Finnish Environment Institute SYKE, Finland

Valorization study of Natura 2000 nature values for Pelister National Park– potential Natura 2000 site

Twinning Project MK 13 IPA EN 02 17

Strengthening the capacities for effective implementation of the acquis in the field of nature protection

Report D2.3. - 1.

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The Ministry of Environment and Physical Planning, Department of Nature,
Republic of North Macedonia
Metsähallitus (Parks and Wildlife Finland), Finland
The State Service for Protected Areas (SSPA), Lithuania

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Foreword

The valorization Study of Natura 2000 nature values for Pelister National Park (Pelister NP) is prepared as a part of Twinning project MK 13 IPA EN 02 17, Strengthening the capacities for effective implementation of the acquis in the field of nature protection. The project implementation period is 18.11.2017 – 17.11.2019. Beneficiary of the project is the Ministry of Environment and Physical Planning (MoEPP), Department of Nature of the Republic of North Macedonia and EU Member state executors are Finnish Environment Institute; (Suomen ympäristökeskus, SYKE); Metsähallitus, Parks and Wildlife Finland and the State Service for Protected Areas (SSPA), Lithuania. Among others, the aims of the project are to "Strengthen capacities for preparation of studies for valorisation of nature values" as well as "Strengthened capacities for preparation of draft management plans for natural protected areas which are of national and EU interest for conservation (potential future Natura 2000 sites)" as well as "Strengthen capacities for preparation of studies for valorisation of nature values".

Pelister NP together with Prespa Lake Nature Monument was chosen as one of the target areas for the Twinning project. It was already identified as potential Natura 2000 site within the previous Natura 2000 project "Strengthening the capacities for implementation of NATURA 2000 – EUROPEAID/136609/IH/SER/MK".

Pelister NP has no valid study for valorisation of nature values, however it is under preparation by DECONS-EMA with the financial support by PONT (Prespa Ohrid Nature Trust). Under Twinning project just a part of Valorization study of nature values of Pelister NP is prepared cooperating with the team preparing Valorization study for Pelister NP. This study has the focus in evaluation of nature values of EU importance.

Preparation of this study (a part of the study) is based on existing national legislation, on requirements of EU Habitats and Birds Directives and on the data on habitats and species collected during the implementation of this Twinning project. Additionally, information collected by DECONS-EMA and Macedonian Ecological Society (MES) preparing the Valorization study of nature values of Pelister NP, and information presented in previous projects and investigations, mentioned in literature, was used.

The focus of this Study for valorisation of Natura 2000 nature values for Pelister NP is on nature values related to Natura 2000: habitats of Habitat Directive Annex I and species of Annex II and IV as well as bird species of European Union Directive on the Conservation of Wild Birds (Council Directive 2009/147/EC). Most attention were paid on Bird directive species of Annex I. This study is prepared in a way that it or part of it should be integrated into the new official Study for valorisation of nature values, which is now under preparation.

Available data and field observations of endemic species, nationally strictly protected and protected species, and Habitats Directive Annex V species inside Pelister NP are also included, because they are important to take into account while establishing Natura 2000 areas and databases of conservation values (including Standard Data Forms (SDF)). Species of different habitat types are listed more in Fact Sheets which are included in Annexes of this Study.

The structure of the Valorization study is mainly following the structure defined in the Rulebook on the content of the valorization or revalorization study for the protected area (2012). In addition to the habitats and species protected under the Habitats Directive special attention is also paid on invasive alien species of the area, because this data was not gathered before. Some of these species can alter ecosystems and need to be taken into account in management practices.

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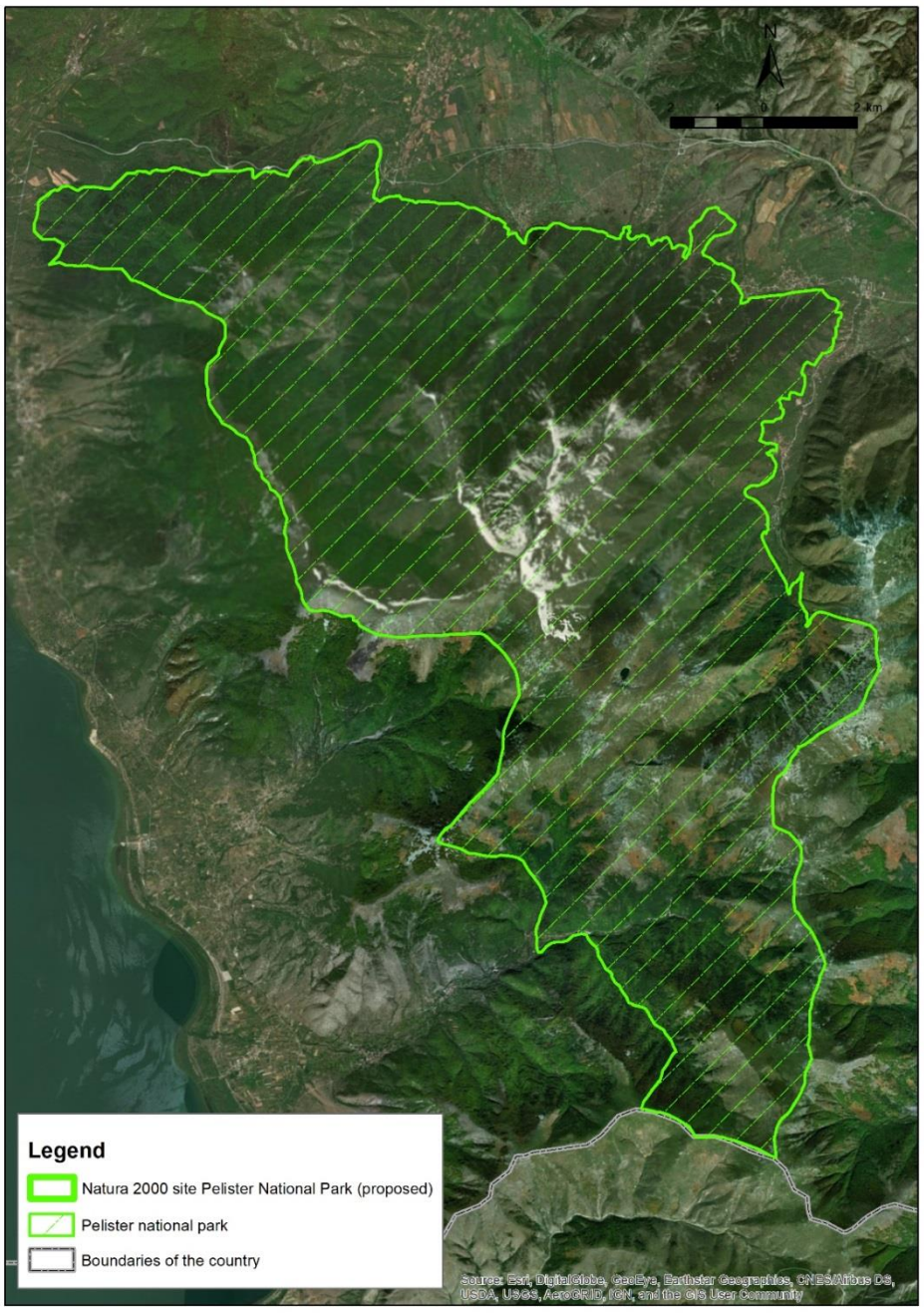
1. Introduction

1.1. Name of the area, its legal base, administrative status

The target area for the Study for valorisation of nature values is Pelister National Park (corresponds to IUCN category II) with a total area of 17 150 hectares (Figure 1). It is the oldest National Park in the Republic of North Macedonia as well as in the former Republic of Yugoslavia. Pelister NP is the second largest national park in the Republic of North Macedonia after Mavrovo NP.



Map 1. Borders of Pelister NP

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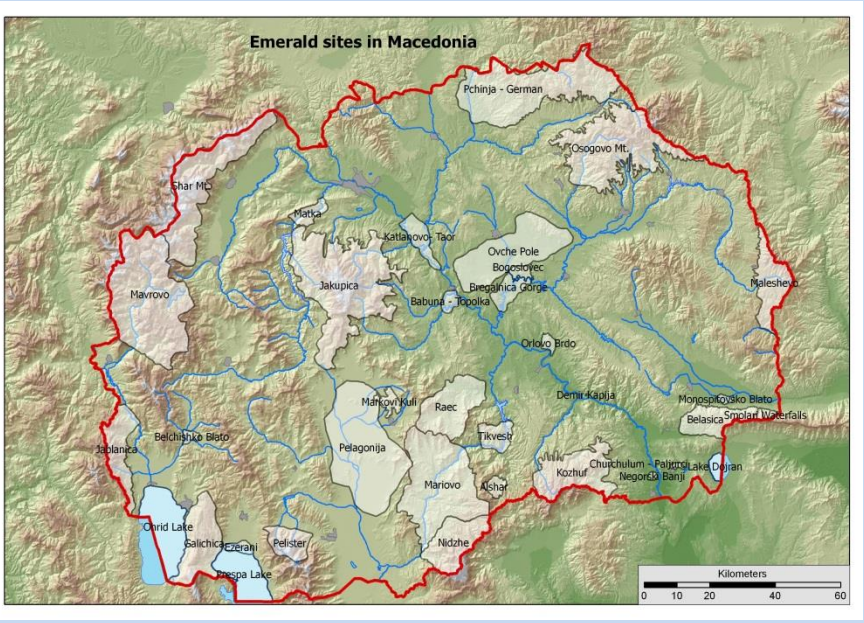
The Pelister NP (12000 hectares) was proclaimed on November 30, 1948 by the law endorsed by the Presidium of the People's Republic of Macedonia (O.J. P.R.M. 38/48). The borders of Pelister NP were extended by additional 5.150 ha in accordance with the new Law on Proclamation of a part of Pelister Mountain for National Park (Official Gazette of the Republic of Macedonia No. 150/07).

According to the Law on Nature Protection Pelister NP administration is responsible for the protection and management of the National Park.

International designations and initiatives

Pelister NP was identified as an Emerald site (code MK0000004) in 2010 (Figure 2). The Emerald network is a network of areas of special conservation interest designated to preserve the network of natural habitats and it is developed on the territory of the Parties to Bern Convention. The main motive behind the development of this network is to contribute to the ecological network similar to Natura 2000 in countries that are not member states of the European Union, using as much as possible similar methodological approach. Pelister NP was identified as a potential Natura 2000 site in the project "Strengthening the capacities for implementation of NATURA 2000 – EUROPEAID/136609/IH/SER/MK" as Site of community interest (Natura 2000 network) in 2017. It is based on European Union Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.



Map 2. Emerald sites in Macedonia

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Pelister NP is also a part of the Balkan Green Belt (code MK002) initiative covering areas in the Republic of North Macedonia, Albania and Greece (Figure 3). Its vision is to conserve and restore the shared natural heritage along the former iron curtain as ecological network connecting high natural values and cultural landscapes, while taking into account economic, social and cultural needs of local communities. The Green Belt crosses 24 European countries (length of 12.500 km), starting from Barents Sea up to Black Sea and it is divided into three parts: Fennoscandian, Central European and Balkan Green Belt

Map 3. The Green Belt in the Republic of North Macedonia

The area of Baba Mountains within Pelister NP, is one of the most important butterfly areas on international level (code MAK-08).

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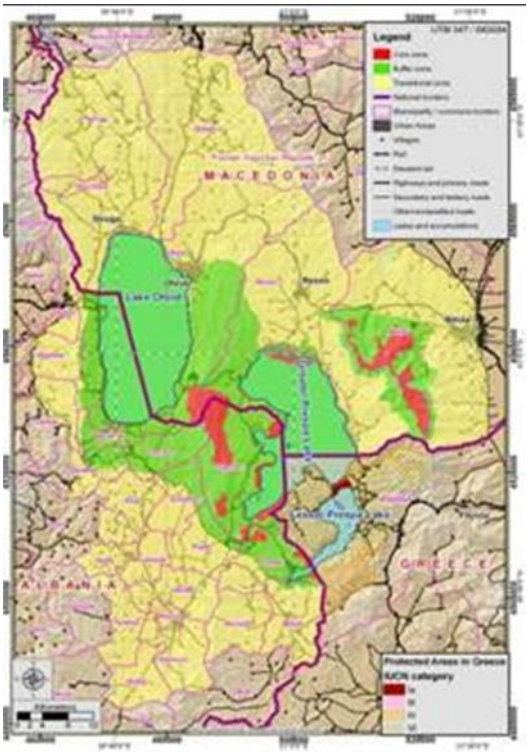
Transboundary designations and initiatives



The Pelister National Park is a part of the transboundary Ohrid-Prespa Biosphere Reserve (Figure 4) declared in 2014 by the UNESCO Man and the Biosphere Programme. It includes the mountain Galicica, the lakes Ohrid and Prespa, and comprises a balanced combination of water bodies and surrounding mountains, bordered by flat areas on its external boundaries. The total area is 446,244.52 hectares (386,915.21 ha terrestrial plus 59,329.31 ha aquatic) in the Republic of North Macedonia and Albania.

The zone of strict protection of Pelister NP is a part of the core zone in the transboundary biosphere reserve. The remaining area within the National Park is a buffer zone of the biosphere reserve. The activities there should be directed towards avoiding negative impact on the core zone and protecting its values.

Map 4. The Transboundary Ohrid-Prespa Biosphere Reserve

1.2. Preparation of the Study for valorisation of nature values

This Study for valorisation of nature values is prepared in the scope of the Twinning project MK 13 IPA EN 02 17, "Strengthening the capacities for effective implementation of the acquis in the field of nature protection" by Finnish Environment Institute (Suomen ympäristökeskus, SYKE), Metsähallitus, Parks and Wildlife Finland and the State Service for Protected Areas (SSPA), Lithuania in cooperation with the Beneficiary of the project – the Ministry of Environment and Physical Planning (MoEPP), Department of Nature of the Republic of North Macedonia.

Additionally, information and contribution has come from the projects implemented by EU/UNDP "Improving management of protected areas". In scope of this project special project "Consultancy support in establishment and implementation of monitoring program for priority selected amphibians and reptile species in the Pelister National Park" and "Consultancy support in establishment and implementation of monitoring program for priority selected habitats in the Pelister National Park" (September 2018 – August 2019) was implemented and additional data for the Twinning project was available. Further PONT (Prespa Ohrid Nature Fund) has supported Pelister NP with Grant Scheme and the MES expert from the project for preparing study for valorization of nature values of Pelister NP provided valuable information especially on bird species and habitat distribution.

Within the Twinning project the following Finish and Lithuanian experts participated in the work:	
Expert	**Role and responsibility**
Arto Ahokumpu	Overall coordination

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Rūta Baškytė	Main responsibility for compiling the plan
Arūnas Pranaitis	Management activities
Petri Ahlroth	Animals
Kimmo Syrjänen	Habitats, plants and animals
Arūnas Balsevičius	Habitats and vascular plants
Zydrunas Preiksa	Habitats, plants and animals
Pekka Rusanen	Birds
Markku Mikkola-Roos	Birds

Within the Twinning project the following Macedonian experts participated in the work:	
Expert	**Role and responsibility**
Vlado Matevski	Habitats and vascular plants
Renata Ćušterevska	Habitats and vascular plants
Dragan Arsovski	Reptiles and amphibians
Metodija Velevski	Birds

2. Description of the area

2.1. General information

Pelister NP is located in the southwestern part of the Republic of North Macedonia, between Prespa Valley and Pelagonia Valley. It covers parts of the northern and north eastern slopes of Baba Mountain. The altitude of the National Park varies between 927 and 2,601 m above the sea level with the highest peak – Pelister. Geographically, the territory of Pelister NP extends between 41°4'15.96" and 40°52'27.85" latitude and 21°3'15.29 "and 21°16'9.41" longitude.

Pelister is one of the most southern mountains in the Balkans with alpine characters. The Macedonian Pine *Pinus peuce* "Molika" is among the most known species values of Pelister NP. It is a Balkan endemic and a tertiary relic tree species with the largest European population in Pelister NP. Pelister is also known for its geological diversity, including stone rivers and glacial lakes. Golemo Ezero ("the Big Lake") is located 2,218 metres above the sea level and Malo Ezero ("the Small Lake") is located at 2,180 metres height.

Administratively, Pelister NP belongs to the municipalities of Bitola and Resen. Only one village, Maloviste, is located within the borders of the national park. Several larger settlements are located around the national park at distances of less than 1 km: Kazani, Rotino, Capari, Magarevo and Trnovo in the northern, i. e. Dihovo and Nizhepole on the eastern border. At the western slopes of Pelister NP we find the villages of Podmochani, Grnchari, Rajca, Kurbinovo, Slivnica, Krani, Arvati, Shtrbovo, Ljubojno, Brajchino and Dolno Dupeni.

The protection of nature and all activities related to protected area management are the responsibility of the Ministry of Environment and Physical Planning (MoEPP). According the Article 74 of the Law on Nature Protection, the National Park is managed integrally throughout the territory. The responsible institution for management of the Pelister NP is the administration of Pelister NP (Public Institution NP Pelister), established in 2006.

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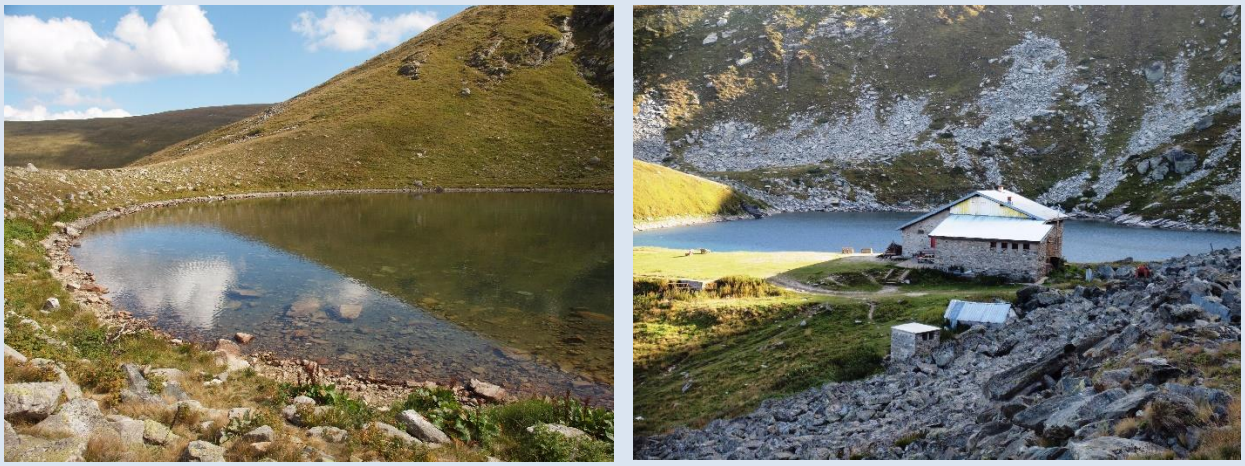
Accordingly, all activities that are carried out within the boundaries of Pelister NP by other entities (natural persons and legal entities) which can in any way affect the protection of nature, biodiversity and all natural heritage, should be previously announced, controlled and approved by Pelister NP administration.

2.2. Ecological information related to the Habitats and the Birds Directives

The data presented in this chapter is mainly based on the inventories carried out by the Twinning project team in 2018 – 2019, data provided by MoEPP which included e. g. former Plan of Management for Pelister National Park (Avramoski 2006 a, b) and collected by the national experts involved into implementation of the project "Improving management of protected areas". National experts participated in the field work and gave comments to the evaluation of the inventory data. Additionally, they provided their own data for the Valorization Study and Management Plan especially on Habitat types, vascular plants, birds, reptiles and amphibians as well as on some other species groups. List of the Annex I of the EU Habitats Directive habitat species is as an ANNEX 2 in this document and list of Habitats Directive Annex II or IV species as well as list of The Birds Directive Annex I bird species as an ANNEX 3 in this document.

2.2.1. Ecosystems and habitats

A total of 22 habitat types listed in the Annex I of the EU Habitats Directive have been found in the area.



Malo Ezero (left) and Golemo Ezero (right) in Pelister NP are alpine lakes with glacial origin and they contain high conservation and recreational values. Photos: Kimmo Syrjänen

1. ***3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea.***

Two water bodies: the glacial lakes Golemo Ezero (3,7 ha) and Malo Ezero (0,66 ha) belongs to this habitat type, although they lack submerged vascular vegetation. The primary production in the lake ecosystem is based on algae. The endemic amphipode species *Niphargus pancici* subsp. *pancici* in Golemo Ezero, and the flatworm *Rhynchelmis komareki* subsp. *komareki*, are recorded from this habitat type in Pelister NP. In addition. other rare invertebrate species like *Chirocephalus diaphanus*, *Arctodiaptomus neithammeri* and *Artcodiaptomus osmanus* have been found in this habitat type at Pelister NP (Avramoski 2006 a). Shoreline vegetation of these lakes is typical for this habitat type.

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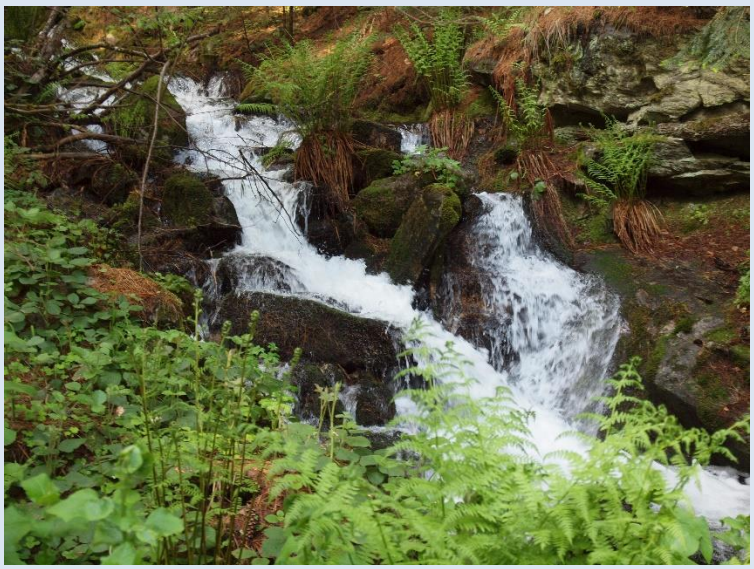

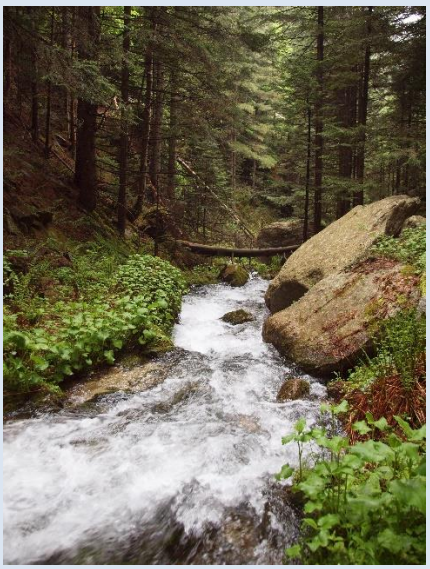

Magarevska river (left) and Rotino river (right) are clear water streams with species rich tall herb fringe on their shores. Habitat Directive plant species *Tozzia carpathica* grows on shores of small streams in a couple of sites in Pelister NP. Photo: Kimmo Syrjänen

2. *3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation.*

Most streams and rivers at Pelister NP belong to this habitat type with scattered submerged vegetation of the vascular plants (*Callitriche spp., Potamogeton spp., Ranunculus aquatilis* s. lat.) and more commonly water growing Willow Moss *Fontinalis antipyretica* growing on stones in river. Streams and brooks at Pelister NP are mainly characterized by clear oligotrophic waters. Their nature values are high also because of endemic trout species: Prespa Trout (*Salmo peristericus)* and Pelagonia Pelagonia Trout (*Salmo pelagonicus*).

Low growing alpine *Juniperus communis/Juniperus nana* heath at northern slope of Mt. Pelister (left). Heaths formed by Balkan spike heath *Bruchenthalia spiculifolia* and blueberry *Vaccinium myrtillus* are also characteristic for Pelister National Park. *Bruchenthalia* grows often mixed with blueberry (right). Photos: Kimmo Syrjänen

3. *4060 Alpine and Boreal heaths.*

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The habitat type 4060 is present at Pelister NP. It is fairly common and abundant at subalpine and alpine areas of the National Park at altitudes 1600 – 2300 m a. s. l. Most of occurrences are located in alpine areas above the natural upper forest boundary. At lower parts of the alpine zone there are low-growing *Juniperus communis* heaths (*Juniperus nana* / *sibirica*) which are changing to *Vaccinium myrtillus* and *Bruckenthalia spiculifolia* -dominated heaths upwards. Different subtypes of alpine and boreal heaths form often mosaics with each other and with alpine grasslands. The Habitats Directive Annex V vascular plant species *Gentiana lutea* is often found in this habitat.

Common juniper *Juniperus communis, Pinus peuce and deciduous scrub* are spreading to alpine heaths and grasslands above Nize Pole. Photo: Kimmo Syrjänen

4. ***5130 Juniperus communis formations on heaths or calcareous grasslands.***

The habitat type 5130 is common in Pelister NP. *Juniperus communis* is typical component of several habitat types of (dry) grasslands and rocky habitats. Description of this type is mainly based on the abundance of juniper. *Juniperus communis* formations with long continuity are often characterized by grazing sensitive herbs and ferns as well as mosses in undergrowth. Most sites of this habitat type are of rather recent origin. Cessation of traditional use (usually grazing and management of pastures by burning or removing junipers) has led on formation and overgrowth of these habitats by dense juniper stands.

