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Final Report - Summary

FLORA

Feasibility Study for Trans-border Biosphere Reserve Osogovo

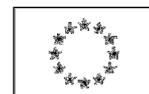
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One of the major tasks when comes to establishing a biosphere reserve is to achieve a sustainable balance between nature protection, economic development and preservation of the cultural values of a region. Correspondingly, a complete research is needed which will provide all data required for proposing recommendations of how to reach that balance. Research on biological diversity, cultural diversity, sociological and economical status are essential in the process of compiling feasibility study for biosphere reserve. Regarding Osogovo Mts., some of these were done during the project related to the initiative European Green Belt, which Osogovo Mts. was part of. In all, sufficient amount of data already exists for continuation of the process for proposing Osogovo Mts. as protected area – biosphere reserve. Yet, it is important to underline here that new additional tools and methodologies should be applied to use all the existing data in favour of composing feasibility study for Osogovo Mts. TBR.

According the ToR, this part has an important role in making a feasibility study for TBR and that is - assessment of Osogovo's conservation function in terms of ecosystems, habitats, ecosystems, plant species and genetic variation, and the need to protect those values.

The designation criteria for Biosphere Reserves (source: Article 4 of „The Statutory Framework of the World Network of Biosphere Reserves“, UNESCO 1996) states that the area should encompass a mosaic of ecological systems representative of major biogeographic regions, including a gradation of human interventions. Moreover, it should be of significance for biological diversity conservation. Following the criteria, this part of the project will cover required information concerning ecosystems diversity of the area, habitats and their valorisation, all that supported by valorisation of plant species and plant associations.

The diversity of natural habitats at Osogovo is determined by many factors. Osogovo is a high mountain and on its slopes we can observe almost all vertical belts of vegetation typical for all Balkan mountains - thermophilous oak forests (especially on the southern slopes), beech forests, alpine grasslands at the highest peaks (Ruen and Carev Vrv). Interesting is that thermophilous forests and grasslands are found mainly on the southern slopes in the Republic of Macedonia, whereby in northern Bulgaria - forests adapted to moisture and continental conditions dominate. Geographical position of Osogovo is also a prerequisite for its diversity of natural habitats. It is situated within the climatic transition between continental and trans-Mediterranean climatic influence. Therefore, the northern and highest parts are similar to the high mountains of Rila-Rhodope Mt., however, its southern part - warm and dry, shows similarity with mountains of Macedonia, located in the surroundings. This combination of diverse influences as a whole determines the uniqueness of Osogovo and its natural habitats. In this article, we will present the unique habitats of the highest parts of the mountain to its lowlands.

Osogovo Mts. is equally important area for both, nature conservation and people livelihood which means it merges the two main objectives 'conservation' and 'sustainable economic development'. There is presence of areas important to be conserved. From aspect of presence of significant habitats with herb-like vegetation, which are one of the important areas to be protected, special attention must be paid to the sub-Alpine part of the Osogovo Mts. (at

altitude of 1600-2250 m.), then habitats (marshes, transitional mires with *Drosera rotundifolia*, sub-Alpine pastures, heaths with *Bruckenthalia spiculifolia* and *Vaccinium*-species, silicate rocky sites), especially on some of the highest points of the massif. On two mountain tops (Ruen and Sultan Tepe) there are also some rare plant species (*Genista fukarekiana*, *Dianthus microlepis*, *Anthyllis aurea*, *Thymus balcanus*, *Geum rivale*, *Cardimine glauca* etc.). When zoning, these areas must be included in the strict protection zone, because beside their habitat, vegetation and floral value, they are magnificent landscapes, too.

Consistent with the Articles of the CBD, a balanced approach to biodiversity conservation generally is essential. One method for such a balanced approach to be achieved is by applying the ecosystem approach and by the efforts to involve all sectors of society in the conservation and management of biodiversity. The UNESCO-MAB World Network of BRs is one way of involving people in biodiversity conservation. To stress the importance of applying the ecosystem approach in the process of composing a feasibility study for TBR is the fact that biosphere reserve approach itself links ecology with economics, sociology and politics (UNESCO, 2000).

By using the data as a result of valorisation of floral elements and habitat types, this report will provide good picture of biologically and ecologically important areas on Osogovo Mts. to be considered as part of the core area. But the story of a trans-boundary biosphere reserve does not end here. According the Seville Strategy, three simple goals are known: “a) use BRs to identify and conserve natural and cultural diversity, b) use BRs as models of land management and of approaches to sustainable development and c) use BRs for research, monitoring, education and training”. The goals clearly represent the inevitable global application of the ecosystem approach. This is why the results related to ecosystems gained by this LOT are going to be essential in compilation of the feasibility study and nomination form.

