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FLORA, VEGETATION AND HABITATS OF *KAYLUKA* PROTECTED AREA

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Abstract. The paper presents results from a study of the flora, vegetation and habitats of *Kayluka* Protected Area (Pleven District, Danube Plain, Bulgaria). It is one of the first protected areas in Bulgaria, with high regional and national significance. The vascular flora is presented by 844 species and subspecies from 99 families. The vegetation cover consists of various communities, but is mostly related to the deciduous forests and calcareous rocky terrains. The ruderalisation is also high because of the transformation of the biggest part of this area into recreational urban territory. Eleven habitat types (from totally 22 types), according to the Annex I of Habitats Directive, were recorded in the protected area, which is a part of the NATURA 2000 site *Studenets*.

Key words: conservation significance, plant communities, Pleven district, species diversity

INTRODUCTION

Kayluka **(Fig. 1)** is one of the first protected territories in Bulgaria (TODOROV 1982). It was designated with an area of 300 ha and a status of National Park by

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Fig 1. Map of the Protected Area *Kayluka* (based on Google Earth) with the localities of vascular plants with conservation significance: **1** - *Galanthus elwesii*; **2** - *Spiranthes spiralis*; **3** - *Himantoglossum caprinum*; **4** - *Celtis glabrata*; **5** - *Anemone sylvestris*; **6** - *Pulmonaria mollis*; **7** - *Jurinea ledebourii.*

Decree №21496/17.10.1939 of the Ministry of Agriculture and State properties. Later, it was transformed into Protected Area and its borders were expanded (999.8 ha) under an Order №3700/29.12.1972 of the Ministry of Forestry and Conservation of Environment. According to the Order №800/04.11.2008, it is a part of NATURA 2000 sites: SPA and SCI BG0000240 *Studenets*. During the period 1946–1971, following the efforts of a special committee led by General Ivan Vinarov, a big part of the valley was transformed into an urban park area. Numerous forest plantations, tree and shrub compositions have replaced or affected significantly its natural vegetation. This was also accompanied by the construction of many chalets, summer houses, hotels, touristic infrastructure such as alleys, artificial lakes and dams, *etc.* Actually, the main part of the protected areas has been used as urban park for different types of recreation. On spring days, thousands of people visit this area (Management Plan of *Kayluka* Protected Area and *Razbititsa* Natural Monument 2011-2021, hereafter abbreviated as MPKPARNM 2011-2021).

In spite of the importance of the protected area (for the conservation of the nature, as well as for a recreational site), its flora, vegetation and habitats have never been studied in any specialized work. This is probably due to the fact that the Protected Area *Kayluka* is located in a region of Bulgaria, which has remained peripheral for the active biodiversity studies. The earliest data on the flora is contained in the work of Urumov (1925), which is generally dedicated to the Pleven District, but *Kayluka* locality was mentioned in relation to many vascular plants. Some of them which were not confirmed by our recent study, could also indicate a possible negative successional changes of the ecosystems there. The main source of information on the flora and vegetation is the PhD thesis by Tzonev (2002). Although it refers to the Middle Danube Plain, there are described many communities found in *Kayluka* Protected Area. It was followed by several works, also by Tzonev (2004, 2009, 2013, 2017), where plant associations or protected species from this region (including *Kayluka*) were published. There are data about the flora of *Kayluka* in some shorter floristic and taxonomic notes as well (Panov 1996; Tzonev et al. 2017). The information about the floristic diversity is also provided in the biggest unpublished inventory of the biota (including flora, vegetation and habitats) - the Management Plan (2011-2021) of the Protected Area *Kayluka* and of the Natural Monument *Razbititsa* (MPKPARNM 2011-2021).

MATERIAL AND METHODS

The largest part (12 km long) of the studied Protected Area *Kayluka* is occupied by the canyon-like Tuchenitsa River valley, a right tributary of the Vit River. It has typical carst structure and its slopes are represented by 40-50 m high steep rocks and walls of organogennic limestone at Upper Cretaceous age (mostly Maastricht), rich in macrofossils (Tzankov et al. 1981). According to Velev (1990) the climate is temperate-continental, with western and north-western winds, and the average of

rainfalls 500-600 mm/year. Due to the high runoff of the Maastricht limestone in the Pleven syncline and the alluvial deposits of the Vit River, the Pleven Heighs are characterized by greater soil humidity of 40-50 mm per year. There are also karst springs - the largest one is Srebrostruy (Mihaylov et al. 1989). Tuchenitsa River is with a short spring freshet and a long summer-autumn low water flow. Specifically, for the rivers crossing the Pleven syncline, the karst feeding significantly influences their flow. Because of the numerous small valleys and steep slopes, there are also episodic torrential floods (Mihaylov et al. 1989). According to Ninov (2002), the dominating soil type is Chromic Luvisol. However, some skeletal soils, such as Rendzic Leptosols, are also common.

The study was carried out over a long period of personal observations performed by the authors (1997-2017), as well as during a special inventory in the period 2008-2009 for the purposes of the special Management Plan. The identification of taxa (***Appendix 1***) and the nomenclature of the vascular plants were according to Kozhuharov (1992) and Delupavlov & Cheshmedzhiev (2003). The full cheklists of established taxa were completed with data for endemic and subendemic (noted with E) (Petrova & Vladimirov 2010), protected species (Annex II, III and IV of Bulgarian Biological Diversity Act), species with conservation significance according to the Bulgarian Red Lists and Red Data Books (Petrova & Vladimirov 2009; Peev et al. 2015). The categories were provided according to Petrova & Vladimirov (2009): CR – *Critically Endangered*; EN – *Endangered*; VU – *Vulnerable*; NT – *Near Threatened*, DD – *Data deficient*, LC – *Least Concern*. For each vascular plant species the frequency and distribution on the territory of the protected area was given. The following groups were presented in the checklist with their abbreviations: Common (C), Comparatively Rare (CoR), Rare (R), Very Rare (VR), Possibly Extinct (PE), and Probably Distributed (PD). The syntaxonomy followed the methodology of Braun-Blanquet (1964). The syntaxonomical nomenclature was based on the latest revision of the European vegetation (Mucina et al. 2016). The habitats were determined according to EUNIS habitat classification (Davies et al. 2004) and the corresponding units with the Habitats Directive (Council Directive 92/43/EEC) were also given.

RESULTS AND DISCUSSION

Flora

On the territory of the studied protected area, 844 species and subspecies of vascular plants belonging to 406 genera and 99 families were identified by the existing literary data and recent study. Most of the vascular plant species in *Kayluka* are widespread in the country as weeds, ruderals or dominant species in the natural and secondary vegetation. However, some of them are rare for this area, especially in the cases when it is located on the periphery of their range of distribution in the country. Such are some species common to the mountain and foothill regions of Bulgaria like

Hepatica nobilis Mill., *Phyllitis scolopendrium* (L.) Newn., *Dryopteris filix-mas* (L.) Shott., and *Ceterach officinarum* DC. They have reached the Danube Plain only in single localities and form small populations limited to the dark and moist valleys. Some of the species noted for the area or its surroundings in the past by URUMOV (1925) currently are possibly extinct from the area.

The checklist of flora does not include dozens of exotic and introduced species, although some of them are spread spontaneously, such as: *Celtis australis* L., *Cercis siliquastrum* L., *Koelreuteria paniculata* Laxm., *etc.* Most of these species, however, do not really spread within the studied protected area and exist only as cultivated single trees or small groups. Such species are: *Celtis occidentalis* L., *Chamecyparis lawsoniana* (A. Murray) Parl., *Gingko biloba* L., *Juniperus virginiana* L., *Picea pungens* Engelm., *Pinus strobus* L., *Taxus baccata* L, *Psedotzuga douglasii* (Sabine ex D. Don) Carrière and many others.

Most of the species (467 taxa) were defined as Common in the whole protected territory. Comparatively Rare were 159 species, Rare - 144, Very Rare - 61 species (with one or two localities) and 7 were Possibly Extinct. One species (*Dictamnus albus* L.) noted by URUMOV (1925) could possibly be found, but has not been confirmed for a long period now and was accepted by us as Probably Distributed. Seven species are included in the Red Data Book of Bulgaria and the Red List as *Vulnerable*, *Endangered* and *Near Threatened*. The population in *Kayluka* of one of them, *Galanthus elwesii* Hook f., is of national significance. *Kayluka* is also one of the few protected areas in Bulgaria with a population of *Jurinea ledebourii* Bunge. The localities of species enlisted in the Red Data Book and the Red List are shown on Fig. 1 with numbers. One species, *Orchis papilionacea* L. (Vu), was found in the vicinities of Pleven, Brestovets and Radishevo (URUMOV 1925), i.e. area, which possibly includes *Kayluka*. However, this species has not been confirmed anywhere in the last decades, and probably is *Extinct*.