5. ***6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites).***

Grasslands of this type are present in subalpine and lower parts of Pelister NP. Most sites are mainly small in area and they are growing over by junipers, bracken, tall herbs and grasses as well as trees and shrubs. This type is more representative on calcareous soils, but there are some species-rich sunny grassland slopes with

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Mesobromion species composition at Pelister NP. Further abandonment results in thermophile scrub with an intermediate stage of thermophile fringe vegetation (*Trifolio-Geranietea*).

Dry grassland between Magarevo and Rotino. This quite recently burned area is slowly changing into *Juniperus communis* formation and thicket with other srubs. It contains fragments of pseudo-steppe and provides possibilities do develop large pseudo-steppe inside Park with suitable management. Long horn beetles from the genus *Dorcadion* (s.l.) which may be endemic for Pelister National Park was met in this open site. Photo: Kimmo Syrjänen

6. *6220* Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea.*

This type is met at lower parts of Pelister NP e. g. above Dihovo – Nize Pole and northeast of Golemo Livida between Magarevo and Rotino villages. There are large and representative pseudo-steppes at western slopes of Pelister NP between park and Prespa Lake, mainly outside of the National Park.

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Most alpine grasslands of the Pelister National Park belong to Oro-Moesian acidophilous grasslands (left). *Dianthus myrtinervius* (right) is low-growing tussock forming alpine plant. It is endemic for mountains of southwestern North Macedonia and northwest Greece. Photos: Kimmo Syrjänen

7. *62D0 Oro-Moesian acidophilous grasslands.*

This is a common and prevailing habitat type at alpine and subalpine parts of the Pelister NP. These alpine grasslands form mosaics of different grassland vegetation communities and with subalpine heaths. This habitat type is typical for central Balkan mountain areas and contains many species with high conservation value. There are local endemic species of vascular plants in this habitat type including *Crocus pelistericus*, *Dianthus myrtinervius* and *Sempervivum octopodes*. Habitats Directive Annex V vascular plant species *Gentiana lutea* is often met in lower parts of alpine grasslands.


Species-rich tall herb fringes are common along streams and springs of the Pelister NP (right). Heart-leaved Ox-eye *Telekia speciosa* is a typical native herb of this habitat type. Photos: Kimmo Syrjänen

8. *6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels.*

A typical habitat type along brooks and streams of Pelister NP. In montane and alpine areas there are species-rich habitats of this type with high representativity. At lowland fringes this has often changed due to human activities. Regarding vascular plants there are several Balkan endemics in this habitat type and *Alchemilla peristerica* is a local endemic.

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9. ***6510 Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis).***

This type of vegetation is present in lower parts of Pelister NP. There are mowed meadows close to Maloviste village which belong either to this type or to *6520 Mountain hay meadows*. In Gjavato pass there is a grassland area inside Pelister NP with long history of overgrowth, but it may originally belong into this type 6510. Also, several small overgrown grasslands with dominating stands of *Asphodelus albus* and *Pteridium aquilinum* are originally meadows and may represent degraded hay meadows or type 6210.

Sphagnum spp. dominated transition mire close to Golemo Ezero. Large part of this habitat type represents rare "Pelagonide Macedonian sedge fens" –habitat with *Carex macedonica* as a characteristic species. Also Balkanian butterwort *Pinguicula balcanica* grows on these mires. Photo: Kimmo Syrjänen

10. ***7140 Transition mires and quaking bogs.***

This habitat type has high conservation value in the Republic of North Macedonia, because this type of habitat consists mainly of EUNIS habitat type "Pelagonide Macedonian sedge fens", which is endemic for the Balkans. In the study area this type is rare and local with few occurrences close to Golemo and Malo Ezero lakes. Habitats Directive Annex V *Sphagnum spp*. mosses are often dominant species in this habitat type. In addition, there are Balkan endemic species of vascular plants.

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Tall herb Balkan campion *Silene asterias* (left) and *Dactylorhiza cordigera* (right) a species of Spotted Orchid genus are both Balkan endemics those are often met along springs of the Pelister NP. Photos: Kimmo Syrjänen

11. *7160 Mineral-rich springs and spring fens.*

This habitat type is rather common especially at alpine zone of Pelister NP at outflow sites where mountain brooks and rivers start to run. There are also springs and spring brooks of this habitat type along slopes of Mt. Pelister and other peaks of Baba mountains inside forest zone. These habitats have specific flora with both boreal and alpine species and several Balkan endemics like *Dactylorhiza cordigera*, *Carex macedonica* and *Silene asterias*. Water-living invertebrates with high conservation value are also present in this habitat type.

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The habitat type 7220 is very rare in Pelister National Park. Localities are characterized by presence of *Cratoneuron filicinum* and/or *Palustriella spp.* moss species and hard alkaline water. Tufa formation is not strong or lacking and the sites are not highly representative. Picture showing springy slope in Sapundica river valley above Nize Pole (left) with *Cratoneuron filicinum* moss and *Silene asterias* (right). Photo: Kimmo Syrjänen

12. *7220* Petrifying springs with tufa formation (Cratoneurion).*

This habitat type is present with small and rather non-representative occurrences in seepage slope of Sapundiza (above Nize Pole), and at springy *Alnus glutinosa* wood close to Gjavato pass in Pelister NP.

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Rich fens are very rare in Pelister NP and usually present as small fragments in mineral rich springy sites. Small spring fen in valley of Ezerska river with *Eriophorum latifolium, Listera ovata* and *Gymnadenia conopsea*. Photo: Kimmo Syrjänen.

13. *7230 Alkaline fens.*

This is a small and rare habitat type at Pelister NP. It is present inside the forest zone, usually at mineral rich places with some trickling groundwater. The typical species composition are fen species of vascular plants including *Eriophorum latifolium*, *Blysmus compressus*, *Listera ovata* and fen mosses like *Campylium stellatum*, *Bryum psedotriquetrum* and *Sphagnum contortum*. The Balkan endemic vascular plants typical for habitat 7160 are also often present in this habitat type.

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Mountain scree in the Pelister NP in southern slope of Mt. Pelister. Siliceous screes are present both at alpine and forest vegetation zones. This habitat type is important for rare lichens and mosses of siliceous substrata, like nationally protected Black Rock-moss *Andreaea rupestris*. Photo: Kimmo Syrjänen

14. *8150 Medio-European upland siliceous scree.*

This is a common and characteristic habitat type for Pelister NP. All boulder scree habitats at the slopes and summit area of Baba mountains are included into this type. Also the famous “stone rivers” of Pelister NP belong to this habitat type. Boulder scree habitats are very important especially for lichens and bryophytes as well as for ferns including rare species with boreal and alpine distribution.

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Siliceous rocky slopes in Yorgov Kamen. This habitat type is common in Pelister NP. *Silene lerchenfeldiana* is Balkan endemic campion species that can be met on cliffs of Pelister NP and it is a characteristic for this habitat type. Photo: Kimmo Syrjänen

15. *8220 Siliceous rocky slopes with chasmophytic vegetation.*

A common habitat type at Pelister NP. Type 8220 is important for floral and vegetational biodiversity. The floral composition includes plant species and plant communities adapted to extreme environmental conditions. The limited genetic exchange between taxa from different mountains provide favourable conditions for endemic speciation, leading to the presence of the North Macedonian and Balkan endemic species within this habitat type. This habitat type is also important for birds like Red-billed chough *Pyrrhocorax pyrrhocorax* in alpine parts Pelister NP. The endemic vascular plant *Sempervivum octopodes* grow often in this habitat type at the alpine area of Pelister NP.

16. *9180* Tilio-Acerion forests of slopes, screes and ravines.*

A rare habitat type in Pelister NP. It is present along slopes of Semnica River between Kazan and Maloviste. Parts of the habitat are recently destroyed during construction of a hydropower plant road. It is also present along Brajcino River, but presence inside the National Park needs to be confirmed. This type can be found at the sides of river ravines in lower parts of Pelister NP and should be further observed.

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Alluvial forests with *Alnus glutinosa* are common as stripes along streams and rivers of Pelister NP, sometimes there are small Black alder woods surrounding springs and in other places where groundwater discharges to surface. Photo: Kimmo Syrjänen

17. *91E0* Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae).*

This priority habitat type is present here and there at slopes and lower part of Pelister NP. At slopes it usually forms corridors and stripes along spring brooks and streams. In some springy sites it forms small woods. This habitat type is important for amphibians, including *Rana dalmatina* and *R. graeca.*

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White oak woods in Pelister NP above Rotino village. Many oak woods have mixed oak species composition. White oak woods with sessile oak *Quercus petraea* are present mainly in lower parts of Pelister NP. Hungarian oak is more frequent in higher parts of oak zone below beech forests. Photo: Kimmo Syrjänen

18. *91AA *Eastern white oak woods.*

Especially when inhabited with old trees this habitat type have great importance for biodiversity conservation. White oak woods are located in lower altitudes and close to borders of Pelister NP. They are characterized by the presence of white oaks *Quercus pubescens* and *Quercus petraea*, but also Turkey oak/Austrian Oak (*Quercus cerris*) and Hungarian/Italian Oak (*Quercus frainetto*) often occur in these forests.

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Near to natural Silver fir forest above Rotino village in Pelister NP (left) and its bottom vegetation with typical forest species including *Prenanthes purpurea, Galium rotundifolium, Oxalis acetosella, Euphorbia amygdaloides, Geranium robertianum, Aremonia agrimonioides, Myosotis sylvatica* and *Rubus hirtus.* Photos: Kimmo Syrjänen

19. *91BA Moesian silver fir forests.*

This habitat type is present especially at northern slopes of Pelister NP. The Moesian Silver Fir (*Abies borisii-regis*) is spreading in Pelister NP and is competitively superior over *Pinus peuce*. There are some pure stands but silver fir grows often mixed with *Pinus peuce* and sometimes with Beech. Silver fir has been favoured by sowing and some stands are of planted origin. Old-growth Silver fir stands have high conservation value.

20. *9280 Quercus frainetto woods.*

In Pelister NP *Eastern white oak woods 91AA** are connected and partly mixed/overlapping with *9280 "Quercus frainetto woods"* those are mainly present at more upper parts of the oak zone just below and sometimes mixed with Moesian beech forests 91W0.

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Beech forest with old trees and coarse decaying wood above Brajzino village in Pelister NP. Huge old living and dead beech trees are important for many rare fungi, insects and other animal species as well as for epiphytic lichens and bryophytes.
Photo: Kimmo Syrjänen

21. *91W0 Moesian beech forests.*

This is probably the most common type of forest in Pelister NP. There are some scattered and fragmented stands with old trees and large decaying logs with characters of pristine forests. These stands have very high conservation value. However, main parts of beech forests in the National Park are managed by selective cuttings in order to produce firewood and timber. These forests are often monotypic and even sized / aged as a result of commercial management practices.

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Macedonian Pine forest with Bracken *Pteridium aquilinum* close to Molika hotel in Magerevo. This is a clear responsibility habitat type for Pelister NP with largest European occurrences of these forests being in the Park. Lower parts of *Pinus peuce* forests are characterized by temperate herbs at the bottom. In upper parts of forest zone undergrowth is mainly boreal with blueberry *Vaccinium myrtillus* as dominating species. Photo: Kimmo Syrjänen

22. *95A0 High oro-Mediterranean pine forests.*

A typical habitat type in Pelister NP. Conservation value of this habitat type with the Macedonian Pine *Pinus peuce* forests is very high. Strict conservation of all natural stands and stands with characteristics of old growth forests of 95A0 at Pelister NP is globally important. Many stands have long forestry history and several stands are regenerated at Yugoslavian time and managed afterward. Green shield moss *Buxbaumia viridis* of Annex II is sometimes present on decaying wood in this habitat type. Habitats Directive Annex V vascular plant species *Gentiana lutea* is often present in subalpine parts of this habitat.

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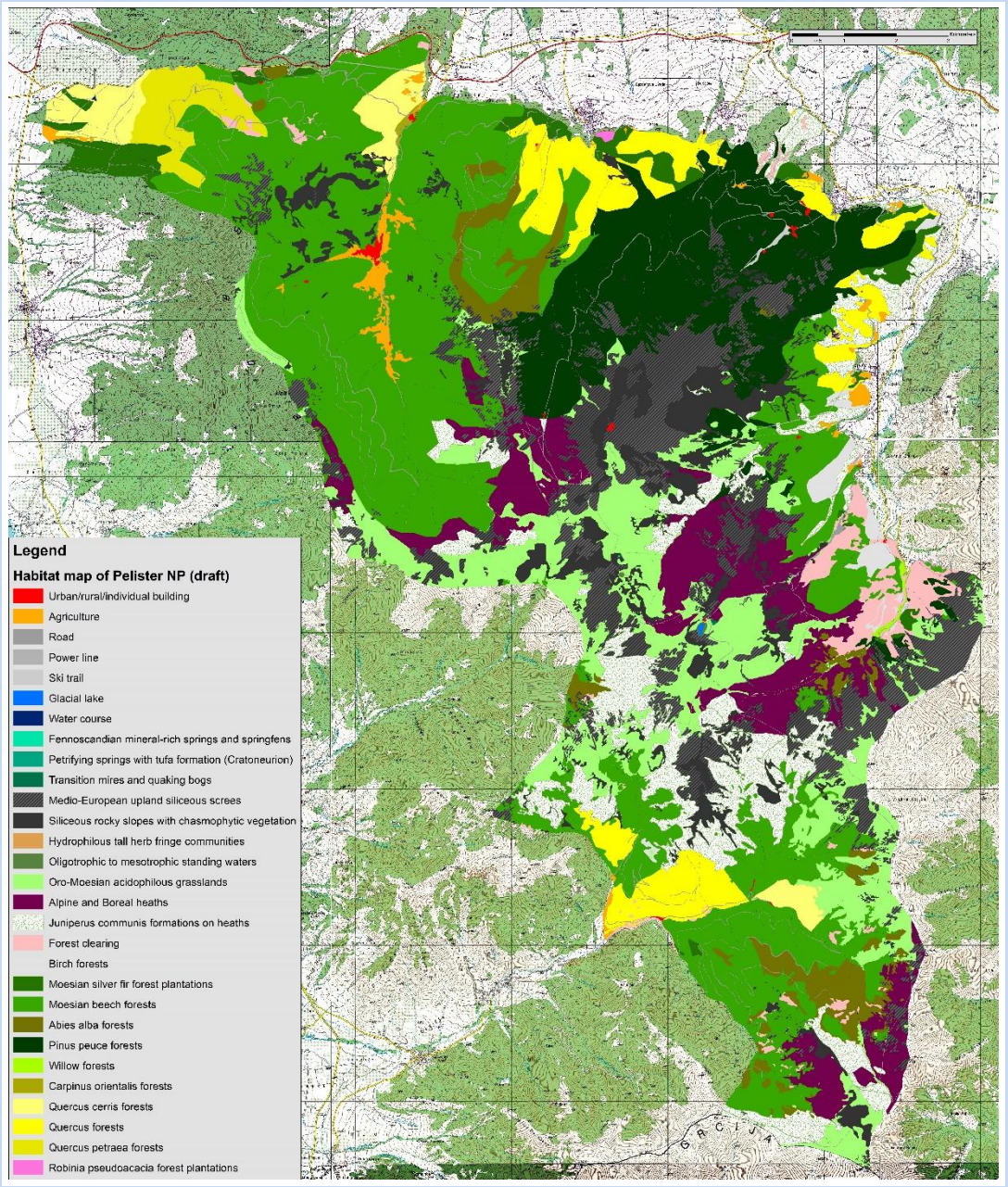

Map 5. Habitat types in Pelister National Park. This map is a draft prepared by Vasko Avukatov from MES. It is based on different remote sensing sources and field surveys by Twinning project and MES, but it is still under preparation.

2.2.2. Flora

Four plant species from Pelister NP are included into Habitats Directive Annex II or IV plant lists. Fresh observations have been made for *Tozzia carpathica*, *Fritillaria gussichiae* and *Buxbaumia viridis* which was found during the Twinning inventories 2018-2019. However, *Mannia triandra* was observed last time more than 50 years ago and the present situation is unknown. In addition to these there are also several other plant species in Pelister NP which are also rare nationally and protected by the Nature Conservation Act. The following protected vascular plants (V), bryophytes (B) and lichens (L) are met in Pelister NP: *Alchemilla peristerica* (V), *Andreaea rupestris* (B), *Buxbaumia viridis* (B), *Crataegus sericeus* (V), *Dianthus myrtinervius* (V), *Eryngium serbicum* (V), *Evernia divaricata* (L), *Fritillaria gussichiae* (V), *Malus florentina* (V), *Parmelina exasperatula* (L), *Pedicularis limnogena* (V), *Peltigera venosa* (L), *Pinus peuce* (V), *Ramalina carpathica* (L),

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Soldanella pindicola (V) and *Tozzia carpathica* (V). In strictly protected species list are following vascular plants: *Crocus pelistericus*, *Gentiana lutea symphyandra*, *Gentiana punctata*, *Sempervivum octopodes* and *Fritillaria gussichiae*.

Carpatian Tozzia is known in the Republic of North Macedonia only from Pelister NP, where it grows along moist shores of clear water streams in a couple of sites. Photo: Kimmo Syrjänen.

1. Carpathian Tozzia (*Tozzia carpathica*)

Habitats Directive Annex II and IV species (code **6244**). *Tozzia carpathica* is an annual hemiparasite that grows at shorelines of subalpine – alpine streams. In the Republic of North Macedonia it is restricted to Pelister NP, but has four known localities here.

2. *Fritillaria gussichiae*

Habitats Directive Annex IV species (code **1845**). It is a spring flowering perennial bulbous herb that grows on sun exposed grasslands and meadows at forest zone and lower parts of alpine zone in Pelister NP. It is a Balkan endemic species and probably considerable amount of European occurrences are in the Republic of North Macedonia.

3. Green Shield Moss (*Buxbaumia viridis*)

Habitats Directive Annex II species (code **1386**). This is an epixylic moss that lives on soft decaying wood of fallen logs or stumps. In the Republic of North Macedonia there are a couple of both old and present

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records. In Pelister NP there is a large viable population in one Moesian Silver Fir forest at Pali Snopje, a site with abundant decaying wood.

4. ***Mannia triandra***

Habitats Directive Annex II species (code **1379**). This liverwort was observed in Pelister NP near the shoreline of Golemo Ezero, 2200 m alt, on wet rocks in 1960.

Invasive plant species at Pelister National Park

The False Acacia (*Robinia pseudacacia*) is the most common and spreading invasive tree species in the Republic of North Macedonia. This species is also the most common and harmful invasive species at Pelister NP. So far it is only present at least in lower parts of the National Park close to Magarevo and quite common along Semica river between Kazan – Maloviste as well as along village Nitze Pole.

Invasive herbs

There are few invasive herbs at Pelister NP. Tall Fleabane (*Erigeron annuus*) is observed by a hydropower plant close to Maloviste. In the same area e. g. *Phytolacca dioica* are also present. Hedge bindweed *Calystegia sepium* is common and spreading along streams close to villages and may also contain non-native intraspecific taxa of garden origin.

Other introduced species

At different parts of Pelister NP Scots pine (*Pinus sylvestris*) seems to be spreading. In northern parts of the national park there are plantations of introduced species like *Pinus sylvestris*, *Pseudotsuga menziesii*, *Pinus strobus*, *Larix sp*., *Picea abies*, *Pinus nigra* and others. These tree-stands should be removed and replaced with natural forest species, in this area this should mainly be oaks and Beech.

2.2.3. Fauna

Altogether **31 animal species** (other than birds) of the Habitats Directive Annex II and IV have been identified in the Pelister NP during inventories in 2018 – 2019 by the Twinning project, however, a total of **47 animal species** of Habitats Directive Annex II and IV have either presently been observed in the area or are documented through literature. In addition to observations done by the Twinning project 2018-2019, there are previous observations (Avramoski 2006 a, b) from certain species of Habitats Directive Annex II and IV, which were not observed during project activities. However, many of them are expected to be continuously present in the National Park.

In addition, there are several species of animals living in Pelister NP, which are not included in the Annexes of Habitats Directive, but which are species of both national and international conservation interest. For example, species of the Long horn beetles from the genus *Dorcadion* (s.l.) and grasshoppers from the genus *Poecilimon*, form small and in many cases endemic populations in the Pelister NP. In the case of *Poecilimon spp*., the taxonomic work is in process and only after more detailed taxonomic studies the level of endemism can be assessed properly. In addition to these species, some species of Coleoptera in the *Carabidae* family have been found only in the alpine areas of the Baba Mountains in the Balkans. In many areas of the Republic of North Macedonia habitats in caves maintain a diverse fauna, which is only partly studied and which may contain species which are not yet defined by taxonomists. In Pelister NP with siliceous bedrocks, however, no large caves have been identified, and the potential for finding endemic cave species is probably low. Still, also another animal species with both national and international value are found in the National Park, like large carnivores. In addition, there are a lot of invertebrate species with high national and international conservation value in the Pelister NP (Avramoski 2006 a, b): these include e.g.: *Deroceras turcicum* (a terrestrial pulmonate gastropod), *Duvalius macedonicus* (a Carabid beetle), *Duvalius peristericus* (a Carabid beetle) and *Eucypris kurtdiebeli* (a fresh water *Crustacean*).

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Vertebrates

Mammals

In the Twinning project team no mammal expert has been available. However, tracks and faeces of especially brown bear and wolf have been observed during inventories. Marks after these large carnivores have been made in several parts of the National Park. Also, rangers of the Pelister NP have confirmed occurrences of these mammal species, and other. Photos taken with game cameras often allow identification of large carnivore individuals, especially if the photos are taken during a short time period. An estimation of age and sex is also possible in many cases.

1. **Wolf (*Canis lupus*)**

Habitats Directive Annex II, IV and V (code **1352**). Tracks of wolf can be found at different parts of Pelister NP from lowlands to subalpine and alpine areas. Within the Twinning project there have been observations on wolf up from Gjavato, Capari and Rotino villages. There are plenty of prey animals available for wolf and the only real threat is poaching. Wolf is a large carnivore with international interest and monitoring of the species should be started nationally. At Pelister NP rangers could do observation on the species. Methods can include game cameras and counting of tracks (including winter counts). The observations of wolf by the Twinning project in Ezerani Nature Park recalls, that there is dispersal corridor from Pelister NP through northern parts of Prespa Lake to Galicica National Park.

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The European Wildcat is a nocturnal and solitary cat species preferring areas with rocks and tall trees,dense thickets and abandoned burrows for shelter and hideaway. Photo: Petri Ahlroth.

2. European Wildcat (*Felis silvestris*)

Habitats Directive Annex IV (code **1363**; for *Felis silvestris silvestris* code **6110**). The European Wildcat has fragmented distribution through temperate broadleaf forests in Europe, because it has already become extinct from some countries. The European Wildcat is in the list of strictly protected species in the Republic of North Macedonia. There are still some pouching of the species and furs of wildcat can be bought easily. Within the Twinning project there was only one observations of wildcat in vicinity of Pelister Info Center at night, but the presence of a larger population in Pelister NP is evident.

Otter *Lutra lutra swimming in Prespa Lake* Photo: Petri Ahlroth.

3. Otter (*Lutra lutra*)

Habitats Directive Annex II and IV (code **1355**). Otter can be found close to very different types of waterbodies. Otters occupy both standing and running waters and they can search food also along very small streams. Otters move in large areas and they have good dispersal ability. Within the Twinning project there were no observations on otter but it was observed at Prespa Lake and there are a lot of suitable stream habitats for the species in the Pelister NP. The otter is in the list of strictly protected species in the Republic of North Macedonia.

4. Lynx (*Lynx lynx*)

Habitats Directive Annex II, IV and V (syn. *Felis lynx*) (code **1361**). At Balkans there is living the Balkan Lynx (*Lynx lynx* subsp. *balcanicus*), being present in eastern Albania and western parts of the Republic of North Macedonia, with smaller populations in Kosovo and Montenegro. In Pelister NP the Lynx is very rare and

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there is no viable population presently in the National Park. However, there are single observations on wandering individual at game cameras (like in 2018). In principle there are suitable habitats and a lot of prey animals for the Lynx in the National Park.

5. Hazel Dormouse (*Muscardinus avellanarius*)

Habitats Directive Annex IV (code **1341**). This mammal is present through temperate broadleaf forests in Europe and mainly feed on nuts of *Corylus avellana* (and *C. colurna*) with other fruits, foliage, pollen and insects. It is given in the Plan of Management for Pelister National Park (Avramoski 2006b). Within the Twinning project there are no fresh observations, but the Hazel Dormouse spends a large proportion of its life sleeping and is not easy to find. There is a lot of suitable habitat with hazel dominated luxurious broadleaf and *Pinus peuce* forests for the Hazel Dormouse at lower parts of Pelister NP.

6. Balkan Chamois (*Rupicapra rupicapra* subsp. *balcanica*)

Habitats Directive Annex II and IV (code **1371**). This chamois inhabit steep, rocky areas in the mountains, utilizing a variety of habitats including alpine meadows, open rocky areas, and (especially during wintertime) forested areas, like mixed broadleaf forests and coniferous woodlands (Aulagnier et al. 2008). A locally small population of the Balkan Chamois in the Pelister NP is in principle directly connected to Greek (and more widely with other western Balkan) populations of the species. However, due to (rather recent) historical poaching of Balkan Chamois popolations in Pelister NP, the number of individuals has remained very low during the last decades. The Balkan Chamois has still been seen annually in the National Park during 2010's, but recent population is low and needs both monitoring and an action plan with real conservation measures to maintain and re-establish the population. At summertime scattered individuals of present flock of the Balkan Chamois can be seen around the Goat rock (коза камен) at alpine part of the Pelister NP. The species may also suffer from competition with other ungulates and in general predation pressure caused by large carnivores can decrease also the stand of Balkan chamois. Overgrowth of alpine heaths and grasslands can decrease an amount of suitable habitats. Management of low-growing alpine grasslands to produce pastures for the Balkan Chamois should be an important target in future management plans of the Pelister NP. Maintaining of alpine grasslands will support also of several other species groups

7. Brown Bear (*Ursus arctos*)

Habitats Directive Annex II and IV (code **1354**). There is a rather large population of Brown Bears at Balkans in Europe. The Dinaric-Pindos population of Balkans has remained relatively stable and consist of 2.500–3.000 individuals (continuing from northeast Italy, Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, North Macedonia, Albania and Bulgaria to Greece). The Brown Bear subpopulation of Pelister NP is important in the middle of Balkan distribution area. There are some traditions of poaching of bear within the surroundings of Pelister NP, which is harmful for the local population and to maintain continuous range of the species. Otherwise there are plenty of food (like blueberries and ants, etc.) as well as mammal prey for the Brown Bear in Pelister NP. The Brown Bear is in the list of strictly protected species in the Republic of North Macedonia. Like with wolf it would be important to maintain ecological connections/corridors to disperse north- and westwards through Gjavato pass and along northern shores of Prespa lake to Galicica mountains.