Algae

A total of 253 diatom taxa were recorded on Osogovo Mt. From them, more than 40 taxa were not properly identified and cannot be fitted into a known species due to the differences in valve morphology and size compared with already described taxa. Additional SEM investigations are necessary for adequate treatment of these taxa. Two taxa from genus *Luticola* have specific characters which are dissimilar with known species and probably belong to undescribed (new) species. The diatom assemblages in peat-bogs are very diverse and contain several rare species (e.g. *Gomphosphaenia tackei*; *Adalafia suchlandtii*, *Chamaepinnularia soehrensii* var. *hassiacca* etc) which were for first time recorded in R. Macedonia. The upper parts of rivers Kriva, Stanechka, Zletovska, Kamenicka, are inhabited by a typical oligotrophic diatom flora. These communities are in general, represented by cosmopolitan species which distribution is reducing due to the human impact (eutrophication). Therefore, some of them are considered as vulnerable or endangered. During these observations a total of 11 rare, 30 endangered and 3 probably new diatom species were observed. Additionally more than 40 taxa were not completely identified and further investigations are necessary for establishing the proper identity of those taxa.

Further, long-time investigation on water bodies on Osogovo Mountain will enlarge the checklist with more species belonging to other ecological groups. The preliminary investigations of water bodies on Osogovo Mt. show that there are at least 15 sites (water bodies, habitats) important for protection. The highest protection was suggested for wetlands on Slana Bara and nearby spring areas of Stanechka river, as well as rivers Esterac and Zelengradska.

The diatoms are not listed in any EU directive or convention. However, there is attempt to classify the diatoms according to their distributions and degree of threat of the habitat (locality) where they occur. Such red list of diatoms from Central and Eastern Europe was published by Lange-Bertalot & Steindorf (1996). One decade later, Krstic et al. (2006) based on this list and modifications based on own observations have published the first red list of diatoms from Macedonia. The level of endangerment for most of the species in the latter list were the same (or similar), with exception for species considered as endemic for lakes Ohrid and Prespa. This list was applicative mainly for the species found in mountain regions in Macedonia. According to both red lists (Krstic et al. 2006 and Lange- Bertalot 1996) several taxa observed in the investigation area are pointed as rare or endangered.

On the basis of species diversity (conservation status, rarity, endemism, etc.) some localities and habitats can be pointed out as very important for the conservation of diatoms. The characterization of particular water bodies or habitats was performed based on presence of rare, endangered and potentially new species as well as the number of identified species present in the sampling site. The water habitats received score 1 is considered as "highly endangered, rare and diversity rich" when the habitat is rare in R. Macedonia, is under threat (climate changes, human impacts, deterioration etc.) and there is a high possibility to be modified or extinct; and has high diversity of diatoms and macroinvertebrates (especially species present on the international list and EU conventions); The water habitats received score 2 when it is considered as " Endangered and diversity rich". Such habitats are more frequently present in the investigated area and Macedonia in general, but are under threat of modification and extinction. These habitats are also biologically rich and provide living space for many species of diatoms and macroinvertebrates. The habitat or water body receive score 3 and is considered as "Vulnerable and diversity rich" when it is under human pressure (as water extraction, eutrophication, modification etc.), and it possess rich flora and fauna.

Vascular flora

Floristic richness of Osogovo Mt. is predetermined from actual ecological conditions, as well as from geological and climate changes on which the flora was exposed in the past. It is a consequence of the geographical distinction of the mountain – geographical position, altitude, relief, geological structure and geological past. This silicate mountain of the Rhodopi massif is 2252 m.a.s.l. high. The highest peak is Ruen. The lower parts are covered with mixed oak forests, whereas the higher parts are covered with beech forests. Both types of forests are under strong anthropogenic pressure. Intensity of farming (sheep breeding) activity significantly decreased the timberline. The lower parts of this mountain (600-1000 m), particularly from the south and the west sides, belong to the continental-submediterranean region. In this belt, the climate-zonal forest community *Querco-carpinetum orientalis* is distributed, which is rich of thermo- and xerophylous plant species (*Quercus pubescens*, *Carpinus orientalis*, *Fraxinus ornus*, *Cornus mas*, *Ranunculus psilostachys* etc). In the higher parts of the mountain continues the *Quercetum frainetto-cerris* community, with its characteristic species: *Q. frainetto*, *Q. cerris*, *Sorbus domestica*, *Lychnis coronaria*, *Helleborus odorus* and others. Above the belt with *Q. frainetto* and *Q. cerris* is the continental region, in which the community *Orno-Quercetum petraeae* is the main one - the highest oak forest belt. Besides *Quercus petraea* and *Fraxinus ornus*, this forest is characterized by *Corylus avellana*, *Festuca heterophylla*, *Luzula forsteri*, *Brachypodium sylvaticum* and others. The belt of the beech forest occupies approximately 1100-1800 m elevation belt. It is separated in three regions: piedmont-continental-mountain region,