1. ***Galanthus elwesii* Hook f.** - EN. It was found in forests of *Tilia tomentosa* Moench or *Carpinus orientalis* Mill. and has numerous populations in the protected area.
2. ***Spiranthes spiralis* (L.) Chevall.** - VU. A single very small population was found in the protected area, in the shrubs mostly of *Fraxinus ornus* L. (TZONEV ET AL. 2017).
3. ***Himantoglossum caprinum* (M. Bieb.) Spreng** - VU. The species is also a target for BG0000240 *Studenets*. The established population was numerous and located mostly in secondary habitats - forest plantations and lilac shrubs (TZONEV ET AL. 2017).
4. ***Celtis glabrata* Stev. ex Planch.** – EN. A single specimen was found on Popskata Skala locality (the Big Dam) in the protected area.
5. ***Anemone sylvestris* L.** - NT. One very small population was found in the protected area. However, it could be of anthropogenic origin.
6. ***Pulmonaria mollis* Velen.** - It was in the old Red Data Book of Bulgaria (VELCHEV

1984), but in the current Red List was assessed as Least Concern. Because of the construction activities around Orbita Hotel (single locality in the area), this population has not been confirmed in the last 15 years.

7. ***Jurinea ledebourii* Bunge.** – EN. Several small populations were found in the protected area, mostly in shrubs and rocky grasslands.

Amongst these species, only *Himantoglossum caprinum* (L.) Spreng. is enlisted both in Annex II and III of the Biodiversity Act. A total of 9 species are protected (enlisted in ***Appendix 3***), and 19 species are in its Annex IV (controlled use).

Vegetation and habitats of the Protected Area *Kayluka*

The vegetation of the *Kayluka* Protected Area is characterized by a great diversity - 10 classes, 11 orders, 14 alliances, 15 associations and 3 communities (***Appendix 2***), but predominantly the artificial and highly anthropogenically influenced communities are dominant. The vegetation and habitats could generally be divided into the following main groups: aquatic, grassland, chasmophytic, forest and shrub. There are a lot of artificial communities such as forest plantations, ruderal vegetation, etc. The checklist of habitats is presented in ***Appendix 3***. It includes 22 natural, semi-natural and artificial habitats. The corresponding habitat types (11 types) according to the Annex I of Habitat Directive and Biodiversity Act were also shown in this checklist.

1. **Aquatic vegetation** - There are no large ponds in *Kayluka*. The Tuchenitsa River flows through it and three small dams were built. The diversity of aquatic vegetation is poor. Typical are the communities dominated by *Myriophyllum spicatum* L., *Potamogeton nodosus* Poir., *P. pussilus* L., *Zannichellia palustris* subsp. *pedicellata* (Wahleb et Rosén) Hook. The vegetation along the periphery of wetlands is dominated by *Typha latifolia* L., *Phragmites australis* (Cav.) Trin. ex Stend., *Schoenoplectus lacustris* (L.) Pall., and *Sparganium erectum* L. Along the Tuchenitsa River there are communities of *Angelica sylvestris* L., *Epilobium hirsutum* L. and *Scrophularia umbrosa* (Stoj.) Peev.
2. **Gralsslands** - This vegetation is presented by petrophytic (rocky) steppes, dry pastures and mesophytic meadows.
   2. 1. The petrophytic (rocky) steppes are spread on the slopes above the rocks. They are dominated by mostly aromatic herbs and semi-shrubs such as *Achillea clypeolata* S. et S., *Satureja montana* ssp. *kitaibelii* (Wierzb. ex Heuff.) Ball., *Teucrium polium* ssp. *capitatum* (L.) Arcangeli.
   2. 2. Dry pastures are relatively rare in the protected area and most of them are degraded. They do not occupy large areas and, in most cases, their floristic composition is highly ruderalized. The dominated grass species are *Poa pratensis* L., *Festuca valesiaca* Schleich. ex Gaud., *Chrysopogon gryllus* (L.) Trin. and *Dichanthium ischaemum* (L.) Roberty.
   2. 3. The mesophilous meadows were mostly distributed in the valley of the Tuchenitsa River in the past. After the transformation of the protected area

for recreational purposes, they were almost completely destroyed. Today, despite the presence of some species, such as *Arhenatherum elatius* (L.) Beauv ex J. et C. Presl., this vegetation has been replaced by ruderal and semi-ruderal communities.

3. **Chasmophytic vegetation** - It occurs on the vertical limestone walls on both sides of the valley, but mostly on the eastern part. The most widespread species in their composition are *Asplenium trichomanes* L., *A. ruta-muraria* L., *Galium lucidum* All., *Seseli rigidum* Waldst. et Kit., etc. Some rare or endemic species also participate in its composition, such as *Centaurea affinis* ssp. *balcanica balcanica* (Urum. et Wagn.) Dost., *Dianthus petraeus* ssp. *noeanus* (Boiss.) Tutin, *Celtis glabrata* Stev. ex Planch. *Kayluka* is *locus classicus* of *Parietaria erronea* Panov - local endemic for this region of the country (Panov 1996), assessed as *Data Deficient* in the Red List of Bulgarian vascular plants.
4. **Forests** - Although there are a lot of forests in the protected area, most of them are plantations, and the natural forest vegetation is highly fragmented, isolated and subject to rapid degradation. Only the massif of the forest *Bohotska Gora* represents a larger complex of natural predominantly oak forest vegetation.
   4.1 Natural forests - The largest areas in *Kayluka* are occupied by the forests dominated by *Quercus cerris* L., in some places co-dominated by *Q. frainetto* ten. *Tilia tomentosa* forests have limited distribution on the northeast slopes of the canyon near the Vinarov House. The forests of *Carpinus orientalis* are the second widespread natural forests after the oak forests in *Kayluka*. They occur on the slopes of the canyon, on shallow and eroded soils and on the rocks. Their flora is a rich in ephemeroides like *Galanthus elwesii*, *Scilla bifolia* L., *Anemone ranunculoides* L., *Isopyrum thalictroides* L., *Corydalis* spp. In *Kayluka*, there is also one small intrazonal forest of *Carpinus betulus* L. - on the eastern slope of the canyon behind the chalet *Srebrostruy*. The alluvial willow-poplar forests have been widespread in the valley of the Tuchenitsa River. Today they practically do not occur in *Kayluka*, mostly only groups of willows and black poplars have been found. In many places, the natural riparian vegetation has been replaced by some not native species like *Acer negundo* L. or planted hybrid poplars.
   4.2 Forest plantations - The most common plantations in the area are these ones of *Robinia pseudoacia* L., *Pinus nigra* L., *Picea abies* (L.) H. Karst., *Populus* x *canadensis*, *Fraxinus pennsylvanica* Marshall, *etc*. The plantations of *Robinia pseudoacacia* are the most widespread amongst the planted alien species. In some places of *Kayluka* there are also *Juglans regia* L. plantations. These plantations are very dry and overgrown with natural tree, shrub and grass species. The coniferous plantations (mainly *Pinus nigra*) have been planted not only because of their rapid growth and their wood, but also in many places, because of aesthetic reasons.

Everywhere, outside of the valley bottom, reaching a certain age, due mostly to the summer drought, these forests begin to dry up. Today, in the most places coniferous plantations are in poor condition, often burned by summer fires. Some other natural and planted species have, also have negligible participation in the forest vegetation of the area. They are *Quercus robur* L. (single or group of threes), *Q. pubescens* Willd., *Ulmus minor* L., *Fraxinus ornus* (common as single three or small groups), *Picea abies*, *Gleditsia triacanthos* L. Very high degree of presence of exotic, non-European species represented as single trees, small groups or even small-scale plantations is characteristic to the park area. Such species are *Pseudotsuga douglasii*, *Picea pungens*, *Juniperus virginiana*, and many others.

5. **Shrubs** - In the Protected Area *Kayluka*, there are many shrubs, which are of natural origin and, could rarely be decorative species. The natural shrub vegetation is secondary due to the forest degradation on the steep slopes of the valley. These degraded forests are represented by mixed or monodominant communities of *Paliurus spina-christi* Mill. and *Syringa vulgaris* L. There are also communities of *Mahonia aquifolium* (Pursh.) Nutt, *Lycium barbarum* L. (Archeological site *Storgozia*), *Cercis siliquastrum* (the dams) and others, some of which spontaneously spread in the park.

CONCLUSION

Although *Kayluka* is one of the first protected areas, it is highly urbanized and used as a recreational park of town Pleven. However, it still has a great floristic, taxonomic and syntaxonomic diversity, and is important for the conservation of many protected and endangered plant species, as well as for plant communities and habitats with European nature conservation significance.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests regarding the publication of this article.

AUTHOR CONTRIBUTIONS

This paper is prepared by Rossen Tzonev. Rumyanka Baleva and Ivan Purvanov completed the manuscript after check in the herbarium of Regional Historical Museum of Pleven, and they also determined the categories of presence and rarity of all plant taxa.

References

Biological Diversity Act. State Gazette, Sofia, issue 77, August 2002, last change and addition issue 66, July 2013 (In Bulgarian)

Braun-Blanquet J. 1964. Plant sociology: The study of plant communities. Hafner, London, 439 pp.