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In addition to the mammals listed in the Habitats Directive there are also several other species of small mammals (Avramoski 2006 a, b) with conservation value in the Pelister NP like: the Lesser Mole Rat (*Nannospalax leucodon* syn. *Spalax leucodon*) (Kryštufek & Amori 2017), the Balkan Mole (*Talpa stankovici*) (Vohralík & Kryštufek 2016), the European Snow Vole (*Chionomys nivalis*) (Kryštufek 2016), the Mediterranean Vole (*Talpa caeca*) (Cassola 2016) and the Balkan Pine Vole (Mitsainas & Kryštufek 2008) as well as the Edible Dormouse (*Myoxus glis* syn. *Glis glis*) and the Forest Dormouse (*Dryomys nitedula*) (Batsaikhan et al. 2016) (ANNEX 3).

Mammals – Bats

With particular bat species also all *Microchiroptera* are listed in Habitats Directive Annex IV. The following bat species of Habitats Directive Annexes are recorded in the Pelister NP (Avramoski 2006 b): Lesser Mouse-eared Myotis (*Myotis blythii*) (Annex II and IV code **1307**) Least concern LC by IUCN (Juste & Paunović 2016), Long-fingered Bat (*Myotis capaccinii*) (Annex IV code **1307**) Vulnerable VU by IUCN (Paunović, M. 2016), Blasius's Horseshoe Bat (*Rhinolophus blasii*) (Annex II and IV, code **1306**) Least concern LC but decreasing by IUCN (Taylor 2016a), the Mediterranean Horseshoe Bat (*Rhinolophus euryale*) (Annex II and IV, code **1305**) Near threatened NT by IUCN (Juste & Alcaldé 2016), Greater Horseshoe Bat (*Rhinolophus ferrumequinum*) (Annex II and IV, code **1304**) Least concern LC by IUCN (Piraccini 2016) and Lesser Horseshoe Bat (*Rhinolophus hipposideros*) (Annex II and IV, code **1306**) Least concern LC by IUCN (Taylor 2016 b).

The species *Myotis capaccinii*, *Rhinolophus blasii* and *Rhinolophus euryale* are in the list of protected species of the Republic of North Macedonia. Within the Twinning project some bats were observed but species were not determined.

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Mediterranean Horseshoe Bat *(Rhinolophus euryale).* Caves with a constant microclimate are chosen for winter roosts, old hollow trees and abandoned buildings are important especially during summer. Photo: Petri Ahlroth

Reptiles and amphibians

In the Management Plan for Pelister National Park (Avramoski 2006) the following amphibians were recorded for the National Park: *Bombina variegata*, *Bufo bufo*, *B. viridis*, *Hyla arborea*, *Rana dalmatina*, *R. graeca*, *R. ridibunda*, *Salamandra salamandra*, *Triturus carnifex* and *T. vulgaris*. On these *Bufo viridis* (syn. *Bufoides viridis* annex IV code **1201**), *Hyla arborea* (annex IV code **1203**), and *Triturus carnifex* (syn. *T. macedonicus* annex II and IV code **5364**), which are species of Habitats Directive Annexes were not observed within the inventories of the Twinning project, neither was *T. vulgaris*. All other amphibians of the list were observed.

Of reptiles the following species are listed in the Management Plan for Pelister National Park (2006): *Ablepharus kitaibelii*, *Anguis fragilis*, *Coluber caspius*, *Coronella austriaca*, *Elaphe longissima*, *Lacerta agilis*, *L. trilineata*, *L. viridis*, *Natrix natrix*, *N. tessellata*, *Podarcis erhardii*, *P. muralis*, *P. taurica*, *Testudo hermanni*, *Vipera ammodytes* and *V. berus*. *Coluber caspius* (syn. *Dolichophis caspius* Annex IV code **6138**), *Coronella austriaca* (Annex IV code **1283**), *Natrix natrix* and *N. tessellata* (Annex IV code **1292**) were not met during inventories within the Twinning project.

The European Copper Skink lives in sun exposed slopes with dry grasslands and scrub at lower part of Pelister NP. Photo: Petri Ahlroth.

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14. European Copper Skink/ European Snake-eyed Skink (*Ablepharus kitaibelii*)

A reptile species of Habitats Directive Annex IV (code **1276**). It is small and slender dark copper coloured – with even more dark flanks – lizard in the family *Scincidae*. It is an endemic reptile of south-eastern Europe and Turkey. This species lives in dry areas including south facing slopes, meadows, scrubland and clearings in woodland (both deciduous and pine), and it is generally found close to ground cover such as leaf-litter, dead wood, stones, bushes and other vegetation (Böhme et al. 2017). In Pelister NP the European copper skink was found at dry grasslands – Juniper scrub close to Magarevo village within the Twinning project. Main threat is overgrowth and afforestation of suitable dry grasslands in the area.

15. Yellow-bellied Toad (*Bombina variegata*)

An amphibian species of Habitats Directive Annex II and IV (code **1193**). It inhabits temporary ponds in different habitats ranging from forests, forest roads, open lowland and highland meadows and sides of lakes and rivers. It can also be found in slightly urbanized environments, such as ponds, ditches and water-filled road trails in small villages and their surroundings. The ponds that the Yellow-bellied Toad inhabits generally lack vegetation and are free of competing species and predators. Although highly adaptable and apparently resistant to extreme flooding events, the population growth of Yellow belied Toads can be sensitive to droughts (Cayuela et al. 2016 a) due to global climate change, or direct human activities (e. g. fires, tillage, etc.). Such unpredictable environments cause high variation in inter-annual fecundity and slightly lower annual survival probabilities of both adults and immatures (Cayuela et al. 2016b, c). Within the Twinning project the Yellow-bellied Toad was observed in Magarevo (Golema Livida), Kazan – Malovishte and a couple of sites along Sapundiza river valley above Nize Pole. Inventories and monitoring of the species should be continued in Pelister NP, because species can be sensitive to climate warming (habitats can dry out) and trend of population in uncertain..

16. Aesculapian Snake (*Elaphe longissima* syn. *Zamenis longissimus*)

A reptile species of Habitats Directive Annex IV (code **1281**). It is a nonvenomous snake of the family *Colubridae* and adults can reach length of 1-1,5 m., which makes it one of the longest snakes in Europe. It is typical at zone of broadleaved forests and it lives in forested hilly landscapes with varied humidity along river valleys. In suitable environments there are available also warm sun-exposed but not hot habitat patches. The Aesculapian Snake eats small mammals (mice, rats, shrews, moles) and birds (also eggs and nestlings). Within the Twinning project one individual of this species was observed in forested slope by the road close to Pelister NP Info Centre.

17. Sand lizard (*Lacerta agilis*)

A reptile species of Habitats Directive Annex IV (code **1261**). It can be found in a wide range of habitat types including meadows, heathland, coastal dunes, grassland, steppe, subalpine and alpine meadows, scrubland, hedgerows, open woodland, in alpine areas, traditionally managed agricultural land and rural garden (Agasyan et al. 2010). Sometimes it is present in sandy semi-desert areas. It is classified as Least concern LC by IUCN (Agasyan et al. 2010). The species was observed within the Twinning project at Magarevo, in skiing slope grassland close to Hotel Molika, and in alpine zone of south-west facing slope of Mt. Pelister at 2.300 m altitude.

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18. Three Lined Lizard (*Lacerta trilineata*)

Habitats Directive Annex IV (code **1251**). It favours semi-open shrub areas, sunny forest edges, roadsides and rocky grasslands with mosaic of higher vegetation and open patches. In field this quick moving lizard is not easy to separate from closely related *L. viridis*. Both species are met in sun-exposed grasslands, Juniper scrub, rocky habitats and roadsides at lower parts of the Pelister NP.

19. Balkan Green Lizard (*Lacerta viridis*)

Habitats Directive Annex IV (code **1263**). The species favour semi-open shrub areas, sunny forest edges, roadsides and rocky grasslands with mosaic of higher vegetation and open patches. In field this quick moving lizard is not easy to separate from closely related *Lacerta trilineata*. Both species are met in sun-exposed grasslands, Juniper scrub, rocky habitats and roadsides at lower parts of the Pelister NP.

20. Erhard's Wall Lizard/Aegean Wall Lizard (*Podarcis erhardii*)

Habitats Directive Annex IV (code **1238**). It is an endemic species to Southeast Europe. The species lives in sunny rocky meadows, open cliffs and other stony habitats. In Pelister NP it was observed at dry grassland in Kazan.

21. Common Wall Lizard (*Podarcis muralis*)

Habitats Directive Annex IV (code **1256**). It is very common species and it lives in many types of habitats including warm forest slopes, forest edges, scrub areas, roadsides and many types of cultural habitats. In Pelister NP it is mainly met in lower areas in grasslands and open forests. This species was met at several sites in lower part of Pelister NP within the Twinning project.

22. Balkan Wall Lizard (*Podarcis taurica*)

Habitats Directive Annex IV (code **1248**). It favours dry meadows, often in sandy soils, scrub areas and rocky shores. It is rather common species in the region, but limited to lower altitudes and rare in the area of Pelister NP. It was observed in vicinity of Magarevo village.

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The Agile Frog. Photo: Petri Ahlroth.

23. Agile Frog (*Rana dalmatina*)

Habitats Directive Annex IV (code **1209**). The Agile Frog is common species in the area. It can be found from many kinds of moist habitats like shores of lakes and ponds, wetlands, ditches, sides of rivers and small streams. Adult individuals move in moist forest areas and can be found far from the open water bodies. Adult individuals also visit moist caves. The Agile Frog is closely related to *Rana graeca* (code **1208**), the Greek stream frog. It is also very probably present in the area of Pelister NP, but occurrence of the species was not confirmed in the National Park within the Twinning project.

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The Nose-horned Viper *Vipera ammodytes* is very venomous but a rare snake species in Pelister NP. Photo: Petri Ahlroth.

24. Nose-horned Viper (*Vipera ammodytes*)

Habitats Directive Annex IV (code **1295**). The Nose-Horned Viper is a rare snake species in Pelister NP. It occurs in many kinds of habitats, favouring sunny rocky slopes and other open and semi-open habitats but can be met in forests as well. In Europe it occurs through Balkan to the Middle East. It was found above Brajchino within the Twinning project. This viper is feared due to high toxicity of its venom, and it is considered to be the most dangerous snake in Europe.

25. Herman's Tortoise (*Testudo hermanni*)

Habitats Directive Annex II and IV (code **1217**). Herman's tortoise inhabits many types of natural habitats such as meadows, open oak forests and secondary growth forests mainly where the influence of the Mediterranean climate is present. Tortoises are mainly threatened by loss of habitat due to urbanization and agriculture. The limited locomotor capabilities of these armoured animals make them very susceptible to fires as well as vehicles, making roadkill tortoises a common site across roads in the Republic of North Macedonia. In Pelister NP Herman's Tortoise have been observed from lower parts of the National Park at oak forests and semi-natural open habitats close to villages of Magarevo and Capari.

Fish Species

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Two individuals of the Pelagonia Trout *Salmo pelagonicus ready for spawning* in river Sapundica in 2019. Photo: Kimmo Syrjänen.

26. Pelagonia Trout (*Salmo pelagonicus* syn. *S. macrostigma*)

Habitats Directive Annex II (code **5354**). *Salmo pelagonicus* is in the list of strictly protected species in the Republic of North Macedonia. The Pelagonia Trout is found at tributaries of the lower Vardar and Aliakmon (North Macedonia and Greece). In Pelister NP it has been observed in streams and rivers running at eastern the side of the Baba massif into the Pelagonian valley. This species is dependent on clear unpolluted water. It is threatened by water uptake and drying of streams due to climate warming.

27. Prespa Trout (*Salmo peristericus* syn. *S. macrostigma*)

Habitats Directive Annex II (code **5355**). The Prespa Trout is found in rivers running to Prespa Lake from western slopes of Baba mountains like Brajcinska river. Most occurrences are located below the area of the National Park. The trout is in the list of strictly protected species in the Republic of North Macedonia. Like Pelagonia Trout the Prespa Trout is dependent on clear unpolluted water. It is threatened by water uptake, pollution and drying of streams due to climate warming.

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Invertebrates

Crustaceans (*Crustacea*)

The Stone Crayfish from Brajchino river. Photo: Petri Ahlroth.

28. Stone Crayfish (*Austropotamobius torrentium**)

Habitats Directive Annex II and V (code **1093**). The Stone Crayfish is a prioritized species of the Habitats Directive. The Stone Crayfish occurs in the middle of Europe and Balkans. Its favourite habitat is the pristine running waters (springs, brooks) but it can also be found in rivers or even lakes in the mountain area (Pârvulescu 2010). Usually it prefers galleries that it digs in the ground banks but it lives very often hidden under submerse roots, stones or rocks. It is more active during the night eating almost everything, that's why it represents a truly sanitary of the waters. It is sensitive to low concentration of oxygen and chemical pollution (Pârvulescu 2010). In Pelister NP this species is found from Brajcinska and Stanishar rivers (at altitude of 1050-1200 asl; according to information of Macedonian Ecological Society). Within the Twinning project this species was observed in Brajcinska river just above the village.

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Insects

In addition to the insect species observed within the Twinning project, the following two Habitats Directive species have been observed previously in Pelister NP (Avramoski 2006a): The False Eros Blue butterfly (*Polyommatus eroides*) (Annex II and IV, code **4042**) and *Paracaloptenus caloptenoides*, a locust species (Orthoptera), (Annex II and IV, code **4053**). These were not observed within the Twinning project, but they both may still exist in the area.

Beetles (*Coleoptera*)

The Cerambyx Longicorn. Photo: Petri Ahlroth.

29. Cerambyx Longicorn/Great Capricorn Beetle (*Cerambyx cerdo*)

Habitats Directive Annex II and IV (code **1088**). The Cerambyx Longicorn is one of the largest European beetle species. The species lives in broad-leaved deciduous forests, parks and other semi-open habitats with large dead Oaks (*Quercus spp.*), it favours warm edges of forests, sun-exposed slopes and roadsides. It was met in Pelister NP above Capari on old oaks. Like in many other longhorn beetles with wings, adults are weak flyers and very rarely fly more than 500 meters from their tree (EU wildlife … 2009). The species normally selects old and decaying trees, such as oaks that are over 100 years old and have a diameter larger than 40 cm (EU wildlife … 2009). It is important to protect all old oaks at lower part of Pelister NP while trying to maintain this fauna species in the National Park.

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Cucujus cinnaberinus, one of the Flat Bark Beetles was found first time for the Republic of North Macedonia by twinning project. Photo: Petri Ahlroth

30. *Cucujus cinnaberinus*

Habitats Directive Annex II and IV (code **1086**). *C. cinnaberinus* is a species of the *Cucujidae* family, the Flat Bark Beetles. The species lives under the bark of dead trees. Both larvae and adults can be found under the bark of Aspen (*Populus*), Oak (*Quercus*), Birch (*Betula*) and sometimes also Pine (*Pinus*) (Nieto et al. 2010 a). Several forest habitat types with primeval or old-growth characteristics can be potential habitats for the species. The species is dependent on the continuum of dead wood in the site or immediate vicinity, where it lives. For this reason, the species has disappeared from large areas in Europe due to intensive forestry activities. However, in Hungary it has met also from Black Locust (*Robinia pseudacacia*) plantation from suitable trees. *C. cinnaberinus* was found first time in the Republic of North Macedonia within the Twinning project inventories in 2018. It was found during the field works in Pelister NP, under the bark of dead Macedonian Pine *Pinus peuce*. Forestry is also the main threat for the species in the only known living area of *C. cinnaberinus* in the Republic of North Macedonia at Pelister NP. Sanitary cuttings in the area do not allow habitats to evolve in a way suitable for the species. All saproxylic species (i.e. species those are dependent on coarse decaying wood) face the same problem in Pelister NP. Amount of dead trees should be increased in Pelister NP and valuable forest habitats with coarse woody debris should be left out of all forestry activities.

31. Stag Beetle (*Lucanus cervus*)

Habitats Directive Annex II (code **1083**). The Stag Beetle lives usually in forest habitats with large oak trees. Stag Beetles are famous because of very large horn-like mandibles of males those are used in the fight

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from the females. Male mandibles are harmless for people but females can give a painful bite for a too eager enthusiast. Larvae of the species use rotten wood of stumps, base of dead standing trees and other dead wood buried in soil with always decayed by white-rot fungi (Nieto et al. 2010). The larvae develop in moist decaying wood near or below the soil surface, and larval development takes about four to five years. The species needs big rotten trunks and stumps those maintain moisture, but it can also be met in the base of fence posts etc. Stag Beetle larvae lives typically on rotten wood of different oak species, but sometimes they are also found on other broad-leaved trees, including the genera *Castanea*, *Fraxinus*, *Populus*, *Quercus*, *Salix* and *Tilia* (Nieto et al. 2010b). The species has relatively good dispersal ability, but suitable habitats and patches of coarse woody debris are scattered in the landscape. All large decaying and dead oaks and decaying coarse woody debris at forest floor should not be cut or removed but left for the stag beetles and a large number of other rare saproxylic species. Within the Twinning project the Stag Beetle was found in oak forests above Capari, Magarevo and Brajcino. Both sexes were present and there seems to be a rather viable population of the Stag Beetle in the Pelister NP. It is important to ensure that there will be a continuum of old oaks and coarse woody debris in Pelister NP and nearby areas also in future.

32. ***Morimus funereus***

Habitats Directive Annex II (code **1089**). This saproxylic beetle is geographically very variable and represents a flagship species of old-growth deciduous forests in Eastern and South-eastern Europe (Solano et al. 2012). *M. funereus* favors old broad-leaved trees with thick bark. The species has been observed in a couple of places from Pelister NP, e. g. on old aspen and oak trees in three separate locations above Capari, on old oaks and beeches in a couple of sites above Brajcino. The species has poor dispersal ability and if local extinctions take place, the probability for recolonization is low. There may be presently a viable population at Pelister NP. Inventories should be done in the area in order to find figure out the size of population. All old large deciduous trees (and especially dead or dying trees) and stands with such trees should be left out from the forestry activities. In areas with lack of suitable trees, the volume of large dead trees should be increased artificially. Restoration activities should be concentrated close to known populations because of the restricted dispersal ability of the species.

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The Rosalia Longicorn is prioritized beetle in EU and rare in Pelister NP. It needs continuity of very old and dead beech trees to survive. Photo: Petri Ahlroth.

33. Rosalia Longicorn (*Rosalia alpina**)

A prioritized beetle of Habitats Directive Annex II and IV (code **1087**). This is inhabitant of beech forests with old-growth characteristics: large old dying or dead trees in more or less sun-exposed habitats (Campanaro et al. 2017). *R. alpina* suffers from fragmentation on suitable habitats in the whole Europe. The intensive use of the beech forests with sanitary cuttings and removal of any dead wood, have reduced the populations of the species in large parts of Europe, and brought it to the brink of extinction (Reißmann 2010). *R. alpina* seems to be rare in Pelister NP and was observed on two locations with old dying beeches above Brajcino within the Twinning project in 2018-2019. However, the habitat seems to be typical for the species and there are some suitable habitats for species especially along western slopes of Pelister NP. The Rosalia Longicorn is supposed to be an average flyer, like many other longhorn beetles, whose spreading is most probably low, in most cases the covered distance is below 1000 m (Reißmann 2010). The size and viability of the *R. alpina* population in Pelister NP needs to be evaluated. The Rosalia Longicorn is one of the most demanding insects of very old beech trees and forests in the National Park.

Dragonflies (Odonata)

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The Balkan Goldenring lives close to clear water streams in several sites in Pelister NP. Photo: Petri Ahlroth.

34. Balkan Goldenring (*Cordulegaster heros*)

Habitats Directive Annex II and IV (code **4046**). The species lives in small, swift streams, usually in the forested slope valleys at mountains (Boudot 2010). All dragonflies are sensitive to decreased water quality and use of pesticides. However, small mountain rivers and streams are mostly located in areas without pollution and eutrophication pressures, those are more common threats in lowland rivers and other water bodies. Uptake of water for irrigation and as drinking water in the Pelister NP can be a threat to this species. Especially climate warming will increase risks for maintenance of this species in Pelister NP in future decades. Within the Twinning project the Balkan Goldenring was observed at forests roads close to small clear water streams at Capari, Magarevo, Magarevo-Rotino and slopes above Gjavato. There is probably a viable population along streams of the National Park and inventories are needed at suitable sites and populations should be monitored.

Butterflies (Lepidoptera)

35. Eastern Eggar (*Eriogaster catax*)

Habitats Directive Annex II and IV (code **1074**). The species has wide distribution in the country. The Eastern Eggar is night active and it lives in semi-open habitats, at the edges of forests and sides of the roads. Strong fluctuation is typical for the populations, but as the species is not especially demanding with the habitat or food plants, it is able to recolonise potential habitats. Usually there is no need for active managements to maintain the habitats for this species. Use of pesticides should be avoided in areas with colonies. In

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Pelister NP colonies of *Eriogaster catax* were found in several places at vicinity of Magarevo village close to pastures.

36. Marsh Fritillary (*Euphydryas aurinia*)

Habitats Directive Annex II (code **1065**). The Marsh Fritillary lives in dry or relatively dry meadows. The larvae feed on different species of family Dipsacaceae (*Knautia spp*., *Succisa pratense*, *Scabiosa spp*. and *Dipsacus spp*.). The species is declining in many European countries due to lack of traditional keeping of animals in pastures. Old pasture areas have been overgrowing and food plants have been disappearing in many areas. Overgrowing of meadows is the main threat for this species. In Pelister NP this butterfly was observed at Magarevo and Capari and above Brajcino.

37. Jersey Tiger (*Gallimorpha quadripunctaria* syn. *Euplagia q., Panaxia q.*)

Habitats Directive Annex II (code **6199**). This butterfly species can be found in forests, semi-open areas, parks, gardens and shrub areas. Larvae are polyphagous. They favour nettle *Urtica dioica*, but may feed on *Plantago*, *Rubus*, *Epilobium*, *Coryllus*, *Ulmus* and many other food plants. The species is not very demanding for specific habitat and, at the moment, no major threats can be identified. In inventories within the Twinning project this species was met at Gjavato in the Pelister NP.

38. Large Copper (*Lycaena dispar*)

Habitats Directive Annex II and IV (code **1060**). The Large Copper can be found in many different types of grassland habitats. The larvae feed on *Rumex spp*. The species is not especially demanding and does not face any major threats except general overgrowth of grasslands. The species is adapted to relatively strong fluctuation in population dynamics, and local extinctions and re-colonisations are typical for the species. At the moment the species is relatively common. It inhabits open and semi-open habitats those are important also for other butterflies. Within the Twinning project the Large Copper was found at lower part of Pelister NP close to Capari and Magarevo villages.

39. Clouded Apollo (*Parnassius mnemosyne*)

Habitats Directive Annex IV (code **1056**) (van Swaay et al 2010). In the Pelister NP this butterfly species has several (small) local populations in different river valleys. The Clouded Apollo favours low-growing herb-rich grasslands and other open or semi-open habitats. Adult individuals can be seen during early and midsummer sucking nectar from flowering plants in different type of grasslands. Larvae feed on different *Corydalis* species in spring, usually they favouring *C. solida*. Both *C. solida* and *C. cava* subsp. *marschalliana* are rather common species in this genus in the Pelister NP. The Clouded Apollo has suffered from overgrowth of old pasture areas. The grazing of animals has been ceased already since 1950`s at Pelister NP (after establishment of the National Park). Also, about that time, after World War II, grazing of natural habitats has decreased over the whole Europe. However, especially adult butterflies can utilize also tall herb stands with nectar plants. In many sites with occurrences of the Clouded Apollo in Pelister NP there are still possibilities to restore these overgrown habitats.

40. Large Blue (*Phengaris arion* syn. *Maculinea arion*)

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Habitats Directive Annex IV (code **1058**). Typical habitats for Large Blue are open and warm meadows with *Thymus* and colonies of *Myrmica* ants. Young larvae feed on flowers of *Thymus spp*. but already at early stages drops down to ground. The larvae cheat ants with chemical compounds and as a result *Myrmica* ants start to treat young larva of the Large Blue as their own larvae. In the nest the young larvae turn to be a predator (or nest parasite) which feeds on the larvae of the host ant. The main threat for the species is overgrowth of suitable habitats, because low growing *Thymus* species are sensitive to competition with higher vegetation. Usually the most effective way to maintain the openness of the habitat is traditional animal keeping at the site. However, overgrazing should be avoided. In Pelister NP the Large Blue was found above Brajcino and there are several observations on species at border of the National Park in Magarevo – Dihovo area in dry grasslands slopes at both site of water pipeline.

