 0.001	***
Bio06 (T_{min} of coldest month) (°C)	-5.5 ± 0.1	-5.5 ± 0.3	-5.5 ± 0.1	-4.9 ± 0.1	-5.2 ± 0.3	-4.6 ± 0.2	-5.4 ± 0.2	-5.2 ± 0.3	< 0.001	***
Bio14 (Precipitation of driest month) (mm)	26 ± 3	24 ± 2	27 ± 1	23 ± 1	22 ± 1	21 ± 0	23 ± 1	22 ± 1	< 0.001	***
Bio17 (Precipitation of driest quarter) (mm)	86 ± 12	83 ± 6	92 ± 3	81 ± 2	80 ± 3	77 ± 1	79 ± 3	80 ± 2	< 0.001	***
Bio19 (Precipitation of coldest quarter) (mm)	93 ± 11	95 ± 10	100 ± 3	91 ± 2	91 ± 3	87 ± 1	90 ± 4	92 ± 4	< 0.001	***
Management and disturbance										
Grazing intensity (none = 0 / intensive = 3)	0.7 ± 0.8	0 ± 0	0.5 ± 0.8	0.6 ± 1.1	0.9 ± 1.0	0.4 ± 0.9	0.4 ± 0.7	0.2 ± 0.4	0.6	
Ploughing intensity (none = 0 / recent = 3)	0 ± 0	0.1 ± 0.3	0.1 ± 0.2	2.6 ± 1.1	1.7 ± 0.8	1.7 ± 0.8	0.2 ± 0.4	0.3 ± 0.5	0.2	
Disturbance total (min = 0 / max = 6)	0.7 ± 0.8	0.1 ± 0.3	0.6 ± 0.8	3.1 ± 0.4	2.5 ± 1.2	2.1 ± 0.8	0.7 ± 0.7	0.6 ± 0.5	0.4	

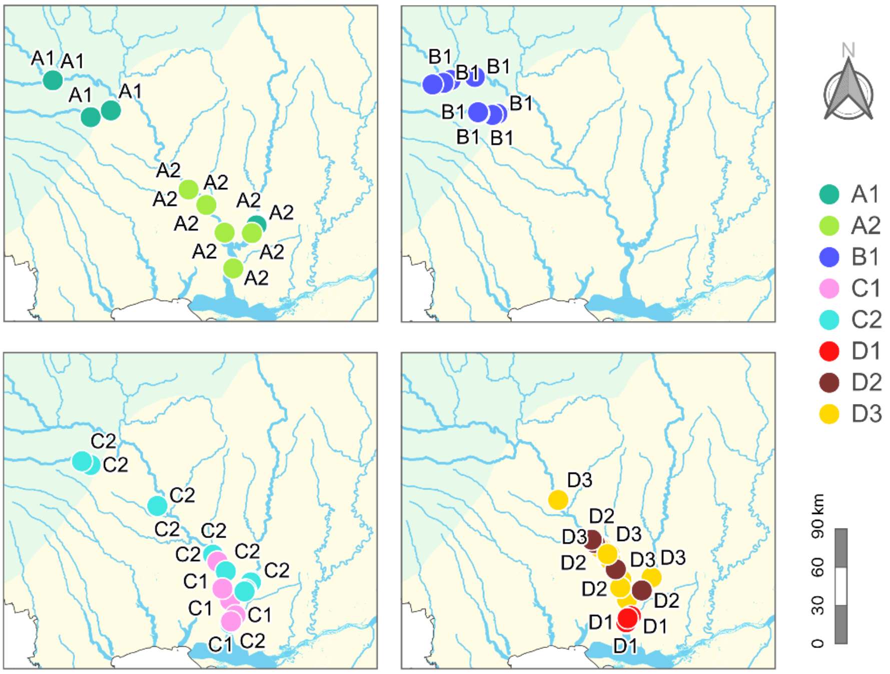

Fig. 6. Distribution maps of the surveyed communities. Codes are explained in the caption of Figure 5.

Abb. 6. Verbreitungskarten der untersuchten Gesellschaften. Die Bedeutung der Kürzel sind in der englischesprachigen Legende von Abbildung 5 erklärt.

Dry perennial anthropogenic herbaceous vegetation (1). In particular, for the individual clusters: A1 – R (5), V38 (1); A2 – R1B (9), R (4); B1 – R11 (16), R (2); C1 – R (4), R11 (2), V (1); C2 – R11 (12), R (5); D1 – R (6), R11 (4), V (2); D2 – R (7), R11 (2); D3 – R11 (13), R (10).

4.6 Land cover

The total area of sandy alluvial terraces within the study region is 21,728 ha, and most of it is situated in the Southern Buh River Valley in the steppe zone (74.2%) (Table 4). All studied river valleys contain only small proportions of natural and semi-natural areas: 0.6% in the Southern Buh River Valley in the steppe zone and 0.2–0.3% in all other regions. In total, natural and semi-natural sites account for 0.46% (100.7 ha) of the total area of alluvial terraces in the river basin, while the average size of one site equals 2.5 ha (table in Supplement E3). Intensively used pastures (1.7%) and recently ploughed areas (0.9%) can also support the existence of some psammophillous species, especially if they border with natural areas. Most of the territory of sandy terraces is represented by artificial forest plantations (50%), predominantly coniferous, preventing the establishment of species and communities of sandy grasslands. The same is true for the large areas of arable lands (16.6%) and settlements (20.2%).

Table 4. Land-cover categories and their ratio for alluvial terraces in the Southern Buh River basin. Areas (river valleys): Southern Buh (s) – Southern Buh River Valley in steppe zone; Southern Buh (f-s) – Southern Buh River Valley in the forest-steppe zone; Inhul River Valley; Kodyma – Kodyma River Valley; Savranka – Savranka River Valley. Percentages are calculated as a ratio of each area value to the total area of the certain region (sum value in row 12); percentages for sum values are calculated as a ratio of each area value to the total area of sandy terraces in all regions (21,728 ha). The extended table is given in Supplement E3.

Tabelle 4. Landnutzungskategorien und deren Anteile an den Flussterassen im Tal des Südlichen Bug (s = Steppenzone, f-s = Waldsteppenzone). Die Prozentwerte stehen für Flächenanteile der Landnutzungstypen in den jeweiligen Flusseinzugsgebieten sowie im Gesamtgebiet. Eine umfassende Version dieser Tabelle steht als elektronischer Anhang E3 zur Vefügung.

	Land-cover category / Region	**Southern Buh (s)**		**Southern Buh (f-s)**		**Inhul**		**Kodyma**		**Savranka**		**Total area**	
		ha	**%**	**ha**	**%**	**ha**	**%**	**ha**	**%**	**ha**	**%**	**ha**	**%**
1	Abandoned fields	182.2	1.1	-	-	245.3	13.5	-	-	-	-	**427.4**	**1.97**
2	Arable land	3047.3	18.9	213.5	19.9	217.3	11.9	71.12	4.3	49.4	4.6	**3598.6**	**16.6**
3	Artificial forest (broadleaf)	1782.5	11.1	362.7	33.9	194.1	10.7	172.51	10.4	20.8	1.9	**2532.5**	**11.7**
4	Artificial forest (coniferous)	5752.9	35.7	363.5	33.9	299.7	16.5	1188.8	71.9	732.4	69	**8337.3**	**38.4**
5	Industrial	1084.8	6.7	–	–	–	–	–	–	–	–	**1084.8**	**4.9**
6	Natural and semi-natural (moderately managed)	89.4	0.6	2.2	0.2	2.7	0.2	3.35	0.2	3.0	0.3	**100.7**	**0.46**
7	Pasture (intensive)	74.9	0.5	70.5	6.6	73.6	4	147.9	8.9	9.0	0.9	**375.9**	**1.7**
8	Ploughing (recent)	201.0	1.3	–	–	7.8	0.4	1.3	0.1	–	–	**210.02**	**0.9**
9	Quarries	483.4	3	6.7	0.6	93.7	5.1	34.8	2.1	9.1	0.9	**627.6**	**2.9**
10	Settlements	3382.9	21	52.1	4.9	686.4	37.7	33.4	2.0	241	23	**4395.5**	**20.2**
11	Waste deposits	34.3	0.2	–	–	–	–	–	–	2.8	0.3	**37.1**	**0.2**
12	**Total area**	**16115.7**	**74.2**	**1071**	**4.9**	**1820**	**8.4**	**1653.1**	**7.61**	**1067**	**4.9**	**21,728**	**100**

4.7 Conservation value

In total, 10 species listed in the Red Data Book of Ukraine and five species listed in regional red lists of the Mykolaiv and Odesa regions were found in the studied communities (Table 5). Most of them were vascular plants, except for the lichen *Cetraria aculeata*. The most frequent species listed in the Red Data Book of Ukraine were *Stipa borysthenica* (25.7%) and *Odontarrhena tortuosa* subsp. *savranica* (21%), whereas the most frequent species listed in the regional red list was *Thymus pallasianus* (33.3%). Most rare in the dataset red-listed species were *Allium saxatile*, *Centaurea margaritacea*, *Goniolimon graminifolium*, *Iris pumila*. The communities with the highest numbers of rare species were D3 *Centaureo margaritalbae-Caricetum colchicae* (mean: 2.3; max: 4), B1 *Centaureo savranicae-Festucetum beckeri* (mean: 1.6; max: 5) and A2 *Phleum phleoides-Stipa borysthenica* (mean: 1.6; max: 4).

Table 5. Rare species in psammophytic and hemipsammophytic communities of Southern Buh River Basin (names of clusters correspond to section 4.1). The synonymous species names according to the protected list (if differs from the followed sources) are given in brackets. Protected lists: Red Data Book of Ukraine – RDU; regional red lists of Mykolaiv and Odesa regions – RDM and RDO. For each species, percentage values of occurences in relevés are given for all relevés (Total) and for each cluster (A1–D3).

Tabelle 5. Seltene Arten in den untersuchten psammophytischen und hemipsammophytischen Gesellschaften im Tal des Südlichen Bug (Clusterkürzel wie in Kapitel 4.1). Im Fall von taxonomischen Unterschieden zwischen dem Naturschutzdokument und der hier verfolgten taxonomischen Sicht ist der Namen in ersterem in Klammern angegeben. Naturschutzdokumente: Rote Liste der Ukraine – RDU; regionale Rote Listen der Verwaltungsbezirke Mykolajiw and Odessa – RDM and RDO. Die Prozentwerte in den Zellen stehen für die prozentuale Häufigkeit der Sippen in allen Aufnahmen (Total) und den einzelnen Gesellschaften (A1–D3).

Species name (L = lichen)	Protected list	Total	A1	A2	B1	C1	C2	D1	D2	D3
Allium saxatile (*A. savranicum*)	RDU	2.9			6					9
Centaurea margaritacea	RDU	2.9					6		22	
Centaurea margaritalba	RDU	12.4							11	52
Centaurea protomargaritacea	RDU	13.3					12	67		17
Cetraria aculeata (*C. steppae*) (L)	RDU	2.9			6	14		8		
Goniolimon graminifolium	RDU	1.0		8						
Odontarrhena tortuosa subsp. *savranica* (*Alyssum savranicum*)	RDU	21.0			17	29	29	8	11	43
Pulsatilla pratensis	RDU	2.9		23						
Stipa borysthenica	RDU	25.7		85			18		22	48
Stipa capillata	RDU	3.8		31						
Centaurea savranica	RDO	3.8	17		17					
Tragopogon floccosus (*T. savranicus*)	RDO	6.7	17		33					
Iris pumila	RDM	1.9		15						
Jurinea longifolia (*J. paczoskiana*)	RDM	8.6				14	24		11	13
Thymus pallasianus	RDM	33.3			56	29	35	42		52
Mean number of rare species in 10 m^2			0.7	1.6	1.6	0.9	1.2	1.3	0.8	2.3

At the community and habitat level, open psammophytic communities of this study (clusters B1, C1, C2, D1, D2, D3) are protected in Ukraine as habitat E1.12 Euro-Siberian pioneer calcareous sand swards of Resolution 4 of the Bern Convention (COUNCIL OF EUROPE 2011), which corresponds to the "Pannonian and Pontic sandy steppe", coded as R11 in the revised EUNIS classification (see section 4.6) and E1.1a in the European Red List of Habitats, respectively, and "Sandy grasslands on neutral substrata" (T1.1.2) of the National Habitat Catalogue of Ukraine (KUZEMKO et al. 2018). Xeric hemipsammophytic vegetation in this study (cluster A) resembles the habitat "E1.2 Perennial calcareous grassland and basic steppes" of the Resolution 4 of the Bern Convention, which is confirmed by the allocation of cluster A2 to "Continental dry grassland" (R1B) by EUNIS-ESy (see section 4.6).

5. Discussion

5.1 Syntaxonomy

The presented study provides the first comprehensive overview of plant-diversity patterns of sandy vegetation in the Southern Buh River Basin, including the description of two associations endemic to the study area. However, the obtained results also raise more general issues regarding higher classification units. A proper place for both hemi-psammophytic vegetation and annual-dominated sandy grasslands of the Pontic region is still missing in the Pan-European (MUCINA et al. 2016) and national Ukrainian (DUBYNA et al. 2019) synthesis, as well as in recent overview studies (e.g. DUBYNA et al. 2020). The syntaxonomical relationships of the described communities with other sandy grasslands need further investigation and comparison of vegetation relevés from Ukraine with those from adjacent regions. In the following, I discuss some aspects and problems of syntaxonomic interpretation, which could be addressed in more detail in such follow-up studies.

