

## *Natural Habitats in the Forest-Free Zone of Malusha Peak (Protected Area "Bulgarka" BG0000399 and Protected Area "Central Balkan - Buffer" BG0001493)*

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**Abstract.** The object of the study was to investigate the natural habitats in the forest-free zone of Malusha Peak, located on the main watershed ridge of the Shipka part of the Central Balkan Mountain range, part of the protected area (PA) "Bulgarka" BG0000399 and PA "Central Balkan - Buffer" BG0001493. According to the EUNIS classification used for making the analyses, seven types of habitats were described in the studied area, including 5 grasslands, 1 shrubland and 1 rocky. According to Annex 1 of the Bulgarian Biological Diversity Act, Annex 1 of the Directive 92/43/EEC and the Red Book of Bulgaria, Volume 3, five of the habitats have a conservation status, among them 6110\* Rupicolous calcareous or basophilic grasslands of *Alysso-Sedion albi*, being a priority for habitat conservation. The largest part of the studied area (about 95%) is occupied by the habitats E2.33 Balkan mountain hay meadows and E 4.438 Oro-Moesian calciphile stripped grasslands. The habitats Oro-Moesian calciphile stripped grasslands, as well as the H3.2A13 Balkan Range of the calcicolous chasmophyte communities, are characterized by a high degree of naturalness, relic origin and a large number of endemic plant species, which makes them particularly valuable for the studied area.

**Key words:** Central Balkan, EUNIS, habitats, Malusha, Bulgarka Natural park, protected areas.

### **Introduction**

Malusha Peak is situated on the main watershed ridge of the Balkan mountain range in the central part of Shipka Mt. of the Central Balkan mountain range. Kazanlak

Valley and the village of Sheynovo are located to the south side, the Uzana Area is to the west of the peak and the historical peak Shipka is to the east. The area is part of PA Bulgarka, code BG0000399, and the PA

“Central Balkan – Buffer”, code BG0001493, according to the Pan-European Ecological Network NATURA 2000. The total area of the studied territory including the forest-free area of the peak itself covers 37.73 ha.

The vertical amplitude of the studied area is about 82 m (between 1259 and 1341 m a.s.l.). The northern and southern exposures are predominant. The relief is quite broken with rock revelations. In most cases the slope varies between 25° and 40° and only at the tops it is moderate. The studied area is mainly composed of Medium-Triassic limestone. The soils are mainly brown, only in some places they are humus-carbonate, often quite shallow and stony. In many places there are rock revelations. The highest part of the territory is Malusha Peak (1341.1 m).

According to forest vegetation zoning of Bulgaria, the studied area belongs to the Balkan Mountain south slope forest vegetation province of the Temperate Continental Forest Zone. According to the geobotanical zoning of Bulgaria, Malusha Peak refers to the Illyrian (Balkan) province of the European broadleaved forest zone and the Central Balkan geobotanical area, Troyan-Kalofer region (BONDEV, 2002), where the typical vegetation is represented by *Acer heldreichii* Orph., *Festuca balcanica* (Acht.) Markgr.-Dann. subsp. *balcanica*, *F. balcanica* subsp. *neicevii* (Acht.) Markgr.-Dann., *Micromeria frivaldszkyana* (Degen) Velen., *Betonica bulgarica* Degen & Nejeff, *Veronica austriaca* L. subsp. *neiceffii* (Degen) Peev, *Cynoglossum germanicum* Jacq.

The ridges of Malusha Peak are in the zone of mesophilous beech and eel forest belt (900-1500 m a.s.l.), (BONDEV, 1991). Paleobotanical studies have proved that the vast beech belt gained its present appearance approximately 2000 years BC, preceded by hornbeam and coniferous forests (FILIPOVICH, 1981; FILIPOVICH *et al.*, 1998). Fir, which formed monodominant forests in some places during the mixed deciduous forest stage, is now found in the beech forests, mostly on the northern slopes