Invasive Insects

Some alien species belonging to invertebrate fauna groups are common and abundant in Pelister NP. The Harlequin Ladybird (*Harmonia axyridis*), Western Conifer Seed-bug (*Leptoglossus occidentalis*) and Brown Marmorated Stink-bug (*Halymorpha halys*) are all very common in the area. All of these species have already colonized all Balkan countries and other large areas in the Central and Western Europe. In this situation there is no way to get rid of them anymore. Many invasive insects have good dispersal ability and reproduction potential. With these abilities and with the lack of their original, natural enemies they have shown amazing colonization ability. This is very typical for many invasive alien species. Western Conifer Seed-bug sucks seeds of conifers and can have at some extent a negative effect on the regeneration of Macedonian Pine *Pinus peuce* and Silver Fir *Abies borisii-regis*.

2.2.4. Birds (Aves)

The Birds Directive – Council Directive 79/409/EEC aims to protect all of the 500 wild bird species naturally occurring in the European Union. In the Birds Directive Annex 1 are listed 194 species and sub-species which are particularly threatened. Each Member States must preserve, maintain or re-establish a sufficient diversity and area of habitats for these species. In addition to the general habitat provisions laid down in Article 3, Member States must also classify the most suitable territories in number and size as Special Protection Areas (SPA) for these 194 particularly threatened species listed in the Annex I of the Birds Directive as well as for regularly occurring migratory species, paying particular attention to wetlands of international importance. These SPAs form an integral part of the Natura 2000 network. In the Annex 2 there are listed 82 bird species those can be hunted. However, the hunting periods are limited, and hunting is forbidden when birds are at their most vulnerable: during their return migration to nesting areas, reproduction and the raising of their chicks. All Member States have to submit reporting on the status and trend in bird populations (Article 12) as well as on derogations (Article 9) they may apply to the Directive's obligations.

Even if European bird species is not mentioned in the annexes, it is covered by the general protection regime provided by Article 1 of the Directive to all species of birds naturally occurring in the wild state in the European territory of the Member States to which the Treaty applies.

Following data on Annex I birds of Pelister NP is mainly based on observations of professor Metodija Velevsky of the Macedonian Ecological Society (MES). Additionally, some complementary field observations are done by the Twinning project experts.

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Bird species of Annex I in the Pelister NP

Raptors

1. **Golden Eagle (*Aquila chrysaetos*)**

Birds Directive Annex I (code **1560)**; IUCN ERL category – LC; Bern Convention Appendix II; Bonn Convention Appendix II; Status in Pelister NP: resident, breeding rare species in high mountain altitudes, 6200 Semi-natural dry grasslands and scrubland facies habitat types. Population size and trend: unknown. Golden Eagle, especially is typically a species of wilderness area. Raptors usually require areas without human disturbance (except lesser kestrel). If nesting sites are identified any disturbance should be avoided in the area during the nesting time.

2. **Short-toed Snake Eagle (*Circaetus gallicus*)**

Birds Directive Annex I (code **1490)**; IUCN ERL category – LC; Bern Convention Appendix II; A Bonn Convention appendix II. Status in the Pelister NP: possibly breeding. Population size and trend: unknown. The Short-toed Snake Eagle favours open areas with snakes and lizard. Traditional land use maintains habitats for snakes and lizards but intensive agriculture does not. For this reason, activities which may be targeted to support rare habitat types with open dry grasslands and their species (plants and butterflies, for example) may also improve living conditions for Short-toed Snake Eagle.

3. **Montagus Harrier (*Circus pygargus*)**

Birds Directive Annex I (code **1620)**; IUCN ERL category – LC; Bern Convention Appendix II; Bonn Convention Appendix II. Status in Pelister NP: possibly breeding in lowland hay meadows. Population size and trend: unknown. Similar features in the landscape those are important for the Short-toed Snake Eagle will also Montagus Harriers which feed on small mammals, lizards, small birds, frogs and even insects.

4. **Peregrine Falcon (*Falco peregrinus*)**

Birds Directive Annex I (code **2020)**; IUCN ERL category – LC; Bern Convention Appendix II; Bonn Convention Appendix II. Status in Pelister NP: resident rare species in high mountain altitudes, rocky areas and in 6200 Semi-natural dry grasslands and scrubland facies habitat types. Population size and trend: unknown.

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The Lesser Kestrel. Photo: Petri Ahlroth.

5. Lesser Kestrel (*Falco naumanni*)

Birds Directive Annex I (code **1940)**; IUCN ERL category – LC; Bern Convention Appendix II; Bonn Convention Appendices I, II; Status in Pelister NP: unknown. Possibly suitable breeding habitats – open areas on valleys or near sparse settlements. Population size and trend: unknown.

6. European Honey Buzzard (the Pern) (*Pernis apivorus*)

Birds Directive Annex I (code **1460)**; IUCN ERL category – LC; Bern Convention Appendix II; Bonn Convention Appendix II. Status in Pelister NP: possibly breeding species in all types of forest. Population size and trend: unknown. Populations of Honey Buzzards have been collapsing in many parts of the world. The reason is not fully understood, and there can be several reasons behind the collapse. In some case amount of food (bees and wasps) has been decreasing due to weather conditions for example, but in some area pesticides are additionally decreasing the numbers of insects they feed. Use of pesticides should be avoided inside the National Park and if possible close to the National Park as well.

Woodpeckers

7. Middle Spotted Woodpecker (*Dendrocopos medius*)

Birds Directive Annex I (code **1870)**; IUCN ERL category – LC; Bern Convention Appendix II. Status in Pelister NP: resident, sparse species in 9100 Forests of Temperate Europe habitat class. Abundance depends on amount of deadwood and old trees, especially oaks. Population size and trend: unknown.

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8. **White-backed Woodpecker (*Dendrocopos leucotos*)**

Birds Directive Annex I (code **1880)**; IUCN ERL category – LC; Bern Convention Appendix II. Status in Pelister NP: resident, sparse species in different forest habitats, especially broadleaf forests including following prioritized habitats:

- *9180* Tilio-Acerion forests of slopes, screes and ravines*
- *91E0* Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*

Abundance depends on amount of deadwood and old trees. Population size and trend: unknown.

9. **Syrian Woodpecker (*Dendrocopos syriacus*)**

Birds Directive Annex I (code **1890)**; IUCN ERL category – LC; Bern Convention Appendix II. Status in Pelister NP: resident, quite common species in open woodlands of 9100 Forests of Temperate Europe habitat class and gropes of old trees in villages. Abundance depends on amount of deadwood and old trees. Population size and trend: unknown.

10. **Black Woodpecker (*Dryocopus martius*)**

Birds Directive Annex I (code **1850)**; IUCN ERL category – LC; Bern Convention Appendix II. Status in Pelister NP: resident, sparse species in all types of forest, in Pelister NP both in broadleaf and coniferous forests:

- *91BA Moesian silver fir forests*
- *95A0 High oro-Mediterranean pine forests*

Abundance depends on amount of deadwood and old trees. Population size and trend: unknown.

All woodpeckers benefit from old and large trees. They use old and dead trees as feeding habitats. Saproxylic insects (i.e. insects those live in dead or dying trees) are the main food resource for many woodpeckers. In addition, they feed on ants and ant larvae and cocoons. Woodpeckers are also raptors on other bird species as they may prey on chicks of other (smaller) bird species. During winter-time woodpeckers may also eat meat and fat from dead mammals. Management activities like forest restoration should include measures to increase the volume of dead wood. Such activities would benefit both rare *saproxylic* insects (some of which are also Annex species of the Habitats Directive) and woodpeckers at the same time.

Other terrestrial birds

11. **Rock Partridge (*Alectoris graeca*)**

Birds Directive Annexes I, II/A (code **320)**; IUCN ERL category – NT; Bern Convention Appendix III. Status in Pelister NP: resident, breeding species. Population is probably decreasing because of overgrowth of suitable habitats – rocky areas and open semi-natural grasslands in high altitudes (*62D0 Oro-Moesian acidophilous grasslands*). However, population size and trend are unknown.

12. **European Nightjar (or the Common Goatsucker) (*Caprimulgus europaeus*)**

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Birds Directive Annex I (code **490)**; IUCN ERL category – LC. Status in Pelister NP: breeding migratory species; typical for 9500 Mediterranean and Macaronesian mountainous forests habitat class. Population size and trends unknown. Nightjar is breeding both is open semi-open and almost closed forest habitats. They hunt insects in open spots during night time. The species is not especially sensitive to human disturbance. However, birds are often killed by cars, because of their habit to rest in open habitats like on the roads. On roads of the National Park low speed limits might benefit nightjars.

13. Corn Crake (*Crex crex*)

Birds Directive Annex I (code **560)**; IUCN ERL category – LC; Bern Convention Appendix II; Bonn Convention Appendix II. Status in Pelister NP: possibly breeding or accidental breeding. Calling males were recorded in lowland hay meadows near Brajcino. Population size and trend: unknown. Corn Crake lives in grasslands, favouring higher hay vegetation which provides shelter from predators. Traditional hay meadows are good nesting habitats for the Corn Crake.

14. Red-backed Shrike (*Lanius collurio*)

Birds Directive Annex I (code **2040)**; IUCN ERL category – LC; Bern Convention Appendix II. Status in Pelister NP: breeding migratory species. Quite common species in open habitats partly overgrown with low trees and bushes. Population size and trend: unknown. All shrike species favour semi-open landscapes. Traditional keeping of animals typically maintains habitats suitable for the species.

15. Woodlark (*Lullula arborea*)

Birds Directive Annex I (code **2640)**; IUCN ERL category – LC; Bern Convention Appendix III. Status in Pelister NP: breeding species in semi-open forested areas, including 5100 Sub-Mediterranean and temperate scrub habitats. Population size and trend: unknown. The Woodlark favours semi-open habitats and young forests with small trees. It can be found also from clear cut areas, but those areas usually provide only temporary habitats for the species. The species can be found also from the lower parts of alpine habitats, close to edge of forest line.

16. Red-billed Chough (*Pyrrhocorax pyrrhocorax*)

Birds Directive Annex I (code **2090)**; IUCN ERL category – LC; Bern Convention Appendix II. Status in Pelister NP: rare resident, breeding species. Red-billed chough is nesting in rocky areas at alpine levels of the mountains. It uses open areas for looking for food. The species is social most time of the year. Population decrease is due to decrease of suitable feeding habitats – open semi-natural grasslands in high altitudes (*62D0 Oro-Moesian acidophilous grasslands*). Aging areas should be kept open. Further overgrowth of areas should be prevented by active management and restoration of overgrown open habitats is recommended.

17. Hazel Grouse (*Tetrastes bonasia*)

Birds Directive Annexes I, II/B (code **340)**; IUCN ERL category – LC; Status in Pelister NP: resident breeding resident species. Occurs typically in forest habitats, especially in mixed or broad- leaved forests (9100: Forests of Temperate Europe habitats class) but in Pelister NP the species can be seen to live also in the

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lower parts of alpine areas. It requires some trees or bushes which provide shelter from predators. Population size and trend: unknown.

18. Lanner Falcon (*Falco biarmicus*)

Birds Directive Annex I (code **2000)**; IUCN ERL category – EN; Bern Convention Appendix II; Bonn Convention Appendix II. Status in Pelister NP: extinct.

19. Bearded Vulture (*Gypaetus barbatus*)

Birds Directive Annex I (code 1470); IUCN ERL category – VU; Bern Convention Appendix II; Bonn Convention Appendix II. Status in Pelister NP: extinct.

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The Egyptian Vulture. Photo: Petri Ahlroth.

20. Egyptian Vulture (*Neophron percnopterus*)

Birds Directive Annex I (code 1480); IUCN ERL category – EN; Bern Convention Appendix II; Bonn Convention Appendices I; II. Status in the Pelister NP: extinct.

All the last three species which have disappeared from the area are raptors. Vultures especially are sensitive to poison baits which are used to kill carnivore species like foxes and wolves. Even if the poisons have not been used in the area large raptor birds do not easily recolonize areas from which they have disappeared. For this reason, re-introduction of vultures and other large raptors has been used in many countries. Many of these projects have been successful and populations have been recovering.

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3. Assessment of values

3.1. Values of the area

3.1.1. Natural values and importance in EU context

Nature values were evaluated in European Community Importance context. **22 habitat types** of the Habitats Directive Annex I and **44 species** (**4 plant and 40 animal species**) protected by Annex II and IV of the Habitats Directive (ANNEX 1 of the Management Plan) and **17 bird species** protected by the Birds Directive Annex I as well as several nationally protected and some endemic species with European Community interest have been identified during the implementation of the Twinning project (2018-2019) in field observations and based on recent literature information (ANNEX 5 of the Management Plan). These numbers indicate high conservation value of the area based on both directives. When assessing natural values and importance in EU context, the ecosystems approach is used in this Management Plan. The key values – habitats and species – were grouped according three key ecosystem types found in Pelister NP: forest ecosystems, open ecosystems as well as freshwater and wetland ecosystems.

The forest ecosystem:

Habitats (Habitats Directive, Annex I):

9180* Tilio-Acerion forests of slopes, screes and ravines
91E0* Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)
91AA *Eastern white oak woods
91BA Moesian silver fir forests
9280 Quercus frainetto woods
91W0 Moesian beech forests
95A0 High oro-Mediterranean pine forests

Flora (plant) species (Habitats Directive):

Buxbaumia viridis**,** (Annex II, code **1386**)

Fauna (animal) species (Habitats Directive):

Canis lupus (Annex II, IV and V, code **1352**)
Felis silvestris (Annex IV, code **1363**)
Muscardinus avellanarius (Annex IV, code **1341**)
Ursus arctos (Annex II and IV, code **1354**)
Rana dalmatina (Annex IV, code **1209**)
Cerambyx cerdo (Annex II and IV, code **1088**)
Cucujus cinnaberinus (Annex II and IV, code **1086**)
Lucanus cervus (Annex II, code **1083**)
Morimus funereus (Annex II, code **1089**)
Rosalia alpina* (Annex II and IV, code **1087**)

Birds Directive species (Habitats Directive):

Caprimulgus europaeus (code **490**)
Dendrocopos leucotos (code **1880**)
Dendrocopos medius (code **1870**)

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Dendrocopos syriacus (code **1890**)
Dryocopus martius (code **1850**)
Pernis apivorus (code **1460**)
Tetrastes bonasia (code **340**)

Assessment:
Diverse forest habitats occupy large part of Pelister NP up to 2000 m asl. In general, commercial forestry activities, such as selective/sanitary cuttings and/or replanting of forest with non-typical species, influence negatively to the conservation status of forest habitats. Lack of different aged coarse dead wood and old trees diminish the value of forest habitats, both in deciduous and coniferous forests. Pelister NP has special value in conserving Macedonian Pine "Molika" forests, which belongs to the habitat type 95A0 High oro-Mediterranean pine forests. However, as a whole there are still a lot of valuable forest habitats in the territory of Pelister NP both in coniferous and deciduous broad-leaf forests.

Conservation value assessment:

Broad-leaf forests: Conservation status is favourable, deteriorating.

Coniferous forests: Conservation status is favourable, deteriorating.

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The open ecosystems:

Habitats: (Habitats Directive, Annex I):

4060 Alpine and Boreal heaths,
5130 Juniperus communis formations on heaths or calcareous grasslands
62D0 Oro-Moesian acidophilous grasslands
6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)
6220* Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea,
6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
6510 Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis
8150 Medio-European upland siliceous screes
8220 Siliceous rocky slopes with chasmophytic vegetation

Flora (plant) species (Habitats Directive):
Fritillaria gussichiae (Annex IV, code: **1845**)
Mannia triandra (Annex II, code **1379**)

Fauna (animal) species (Habitats Directive):
Euphydryas aurinia (Annex II, code **1065**)
Lycaena dispar (Annex II and IV, code: **1060**)
Rupicapra rupicapra* subsp. *balcanica (Annex II and IV, code **1371**)
Ablepharus kitaibelii (Annex IV, code **1276**)
Lacerta agilis (Annex IV, code **1261**)
Lacerta trilineata (Annex IV, code **1251**)
Lacerta viridis (Annex IV, code **1263**)
Podarcis erhardii (Annex IV, code **1238**)
Podarcis muralis (Annex IV, code **1256**)
Podarcis taurica (Annex IV, code **1248**)

Birds Directive species:
Alectoris graeca (code **320**)
Aquila chrysaetos (code **1560**)
Circaetus gallicus (code **1490**)
Circus pygargus (code **1620**)
Crex crex (code **560**)
Falco naumanni (code **1940**)
Falco peregrinus (code **2090**)
Lanius collurio (code **2040**)
Pyrrhocorax pyrrhocorax (code **2090**)

Assessment:

The area of habitats types related to open ecosystems is decreased, mainly due to overgrowth, but still these ecosystems cover a large part of Pelister NP, especially in alpine area above 2000 m asl. In lower areas overgrowing has reduced the area of all grasslands dramatically due to changes in grazing practises. In alpine area the habitats are still in moderate condition, even though overgrowth and climate change are

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threatening the values. Also, iconic stone rivers at slopes of Baba mountains, which belongs to habitat type *8150 Medio-European upland siliceous screes*, are suffering from overgrowth to some extent.

Conservation value assessment:

Alpine grasslands and heats: Conservation status is favourable, deteriorating.

Meadows in forest zone: Conservation status is unfavourable, deteriorating.

Rocky habitats: Conservation status is favourable, stable - decreasing.

Freshwater and wetlands ecosystems:

Habitats: (Habitats Directive, Annex I):

3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea.)

3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation

7140 Transition mires and quaking bogs

7160 Mineral-rich springs and springfens

7220* Petrifying springs with tufa formation (Cratoneurion)

Flora (plant) species (Habitats Directive):

Tozzia carpathica (Annex II and IV, code **6244**)

Fauna (animal) species (Habitats Directive):

Lutra lutra (Annex II and IV, code **1355**)

Bombina variegata (Annex II and IV, code **1193**)

Salmo peristericus (Annex II, code **5355**)

Salmo pelagonicus (Annex II, code **5354**)

Cordulegaster heros (Annex II and IV, code: **4046**)

Austropotamobius torrentium* (Annex II and V, code: **1093**)

Assessment:

Standing waters (lakes) occupy a very small area of the National Park, but they are very valuable in all aspects. Running waters, such as streams and rivers are typical for the Pelister NP and are vulnerable to several kind of human activities, e. g. water uptake and dams, construction of hydropower plants, roads, etc., even outside the National Park. Also, climate warming with increasing dry periods will affect negatively on this habitat type. However, main part of the running waters and their surroundings are considered to be in quite good condition so far.

Conservation value assessment: Conservation status is favourable, stable-decreasing.

Grouping of key nature values (particularly habitats and species typical for the habitats) in the key ecosystem types helps not only for proposing of common objectives and management measures, but helps to identify main values in the area. Particularly this is very helpful until real habitat mapping is conducted in exhaustive manner. Eight habitat types in Habitat Directive Annex I were identified in forest ecosystems, thirteen habitat types in open ecosystems and two habitat types in freshwater ecosystems. Pelister NP with 22 habitat types of the Habitats Directive Annex I, 44 species protected by Annex II and IV of the Habitats Directive and 17 bird species protected by the Birds Directive as well as large amount of endemic species makes Pelister unique mountain area in Europe with high conservation values. This valuable area is proposed to be protected by both EU directives – Habitats Directive and Birds Directive.

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3.2. Threats and pressures

The threat analysis is described in ecosystem approach, habitat types and associated species. The result for the analysis is partially based on the METT evaluation workshop held in Bitola November 2018. The codes used in the analysis are official codes for Natura 2000 Standard Data Forms.

3.2.1. Threats and pressures to forests ecosystems and species

Assessed threats to forests habitats of forest habitat types: *9180 * Tilio-Acerion forests of slopes, screes and ravines*, *91E0* Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*, *91AA *Eastern white oak woods*, *91BA Moesian silver fir forests*, *9280 Quercus frainetto woods*, *91W0 Moesian beech forests*, *95A0 High oro-Mediterranean pine forests*, and species: *Buxbaumia viridis*, *Muscardinus avellanarius*, *Cerambyx cerdo*, *Lucanus cervus*, *Morimus funereus*, *Rosalia alpina**, *Dendrocopos leucotos*, *Dendrocopos medius*, *Dendrocopos syriacus*, *Dryocopus martius* are:

B02.01.01	Forest replanting (native trees) in 9280, 91W0 and 91AA	medium
B02.01.02	Forest replanting and natural spreading (non-native trees)	medium
B02.04	Removal of dead and dying trees	high
B07	Selective/sanitary cuttings, including removing of old trees	high
D02.01.01	Suspended electricity and phone lines	low
F04.02	Collection (fungi, lichen, berries, etc.) (collecting of rare plant species)	low
I01	Invasive non-native species	medium
J01	Fire and fire suppression	low
J02.05.05	Small hydropower projects, weirs	low
	in *9180 * Tilio-Acerion forests of slopes, screes and ravines*	high
	in *91E0* Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*	low
M01	Changes in abiotic conditions (temperature changes)	low
M02	Changes in biotic conditions (habitat sifting and alteration)	medium

Forestry activities as selective/sanitary cuttings influence negatively the conservation quality of natural forest habitats. Now there is a lack of dead wood and old trees and some broad-leaved forests have been converted to coniferous forest. All forestry activities are implemented according to Pelister NP forest management plan. This document is prepared like commercial forestry plan and does not take into account the requirements of protection of nature values, habitats and species protection according the Habitats and Birds Directives, since the area is just identified as a potential Natura 2000 site. Some *95A0 High oro-Mediterranean pine forests* and *91AA *Eastern white oak woods* are slowly changing to *Abies borisii-regis* forests by natural succession without active management. In a conservational point of view, it would be worth favouring these two habitat types.

Parts of *9180 * Tilio-Acerion forests of slopes, screes and ravines* habitat is demolished recently by construction of a hydropower plant road close to Malovishte village.

In some area typical habitats for oak, beech and Macedonian Pine forest has been planted by non-native species, especially like *Pinus sylvestris* and *Pinus nigra*, but also with *Pseudotsuga menziesii*, *Picea abies*, *Larix spp.*, *Pinus strobus*, etc. The Black locust (*Robinia pseudacacia*) has been used as ornamental tree in villages and it is spreading locally at lower parts of Pelister NP into river valleys and forest slopes. It's very important to avoid plantings of invasive species and all non-native species should be removed from the whole territory of the National Park in a reasonable timeframe.

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3.2.2. Threats and pressures to open ecosystems and species

3.2.2.1. Assessed threats and pressures to temperate heath and scrub, to habitat types: *4060 Alpine and Boreal heaths*, *5130 Juniperus communis formations on heaths or calcareous grasslands*, and species: *Alectoris graeca*, *Aquila chrysaetos*, *Falco peregrinus*, *Pyrrhocorax pyrrhocorax*, *Lacerta agilis* are:

A04.01	Intensive grazing	low
A04.03	Abandonment of pastoral systems, lack of grazing	high
E04	Structures, buildings in the landscape	low
F04.02	Collection (fungi, lichen, berries, etc.) (collecting of rare plant species)	low
I02	Problematic native species	medium
J01	Fire and fire suppression	medium
K01.01	Erosion	low
K02	Biocenotic evolution, succession	medium
M02.01	Habitat shifting and alteration	medium

Overgrowth by trees is a threat in Pelister NP for both habitat types: *4060 Alpine and Boreal heaths* and *5130 Juniperus communis formations on heaths or calcareous grasslands*. They consist mainly of successional habitat types at Pelister NP. Lower growing subtypes are overgrown by higher ones, i. e. *Juniperus communis* is overgrowing *Vaccinium myrtillus* and *Bruckenthalia spiculifolia* -dominated heaths. At the same time wooded species are spreading in alpine heaths. At upper parts of forest zone there are overgrown heaths inside expansive forests and high juniper shrub. *Pinus peuce* seems to colonise alpine heaths and grasslands quickly at certain areas in the National Park. In addition to Common Juniper, deciduous trees and scrub (*Prunus spp.*, *Betula pendula*, *Acer obtusum*, *Rubus spp.*, *Rosa spp.*) are colonizing subalpine parts of heaths in certain parts of Mt. Pelister. Also, dense colonies of Bracken (*Pteridium aquilinum*) are spreading to mountain heaths at places. Probably climate warming will enhance these negative changes. Overgrazing in some cases could be a threat to this habitat type.

Uncontrolled large-scale fires can damage these habitats, as Alpine heaths rich in junipers are particularly susceptible to disturbance by fire. Also, for some animal species, especially invertebrates and reptiles, large-scale fires can make negative impact for local subpopulations. However, it has to be noted that in many cases fires contribute positively conservation of values and controlled burnings could be used as management measure.

Erosion can be a threat mainly due to rainwater at sites with open soil like at paths and roads. Steep slopes are more vulnerable to erosion, but natural erosion is a part of natural development of ecosystems. In principle overgrazing which leads to the disappearance of vegetation that anchor down the soil, will increase risk of erosion. However, at this moment grazing pressure is low in the area.

3.2.2.2. Assessed threats and pressures to ***semi-natural grassland formations***, to habitat types: *62D0 Oro-Moesian acidophilous grasslands*, *6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)*, *6220* Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea*, *6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels*, *6510 Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)*, and species: *Fritillaria gussichiae*, *Euphydryas aurinia*, *Lycaena dispar*, *Rupicapra rupicapra* subsp. *balcanica*, *Ablepharus kitaibelii Lacerta agilis*, *Lacerta trilineata*, *Lacerta viridis*, *Podarcis erhardii*, *Podarcis muralis*, *Vipera ammodytes*, *Alectoris graeca*, *Aquila chrysaetos*, *Circaetus gallicus*, *Circus pygargus*, *Crex crex*, *Falco naumanni*, *Falco peregrinus*, *Lanius collurio*, *Pyrrhocorax pyrrhocorax* are:

A04.01	Intensive grazing	low

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A04.03	Abandonment of pastoral systems, lack of grazing	high
E04	Structures, buildings in the landscape	low
I01	Invasive non-native species	medium
I02	Problematic native species	medium
J01	Fire and fire suppression	medium
K02	Biocenotic evolution, succession	medium
M01.01	Changes in abiotic conditions; temperature changes (e.g. rise of temperature & extremes)	medium

Lack of grazing is the main threat for the most of Pelister NP natural and semi-natural grassland formations. It is very likely that the grassland ecosystems had coexisted with grazing by large wild herbivores for millennia. As a result of decline in the old grazing traditions (mountain summer pasturing), at lower parts of alpine grasslands juniper bushes are spreading actively. Also, *Pinus peuce* is spreading to alpine grasslands, where individual trees remain stunted and dwarf due to wind exposed conditions.