mountain continental region and subalpine mountain region. All of these regions are characterized with a different climate community, such as *Festuco heterophyllae*-Fagetum for piedmont-continental-mountain region, *Calamintho grandiflorae*-Fagetum for mountain continental region, and Fagetum subalpinum for subalpine mountain region. Floristic composition in the first association contains mesophyllous beech forest elements, but also thermophyllous species from oak forests. In the higher forest communities only mesophyllous species are found, which are adapted on conditions in dense beech forests. Key species are *Actaea spicata*, *Calamintha grandiflora*, *Dentaria bulbifera*, *Circea lutetiana*, *Luzula sylvatica*. Because of the strong human influence, the timberline in Osogovo Mt. is significantly unequal. Maximum altitude in some places is about 1800 m, but in other areas it is descending lower. All areas above the forests, up to the highest parts of the mountain are covered with vegetation of dwarf shrub with *Vaccinium myrtillus*, *V. ulliginosum* and *Bruckenthalia spiculifolia*, as well as different grassland communities from *Seslerietalia comosae*.

Fungi

In total there are approximately 342 fungi species known from Osogovo Mt. This list was compiled on the basis of published data by Karadelev (1999); Karadelev & al. (2004, 2006 & 2007); Karadelev & Rusevska (2004/2005); Dimitrova & Assyov (2004) (Gyosheva et al. 2006) and Karadelev & Spa-si-kova (2004a & b). The largest number of species, belong to Basidiomycota, less of them are from Ascomycota and few species of lichens and Myxomycota group. Of the lignicolous species, the main part was collected on *Fagus*, *Quercus*, *Pinus* and *Populus*. A few species were collected on *Betula*, *Prunus*, *Malus*, *Picea*, on mushroom fruiting body, etc. As far as the terricolous species are concerned, the majority of them were collected in two beech associations (*Calamintho grandiflorae*-Fagetum and *Festuco heterophyllae*-Fagetum) and three oak associations (*Querco-Carpinetum orientalis macedonicum*, *Quercetum frainetto-cerris* and *Orno-Quercetum petraeae*), which are the best studied forests in the mountain. Certain species can be categorised as rare and interesting findings. The species: *Agaricus campestris*, *A. macrosporus*, *Amanita caesarea*, *Auricularia auricula-judae*, *Boletus aereus*, *B. fechtneri*, *Lopharia spadicea*, *Macrolepiota procera*, *Phellinus robustus* and *Tremella foliacea* have been proposed for protection according to the Preliminary Red List of Fungi of the Republic of Macedonia (Karadelev 1999, 2000, 2001, 201). The species: *Aleurodiscus disciformis*, *Astraeus hygrometricus*, *Lopharia spadicea* and *Tremella foliacea* belong to the group of particularly rare or rare species in Macedonia, *Phellinus robustus* is a species existing only in an endangered or rare habitat, while *Agaricus macrosporus*, *Amanita caesarea*, *Boletus aereus*, *B. fechtneri* and *Macrolepiota procera* belong to the group of particularly rare or rare species, threatened due to excessive exploitation. Species like, *Amanita caesarea*, *Boletus aereus*, *Boletus satanus*, *Ganoderma pfeifferi*, *Clavariadelphus pistillaris*, *Haasiella venustissima*, *Lentinellus ursinus*, *Mutinus caninus*, *Pachyella babingtonii* are categorized as endangered or critically endangered according the IUCH criteria thus special attention in terms of protection of habitats where they can be found should be taken in to consideration.