(NEYCHEV, 1909). The separate stages in the development of the forest vegetation throughout Holocene in the Balkan mountain range can be easily followed on the northern macroslope of the Balkan Mountain range, which is almost forest-free (FILIPOVICH *et al.*, 1997). Those are: the mixed deciduous forest stage dominated by *Tilia*, *Ulmus*, *Fraxinus* and *Quercus*; the stage of hornbeam and coniferous forests and beech expansion. The southern steep and sunlit slopes are dominated by grassland and meadow vegetation and the natural coniferous species, found only mixed in beech forests, have a limited distribution. The active anthropogenic activity over the past few centuries has contributed to lower artificially the upper border of the forest in order to free territories for the feeding needs of pastoral livestock. Historical data show that in the past there were a large number of livestock animals grazing on the mountain ridge, mainly sheep. Vegetation was quite different from the present. In general, the forests occupied less area in that territory, but forest communities were almost entirely dominated by natural species. Mainly beech forests prevailed. Livestock farming and agriculture have been largely extensive. The meadows were mown. The mountain has been intensively used for grazing domestic animals, which has been related to periodic fires, burning on the slopes. The bare ridges, the meadows and small pieces of arable land occupied much larger areas on the mountain slopes. Over the last few decades, the grazing regime has been severely reduced and, in many areas, – practically suspended, which is a prerequisite for the occurrence of successions in the composition and structure of the flora in the studied territory (MESHINEV & POPOV, 2000). Studies carried out so far on the species composition of the area show relatively high floristic diversity and the presence of new species for that floristic region (MARINOV *et al.*, 2015). The great amount of collected information with regard to the flora of the area, provoked the aim of the present study, namely describing

the characteristics of the natural habitats in the forest-free zone of Malusha Peak.

### Material and Methods

The localization and characterization of the natural habitats was carried out during the period 2010-2017 by the transect route method. The selection of transects was carried out with the aim of covering the maximum area of the region and achieving representativeness for the habitat diversity.

The species composition of the established habitats is described on the basis of the floristic analysis of the studied area (MARINOV *et al.*, 2015).

Nomenclature of species composition was accomplished according to DELIPAVLOV & CHESHMEDJIEV (2011) and ASSYOV & PETROVA (2012).

The study of the habitats of the investigated territory was carried out according to EUNIS classification (European Environment Agency, 2017). It is the most complete and constantly updated EU classification with detailed definitions of natural habitats. The relevant category of threats for natural habitats is indicated according to the criteria adopted in the Red Book of the Republic of Bulgaria, Volume 3 (RDB) (BISERKOV *et al.*, 2015) and the corresponding classification codes in the Habitats Directive 92/43/EEC (1992) and the Biological Diversity Act of Bulgaria - BDA (Biological Diversity Act, 2002-2007). Habitats according to Directive 92/43/EEC are compared to KAVRAKOVA *et al.* (2009). The established habitats in the forest-free part of the ridge of Malusha Peak are presented in Fig. 1.

Information on the following major characteristics of the natural habitats was collected:

- Location of the habitat in the studied area;
- Dominant and typical plant species;
- Major ecological characteristics of the communities - altitude range, soil types, prevailing exposure and slope of the terrain in degrees.

### Results and Discussion

The grasslands of Malusha Peak are predominantly occupied by grassy species and shrubs are less represented, spreading mainly around the upper border of the forest. Mosses and lichens are most often subordinate species in the plant communities. Mesophytic species are most widely spread. Most of the plant species are indifferent to the rock-based response and soil fertility. From a plant-geographic point of view, the vegetation cover is almost entirely of the Central-European type (BONDEV, 2002).

For hundreds of years, the grasslands on the mountain ridges, maintained through grazing by stock, have developed as specific semi-natural habitats that preserve rich biodiversity.

As a result of the research studies, the following habitats were identified:

*Meadows, pastures, steppes and outskirts of forests*

*E1.111 Middle European stone crop swards*

The habitat is a dry land of limestone rocks and rock revelations from the plains to the mountains. The main location is in the plains and the hilly belt up to 900-1000 m a.s.l., but the habitats can be found even higher. Most often they occupy small areas and form complexes with perennial grasslands. The soils are underdeveloped, poor, mainly stony, alkaline or neutral. The vegetation comprises pioneer species, open, thermophilic, consisting predominantly of mosses, lichens, terrophytes and succulents. *Sedum album* L., *S. annuum* L., *S. anopetalum* DC. (syn. *S. ochroleucum* Chaix), *S. acre* L., *S. hispanicum* L., *S. maximum* L., are prevalent, found with other species of *Alyssum alyssoides*-*Sedum albi*. The habitat is characterized by the rich diversity of mosses (*Syntrichia* spp., *Bryum* spp., *Grimmia* spp.) and lichens (*Xanthoria* spp., *Cladonia* spp., *Collema* spp.), which use the better hydrological conditions in the autumn and especially in the winter for vegetation and development (GUSEV *et al.*, 2015).