However, overgrazing can be also a threat to this habitat and it can increase erosion. The organization of grazing in different localities may strongly affect the quality of the habitats. The concentration of animals on small patches of pasture (fenced areas, such as sheep-folds) may cause eutrophication and may destroy the grassland canopy and accelerate invasion by nitrophilous species of weeds.

Uncontrolled large-scale fires can damage alpine meadows, even if grasslands have some natural recovery ability on this kind of disturbance. For some fauna species, especially invertebrates and reptiles, large-scale fires can have negative impact particularly on local subpopulations. However, as stated earlier, controlled fire can be seen as a good management measure for these habitats.

Climate warming can increase change and degradation of the habitats.

Road constructions, buildings and tourism can cause some threat to this habitat type, but especially for associated animal species those are sensitive to human disturbance, as Balkan Chamois (*Rupicapra rupicapra* subsp. *balcanica*) and Golden Eagle (*Aquila chrysaetos*).

3.2.2.3. Assessed threats and pressures to screes and rocky habitats, to habitats *8150 Medio-European upland siliceous screes* and *8220 Siliceous rocky slopes with chasmophytic vegetation*, and species: *Pyrrhocorax pyrrhocorax* are:

G01.04	Mountaineering, rock climbing, speleology. Rock climbing and related activities have been recorded as pressures on some areas	low
M01	Changes in abiotic conditions (Climate change)	low

In Pelister NP at alpine area many siliceous screes are affected by World War I constructions. Chains of trenches with stony dugouts are running through summit screes. These constructions have not been affected much on species composition but provide more historical and cultural values to these habitats. Siliceous screes are in natural stage at alpine area and there are no pressures. At forest zone some scree are overgrowing by three species and may need management.

3.2.3. Threats and pressures to freshwater and wetlands ecosystems and species

3.2.3.1. Assessed threats to freshwater habitats *3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea*, *3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation*, and species: *Tozzia carpathica*,

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Lutra lutra Bombina variegata, *Salmo peristericus*, *Salmo pelagonicus*, *Cordulegaster heros*, *Austropotamobius torrentium** are:

B07	Forestry activities: soil erosion due to forest clearing	low
H01	Pollution to surface waters	low
I02	Problematic native species	low
J02.05.05	Small hydropower projects, weirs	low
J02.06	Water abstractions from surface waters	medium
K01.01	Erosion	medium
M01	Changes in abiotic conditions (Climate change)	low
M02.01	Habitat shifting and alteration	low

In principle there are no severe threats to standing waters in Pelister NP, because both lakes are inside the strictly protected zone of the National Park. Visitors around Golemo Ezero (Lake) and other small lakes can cause some eutrophication threats. Introduced fish into Golemo Ezero (Lake) may have affected negatively the lake ecosystem and its species composition, including population of endemic amphipode *Niphargus pancici* subsp. *pancici*. Shore of Golemo Ezero (Lake) and active visits by jeeps and other off-road vehicles can increase possibility of oil or gasoline emission risk to the lake.

For the rivers and streams of Pelister NP, there are several threats and pressures over this habitat type including erosion related with sedimentation caused by forest cutting and road construction inside and outside of protected area. Eutrophication and pollution due to waste waters (coming mainly outside of protected areas) are severe threats on a lower part of rivers. Dredging of water courses and construction of hydropower plants (river Semnica inside Pelister NP, river Brajcinska outside of borders of the National Park) has caused deterioration of habitat and these negative impacts are continuing in certain extent. Any dam that is an obstacle to fish migration divides the trout population and prevent its full functioning. There is considerable water abstraction and dams to direct water inside the National Park, which is a threat for biodiversity values of Pelister NP and also to this habitat outside of the Park. Increase of tourism can cause threat to water quality and cases of illegal fishing of salmon species. Introduced fish species of Prespa Lake and Vardar river valley will cause a threat to natural fauna of Pelister NP rivers. Climate warming will probably have negative impacts on this habitat type currently and during future decades due to prolonged drought periods.

3.2.3.2. Assessed threats to wetlands ecosystem cowering small patches of different habitat types, belonging to class Raised bogs and mires and fens: *7140 Transition mires and quaking bogs*, *7160 Mineral-rich springs and springfens*, *7220* Petrifying springs with tufa formation (Cratoneurion)* are:

E04	Structures, buildings in the landscape	low
K02	Biocenotic evolution, succession	medium
M01	Changes in abiotic conditions (Climate change)	low
M02.01	Habitat shifting and alteration	medium

Inside Pelister NP there are no severe threats to this habitat class. In several places there are constructed structures for water uptake for hikers and other people moving in the National Park. These well structures are in principle not harmful for the habitat, however some surveillance is recommended. In small springs trampling can cause some decrease in quality. Wild boars (*Sus scrofa*) groups may cause some damage to springs, especially for drinking water for humans but also disturbance to typical vegetation including bryophytes. So far uptake of ground water is not done at alpine part of Pelister NP. Warming climate can

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cause warming of ground water and decrease of outflow during summertime. Construction of local roads or buildings can be harmful.

3.3. Management effectiveness and competences

The Management Effectiveness Tracking Tool (METT) is one of the two most widely used/adapted globally applicable generic systems developed to assess protected area management effectiveness. It is used to report progress towards the Convention on Biological Diversity. The methodology is a rapid assessment based on a scorecard questionnaire. The scorecard includes all six elements of management identified in the IUCN-WCPA. Framework (context, planning, inputs, process, outputs and outcomes), but has an emphasis on context, planning, inputs and processes. It is basic and simple to use and provides a mechanism for monitoring progress towards more effective management over time. It is used to enable protected area (PA) managers and donors to identify needs, constraints and priority actions to improve the effectiveness of protected area management.

Results of METT discussed and agreed at the workshop with personnel of Pelister NP administration and stakeholders supported by PONT (Prespa Ohrid Nature Trust).

According to the METT evaluation (ANNEX 4) the total score for Pelister NP was 47 points out of 99 point which is the maximum. When evaluating result, the context has the highest ranking 3/3 due to clear legal status of the area. Other key elements (planning, input, processes) has evaluation level of app. 40 % of the maximum level. As an outcome the evaluation indicates that “Some biodiversity, ecological and cultural values are being partially degraded but the most important values have not been significantly impacted”.

However, it is important to give a remark, that this evaluation is not based on fully understanding of the requirement of implementing EU’s Habitats and Birds Directives in Pelister NP. It mainly refers the requirements of the management of the area as the National Park with existing working environment. The need for sustainable funding from government is not adequately addressed. Additionally, the capacity in law enforcement and handling ecological issues by the administration has to be strengthened.

Conclusion

Pelister NP with **22 habitats** of the Habitats Directive Annex I, at least **41 species** of Annexes II and IV of the Habitats Directive and **17 bird species** protected by the Birds Directive being important at European Community level should upon the agreement of the European Commission be established as Special Area of Conservation (SAC) under Habitats Directive and Specially Protected Area (SPA) under Birds Directive. Additionally, several endemic species of makes Pelister NP unique mountain in Europe with high conservation values. During the Twinning project it was proposed to establish Pelister NP Natura 2000 sites with the existing borders of national park. Standard Data Form for Pelister NP Natura 2000 site can be found as an ANNEX 1 in this document.

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ANNEXES

ANNEX 1. Standard Data Form for proposed Pelister NP Natura 2000 site

NATURA 2000 - STANDARD DATA FORM

For Special Protection Areas (SPA),
Proposed Sites for Community Importance (pSCI),
Sites of Community Importance (SCI) and
for Special Areas of Conservation (SAC)

SITE **MK0000010**

SITENAME **Pelister**

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1. SITE IDENTIFICATION

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1.1 Type	1.2 Site code
B	MK0000010

1.3 Site name

Pelister

1.4 First Compilation date	1.5 Update date

1.6 Respondent:

Name/Organisation:	Ministry of environment and physical planning
Address:	Bul. Goce Delcev no. 18, Skopje, R. Macedonia
Email:	

1.7 Site indication and designation / classification dates

Date site classified as SPA:	0002-12
National legal reference of SPA designation	No data

2. SITE LOCATION

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2.1 Site-centre location [decimal degrees]:

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Longitude
21.1893

Latitude
40.9675

2.2 Area [ha]:

17176,74 ha

2.3 Marine area [%]

2.4 Site length [km]: 25 km

2.5 Administrative region code and name

NUTS level 2 code	Region Name
MK00	Macedonia

2.6 Biogeographical Region(s)

Alpine (100.0 %)

3. ECOLOGICAL INFORMATION

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3.1 Habitat types present on the site and assessment for them

Annex I Habitat types						Site assessment			
Code	PF	NP	Cover [ha]	Cave [number]	Data quality	A|B|C|D	A|B|C		
						Representativity	Relative Surface	Conservation	Global
3130			5		G	A	C	A	A
3260			60		G	A	C	A	B
4060			1900		M	B	B	B	B
5130			450		M	B	C	B	B
6210			35		M	B	C	B	B
6220	*		100		M	B	C	B	B
6230	*		10		M	A	C	B	B
62D0			1500		M	A	B	B	B

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6430			60		M	B	B	B	B
6510			35		M	B	C	A	B
7140			10		M	A	C	A	B
7160			2		M	A	C	A	A
7220	*		0,1		M	B	C	B	B
7230			10		M	A	C	B	B
8150			3000		M	A	B	A	B
8220			900		M	B	C	B	B
9180	*		20		M	B	C	B	B
91E0	*		100		M	A	C	A	B
91W0			4400		M	A/B	B	B	B
91AA	*		1000		M	B	C	B	B
91BA			710		M	A	B	A	B
9260			0,5		M	C	C	B	B
9280			200		M	B	C	B	B
92A0			2130		M	A	A	A	A

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- **PF:** for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter "X" in the column PF to indicate the priority form.
- **NP:** in case that a habitat type no longer exists in the site enter: x (optional)
- **Cover:** decimal values can be entered
- **Caves:** for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available.
- **Data quality:** G = 'Good' (e.g. based on surveys); M = 'Moderate' (e.g. based on partial data with some extrapolation); P = 'Poor' (e.g. rough estimation)

3.2 Species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC and site evaluation for them

Species					Population in the site						Site assessment			
G	Code	Scientific Name	S	NP	T	Size		Unit	Cat.	D.qual.	A|B|C|D	A|B|C		
						Min	Max				Pop.	Con.	Iso.	Glo.
B	320	Alectoris graeca			p				R	M				
B	1560	Aquila chrysaetos			p				V	M				
I	1093	Austropotamobius torrentium*			P				R	M	B	A	C	C
F	5261	Barbus balcanicus			P				DD	P				
A	1193	Bombina variegata			P				R	M	C	B	C	C
P	1386	Buxbaumia viridis			P				R	M	A	B	A	B
I	1078	Callimorpha quadripunctaria			P				R	M	C	B	B	C
M	1352	Canis lupus			P				R	M	C	A	C	C
B	490	Caprimulgus europaeus			p				R	M				
I	1088	Cerambyx cerdo			P				R	M	C	B	C	C
B	1490	Circaetus gallicus			p				V	M				
B	1620	Circus pygargus			p				V	M				
I	4046	Cordulegaster heros			P				R	M	C	C	C	C
B	560	Crex crex			p				R	M				
I	1086	Cucujus cinnaberinus			P				R	M	A	C	C	C
B	1870	Dendrocopos medius			p				R	M				
B	1880	Dendrocopos leucotos			p				R	M				

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B	1890	Dendrocopos syriacus			p				C	M				
B	1850	Dryocopus martius			p				R	M				
I	1074	Eriogaster catax			P				R	M	C	B	C	C
I	1065	Euphydryas aurinia			P				R	M	B	B	C	C
B	1940	Falco naumanni			p				V	M				
B	2020	Falco peregrinus			p				V	M				
P	1845	Fritillaria gussichiae			p				R	M	C	B	C	B
B	2040	Lanius collurio			p				C	M				
I	1083	Lucanus cervus			P				C	M	C	B	C	B
B	2640	Lullula arborea			p				C	M				
M	1355	Lutra lutra			P				R	M	C	C	C	C
I	1060	Lycaena dispar			P				R	M	B	B	C	C
M	1361	Lynx lynx			p				V	M	D	A	B	C
P	1379	Mannia triandra			p				DD	P				
I	1089	Morimus funereus			p				R	M	C	B	C	C
M	1307	Myotis blythii			p				DD	P				
M	1316	Myotis capaccinii			p				DD	P				
I	4053	Paracaloptenus caloptenoides			p				DD	P				
B	1460	Pernis apivorus			p				R	M				
I	4042	Polyommatus eroides			p				DD	P				
B	2090	Pyrrhocorax pyrrhocorax			p				R	M				
M	1306	Rhinolophus blasii			p				DD	P				
M	1304	Rhinolophus ferrumequinum			p				DD	P				
M	1303	Rhinolophus hipposideros			p				DD	P				
I	1087	Rosalia alpina*			p				R	M	B	B	C	C
M	1371	Rupicapra rupicapra balcanica			p				R	M	C	A	B	C
		Salmo												

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F	5354	pelagonicus			p				P	M	B	C	A	B
F	5355	Salmo peristericus			p				P	M	A	C	A	B
R	1217	Testudo hermanni			p				R	M	C	C	C	C
B	340	Tetrastes bonasia			p				C	M				
P	6244	Tozzia carpathica			P	100	5000	I	R	M	A	A/B	A	A
R	5364	Triturus macedonicus			p				V	P				
M	1354	Ursus arctos			p				R	M	B	A	B	C

- **Group:** A = Amphibians, B = Birds, F = Fish, I = Invertebrates, M = Mammals, P = Plants, R = Reptiles
- **S:** in case that the data on species are sensitive and therefore have to be blocked for any public access enter: yes
- **NP:** in case that a species is no longer present in the site enter: x (optional)
- **Type:** p = permanent, r = reproducing, c = concentration, w = wintering (for plant and non-migratory species use permanent)
- **Unit:** i = individuals, p = pairs or other units according to the Standard list of population units and codes in accordance with Article 12 and 17 reporting (see reference portal)
- **Abundance categories (Cat.):** C = common, R = rare, V = very rare, P = present - to fill if data are deficient (DD) or in addition to population size information
- **Data quality:** G = 'Good' (e.g. based on surveys); M = 'Moderate' (e.g. based on partial data with some extrapolation); P = 'Poor' (e.g. rough estimation); VP = 'Very poor' (use this category only, if not even a rough estimation of the population size can be made, in this case the fields for population size can remain empty, but the field "Abundance categories" has to be filled in)

3.3 Other important species of flora and fauna (optional)

Species					Population in the site				Motivation					
Group	CODE	Scientific Name	S	NP	Size		Unit	Cat.	Species Annex		Other categories			
					Min	Max		C|R|V|P	IV	V	A	B	C	D
R	1276	Ablepharus kitaibelii						R	x					x
P		Alchemilla peristerica						R				x		
P		Andreaea rupestris						R						x
Fu		Boletus regius						R						x
R	6138	Coluber caspius						V	x					
R	1283	Coronella austriaca						V	x					
P		Crataegus sericeus						R				x		
P		Crocus pelistericus						R				x		
F		Chroogomphus helveticus												x

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Species					Population in the site				Motivation					
Group	CODE	Scientific Name	S	NP	Size		Unit	Cat.	Species Annex		Other categories			
					Min	Max		C|R|V|P	IV	V	A	B	C	D
A	1201	Bufo viridis						V	x					
P		Dianthus myrtinervius						R				x		
I		Dorcadion sp.						R				x		
P		Heracleum orphanidis						R				x		
P		Viola velutina						R				x		
P		Dianthus stenopetalus						R						x
I		Duvalius macedonicus						DD					x	
I		Duvalius peristericus						DD					x	
R	1281	Elaphe longissima						R	x					x
I		Eucypris kurtdiebeli						DD				x		
M	6110	Felis silvestris						R	x					
P	1845	Fritillaria gussichiae						R	x					x
P	1657	Gentiana lutea						R		x				
P		Gentiana punctata						R						x
P		Knautia magnifica						R						x
R	1261	Lacerta agilis						R	x					
R	1251	Lacerta trilineata						R	x					
R	1263	Lacerta viridis						R	x					
M	1341	Muscicardinus avellanarius						R	x					
M		Nannospalax leucodon						DD						x
R	1292	Natrix tessellata						DD	x					
I		Nebria aetolica macedonica						DD						x
I		Niphargus pancici pancici						DD				x		x
I	6265	Phengaris arion (Maculinea						R	x					

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Species					Population in the site				Motivation					
Group	CODE	Scientific Name	S	NP	Size		Unit	Cat.	Species Annex		Other categories			
					Min	Max		C|R|V|P	IV	V	A	B	C	D
		arion)												
P		Pinguicula balcanica						R						x
I	1056	Parnassius mnemosyne						R	x					
R	1238	Podarcis erhardii						R	x					
R	1256	Podarcis muralis						R	x					x
R	1248	Podarcis taurica						R	x					
A	1209	Rana dalmatina						C	x					
A	1208	Rana graeca						DD	x					
P		Saxifraga pedemontana ssp. cymosa						R						x
P		Saxifraga stellaris ssp. alpigena						R						x
P		Sempervivum octopodes						R					x	
P		Sempervivum marmoreum						R						x
Fu		Suillus sibiricus ssp. helvetica						DD						x
P		Soldanella pindicola						R						x
I		Tapinopterus comita						DD						x
I		Tapinopterus monastirensis monastirensis						DD						x
I		Trechus goebli goebli						DD						x
P		Viola parvula						V						x
R	1295	Vipera ammodytes						V	x					
I		Winklerites moraveci						DD						

Group: A = Amphibians, B = Birds, F = Fish, Fu = Fungi, I = Invertebrates, L = Lichens, M = Mammals, P = Plants, R = Reptiles
CODE: for Birds, Annex IV and V species the code as provided in the reference portal should be used in

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addition to the scientific name
S: in case that the data on species are sensitive and therefore have to be blocked for any public access enter: yes
NP: in case that a species is no longer present in the site enter: x (optional)
Unit: i = individuals, p = pairs or other units according to the standard list of population units and codes in accordance with Article 12 and 17 reporting, (see reference portal)
Cat.: Abundance categories: C = common, R = rare, V = very rare, P = present
Motivation categories: IV, V: Annex Species (Habitats Directive), A: National Red List data; B: Endemics; C: International Conventions; D: other reasons

4. SITE DESCRIPTION

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4.1 General site character

Habitat class	% Cover
N06	0,5
N07	0,5
N08	13
N09	1
N10	0,5
N11	9
N15	0,5
N16	32
N17	16,5
N19	0,5
N20	2
N21	0,01
N22	24
N23	0,01
Total Habitat Cover	100,0

Other Site Characteristics

Pelister National Park (17176 ha) is located between Prespa valley to the west and the Pelagonian Valley to the east. It is a part of Baba mountain massif with highest peak Mt. Pelister (2601 m asl.), To the north it is bordered by the (small) Capari valley and Gjavato pass (at 1169 m alt.). In the south Pelister National Park is in directly connected to Greek border and to Ori Varnounta mountain (Site Code: GR1340003) Natura 2000 area of the same mountain chain, also Ethnikos Drymos Prespon Natura 2000 area (Site Code: GR1340001) is in immediate vicinity of the Pelister National Park, and all these sites are integrated as a part of the Green Belt of Balkans. On territory of the Republic of North Macedonia Baba Mountain massif covers an area of about 367,5 km², of which 39,7 km² is over 2000 m. This area provides alpine habitats and species in their southernmost localities at Balkan Peninsula and the whole Europe with remarkable occurrences of the Balkan Tertiary relicts in several habitat types and species groups. A meridian direction of Pelister Natipnal Park obtains a length of 25 km. The Baba mountain has 24 peaks higher than 2,000 m. Except the highest, Pelister (2601 m), prominent peak consist of Stiv (2468 m), Veternica (2420 m), Muza (2351 m) and, Visoka Chuka (2182 m), Vrteshka (2010 m) etc. .

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In geological structure Baba mountains is a typical horst formation which consist of Paleozoic schists and granites in the central parts of Pelister National park. These rocks have been transformed by tectonic and erosive forces over millenia. The central mountain ridge of the Baba mountains starts from north at the top of Vrteska 2010 m, and continuing on the territory of Northern Greece. To the east and to the west of it are located parallel ridges, which are separated by river valleys. In relief forms of Pelister National Park, the stone rivers (Medio European boulder scree) at a height of 1300 to 2000 m altitude, are among the most remarkable screes of the Balkan Peninsula. Alluvial fans are also an important geomorphological feature of the relief, used to occur in a long belt along the eastern, northern and western foot and slopes of the Baba mountain massif. The highland parts of Pelister National Park were affected during the Pleistocene several glaciations that left their marks in today's relief in the form of fossil glacial forms: cirques and moraines. Some traces of the circus has diameter over 2000 m, two of which are constantly filled with water: Golemo and Malo Lake. Their basins are enclosed by moraines.

Pelister National Park includes following HD habitats: 3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea; 3160 Natural dystrophic lakes and ponds; 3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation; 4060 Alpine and Boreal heaths; 5130 Juniperus communis formations on heaths or calcareous grasslands; 6220 * Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea; 6230 * Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe); 62D0 Oro-Moesian acidophilous grasslands; 6420 Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion; 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; 6510 Lowland hay meadows; 6520 Mountain hay meadows; 7140 Transition mires and quaking bogs; 7160 Fennoscandian mineral-rich springs and springfens; 7220 * Petrifying springs with tufa formation (Cratoneurion); 7230 Alkaline fens; 8150-Medio-European upland siliceous screes; 8220 Siliceous rocky slopes with chasmophytic vegetation; 9180 * Tilio-Acerion forests of slopes, screes and ravines; 91E0 * Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae); 91W0 Moesian beech forests; 91AA *Eastern white oak woods; 91BA Moesian silver fir forests; 9260 Castanea sativa woods; 9280 Quercus frainetto woods; 92A0 Salix alba and Populus alba galleries;

Very large area of Pelsiter National Park consist of habitats of Habitats Directive Annex 1. In addition there are some plantations of coniferous woods (about 340 ha). There are also representative sites of priority habitats outside of the park in immendiate vicinity.

4.2 Quality and importance

In addition to Annex I habitats Pelister National Park hosts following Habitat Directive species and other important species: Mammals include large Carnivores: Canis lupus, Lynx lynx, Ursus arctos. On these Pelister NP is important to maintain stands of wolf and brown bear. Lynx is nowadays more casual strider at the Park. Mammals also include: Rupicapra rupicapra subsp. balcanica with very small population at the Park and European wildcat Felis silvestris.. Amphibia: Bombina variegata, Bufoides viridis, Rana dalmatina, Rana graeca, Triturus macedonicus. Reptiles:

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Ablepharus kitaibelii, Coluber caspius, Coronella austriaca, Elaphe longissima, Lacerta agilis, Lacerta trilineata, Lagerta viridisa, Podarcis erhardii, Podarcis muralis, Podarcis taurica, Testudo hermanni, Vibera ammodytes. Land Invertebrates: Cerambyx cerdo, Cordulegaster heros, Cucujus cinnaberinus, Eriogaster gatax, Euphydryas aurinia, Lucanus cervus, Paracaloptenus caloptenoides, Parnassius pnemosyne, Phengaris arion, Polyommatus eroides, Rosalia alpina Plant: Buxbaumia viridis, Mannia triandra, Tozzia carpathica, Fritillaria gussichiae; in addition following narrow range (N-Greece – SW North Macedonia) endemic plant species: Alchemilla peristerica, Crocus pelistericus, Dianthus myrtinervius, Heracleum orphanidis, Sempervivum octopodes, Viola velutina are met especially at alpine parts of Baba mountains. Following endemic insects have been recorded from the Park: Winklerites moraveci, Nebria macedonica macedonica, Duvalius macedonicus, Duvalius peristericus, Deltomerus sterbai, Tapinopterus comita, Tapinopterus monastirensis monastirensis, Trechus goebli goebli and Trechus hajeki. In addition to these two Dorcadion spp. longhorn beetle species and Poecilimon spp. grasshoppers which may be endemic for Baba mountains have observed from the Park. In addition there are about 20 species of Bird directive Annex I met from the area. Watercourses inside and at slopes and base of Pelister National Park are important for two endemic trout species Salmo pelagonicus and Salmo peristericus. Also prioritized crustacean Autropotamobius torrentium* is met at rivers on western side of Baba mountains,

Pelister is registered as Important Plant Area (IPA). For NATURA 2000 the whole area contains values of both Habitat directive Annex I habitat types and species of Annexes II and IV (and V) as well as several Balkan and more local endemics and Nationally protected and strictly protected species on several species groups.