5.1.1 Open perennial-dominated sandy grasslands (clusters B and D)

A major issue in the syntaxonomical classification of open perennial-dominated sandy grasslands is whether they should be combined in one class *Koelerio-Corynephoretea* s.l. or the continental types should be separated at class (*Festucetea vaginatae*, or at least ordinal level (*Festucetalia vaginatae*). Since the *Festucetea vaginatae* class was described (VICHEREK 1972), a number of studies supported its existence in national syntaxonomic systems (e.g. CHYTRÝ 2007, SANDA et al. 2008, DZIUBA & DUBYNA 2019, DUBYNA et al. 2020). The vegetation of the *Festucetea vaginatae* represents psammophytic communities of the Pannonian region and Eastern Europe, occurring on base-rich sands, which are richer in species compared to the suboceanic *Koelerio-Corynephoretea* vegetation (VICHEREK 1972, CHYTRÝ 2007). According to another widespread opinion, it makes no sense to divide continental psammophytic vegetation into two classes, since they are are very similar floristically, physiognomically, and ecologically (DENGLER 2001a, 2003, KUZEMKO 2009, MUCINA et al. 2016). Among these authors, DENGLER (2001a, 2003) and KUZEMKO (2009) consider the *Festucetalia vaginatae* order as a synonym of the *Sedo acris-Festucetalia* Tx. 1951 *nom. invers. propos.* Since national and supra-national studies could not fully resolve this issue till now, the syntaxonomical scheme of this work follows the point of view established in the EuroVegChecklist synthesis (MUCINA et al. 2016) as a current solution: sandy grasslands of the Pontic region are placed into *Festucetalia vaginatae* order of *Koelerio-Corynephoretea* class. Nonetheless, I believe that it is still needed to conduct a large-scale study with numerical analysis of psammophytic vegetation across Europe a better-founded decision on syntaxonomy of these communities.

In Ukraine, a large number of studies of psammophytic vegetation have been concentrated on the Black Sea coast, where a number of associations were described, e.g. the *Centaureo odessanae-Caricetum colchicae*, the *Secali-Cynodontetum dactyli*, the *Secali-Stipetum borysthenicae*, and the *Scabioso argenteae-Caricetum colchicae*. They share species with the vegetation of white dunes, such *Astrodaucus littoralis*, *Cynanchum acutum*, and *Eryngium maritimum* (DZIUBA & DUBYNA 2019). Conversely, these dune species are absent in the communities described in this paper, resembling inland types of *Festucion beckeri* communities. Such differences in species composition were the reason for describing the new alliance *Artemisio arenariae-Festucion beckeri* Dubyna et Dziuba in Dubyna et al. 2019, which comprises coastal communities of the *Festucetalia vaginatae* in Southern Ukraine.

By contrast, the communities described here do not include any species typical for the coastal dunes and represent the inland *Festucion beckeri* vegetation, similar and closely related to the sands of the Dnipro River Valley (VICHEREK 1972, SHEVCHYK & SOLOMAKHA 1996, DUBYNA et al. 2020). The comparison of the floristic composition of the described in this paper units (B1 *Centaureo savranicae-Festucetum beckeri* and D3 *Centaureo margaritalbae-Caricetum colchicae*) with literature data from sands of the Dnipro river (*Centaureo borysthenicae-Festucetum beckeri* and *Centaureo brevicipitis-Festucetum beckeri* in VICHEREK 1972) showed the significant role of vicariant species for the differentiation of communities, namely of the genera *Centaurea, Tragopogon,* and *Thymus* (section 4.2). The presence of vicariant species is a common feature of the sandy grasslands of the class *Koelerio-Corynephoretea*. For example, this has been mentioned for the alliances and associations in Central European, Pannonian, and Pontic regions (ĆUK et al. 2015, MUCINA et al. 2016).

Moreover, such vicariant species can also be traced between the "southern" and "northern" sandy communities within the same river valley. This leads to a clear similarity in the patterns of distribution of associations of *Festucion beckeri* alliance in two different river basins. *Centaureo brevicipitis-Festucetum beckeri* (original name: *Centaureo brevicepsis-Festucetum beckeri*) is common in the Dnipro River Valley in the steppe zone, while it is replaced by association *Centaureo borysthenicae-Festucetum beckeri* at the northern border of steppe zone and in the forest-steppe zone (VICHEREK 1972). Likewise, as shown in this work, the *Centaureo margaritalbae-Caricetum colchicae* occupies sandy areas of the Southern Buh River Basin in the steppe zone, while the *Centaureo savranicae-Festucetum beckeri* is distributed to the north, in the southern part of the forest-steppe zone (Fig. 6). Thus, there are two directions of distribution of vicariant species and syntaxa in the Black Sea Lowland: 1) from west to east between valleys and basins of different rivers, and 2) from north to south along the valley of one river. Such a pattern is also related to the direction of the flow of the main rivers in the region (from north to south).

5.1.2 Annual-dominated sandy vegetation (cluster C)

The relevés of annual-dominated successional sandy grasslands of this study (cluster C) are unevenly distributed across the study region, which is caused by the peculiarities of land use (discussed in Section 5.2). In particular, relevés of cluster C were collected mainly in the adjacent areas to the stands of cluster D (Fig. 6). Therefore, vegetation units C and D share a common species pool, particularly characteristic for the steppe zone species, which is also reflected in the structure of the dendrogram based on the modified TWINSPAN classification (Fig. 2).

The allocation of annual-dominated pioneer and ruderal sandy communities within the European and, in particular, Ukrainian syntaxonomical scheme at the alliance level still needs some clarification. Among them are the alliances *Bassio laniflorae-Bromion tectorum* in Pannonian region (SANDA et al. 2008, BORHIDI et al. 2012, MUCINA et al. 2016, ĆUK et al. 2019, PREISLEROVÁ et al. 2022) and *Sileno conicae-Cerastion semidecandri* in Central Europe (DENGLER 2004b, MUCINA et al. 2016, PREISLEROVÁ et al. 2022). Both these alliances share the characteristic species with open sandy grasslands, but largely lacks the tussock grasses, such as *Festuca* spp., *Koeleria* spp., and *Stipa borysthenica*. Some authors consider the possibility of combining them into one alliance (note by J. Dengler in MUCINA et al. 2016). However, the associations, which were described in Pannonian region as annual-dominated pioneer and ruderal vegetation – e.g. *Plantaginetum arenariae*, *Secaletum sylvestre*, *Secali sylvestri-Brometum tectorum*, are listed in Ukrainian Prodrome and placed in *Artemisio arenariae-Festucion beckeri* alliance at the same time (DZIUBA & DUBYNA 2019). Another opinion, based on particular vegetation relevés of disturbed and ruderal sandy communities made in early spring, is also given in the Ukrainian literature (SHEVCHYK et al. 2018), but there is obviously no sense in comparing such early-spring relevés with those made during the main vegetation period.

Thus, the surveyed communities *Mollugo cerviana-Carex colchica* and *Secale sylvestre-Plantago arenaria* (clusters C1 and C2) can either be framed into the Pannonian alliance *Bassio laniflorae-Bromion tectorum*, or into one of the possibly existing and not yet described alliances 1) joint alliance unifying annual-dominated pioneer sandy grasslands of Central European, Pannonian and Pontic regions, 2) separate vicariant alliance in Ukraine. I do not consider the placement of these communities into the ruderal vegetation (e.g. *Digitario sanguinalis-Eragrostietea minoris*) since their characteristic species are diagnostic for the *Koelerio-Corynephoretea* (incl. *Festucetea vaginatae*) and neophyte species (especially *Chenopodiaceae* and *Amaranthaceae*) are not represented.

The high-level classification of annual-dominated pioneer sandy grasslands in Europe is somewhat unclear. According to the EuroVegChecklist (MUCINA et al. 2016), these pioneer alliances are placed into the order *Alysso-Sedetalia* of the class *Sedo-Scleranthetea*, unlike the typical sandy alliances *Festucion beckeri* and *Festucion vaginatae* place in the *Festucetalia vaginatae* of *Koelerio-Corynephoretea canescentis*. Based on my results and referring to the syntaxonomical surveys conducted in other regions of Europe (e.g. DENGLER 2001a, 2004b, SANDA et al. 2008), this decision should be re-examined: the pioneer sandy vegetation and perennial-dominated continental sandy vegetation share the characteristic psammophilous species on high classification level and should be placed in one order.

5.1.3 Hemipsammophytic vegetation (cluster A)

The syntaxonomic assignment of studied hemipsammophytic communities (cluster A) needs further clarification. In particular, the *Phleum phleoides-Stipa borysthenica* community (A2) represents closed xeric grasslands on sandy-loamy soils, dominated by narrow-leaved grasses, with numerous species diagnostic of *Festuco-Brometea* grasslands and few constant psammophilous and acidophilous species among the characteristic taxa. Some heterogeneity of the species composition between individual relevés of cluster A2 reflects different stages of succession and corresponds to the content of organic carbon in the soil. However, most relevés of this cluster resemble hemipsammophytic xeric steppes recently reported with provisory naming *Stipo borysthenicae-Phleetum phleoidis* ass. prov. (VYNOKUROV 2016). A next successional stage of grasslands on sandy-loamy soils with higher humus content was described as *Ephedro distachyae-Stipetum capillatae* subass. *helichrysetosum arenarii* from South-Eastern Ukraine (KOLOMIYCHUK & VYNOKUROV 2016). This syntaxon represents a local variant of bunchgrass steppes with dominance of xeric grasses (*Agropyron pectinatum*, *Festuca valesiaca*, *Stipa capillata*) and a few facultative psammophilous species among the diagnostic species (e.g. *Helichrysum arenarium*, *Astragalus varius*, *Echinops ruthenicus*).

The vegetation of closed dry grasslands on sandy-loamy soils is also known outside of Ukraine. In the Pannonian region, closed sandy steppe grasslands with higher humus content are known as the associations *Astragalo austriaci-Festucetum sulcatae* and *Pulsatillo pratensis-Festucetum rupicolae* within *Festucion valesiacae* alliance of *Festuco-Brometea* class (ŠEFFEROVÁ STANOVÁ et al. 2008, BORHIDI et al. 2012, AĆIĆ et al. 2015). The meso-xeric sandy and siliceous grasslands of the Balkan Peninsula were recently placed in the *Trifolio arvensis-Festucetalia ovinae* of the *Koelerio-Corynephoretea* (PEDASHENKO et al. 2013, DENGLER et al. 2018), although in the EuroVegChecklist (MUCINA et al. 2016) the *Trifolio arvensis-Festucetalia ovinae* is synonymous of *Sedo-Scleranthetalia*). The Central European alliance *Koelerio-Phleion phleoidis* (*Festuco-Brometea* class) represents a complex vegetation type on rocky and sandy-loamy soils, distinguished by a mixture of diagnostic species of the alliances *Festucion valesiacae*, *Bromion erecti*, and sandy grasslands of *Armerion elongata* (CHYTRÝ et al. 2007). However, the *Koelerio-Phleion phleoidis* can be a partial synonym of the *Armerion elongatae* (OBERDORFER & KORNECK 1978, WILLNER et al. 2019), although the affiliation of *Armerion elongatae* s.l. at the class level remains unresolved in such a case. Finally, in the European part of Russia (Belgorod and Kursk regions), the hemipsammophytic steppes were described as a new suballiance *Artemisio campestris-Stipenion capillatae* within the alliance *Festucion valesiacae* in the subzone of meadow steppes of the south-western part of the Central Russian Upland (POLUYANOV et al. 2017). Vegetation of the *Artemisio campestris-Stipenion capillatae* from the Russian Upland is dominated by grassland species with a wide ecological amplitude (e.g. *Artemisia campestris* s.l., *Festuca valesiaca*, *Stipa capillata*), while both psammophilous species (*Astragalus varius*, *Jurinea cyanoides, Silene borystenica, Stipa borystenica*) and meso-xerophilous forbs (*Galium verum* s.l., *Lotus corniculatus*, *Silene chlorantha*) are occurring in these communities with lower cover.

As another type of transitional community on loamy-sandy soils, xero-mesic hemipsammophytic grasslands of river floodplains of Eastern Europe with a complex of characteristic species (e.g. *Agrostis vinealis*, *Dianthus borbasii*, *Koeleria delavignei*) were allocated to the *Agrostion vinealis* alliance (MUCINA et al. 2016). In Ukraine, relevés assigned to the *Agrostion vinealis* are mostly known from the forest zone and northern part of the forest-steppe zone in Ukraine (KUZEMKO 2019). The closed sandy grasslands of the *Armerion elongatae* alliance are known in Northern and Central Europe, e.i. Baltic countries, Denmark, Germany, Poland, Sweden and the Czech Republic (DENGLER 2001a, 2001c, 2003, 2004b, SÁDLO et al. 2007), making them a possible western vicariant of the *Agrostion vinealis*. Communities of the *Armerion elongatae* are rich in both psammophilous species (*Corynephorus canescens*, *Stipa borysthenica*) and loamy grassland species (*Koeleria macrantha*, *Potentilla arenaria*) and develop on soils with higher humus and fine soil particle content compared to open sandy vegetation *Corynephorion canescentis* (SÁDLO et al. 2007). The already mentioned concept of *Armerion elongatae* s.l. (including *Koelerio-Phleion phleoidis* p.p.) considers the possibility of a wide definition of this alliance – both floristically and territorially, including distribution in Eastern Europe (WILLNER et al. 2019).