Council Directive 92/ 43/ EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Retrieved on 01.10.2018 from http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm.

Davies C., Moss D. & Hill M. 2004. EUNIS habitat classification revised. Final report to Environment Agency and European Topic Centre on Nature Protection and Biodiversity.

Delipavlov D. & Cheshmedzhiev I. (Eds) 2003. Key to the plants in Bulgaria. Agric. Univ. Press, Plovdiv, 591 pp. (In Bulgarian).

Kozhuharov S. (Ed.) 1992. Field Guide to the vascular plants in Bulgaria. Nauka & Izkustvo, Sofia, 788 pp. (in Bulgarian).

Management plan of *Kayluka* Protected Area and *Razbititsa* Natural Monument 2011-2021, established according to order RD-206/28.03.2011 of MOEW (State Gazette, nr. 31/2011). Retrieved on 01.10.2018 from: http://www.moew.government.bg/bg/priroda/zastiteni-teritorii/planove-za-upravlenie-na-zastiteni-teritorii-vlezli-v-sila/zastiteni-mestnosti-i-prirodni-zabelejitelnosti/ (In Bulgarian).

Mihaylov C., Tishkov H., Zyapkov L. & Gorunova D. 1989. Danube plainy-hilly region. - In: Mishev K. (Ed.), Geography of Bulgaria. Vol. 3, Physico-geographic and social-economic regioning of Bulgaria, Publ. House of BAS, Sofia, 29-65 (In Bulgarian).

Mucina L., Bültmann H., Dierssen K., Theuriat JP., Raus T., Čarni A., Šumberová K., Willner W., Dengler J., Gavilán García R., Chytrý M., Hájek M., Di Pietro R., Iakushenko D., Pallas J., Daniëls F., Bergmeier E., Santos Guerra A., Ermakov N., Valachovič M., Schaminée J., Lysenko T., Didukh Y., Pignatti S., Rodwell J., Capelo J., Weber H., Solomeshch A., Dimopoulos P., Aguiar C., Hennekens S. & Tichý L. 2016. Vegetation of Europe: Hierarchical floristic classification system of vascular plants, bryophytes, lichen, and algal communities. – Appl. Veget. Sci. 19 (1): 3-264.

Ninov N. 2002. Soils. – In: Kopralev I. (Ed.), Geography of Bulgaria. Physical Geography. Socioeconomic Geography, ForCom, Sofia, 277-315 (In Bulgarian).

Peev D., Petrova A., Anchev M., Temniskova D., Denchev C., Ganeva A., Gussev Ch. & Vladimirov V. (Eds). 2015. Red Data Book of the Republic of Bulgaria. Vol. 1. Plants and Fungi. BAS & MoEW, Sofia, 881 pp.

Petrova A. & Vladimirov V. (Eds). 2009. Red List of Bulgarian Vascular Plants. – Phytol. Balcan. 15 (1): 63-94.

Petrova A. & Vladimirov V. 2010. Balkan endemics in the Bulgarian flora. – Phytol. Balcan. 16 (2): 293-311.
Panov P. 1996. New taxa for the Bulgarian Flora. - Fitologija 48: 3-10.
Todorov T. 1982. Protected natural objects in Pleven District. Aleksandar Pushev Printing House, Pleven, 53 pp. (In Bulgarian).
Tzankov V., Pamoukchiev A., Tchechmejieva V. & Motekova N. 1981. Les fossils de Bulgarie. V. Cretace Superieur. Editions de L'Academie Bulgare Des Sciences, Sofia, 233 pp. (In Bulgarian).
Tzonev R. 2004. New data and summarized information about the chorology of some rare, threatened and endemic plants in Middle Danube Plain and Balkan Foothill region - Ann. Univ. Sof., Biol. Fac., Book 2 – Botany 97: 62-72.
Tzonev R. 2009. Syntaxonomy of the natural and semi-naturalvegetation of the Middle Danube Plain in Bulgaria. – Biotechnol. & Biotechnol. EQ. 23/2009/ SE, Special edition – on-line: 354-359.
Tzonev R. 2013. New plant associations from Danube Plain, Bulgaria. - Phytol. Balc. 19 (2): 233-256.
Tzonev R. 2017. Two new associations from the herbaceous riparian vegetation in the Central Danubian Plain, Bulgaria. - Phytol. Balcan. 23 (2): 271-280
Tzonev R., Baleva R. & Purvanov I. 2017. Report 75-77. - In: Vladimirov V. Dane F., Stevanovic V. & Tan K. (Eds), New floristic records in the Balkans, 32; Phytol. Balcan. 23 (1): 137-138.
Velev S. 1990. The climate of Bulgaria. Narodna Prosveta, Sofia, 179 pp. (In Bulgarian).
Velchev (Ed.) 1984. Red Data Book of the P. R. Bulgaria. 1 Plants. Izd. BAN, Sofia, 447 pp. (In Bulgarian).
Urumov I. 1925. Fourteenth contribution to the Bulgarian flora. Book. 21. BAS, Sofia, 208 pp. (In Bulgarian).

Appendix 1.

Checklist of vascular plants in the Protected Area *Kayluka*. For abbreviations, please follow the text of the paper.

POLYPODIOPHYTA

Aspidiaceae: *Dryopteris filix-mas* (L.) Shott. – VR; BA IV; **Aspleniaceae:** *Asplenium trichomanes* L. – C; *A. adianthum-nigrum L.* – R; *A. ruta-muraria L.* – C; *Phyllitis scolopendrium* (L.) Newn. – VR; *Ceterach officinarum* DC – VR; **Athyriaceae:** *Cystopteris fragilis* (L.) Bernh. – R; **Polypodiaceae:** *Polypodium vulgare* L. – VR.

EQUISETOPHYTA

Equisetaceae: *Equisetum arvense* L. – C; *E. telmateja* Ehrh. – CoR; *E. ramosissimum* Desf. – R; **MAGNOLIOPHYTA:** Magnoliopsida: **Juglandaceae:** *Juglans*

regia L. – R; **Salicaceae:** *Populus alba* L. – CoR; *P nigra* L. – CoR; *Salix fragilis* L. – CoR; *S. alba* L. – C; *S. purpurea* L. – R; **Betulaceae:** *Alnus glutinosa* (L.) Gaertn. – VR; *Carpinus betulus* L. – VR; *C. orientalis* Mill. – C; *Corylus avellana* L. – R; **Fagaceae:** *Quercus cerris* L. – C; *Q. dalechampii* Ten. – VR; *Q. robur* L. – R; *Q. frainetto* Ten. – CoR; *Q. virgilliana* (Ten.) Ten. – R; *Q. pubescens* Willd. – R; **Ulmaceae:** *Ulmus minor* L. – C; *Celtis glabrata* Stev. ex Planch. – VR; EN; E; **Moraceae:** *Morus alba* L. – C; *Ficus carica* L. – C; **Canabaceae:** *Humulus lupulus* L. – C; *Canabis sativa* L. – C; **Urticaceae:** *Urtica urens* L. – C; *U. dioica* L. – C; *Parietaria erronea* Panov – C; DD; E; *P. officinalis* L. – C; **Santalaceae:** *Comandra elegans* (Roch. et Rchb.) Reichenb. – C; *Thesium simplex* Velen. ssp. *moesiacum* (Velen.) Koz. et Kuzm. – VR; E; **Polygonaceae:** *Rumex acetosella* L. – R; *R. tuberosus* L. – C; *R. crispus* L. – C; *R. pulcher* L. – C; *R. obtusifolius* L. – C; *Polygonum aviculare* L. – C; *P. rurivagum* Boreau. – C; *Persicaria maculata* (Raf.) S. F. Gray – C; *P. hydropiper* (L.) Opiz. – C; *P. mitis* (Schrank) Assen. – C; *Bilderdykia convolvulus* (L.) Dum. – C; *B. aubertii* (Louis Henry) Moldenke – C; **Phytolaccaceae:** *Phytolacca americana* L. – C; **Portulacaceae:** *Portulaca oleraceae* L. – C; **Caryophyllaceae:** *Paronychia cephalotes* (Bieb.) Bess. – C; *Herniaria hirsuta* L. – C; *Scleranthus perennis* L. – C; *S. annus* L. – C; *Minuartia setacea* (Thurill) Hay. ssp. *setacea* – C; *Arenaria serpyllifolia* L. – C; *Holosteum umbellatum* L. – C; *Stellaria holostea* L. – C; *S. graminea* L. – C; *S. media* (L.) Vill. – C; *Myosoton aquaticum* (L.) Moench. – C; *Moenchia mantica* (L.) Bartl. – CoR; *Cerastium glomeratum* Thuill. – C; *C. brachypetalum* Pers. – C; *Gypsophilla muralis* L. – CoR; *Saponaria officinalis* L. – C; *Petrorhagia saxifraga* (L.) Link. – C; *P. prolifera* Ball. et Heyw. – CoR; *P illyrica* Ball. et Heyw. – CoR; *Dianthus armeria* L. – PE; *D. pallens* S. et S. – C; *D. petraeus* Waldst. et Kit. ssp. *noeanus* (Boiss.) Tutin – R; E; *D. giganteus* D'Urv. ssp. *giganteus* – R; *D. moesiacus* Vis. et Panc. ssp. *moesiacus* – R; E; *Cucubalus baccifer* L. – CoR; *Silene alba* (Mill.) E. Krause – C; *S.conica* L. ssp. *conica* – CoR; *S. dichotoma* Ehrh. ssp. *dichotoma* – C; *S. dichotoma* ssp. *racemosa* (Otth.) Grbn. – C; *S. noctiflora* L. – C; *S. vulgaris* (Moench.) Garcke. ssp. *vulgaris* – C; *S. italica* (L.) Pers. – C; *S. viridiflora* L. – C; *Lychnis coronaria* (L.) Desr. – C; *Viscaria vulgaris* Rohl. ssp. *atropurpurea* (Griseb.) Stoj. – CoR; **Chenopodiaceae:** *Chenopodium botrys* L. – C; *C. vulvaria* L. – CoR; *C. polyspermum* L. – C; *C. hybridum* L. – C; *C. ficifolium* Sm. – C; *C. glaucum* L. – C; *C. album* L. – C; *Atriplex hortensis* L. – C; *A.hastata* L. – CoR; *A. patula* Waldst. et Kit. – C; *Kochia scoparia* (L.) Schra – C; *Salsola ruthenica* Iljim. – CoR; *Polycnemum arvense* L. – CoR; **Amaranthaceae:** *Amaranthus hybridus* L. – C; *A. retroflexus* L. – C; *A. albus* L. – C; *A. lividus* L. – CoR; **Ranunculaceae:** *Helleborus odorus* Waldst. et Kit. – C; *Isopyrum thalictroides* L. – C; *Nigella arvensis* L. – C; *Consolida regalis* S. F. Gray. – C; *C. hispanica* (Costa) Greut. et Burd. – C; *Thalictrum aquilegifolium* L. ssp.