That is a rare habitat in the studied area. It is found in several places on limestone revelations and stone chippings on the southern slope of Malusha Peak. The dominating species are: *Sedum album* L. and *S. anopetalum* (syn. *S. ochroleucum* Chaix). Other species found are: *Acinos arvensis* (Lam.) Dandy, *Alyssum turkestanicum* Regel & Schmalh. (syn. *S. desertorum* Stapf), *Arenaria serpyllifolia* L., *Asplenium ruta-muraria* L., *Bromus tectorum* L., *Chondrilla juncea* L., *Convolvulus arvensis* L., *Erodium cicutarium* (L.) L'Her., *Festuca dalmatica* (Hackel) K. Richter, *Melica ciliata* L., *Potentilla obscura* Willd., *Teucrium chamaedrys* L.

The habitat is included in the RDB – Habitats under code 01E1, category 'Nearly Threatened' [NT], (GUSEV *et al.*, 2015), in the Biological Diversity Act and the [Bern Convention](#) (1979). In Annex 1 of Directive 92/43/EEC it is identified by code 6110 '*Rupicolous calcareous or basophilic grasslands of Alyso-Sedion albi*'.

#### E2.33 Balkan mountain hay meadows

Mountain hay meadows are secondary, continuous succession plant communities that originated in the place of destroyed mesophilous oak and beech forests in the mountains. The soils are brown forest (*Eutric* and *Dystric Cambisols*) and dark-colored *Mollic Cambisols*, fresh or wet. Mountain hay meadows are maintained and preserved by forest restoration through grazing or systematic mowing. When those activities ceased, processes of restoration of forest vegetation are observed. Under the influence of grazing, the mountain meadows are quickly covered with turf and they become mountain pastures. Their optimum development is between 1000 and 1600 m a.s.l. (RUSAKOVA & DIMITROV, 2015).

This is one of the most common habitats in the ridges of Malusha Peak. It is found on relatively moist and rich soils, usually above 800-900 m a.s.l. They are mostly used for hay production or grazing. Due to the depopulation of the small villages in the area, the habitat is also characterized by the

spread of shrubs and the restoration of the forest vegetation. There is a rich diversity of cereal grasses: *Agrostis capillaris* L., *Avenula pubescens* (Hudson) Dumort., *Cynosurus cristatus* L., *Dactylis glomerata* L., *Festuca nigrescens* Lam., *F. pratensis* Hudson, *Holcus mollis* L., *Poa pratensis* L. The species composition is quite varied. The following species are also found: *Agrimonia eupatoria* L., *Antoxanthum odoratum* L., *Filipendula vulgaris* Moench, *Galium album* Miller, *G. verum* L., *Hypochoeris radicata* L., *Luzula campestris* (L.) DC., *Leucanthemum vulgare* Lam., *Lotus corniculatus* L., *Peucedanum carvifolia* Vill., *Potentilla argentea* L., *P. reptans* L., *Plantago lanceolata* L., *Ranunculus acris* L., *Stachys germanica* L., *Stellaria graminea* L., *Thymus pulegiodes* L., *Trifolium alpestre* L., *T. repens* L., *Veronica chamaedrys* L. as well as the species of conservation importance: *Lilium albanicum* Griseb., *Betonica bulgarica* Degen & Nejceff and *Orchis militaris* L.

The habitat is included in the RDB – Habitat under code 16E2, category "vulnerable" [VU], (RUSAKOVA & DIMITROV, 2015), in the BDA and the [Bern Convention](#) (1979). In Annex 1 of Directive 92/43/EEC it is identified by code 6520 *Mountain hay meadows*.

#### E4.438 Oro-Moesian calciphile stripped grasslands

That habitat has a limited distribution in the mountains of Bulgaria. Among the main characteristics of the habitat are the high altitude – from about (1600) 2000 to 2900 m a.s.l. and the alkaline soil-forming rocks – limestone shales and marble. Soils are predominantly skeletal and quite dry during the vegetation season. The habitat is located on the ridges and on the slopes of the mountains in Bulgaria. Plant communities formed in those environmental conditions are most often open, the projective cover in some places being very low – about 20-30%, rarely reaching up to 60%. In habitats of this type there are dry, rocky and stony terrains with northern to southern exposure, some of them very steep, with shallow soils

(rendzinas) on limestone or dolomites, on the ridges and on the slopes around them. The phytocoenoses developing in the Balkan mountain range are dominated by: *Sesleria latifolia* (Adamovic) Degen, *S. rigida* Heuffel ex Reichenb. subsp. *achtarovii* (Deyl) Deyl, etc. Their distribution is limited and the area of the separate plots is small. The communities are open and their floristic composition is quite rich (RUSAKOVA, 2015).