4.3 Threats, pressures and activities with impacts on the site

The most important impacts and activities with high effect on the site

Negative Impacts			
Rank	Threats and pressures [code]	Pollution (optional) [code]	inside/outside [i|o|b]
L	A04.01		i
H	A04.03		i
M	B02.01.01		i
M	B02.01.02		i
H	B02.04		b
H	B07		i
L	D02.01.01		i
L	E04		i
L	F04.02		i
M	F34		b
L	G01.04		i
L	H01		i
M	I02		b
M	J01		b
L	J02.05.05		i
L	K01.01		i
M	K02		b
L	M01		b
M	M02		i
M	M02.01		i

Positive Impacts			
Rank	Activities, management [code]	Pollution (optional) [code]	inside/outside [i|o|b]

Rank: H = high, M = medium, L = low
Pollution: N = Nitrogen input, P = Phosphor/Phosphate input, A = Acid input/acidification,
T = toxic inorganic chemicals, O = toxic organic chemicals, X = Mixed pollutions
i = inside, o = outside, b = both

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4.4 Ownership (optional)

4.5 Documentation

5. SITE PROTECTION STATUS (optional)

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5.1 Designation types at national and regional level:

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Code	Cover [%]	Code	Cover [%]	Code	Cover [%]
MK02	100.0				

5.2 Relation of the described site with other sites:

5.3 Site designation (optional)

6. SITE MANAGEMENT

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6.1 Body(ies) responsible for the site management:

6.2 Management Plan(s):

An actual management plan does exist:

- [ ] Yes
- [ ] No, but in preparation
- [X] No

6.3 Conservation measures (optional)

7. MAP OF THE SITES

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INSPIRE ID: MK0000010

Map delivered as PDF in electronic format (optional)

- [ ] Yes
- [X] No

Reference(s) to the original map used for the digitalisation of the electronic boundaries (optional).

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ANNEX 2. List of habitats under Habitats Directive

Habitats classes	Habitats types (Habitats Directive, Annex 1)
3100 Standing water	3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletalea uniflorae* and/or *Isoeto-Nanojuncetea*
3200 Running water - sections of water courses with natural or semi-natural dynamics	3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
4000 Temperate heath and scrub	4060 Alpine and Boreal heaths
5100 Sub-Mediterranean and temperate scrub	5130 *Juniperus communis* formations on heaths or calcareous grasslands
6200 Semi-natural dry grasslands and scrubland facies	62D0 *Oro-Moesian acidophilous* grasslands
	6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites)
	6220 * Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*
6400 Semi-natural tall-herb humid meadows	6430 *Hydrophilous* tall herb fringe communities of plains and of the montane to alpine levels
	6510 Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)
7100 Sphagnum acid bogs	7140 Transition mires and quagingbogs
	7160 Mineral-rich springs and springfens
7200 Calcareous fens	7220* Petrifying springs with tufa formation (*Cratoneurion*)
	7230 Alkaline fens
8100 Scree	8150 Medio-European upland siliceous screes
8200 Rocky slopes with chasmophytic vegetation	8220 Siliceous rocky slopes with *chasmophytic* vegetation
9100 Forests of Temperate Europe	9180 * *Tilio-Acerion* forests of slopes, screes and ravines
	91AA *Eastern white oak woods
	91BA Moesian silver fir
	91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)
	91W0 *Moesian* beech forests
9200 Mediterranean deciduous forests	9280 *Quercus frainetto* woods
9500 Mediterranean and Macaronesian mountainous coniferous forests	95A0 High oro-Mediterranean pine forests

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ANNEX 3. List of species protected by the Habitats and Birds Directive

Species name	Directive, Annex	Species code
Flora (plant) species		
1. Mannia triandra	Habitats Directive, Annex II	**1379**
2. Green shield moss *(Buxbaumia viridis)*	Habitats Directive, Annex II	**1386**
3. Fritillaria gussichiae	Habitats Directive, Annex IV	**1845**
4. Carpathian Tozzia (*Tozzia carpathica)*	Habitats Directive, Annex II, IV	**6244**
Fauna ex. Aves (animals other than birds) species		
1. Wolf *(Canis lupus)*	Habitats Directive, Annex II, IV, V	**1352**
2. European wildcat (*Felis silvestris)*	Habitats Directive, Annex IV	**1363**
3. Otter *(Lutra lutra)*	Habitats Directive, Annex II, IV	**1355**
4. Lynx (*Lynx lynx)*	Habitats Directive, Annex II, IV, V	**1361**
5. Hazel dormouse (*Muscardinus avellanarius)*	Habitats Directive, Annex IV	**1341**
6. Balkan chamois (*Rupicapra rupicapra subsp. Balcanica)*	Habitats Directive, Annex II, IV	**1371**
7. Brown bear (*Ursus arctos)*	Habitats Directive, Annex II, IV	**1354**
8. Lesser mouse-eared myotis (*Myotis blythii)*	Habitats Directive, Annex II and IV	**1307**
9. Long-fingered bat (*Myotis capaccinii)*	Habitats Directive, Annex IV	**1316**
10. Blasius's horseshoe bat (*Rhinolophus blasii)*	Habitats Directive, Annex II, IV	**1306**
11. Mediterranean horseshoe bat (*Rhinolophus euryale)*	Habitats Directive, Annex II, IV	**1305**
12. Greater horseshoe bat (*Rhinolophus ferrumequinum)*	Habitats Directive, Annex II, IV	**1304**
13. Lesser horseshoe bat (*Rhinolophus hipposideros)*	Habitats Directive, Annex II, IV	**1303**
14. European copper skink (*Ablepharus kitaibelii)*	Habitats Directive, Annex IV	**1276**
15. Yellow-bellied toad (*Bombina variegata)*	Habitats Directive, Annex II, IV	**1193**
16. Aesculapian snake (*Elaphe longissima)*	Habitats Directive, Annex IV	**1281**
17. Sand lizard (*Lacerta agilis)*	Habitats Directive, Annex IV	**1261**
18. Three Lined Lizard *(Lacerta trilineata)*	Habitats Directive, Annex IV	**1251**
19. Balkan Green Lizard *(Lacerta viridis)*	Habitats Directive, Annex IV	**1263**
20. Erhard's wall lizard *(Podarcis erhardii)*	Habitats Directive, Annex IV	**1238**
21. Common Wall Lizard *(Podarcis muralis)*	Habitats Directive, Annex IV	**1256**
22. Balkan Wall Lizard *(Podarcis taurica)*	Habitats Directive, Annex IV	**1248**
23. Agile Frog *(Rana dalmatina)*	Habitats Directive, Annex IV	**1209**
24. Herman's Tortoise *(Testudo hermanni)*	Habitats Directive, Annex II, IV	**1217**
25. Nose-Horned viper (*Vipera ammodytes*)	Habitats Directive, Annex IV	**1295**
26. Pelagonia trout (*Salmo pelagonicus)*	Habitats Directive, Annex II	**5354**
27. Prespa trout (*Salmo peristericus)*	Habitats Directive, Annex II	**5355**
28. Stone crayfish *(Austropotamobius torrentium *)*	Habitats Directive, Annex II, V	**1093**
29. Cerambyx Longicorn *(Cerambyx cerdo)*	Habitats Directive, Annex II, IV	**1088**
30. *Cucujus cinnaberinus*	Habitats Directive, Annex II, IV	**1086**
31. Stag beetle *(Lucanus cervus)*	Habitats Directive, Annex II	**1083**
32. *Morimus funereus*	Habitats Directive, Annex II	**1089**
33. Rosalia longicorn (*Rosalia alpina* *)	Habitats Directive, Annex II, IV	**1087**
34. Balkan goldenring (*Cordulegaster heros)*	Habitats Directive, Annex II, IV	**4046**
35. Eastern Eggar (*Eriogaster catax)*	Habitats Directive, Annex II, IV	**1074**
36. Marsh Fritillary (*Euphydryas aurinia)*	Habitats Directive, Annex II	**1065**
37. Jersey Tiger (*Gallimorpha quadripunctaria)*	Habitats Directive, Annex II	**6199**

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38. Large copper (*Lycaena dispar)*	Habitats Directive, Annex II, IV	**1060**
39. Clouded Apollo (*Parnassius mnemosyne)*	Habitats Directive, Annex IV	**1056**
40. Large blue butterfly *(Phengaris arion)*	Habitats Directive, Annex IV	**1058**
Bird species		
1. Golden eagle *(Aquila chrysaetos)*	Birds Directive, Annex 1	**1560**
2. Short-toed snake eagle *(Circaetus gallicus)*	Birds Directive, Annex 1	**1490**
3. Montagus harrier *(Circus pygargus)*	Birds Directive, Annex 1	**1620**
4. Peregrine falcon *(Falco peregrinus)*	Birds Directive, Annex 1	**2020**
5. Lesser kestrel *(Falco naumanni)*	Birds Directive, Annex 1	**1940**
6. European honey buzzard *(Pernis apivorus)*	Birds Directive, Annex 1	**1460**
7. Middle spotted woodpecker *(Dendrocopos medius)*	Birds Directive, Annex 1	**1870**
8. White-backed woodpecker *(Dendrocopos leucotos)*	Birds Directive, Annex 1	**1880**
9. Syrian woodpecker *(Dendrocopos syriacus)*	Birds Directive, Annex 1	**1890**
10. Black woodpecker *(Dryocopus martius)*	Birds Directive, Annex 1	**1850**
11. Rock partridge *(Alectoris graeca)*	Birds Directive, Annexes I, II/A	**320**
12. European nightjar *(Caprimulgus europaeus)*	Birds Directive, Annex 1	**490**
13. Corn crake *(Crex crex)*	Birds Directive, Annex 1	**560**
14. Red-backed shrike *(Lanius collurio)*	Birds Directive, Annex 1	**2040**
15. Woodlark *(Lullula arborea)*	Birds Directive, Annex 1	**2640**
16. Red-billed chough *(Pyrrhocorax pyrrhocorax)*	Birds Directive, Annex 1	**2090**
17. Hazel grouse (*Tetrastes bonasia)*	Birds Directive Annexes I, II/B	**340**
18. Lanner falcon *(Falco biarmicus)* (*)	Birds Directive, Annex 1	**2000**
19. Bearded vulture *(Gypaetus barbatus)* (*)	Birds Directive, Annex 1	**1470**
20. Egyptian vulture *(Neophron percnopterus)* (*)	Birds Directive, Annex 1	**1480**
(*) = Being extinct in Pelister National Park		

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ANNEX 3 Fact sheets of the birds, habitats and species of Pelister National Park

Table of Contents

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Bird Directive Annex I and II species, and other bird species with international conservation interest

Hazel Grouse (Bonasa bonasia)

Status in Europe		
EU Birds Directive Annex I and II		
Threat status in Europe:	Least Concern (IUCN)	LC

Ecology

The species favours dense, mixed forests with rich and varied undergrowth, both on plains and in mountainous areas. A non-migratory species.

Methods for inventory and monitoring

The recommended methods for a breeding population are line-transect counts and point-counts.

Fig. 2. The Hazel Grouse is exclusively a forest species all year-round. Photos: Petri Ahlroth.

Proposed conservation actions

Forestry practices should be integrated with habitat conservation. In countries on the edge of its range, such as North Macedonia, protected areas may be effective in preventing population decline. Exploitation of these small populations should be sustainable.

Breeding status and trends in RNM		
Population size (min/max)	100-500 breeding pairs	
Population trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Breeding distribution (map and size)		Not available
Breeding distribution trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Progress of species action and management plans		None
Main pressures and threats		
The species is very sensitive to habitat changes, particularly modern forestry practices, due to the specific habitat structure requirements. Intensified hunting may lead to vulnerability on a local scale.		
Conservation measures		Some
Hunting season is limited to the period 10. October - 15. December		
Natura 2000 (SPA) coverage Area		
Information related to Art 7 (huntable) species		Hunting season
Hunting bag (statistics min/max)	?-?	Unknown

References

BirdLife International (2018) *Species factsheet: Bonasa bonasia*.

Short-toed Eagle (*Circaetus gallicus*)

Status in Europe		
EU Birds Directive Annex I		
Threat status in Europe:	Least Concern (IUCN)	LC

Ecology

The Short-toed Eagle inhabits a variety of habitats, but it requires some extent of tree cover. A migratory species.

Methods for inventory and monitoring

The recommended method is active searching inside breeding territories.

Fig. 7. The Short-toed Eagle has specialized in feeding on snakes and other reptiles. Photos: Petri Ahlroth.

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Breeding status and trends in RNM		
Population size (min/max)	120-150 breeding pairs	
Population trend		
Short term (last 12 years)		Stable
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Breeding distribution (map and size)		Not available
Breeding distribution trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Progress of species action and management plans		None
Main pressures and threats		
Changes in agriculture and land use may limit the availability of suitable hunting habitats and reduce prey such as populations of snakes.		
Conservation measures		None
Natura 2000 (SPA) coverage Area		
Information related to Art 7 (huntable) species		Not huntable
Hunting bag (statistics min/max)	0-0	

References

BirdLife International (2018) *Species factsheet: Circaetus gallicus*.

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Montagu's Harrier (Circus pygargus)

Status in Europe		
EU Birds Directive Annex I		
Threat status in Europe:	Least Concern (IUCN)	LC

Ecology

The species favours open lowland areas with tall meadow vegetation, including crop fields. A migratory species.

Methods for inventory and monitoring

The recommended methods are active searching inside breeding territories and point-counts.

Fig. 8. Female and male of Montagu's Harrier. A major part of the North Macedonian population breeds in the Pelagonia Valley. Photos: Petri Ahlroth.

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Breeding status and trends in RNM		
Population size (min/max)	100-140 breeding pairs	
Population trend		
Short term (last 12 years)		Stable
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Breeding distribution (map and size)		Not available
Breeding distribution trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Progress of species action and management plans		None
Main pressures and threats		
The conversion of original habitats to agricultural land, where harvesting causes frequent breeding failures.		
Conservation measures		None
Natura 2000 (SPA) coverage Area		
Information related to Art 7 (huntable) species		Not huntable
Hunting bag (statistics min/max)	0-0	

References

BirdLife International (2018) *Species factsheet: Circus pygargus*.

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Golden Eagle (Aquila chrysaetos)

Status in Europe		
EU Birds Directive Annex I		
Threat status in Europe:	Least Concern (IUCN)	LC

Ecology

This species requires undisturbed nesting areas such as mountain forests or large woodlands. Hunting activity takes place in open habitats. Breeding sites are entirely on the ground at mountain cliffs in North Macedonia. A non-migratory or partially migratory species.

Methods for inventory and monitoring

The recommended method is active searching in breeding territories.

Fig. 9. The Golden Eagle breeds in undisturbed areas. Photo: Petri Ahlroth.

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Breeding status and trends in RNM		
Population size (min/max)	60-100 breeding pairs	
Population trend		
Short term (last 12 years)		Decreasing
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Breeding distribution (map and size)		Not available
Breeding distribution trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Progress of species action and management plans		None
Main pressures and threats		
Habitat loss, persecution and poisoning.		
Conservation measures		Some
A few vulture feeding stations are also used by this species.		
Natura 2000 (SPA) coverage Area		
Information related to Art 7 (huntable) species		Not huntable
Hunting bag (statistics min/max)	0-0	

References

BirdLife International (2018) *Species factsheet: Aquila chrysaetos*.

Booted Eagle (Hieraaetus pennatus)

Status in Europe		
EU Birds Directive Annex I		
Threat status in Europe:	Least Concern (IUCN)	LC

Ecology

The Booted Eagle favours open woodland areas, often close to mountains. Nesting takes place in trees. A migratory species.

Methods for inventory and monitoring

The recommended method is active searching of breeding territories.

Fig. 10. The Booted Eagle is a rare breeding species present in certain areas of North Macedonia. Pictures illustrate a pale and a dark morph. Photos: Petri Ahlroth.

Breeding status and trends in RNM		
Population size (min/max)	15-25 breeding pairs	
Population trend		
Short term (last 12 years)		Stable
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Breeding distribution (map and size)		Not available
Breeding distribution trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Progress of species action and management plans		None
Main pressures and threats		
Habitat loss and persecution.		
Conservation measures		None
Natura 2000 (SPA) coverage Area		
Information related to Art 7 (huntable) species		Not huntable
Hunting bag (statistics min/max)	0-0	

References

BirdLife International (2018) *Species factsheet: Hieraaetus pennatus*.

Black Woodpecker (*Dryocopus martius*)

Status in Europe		
EU Birds Directive Annex I		
Bern Convention Appendix II		
Threat status in Europe:	Least Concern (IUCN)	LC

Ecology

The species is found in all types of mature forests. Mainly non-migratory.

Methods for inventory and monitoring

The recommended methods are line-transect counts and point-counts.

Fig. 14. The Black Woodpecker requires old trees for excavating nest-holes. Photo: Petri Ahlroth.

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Breeding status and trends in RNM		
Population size (min/max)	1.500-5.000 breeding pairs	
Population trend		
Short term (last 12 years)		Stable
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Breeding distribution (map and size)		Not available
Breeding distribution trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Progress of species action and management plans		None
Main pressures and threats		
Forestry management.		
Conservation measures		None
Natura 2000 (SPA) coverage Area		
Information related to Art 7 (huntable) species		Not huntable
Hunting bag (statistics min/max)	0-0	

References

BirdLife International (2018) *Species factsheet: Dryocopus martius*.

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Middle Spotted Woodpecker (*Dendrocopos medius*)

Status in Europe		
EU Birds Directive Annex I		
Bern Convention Appendix II		
Threat status in Europe:	Least Concern (IUCN)	LC

Ecology

The species is restricted to mature deciduous forests, preferring Oak forests. A non-migratory species.

Methods for inventory and monitoring

The recommended methods are line-transect counts and point-counts.

Fig. 15. The Middle Spotted Woodpecker is an all-year specialist inhabiting mature oak forests. Photo: Petri Ahlroth.

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Breeding status and trends in RNM		
Population size (min/max)	3.000-10.000 breeding pairs	
Population trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Breeding distribution (map and size)		Not available
Breeding distribution trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Progress of species action and management plans		None
Main pressures and threats		
Forestry management.		
Conservation measures		None
Natura 2000 (SPA) coverage Area		
Information related to Art 7 (huntable) species		Not huntable
Hunting bag (statistics min/max)	0-0	

References

BirdLife International (2018) *Species factsheet: Dendrocopos medius*.

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White-backed Woodpecker (*Dendrocopos leucotos*)

Status in Europe		
EU Birds Directive Annex I		
Bern Convention Appendix II		
Threat status in Europe:	Least Concern (IUCN)	LC

Ecology

The species favours old-growth and over-mature, relatively open deciduous and mixed forests that have a high proportion of dead or decaying trees. Mainly non-migratory.

Methods for inventory and monitoring

The recommended methods are line-transect counts and point-counts.

Fig. 16. The White-backed Woodpecker requires decaying trees to survive. Photo: Petri Ahlroth.

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Breeding status and trends in RNM		
Population size (min/max)	200-400 breeding pairs	
Population trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Breeding distribution (map and size)		Not available
Breeding distribution trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Progress of species action and management plans		None
Main pressures and threats		
Unfavourable forest management practices.		
Conservation measures		None
Natura 2000 (SPA) coverage Area		
Information related to Art 7 (huntable) species		Not huntable
Hunting bag (statistics min/max)	0-0	

References

BirdLife International (2018) *Species factsheet: Dendrocopos leucotos*.

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Woodlark (*Lullula arborea*)

Status in Europe		
EU Birds Directive Annex I		
Threat status in Europe:	Least Concern (IUCN)	LC

Ecology

The species inhabits a variety of open and semi-open habitats on well-drained soils. A partially migratory species.

Methods for inventory and monitoring

The recommended methods are line-transect counts and point-counts.

Fig. 17. The Woodlark is a species of open terrain. Photo: Petri Ahlroth.

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Breeding status and trends in RNM		
Population size (min/max)	5.000-15.000 breeding pairs	
Population trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Breeding distribution (map and size)		Not available
Breeding distribution trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Progress of species action and management plans		None
Main pressures and threats		
Habitat loss and degradation.		
Conservation measures		None
Natura 2000 (SPA) coverage Area		
Information related to Art 7 (huntable) species		Not huntable
Hunting bag (statistics min/max)	0-0	

References

BirdLife International (2018) *Species factsheet: Lullula arborea*.

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Red-backed Shrike (*Lanius collurio*)

Status in Europe		
EU Birds Directive Annex I		
Bern Convention Appendix II		
Threat status in Europe:	Least Concern (IUCN)	LC

Ecology

The species inhabits a wide variety of semi-open bushy areas. A migratory species.

Methods for inventory and monitoring

The recommended methods are line-transect counts and point-counts.

Fig. 19. Female Red-backed Shrike. The species breeds commonly in half-open areas in North Macedonia. Photo: Petri Ahlroth.

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Breeding status and trends in RNM		
Population size (min/max)	15.000-50.000 breeding pairs	
Population trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Breeding distribution (map and size)		Not available
Breeding distribution trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Unknown
Progress of species action and management plans		None
Main pressures and threats		
Loss of habitats.		
Conservation measures		None
Natura 2000 (SPA) coverage Area		
Information related to Art 7 (huntable) species		Not huntable
Hunting bag (statistics min/max)	0-0	

References

BirdLife International (2018) *Species factsheet: Lanius collurio*.

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Red-billed Chough (*Pyrrhocorax pyrrhocorax*)

Status in Europe		
EU Birds Directive Annex I		
Bern Convention Appendix II		
Threat status in Europe:	Least Concern (IUCN)	LC

Ecology

The species favours high mountain pastures with rocky crags. A non-migratory species.

Methods for inventory and monitoring

The recommended method for the small populations is mapping.

Fig. 20. The Red-billed Chough is a rare breeding species in the mountainous areas of North Macedonia. Photo: Petri Ahlroth.

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Breeding status and trends in RNM		
Population size (min/max)	50-80 breeding pairs	
Population trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Decreasing
Breeding distribution (map and size)		Not available
Breeding distribution trend		
Short term (last 12 years)		Unknown
Long term (ca 1980-2018, or a period as close as possible to that)		Decreasing
Progress of species action and management plans		None
Main pressures and threats		
Changes in grazing regimes, conversion of grazing habitat to forest, intensive farming and recreational disturbance.		
Conservation measures		None
Natura 2000 (SPA) coverage Area		
Information related to Art 7 (huntable) species		Not huntable
Hunting bag (statistics min/max)	0-0	

References

BirdLife International (2018) *Species factsheet: Pyrrhocorax pyrrhocorax*.

Grubač B &Velevski M (2016) *The Red-billed Chough Pyrrhocorax pyrrhocorax (Linnaeus, 1758) in Serbia and Macedonia*. Nature Conservation 66(2): 5–17.

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Habitat types

Freshwater habitats

3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea

Status in Europe			
Habitats directive, Annex I		Habitat type:	3130
Threat status in EU28+	Least concern		LC
Threat status in EU28	Least concern		LC
EU conservation status by biogeographical region			
Alpine	Favourable		FV
Atlantic	Unfavourable-Inadequate		U1
Black Sea	Favourable		FV
Boreal	Unfavourable-Inadequate		U1
Continental	Unfavourable-Bad		U2
Macaronesian	Unfavourable-Inadequate		U1
Mediterranean	Unfavourable-Inadequate		U1
Pannonian	Unfavourable-Inadequate		U1
Steppic	Favourable		FV

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013*): 22.12 x 22.31 - aquatic to amphibious short perennial vegetation, oligotrophic to mesotrophic, of lake, pond and pool banks and water-land interfaces belonging to the Littorelletalia uniflorae order. 22.12 x 22.32 - amphibious short annual vegetation, pioneer of land interface zones of lakes, pools and ponds with nutrient poor soils, or which grows during periodic drying of these standing waters: Isoeto-Nanojuncetea class. These two units can grow together in close association or separately. Characteristic plant species are generally small ephemerophytes.*

Description according to EUNIS (Evans & Roekaerts2015) C1.1 Permanent oligotrophic lakes, ponds and pools: *Waterbodies with a low nutrient (nitrogen and phosphorus) content, mostly acid (pH 4-6). Includes oligotrophic waters of medium or high pH, e.g. calcareous and basic unpolluted nutrient-poor lakes and pools, which are rare in much of Europe and noted as a habitat of charophytes (C1.14). Excludes peaty, dystrophic waters (C1.4). Because of the low nutrient status, beds of vascular plants are often sparse and open. Plant communities: Charion fragilis, Nitellion flexilis, Nelumboion nuciferae, Scorpidio-Utricularion minoris, Oenanthion aquaticae, Zannichellion pedicellatae, Parvopotamion, Potamion graminei, Nitellion syncarpae-tenuissimae, Sphagno-Utricularion, Ranunculion aquatilis, Hyperico elodis-Sparganion, Charion vulgaris, Potamion. Species: Callitriche sp. Chara sp, Isoetes sp, Nitella sp, Potamogeton sp, Sparganium sp, Eleocharis quinqueflora, Eleocharis ovata.*

C3 Littoral zone of inland surface waterbodies C3.4 Species-poor beds of low-growing water-fringing or amphibious vegetation. Includes isoetids of the shores of oligotrophic lakes, Nasturtium aquaticum by streams, mediterranean dwarf Scirpus swards, and other species-poor but dissimilar types of vegetation.

Plant communities: Deschampsion litoralis, Littorellion uniflorae, Lobelion dortmannae, Rorippion islandicae, Subularion aquaticae.

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Fig. 21. The Golemo Ezero (Big Lake) is a clear water oligotropic alpine lake of glacial origin. It belongs to HD type 3130. Photo: Kimmo Syrjänen.

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EUNIS includes oligotrophic water bodies C 1.1 following EU Habitats Directive Annex I habitat types:

2190 Humid dune slacks, 3110 Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae), 3120 Oligothrophic waters containing very few minerals generally on sandy soils of the West Mediterranean, with Isoetes spp., 3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. C3.4 Species-poor beds of low-growing water-fringing or amphibious vegetation contains following EU habitat types: 1150, 3110, 3120, 3130 and 3170.