storgosiacum P. Pan. – CoR; E; *T. minus* L. – CoR; *Anemone sylvestris* L. – VR; NT; BA III; *A. ranunculoides* L. – C; *Clematis vitalba* L. – C; *C. recta* L. – VR; *Ranunculus trichophyllus* Chaix. – CoR; *R. ficaria* L. – C; *R. pedatus* Waldst. et Kit. – VR; *R. illyricus* L. – C; *R. millefoliatus* Vahl.– C; *R. repens* L. – C; *R. sardous* Crantz – VR; *R. acris* L. – C; *R. sceleratus* L. – C; *R. arvensis* L. – C; *R. auricomus* L. – VR; *R. villosus* DC. ssp. *constantinopolitanus* A. Elen. – VR; E; *R. falax* (Wimm. et Grab.) Sloboda – VR; *R. polyanthemos* L. – C; *Hepatica nobilis* Mill. – VR; *Adonis flammea* Jacq. – C; *A. aestivalis* L. – C; **Berberidaceae:** *Berberis vulgaris* L. – VR; *Mahonia aquifolium* (Pursh.) Nutt. – C; **Ceratophyllaceae:** *Ceratophyllum demersum* L. – C; **Aristolochiaceae:** *Aristolochia clematitis* L. – C; **Paeoniaceae:** *Paeonia peregrina* Mill. – VR; BA IV; **Hypericaceae:** *Hypericum hirsutum* L. – CoR; *H. perforatum* L. – C; *H. elegans* Stephan. ex Willd. – VR; **Papaveraceae:** *Chelidonium majus* L. – C; *Glaucium corniculatum* (L.) J. H. Rudolph. – VR; *Papaver dubium* L. – C; *P. rhoeas* L. – C; *Corydalis solida* (L.) Swartz. – C; *C. bulbosa* (L.) DC – C; *Fumaria vaillantii* Loisel. – CoR; *F officinalis* L. – C; **Brassicaceae:** *Sisimbrium officinale* (L.) Scop. – C; *S. orientale* L. – C; *Descurainia sofia* (L.) Webb. ex Prantl. – C; *Alliaria petiolata* (Bieb.) Cavara et Grande – C; *Myagrum perfoliatum* L. – C; *Erysimum repandum* L. – C; *E. diffusum* Ehrh. – C; *E. cuspidatum* (Bieb.) DC – C; *Hesperis sylvestris* Crantz. ssp. *sylvestris* – CoR; VU; BA III *Rorripa sylvestris* (L.) Bess. – C; *R. pyrenaica* (L.) Reichenb. – CoR; *Turritis glabra* L. – CoR; *Cardamine bulbifera* (L.) Crantz. – CoR; *Arabis turrita* L. – CoR; *A. recta* Vill. – CoR; *A. sagittata* (Bertol.) DC – CoR; *Lunaria annua* L. – CoR; *Alyssum saxatile* L. – C; *A. minutum* Schlecht. ex DC. – C; *A. alyssoides* L. – C; *A. minus* (L.) Rothm. ssp. *hirsutum* (Bieb.) Stoj. et Stev. – C; *Berteroa incana* (L.) DC – C; *Draba muralis* L. – VR; *Erophila verna* (L.) Bess. ssp. *verna* – C; *Camelina microcarpa* Andz. ex DC. – VR; *C. sativa* (L.) Crantz. ssp. *sativa* – VR; *Capsella bursa-pastoris* (L.) Medic – C; *Thlaspi perfoliatum* L. – C; *T. arvense* L. – C; *T. alliaceum* L. – C; *Lepidium perfoliatum* L. – CoR; *L. campestre* (L.) R. Br. – C; *Cardaria draba* (L.) Desv. – C; *Conringia orientalis* (L.) Dum. – C; *Brassica nigra* (L.) Koch – C; *Sinapis arvensis* L. – C; *Calepina irregularis* (Asso) Thell. – C; *Raphanus raphanistrum* L. – C; **Resedaceae:** *Reseda lutea* L.– C; **Crassulaceae:** *Sedum maximum* (L.) Suter. – C; *S. hispanicum* L. – C; *S. album* L. – VR; *S. ochroleucum* Chaix. – VR; *S. sartorianum* Boiss. – CoR; **Saxifragaceae:** *Saxifraga tridactylites* L. – CoR; **Rosaceae:** *Filipendula vulgaris* Moench. – C; *Rubus caesius* L. – C; *R. lloydianus* Genev. – R; *Rosa myriacantha* DC ex Lam. et DC. – R; *R. arvensis* Huds. – R; *R. gallica* L.– C; *R. canina* L. – C; *R. vosagiaca* Desp. – VR; *Agrimonia eupatoria* L. ssp. *eupatoria* – C; *Aremonia agrimonoides* (L.) DC. – R; *Sanguisorba minor* Scop. ssp. *minor* – C; *Geum urbanum* L. – C; *Potentilla micrantha* Ramond ex DC. – CoR; *P. supina* L. – CoR; *P. argentea* L. – C; *P. neglecta* Baumg. – C; *P. bornmuelleri* Borb. – VR;