For the area of Malusha Peak the most typical communities are dominated by: the two species of *Sesleria* – *Sesleria latifolia* (Adamovic) Degen and *Sesleria rigida* Heuffel ex Reichenb. subsp. *achtarovii* (Deyl) Deyl, which form monodominant spots of different sizes – from several square meters to several hundred square meters.

The species composition is diverse. The following species are found: *Allium paniculatum* L., *Anthyllis vulneraria* L., *Asyneuma canescens* (Waldst. & Kit.) Griseb. et Schenk, *Carex humilis* Leyss., *Cerastium banaticum* (Rochel) Heuff., *Euphrasia salisburgensis* Funck, *Festuca dalmatica* (Hackel) K. Richter, *Filipendula vulgaris* Moench, *Gentiana cruciata* L., *Hieracium hoppeanum* Schult., *Linum catharticum* L., *Luzula multiflora* (Retz.) Lej., *Potentilla cinerea* Chaix ex Vill., *Primula veris* L., *Scabiosa columbaria* L., *Seseli libanotis* (L.) Koch, *Teucrium chamaedrys* L., *Thymus vandasii* Velen., *Trifolium alpestre* L., as well as the species of conservation importance: *Veronica austriaca* L. ssp. *Neiceffii* (Degen) Peev, *Draba lasiocarpa* Rochel, *Carum graecum* Boiss. & Heldr., *Festuca balcanica* (Acht.) Markgr.-Dann. subsp. *neicevii* (Acht.) Markgr.-Dann., *Laserpitium siler* L., *Semprevivum erythraeum* Velen., *Trinia glauca* (L.) Dumort.

The habitat is included in the RDB – Habitat under code 25E4, category 'endangered' [EN], (RUSAKOVA, 2015), in the BDA. In Annex 1 of Directive 92/43/EEC it is identified by code 6170 *Alpine and subalpine calcareous grasslands; subtype 36.43. - Calciophilous stepped and garland grasslands.*

#### E 5.21 Xero-thermophile fringes

The habitat is often found in the studied territory; however, it occupies small areas everywhere, most often located at forest fringes. In most places it has a secondary origin, because it is located along the roads and at woodland fringes, most often in dry and sunlit areas. The species composition is quite varied and includes both forest species and ruderals, and, species typical of xerophytic grassland cenoses.

The following species are found in the habitat: *Achillea millefolium* L., *Agrostis capillaris* L., *Anthemis tinctoria* L., *Avenula pubescens* (Hudson) Dumort., *Carlina vulgaris* L., *Centaurea stenolepis* A. Kern., *Clematis vitalba* L., *Clinopodium vulgare* L., *Coronilla varia* L., *Dactylis glomerata* L., *Daucus carota* L., *Digitalis grandiflora* Mill., *Dorycnium herbaceum* Vill., *Galium album* Mill., *Gymnadenia conopsea* (L.) R. Br., *Leucanthemum vulgare* Lam., *Mentha spicata* L., *Origanum vulgare* L., *Picris echioides* L., *Plantago lanceolata* L., *Poa pratensis* L., *Potentilla pilosa* Willd., *Silene italica* (L.) Pers., *Stachys germanica* L., *Trifolium alpestre* L. The species *Atropa bella – donna* L. and *Dactylorhiza saccifera* (Brongn.) Soó are also quite widely spread.

The habitat has no conservation status.

#### E5.43 Shady woodland edge fringes

Plant communities, called 'tall herbs', are widely distributed throughout the country in the river valleys. They represent a variety of mixed phytocoenoses with grasses of 1 m to 1,5 and even 2 m height. They usually occupy narrow strips (up to 2-3 m, often narrower) along the running waters and at the wet riverbanks. Most of them can grow both in the water (in shallow water of 0.10-0.20 m) and in over-wet soils. The species composition of the cenoses is quite diverse and depends both on the altitude and the sunlight, as well as on the surrounding plant communities. According to that, they can be divided into three main sub-types corresponding to different codes of EUNIS habitat classification. The following subtype is spread on the studied