As shown above, a holistic view of the hemipsammophytic communities, including xero-mesic, meso-xeric and xeric communities on sandy-loamy and loamy-sandy soils, and their place in syntaxonomy is still lacking on a European scale (MUCINA et al. 2016, WILLNER et al. 2019). In Ukraine, the difficulties in their investigation are also caused by a lack of vegetation relevé data, especially in Southern Ukraine, namely the Pontic region. In addition to the previously mentioned examples of xeric grasslands on sandy-loamy soils

(KOLOMIYCHUK & VYNOKUROV 2016, VYNOKUROV 2016; cluster A2 of this study), only a few mentions of hemipsammophytic vegetation exist in the relevant literature for the Pontic region. So, for example, hemipsammophytic vegetation with a mixture of psammophilous, meso-xerophilous and subhalophilous species is known as *Allio guttati-Festucetum rupicolae* in sandy depressions of Southern Ukraine (UMANETS & SOLOMAKHA 1999b). Recently, both xeric and mesic hemipsammophytic grasslands were also sampled during the 15th EDGG Field Workshop in Southern Ukraine (MOYSIYENKO et al. 2022), but these data have not been processed yet.

Therefore, based on the prevailing diagnostic species, the physiognomy of communities, and after applying the EUNIS-ESy and EuroVegChecklist expert systems (section 4.6), I placed the *Phleum phleoides-Stipa borysthenica* community (cluster A2) into the *Festucetalia valesiacae* order as a preliminary decision. I assume such transitional communities to be more widespread in the Pontic region where the *Festucion beckeri* alliance occurs. Thus, I refrained from formally describing a new association and exact placement of these communities on a higher classification level, as it should be done later in the research based on a more extended dataset. However, based on the results of my regional study, I believe that hemipsammophytic communities in the Pontic region differ floristically from the Central European ones and represent a vicariant alliance, although it can be confirmed only after collecting a sufficient amount of data from Southern Ukraine and adjacent regions. Moreover, I assume that it is important to distinguish xeric communities transitional between sands and true steppes (like cluster A2 in this study, distributed on slopes and dry plains in steppic climate) and mesic and xero-mesic ones (like *Agrostion vinealis* in river floodplains and depressions, mainly in forest and forest-steppe zones), which is also confirmed by characteristic species. Finally, I do not reject the possibility of assigning both xeric and xero-mesic hemipsammophytic communities to the class *Koelerio-Corynephoretea* (like *Armerion elongatae* according to DENGLER 2003, 2004b, SÁDLO et al. 2007), but this also requires performing a large-scale survey and, in general, a clear definition of the delimitation criteria for classes in phytocoenology.

5.2 Land use impact and conservation

Human activities have adversely affected sandy dry grasslands of the Southern Buh River Basin during the last century. Only small and disjoint fragments are still present in a semi-natural or natural state compared to the total area of sandy terraces (see section 4.7, Table 4). Such a decrease in quantity and quality of the sandy habitats is also reported in most European countries where sandy grassland communities occur (JANSSEN et al. 2016).

Alluvial sands in the southern part of the study area were used as vineyards and pastures from the end of the 19th to the first half of the 20th Century (PACZOSKI 1917), while since the 1970s they have been intensively afforested by coniferous trees such as *Pinus sylvestris* and *P. pallasiana* (KOLOMIETS et al. 2008). Intensive use of sandy areas in a near-natural stage is still taking place. The communities *Mollugo cerviana-Carex colchica* (C1) and *Secale sylvestre-Plantago arenaria* (C2) represent stages of succession following a disturbance in recent years, such as intensive grazing and ploughing for forestation. Studied perennial-dominated sandy grasslands south of Mykolaiv city (the locality "Halytsynivski pisky") are recovering after unsuccessful afforestation, which is reflected in the structure of community *Centaurea protomargaritacea-Calamagrostis epigejos* (D1).

Sandy areas located in the forest-steppe zone were intensively afforested during the 20th Century (SOBKO 1972). Their extent rarely changed till the present day. As a result, the river valleys situated in the forest-steppe zone are represented by the lowest proportions of natural and semi-natural sandy vegetation (0.2-0.3%; Table 4). However, the remaining natural sandy areas have not been used for a long time. This is reflected by homogeneous stands of the association *Centaureo savranicae-Festucetum beckeri* (cluster B1) characterised by highly constant diagnostic species and homogeneous structure.

Throughout the river basin, communities with a higher level of grazing intensity (A1, C2, D1, D2), contain synanthropic plants (*Berteroa incana*, *Calamagrostis epigejos, Convolvulus arvensis*, *Echium vulgare*, *Elytrigia repens*, *Vicia villosa*) among the characteristic species. Recently ploughed or intensively grazed sandy areas (C1, C2, D1) differ by the occurrence of neophytes (*Ambrosia artemisiifolia*, *Cenchrus longispinus*, *Erigeron canadensis*, *Lycium barbarum*, *Oenothera biennis*, *Tribulus terrestris*, *Pinus sylvestris*, *Prunus armeniaca*), which are typical invaders of sandy habitats across Europe (AXMANOVÁ et al. 2021, KUZEMKO et al. 2022). Nevertheless, neophyte species occur with low constancy and low cover in the studied communities, which indicates semi-natural vegetation (not ruderal), even in sandy areas influenced by intensive disturbances.

Despite the varying disturbance levels of the studied communities, they nowadays have a high conservation value (see section 4.8). Especially stands of the *Centaureo margaritalbae-Caricetum colchicae*, *Centaureo savranicae-Festucetum beckeri*, and the *Phleum phleoides-Stipa borysthenica* community are home to species listed as "endangered" in the Red Data Book of Ukraine. Among them are the endemics *Centaurea margaritacea*, *C. margaritalba*, and *C. protomargaritacea* (belonging to the so-called "pearl knapweeds") only known from locations in the Southern Buh River Basin. During the last decades, the populations of endemic pearl knapweeds are constantly declining in Ukraine in most locations both in the Southern Buh River (KRYTSKA & DERKACH 1991, KOLOMIETS et al. 2008) and Dnipro River (MOYSIYENKO et al. 2014, DIDENKO et al. 2018) valleys. One of only two known populations of *Centaurea margaritacea* has even gone extinct (KOLOMIETS et al. 2008).

At the beginning of my research, areas of natural and semi-natural sandy vegetation in the Southern Buh River Basin were not enough represented within the regional nature conservation network and the Emerald network of Ukraine. Based on the obtained results and to address the issue of protection of the valuable habitats and rare endemic species, I propose four new local reserves – "Balka Zarubina", "Halytsynivski Pisky", "Matviivski Kuchuhury", "Ozharski Pisky". Also, I proposed four new Emerald Network sites – "Halytsynivski Pisky", "Lower Inhul River Valley", "Mykolaivske Pobuzhzhia", "Voznesenske Pobuzhzhia" – which were previously published and approved by the Ministry of Energy and Environment Protection of Ukraine (SHYRIAIEVA & VYNOKUROV 2020).

Erweiterte deutsche Zusammenfassung

Einleitung – Pontische Sandtrockenrasen des Verbandes *Festucion beckeri* kommen vom Donaudelta im Westen bis zum Donbecken im Osten vor. In der Ukraine gab es bereits pflanzensoziologische Studien dieses Vegetationstyps aus dem Dnepr-Einzugsgebiet und von der Schwarmeerküste sowie darauf aufbauend nationale Synthesen (KUZEMKO 2009, DZIUBA & DUBYNA 2019, DUBYNA et al. 2020). In anderen Regionen war die Datenlage dagegen ungenügend, so im Tal des Südlichen Bug. Die vorliegende Studie versucht diese Lücke zu füllen.

Untersuchungsgebiet – Die Studie beschäftigt sich mit den sandigen Flussterassen des Südlichen Bug und seiner Nebenflüsse Inhul, Kodyma and Savranka im Südwesten der Ukraine. Sie gehören zu den Vewaltungsregionen Mykolajiw und Odessa. Das Klima ist sub-kontinental im Norden und semiarid im Süden des Untersuchungsgebietes, mit Jahresmitteltemperaturen zwischen 9,5 und 10,7 °C und Jahresniederschlägen von 400 bis 550 mm (RUDENKO 2007, KARGER et al. 2017, 2018).

Methoden – Zwischen 2018 und 2020 wurden 105 Vegetationsaufnahmen aufgenommen. Ich habe sie mit den Programmen JUICE 7.1 (TICHÝ 2002) and R (R CORE TEAM 2022) analysiert. Für die Vegetationsklassifikation verwendete ich den modifizierten TWINSPAN-Algorithmus (ROLEČEK et al. 2009) mit drei *pseudospecies cut levels* (0, 5, 15 %), vier Aufnahmen als minimaler Gruppengröße für eine weitere Aufteilung und *total inertia* als Clusterheterogenitätsmaß. Zur Habitatklassifizierung und zur Überprüfung der syntaxonomischen Zuordnung fanden die elektronischen Expertensysteme EUNIS-ESy und EuroVegChecklist Anwendung. Ich verwendete Ordinationsmethoden (CCA, DCA), um die Beziehung zwischen Umweltfaktoren und Artenzusammensetzung zu visualisieren, und Varianzanalysen, um zu ermitteln, wie sich die unterschiedenen Vegetationstypen in ihren Eigenschaften und Umweltbedingungen unterscheiden. Schließlich bestimmte ich mit QGIS 3.16 die aktuelle Flächenausdehnung von Sandtrockenrasen und setzte sie in Bezug zur Gesamtfläche von Sandablagerungen im Gebiet.

Ergebnisse – Die nicht überwachte Klassifikation ergab acht Hauptgruppen, die ich wie folgt interpretierte: offene Sandtrockenrasen des *Festucion beckeri* (*Centaureo savranicae-Festucetum beckeri* ass. nova, *Centaureo margaritalbae-Caricetum colchicae* ass. nova sowie zwei informelle Gesellschaften), therophytenreiche Sandpioniervegetation an gestörten Stellen (*Mollugo cerviana-Carex colchica*-Gesellschaft, *Secale sylvestre-Plantago arenaria*-Gesellschaft) sowie Übergänge zwischen Sand- und Kalktrockenrasen („hemipsammophytische" Gesellschaften: *Convolvulus arvensis-Festuca stricta* subsp. *sulcata*-Gesellschaft, *Phleum phleoides-Stipa borysthenica*-Gesellschaft). Die drei laut CCA maßgeblichen Faktorenkomplexe für die Differenzierung der Pflanzengesellschaften waren der organische Kohlenstoffgehalt, drei bioklimatische Variablen (Minimaltemperatur im kältesten Monat sowie Niederschlag im trockensten und im kältesten Vierteljahr) sowie das Störungsregime (Pflügen, intensive Beweidung). Gemäß Landnutzungsanalyse bedecken Sandtrockenrasen aktuell nur 0,46 % der sandigen Böden.

Diskussion – Diese Arbeit ist die erste umfassende Studie der Sandvegetation im Tal des Südlichen Bug. Einige der gefundenen Vegetationseinheiten sind aus den benachbarten Tälern nicht bekannt, wobei zwei Assoziationen wahrscheinlich sogar endemisch sind. Darüber hinaus ergeben sich Fragen bezüglich der übergeordneten Syntaxa. Bislang gibt es keine höheren Syntaxa für die ruderalen Sandtrockenrasen wie für die hemipsammophytischen Gesellschaften der pontischen Region, und zwar gleichermaßen in der europäschen Synthese (MUCINA et al. 2016) wie auch in ukrainischen Übersichtsarbeiten (DUBYNA et al. 2019, 2020). Die syntaxonomischen Beziehungen der beschriebenen Einheiten zu anderen Sandtrockenrasen bedürfen weiterer Untersuchungen basierend auf einem umfassenden Datenset aus der Ukraine und benachbarten Regionen. Die untersuchten Pflanzengesellschaften berherbergen mehrere seltene und endemische Pflanzenarten, während zugleich kaum ein Schutzstatus besteht. Dies ist besorgniserregend und sollte geändert werden. In diesem Sinne schlage ich acht neue Naturschutzgebiete vor.

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Supplements

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. Table with header data for all relevés.

Anhang E1. Tabelle mit den Kopfdaten aller Vegetatiionsaufnahmen.

Supplement E2. Sorted table with vegatation data for all relevés.

Anhang E2. Sortierte Tabelle der in dieser Studie verarbeiteten Vegetationsaufnahmen.

Supplement E3. Table with extended data on land-cover categories for alluvial terraces in Southern Buh River Basin.

Anhang E3. Tabelle mit erweiterten Daten zu Landbedeckungskategorien für alluviale Terrassen im Einzugsgebiet des südlichen Bug.

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Supplement E1. Table with header data for all relevés. Abbreviation for authors: Author(s): DS: Dariia Shyriaieva, DV: Denys Vynokurov, VS: Viktor Skorobohatov, HK: Hanna Kolomiets.

Anahng E1. Tabelle mit den Kopfdaten aller Vegetatiionsaufnahmen. Abkürzungen für die Autorinnen und Autoren: DS: Dariia Shyriaieva, DV: Denys Vynokurov, VS: Viktor Skorobohatov, HK: Hanna Kolomiets.