P. reptans L. – C; *P. pedata* Willd. – VR; *P. pilosa* Willd. – CoR; *P. obscura* Willd. – C; *Fragaria vesca* L. – CoR; *F. moschata* Duch. – C; *Pyrus pyraster* Burgsd. – C; *P. nivalis* Jacq. – R; *Malus sylvestris* Mill. – R; *M. praecox* (Pall.) Borkh. – VR; *Sorbus domestica* L. – R; *S. torminalis* (L.) Crantz– VR; *Cotoneaster niger* (Thunb.) Fries – PE; *C. integerrimus* Medic. – VR; *Crataegus monogyna* Jacq. – C; *Prunus machaleb* L. – VR; *P avium* L. – VR; *P. spinosa* L. – C; *P. cerasifera* Ehrh. – C; **Fabaceae:** *Chamaecytisus hirsutus* (L.) Link. – C; *Bituminaria bituminosa* (L.) Stirt. – C; *Amorpha fruticosa* L. – C; *Galega officinalis* L. – C; *Robinia pseudoacacia* L. – C; *Astragalus onobrychis* ssp. *chlorocarpus* (Griseb.) Stoj. et Stef. – C; *A. cicer* L. – CoR; *A. glycyphyllos* L. – CoR; *Dorycnium herbaceum* Vill. – C; *Lotus corniculatus* L. – C; *Coronilla scorpioides* (L.) Koch – C; *C. varia* L. – C; *Onobrychis vicifolia* Scop. – R; *O. arenaria* (Kit.) DC – R; *Ononis arvensis* L. – R; *Trigonella coerulea* (L.) Ser. – R; *Medicago lupulina* L. – C; *M. falcata* L. – C; *M. arabica* (L.) Huds. – R; *M. orbicularis* (L.) Bartal. – R; *M. minima* (L.) Bartal. – CoR; *M. rigidula* (L.) All. – R; *Melilotus alba* Medic. – C; *M. officinalis* (L.) Pall. – C; *Trifolium campestre* Schreb. – C; *T. repens* L. ssp. *repens* – C; *T. alpestre* L. ssp. *lanigerum* (Ser.) Hayek – C; E; *T.. ochroleucon* Huds. ssp. *caucasicum* (Tausch.) Koz. – VR; *T. pratense* L. – C; *T. echinatum* Bieb. – C; *T. incarnatum* L. ssp. *molinerii* (Babb. ex Hornem.) Syme – R; *T. arvense* L. – C; *Vicia serratifolia* Jacq. – CoR; *V. narborensis* L. – C; *V. tetrasperma* (L.) Schrb. – C; *V. lathyroides* L. – C; *V. peregrina* L. – C; *V. pannonica* Crantz ssp. *panonica* Crantz – C; *V. pannonica* ssp. *striata* (Bieb.) Nyman – C; *V. grandiflora* Scop. – C; *V. sativa* L. – C; *V. hirsuta* (L.) S. F. Gery. – CoR; *V. varia* Host. – C; *V. cracca* L. – C; *Lathyrus nissolia* L. – C; *L. aphaca* L. – C; *L. pannonicus* (Jacq.) Garcke ssp. *varius* (C. Koch) Ball. – VR; *L. sylvestris* L. – R; *L. sativus* L.– R; *L. hirsutus* L. – C; *L. pratensis* L. – R; *L. tuberosus* L. – C; *L. sphaericus* Retz. – C; *L. laxiflorus* (Desf.) O. Kuntze – R; *L. niger* (L.) Bernh. – R; *L. vernus* (L.) Berhn. – VR; **Oxalidaceae:** *Oxalis corniculata* L. – C; **Geraniaceae:** *Geranium sanguineum* L CoR; *G. lucidum* L. – CoR; *G. robertianum* L. – C; *G. phaeum* L. – VR; *G. columbinum* L. – CoR; *G. dissectum* L. – R; *G. pussilum* L. – C; *G. pyrenaicum* Burm. – C; *G. rotundifolium* L. – C; *Erodium cicutarium* (L.) L' Her – C; **Zygophyllaceae:** *Tribulus terestris* L. C; **Linaceae:** *Linum hirsutum* L. ssp. *hirsutum* – R; *L. tenuifolium* L. – CoR; **Euphorbiaceae:** *Mercurialis ovata* Sternb. et Hoppe – R; *M. perennis* L. – R; *Euphorbia chamaesyce* L. – C; *E. polychroma* Kern. – CoR; *E. helioscopia* L. – C; *E. amygdaloides* L. – R; *E. nicaensis* All. ssp. *nicaensis* – C; *E. cyparissias* L. – C; *E. esula* L. ssp. *tommasiniana* (Bertol.) Nyman – C; *E. agraria* Bieb. – C; **Rutaceae:** *Haplophyllum suaveolens* (DC) G. Don. – CoR; *Dictamnus albus* L. – PD; **Simaroubaceae:** *Ailanthus altissima* (Mill.) Swingle – C; **Polygalaceae:** *Polygala vulgaris* L. – R; *P. major* Jacq. – R; **Anacardiaceae:** *Cotinus coggygria* Scop. – C; **Aceraceae:** *Acer tataricum*

L. – C; *A. campestre* L. – C; **Celastraceae:** *Euonymus verrucosus* Scop. – CoR; *E. europaeus* L. – CoR; **Staphyleaceae:** *Staphylea pinnata* L. – R; **Rhamnaceae:** *Rhamnus catharticus* L. – R; *Rh. saxsatilis* Jacq. ssp. *saxatilis*– R; *Paliurus spina-christi* Mill. – C; **Tiliaceae:** *Tilia tomentosa* Moench. – C; *T cordata* Mill. – R; **Malvaceae:** *Abutilon theophrastii* Medic. – C; *Lavatera thuringiaca* L. – C; *Althaea hirsuta* L. – CoR; *A. officinalis* L. – CoR; *A. cannabina* L. – CoR; *Alcea rosea* L. – R; *A. pallida* (Waldst. et Kit. ex Wild.) Waldst. et Kit. – R; *Malva sylvestris* L. – C; *Hibiscus trionum* L. – C; **Thymeleaceae:** *Thymelaea passerina* (L.) Coss. et. Germ. – R; **Eleagnaceae:** *Elaeagnus angustifolia* L. – R; **Violaceae:** *Viola mirabilis* L. – VR; *V. reichenbachiana* Jord. ex Boreau. – CoR; *V. sieheana* Becker – R; *V. jordanii* Hanry. – C; *V. suavis* Bieb. – C; *V. odorata* L. – C; *V. alba* L. – C; *V. hirta* L. – C; *V. kitaibeliana* Schult. – CoR; *V. arvensis* Murr. – C; **Cistaceae:** *Helianthemum nummularium* (L.) Mill. – R; *Rhodax canus* (L.) Fuss. – PE; **Tamaricaceae:** *Tamarix ramosissima* Ledeb. – R; **Cucurbitaceae:** *Bryonia alba* L. – VR; **Lythraceae:** *Lythrum salicaria* L. – R; **Onagraceae:** *Epilobium hirsutum* L. – C; *E. parviflorum* Schreb. – CoR; **Haloragaceae:** *Myriophyllum spicatum* L. – CoR; **Cornaceae:** *Cornus mas* L.– C; *C. sanguinea* L. – C; **Araliaceae:** *Hedera helix* L. – C; **Apiaceae:** *Eryngium campestre* L. – C; *Myrroides nodosa* (L.) Cann. – C; *Anthriscus sylvestris* (L.) Hoffm. – R; *A. nemorosa* (Bieb.) Spreng. – R; A. *cerefolium* (L.) Hoffm. – C; *A. caucalis* Bieb. – R; *Torilis ucranica* Spreng. – R; *T japonica* (Houtt.) DC – R; *T. arvensis* (Huds.) Link. ssp. *arvensis* – C; *T arvensis* ssp. *neglecta* (Schult.) Thell. – C; *Caucalis platicarpos* L. – C; *Turgenia latifolia* (L.) Hoffm. – VR; *Orlaya grandiflora* (L.) Hoffm. – C; *Bifora radians* Bieb. – C; *Conium maculatum* L. – C; *Bupleurum praealtum* L. – C; BA IV; *B. affine* Sald. – VR; BA IV; *Falcaria vulgaris* Bernh. – C; *Pimpinella saxifraga* L. – CoR; *Aegopodium podagraria* L. – CoR; *Sium latifolium* L. – VR; *Berula erecta* (Huds.) Coville – C; *Seseli rigidum* Waldst. et Kit. ssp. *rigidum* – CoR; *Physospermum cornubiensis* (L.) DC – VR; *Angelica pancicii* Vand. – VR; VU; E; *A. sylvestris* L. – R; *Ferulago sylvatica* (Bess.) Reichenb. – R; *Peucedanum longifolium* Waldst. et Kit. – VR; *P. alsaticum* L. – CoR; *Pastinaca hirsuta* Panc. – C; *P. sativa* L. ssp. *sativa* – C; *Heracleum sibiricum* L. – C; *Tordilium maximum* L. – C; *Laser trilobum* (L.) Borkh. – C; *Daucus carota* L. – C; **Primulaceae:** *Lysimachia nummularia* L. – C; *L. vulgaris* L. ssp. *glandulo-villosa* (Beck.) Peev – R; *L. punctata* L. – VR; *Anagalis arvensis* L. ssp. *arvensis* – C; *A. arvensis* L. ssp. *foemina* (Mill.) Schinz. et Thell. – C; *Androsace maxima* L. – R; *Primula veris* L. ssp. *canescens* (Len.) Ludi – R; BA IV; **Plumbaginaceae:** *Plumbago europaea* L. – R; **Oleaceae:** *Fraxinus ornus* L. – C; *Syringa vulgaris* L. – C; *Ligustrum vulgare* L. – C; **Gentianaceae:** *Centaurium erythraea* Rafn. ssp. *erythraea* – C; **Apocynaceae:** *Vinca herbacea* Waldst. et Kit. – CoR; *V. minor* L. – CoR; **Asclepiadaceae:** *Vincetoxicum*