The species *Aleurodiscus disciformis*, *Astraeus hygrometricus*, *Amanita caesarea*, *Boletus aereus*, *Boletus fechtneri* and *Lopharia spadicea* are also part of the Red List of Europe, while *Astraeus hygrometricus*, *Boletus queletii*, *Cyathus stercoreus*, *Funalia trogii*, *Ganoderma Pfeifferi*, *Geastrum striatum*, *Hericium coralloides*, *Hygro-pho-rus pudorinus*, *Ischnoderma resinum*, *Lactarius violascens*, *Scitinostroma aluta* and *Tricholoma sejunctum* have not been

included in the Preliminary Red List of Fungi of the Republic of Macedonia, but are species protected in the European Red List of Fungi (Ing, 1993). *Antrodia malicola* and *Suillus variegatus* are species known from two localities in Macedonia, one of them Osogovo Mt., while for the species *Gyrophanopsis polonensis* this mountain is the only locality in Macedonia. Another interesting data known only from this region is *Pluteus exiguus*, collected from the guest house (inn) of St. Joakim Osogovski Monastery, on moist wood in a bathroom. Mycodiversity of Osogovo Mt. has about thirty new species for the Republic of Macedonia. The species *Amanita caesarea* and *Panaeolus semiovatus* (as *Panaeolus fumiputris*) have been mapped by Lange (1974). The species *Crinipellis scabellus*, *Cyclaneusma niveum*, *Endoptychum agaricoides*, *Ganoderma pfeifferi*, *Gyrophanopsis polonensis*, *Hemimycena crispula*, *Hygrophorus latitabundus*, *Hygrophorus persoonii*, *Hymenoscyphus fructigenus*, *Hyphoderma roseocremeum*, *Hypoxylon vogesiacum*, *Lactarius glaucescens*, *Macrolepiota excoriata*, *Morchella elata*, *Mucilago crustacea*, *Mycena leptocephala*, *Peltigera elisabethae* cf., *Peltigera horizontalis* cf., *Phallus hadriani*, *Pholiota cerifera* cf., *Pluteus exiguus*, *Psathyrella tephrophylla*, *Russula mairei*, *Scleroderma areolatum*, *Scleroderma bovista*, *Tricholoma imbricatum*, *Tricholoma inocybeoides* cf., *Typhula micans*, *Typhula quisquiliaris* and *Uromyces pisi* stand as new species for the Republic of Macedonia.

The fungi species that contributes to forest management are also worth to be mention here. This group includes wood decaying parasitic fungi, which have a huge role in forest management. Saprotrophs decaying fungi, conversely, have a clear positive impact by participating in the decomposition of dead wood, and thus contribute to the preservation and improvement of soil fertility. Important economic decaying fungi are *Armillaria mellea*, *Fomes fomentarius* and *Fomitopsis pinicola*.

Habitats

The priority habitat types listed in the Habitat Directive, which are registered on Osogovo, cannot be considered as prevailing and predominant habitat types on this mountain, judging by the area they cover and the significance they bear. The habitat with Oriental hornbeam (NATURA 2000:40A0) is mainly represented with rather degraded, bush-like populations which do not create a continuous belt, but rather appear in a scattered manner up to altitude of 750-800 m.

The habitat type on the hilly pastures (NATURA 2000:6220), i.e. the communities belonging to this habitat, are maintained by grazing. However, diminished stockbreeding on the whole territory of the Osogovo Mt., in particular in its lower areas, has led to their gradual becoming overgrown. The habitats with riparian vegetation (NATURA 2000:91E0; 92A0) which develop down the lower course of the rivers belonging to the Osogovo Mt. thrive on relatively small areas and are potentially threatened by prospective waterworks which could be performed on higher altitudes, or by pending construction of water accumulations for water supply or for irrigation. The habitat (NATURA 2000: 6230) with *Nardus stricta* is not particularly threatened, as it is part of the sub-Alpine pasture vegetation. On the Osogovo Mt. there are substantial number of important habitat types, which are, however, not reported in the list of Priority Habitat Types of the Habitat Directive. From phytocenological aspect, they are extremely important, as inside them some important plant communities develop. Besides, they are habitats with an exceptional floral diversity. Such habitats are the sub-Alpine pastures (NATURA 2000:62.D0), the mountain marshes and peat bogs (NATURA 2000:7140), Hydrophyllous tall herb fringe communities of plains and of the montane to alpine levels (NATURA 2000:6430), vegetation of

Alpine and boreal heaths (NATURA 2000:4060), as well as miscellaneous types of forest habitats. Hydrophyllous tall herb fringe communities of plains and of the montane to alpine levels.

The important habitats with grass-like, bush-like and marsh vegetation is located in the sub-alpine belt of the Osogovo Mt.

D2.3 - TRANSITION MIRES AND QUAKING BOGS (NATURA 2000: 7140 - Transition mires and quaking bogs) (1700-2000 m.)