							GPS				Cover					Disturbance			No. of species			Soil parameters					
Releve number	Field ID	Cluster code	Date (yyyy/mm/dd)	Author(s)	Locality in Ukraine	Plot size (m^2)	Latitude	Longitude	Aspect	Inclination	vegetation total (%)	herb layer (%)	cryptogamic layer (%)	litter (%)	Max. microrelief (cm)	grazing intensity	ploughing intensity	total disturbance	total	vascular plants	cryptogams	pH water	pH KCl	Organic Carbon (%)	N (mg/100 g)	CO_2 (%)	$CaCO_3$ (%)
1	BS19011	A1	2019/07/16	DS, DV	Mykolaiv Region, Vitove distr., between Mariivka and Mykhailo-Laryne villages; Inhul River Valley	10	47,146398	32,218602	330	3	67	65	3	70	2	0	0	0	23	22	1	6,9	5,5	1,79	16,5	1,37	3,11
2	BS19012	A1	2019/07/16	DS, DV	Mykolaiv Region, Vitove distr., between Mariivka and Mykhailo-Laryne villages; Inhul River Valley	10	47,14632	32,21879	350	5	80	75	5	80	4	0	0	0	25	24	1	7,4	6,2	1,71	12,8	1,2	2,32
3	BS19014	A1	2019/07/16	DS, DV	Mykolaiv Region, Vitove distr., between Mariivka and Mykhailo-Laryne villages; Inhul River Valley	10	47,138742	32,216466	250	4	70	70	1	60	4	0	0	0	28	25	3	6,9	5,9	0,88	8,33	1,67	3,79
4	BS19036	A1	2019/07/19	DS, DV	Mykolaiv Region, Vradiivka distr., near Berizky village; Kodyma River Valley	10	47,885845	30,521686	315	2	90	65	75	70	NA	2	0	2	30	26	4	7,3	6,3	1,9	14,4	0,77	1,75
5	BS19045	A1	2019/07/20	DS, DV	Odesa Region, Savran distr., near Vilshanka village; Southern Buh River Valley	10	48,137756	30,136059	-	0	75	75	0,5	70	5	1	0	1	23	21	2	NA	6,8	1,7	26,4	1,23	2,8
6	BS19046	A1	2019/07/20	DS, DV	Odesa Region, Savran distr., near Vilshanka village; Southern Buh River Valley	10	48,13756	30,13549	-	0	90	90	5	60	4	1	0	1	27	24	3	7,5	7,4	1,26	20,4	0,61	1,39
7	BS19008	A2	2019/07/16	DS, DV	Mykolaiv Region, Bashtanka distr., near Mariivka village; Inhul River Valley	10	47,158021	32,234891	-	0	70	60	15	45	3	0	0	0	31	30	1	7,1	5,7	0,76	9,7	1,38	3,15
8	BS19009	A2	2019/07/16	DS, DV	Mykolaiv Region, Bashtanka distr., near Mariivka village; Inhul River Valley	10	47,15766	32,23488	350	4	70	65	15	60	4	0	0	0	35	32	3	7,7	5,6	1,34	24,4	1,37	3,11
9	BS19010	A2	2019/07/16	DS, DV	Mykolaiv Region, Bashtanka distr., near Mariivka village; Inhul River Valley	10	47,152498	32,227696	255	8	65	65	5	40	7	0	0	0	30	28	2	7,7	6,3	1,69	14,2	1,18	2,68
10	BS19013-1	A2	2019/07/16	DS, DV	Mykolaiv Region, Vitove distr., between Mariivka and Mykhailo-Laryne villages; Inhul River Valley	10	47,144595	32,225414	220	15	70	65	4	55	6	0	0	0	29	20	9	6,5	5,4	1,2	9,15	1,76	4,1
11	BS19013-2	A2	2019/07/16	DS, DV	Mykolaiv Region, Vitove distr., between Mariivka and Mykhailo-Laryne villages; Inhul River Valley	10	47,14454	32,22553	240	10	70	70	3	60	4	0	0	0	33	26	7	7,3	6,1	1,44	9,15	1,68	3,81
12	BS19017	A2	2019/07/17	DS, DV	Mykolaiv Region, Vitove distr., near Peresadivka village; Inhul River Valley	10	47,084547	32,16918	305	2	62	60	3	70	6	0	1	1	25	24	1	6,3	6,1	1,28	7,9	2,8	4,74
13	BS19005	A2	2019/07/15	DS, DV	Mykolaiv Region, Korabelny distr., near Mykolaiv city; Southern Buh River Valley	10	46,838331	31,979077	280	7	75	70	6	55	3	0	0	0	31	27	4	8	5,6	1,15	14,1	1,88	4,27
14	SB18098	A2	2018/07/11	DS	Mykolaiv Region, Mykolaiv distr., near Petrovo-Solonikha village; Southern Buh River Valley	10	47,088016	31,890444	80	3	60	55	5	65	NA	0	0	0	19	17	2	NA	NA	NA	NA	NA	NA
15	SB20172-1	A2	2020/07/24	DS, DV, VS	Mykolaiv Region, Mykolaiv distr., near Kovalivka village; gulley, Southern Buh River Valley	10	47,281576	31,704376	265	21	75	75	0,1	60	5	0	0	0	38	37	1	7,7	7,1	1,53	14,2	1,27	2,88
16	SB20172-2	A2	2020/07/24	DS, DV, VS	Mykolaiv Region, Mykolaiv distr., near Kovalivka village; gulley, Southern Buh River Valley	10	47,281442	31,704519	260	20	80	76	6	45	3	0	0	0	44	38	6	NA	6,3	1,44	15,6	1,65	3,75
17	SB20173	A2	2020/07/24	DS, DV, VS	Mykolaiv Region, Mykolaiv distr., near Kovalivka village; gulley, Southern Buh River Valley	10	47,280046	31,704059	55	3	90	90	0,1	85	3	0	0	0	31	30	1	6,9	6,1	0,88	18,3	0,56	1,28
18	SB20187	A2	2020/07/26	DS, VS	Mykolaiv Region, Veselynivka distr., near Riumivske village; Southern Buh River Valley	10	47,388512	31,519852	85	26	80	70	20	90	7	0	0	0	18	15	3	NA	7,1	0,62	7,19	0,66	1,51
19	SB20188	A2	2020/07/26	DS, VS	Mykolaiv Region, Veselynivka distr., near Riumivske village; Southern Buh River Valley	10	47,387095	31,52213	50	4	85	75	15	85	2,5	0	0	0	38	35	3	NA	6,8	1,42	9,76	2,2	4,6
20	BS19032-1	B1	2019/07/19	DS, DV	Mykolaiv Region, Vradiivka distr., near Kumari village; Kodyma River Valley	10	47,908715	30,62159	-	0	65	65	8	20	3	2	0	2	24	20	4	7,4	7,1	1,38	3,61	1,29	2,94
21	BS19032-2	B1	2019/07/19	DS, DV	Mykolaiv Region, Vradiivka distr., near Kumari village; Kodyma River Valley	10	47,908626	30,621701	160	2	55	55	10	15	5	2	0	2	16	13	3	6,9	6,2	0,91	6,39	1,76	3,99
22	BS19033	B1	2019/07/19	DS, DV	Mykolaiv Region, Vradiivka distr., near Berizky village; Kodyma River Valley	10	47,900516	30,570985	-	0	97	45	90	70	2	0	0	0	27	25	2	NA	6,4	1,9	10	1,64	3,72
23	BS19034	B1	2019/07/19	DS, DV	Mykolaiv Region, Vradiivka distr., near Berizky village; Kodyma River Valley	10	47,900758	30,571419	-	0	80	60	50	20	4	0	0	0	19	16	3	6,4	5,3	0,59	10,6	1,22	2,77
24	BS19035	B1	2019/07/19	DS, DV	Mykolaiv Region, Vradiivka distr., near Berizky village; Kodyma River Valley	10	47,885986	30,5212	330	4	80	40	65	15	NA	2	0	2	17	15	2	6,4	5,8	0,49	7,37	1,2	2,32
25	BS19038	B1	2019/07/19	DS, DV	Mykolaiv Region, Vradiivka distr., near Syrove village; Kodyma River Valley	10	47,911844	30,432765	-	0	60	50	15	20	10	0	1	1	33	28	5	5,4	4,7	0,74	22	1,52	3,46
26	BS19039	B1	2019/07/19	DS, DV	Mykolaiv Region, Vradiivka distr., near Syrove village; Kodyma River Valley	10	47,909383	30,431423	-	0	85	60	40	15	5	0	0	0	18	12	6	5,6	5	1,1	8,48	2,2	4,99
27	BS19040	B1	2019/07/19	DS, DV	Mykolaiv Region, Kryve Ozero distr., near Lukanivka village; Kodyma River Valley	10	47,91917	30,427457	-	0	50	50	5	70	3	0	0	0	14	12	2	7,3	5,2	0,68	20,5	1,48	3,37
28	BS19041	B1	2019/07/19	DS, DV	Mykolaiv Region, Kryve Ozero distr., near Lukanivka village; Kodyma River Valley	10	47,919486	30,424819	305	3	85	25	75	45	4	0	0	0	24	19	5	5,6	4,8	0,66	7,6	0,15	0,35
29	BS19043	B1	2019/07/20	DS, DV	Odesa Region, Savran distr., near Vilshanka village; Southern Buh River Valley	10	48,139499	30,145199	-	0	95	70	70	60	2	0	0	0	48	46	2	7,4	6,5	0,79	21,2	1,42	3,24
30	BS19044	B1	2019/07/20	DS, DV	Odesa Region, Savran distr., near Vilshanka village; Southern Buh River Valley	10	48,13966	30,14526	180	3	90	60	80	20	3	2	0	2	25	24	1	6,7	5,7	0,51	7,82	2,3	4,61
31	BS19047	B1	2019/07/20	DS, DV	Odesa Region, Savran distr., near Savran urban-type settlement; Savranka River Valley	10	48,11178	30,028611	-	0	40	30	12	25	3	0	0	0	13	11	2	NA	5,1	0,65	15	1,88	4,28
32	BS19048-1	B1	2019/07/20	DS, DV	Odesa Region, Savran distr., near Savran urban-type settlement; Savranka River Valley	10	48,120077	30,072378	-	0	80	35	55	65	4	0	0	0	16	12	4	7,6	6,2	1,1	10,1	2,3	4,63
33	BS19048-2	B1	2019/07/20	DS, DV	Odesa Region, Savran distr., near Savran urban-type settlement; Savranka River Valley	10	48,11999	30,07246	-	0	60	35	40	50	6	0	0	0	19	12	7	5,7	4,7	0,62	5,7	1,79	4,7
34	BS19049	B1	2019/07/20	DS, DV	Odesa Region, Savran distr., near Savran urban-type settlement; Savranka River Valley	10	48,119416	30,071732	-	0	45	40	2,5	75	1	0	0	0	27	23	4	7,8	5,5	0,9	17,9	1,38	3,14
35	BS19050	B1	2019/07/20	DS, DV	Odesa Region, Savran distr., near Savran urban-type settlement; Savranka River Valley	10	48,12012	30,07119	325	2	90	35	80	15	6	0	0	0	22	17	5	5,9	5,1	0,19	5,48	1,33	3,3
36	SB20132	B1	2020/07/03	DS	Mykolaiv Region, Kryve Ozero distr., near Onyskove village; Southern Buh River Valley	10	48,160905	30,39189	-	0	97	55	90	20	3	1	0	1	21	18	3	NA	5,1	0,91	9,29	1,2	2,31
37	SB20133	B1	2020/07/03	DS	Mykolaiv Region, Kryve Ozero distr., near Onyskove village; Southern Buh River Valley	10	48,160826	30,391938	-	0	80	35	85	7	8	1	0	1	26	21	5	NA	5,5	0,7	8,57	2,12	4,83
38	BS19052	C1	2019/07/23	DS	Mykolaiv Region, Korabelny distr., near Mykolaiv city; Southern Buh River Valley	10	46,846613	32,002421	-	0	45	31	0	3	4	0	3	3	6	6	0	NA	NA	NA	NA	NA	NA
39	BS19053	C1	2019/07/23	DS	Mykolaiv Region, Korabelny distr., near Mykolaiv city; Southern Buh River Valley	10	46,846226	32,001828	-	0	35	14	60	7	2	0	3	3	11	9	2	NA	NA	0,3	NA	NA	NA
40	BS19055	C1	2019/07/23	DS	Mykolaiv Region, Korabelny distr., near Mykolaiv city; Southern Buh River Valley	10	46,845149	32,001867	-	0	45	25	20	1	3	0	3	3	10	9	1	NA	NA	0,5	NA	NA	NA
41	BS19058	C1	2019/07/23	DS	Mykolaiv Region, Korabelny distr., near Mykolaiv city; Southern Buh River Valley	10	46,843854	32,001594	-	0	35	33	0	5	4	1	3	4	9	9	0	7,3	6,2	NA	NA	NA	NA
42	SB18094	C1	2018/07/10	DS	Mykolaiv Region, Mykolaiv city, Lisky distr., Southern Buh River Valley	10	46,950182	31,9467	-	0	60	42	15	15	NA	0	3	3	13	12	1	6,7	5,7	0,43	NA	NA	3,9
43	SB19056	C1	2019/07/23	DS	Mykolaiv Region, Korabelny distr., near Mykolaiv city; Southern Buh River Valley	10	46,845036	32,00183	-	0	65	30	40	5	2	0	3	3	12	11	1	7,1	6,1	NA	5,1	NA	3,2
44	SB20110	C1	2020/06/19	DS	Mykolaiv Region, Nova Odesa distr., near Balovne village; Southern Buh River Valley	10	47,031603	31,868027	-	0	30	12	20	2	1	3	0	3	19	16	3	7	6,2	0,57	10,5	1,27	2,89
45	BS19004	C2	2019/07/15	DS	Mykolaiv Region, Korabelny distr., near Mykolaiv city; Southern Buh River Valley	10	46,848233	31,99928	270	3	40	35	20	5	2	0	2	2	14	13	1	6,5	6,1	1	7,16	1,58	3,59
46	BS19018	C2	2019/07/17	DS, DV	Mykolaiv Region, Vitove distr., near Peresadivka village; Inhul River Valley	10	47,08408	32,16972	-	0	50	45	6	10	6	0	2	2	18	15	3	7,5	6,4	0,34	10	1,7	2,43
47	BS19019	C2	2019/07/17	DS, DV	Mykolaiv Region, Vitove distr., near Kalynivka village; Inhul River Valley	10	47,075214	32,156879	225	7	90	70	55	5	5	1	2	3	18	17	1	7,2	6,2	2,15	10	1,52	3,46
48	BS19020	C2	2019/07/17	DS, DV	Mykolaiv Region, Vitove distr., near Kalynivka village; Inhul River Valley	10	47,07499	32,1586	-	0	70	40	40	15	3	2	2	4	14	13	1	6,4	5,9	0,71	11,2	1,54	3,5
49	BS19021	C2	2019/07/17	DS, DV	Mykolaiv Region, Vitove distr., near Sviatomykolaivka village; Inhul River Valley	10	47,022389	32,105882	-	0	70	60	25	10	13	1	2	3	21	20	1	6,6	5,8	0,4	10,1	1,2	2,31
50	BS19022	C2	2019/07/17	DS, DV	Mykolaiv Region, Vitove distr., near Sviatomykolaivka village; Inhul River Valley	10	47,0237	32,10623	-	0	70	65	20	20	4	0	2	2	35	33	2	7	6,3	1,17	8,49	2,3	4,63