There is a significant overlap in EU's lake habitats and the co-occurrence of two or more habitats in several lakes is possible. EU's interpretations of habitats 3110, 3130, 3140, 3150 and 3160 are somewhat vague and have caused confusion across Member States (O´Connor 2015). In Pelister National Park lakes Golemo and Malo Ezero belong entirely to type 3130. Some pools along east slope of Mt. Pelister may also belong to this type. A couple of small ponds at springy mires close to Malo Ezero will belong into 3160 Natural dystrophic lakes and ponds. Some oligotrophic pools may represent temporary pools (more continental than mediterranean type) but there are also characteristics of 3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea in certain pools close to Golemo and Malo Ezero.

Vascular plant communities and typical species of 3110 in the Pelister National Park

In the Pelister National Park there are two unique glacial lakes: Golemo and Malo Ezero. They belong to the habitat 3110 with their clear oligotrophic water, although they lack submerged vascular vegetation. These lakes do not have any larger plants and the primary production of the lake ecosystem is based on algae. Alluvial shoreline belt is characterized by species poor water fringing vegetation with *Deschampsia cespitosa* and *Carex leporina* as constant species.

Habitat directive and other important species

These lake ecosystems contain unique invertebrates.

Inventory and Monitoring

Monitoring should include data on hydrology (annual dynamics) and water chemistry in addition to inventories of species. Inventories and species list of pools at the eastern slope of the Baba Mountains are also needed.

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Fig. 22. Shallow oligo-mesotrophic pool at a slope of the Golemo Ezero also belong into 3130. In water *Eleocharis palustris* and *Callitriche sp.,* at moist shore *Eleocharis acicularis, Carex macedonica* and *Deschampsia cespitosa* etc. Photo: Kimmo Syrjänen.

Threats and pressures

In principle there are no severe threats because both lakes are inside the National Park of Pelister which is a strictly protected zone. Especially Golemo Ezero is actively visited by tourists, a cause for eutrophication to this small lake (Avramoski 2006a). The illegal introduction of fishes into this lake a few decades ago may have had negative effects on the ecosystem and species composition of this lake. A mountain hut is located next to the shore at the Golemo Ezero and its active use by Jeeps and other off-road vehicles increases the chances of oil and gasoline relateds accidents to the lake.

Range

This habitat type is very rare in North Macedonia.

Area

Area of the Golemo Ezero is 3.7 hectares and 0.66 hectares of the Malo Ezero (Avramoski 2006a). In addition, some oligo-mesotrophic pools in the surrounding area should be added to this habitat type.

Structure and function

These two lakes are formed by the interaction of erosion and accumulative glacial processes. They are concave ellipsoid pools without outflow. Waters of the Golemo Ezero discharge through moraine/gravelly bank at fountainheads of the Ezerska River, a left tributary of the river Sapuncica. Golemo Ezero is located in 2.218 m altitude, it covers an area of 3.7 hectares, and the catchment area will gather a total of 185,374 m^3 of water annually. Maximum depth of lake is 14.5 m, and it is the third deepest natural lake and deepest mountain lake in the Republic of North Macedonia. The Malo Ezero is at 2180 m a.s.l., covers 0.66 hectares and is only 2.6 m deep, it is a fountainhead of the Crvena river. These two lakes get water from melting snow, precipitation and

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as ground water. Structure and function of these lake ecosystems is in good order. As a consequence of climate warming, longer warmer periods can increase the productivity and eutrophication of both lakes and the shallower Malo Ezero can dry up partially or completely during warm summers in the future.

Management principles

Management actions have not been needed so far and managing these lakes would be difficult if it were deemed necessary. There may already be behavioural adaptations of crustaceans and other water invertebrates to the presence of fish. Poisoning of fishes with rotenone (a nonselective piscicide) is not recommended because it can be harmful to other water animals that have inhabited these lakes over thousands of years.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	FV
Structure and function	FV
Future prospects	U1-
Overall assessment of Conservation Status	**U1-**

References:

Avramoski, O. (ed.) 2006a: *The Plan of Management for Pelister National Park. – Pelister National Park & Pelister Mountain Conservation Project.* Swiss Agency for Development and Cooperation (SDC) through the Pelister Mountain Conservation Project. 67 pp.

Avramoski, O. (ed.) 2006b: *The Plan of Management for Pelister National Park - Supplement. – Pelister National Park & Pelister Mountain Conservation Project.* Swiss Agency for Development and Cooperation (SDC) through the Pelister Mountain Conservation Project. 112 pp.

O'Connor, Á. 2015: *Habitats Directive Annex I lake habitats: a working interpretation for the purposes of site-specific conservation objectives and Article 17 reporting*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland.

EUNIS Factsheet: *Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoeto-Nanojuncetea.* https://eunis.eea.europa.eu/habitats/10065

European commission 2013: *The Interpretation Manual of European Union Habitats - EUR28. – European Commission DG Environment.* Nature ENV B.3. 144 pp.

http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf.

Tryfon, E. 2016: https://forum.eionet.europa.eu/european-red-list-habitats/library/terrestrial-habitats/c.-freshwater/c1.1b-permanent-oligotrophic-mesotrophic-waterbody-soft-water-species

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3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation

Status in Europe			
Habitats directive, Annex I		Habitat type:	3260
Threat status in Europe EU28+	Vulnerable		VU
Threat status in EU28	Vulnerable		VU
EU conservation status by biogeographical region			
Alpine	Unfavourable-Inadequate		U1
Atlantic	Unfavourable-Bad		U2
Black Sea	Unfavourable-Inadequate		U1
Boreal	Unfavourable-Bad		U2
Continental	Unfavourable-Inadequate		U1
Macaronesian	Not present		-
Mediterranean	Unfavourable-Bad		U2
Pannonian	Unfavourable-Inadequate		U1
Steppic	Favourable		FV

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *"1) Water courses of plain to montane levels, with submerged or floating vegetation of the Ranunculion fluitantis and Callitricho-Batrachion (low water level during summer) or aquatic mosses." "2) Plants: Ranunculus saniculifolius, R. trichophyllus, R. fluitans, R. peltatus, R. penicillatus ssp. penicillatus, R. penicillatus ssp. pseudofluitantis, R. aquatilis, Myriophyllum spp., Callitriche spp., Sium erectum, Zannichellia palustris,* Potamogeton *spp., Fontinalis antipyretica."*

*"*4) This habitat is sometimes associated with *Butomus umbellatus* bank communities. It is important to take this point into account in the process of site selection."

According to EUNIS (Evans & Roekaerts2015) this type includes all kind of spring brooks and streams without depending on trophic status or flowing velocity of water course:

C2.18 Acid oligotrophic vegetation of spring brooks.

C2.19 Lime rich oligotrophic vegetation of spring brooks

C2.1A Mesotrophic vegetation of spring brooks

C2.1B Eutrophic vegetation of spring brooks

C2.25 Acid oligotrophic vegetation of fast flowing streams

C2.26 Lime rich oligotrophic vegetation of fast flowing streams

C2.27 Mesotrophic vegetation of fast flowing streams

C2.28 Eutrophic vegetation of fast flowing streams

C2.33 Mesotrophic vegetation of slow-flowing streams

C2.34 Eutrophic vegetation of slow-flowing streams

Occurrence of habitat type and related types in Pelister National Park and Prespa Lake

Most brooks and streams at the Pelister National Park and the Prespa Lake belong to the habitat type 3260. Oligotrophic brooks and streams are typical at upper reaches of water courses running from the Pelister National

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Park towards east or into the Prespa Lake. Vegetation that is more related to mesotrophic and eutrophic brooks and streams is found at medium and especially at lower parts of brooks and streams entering the Prespa Lake.

Shorelines of brooks and streams are typically 6430 “Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels”. At the upper courses in the Pelister National Park this habitat is diverse and contains a lot of conservation values in vascular plants (Čarni & Matevski 2010) and other species groups (Avramoski 2006a, b). Along spring affected brooks and in areas with high groundwater stands of *Alnus glutinosa* belong to 91E0 “*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)”. This habitat type is occasionally found at lower part of streams. At lower shoreline habitats that run towards the Prespa Lake nitrophilic vegetation can be found and these part of rivers belong either to 3280 “Constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of *Salix* and *Populus alba”* or to 3290 “Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion”.

Fig. 25. 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation are common habitat types in brooks and rivers running to the Prespa Lake at the Pelister National Park. At slopes of the Pelister National Park these brooks and streams have clear oligotrophic water and submerged vegetation is characterized mainly by water bryophytes like *Fontinalis antipyretica*. At the shorelines of mountain brooks and streams there is usually tall herb fringes with diverse flora. Rotino river. Photo: Kimmo Syrjänen.

Vascular plant communities and typical species of 3260

The following plant species were found at the upper part of the Capari River in zone of Oro-Mediterranean *Pinus peuce* forest: *Cirsium appendiculatum*, *Athyrium filix-femina*, *Epilobium parviflorum*, *Heracleum sphondylium* subsp. *verticillatum*, *Rumex alpinus*, *Geranium reflexum*, *Doronicum austriacum*, *Telekia speciosa*, *Angelica pancicii*, *Brachythecium rivulare*, *Scapania undulata*, *Hygrohypnum duriusculum*, *Porella cordaeana*, *Chiloscyphus polyanthos* and *Pellia neesiana.*

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Mesotrophic and eutropic vegetation is available at lower parts. *Callitriche spp.* is occasionally present in streams and *Epilobium hirsutum* is common at shores. Closer to the Prespa Lake *Phragmites australis*, *Iris pseudacorus*, *Alisma plantago-aquatica*, *Solanum dulcamara*, *Bidens frondosus* and sometimes the rare and protected *Beckmannia eruciformis* are present along streams.

Habitat directive species and other important species of 3260

Carpathian Tozzia (*Tozzia carpathica*) is a HD species of annexes II and IV and it grows on the shoreline fringes of the subalpine brooks in the Pelister National Park (Čarni & Matevski 2010, Matevski et al. 2019). The Otter (*Lutra lutra*) is a HD mammal species living in these streams and brooks. Bats are also typical for stream habitats. At lower reaches the Kingfisher (*Alcedo atthis*) is also present in the Golemo Reka.

The Pelagonide Trout (*Salmo pelagonicus*) is a fish species with a high conservation value in these brooks and streams of the Pelister National Park (Avramoski 2006a). It is present in streams running eastward from the Pelister National Park and found from Lower Vardar (Crna system) and upper Aliakmon drainages (Macedonia and Greece) (Kottelat & Freyhof 2007). It is listed as threatened (vulnerable, VU) at global Red List of IUCN (Freyhof & Kottelat 2008). At streams running to the Prespa Lake from the Pelister National Park, spawns even more threatened trout, namely the Prespa Trout (*Salmo peristericus*) that is classified as Endangered (EN) at global Red List of IUCN (Crivelli 2006). The Prespa Trout is endemic for the Prespa Lake and it is only found in the Agios Germanos river (Greece), the Brajcinska river, the Kranska river and the Leva Reka stream (a tributary of the Golemo Reka) (Vrahnakis & Fotiadis 2009).

Fig. 26. a) 3260 at the alpine part of the Pelister National Park with clear oligotrophic spring water at a slope below the Golemo Ezero. **b)** The Magarevska River at 1600 m a.s.l. with several water mosses (e.g. *Fontinalis antipyretica*) and tall herb fringe. Photos: Kimmo Syrjänen.

This habitat type is very important for other fish species, crustaceans, molluscs and other invertebrates as well as for clear water algae. Avramoski (2006a) lists for example the rare Ostracode Crab (*Eucypris kurtdiebeli*) and the Amphipode Crab (*Niphargus pancici pancici*) from springs and spring brooks of the Pelister National Park. Several amphibians are dependent on this habitat type including HD annex amphibians *Rana graeca* and *Rana dalmatina*. *Salamandra salamandra* is commonly found along brooks and streams in the Pelister National Park. They are also important water sources and habitats for several mammals and birds.

Inventory and Monitoring

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Currently there is no Standard Field Inventory Form for riparian habitats. Inventory information should be collected on GPS marked polygons/transects along river or sampling plots inside the studied river. Repeated visits and an iteration of the inventory at the same site is a basic method of monitoring. Suitable monitoring period is between 5-10 years for this habitat type. Transects along different altitudinal parts of a river should be included in monitoring. The methodology used by Vrahnakis & Fotiadis (2009) for land use analyses and vegetation would be a good method for monitoring streams. In addition to monitoring vegetation, water flow and analyses of water chemistry are needed. Monitoring of fishes and invertebrate fauna would also provide important information on the development of conservation status of this habitat type.

Fig. 27. Eutrophicated lower reach of the Brajcinska river at the Prespa Lake National Monument. Photo: Kimmo Syrjänen.

Threats and pressures

There are several threats and pressures towards this habitat including erosion and sedimentation by forest cutting and road construction inside and outside of the protected areas. Eutrophication and pollution due to waste waters (coming mainly outside of the protected areas) are severe threats. Dredging of water courses and the construction of hydropower plants (the River Semnica inside the Pelister National Park, the River Brajcino outside of border of the National Park) has caused deterioration of the habitat and these negative impacts are continuing in certain extent. There is some amount of water abstraction inside the National Park, but water uptake forms a more severe threat outside the park. Increase of tourism can also be a threat to water quality. Fish pools of rainbow trout along the Brajcinska River (Avramoski 2006a) can cause a threat to natural fauna. Climate warming will probably have negative impacts on this habitat type now and in the future.

Range

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In the study area this habitat type is found at the Pelister National Park and widely at the Prespa Lake catchment area. It is a common habitat type in Macedonia (Bregalnica River catchment – Kriva Lakavica among others (Matevski et al. 2018)).

Area

Area of this habitat type appears to be rather stable in the Pelister National Park, but it may decrease due to a hydropower plant in the river Semnica that has caused deterioration of this habitat type between Kazan and Malovishte villages. Inside the Prespa Lake National Monument and the Ezerani conservation area situation is stable, but the lower parts of this habitat type have already changed due to eutrophication and habitat changes. The ength of the streams is 306 kilometers in the Pelister National Park (intermittent streams 118 km and streams 188 km). It is estimated that 50 hecteres of this habitat type exist inside the National Park. There is only 0,5 - 1 hectares of this habitat type at the Prespa Lake area.

Structure and function

This habitat is dependent on surface and ground water. The structure and function are close to optimal at the upper reaches in the Pelister National Park. Some extra sediment may be gathered by waters running from mountain- and forest roads to brooks. Local forest cuttings at the lower part of the Park can increase erosion and sedimentation of streams. Outside the conservation areas water courses are affected by waste waters of villages and the Resen town, as well as fertilizers and pesticides from agriculture. Irrigation and the uptake of groundwater have negative impacts on this habitat type. Watercourses entering to the Lake Prespa have eutrophicated at the lower part of their reaches during a long time period. These lower parts of streams have also naturally more nutrients than the upper parts, but most of eutrophication is human induced. Dredging of the lower parts of water courses have also affected negatively on the structure and function of this habitat type.

Management principles

This habitat type should be left intact and excavation, road construction and forest cutting etc. activities at shorelines should be avoided. All management actions that prevent the accumulation of sediments into natural brooks and streams and decrease eutrophication are encouraged. More attention should be paid to improve the water quality and conservation status of the habitat especially at streams between the Pelister National Park and the Prespa Lake where the Prespa Trout spawns. These ecological corridors with entire riparian vegetation and large enough buffers should be included in conservation. Conditions of these streams may need to be improved by restoration/management actions when they are needed (see analyses of land use by Vrahnakis & Fotiadis 2009). The four small hydro power plants: Šemnica (Malovište) Kažani, Brajčino-1 and Brajčino-2, which cover the waters of Brajčinska Reka and the river Šemnica, affect the quality and flow regime of water, and negative impacts the habitat quality and species richness.

Effects of hydropower plants on biodiversity should be analysed and the negative impacts compensated by owner companies. The required biological minimum should be restored in the river, so that the ecosystems can be recovered. The current biological minimum is set at 10 % of the average of the annual flow. It should be reassessed considering the high ecological sensitivity of the area. Clearing all unnatural obstacles from the riverbed is needed. A thorough restoration of damaged habitats should be done and forests should be re-established where they have been cut.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	U1

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Structure and function	U2
Future prospects	U1
Overall assessment of Conservation Status	**U2**

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Temperate heath and scrub

4060 Alpine and Boreal heaths

Status in Europe			
Habitats directive, Annex I		Habitat type:	4060
Threat status in Europe EU 28+	Least concern		NT
Threat status in EU28	Least concern		NT
EU conservation status by biogeographical region			
Alpine	Favourable		FV
Atlantic	Unfavourable-Bad		U2
Black Sea	Not present		
Boreal	Unfavourable-Inadequate		U1
Continental	Favourable		FV
Macaronesian	Favourable		FV
Mediterranean	Unknown		XX
Pannonian	Not present		-
Steppic	Not present		-

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *"Small, dwarf or prostrate shrub formations of the alpine and sub-alpine zones of the mountains of Eurasia dominated by ericaceous species, Dryas octopetala, dwarf junipers, brooms or greenweeds; Dryas heaths of the British Isles and Scandinavia."*

This habitat type consists of several subtypes. These four can be recognized from Pelister National Park:

31.43 - Mountain dwarf juniper scrub.

31.46 - Bruckenthalia heaths

31.4A - High mountain dwarf bilberry heaths

31.4B - High mountain greenweed heaths

Description according to EUNIS (Evans & Roekaerts 2015): "F2 Arctic, alpine and subalpine scrub

F2.2 Evergreen alpine and subalpine heath and scrub, F2.26 Bruckenthalia heaths Description:

Formations of *Bruckenthalia spiculifolia*, often accompanied by *Juniperus nana*, *Vaccinium myrtillus* and herbaceous alpine grassland species, occupying damp, non-calcareous substrates of high mountains of the Balkan Peninsula and northern Anatolia. Plant communities: *Bruckenthalion spiculifoliae*

Species: *Bruckenthalia spiculifolia*, *Juniperus nana*, *Vaccinium myrtillus*."

There is already a fact sheet available of this habitat type for the Republic of Macedonia (Matevski et al. 2017). Here is presented the current situation for Pelister National Park.

Occurrence of habitat type and subtypes in Pelister National Park

The habitat type 4060 "Alpine and Boreal heaths" is present at the Pelister National Park. It is fairly common and abundant at subalpine and alpine areas of the park at altitudes 1600 – 2300 m a.s.l. It mostly occurs at alpine areas above natural upper forest boundary, but there are remnants of this habitat type also inside the forest zone in overgrowing pastures or burned sites. Different subtypes of alpine and boreal heaths often form mosaics

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with each other. At lower parts of the alpine zone there are low-growing *Juniperus communis* heaths (*Juniperus nana / sibirica*) that change to *Vaccinium myrtillus* and *Bruckenthalia spiculifolia* dominated heaths towards higher elevations. Especially at higher altitudes these heaths form mosaics with alpine grasslands. At subalpine parts small heaths with broom(s) *Chamaecytisus* spp. are also found mixed with grasslands and other heath types. *Juniperus communis* shrubs that grow tall (over 0.5-1 m) at subalpine areas or lower parts of the Pelister National Park on overgrowing grasslands belong to type 5130 "*Juniperus communis* formations on heaths or calcareous grasslands", not to alpine heaths.

Fig. 28. 4060 Alpine and Boreal heaths is a common habitat type at subalpine and alpine parts of the Pelister National Park. **a)** Dwarf mountain juniper heath at slope of the Mt. Pelister. **b)** *Pinus peuce* is spreading quickly upwards to Alpine and Boreal heaths in certain northern slopes of the Mt. Pelister.

Vascular plant communities and typical species of 4060 in Macedonia

Typical species of the habitat 4060 in the Pelister National Park include: *Juniperus communis*, *Vaccinium myrtillus*, *Calamagrostis arundinacea*, *Bruckenthalia spiculifolia*, *Deschampsia flexuosa*, *Vaccinium uliginosum*, *Rubus idaeus*, *Epilobium angustifolium*, *Sesleria comosa*, *Thymus jankae*, *Luzula spicata*, *Festuca* spp., *Carex kitaibeliana*, *Lilium albanicum*, *Galium breviramosum*, *Gentiana lutea* subsp. *symphiandra*, *Crepis viscidula*, *Tephroseris papposa*, *Podospermum roseum* spp. *peristericum*, *Pedicularis orthantha*.

Habitat directive and other important species

4060 is important for several alpine animal species including the hazel grouse *Tetrastes bonasia* with its southernmost localities in Europe at middle Balkan. Alpine heaths together with grasslands provide summertime grazing areas for Chamois *Rupicapra rupicapra* in the Pelister National Park.

Inventory and Monitoring

Standard Field Inventory Form for grasslands should be used in inventories and during monitoring. Inventory information should be collected on GPS marked polygons/ sampling plots inside the studied heathland stands. Repeated visits and iteration of inventory at the same site is basic method of monitoring. Suitable monitoring period is between 5-10 years for this habitat type. Different subtypes should be taken into account during monitoring. Both managed and unmanaged stands should be monitored at different altitudes and in different successional stages of occurrences of this habitat type.

Threats and pressures

In the Pelister National Park the Alpine and Boreal heaths are suffering from overgrowth. Lower growing subtypes are overgrown by higher ones i.e. *Juniperus communis* is overgrowing *Vaccinium myrtillus* and *Bruckenthalia spiculifolia* dominated heaths. At the same time wooden species are spreading to alpine heaths. At upper parts of the forest zone there are overgrown heaths inside expansive forests and high juniper shrub. *Pinus peuce* seems to colonise alpine heaths and grasslands quickly at certain areas in the Pelister National Park.

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In addition to the common juniper, deciduous trees and scrubs (*Prunus* spp., *Betula pendula*, *Acer obtusum*, *Rubus* spp., *Rosa* spp.) are colonizing subalpine parts of heaths in certain parts of the Pelister National Park. Dense colonies of bracken (*Pteridium aquilinum*) are also spreading to mountain heaths at places. Climate warming will most likely enhance these negative changes. Although overgrazing is a threat to this habitat type, some amount of management and grazing is needed to keep it up. Possible threats to this habitat type are also the construction of mountain roads and buildings, consequences of massive tourism (construction of infrastructure, trampling) and eutrophication caused by airborne pollutants (mainly nitrogen).

Fig. 29. Spike heath (*Bruckenthalia spiculifolia*) is an evergreen shrub native to Southeast Europe and Asia Minor. Bruckenthalia heath is a subtype of 4060 Alpine and Boreal heaths. This habitat is typical for mountains of the Balkan peninsula. Photo: Kimmo Syrjänen.

Range

This habitat type is found in several sites in the Pelister National Park and Macedonia. In addition to the Pelister National Park it occurs in many other mountains of Macedonia including Shar Planina, Korab, Deshat, Jablanica, Galichica, Kozuf, Nidze, Ilinska Planina, Plakenska Planina, Bigla, Stogovo, Bistra, Jakupica, Skopska Crna Gora, Kozjak, Osogovo, Plachkovica, Vlaina, Maleshevski Planinski and Belasica (Matevski et al. 2017).

Area

The size of this habitat is probably decreasing in the Pelister National Park due to overgrowth. It is also possible that heaths colonize alpine grasslands at the same time with some extent. The total area 4060 is estimated to be at the Pelister National Park about 1900 hectares.

Structure and function

Slopes of Pelister contain large areas of Alpine and Boreal heaths. The present distribution of these heaths is probably a consequence of historical land-use including cutting of mountain forests at the Ottoman Empire period and long lasting grazing since then before the establishment of the Pelister National Park. Overgrazing leads to the expansion of grassland at the cost of heaths. Currently grazing pressure on heaths has remained low for the past several decades. Due to this heaths are slowly spreading to alpine grasslands and at the same

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time there is overgrowth in the lower parts. Formations of these low-growing shrub habitats are dependent also on hard winds and harsh wintertime conditions of mountains (including the level of snow cover). Right now Alpine and Boreal heaths at many parts of the Pelister National Park are subject to heavy overgrowth and more or less natural succession towards forests. Macedonian pine (*Pinus peuce)* is also spreading quickly to Alpine and Boreal heaths at Pelister. This trend may increase due to climate warming. Juniper heaths and *Juniperus communis* shrubs are competitively superior over low growing heath types and seem to be spreading as well.

The habitat of Alpine and Boreal heaths is extremely important for the stability of the slopes on which it develops. It also provides high biodiversity and high productivity and affects positively to the hydrology of the mountain.

Fig. 30. Bruckenthalia heaths form mosaics with other heath types and alpine grasslands at the slopes of the Mt. Pelister. Photos: Kimmo Syrjänen.

Management principles

Sustainable grazing regimes in particular can facilitate high diversity, reduce evapo-transpiration and increase runoff without causing erosion, grazing benefits to the highlands that are often unrecognised (Zagbi 2008). Inside the Pelister National Park grazing pressure at Alpine and Boreal heaths is at present mainly too low to keep up this habitat type. Especially *Bruckenthalia* heaths are a characteristic habitat type for Southeast Europe and should therefore have a high conservation value in Macedonia and in the Pelister National Park. Management with clearing of trees and part of junipers with moderate grazing is needed to maintain *Bruckenthalia* and *Vaccinium* heaths at their present positions. Management actions to maintain and improve *Bruckenthalia* and *Vaccinium* heaths are needed soon. High biodiversity, reduction of transpiration and the reduction of erosion can be best achieved with sustained grazing regimes. Also, the Alpine and Boreal heaths are attractive for some recreational activities such as hiking and wintertime freeride.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	U1

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Structure and function	U1
Future prospects	U2
Overall assessment of Conservation Status	**U2**

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Sclerophyllous Scrub (Matorral)

5130 Juniperus communis formations on heaths or calcareous grasslands

Status in Europe			
Habitats directive, Annex I		Habitat type:	5130
Threat status in Europe EU28+	Least concern		LC
Threat status in EU28	Least concern		LC
EU conservation status by biogeographical region			
Alpine	Unfavourable-Inadequate		U1
Atlantic	Unfavourable-Inadequate		U1
Black Sea	Not present		-
Boreal	Unknown		XX
Continental	Favourable		FV
Macaronesian	Not present		-
Mediterranean	Unknown		XX
Pannonian	Unfavourable-Inadequate		U1
Steppic	Not present		-

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *"Formations with Juniperus communis of plain to montane levels. They mainly correspond to phytodynamic succession of the following types of vegetation: a) generally, mesophilous or xerophilous calcareous and nutrient poor grasslands, grazed or let lie fallow, of the Festuco-Brometea and Elyno-Seslerietea. b) more rarely, heathlands of the Calluno vulgaris-Ulicetea minoris (31.2)." Plants: Juniperus communis, Crataegus spp., Rosa spp., Prunus spinosa. For a) typical species of the Festuco-Brometea and Elyno-Seslerietea.*

For b) Calluna vulgaris, Vaccinium myrtillus, Empetrum nigrum, Erica tetralix, Deschampsia flexuosa, Nardus stricta."