hirundinaria L. – CoR; **Convolvulaceae:** *Convolvulus arvensis* L – C; *C. cantabrica* L. – C; *Calystegia sepium* (L.) R. Br. – C; *C. sylvatica* (Kit.) Griseb. – C; **Cuscutaceae:** *Cuscuta monogyna* Vahl. – C; *C. europaea* L. – C; *C. epithymum* L. ssp. *epithymum* – CoR; **Rubiaceae:** *Sherardia arvensis* L. – C; *Crucianella angustifolia* L. – R; *Asperula purpurea* (L.) Ehrend. – R; *A. taurina* L. ssp. *leucanthera* (G. Beck.) Hayek – CoR; E; *A. tenella* Heuff. ex Deg. – R; *A. cynanchia* L. – C; *Galium humifusum* Bieb. – C; *G. octonarium* (Klokov) Soo – C; *G. pseudoaristatum* Schur. – C; E; *G. verum* L. – C; *G. lucidum* All. – C; *G. album* Mill. ssp. *album* – C; *G. aparine* L. – C; *Cruciata pedemontana* (Bell.) Ehrend. – C; *C. laevipes* Opiz. – C; *C. glabra* (L.) Ehrend. – R; **Boraginaceae:** *Heliotropium europaeum* L. – C; *Buglossoides purpurocaerulea* (L.) Johnst. – C; *B. arvensis* (L.) Johnst. – C; *Cerinthe minor* L. – C; *Echium italicum* L. – C; *E. vulgare* L. – C; *Pulmonaria officinalis* L. – C; *P. mollis* Wulf. ex Horn. – VR; LC; *Nonea pulla* (L.) DC – R; *Symphitum officinale* L. – R; *Anchusa procera* Bess. – CoR; *A. officinalis* L. – C; *Asperugo procumbens* L. – C; *Myosotis laxa* Lehm. ssp. *caespitosa* (C. F. Schultz.) Hyl. ex Nordhl. – R; *M. scorpiodes* L. – R; *M. stricta* Link. et Koem. et Schult. – R; *M. ramosissima* Roch. – CoR; *Lappula marginata* (Bieb.) Gurke. – CoR; *L. squarosa* (Retz.) Dum. – R; *Cynoglossum officinale* L. – R; *C. creticum* Mill. – R; *C. hungaricum* Simk. – R; **Verbenaceae:** *Verbena officinalis* L. – C; **Lamiaceae:** *Teucrium polium* L. ssp. *capitatum* (L.) Arcangeli – C; *T. montanum* L. ssp. *montanum* R; *T. chamaedrys* L. – C; *Ajuga chamaepytis* (L.) Schreb. ssp. *chia* (Schreb.) Arcangeli – C; *A. laxmanii* (L.) Benth. – CoR; *A. genevensis* L. – C; *A. reptans* L. – C; *Mentha pulegium* L. – C; *M. arvensis* L. C; *M. aquatica* L. – CoR; *M. spicata* L. ssp. *spicata* – C; *M. longifolia* (L.) Huds. – C; *Lycopus europaeus* L. – C; *L. exaltatus* L. – CoR; *Origanum vulgare* L. ssp. *vulgare* – CoR; *Thymus callierii* Borb. ex Velen. ssp. *urumovii* Velen. – C; E; *T. moesiacus* Velen. – R; E; *T. sibthorpii* Benth. – R; E; *Melissa officinalis* L. ssp. *officinalis* – R; *Satureja montana* L. ssp. *kitaibelii* (Wierzb. ex Heuff.) Ball. – C; E; *Calamintha sylvatica* Bromf. ssp. *sylvatica* – CoR; *C. nepeta* (L.) Savi. ssp. *glandulosa* (Req.) Ball. – CoR; *Acinos arvensis* (Lam.) Dandy – CoR; *A. rotundifolius* Pers. – CoR; *A. alpinus* (L.) Moench. ssp. *hungaricus* (Simonk.) Sojak – C; *Clinopodium vulgare* L. – C; *Marrubium peregrinum* L. – PE; *Sideritis montana* L. – C; *Glechoma hederacea* L. – C; *G. hirsuta* Waldst. et Kit. – C; *Melittis melissophyllum* L. ssp. *albida* (Guss.) Ball. – R; *Leonurus cardiaca* L. – CoR; *L. marrubiastrum* L. – CoR; *Ballota nigra* L. ssp. *nigra* – C; *Stachys officinalis* (L.) Trev. – CoR; *S. germanica* L. – C; *S. annua* L. – C; *S. recta* L. ssp. *subcrenata* (Vis.) Briq. – C; E; *S. palustris* L. – CoR; *S. sylvatica* L. – R; *Phlomis tuberosa* L. – CoR; *Lamium maculatum* L. – CoR; *L. amplexicaule* L. – C; *L. purpureum* L. – C; *Lamiastrum galeobdolon* (L.) Ehrend. et Polaschek. ssp. *galeobdolon* – CoR; *Galeopsis ladanum* L. – R; *Prunella laciniata* L. – CoR; *P vulgaris* L. – C; *Salvia verticillata* L. – C; *S.*

aethiopis L. – C; *S. amplexicaulis* Lam. – R; *S. virgata* Jacq. – R; *S. nemorosa* L. – C; *Scutellaria columnae* All. – R; *S. altissima* L. – R; **Solanaceae:** *Hyoscyamus niger* L. – R; *Physalis alkekengi* L. – R; *Solanum dulcamara* L. – C; *S. nigrum* L. – C; *S. schultesii* Opiz. – C; *Datura stramonium* L. – C; *Lycium barbatum* L. – C; **Scrophulariaceae:** *Verbascum blattaria* L. – CoR; *V. phoeniceum* L. – C; *V. phlomoides* L. – C; *V. banaticum* Schrad. – C; *V. nigrum* L. – CoR; *V. lychnitis* L. – CoR; *Kickxia spuria* (L.) Dum. – R; *K. elatine* (L.) Dum. – C; *Cymbalaria muralis* Gaertner. – R; *Linaria vulgaris* Mill. – C; *L. genistifolia* (L.) Mill. ssp. *linifolia* (Boiss.) Davis. – C; *L. genistifolia* ssp. *genistifolia.* – C; *Scrophularia umbrosa* (Stoj.) Peev – CoR; *Gratiola officinalis* L. – CoR; *Pseudolysimachion orhideum* (Crantz) Wraber – R; *Veronica austriaca* L. ssp. *jaquinii* (Baugm.) Maly – C; *V. prostrata* L. – R; *V. chamaedrys* L. – R; *V. teucrium* L. ssp. *teucrium* – R; *V. anagalis-aquatica* L. ssp. *anagalidiformis* (Boreau.) Jav. et Soo – C; *V. triphyllos* L. – C; *V. arvensis* L. – C; *V. verna* L. ssp. *verna* – C; *V. triloba* (Opiz.) Kern. – C; *V. hederifolia* L. – C; *V. persica* Poir. – C; *V. polita* Fries – C; *Digitalis lanata* Ehrh. – C; *Melampyrum arvense* L. ssp. *arvense* – CoR; *M. arvense* ssp. *pseudobarbatum* (Schur.) Wettst. – CoR; *M. cristatum* L. ssp. *solstitiale* (Ronn.) Ronn. – CoR; *Odontites verna* (Bell.) Dum ssp. *serotina* (Dum) Corb. – C; *Rhinanthus rumelicus* Vel. – C; E; **Orobanchaceae:** *Lathraea squamaria* L. – VR; *Orobanche ramosa* L. – R; *O. alba* Steph. ex Willd. – R; *O. caryophyllaceae* Sm. – R; *O. gracilis* Sm. – R; **Acanthaceae:** *Acanthus balcanicus* Heyw. – R; E; **Plantaginaceae:** *Plantago lanceolata* L. – C; *P major* L. – C; *P. media* L. – C; **Caprifoliaceae:** *Sambucus ebulus* L. – C; *S. nigra* L. – CoR; *Viburnum lantana* L. – C; **Valerianaceae:** *Valerianella coronata* (L.) DC – C; *V. carinata* Loisel. – C; *Valeriana officinalis* L. ssp. *officinalis* – CoR; **Dipsacaceae:** *Cephalaria transilvanica* (L.) Roem. et Schult. – C; *Dipsacus laciniatus* L. – C; *Knautia arvensis* (L.) Coult. – C; *Scabiosa ochroleuca* L. ssp. *ochroleuca* – C; *S. micrantha* Desf. – R; *S. argentea* L. – CoR; **Campanulaceae:** *Campanula persicifolia* L. – CoR; *C. lingulata* Waldst. et Kit. – CoR; *C. sibirica* L. – C; *C. bononiensis L.* – C; *C. trachelium* L. ssp. *trachelium* – CoR; *C. rapunculoides* L. – CoR; **Asteraceae:** *Eupatorium cannabinum* L. – C; *Solidago canadensis* L. – R; *Bellis perennis* L. – C; *Aster amellus* L. – VR; *Erigeron acer* L. – C; *E. anuus* (L.) Presl. – C; *Filago vulgaris* Lam. C; *Inula helenium* L. – VR; *I. conyza* DC. – CoR; *I. germanica* L. – CoR; *I. bifrons* L. – CoR; *I. ensifolia* L. – CoR; *I. hirta* L. – CoR; *I. salicina* L. ssp. *aspera* (Poir.)Hay. – CoR; *I. britanica* L. – CoR; *Pulicaria dysenterica* (L.) Bernh. – C; *Galinsoga parviflora* Cav. – CoR; *Xanthium spinosum* L. – C; *X. strumarium* L. – C; *X. italicum* Moret. – C; *Bidens tripartita* L. – CoR; *B. frondosa* L. – C; *Anthemis tinctoria* L. – C; *A. austriaca* Jacq. – CoR; *A. arvensis* L. – CoR; *Achillea nobilis* L. ssp. *neilreichii* (A. Kern.) Velen. – R; *A. millefolium* L. – C; *A. clypeolata* S. et S. – C; E;