E1.332 - HELLENO-BALCANIC SHORT GRASS AND THEROPHYTE COMMUNITIES (NATURA 2000: 6220 *Pseudo-steppe with grasses and annuals of the Thero-rachypodietea)

E1.833 - BALCANIC MONTANE [Nardus stricta] SWARDS (NATURA 2000: 6230 - *Species-rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe) (1670-1950 m.)

E4.39 - ORO-MOESIAN ACIDOPHILOUS GRASSLANDS (NATURA 2000: 62D0 - Oro-Moesian acidophilous grasslands (1550-2250 m.)

E5.572 - MOESIAN TALL HERB COMMUNITIES (NATURA 2000: 6430 – Hydrophyllous tall herb fringe communities of plains)

F2.26 - [BRUCKENTHALIA] HEATHS (NATURA 2000: 4060 – Alpine and Boreal heaths) (1800-1900 m.)

F2.2A2 - BALCANO-HELLENIC DWARF BILBERRY HEATHS (NATURA 2000: 4060 – Alpine and Boreal heaths) (1600-2200 m.) The important habitats with grass-like, bush-like and marsh vegetation are located in the sub-Alpine belt of the Osogovo Mt. (Sultan Tepe-Ruen).

The communities which are part of the habitats in the mountain marshes and peat bogs - Sphagnum comm. (NATURA 2000:7140), as well as the vegetation of the Alpine and sub-Alpine high grass-like plants (NATURA 2000:6430), belonging to the Cirsion appendiculati alliance, are increasingly represented on silicate mountains, which is the case with the Osogovo mountain. They thrive beside wellsprings and mountain brooks at higher altitudes, which means that possible waterworks related to capture of the waters on higher altitudes could have an adverse effect on these habitats. Decreased stockbreeding and considerable reduction in the cattle will lead to loss of the habitats, both in the hilly pastures and in the sub-Alpine pastures zones (their being overgrown with Chamaecytisus absinthoides, Pteridium aquilinum and other species is already in progress). Mine openings, disposal of the slag (dross) and the numerous access paths altogether cause fragmentation of the habitats of the communities in the hill and mountain belt.

From aspect of presence of significant habitats with grass-like vegetation, presented in the heading “Important areas to be protected”, special attention must be paid to the sub-Alpine part of the Osogovo Mt. (at altitude of 1600-2250 m.) and to protection, in an integral manner, of the set of habitats (marshes, sub-Alpine pastures, bushes with Bruckenthalia spiculifolia and Vaccinium-species, silicate rocky places), especially on the Sultan Tepe and Ruen peaks. On these two mountain tops there are also some rare plant species (Genista fukarekiana, Dianthus microlepis, Anthyllis aurea, Thymus balcanus, Geum rivale, Cardimine glauca etc.). When

zoning, these areas must be included in the strong protection zone, because beside their habitat, vegetation and floral value, they are magnificent landscapes, too.

Ecosystems

As habitats are defined mainly by their floral component, and are essentially homologous with ecosystems, we may take that classification of habitats is similar to the one of ecosystems. However, diversity of ecosystems might be even bigger, because certain differences in the vitality or degradation phases of a given habitat assume different mass-energy balance or different ecosystem. For practical reasons, ecosystem types should be generalized to the extent at which conservation practices will be applicable. Generalization leads inevitably to the definition of the so called “key ecosystems”. Hierarchically set classification of Europe’s habitats EUNIS can serve as basis for such generalization.

Total of 28 basic sets of habitats has been identified in Osogovo Mts. Some of these habitats are of anthropogenic origin, but still have certain significance for biological diversity and are thus part of this classification.

In order to define the most important (key) ecosystem types in Macedonia, we took the third level of EUNIS habitats classification as basis. This classification of the ecosystems in Macedonia can be used to assess ecosystem services of natural ecosystems.

Some of these ecosystems have lesser importance in terms of ecosystem services as they are represented on small areas, while some are key ecosystems and cover significant area of Macedonia’s territory. Key ecosystems are crucial for proper accomplishment of biogeochemical cycles, supply of water, circulation of gases in atmosphere, supply of timber and other products, etc. (lake and river ecosystems, deciduous, evergreen and mixed forest ecosystems). However, less represented ecosystems have enormous importance for biological diversity in Macedonia, as they are habitats that accommodate rare, relict and endemic species (for instance, acid and base peats, saline steppe ecosystems, rocky and stone ecosystems, cave ecosystems).