territory: *Nitrophilous tall-herb in the river valleys in shady areas of forests*. Those communities belong to the semi-ruderal syntaxons of the *Galio-Urticetea* class, union *Aegopodion podagrariae* (order *Lamio albi-Chenopodietalia boni-henrici*) and order *Convolvuletalia sepium*. They form strips near streams and small rivers in shaded places, in humid valleys and slopes with high air and soil humidity. Most often the species found are: *Aconitum lamarckii* Rchb., *Aegopodium podagraria* L., *Alliaria petiolata* (M. Bieb.) Cavara & Grande, *Anthriscus sylvestris* (L.) Hoffm., *Carex pendula* Hudson, *Chaerophyllum hirsutum* L., *Chelidonium majus* L., *Circaea lutetiana* L., *Galeopsis speciosa* Mill., *Galium aparine* L., *Geranium phaeum* L., *G. robertianum* L., *Geum urbanum* L., *Glechoma hederacea* L., *Heracleum sibiricum* L. (VALCHEV *et al.*, 2015).

The habitat is included in the RDB – Habitat under code 28E5, category ‘endangered’ [EN], (VALCHEV *et al.*, 2015) and in the BDA. In Annex 1 of Directive 92/43/EEC it is identified by code 6430 *Hydrophilous tall herb fringe communities of plains and of mountain to alpine levels*.

#### *Bushes and Small Shrubs*

##### *F2.333 Subalpine bramble brush*

A relatively rare habitat, with a secondary origin, spread at woodland edge fringes in the eastern part of the studied area. Those are usually communities formed in the succession processes associated with the reestablishment of forest ecosystems.

The habitat has no conservation status.

#### *Cave and Rocky Habitats*

##### *H3.2A13 Balkan Range calcicolous chasmophyte communities*

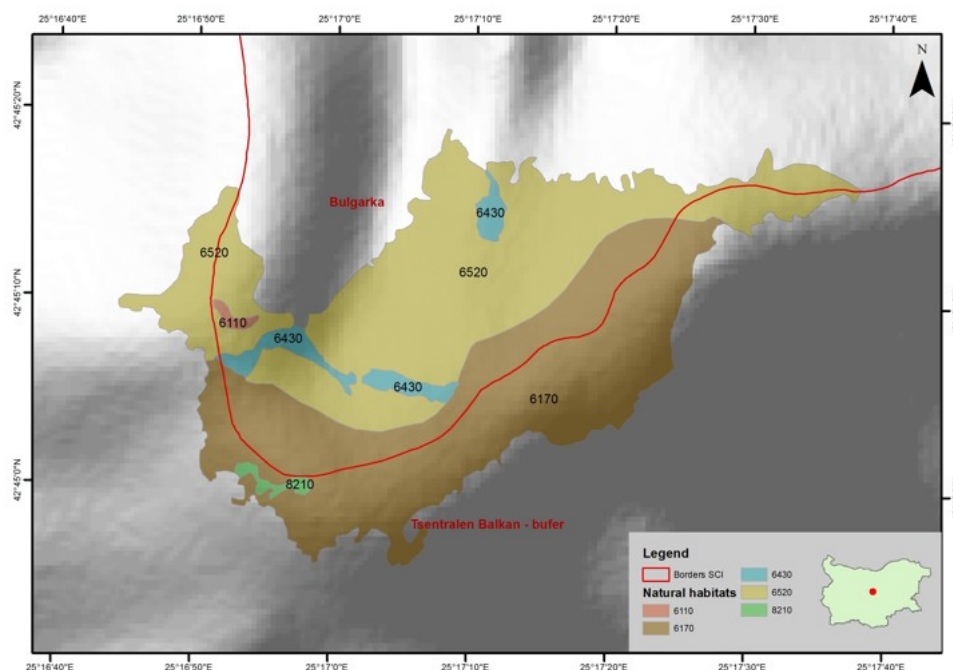
This habitat occupies vertical or steep limestone rock walls, as well as sharp rock ridges. There is no soil or it is very poor (most often Rendzic Leptosols). Separate plant individuals or small groups of plants are usually scattered at great distances from one another, the biotic links between them

are poorly expressed and in most cases the organisms live in an environment created by them. Total projective cover is scarce. Limestone rock revelations: walls, garlands, peaks, etc. in the Balkan mountain range are localized mainly in the higher parts, especially on ridges. There are quite a few endemic, rare and endangered species in them (GUSEV & RUSAKOVA, 2015).