51	BS19031-1	C2	2019/07/18	DS, DV	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,80219	31,95576	-	0	80	60	40	20	7	1	0	1	17	16	1	7,3	6,9	1,17	2,87	1,66	3,79
52	BS19037	C2	2019/07/19	DS, DV	Mykolaiv Region, Vradiivka distr., near Syrove village; Kodyma River Valley	10	47,911859	30,432775	-	0	85	65	55	70	NA	0	1	1	10	9	1	7,8	5,4	0,94	10,1	1,9	4,31
53	BS19057	C2	2019/07/23	DS	Mykolaiv Region, Korabelny distr., near Mykolaiv city; Southern Buh River Valley	10	46,843312	32,001215	-	0	70	60	20	5	2	0	2	2	13	12	1	NA	NA	NA	NA	NA	NA
54	BS19061	C2	2019/07/24	DS	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,788007	31,945489	-	0	50	50	0	NA	4	0	2	2	15	14	1	NA	NA	NA	NA	NA	NA
55	BS19063	C2	2019/07/24	DS	Mykolaiv Region, Voznesensk distr., near Buzke village; Southern Buh River Valley	10	47,602837	31,200436	-	0	95	40	80	NA	3	3	2	5	19	18	1	6,7	6,2	0,91	8,73	0,76	1,73
56	BS19064	C2	2019/07/24	DS	Mykolaiv Region, Voznesensk distr., near Buzke village; Southern Buh River Valley	10	47,604482	31,20354	-	0	45	40	0,2	NA	NA	0	3	3	22	22	0	7,8	5,9	0,73	9,21	2,2	4,6
57	SB18089	C2	2018/07/10	DS	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,802689	31,956625	40	2	40	25	20	15	2	1	0	1	17	15	2	NA	NA	NA	NA	NA	NA
58	SB18102	C2	2018/07/12	DS	Mykolaiv Region, Vitove distr., near Mishkovo-Pohorilove village; Inhul River Valley	10	47,011895	32,094123	200	3	85	30	70	5	NA	1	2	3	19	18	1	6,6	5,1	0,62	9,96	1,11	2,53
59	SB20152-1	C2	2020/07/24	DS, DV, VS	Mykolaiv Region, Nova Odesa; Southern Buh River Valley	10	47,270861	31,777899	-	0	80	55	60	5	2	2	2	4	28	27	1	7,5	7	1,17	4,3	1,11	2,53
60	SB20152-2	C2	2020/07/24	DS, DV, VS	Mykolaiv Region, Nova Odesa; Southern Buh River Valley	10	47,270771	31,77801	-	0	85	60	70	10	3	2	2	4	27	26	1	NA	6	0,99	10,7	1,81	4,12
61	SB20154	C2	2020/07/24	DS, DV	Mykolaiv Region, Nova Odesa; Southern Buh River Valley	10	47,267514	31,771463	-	0	80	55	50	5	1	0	1	1	24	23	1	5,9	5,8	0,98	8,7	1,32	2,99
62	BS19024	D1	2019/07/18	DS, DV	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,791736	31,947897	-	0	70	28	55	12	15	1	2	3	20	16	4	6,7	6,1	0,46	9	0,92	2,9
63	BS19025	D1	2019/07/18	DS, DV	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,79179	31,947	-	0	70	65	15	15	7	0	2	2	20	16	4	5,9	5,7	0,81	5,37	1,53	3,49
64	BS19026	D1	2019/07/18	DS, DV	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,78756	31,935198	170	10	27	27	0	7	6	0	2	2	21	21	0	NA	NA	0,38	7,82	1,68	3,81
65	BS19027	D1	2019/07/18	DS, DV	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,78799	31,93491	-	0	60	60	0	25	9	0	2	2	19	19	0	NA	6,7	0,8	8,6	1,12	2,55
66	BS19028	D1	2019/07/18	DS, DV	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,788312	31,941491	-	0	33	30	3	10	4	0	2	2	13	10	3	6,9	5,1	0,11	5,74	0,1	0,23
67	BS19029	D1	2019/07/18	DS, DV	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,78785	31,93919	-	0	45	45	1	15	5	0	2	2	18	15	3	8,2	6,6	0,51	8,62	1,97	4,49
68	BS19030	D1	2019/07/18	DS, DV	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,788168	31,941133	-	0	40	35	4	25	6	0	2	2	14	10	4	7,9	6,1	0,93	8,57	0,77	1,75
69	BS19059	D1	2019/07/18	DS, DV	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,790155	31,946395	-	0	60	40	30	50	5	0	2	2	11	10	1	NA	NA	NA	NA	NA	NA
70	BS19060	D1	2019/07/24	DS	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,788007	31,945489	-	0	60	40	25	25	4	0	2	2	14	11	3	NA	NA	NA	NA	NA	NA
71	SB18083	D1	2018/07/08	DS, HS	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,791471	31,93892	-	0	30	30	0	2	10	1	2	3	21	21	0	NA	NA	NA	NA	NA	NA
72	SB18084	D1	2018/07/09	DS, HS	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,819936	31,95338	-	0	70	20	60	10	1	0	0	0	18	13	5	NA	NA	NA	NA	NA	NA
73	SB20111	D1	2020/06/19	DS	Mykolaiv Region, Nova Odesa distr., near Balovne village; Southern Buh River Valley	10	47,032537	31,868413	260	2	60	30	35	18	2	3	0	3	22	21	1	6,6	5,9	0,75	5,77	1,28	2,91
74	BS19015	D2	2019/07/16	DS, DV	Mykolaiv Region, Vitove distr., near Peresadivka village; Inhul River Valley	10	47,13837	32,21682	-	0	55	50	10	20	5	0	0	0	30	24	6	6,6	6	1,19	12,1	1,52	3,47
75	BS19016	D2	2019/07/16	DS, DV	Mykolaiv Region, Vitove distr., near Peresadivka village; Inhul River Valley	10	47,138103	32,216722	-	0	60	55	15	10	9	0	1	1	30	27	3	6,9	5,8	0,86	9,97	1,79	4,6
76	BS19023-1	D2	2019/07/17	DS, DV	Mykolaiv Region, Vitove distr., near Mishkovo-Pohorilove village; Inhul River Valley	10	47,013706	32,097061	-	0	75	65	20	30	3	1	0	1	25	24	1	7,4	6,2	0,91	5,65	1,83	4,17
77	BS19023-2	D2	2019/07/17	DS, DV	Mykolaiv Region, Vitove distr., near Mishkovo-Pohorilove village; Inhul River Valley	10	47,01363	32,09722	-	0	70	55	15	40	4	1	0	1	32	31	1	8,2	7,3	0,49	14,3	1,53	3,47
78	SB18095	D2	2018/07/10	DS	Mykolaiv Region, Mykolaiv city, Lisky distr., Southern Buh River Valley	10	46,950247	31,947752	-	0	55	35	20	10	NA	0	0	0	15	14	1	NA	NA	NA	NA	NA	NA
79	SB18101	D2	2018/07/10	DS	Mykolaiv Region, Vitove distr., near Mishkovo-Pohorilove village; Inhul River Valley	10	47,014095	32,097458	-	0	60	45	17	25	2	2	0	2	22	21	1	7,5	6,4	1,1	7,89	7,46	4
80	SB20175	D2	2020/07/24	DS, DV	Mykolaiv Region, Mykolaiv distr., near Kovalivka village; Southern Buh River Valley	10	47,299758	31,710205	-	0	75	60	30	90	3	0	0	0	20	14	6	7,4	4,9	0,91	20	0,87	1,97
81	SB20181	D2	2020/07/25	DS	Mykolaiv Region, Veselynivka distr., near Variushyne village; Southern Buh River Valley	10	47,343231	31,618185	-	0	90	60	60	70	6	0	1	1	24	20	4	7,3	6,3	1,1	20,1	1,51	3,44
82	SB20182	D2	2020/07/25	DS, DV, VS	Mykolaiv Region, Veselynivka distr., near Variushyne village; Southern Buh River Valley	10	47,366721	31,586381	-	0	80	70	20	50	6	0	0	0	30	25	5	NA	NA	NA	NA	NA	NA
83	BS19006	D3	2019/07/15	DS, DV	Mykolaiv Region, Korabelny distr., near Mykolaiv city; Southern Buh River Valley	10	46,83649	31,97726	-	0	70	40	50	20	4	0	0	0	28	25	3	6,2	5,7	1,13	10	2,35	5,35
84	BS19007	D3	2019/07/15	DS, DV	Mykolaiv Region, Korabelny distr., near Mykolaiv city; Southern Buh River Valley	10	46,83745	31,977735	-	0	80	55	35	35	2	0	0	0	24	21	3	6,9	5,7	0,57	11,6	1,47	3,35
85	BS19031-2	D3	2019/07/18	DS, DV	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,802053	31,955884	-	0	85	62	70	20	2	1	0	1	17	15	2	7,1	6,2	0,68	8,25	1,16	2,65
86	BS19004	D3	2019/07/15	DS, DV	Mykolaiv Region, Korabelny distr., near Mykolaiv city; Southern Buh River Valley	10	46,83821	31,9792	280	2	70	65	10	40	3	0	0	0	34	29	5	7,5	7,4	1,26	3,54	1,36	3,9
87	BS19065	D3	2019/07/25	DS	Mykolaiv Region, Voznesensk distr., near Buzke village; Southern Buh River Valley	10	47,640642	31,244421	-	0	90	50	70	65	2	0	0	0	23	21	2	NA	5,7	1,2	10	1,37	3,11
88	SB18078	D3	2018/06/10	DS	Mykolaiv Region, Mykolaiv distr., near Kovalivka village; Southern Buh River Valley	10	47,307383	31,71892	-	0	80	50	40	30	3	0	0	0	28	21	7	NA	NA	NA	NA	NA	NA
89	SB18087	D3	2018/07/09	DS, HS	Mykolaiv Region, Korabelny distr., near Mykolaiv city; Southern Buh River Valley	10	46,832368	31,970673	-	0	85	35	55	15	NA	0	0	0	22	18	4	5,9	5,8	0,81	9,31	2,4	4,64
90	SB18090	D3	2018/07/10	DS	Mykolaiv Region, Vitove distr., near Halytsynove village; Southern Buh River Valley	10	46,803229	31,956841	260	1	90	45	70	40	3	1	0	1	25	23	2	NA	NA	NA	NA	NA	NA
91	SB18099	D3	2018/07/11	DS	Mykolaiv Region, Mykolaiv distr., near Petrovo-Solonikha village; Southern Buh River Valley	10	47,088075	31,889393	-	0	65	50	15	35	2	0	0	0	14	11	3	NA	NA	NA	NA	NA	NA
92	SB18117	D3	2018/07/13	DS	Mykolaiv Region, Nova Odesa distr., near Balovne village; Southern Buh River Valley	10	47,034505	31,87869	-	0	85	40	55	25	NA	1	0	1	22	20	2	NA	NA	NA	NA	NA	NA
93	SB18118	D3	2018/07/13	DS	Mykolaiv Region, Nova Odesa distr., near Balovne village; Southern Buh River Valley	10	47,034568	31,877551	-	0	90	30	80	15	NA	1	0	1	18	17	1	NA	NA	NA	NA	NA	NA
94	SB18172	D3	2018/07/31	DS	Mykolaiv Region, Mykolaiv distr., near Kovalivka village; Southern Buh River Valley	10	47,307371	31,718141	50	4	65	40	35	15	8	0	0	0	26	19	7	NA	NA	NA	NA	NA	NA
95	SB20153	D3	2020/07/18	DS, DV	Mykolaiv Region, near Nova Odesa; Southern Buh River Valley	10	47,267957	31,769987	-	0	80	55	60	25	2	1	0	1	25	23	2	7,1	6,4	0,65	9,36	1,18	2,68
96	SB20155	D3	2020/07/18	DS, DV	Mykolaiv Region, Nova Odesa distr., near Zaive village; Southern Buh River Valley	10	47,230681	31,761824	-	0	80	65	40	30	3	0	1	1	31	28	3	6,8	6,2	0,77	9,5	0,66	1,51
97	SB20156	D3	2020/07/19	DS, DV	Mykolaiv Region, Nova Odesa distr., near Zaive village; Southern Buh River Valley	10	47,233415	31,768583	275	8	80	65	70	20	2	0	0	0	27	25	2	7,7	6,8	0,77	5,57	3,47	7,89
98	SB20157	D3	2020/07/19	DS, DV	Mykolaiv Region, Nova Odesa distr., near Novopetrivske village; Southern Buh River Valley	10	47,221627	31,77878	-	0	90	60	80	20	1	0	0	0	22	20	2	7,4	6,4	0,39	5,61	0,87	1,97
99	SB20174	D3	2020/07/24	DS, DV, VS	Mykolaiv Region, Mykolaiv distr., near Kovalivka village; Southern Buh River Valley	10	47,299888	31,709641	-	0	60	40	60	40	11	0	1	1	29	21	8	NA	6,2	0,66	8,49	1,42	3,22
100	SB20176	D3	2020/07/25	DS, DV, VS	Mykolaiv Region, Mykolaiv distr., near Kovalivka village; Southern Buh River Valley	10	47,307772	31,70935	-	0	65	35	45	20	5	0	1	1	23	18	5	6,4	5,6	0,56	4,27	1,22	2,78
101	SB20177	D3	2020/07/24	DS, DV, VS	Mykolaiv Region, Mykolaiv distr., near Andriivka village; Southern Buh River Valley	10	47,316063	31,693557	-	0	85	40	65	40	5,5	0	1	1	28	22	6	NA	5,4	1,26	14,4	1,27	2,88
102	SB20178-1	D3	2020/07/25	DS, DV, VS	Mykolaiv Region, Mykolaiv distr., near Andriivka village; Southern Buh River Valley	10	47,315499	31,684017	-	0	80	50	65	35	7	0	1	1	31	22	9	7,6	7,4	2,14	16,4	2,13	4,85
103	SB20178-2	D3	2020/07/25	DS, DV, VS	Mykolaiv Region, Mykolaiv distr., near Andriivka village; Southern Buh River Valley	10	47,315459	31,68419	-	0	80	45	60	20	5,5	0	1	1	24	16	8	7,6	7,1	0,72	5,78	1,78	4,4
104	SB20179	D3	2020/07/25	DS, DV, VS	Mykolaiv Region, Mykolaiv distr., near Yasna Poliana village; Southern Buh River Valley	10	47,312749	31,66413	-	0	70	40	55	35	5	0	1	1	23	19	4	NA	NA	0,25	6,77	0,41	0,93
105	SB20180	D3	2020/07/25	DS, DV, VS	Mykolaiv Region, Mykolaiv distr., near Yasna Poliana village; Southern Buh River Valley	10	47,312443	31,664133	-	0	70	55	30	20	12	0	1	1	27	24	3	NA	5,7	0,09	4,22	2,8	4,73