Matricaria perforata Merat. – C; *M. trichophylla* (Boiss.) Boiss. – C; *Leucanthemum vulgare* Lam. – R; *Chamomilla recutita* (L.) Rausch. – CoR; *Tanacetum vulgare L.* – CoR; *T corymbosum* (L.) Schultz-Bib. – CoR; *Artemisia vulgaris* L. – C; *A. absinthium* L. – C; *A. annua* L. – C; *A. scoparia* Waldst. et Kit. – C; *Tussilago farfara* L. – CoR; *Doronicum hungaricum* L. – CoR; *D. orientale* Hoffm. – VR; *Senecio vulgaris* L. – C; *S. vernalis* Waldst. et Kit. – C; *S. jacobaea* L. ssp *jacobaea* – CoR; *Echinops banaticus* Roch. ex. Schrad. – C; BA IV; *E. ritro* L. – R; BA IV; *E. sphaerocephalus* L. ssp. *sphaerocephalus* – R; BA IV; *Xeranthemum annuum* L. – C; *Carlina vulgaris* L. – CoR; *Arctium lappa* L. – C; *A. minus* Bernh. – C; *Jurinea ledebourii* Bunge. – R; EN; BA III; *Carduus nutans* L. – C; *C. thoermeri* Weinm. – C; *C. acanthoides* L. – C; *Cirsium vulgare* (Savi.) Ten. – C; *C. ligulare* Bois. – C; *C. arvense* (L.) Scop. – C; *C. creticum* (L.) D"Urv. – C; *Onopordum acanthium* L. – C; *Crupina vulgaris* Cass. – CoR; *Serratula tinctoria* L. – CoR; *Centaurea jacea* L. – R; *C. calcitrapa* L. – C; *C. solstitialis* L. – C; *C. cyanus* L. – C; *C. orientalis* L. – C; *C. salonitana* Vis. – CoR; *C. scabiosa* L. ssp. *spinulosa* (Roch. ex Spreng.) Dost. – C; *C. diffusa* Lam. – C; *C. rutifolia* S. et S. ssp. *jurineifolia* (Boiss.) N – C; *C. affinis* Friv. ssp. *affinis* – R; *C. affinis* Friv. ssp. *balcanica* (Urum. et Wagn.) Dost. – R; E; *C. rhenana Boreau* – CoR; *C. iberica* Trev. ex Spreng. – C; *Carthamus lanatus* L. – C; *Conyza canadensis* (L.) Cronq. – C; *Cichorium intybus* L. – C; *Lapsana communis* L. – C; *Leontodon hispidus* L. ssp. *hispidus* – C; *L. crispus* Vill. ssp. *crispus* – C; *Picris hieracioides* L. ssp. *hieracioides* – C; *Tragopogon dubius* Scop. – C; *Scorzonera lhispanica* L. – R; *Chondrilla juncea* L. – C; *Taraxacum serotinum* (Waldst. et Kit.) Poir. – C; *T officinale* Web. – C; *Sonchus oleraceus* L. – C; *S. arvensis* L. ssp. *arvensis* – C; *S. arvensis* L. ssp. *uliginosus* (Bieb.) Nym. – CoR; *Lactuca serriola* L. – C; *L. saligna* L. – C; *L. quercina* L. ssp. *quercina* – R; *L. viminea* (L.) J. et C. Presl. – R; *Mycelis muralis* (L.) Dum. – CoR; *Crepis sancta* (L.) Babcok. – R; *C. foetida* L. ssp. foetida – C; *C. foetida* ssp. *rhoedifolia* (Bieb.) Celak – C; *C. setosa* Hall. – C; *C. pulchra* L. – CoR; *Hieracium hoppeanum* Schult. – R; *H. praealtum* Vill. ex Goch. ssp. *bauchinii* (Bess.) Petum. – R; *H. cymosum* L. ssp. *cymosum* – R; *H. echioides Lunm.* – R; *H. umbellatum* L. – R; *H. racemosum* Waldst. et Kit. – R.

Liliopsida: Butomaceae: *Butomus umbellatus L.* – C; **Alismataceae:** *Alisma plantago-aquatica* L – C; *A. lanceolatum* With. – C; **Hydrocharitaceae:** *Elodea canadensis* Michx. – CoR; **Potamogetonaceae:** *Potamogeton pectinatus* L. – C; *P. pussilus* L. – R; *P. natans* L. – C; *P. crispus* L. – C; **Zannichelliaceae:** *Zannichellia palustris* L. ssp. *pedicelata* Wahl. et Rosen – C; **Liliaceae:** *Colchicum autumnale* L. – CoR; *Gagea pratensis* (Pers.) Dum. – C; *G. lutea* (L.) Ker- Gaw. – R; *G. minima* (L.) Ker- Gaw. – C; *G. arvensis* (Pers.) Dum. – C; *Allium scordoprasum* L. – C; *A. sphaerocephalon* L. – R; *A. moschatum* L. – C; *A. flavum* L. – CoR; *A. rotundrum* L. – C; *A. paniculatum*

ssp. *fuscum* (Waldst. et Kit.) Arcang. – CoR; E; *Lilium martagon* L. – R; BA IV; *Scilla bifolia* L. – C; BA IV; *Ornithogalum nutans* L. ssp. *nutans* – R; *O. pyrenaicum* L. – CoR; *O. narbonense* L. – C; *O. refractum* Kit. ex Schecht. – R; *O. sibthorpii* Greut. – R; *O. kochii* Parl. – R; *O. umbellatus* L. – C; *Hyacinthella leucophaea* (Stev.) Shur. – C; *Muscari botryoides* (L.) Mill. – VR; *M. racemosum* (L.) Lam. et DC. – C; *M. tenuiflorum* Tausch. – C; *Asparagus tenuifolius* Lam. – C; BA IV; *A. officinalis* L. – C; BA IV; *Ruscus aculeatus* L. – R; BA IV; *Polygonatum latifolium* (Jacq.) Desf. – C; *Convalaria majalis* L. – VR; **Amarillidaceae:** *Galanthus elwesii* Hook fil. ssp. *minor* Welb. – R; EN; BA III; *Sternbergia colchiciflora* Waldst. et Kit. – C; **Dioscoreaceae:** *Tamus communis* L. – R; **Iridaceae:** *Crocus flavus* West. – C; BA IV; *Iris sintenisii* Janka – CoR; *I. pseudacorus* L. – R; *I. pumila* L. – VR; *I. variegata* L. – CoR; **Orchidaceae:** *Orchis papilionaceae* L. – PE; BA III; *O. simia* L. – R; BA IV; *O. purpurea* Huds. – R; BA IV; *Ophrys scolopax* Cav ssp. *cornuta* (Stev.) Camus. – PE; BA III; *Himantoglossum caprinum* (L.) Spreng. - BA II III; *Cephalanthera damasonium* (Mill.) Druce. – R; *Spiranthes spiralis* (L.) Chevall. – VR; VU; BA III; **Juncaceae:** *Juncus effusus* L. – R; *J. inflexus* L. – C; *J. conglomeratus* L. – C; *J. compressus* Jacq. – C; *Luzula campestris* (L.) DC – VR; **Cyperaceae:** *Schoenoplectus lacustris* (L.) Pall. – C; *Eleocharis palustris* (L.) R. Br. – C; *Bolboschoenus maritimus* (L.) Palla – C; *Carex praecox* Schreb. – C; *C. hirta* L. – R; *C. remota* L. – R; *C. muricata* L. – C; *C. divisa* Huds. – CoR; *C. michelii* Host. – CoR; *C. flacca* Schreb. – CoR; *C. caryophyllea* Latourr. – C; *C. digitata* L. – VR; *C. tomentosa* L. – R; *C. riparia* Curt.– CoR; *C. pseudocyperus* L. – C; *C. pilosa* Scop. – VR; *C. melanostachya* Bieb. ex Willd. – R; *C. distans* L. – R; **Poaceae:** *Dichanthium ischaemum* (L.) Roberty. – C; *Chrysopogon gryllus* (L.) Trin. – C; *Tragus racemosus* (L.) Desf. – C; *Echinochloa crus-galli* (L.) Beauv. – C; *Setaria verticillata* (L.) Beauv. – C; *S. pumila* (Poir.) Schult. – C; *S. italica* (L.) Beauv. – R; *S. viridis* (L.) Beauv. – C; *Anthoxanthum odoratum* L. – CoR; *Stipa capillata* L. – C; BA IV; *S. pulcherrima* L. – C; BA IV; *Piptatherum virescens* (Trin.) Boiss. – C; *Phleum phleoides* (L.) Karst. – CoR; *P. montanum* C. Koch. – CoR; *P. pratense* L. ssp. *pratense* – C; *P. graecum* Boiss. et Heldr. – CoR; *P. paniculatum* Huds. – CoR; *Alopecurus myosuroides* Huds. – C; *A. pratensis* L. – C; *Agrostis stolonifera* L. – C; *A. castellana* L. – VR; *Calamagrostis epigeios* (L.) Roth. – C; *Vulpia myurus* (L.) C. C. Gmel. – CoR; *Avena fatua* L. – C; *Arrhenatherum elatius* (L.) Beauv ex J. et C. Presl. – C; *Cynodon dactylon* (L.) Pers. – C; *Phragmites australis* (Cav.) Trin. ex Stend. – C; *Cleistogenes serotina* (L.) Keng. – CoR; *Eragrostis minor* Host. – C; *E. pilosa* (L.) Beauv. – C; *Koeleria macrantha* (Ladab.) Schult. et Schult. – C; *Melica ciliata* L. – C; *M. transsilvanica* Schur. – CoR; *M. uniflora* Reutz. – C; *Briza media* L. – CoR; *Dactylis glomerata* L. ssp. *glomerata* – C; *Cynosurus echinatus* L. – CoR; *Sclerochloa dura* (L.) Beauv. – C; *Poa compressa* L. – CoR; *P. bulbosa* L. – C; *P. angustifolia* L.– C;