In some places there are large limestone rock revelations in the studied territory. Depending on the sunlight and slope, plant communities of different species composition are formed, alternating with bare rocks. Communities of the Balkan endemic *Haberlea rhodopensis* Friv. are formed on darker and wet limestone rocks. The sunlit rock blocks, where there is a thicker soil layer, communities of the endemites typical of the Balkan mountain develop, such as *Festuca balcanica* (Acht.) Markgr.-Dann. subsp. *neicevii* (Acht.) Markgr.-Dann. and *Micromeria frivaldszkyana* (Degen) Velen. Other rare species are also found in those communities, for example *Seseli bulgaricum* P. W. Ball.

The habitat is included in the RDB – Habitat under code 08H3, category ‘vulnerable’ [VU], (GUSEV & RUSAKOVA, 2015) and in the BDA. In Annex 1 of Directive 92/43/EEC it is identified by code 8210 *Calcareous rocky slopes with chasmophytic vegetation*.

Data analysis shows that grasslands are the most widely spread on the studied territory. Out of the total area of the forest-free zone of the peak itself, which is approximately 37.73 ha, the largest share (95%) is occupied by E2.33 *Balkan mountain hay meadows* (18.68 ha) and E4.438 *Oro-Moesian calciphile stripped grasslands* (17.069 ha). The area occupied by the habitats E5.21 *The Xero-thermophile fringes* and F2.333 *Subalpine bramble brush* is a small share of the studied area, most often at the forest fringes. Due to the small area occupied by the two habitats, they are not indicated on the map (Fig. 1).



**Fig. 1.** Map of the studied territory by the identified habitat types, according to the EUNIS classification.

Seven major habitat types were identified according to EUNIS classification, five of them having a conservation status and included in Directive 92/43/EEC under codes: E1.111/6110; E4.438/6170; E5.43/6430; E2.33/6520 and H3.2A13/8210, respectively, as well as in Annex 1 of the Biological Diversity Act (Table 1). According to the two normative documents, the priority conservation type of habitat is 6110 *Rupicolous calcareous or basophilic grasslands of Alysso-Sedion albi*.

According to the Red Book of the Republic of Bulgaria, Volume 3, two of the five habitats of conservation importance have the status of endangered (EN), two are vulnerable (VU) and one nearly threatened (NT), (Table 1). The habitats E1.111 Middle European stone crop swards and Balkan mountain hay meadows are also protected by Bern Convention.

### Conclusions

Five grasslands, one shrubland and one rocky habitats found in the forest-free zone

of Malusha Peak, are subject to protection in the protected areas BG0000399 "Bulgarka" and BG0001493 "Central Balkan – Buffer". All the habitats with the exception of F2.333 Subalpine bramble bush and E 5.21 Xerothermophile fringes have a conservation status determined by the Bulgarian legislation.

The study of natural habitats shows a typical habitat diversity in Malusha Peak area. Along with the priority habitat 6110 *Rupicolous calcareous or basophilic grasslands of Alysso-Sedion albi*, the habitats E4.438 *Oro-Moesian calciphile stripped grasslands* and H3.2A13 *Balkan Range of calcicolous chasmophyte communities*, which are characterized by a high degree of naturalness, relic origin and a large number of endemic plant species, are also especially valuable for that concrete area.

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**Table 1.** The identified habitat types according EUNIS classification, conservation status in Red Book of Bulgaria and Directive 92/43/EEC under codes and areas.

Habitat code	Habitat name	Habitat code Red Book	Threat category	Habitat HD 92/43	Area ha
E1.111	Middle European stone crop sward	01E1	NT	6110 - *Rupicolous calcareous or basophilic grasslands of <i>Alyssosedion albi</i>	0.148028
E2.33	Balkan mountain hay meadow	16E2	VU	6520 - Mountain hay meadows	18.687587
E4.438	Oro-Moesian calciphile stripped grasslands	25E4	EN	6170 - Alpine and subalpine calcareous grasslands	17.269172
E5.21	Xero-thermophile fringes	-	-		
E5.43	Shady woodland edge fringe	28E5	EN	6430 - Hydrophylious tall herb fringe communities of plains and of mountaine to alpine levels	1.375677
F2.333	Subalpine bramble brush	-	-		
H3.2A13	Balkan Range calcicolous chasmophyte communities	08H3	VU	8210 - Calcareous rocky slopes with chasmophytic vegetation	0.24861

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