Supplement E2. Sorted table of the vegetation relevés processed in this study (cover in %; D.s. = Diagnostic species). Species are sorted by their fidelity; cryptogams (bryophytes and lichens) are given after vascular plants in all sections. Letters in the column on the left of the species names: "V" – vascular plants, "B" – bryophytes, "L" – lichens.

Anhang E2. Sortierte Tabelle der in dieser Studie verarbeiteten Vegetationsaufnahmen (Deckung in %; D.s. = Diagnostische Arten). Die Arten sind nach ihrer Treue sortiert; Kryptogamen (Moose und Flechten) sind in allen Abschnitten nach den Gefäßpflanzen aufgeführt. Buchstaben in der linken Spalte: "V" – Gefäßpflanzen, "B" – Moose "L" – Flechten.

	Cluster code	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	C1	C1	C1	C1	C1	C1	C1	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D2	D2	D2	D2	D2	D2	D2	D2	D2	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3
	Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	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	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
	D.s. *Convolvulus arvensis-Festuca stricta* subsp. *sulcata* community																																																																																																										
V	*Convolvulus arvensis*	0.01	.	0.01	0.1	0.2	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Echium vulgare*	0.2	0.1	0.5	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Festuca stricta* subsp. *sulcata*	15	.	55	.	0.5	60	.	.	.	17	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Vicia villosa*	.	.	0.1	0.2	1	0.3	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Elytrigia repens*	1	0.1	.	.	1	0.3	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Galium verum*	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Lactuca serriola*	.	0.1	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Achillea pannonica*	.	0.1	.	1	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Vicia hirsuta*	0.2	.	0.5	.	0.2	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.
V	*Carex hirta*	.	.	.	.	40	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Veronica prostrata*	.	.	.	0.2	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	D.s. *Phleum phleoides-Stipa borysthenica* community																																																																																																										
V	*Phleum phleoides*	.	.	.	.	.	.	0.3	3	5	3	1	.	.	0.2	12	4	2	1	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Galium ruthenicum*	.	.	.	.	.	.	.	1	0.2	0.2	15	.	0.1	.	3	12	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.
V	*Festuca valesiaca*	.	.	.	.	.	.	30	40	40	.	.	40	.	.	.	.	.	8	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Cleistogenes serotina* subsp. *bulgarica*	.	.	.	.	.	3	.	2	3	.	0.1	.	.	.	0.5	0.3	1	0.5	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Koeleria macrantha*	.	.	.	.	.	.	.	0.5	0.5	.	.	.	.	.	.	.	0.1	0.1	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Stipa borysthenica*	.	.	.	.	.	.	1	.	3	40	40	.	60	45	40	40	0.5	60	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	1	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25	57	.	.	.	.	40	37	25	.	.	40	.	.	25	15	.	25	.	0.5	0.1	8	.	.	.	1
V	*Bothriochloa ischaemum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	8	1	0.5	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Eryngium campestre*	.	.	1	0.5	.	7	0.1	1	0.5	.	0.2	0.3	0.1	1	0.5	0.1	0.1	.	3	.	.	0.2	.	.	0.2	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	0.5	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	0.5	.	.	0.5	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Stipa capillata*	.	.	.	.	.	.	3	5	1	.	.	.	.	.	.	.	55	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Salvia nemorosa*	.	.	.	.	.	.	0.2	0.3	.	.	.	.	.	.	.	.	0.5	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Achillea ochroleuca*	.	.	.	.	.	.	8	0.5	0.5	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Hylotelephium maximum* subsp. *maximum*	.	.	.	.	.	.	1	0.3	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Veronica barrelieri*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0.2	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Pulsatilla pratensis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	2	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Allium guttatum*	.	.	.	.	.	.	0.1	0.2	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Verbascum phoeniceum*	.	0.01	.	.	.	.	.	.	0.1	.	0.1	.	.	0.2	.	0.3	0.1	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Bromus squarrosus* subsp. *squarrosus*	0.1	.	.	.	.	.	.	0.01	.	0.1	0.1	.	.	.	0.1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	0.1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Sisymbrium polymorphum*	.	.	.	.	.	.	0.5	0.1	.	.	.	.	.	0.1	0.2	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.2	.	.	.	.	.	0.1	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Stachys recta*	.	.	0.3	.	.	.	.	0.5	.	.	.	.	.	0.2	0.3	0.5	1	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Hypericum perforatum*	.	0.01	.	.	.	.	.	0.1	.	.	.	.	0.1	.	0.2	.	0.3	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B	*Weissia longifolia*	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	0.1	1	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
B	*Ptychostomum capillare*	.	.	.	.	.	.	.	.	.	1	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	D.s. ass. *Centaureo savranicae-Festucetum beckeri*																																																																																																										
V	*Tragopogon floccosus*	.	.	.	1	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	0.5	0.5	0.5	0.5	0.2	0.5	.	0.5	0.5	.	0.5	0.3	0.5	0.5	0.5	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Festuca beckeri*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	.	20	40	40	8	17	1	22	25	30	15	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	5	.	.	.	.	.	.	0.5	38	30	30	35
V	*Asperula graveolens*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.5	.	.	.	.	.	.	0.5	.	.	.	2	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Centaurea savranica*	.	.	.	1	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	3	.	1	0.5	.	.	.	0.5	7	.	0.5	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Thymus pallasianus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	17	0.3	7	.	2	15	0.5	3	1	.	1	7	0.2	3	10	25	10	.	.	0.2	.	.	25	.	2	.	.	.	.	.	20	.	.	.	.	.	3	.	10	7	30	.	1	.	.	17	.	.	.	.	1	4	2	.	.	.	.	.	.	.	.	.	5	0.1	30	.	.	0.5	.	1	.	6	8	2	8	2	15	.	.	.	.	0.1	.	.	.
V	*Silene borysthenica*	.	.	.	0.2	0.5	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	0.3	0.01	0.1	0.5	0.2	0.1	1	0.5	0.2	1	0.3	0.5	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	5	1	.	0.5	2	0.5	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	0.5	.	0.2	.	.	.	.	.	2	.	.	.	0.5	.	.	.	.	.	0.5	.	.	0.5	.	.	.	0.5	1	.	.
V	*Veronica verna* agg.	0.1	0.1	.	.	.	.	0.01	.	.	0.1	0.1	0.1	0.1	.	0.1	0.1	.	.	0.1	0.1	0.01	0.01	0.1	0.01	0.1	0.1	0.1	0.1	.	.	0.1	0.1	0.2	0.1	0.2	0.01	0.01	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	0.2	0.1	.	0.1	.	.	0.1	0.01	0.01	0.1	.	.	0.01	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	0.01	0.01	0.01
V	*Viola tricolor* agg.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	0.01	0.1	.	0.1	0.1	.	0.1	.	0.1	.	.	0.01	0.01	.	.	0.1	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	0.5	0.1	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.5	.	0.1	.	.	.	.	.	.
V	*Koeleria glauca* subsp. *glauca*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Cytisus ruthenicus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B	*Polytrichum piliferum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.	5	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
L	*Cladonia rei*	.	.	.	.	.	.	.	.	.	0.2	0.2	.	.	.	.	0.01	.	.	.	.	.	0.1	3	.	0.5	5	3	5	.	.	.	.	.	.	7	0.01	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	0.5	.	.	.	.	0.5	.	.	.	.	.	5	0.5	.	.	.	.	.	12	.	.	.	.	.	3	0.1	.	.	.	10	.	.	2	5	1	.
B	*Brachythecium albicans*	.	.	.	5	0.5	3	.	5	1	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	2	0.5	.	0.2	80	.	.	0.1	2	0.1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.
	D.s. *Mollugo cerviana-Carex colchica* community																																																																																																										
V	*Mollugo cerviana*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	5	2	1	0.5	.	1	0.3	0.5	.	.	.	0.1	.	.	.	.	.	.	.	2	.	.	.	0.2	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1
V	*Eragrostis minor*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	0.2	.	.	.	.	.	.	7	1	.	3	0.5	0.1	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	7	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	.	.	.	.	0.5
V	*Portulaca oleracea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	2	.	0.1	10	.	.	.	.	.	.	.	0.1	0.01	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	D.s. *Secale sylvestre-Plantago arenaria* community																																																																																																										
V	*Secale sylvestre*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.1	0.5	5	.	1	.	.	0.5	0.5	.	.	.	.	.	.	.	.	.	.	25	.	35	7	15	.	.	50	40	.	.	0.2	7	0.1	20	35	7	.	.	.	.	.	.	.	.	.	0.2	0.1	.	.	.	.	.	.	0.1	.	.	.	5	0.2	.	.	.	0.5	.	0.1	.	.	.	.	5	.	.	.	.	1	.	0.2	1	0.2	.
V	*Erodium cicutarium*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	0.2	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Cuscuta* species	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.5	.	3	.	.	0.5	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Tribulus terrestris*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	13	.	0.2	0.01	.	.	.	.	0.01	0.1	.	.	.	4	1	0.2	.	.	0.1	0.01	0.1	.	.	.	.	.	.	.	0.2	.	.	0.01	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.
V	*Chenopodium album*	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	0.1	0.01	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	D.s. *Centaurea protomargaritacea-Calamagrostis epigejos* derivative community																																																																																																										
V	*Centaurea protomargaritacea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	2	.	.	.	.	5	2	.	.	.	3	0.1	0.5	0.5	2	0.5	.	.	.	.	.	.	.	.	.	.	3	.	4	.	.	.	0.5	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Calamagrostis epigejos* subsp. *epigejos*	.	60	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	0.5	2	1	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	15	50	0.2	3	2	30	30	12	.	10	.	.	.	.	.	.	.	.	.	.	20	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	1	0.1	.	.	.
V	*Centaurea odessana*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Filago arvensis*	.	.	.	.	.	.	.	.	.	.	.	0.01	0.1	.	.	.	.	.	0.1	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	.	0.01	.	.	.	.	.	.	.	0.1	.	0.5	.	.	.	.	.	6	.	0.2	0.1	.	0.1	.	0.01	3	.	.	0.5	.	0.1	.	.	.	.	.	0.01	.	0.01	.	.	0.2	.	.	.	.	.	.	.	.	.	0.5	.	.	0.1	.	.	.	.	.	0.01
V	*Heliotropium ellipticum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B	*Bryum argenteum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25	3	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	D.s. *Seseli tortuosum-Cynodon dactylon* community																																																																																																										
V	*Tragopogon borystenicus*	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.	0.1	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0.3	0.3	0.5	0.5	.	.	0.1	.	.	.	.	.	.	.	.	1	0.5	0.5	.	1	.	0.5	.	.	.	.	0.1	0.3	.	1
V	*Seseli tortuosum*	0.5	.	0.5	0.1	.	.	.	0.5	0.3	.	.	0.5	0.2	.	.	0.5	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	0.2	0.5	0.3	0.5	1	0.5	.	0.01	0.2	0.1	.	0.5	0.5	0.3	.	.	.	.	.	0.3	.	.	0.1	.	0.2	0.2	0.5	.	.	0.5	.
V	*Cynodon dactylon*	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	0.2	.	.	.	.	.	.	0.1	2	.	.	1	.	.	.	.	0.1	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	0.1	45	0.3	2	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.
V	*Verbascum* species	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Bassia sedoides*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Melica transsilvanica* subsp. *transsilvanica*	.	0.3	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.2	0.2	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Centaurea margaritacea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	D.s. ass. *Centaureo margaritalbae-Caricetum colchicae*																																																																																																										
V	*Centaurea margaritalba*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	2	5	2	1	3	1	.	0.5	4	0.5	2	5	.	.
V	*Cerastium gracile*	.	.	.	.	.	.	.	.	.	.	.	0.01	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	0.1	.	0.01	.	.	.	.	.	.	0.01	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	0.01	0.01	0.01	.	.	.	0.01	0.01	.	.	.	0.2	0.01	0.01	0.01	0.1	.	0.01
V	*Holosteum umbellatum*	.	.	.	.	.	0.01	0.01	.	.	.	.	.	.	.	0.01	0.01	.	.	.	.	.	0.01	0.01	.	0.1	.	.	0.1	.	.	.	.	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	0.01	.	0.01	0.01	0.01	0.01	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	0.01	.	0.01	.	.	0.01	.	.	0.01	0.01	.	0.01	.	.	.	0.01	0.01	0.01	0.01	0.01	0.1	0.01	0.01	0.01	0.01	0.01	.
V	*Valerianella carinata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	0.01	.	.	.	.	.	0.01	0.01	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Papaver laevigatum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.01	.	.	.	.	.	.	.
V	*Odontarrhena tortuosa* subsp. *savranica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.1	.	.	.	.	.	0.1	.	.	.	.	.	0.5	.	3	.	.	.	.	.	.	0.5	.	.	.	1	.	5	.	2	0.1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	10	.	.	.	0.01	0.1	23	0.1	.	0.5	.	4	.	.	3	.	0.3	1	.	.	.	.	.	0.1	.	.	.
B	*Hypnum cupressiforme*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.1	.	.	.	.	.
L	*Cladonia pyxidata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	3	1	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.
	Species diagnostic for two clusters:																																																																																																										
V	*Poa angustifolia*	25	7	.	40	20	2	.	5	.	.	1	0.2	1	0.3	1	0.1	2	.	0.1	0.1	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	1	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Lomelosia argentea*	0.1	.	1	.	.	.	.	.	.	0.5	0.3	.	0.5	0.3	0.5	0.01	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	1	.	.	0.1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	1	.	.	.	.	2	2	.	2	0.2	.	3	0.2	0.5	1	0.2	.	2	0.5	0.1	2	1	.	.	.	.	.	1
V	*Plantago arenaria*	.	.	0.1	.	.	.	.	.	.	4	5	1	.	0.3	.	.	.	.	.	.	.	.	.	3	0.1	.	.	.	.	.	.	.	.	.	.	.	.	1	17	6	0.5	1	0.5	0.1	5	10	45	10	22	30	0.5	.	7	3	10	8	.	0.5	1	15	0.5	.	.	0.1	.	.	.	.	.	.	.	.	0.2	5	0.5	0.5	0.5	.	.	.	.	.	.	.	0.5	.	1	.	.	.	0.5	.	.	.	1	0.5	15	5	.	.	.	.	.	.	.
V	*Bassia laniflora*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	2	0.3	5	0.2	.	.	.	0.3	0.5	.	.	.	.	.	.	.	.	0.1	.	1	1	0.1	0.1	0.3	.	15	0.5	7	0.2	30	.	15	15	0.1	.	0.5	0.1	10	3	0.2	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	0.2	.	.	.	.	.	.	10	.	0.3	.	.	0.1	.	.	.	.	0.3	.	.	.	.	.	0.2	.	.	.	0.1
V	*Anthemis ruthenica*	.	.	1	.	.	.	.	.	.	.	.	0.01	0.1	.	.	.	.	.	.	.	.	.	.	0.01	0.2	0.1	.	0.3	0.01	0.01	.	.	0.2	0.2	0.3	.	0.01	.	.	.	.	.	.	.	.	0.01	0.2	0.1	3	0.1	.	4	0.2	0.5	1	2	.	0.5	0.01	.	0.1	.	0.1	0.1	.	.	.	.	.	.	2	.	0.01	0.01	0.3	2	0.2	.	0.1	.	0.01	0.01	.	.	.	.	.	.	.	.	.	0.01	.	0.01	0.5	.	.	.	.	.	.	.	.	.	0.01
V	*Helichrysum arenarium*	.	.	.	.	.	.	.	.	.	0.3	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.	.	.	.	.	.	.	.	1	5	.	.	.	.	.	0.1	.	0.3	.	.	.	1	7	.	.	.	.	.	.	2	0.2	0.2	0.1	0.5	0.5	2	4	1	0.1	5	0.3	0.5	7	1	3	.	.	.	.	2	.	0.5	.	.	.	2	0.5	1	1	0.1	.	1	2	1	3	0.2	1	0.5	.	0.5	0.2	0.5	0.5	0.5	0.5	1	2	0.5
V	*Cytisus borysthenicus*	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	3	1	1	0.1	0.5	.	2	.	.	.	.	.	.	.	.	2	.	.	3	0.3	2	2	.	.	1	2	.	0.5	1	0.5	.	.	.	.	.	0.1	.	5	.	2	.
V	*Koeleria glauca* subsp. *sabuletorum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	30	5	.	.	1	6	.	.	.	.	.	.	.	.	.	0.1	1	.	.	.	.	0.5	.	.	.	.	1	.	.	.	0.3	.	.	2	1	3	1	1
	Other species:																																																																																																										
V	*Artemisia marschalliana*	.	.	0.1	12	12	10	2	1	6	1	1	3	0.3	.	5	7	.	0.5	1	.	.	1	0.5	10	7	4	2	2	3	0.1	.	4	3	4	10	7	10	.	.	.	.	2	.	.	.	2	.	5	.	.	2	.	.	25	2	25	0.5	0.5	2	1	3	0.1	40	.	.	.	.	.	.	.	2	5	0.01	15	10	.	0.5	12	2	.	0.5	65	7	7	0.2	0.2	7	3	25	2	7	10	2	2	12	.	5	40	1	1	10	5	2	0.2	7
V	*Anisantha tectorum*	.	.	.	.	.	.	.	.	.	.	0.1	.	0.1	0.1	0.2	.	.	.	.	0.1	0.3	0.1	.	.	15	0.1	.	0.01	1	.	.	.	.	0.5	0.5	0.01	0.01	.	.	.	.	.	1	0.1	0.2	1	0.5	.	3	0.3	3	0.3	1	0.1	5	6	0.5	15	0.5	0.2	0.5	8	0.5	0.2	2	.	0.3	0.1	3	1	3	0.5	0.01	5	7	3	0.2	1	2	.	0.5	3	0.2	2	1	0.1	0.2	7	0.5	0.1	0.5	12	7	1	0.1	0.3	2	1	0.2	4	2	0.5	2	4	2