P annua L. – C; *P nemoralis* L. – C; *P pratensis* L. – C; *Puccninellia limosa* (Schur.) Holmb. – CoR; *Festuca pratensis* L. – CoR; *F. heterophylla* Lam. – C; *F. valesiaca* Schleich. ex Gaud. – C; *Bromus sterilis* L. – C; *B. tectorum* L. – CoR; *B. inermis* Leyss. – C; *B. ramosus* Huds. – VR; *B. arvensis* L.– C; *B. secalinus* L. – CoR; *B. mollis* L. – C; *B. racemosus* L. – C; *B. squarosus* L. – CoR; *Brachypodium sylvaticum* (Huds.) Beauv. – C; *Lolium perenne* L. – C; *Dasypyrum villosum* (L.) Caud. – C; *Aegilops cilindrica* Host. – C; *Hordeum bulbosum* L. – R; *H. leporinum* Link. – R; *H. murinum* L. – C; *Elymus hispidus* (Opiz.) Meld. ssp. *barbulatus* (Schur.) Meld. – CoR; *E. repens* (L.) Gould. – C; *E. elongatus* (Host.) Greut. ssp. *elongatus* – CoR; *Digitaria sanguinalis* (L.) Scop. – C; *Glyceria plicata* (Fries.) Fries. – C; *Sorghum halepense* (L.) Pers. – C; *Taeniatherum caput-medusae* (L.) Nevski. – CoR; **Araceae:** *Arum maculatum* L. – C; **Lemnaceae:** *Lemna minor* L. – C; **Typhaceae:** *Typha angustifolia* L. – C; *T latifolia* L. – C; **Sparganiaceae:** *Sparganium erectum* L. ssp. *neglectum* (Beeby) Schinz. et Thell. – C; *S. erectum* ssp. *erectum* L. – C.

Appendix 2.

Synoptic scheme of the Protected Area *Kayluka*

Class *Lemnetea minoris* (R. Tx. 1955) de Bolos et Masclans 1955
Order *Lemnetalia minoris* (R. Tx. 1955) de Bolos et Masclans 1955
Alliance *Lemnion gibbae* R. Tx. et Schwabe-Braun in R. Tx. 1974
Association *Lemnetum minoris* Th. Müller et Görs 1960
Class *Potamogetonetea pectinati* R. Tx. et Prsg. 1942
Order *Potamogetonetalia pectinati* W. Koch 1926
Alliance *Potamogetonion pectinati* (Koch 1926) Görs 1977
Association *Myriophylletum spicati* Soó 1927
Association *Ceratophylletum demersi* Corillion 1957
Class *Phragmitetea communis* Tx. et Psrg. 1942
Order *Phragmitetalia communis* Koch 1926
Alliance *Phragmition communis* Koch 1926
Association *Typhetum latifoliae* G. Lang 1973
Association *Phragmitetum communis* von Soó 1927
Order *Nasturtio-Glyceiretalia* Pignatti 1953
Alliance *Glycerio-Sparganion* Br.-Bl. et Sissingh in Boer 1942
Association *Leersietum oryzoidis* Eggler 1933
Class *Epilobietea angustifolii* Tx. et Preising ex von Rochow 1951
Order *Convolvuletalia sepium* Tx. ex Moor 1958
Alliance *Archangelicion litoralis* Scamoni et Passarge 1963
Association *Brachypodio sylvatici-Angelicetum sylvestris* Tzonev 2017
Class *Montio-Cardaminetea* Br.-Bl. et Tx. ex Klika et Hadac 1944

Order *Montio-Cardaminetalia* Pawlowski in Pawlowski et al. 1928
Alliance *Cratoneurion commutati W. Koch 1928*
Comunities of spring calciphite mosses *(Cratoneuron spp.)*
Class *Thlaspietea rotundifolii* Br.-Bl. 1947
Chasmophytic communities *Parietaria erronea, Galium lucidum, Aspenium ruta-muraria, A. trichomanes*
Class *Festuco-Brometea* Br. Bl. et Tx. 1943
Order *Festucetalia valesiacae* Klika 1931
Alliance *Festucion rupicolae* Soó 1940
Association *Bothriochloetum (Andropogonetum) ischaemi* (Krist. 1937) Pop 1977
Communities of *Chrysopogon gryllus*
Alliance *Saturejon montanae* Horvat 1962
Association *Potentillo pilosae-Achilleetum clypeolatae* Tzonev 2013
Class *Querco-Fagetea* Br.-Bl. et Vlieg. 1937
Order *Quercetalia pubescentis* Br.-Bl. (1931) 1932
Alliance *Quercion frainetto* Ht. 1954
Association *Cotino-Quercetum cerris* Rousakova et Tzonev 2003
Order *Fagetalia sylvaticae* Pawlowski et al. 1928
Alliance *Carpinion betuli* Issler 1931
Association *Carpinetum betuli* Dinic 1977 s.l.
Alliance *Aceri tatarico-Quercion* Zól. - Jakucs 1957
Association *Staphyleo-Tilietum tomentosae* Tzonev 2013
Alliance *Syringo-Carpinion orientalis* Jakucs 1959
Association *Arabio turritae-Carpinetum orientalis* Tzonev 2013
Association *Syringo-Paliuretum* nom. prov.
Class *Salicetea albae* Moor 1958
Order *Salicetalia purpureae* Moor 1958
Alliance *Salicion albae* Soo 1930
Association *Salici-Populetum* Isl. 1958
Class *Robinietea* Jurko ex Hadac et Sofron 1980
Order *Chelidonio-Robinietalia* Jurko ex Hadac et Sofron 1980
Alliance *Balloto nigrae-Robinion* Hadac et Sofron 1980
Communities of *Robinia pseudoacacia*

Appendix 3

Checklist of habitats from EUNIS classification and related units from the Habitat Directive in the Protected Area *Kayluka*

C2.12 Hard water springs - **7220 *Petrifying springs with tufa formation (*Cratoneurion*).**

C2.2 Permanent non-tidal, fast, turbulent watercourses + E5.42 Tall-herb communities of humid meadows - **6430 Hydrophilous tall herb fringe**

communities of plains and of the montane to alpine levels.

E1.21 Helleno-Balkanic savory steppes - **6240* Sub-pannonic steppic grasslands**

E1.22 Arid subcontinental steppic grassland - **6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)**

E2.7 Unmanaged mesic grasslands - **6510 Lowlan hay meadows**

F3.24 Subcontinental and continental deciduous thickets

FB.4 Vineyards

G1.111Middle European Salix alba forests - **91E0* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)**

G1.7A Steppe oak woods - **91I0* Euro-Siberian steppic woods with *Quercus* spp.**

G1.A3 Carpinus betulus woodland - *91G0* Pannonic woods with Quercus petraea and Carpinus betulus*

G1.7C2 *Carpinus orientalis woods*

G1.7C41 *Silver lime woods* - **91Z0 Moesian Silver lime woods**

G1.C3 [*Robinia*] plantations

G1.D2 [*Juglans*] groves

G1.C4 Other broadleaved deciduous plantations

G3.F1 Native conifer plantations

G3.F2 Exotic conifer plantations

H1 Terrestrial underground caves, cave systems, passages and waterbodies - **8310 Caves not open to the public**

H3.2A Illyrio-Helleno-Balkanic cinquefoil cliffs - **6110* Rupicolous calcareous or basophilic grasslands of the *Alysso-Sedion albi* + 8210 Calcareous rocky slopes with chasmophytic vegetation**

I2 Cultivated areas of gardens and parks

J5 Highly artificial man-made waters and associated structures

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