V	*Poa bulbosa*	.	.	.	10	7	.	4	3	6	2	2	2	3	.	.	.	1	.	1	10	3	2	7	2	15	.	.	0.5	0.5	7	2	.	.	2	10	3	5	1	2	3	.	.	1	3	.	3	3	7	5	20	0.3	2	1	10	7	2	.	5	1	2	.	.	.	3	.	.	1	5	0.1	.	0.5	0.2	0.2	3	.	2	5	0.1	2	.	.	.	.	.	0.5	1	2	.	.	.	.	2	2	1	2	.	.	1	2	.	.	4	0.5	0.5	0.2
V	*Carex colchica*	.	0.01	.	.	.	.	5	0.1	0.1	.	.	.	3	0.1	.	.	.	.	.	15	25	15	5	.	0.5	3	1	0.3	10	10	3	0.3	0.5	6	.	15	1	35	35	20	30	10	10	5	.	.	.	.	.	.	5	12	.	.	.	.	.	.	.	.	5	10	10	1	.	.	0.5	30	5	.	5	1	17	.	5	30	0.5	4	30	.	.	.	20	22	5	10	3	3	5	33	.	0.5	0.1	2	10	52	2	.	30	5	7	1	2	3	0.2
V	*Alyssum* cf. *turkestanicum/minutum*	.	.	.	.	.	0.01	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.01	.	.	1	0.2	.	.	.	.	0.1	.	0.5	.	0.1	0.1	.	0.1	0.01	0.2	0.2	0.01	1	0.1	0.1	0.01	0.01	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.01	0.1	0.1	0.01	0.01	0.1	.	.	0.2	0.1	.	0.1	0.01	0.3	.	0.01	0.01	0.1	0.01	0.01	0.1	0.01	0.1	0.5	0.5	0.01	0.01	0.01	0.01	.	.	0.01	0.1
V	*Euphorbia seguieriana*	.	.	.	.	.	4	0.3	0.1	.	.	0.1	.	0.1	1	0.1	2	.	0.01	.	0.3	.	.	1	0.5	.	.	1	.	0.5	0.5	5	5	.	.	1	0.5	0.1	.	.	.	.	.	.	0.2	.	3	.	.	5	4	.	.	.	.	1	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	0.5	.	2	0.2	3	4	10	3	4	.	0.1	0.1	0.3	0.2	.	.	.	0.5	.	.	.	0.1	0.2	.	.	1	0.3	3	0.2	15	0.3	0.5	0.3	0.5	0.2
V	*Trifolium arvense*	2	1	0.5	0.2	1	1	1	1	0.1	.	0.2	7	0.3	.	0.01	2	.	.	0.2	.	.	.	.	0.5	0.1	0.5	0.1	.	.	.	5	15	.	.	.	0.3	0.1	.	.	.	.	.	.	.	.	30	0.5	15	7	20	.	.	4	.	12	.	.	.	0.1	0.5	0.01	0.3	2	.	.	.	1	.	.	.	.	.	0.01	25	35	7	15	.	.	0.2	0.1	0.1	.	.	.	15	2	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	0.2
V	*Chondrilla juncea*	0.5	.	0.5	1	0.5	3	0.2	.	.	.	.	.	0.1	.	.	.	0.01	.	0.3	.	0.5	.	.	.	.	0.5	.	.	0.1	0.5	.	0.1	.	.	.	.	0.1	.	.	.	.	2	.	.	0.5	0.5	.	.	0.1	0.1	.	.	1	.	1	.	.	.	0.5	.	.	0.5	0.1	0.2	.	0.2	0.2	.	.	.	0.3	.	0.1	0.1	0.3	.	0.1	.	.	.	0.2	0.1	0.2	0.1	.	0.3	0.5	.	.	.	.	0.2	.	.	.	0.1	.	.	0.1	.	.	.	.	.	.
V	*Gypsophila paniculata*	.	.	.	0.1	.	.	3	0.3	.	.	0.3	.	.	.	1	3	3	0.01	0.5	.	.	.	.	.	.	.	.	.	0.1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	1	.	.	2	0.1	0.2	0.2	.	0.3	.	0.1	.	.	.	0.2	.	0.5	1	.	2	0.5	.	.	0.5	2	1	2	.	0.5	.	.	0.1	.	.	.	.	.	1	2
V	*Cerastium semidecandrum*	.	.	.	.	.	0.1	0.01	.	0.1	.	.	.	.	0.01	2	.	.	.	.	.	.	0.01	0.2	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.2	0.1	.	.	.	.	.	.	0.1	0.01	0.1	0.01	.	.	0.01	0.1	.	.	.	0.01	.	0.01	0.01	.	.	0.1	0.5	.	0.1	.	.	.	.	.	.	.	.	.	0.01	.	0.01	0.01	0.1	0.01	0.01	.	.	.	.	.	.	.	.	.	.	0.1
V	*Rumex acetosella*	5	.	.	0.2	.	.	3	0.1	.	3	0.5	.	0.5	.	0.5	2	.	.	.	.	.	.	.	.	.	.	0.2	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0.3	0.1	0.3	.	.	.	1	.	.	.	.	0.1	3	0.1	.	.	.	0.1	0.5	.	.	1	.	.	.	0.3	.	8	0.1	.	.	.	.	.	.	.	.	0.2	1	.	.
V	*Linaria genistifolia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	0.1	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	2	.	.	.	.	.	.	0.1	0.2	2	0.1	.	0.3	.	.	.	4	1	.	1	.	.	.	0.1	0.1	1	0.2	.	0.1	.	.	.	.	.	.	.	.	.	.	2	0.5	.	.	0.2	.	0.1	.	0.1	0.3	0.5	0.2	0.5	0.3
V	*Astragalus varius*	.	.	.	.	.	10	.	0.5	0.2	.	0.1	.	.	0.2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	1	.	.	.	.	0.5	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	2	.	0.5	0.1	1	0.5	.	.	.	.	.	.	0.1	0.5
V	*Arenaria serpyllifolia*	0.01	0.01	0.1	.	0.1	0.1	0.01	.	.	0.1	.	.	.	0.3	0.01	0.01	0.01	.	0.01	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	0.2	0.2	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	0.01	0.1	0.01	.	.	.	0.01	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.
V	*Potentilla argentea*	4	0.5	0.1	0.5	0.5	.	0.5	0.5	.	0.5	.	.	6	.	.	.	0.01	.	0.5	.	0.2	1	.	0.1	1	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	0.1	.	.	.	.	.	0.2	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	0.1	0.2	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Erigeron canadensis*	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	0.1	0.01	0.1	0.2	.	0.5	.	.	.	.	0.1	.	0.1	.	.	.	.	.	0.1	0.5	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	0.2	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	0.01	.	.	.	.	.	.	.
V	*Myosotis stricta*	.	0.01	.	.	.	.	.	.	.	.	.	0.01	.	.	0.01	.	.	.	0.01	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	0.01	0.1	.	.	.	.	.	0.01	.	.	.	.	.	0.01	0.01	0.01	.	.	.	.	.	0.01	0.01	.	.	.	.	.	.	.	.	.
V	*Arabidopsis thaliana*	0.01	0.5	.	.	.	.	.	0.01	0.1	.	.	0.01	0.01	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.01	.	.	.	.	0.1	0.1	0.01	0.01	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	0.01	.	.	.	0.1	.	.	.	.	.	.
V	*Senecio leucanthemifolius* subsp. *vernalis*	.	0.01	.	.	.	.	.	.	.	.	0.1	0.1	.	.	0.1	.	.	.	.	.	.	0.01	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	0.01	0.01	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	0.01	0.2	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	0.1	.	0.1	.	.	.	.
V	*Jurinea cyanoides*	.	.	.	.	.	.	.	.	15	.	1	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	5	1	.	1	.	.	.	.	13	.	.	.	.	.	2	.	.	.	.	.	1	.	.	3	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	1	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	1	.	0.2	0.1	.	.	.	.	.	7	.	.	.	.
V	*Pilosella echioides*	6	0.2	.	.	.	.	0.01	0.5	.	.	0.5	.	.	.	.	0.2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0.2	.	1	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	.	.	0.5	.	0.1	.	0.3	0.5	0.3	.	0.3	.	.	.	.
V	*Polygonum patulum*	.	0.01	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.2	.	.	.	0.1	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	0.1	.	.	.	0.2	.	.	.	.	.	.	.	.	.	0.1	0.01	.	.	.	.	.	.	.	.	.	0.1	0.2	0.1	.	.	.	.	0.01	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Androsace elongata*	.	.	0.01	.	.	0.01	.	.	0.2	0.1	0.1	0.01	0.1	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	0.1	.	.	.	.	.	0.01	0.01	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.
V	*Draba verna*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	0.01	.	.	0.01	.	.	.	.	.	.	.	.	0.01	0.01	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	0.01	.	.	.	.	.	.	.	.	.	0.01	.	0.01	.	.	.	.
V	*Artemisia austriaca*	.	.	.	.	.	0.3	0.5	0.2	.	.	.	.	.	.	.	.	.	.	.	0.1	4	17	0.5	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Setaria viridis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	0.2	.	.	.	0.1	.	.	.	0.2
V	*Jurinea longifolia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	1	.	.	.	.	.	.	.	0.5	.	.	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0.2	0.3	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.
V	*Lamium amplexicaule* var. *amplexicaule*	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	0.01	.	.	.	.	.	0.01	0.01	.	.	.	.	.	.	.	.	.	0.01	0.1	.	.	.	.	.
V	*Berteroa incana*	2	0.2	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.2	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Jacobaea borysthenica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Medicago falcata*	.	.	.	0.3	.	0.3	.	.	.	.	.	.	.	.	0.2	.	0.2	.	2	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Alyssum alyssoides*	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.2	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Xeranthemum annuum*	.	.	.	.	.	.	0.01	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.
V	*Potentilla incana*	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	3	.	.	.	.	.	2	0.5	.	.	.	.	.	30	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Centaurea diffusa*	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Veronica arvensis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Verbascum lychnitis*	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	0.3	2	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Pilosella officinarum*	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Crepis sancta* subsp. *nemausensis*	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Centaurea scabiosa* subsp. *adpressa*	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Dianthus platyodon*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Securigera varia*	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Poa compressa*	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Medicago minima*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.
V	*Veronica triphyllos*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	0.01	.	0.01	.	.	.	.	.	.	.
V	*Centaurea salonitana*	.	.	2	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Asperula cynanchica*	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Equisetum ramosissimum*	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Trifolium diffusum*	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Erysimum diffusum*	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Agropyron cristatum*	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Echinops ritro*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
V	*Grindelia squarrosa*	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Allium saxatile*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
V	*Scirpoides holoschoenus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.
V	*Salsola tragus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	0.1	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Polycnemum arvense*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.
V	*Anchusa gmelinii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	0.01	.	.	.	.	.	.	.	.
V	*Sideritis montana*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	0.2	.	.	.	.	.	.	.	.	.
V	*Teucrium chamaedrys*	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Jacobaea vulgaris*	.	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Prunus spinosa* subsp. *dasyphylla* juv.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Taraxacum* sect. *Taraxacum*	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Plantago lanceolata*	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Silene latifolia*	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Hieracium umbellatum*	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Thymus × dimorphus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Euphorbia agraria*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Potentilla recta*	.	.	.	.	.	.	.	.	.	0.1	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Carex supina*	.	.	.	.	.	.	.	.	4	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Iris pumila*	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Rosa* species	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Thesium ramosum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Pinus sylvestris* juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Ambrosia artemisiifolia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Crepis ramosissima*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Medicago monspeliaca*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	0.01	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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V	*Noccaea perfoliata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Knautia arvensis*	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Picris hieracioides*	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Lotus corniculatus*	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Euphorbia esula* subsp. *tommasiniana*	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Herniaria incana*	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Jacobaea erucifolia*	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Erysimum canum*	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Achillea setacea*	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Malva thuringiaca*	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Falcaria vulgaris*	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Lycium barbarum* juv.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Goniolimon tataricum*	.	.	.	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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V	*Dianthus carbonatus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Teucrium polium*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Carduus nutans*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Verbascum chaixii* subsp. *austriacum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Goniolimon graminifolium*	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Arenaria rigida*	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Onobrychis arenaria*	.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Bromopsis riparia*	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Alyssum hirsutum*	.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Thalictrum minus*	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Prunus tenella*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Prunus armeniaca* juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Potentilla astracanica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Linaria* species	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Petrorhagia prolifera*	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Dactylis glomerata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Trifolium campestre*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Arenaria procera* subsp. *pubescens*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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V	*Linaria odora* subsp. *dulcis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Sedum acre*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Anchusa procera*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Digitaria sanguinalis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Erigeron acris* subsp. *serotinus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Cenchrus longispinus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Oenothera biennis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Gypsophila muralis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Tragopogon dubius* subsp. *major*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
V	*Veronica praecox*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
V	*Eragrostis pilosa*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.
	Other cryptogam species:																																																																																																										
B	*Syntrichia ruralis* agg.	.	.	.	70	0.1	4	15	10	4	1	3	3	4	2	.	.	.	.	1	1	1	90	45	65	7	.	.	.	0.5	80	12	52	0.5	2	70	82	70	.	45	20	.	15	40	7	20	4	55	40	25	18	40	55	20	25	85	.	20	70	60	70	50	5	7	.	.	.	.	.	.	.	.	45	35	2	.	20	15	20	17	12	40	18	50	25	70	7	70	20	50	70	6	55	80	8	60	38	70	80	20	.	20	40	30	50	25
B	*Ceratodon purpureus*	.	.	.	0.2	.	.	.	.	.	.	.	2	0.1	.	.	2	.	10	12	.	.	2	0.2	7	5	2	5	2	65	.	0.5	.	20	.	0.1	8	10	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	5	.	.	.	.	0.3	2	30	15	.	.	1	10	.	.	.	.	.	0.5	15	3	7	.	10	0.5	7	.	.	17	2	.	.	.	20	25	20	17	20	3	1	.	.	.
B	*Bryum caespiticium*	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	5	1	.	.	3	1	.	.	.	.	.	3	1	.	.	.	.	.	.	.	.	.	.	1	1	.	0.1	3	0.3	3	.	.	.	.	.	.	.	.	.	1	2	.	1	.
L	*Cladonia rangiformis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	1	3	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.
B	*Rhynchostegium megapolitanum*	.	.	.	0.5	.	1	.	0.1	.	0.1	0.1	.	.	.	.	.	3	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	3	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B	*Bryum* species	3	5	.	.	.	.	.	.	.	.	.	.	0.1	.	.	3	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	0.3	0.5	3	.	.	.	0.1	0.2	0.2	4
L	*Cladonia fimbriata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	0.5	.	.	.	.	3	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.
L	*Cladonia foliacea*	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	0.2	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.3	0.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	.	.
L	*Cladonia furcata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23	.	.	.
L	*Cladonia* species	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
L	*Cladonia glauca*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B	*Tortula* species	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	5	.	1	.	.
L	*Cladonia subulata*	.	.	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	0.1	0.01	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
L	*Cetraria aculeata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B	*Homalothecium lutescens*	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
L	*Parmelia pulla* var. *pokornyi*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
L	*Placynthiella uliginosa*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
L	*Didymocyrtis cladoniicola*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
L	*Diploschistes muscorum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.
B	*Bryum dichotomum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Shyriaieva: Classification, ecological differentiation, and conservation value of Pontic sandy grasslands in Southern Buh River Basin (Ukraine).
– Tuexenia 42 (2022).

Supplement E3. Table with extended data on land-cover categories for alluvial terraces in Southern Buh River basin.

Anahng E3. Tabelle mit erweiterten Daten zu Landbedeckungskategorien für alluviale Terrassen im Einzugsgebiet des südlichen Bug.

Region:		Abandoned fields	Arable land	Artificial forest (broadleaf)	Artificial forest (coniferous)	Industrial land	Intensive pasture	Natural and semi-natural grassland (unmanaged)	Quarries	Recent ploughing	Settlements	Waste deposits	Sum (for each region)	
Southern Buh River valley (steppe zone)	area, ha	182,2	3047,3	1782,5	5752	1084,8	74	89,4	483,4	200	3382,9	34,3	area, ha	16115,7
	% of sandy area in region	1,1	18,9	11,1	35,7	6,7	0,5	0,6	3	1,3	20,9	0,2	% of total sandy area	74,2
	number of polygons	7	17	23	30	6	5	25	16	34	31	3	number of polygons	197
	area average, ha	26	179,3	77,5	191,8	180,8	14	3,6	30,2	5,9	109,1	11,4	area average, ha	81,8
Southern Buh River valley (forest-steppe zone)	area, ha	–	213,5	362,7	363,5	–	70,5	2,2	6,7	–	52,1	–	area, ha	1071,1
	% of sandy area in region	–	19,9	33,9	33,9	–	6,6	0,2	0,6	–	4,9	–	% of total sandy area	4,9
	number of polygons	–	6	8	7	–	7	1	1	–	6	–	number of polygons	36
	area average, ha	–	35,6	45,3	51,9	–	10,1	2,2	6,7	–	8,7	–	area average, ha	29,8
Inhul River valley	area, ha	245,3	217,3	194	299,7	–	73,6	2,7	93,7	7,8	686,4	–	area, ha	1820,5
	% of sandy area in region	13,5	11,9	10,7	16,5	–	4	0,1	5,1	0,4	37,7	–	% of total sandy area	8,4
	number of polygons	4	7	3	5	–	10	2	10	5	10	–	number of polygons	56
	area average, ha	61,3	31	64,7	59,9	–	7,4	1,4	9,4	1,6	68,6	–	area average, ha	32,5
Kodyma River valley	area, ha	–	71,1	172,5	1188,8	–	147,9	3,4	34,8	1,3	33,4	–	area, ha	1653,1
	% of sandy area in region	–	4,3	10,4	71,9	–	8,9	0,2	2,1	0,1	2,0	–	% of total sandy area	7,6
	number of polygons	–	5	4	9	–	6	7	5	2	1	–	number of polygons	39
	area average, ha	–	14,2	43,1	132,1	–	24,7	0,5	7	0,6	33,4	–	area average, ha	42,4
Savranka River valley	area, ha	–	49,4	20,7	732,4	–	9	3	9,1	–	240,7	2,8	area, ha	1067,2
	% of sandy area in region	–	4,6	1,9	68,6	–	0,8	0,3	0,8	–	22,6	0,3	% of total sandy area	4,9
	number of polygons	–	4	2	8	–	2	6	3	–	5	2	number of polygons	32
	area average, ha	–	12,3	10,4	91,5	–	4,5	0,5	3	–	48,1	1,4	area average, ha	33,4
Sum (for each land-cover category)	area, ha	427,4	3598,6	2532,5	8337,3	1084,8	375,9	100,7	627,6	210	4395,5	37,1	Total area, ha	21727,6
	% of total area (21727,6 ha)	2	16,6	11,7	38,4	5	1,7	0,5	2,9	1	20,2	0,2		