Description according to EUNIS (Evans & Roekaerts2015): "F3.16 Juniperus communis scrub. Temperate and mediterranean-montane communities dominated by Juniperus communis, mostly Juniperus-dominated variants of units F3.11, F3.13, F3.22-F3.24. Calluna vulgaris, Crataegus spp., Pinus sylvestris, Quercus petraea, Bromus erectus and Festuca rupicola are also present." "Plant communities: Vaccinio-Juniperion communis. Species: Juniperus communis, Crataegus spp., Rosa spp., Prunus spinosa." "Associated habitat types: Most often found as a succession from mesophilous or xerophilous calcareous and nutrient poor grasslands, such as Festuco-Brometea and Elyno-Seslerетea, or more rarely, heathlands of the Calluno vulgaris-Ulicetea minoris."

Occurrence of habitat type in the Pelister National Park and the Prespa region

"5130 *Juniperus communis* formations on heaths or calcareous grasslands" are common in Macedonia and in the study area in the Pelister National Park and around the Prespa Lake. *Juniperus communis* is a typical component of several habitat types of (dry) grasslands and rocky habitats. Description of this type is mainly based on the abundance of juniper. *Juniperus communis* formations with long continuity are often characterized by grazing sensitive herbs and ferns as well as pleucarpic mosses in undergrowth.

Fig. 31. 5130 *Juniperus communis* formations on heaths or calcareous grasslands are commonly found at Macedonia and the study area. *Juniper communis* formation on acidic soil above Malovishte village at Pelister National Park. Slow succession towards a forest is going on. Photo: Kimmo Syrjänen.

Most sites of this habitat type are of rather recent origin. Cessation of traditional use (usually grazing and management of pastures by burning or removing junipers) has lead on to the formation and overgrowth of these habitats. At lower altitudes in the study area *Juniperus communis* is usually accompanied by *Juniperus oxycedrus* and stands of 5130 often include both juniper species. At these parts of the study area *Juniperus communis* is naturally a component of 6220 "*Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea" but it is also one of the most important colonizing scrubs and often the main cause of overgrowth of this habitat type. In Pelister National Park *Juniperus communis* is overgrowing 6210 "Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)" that is usually present in small fragments at forest zones and subalpine slopes. 5130 *Juniperus communis* formations are common around villages, especially at slopes between meadows and forests (fig. 31). At lower parts of the alpine area and more typically at the subalpine parts of Pelister National Park there are overgrowing stages of 4060 "Alpine and Boreal heaths" and to some extent also 62D0 "Oro-Moesian acidophilous grasslands", that have already changed into 5130 habitat type. *Juniperus communis* is also found along siliceous screes and rocky slopes in Pelister National Park. Sometimes there are a lot of junipers at open forests and some of these occurrences are transitions to forest vegetation (including oak-, beech- and Macedonian pine forests). This habitat type is also related to the habitat 5210 Arborescent matorral with *Juniperus* spp.

Vascular plant communities and typical species of 5130 in Macedonia

In the Pelister National Park substrates are mainly acidic whereas at the western shore of the Prespa Lake they are calcareous. This affects the species composition. Typical species of 5130 in the Pelister National Park include: *Juniperus communis*, *Juniperus oxycedrus*, *Arceuthobium oxycedri*, *Dryopteris filix-mas*, *Rubus idaeus*,

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Calamagrostis arundinacea, *Rosa* spp., *Festuca* spp., *Festuca valesiaca*, *Chrysopogon gryllus*, *Odontites luteus*, *Plantago bellardii*, and *Pyrus spinose.*

Fig. 32. a) Slowly overgrowing pseudo-steppe grassland – *Juniperus communis* formation at sun exposed slope near the village Nitze Pole. **b)** Subalpine colonizing junipers along a path to the Golemo Ezero.

Habitat directive and other important species

5130 is often an overgrowing phase, but it's still an important habitat for many species of 6220* and 6210 including orchids such as *Spiranthes spiralis, Orchis papilionacea* and *Dactylorrhiza sambucina.* 5130 is a foraging environment for Wood lark *Lullula arborea* and Red-backed shrike *Lanius collurio* at the study area.

Inventory and Monitoring

Standard Field Inventory Form for grasslands can be used in inventories and monitoring. Inventory information should be collected on GPS marked polygons/ sampling plots inside the studied scrubland stands. Repeated visits and iteration of inventory at the same site is a basic monitoring method. Suitable monitoring period is between 5-10 years for this habitat type. Both managed and unmanaged stands should be monitored at different altitudes and at different successional stages.

Threats and pressures

5130 *Juniperus communis* formations on heaths or calcareous grasslands consist mainly of successional habitat types at the study area. In certain parts of the Pelister National Park there is also degradation of this habitat type because of overgrowth by trees. However, this habitat is now present at many places and its size is probably increasing. Beside natural dynamics there are no severe threats to this habitat type.

Range

This habitat type is quite common in North Macedonia including the Pelister National Park and the Prespa region. It has scattered occurrences though the country.

Area

Area of this type is probably increasing in the Pelister National Park and in the Prespa region due to cessation of traditional use. The total area in the Pelister National Park is estimated to be about 450 hectares and a couple of hectares in the Prespa area.

Structure and function

5130 is for the most part a successional habitat type and often part of an overgrowth process. The occurrences of juniper formations have probably replaced earlier successional stages of another habitat types. However, on nutrient poor and dry soils and rocky areas this type can remain rather open for a long time and host habitat

patches of dry grasslands and their typical species. In some sites *Juniperus communis* can grow in a decade and form dense thickets that will eventually grow into a forest.

Fig. 33. Juniper dwarf mistletoe (*Arceuthobium oxycedri*) is an evergreen hemiparasite of junipers. It is a rather common species in the Pelister National Park and grows mainly on *Juniperus oxycedrus* (above) and sometimes on *J. communis* at juniper scrub. The species is related to European mistletoe (*Viscum album*) and they belong to the same family (Santalaceae). Photo: Kimmo Syrjänen.

Management principles

During the past period since 1948, there was a law banning the breeding of sheep and grazing in the protected areas that contributed to the advanced succession of many bush formations in the lowland and subalpine belt of the National Park Pelister, including the habitat with *Juniperus communis*. Today the consequences of this law are obvious, so that many areas of the belt of the hilly and mountain pastures are covered by this habitat.

Management of 5130 needs careful planning of conservation actions. Maintenance of *Juniperus communis* formations may need management time after time. Sites with long persistence of junipers and dry open grassland at the same site have higher conservation value than new successional stands. Occasional clearing and removal of junipers and other shrubs and young trees are needed to maintain this habitat type. In most habitats, especially in the overgrown prioritized * HD habitats, it would be more important to direct conservation actions so that earlier successional habitats are restored. *Juniperus communis* shrub is competitively superior over dry grasslands and low growing heath types. Some bushes of junipers needs to be left intact in management, but their abundance and cover should be highly decreased. Also grazing is needed to restore former grassland types.

5130 seems to be spreading in the study area and the speed of this process may be increased by climate warming. Maintaining this type can be a conservation goal at sites where there is long continuity of junipers and/or not possibilities to organize sustainable management and grazing regimes. These can include rocks and rocky slopes with junipers as well as other sites where overgrowth process is slow. In most sites the original

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habitat type should be a target of management action. Habitats types 6220*, 6120*, 6120, 62D0 and 4060 should be prioritized over 5130 in management planning and actions.

Fig. 34. a) *Juniperus communis* and **b)** *Juniperus oxycedrus* are both typical for 5130 in Macedonia. *Juniperus communis* is the dominant species of this habitat type. Photos: Kimmo Syrjänen.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	FV
Structure and function	FV
Future prospects	FV
Overall assessment of Conservation Status	**FV**

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Natural and semi-natural grassland formations

6220* Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea

Status in Europe			
Habitats directive, Annex I		Habitat type:	6220*
* Priority habitat type			
Threat status in Europe EU28+	Vulnerable		VU
Threat status in EU28	Vulnerable		VU
EU conservation status by biogeographical region			
Alpine	Unknown		XX
Atlantic	Unfavourable-Bad		U2
Black Sea	Unfavourable-Inadequate		U1
Boreal	Not present		-
Continental	Unfavourable-Inadequate		U1
Macaronesian	Not present		-
Mediterranean	Unfavourable-Inadequate		U1
Pannonian	Not present		-
Steppic	Not present		-

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *"1) Meso- and thermo-Mediterranean xerophile, mostly open, short-grass annual grasslands rich in therophytes; therophyte communities of oligotrophic soils on base-rich, often calcareous substrates. Perennial communities - Thero-Brachypodietea, Thero-Brachypodietalia: Thero-Brachypodion. Poetea bulbosae: Astragalo-Poion bulbosae (basiphile), Trifolio-Periballion (silicolous). Annual communities - Tuberarietea guttatae Br.-Bl. 1952 em. Rivas-Martínez 1978, Trachynietalia distachyae Rivas-Martínez 1978: Trachynion distachyae (calciphile), Sedo-Ctenopsion (gypsophile), Omphalodion commutatae (dolomitic and silico-basiphile). In France a distinction can be made between: (a) annual herbaceous vegetation of dry, initial, low-nitrogen soils ranging from neutro-basic to calcareous: Stipo capensis-Brachypodietea distachyae (Br-Bl. 47) Brullo 85; (b) vegetation of more or less closed grasslands on deep, nitrocline and xerocline soil: Brachypodietalia phoenicoidis (Br-Bl. 31) Molinier 34. In Italy this habitat mainly exists in the South and on the islands (Thero-Brachypodietea, Poetea bulbosae, Lygeo-Stipetea). 2) Plants: Brachypodium distachyum, B. retusum*."

According to EUNIS (Evans & Roekaerts 2015) this habitat type is included in: E1.3 Mediterranean xeric grassland that contains only one Annex I type (6220*) with the same description as above.

Plant communities according to EUNIS (Evans & Roekaerts 2015) include: Diantho humilis-Velezion rigidae, Cymbopogoni-Brachypodion ramosi, Plantagini-Catapodion marini, Moricandio-Lygeion sparti, Dauco-Catananchion luteae, Sedo-Ctenopsion gypsophilae, Trachynion distachyae, Thero-Brachypodion, Armerion girardii, Omphalodion commutatae, Stipion retortae.

Typical plant species (Evans & Roekaerts 2015): *Brachypodium distachyum*, *B. retusum*, *B. fasciculatus*, *B. madritensis*, *B. rubens*, *B. alopecuros*, *Aegilops neglecta*, *A. geniculata*, *A. triuncialis*, *Avena sterilis*, *A. barbata*, *Lagurus ovatus*, *Cynosurus echinatus*, *Stipa capensis*, *Hyparrhenia hirta*, *Andropogon distachyos*, *Cynodon dactylon*, *Dactylis hispanica*, *Urginea maritima*, *Asphodelus microcarpus*, *Lloydia graeca*, *Anacamptis pyramidalis*.

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Fig. 35. 6220 * Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea is a priority habitat type that is present at several sites in Macedonia. This habitat type has occurrences both at the Pelister National Park and along the Prespa Lake. Grazed dry grassland of 6220* between Dihovo and Nize Pole villages at the border of the Pelister National Park. Photo:

Vascular plant communities and typical species of 6220 in study areas

Avramoski (2006b) lists for the Pelister National Park Mediterranean xeric grassland E1.3, East Mediterranean xeric grassland E1.33, Helleno-Balkanic short grass and therophyte communities Trifolion cherleri [K. Micevski 1970] E1.332. Class: Festuco-Brometea Br.-Bl. et R. Tx. 1943 Order: Astragalo-Potentilletalia K. Micevski 1970, Alliance: Trifolion cherleri K. Micevski 1970.

The dry grasslands on siliceous geological bedrock on the territory of the Republic of Macedonia have been assigned to the class Festuco-Brometea, order Astragalo-Potentilletalia and alliance Trifolion cherleri (Ćušterevska et al. 2012) This vegetation type belongs to 6220*.

In the classification scheme, as adopted by the EuroVegChecklist (Mucina et al., 2016), the Trifolion cherleri represents submediterranean therophyte communities in the Southern Balkans (Submediterranean silicicolous therophytic swards of Macedonia and Southern Bulgaria) classified in the Helianthemetalia guttati Br.-Bl. in Br.-Bl. & al. 1940 (Helianthemetea guttati Rivas Goday et Rivas-Mart. 1963).

Typical species in pseudo-steppe at lower parts of Pelister National Park include: *Agrimonia eupatoria*, *Allium vineale*, *Arenaria serpyllifolia*, *Avena fatua*, *Avena sterilis*, *Bothriochloa ischaemum*, *Carex caryophyllea*, *Centaurea grisebachii*, *Cerastium semidecandrum*, *Chrysopogon gryllus*, *Cladonia convoluta*, *Dianthus pinifolius*, *Dichanthium ischaemum*, *Echinaria capitata*, *Eryngium campestre*, *Erysimum diffusum*, *Festuca valesiaca*, *Hypericum perforatum* subsp. *veronense*, *Hypericum rumeliacum*, *Juniperus communis*, *Juniperus oxycedrus*, *Linaria genistifolia*, *Linum catharticum*, *Odontites luteus*, *Odontites rubra*, *Orchis papilionacea*, *Parvotrisetum myrianthum*, *Petrorhagia dubia*, *Phleum phleoides*, *Plantago bellardii*, *Plantago holosteum*, *Poa bulbosa*, *Sanguisorba minor* subsp. *balearica*, *Scleranthus perennis*, *Spiranthes spiralis*, *Stipa* spp., *Syntrichia ruralis*, *Taeniatherum caput-medusae* subsp. *asperum*, *Teucrium chamaedrys*, *Thymus thracicus*, *Trifolium cherleri* and others.

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Fig. x. *Spiranthes spiralis* orchid lives in this habitat. Photo: Kimmo Syrjänen.

Habitat directive and other important species

This habitat type is important for many reptiles of the Habitat Directive, including *Podarcis erhardii, P. muralis, P. tauricus, Lacerta trilineata* and *Lacerta viridis* as well as snake species at the Prespa Lake and the Pelister National Park. Rare orchid *Spiranthes spiralis* occurs mainly in this habitat type at the Pelister National Park. It is also important for diverse insect fauna of thermophile sun exposed habitats. It is a foraging environment for the Wood lark (*Lullula arborea*) and the Red-backed shrike (*Lanius collurio*) at the study area.

Inventory and Monitoring

Standard Field Inventory Form for grasslands should be used in inventories and monitoring. Inventory information should be collected on GPS marked polygons/ sampling plots inside of the studied dry grassland stands. Drone photos or other aerial images may be useful as well while following and analysing monitoring results. Repeated visits and iteration of inventory of vegetation at the same site is a basic method of monitoring. Suitable monitoring period is between 5-10 years for this habitat type. Different kind of vegetation (sub) types should be included in monitoring. Both altered (overgrown, restored) and presently representative sites should be monitored.

Threats and pressures

This habitat type is dependent on some extent on human disturbance, especially grazing. Without management these dry grasslands turn into shrub, dominated mainly by *Juniperus communis* and/or *Juniperus oxycedrus*. Bracken *Pteridium aquilinum*, *Rubus* spp., *Prunus* spp. and *Rosa* spp. can be involved in overgrowth. Also other bushes and tree species, including *Pinus sylvestris* and *Pinus peuce* will disperse into this habitat type that will eventually develop into a forest. Construction of roads and buildings can be harmful locally. Overgrazing, erosion and wildfires can be a threat, but this habitat type can recover from these kinds of disturbances if they are not too severe.

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Fig. 36. a) 6220 * Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea habitat type has several representative occurrences connected to the Pelister National Park. 6220* near the Ljubojno village. **b)** 6220* is prone to overgrowth by bushes and trees, badly overgrown site near the Nitze Pole village. Photos: Kimmo Syrjänen.

Range

In Macedonia this habitat type is quite widely distributed (see Ćušterevska et al. 2012) and it is present in the study area both at the Pelister National Park and occasionally along the Prespa Lake. There are large and representative pseudo-steppes at the western slopes of the Pelister National Park between park and the Prespa Lake, mainly outside of the conservation areas.

Area

In the Pelister National Park this habitat type is present in the lower parts of the park and in several places at close vicinity outside of present park border. Many occurrences are rather small patches and in many sites there is overgrowth going on. At the Pelister National Park there are representative occurrences at the slopes of nearby villages Dihovo, Nize Pole, Kazani – Maloviste and Ljubojno at least. The total area is approximately 100 hectares in the Pelister National Park.

In the vicinity of the Nizepole village there are small stands, fragments of plant community dominated by the *Chrysopogon gryllus*. These stands are partly actively maintained by goat grazing and there are some elements of meadows. In front of the village of Malovishte (between Kazani and Malovishte) a registered population of donkey exist. In the plant community *Tunicio-Trisetetum myrinathi* subass. *sanguisorbetosum muricatae* (Micevski, 1971), the characteristics and associations of different species are present, species including the alliance *Trifolion cherlerli - Parvotrisetum myrianthum, Petrorhagia dubia, Sanguisorba minor* subsp*. balearica, Bothriochloa ischaemum, Echinaria capitata, Taeniatherum caput-medusae* subsp*. asperum, Phleum phleoides* and *Hypericum perforatum* subsp*. Veronense*. The presence of the *Tunicio-Trisetetum myrinathi* subass. *sanguisorbetosum muricatae* in the investigated area means that the distribution of this plant community is extended in south west parts of the Republic of Macedonia.

Structure and function

This habitat type is typically present at sun exposed grazed slopes in thermophilic sites both at rocky and gravelly soils. It is dependent on management including grazing and clearing. Without management it will often turn to habitat type 5130 "*Juniperus communis* formations on heaths or calcareous grasslands" and further develop into a forest.

Management principles

Management should be based on careful planning and it can include clearing of bushes and young trees, grazing and controlled small scale burnings. Overgrazing needs to be avoided. Management target is to maintain high quality sites and to restore overgrown sites back to a more improved condition with a high biodiversity value.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	U1
Structure and function	U1
Future prospects	U2
Overall assessment of Conservation Status	**U2**

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62D0 Oro-Moesian acidophilous grasslands

Status in Europe		
Habitats directive, Annex I	Habitat type:	62D0
Threat status in Europe EU28+	Least concern (IUCN)	LC
Threat status in EU28	Least concern (IUCN)	LC
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Atlantic	Not present	-
Black Sea	Not present	-
Boreal		-
Continental	Unfavourable-Inadequate	U1
Macaronesian	Not present	-
Mediterranean	Not present	-
Pannonian	Not present	-
Steppic	Not present	-

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *"Alpine and sub-alpine grasslands developed over crystalline rocks and other lime-deficient substrates or on decalcified soils at 1600 – 2900 m above sea level on high mountains of the Central Balkan Peninsula, including the Balkan Range, Rila, Pirin, Slavyanka, the Central Rhodopes, Osogovska Planina. Belasitza. The communities are dominated by grasses such as Festuca paniculata, Bellardiochloa violacea, Festuca airoides, Calamagrostis arundinacea, Festuca nigrescens and Agrostis capillaris. The Balkan endemics Festuca balcanica, F. riloensis, F.valida, Sesleria comosa and Carex bulgarica also occur in these communities."*

"2) Plants: Festuca airoides, Festuca balcanica, Festuca nigrescens, Festuca paniculata, F. riloensis, Festuca valida, Bellardiochloa violacea, Calamagrostis arundinacea, Sesleria comosa, Aquilegia aurea, Lilium jankae, Gentiana lutea, Gentiana punctata, Viola rhodopaea, Primula deorum, Carex bulgarica"

According to EUNIS (Evans & Roekaerts 2015) this EU habitat type is included as part of "E4.3 Acid alpine and subalpine grassland." with description: "Alpine and subalpine grasslands developed over crystalline rocks and other lime-deficient substrates or on decalcified soils of mountains. On boreal mountains, Carex bigelowii and Juncus trifidus often dominate. The acid alpine grasslands of central Europe are more mixed, with Armeria alpina, Armeria alliacea (Armeria montana), Euphrasia minima, Gentiana alpina, Geum montanum, Juncus trifidus, Lychnis alpina, Pedicularis pyrenaica, Phyteuma hemisphaericum, Pulsatilla alpina ssp. *sulphurea, Ranunculus pyrenaeus, Sempervivum montanum, Botrychium lunaria."*

And with following plant communities: "Agrostion alpinae, Agrostion schraderanae, Anemonastro sibirici-Festucion ovinae, Anemonion speciosae, Calamagrostion arundinaceae, Calamagrostion villosae, Campanulion albanicae, Campanulo herminii-Nardion strictae, Carici-Juncion trifidi, Carici macrostyli-Nardion, Caricion curvulae, Equiseto-Galion borealis, Festucion eskiae, Festucion macratherae, Festucion supinae, Festucion variae, Festucion versicoloris, Festucion woronowii, Festucion xanthinae, Juncion trifidi, Kobresion capilliformis, Kobresio-Dryadion, Nardo-Caricion rigidae, Poion violaceae, Potentillo montenegrinae-Festucion paniculatae, Potentillo ternatae-Nardion, Potentillo-Polygonion vivipara, Ranunculo pollinensis-Nardion strictae, Sesamoido pygmaeae-Poion violaceae, Seslerion comosae, Trifolion parnassii, Trisetion fusci"

There is already a fact sheet available of this habitat type for the Republic of Macedonia (Matevski et al. 2017). Presented here is the situation of habitat type in the Pelister National Park. According to Avramoski (2006a, b)

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the alpine ecosystems of Pelister National Park include eight alpine and sub-alpine plant communities that are mainly considered to belong into this habitat type 62D0: Festucetum paniculatae, Centaureo-Festucetum variae, Geranio-Poetum violaceae, Genisto-Nardetum, Jasioni-Caricetum curvulae, Jasioni-Festucetum supinae, Diantho myrtinervius-Festucetum and Lino-Seslerietum.

On these vegetation communities, Diantho myrtinervius-Festucetum is considered to be endemic to Macedonia occurring only within the zone between Pelister and Nidze Kajmakcalan (Avramoski 2006a), and it is typical habitat for the locally endemic *Dianthus myrtinervius (*Macedonian: polegnat karanfil). In addition to this, the following grass communities of Pelister alpine grasslands are considered to be Balkan endemics: Geranio-Poetum violaceae, Festucetum panniculatae and Centaureo-Festucetum variae (Avramoski 2006a).

Fig. 39. 62D0 Oro-Moesian acidophilous grasslands are common at alpine and subalpine part of the Pelister National Park. These alpine grasslands form mosaics of different grassland vegetation communities and with subalpine heaths. This habitat type is typical for central Balkan mountains and contains many species with high conservation value. Photo: Kimmo Syrjänen.

Occurrence of the habitat type and related types in the Pelister National Park

Alpine grasslands of the Pelister National Park have high conservation value and they are characteristic for the Park (Avramoski 2006a). This habitat type is rather complex and contains several vegetation communities. Part of *Nardus stricta* communities growing at alpine zone are related to: “6230 * Species-rich Nardus grasslands, on siliceous substrates in mountain”. Pure representatives of this type are found also at the Pelister National Park. *Nardus stricta* is often present at part of high altitude Poion violaceae vegetation communities. Oro-Moesian grassland vegetation is present in many alpine rocky slopes where it shifts to 8220 “Siliceous rocky slopes with

chasmophytic vegetation" (with vegetation community Asplenio-Silenetum lerchenfeldianae) (Avramoski 2006a). At lower elevations sites of alpine grasslands are mixed or often form small scale mosaics with 4060 "Alpine and boreal heaths". Related habitats in the Pelister National Park may also include "6150 Siliceous alpine and boreal grasslands".

Vascular plant communities and typical species of 62D0

Acidophilous grasslands of the alpine and subalpine belts are classified within Juncetea trifidi (Mucina et al., 2016). These grasslands in the Balkan Peninsula belong to the endemic order Seslerietalia comosae. Within this habitat type there are two sub-habitats. The first sub-habitat type is represented by communities (alliance Poion violaceae) from the subalpine belt that develop on deep acidic soils and are usually wind-sheltered. The stands are dense and fairly uniform. In being overgrazed, these communities are converted to Potentillo ternatae-Nardion (Horvat 1960). The second sub-habitat type includes communities on deep soils from the subalpine and alpine Belt of Pelister Mt that develop in wind-exposed habitats (alliance Seslerion comosae) (Čarni and Matevski, 2015). These communities appear on ridges that are exposed to wind, where the bedrock is without carbonates (Horvat 1935).

Fig. 40. *Dianthus myrtinervius* is an endemic species of the North Macedonia and Northwest Greece. It is a characteristic species of the vegetation community *Diantho myrtinervius-Festucetum,* which is considered to be an endemic community with a very restricted distribution (only within the zone between Pelister and Nidze Kajmakcalan) (Avramoski 2006a). *Dianthus myrtinervius* is a common tussock-forming species at the highest alpine grasslands of Mt. Pelister. Photo: Kimmo Syrjänen.

Characteristic species for this habitat type in the Republic of Macedonia include (Matevski et al 2017): *Bellardiochloa violacea*, *Campanula alpina*, *Carex curvula*, *Deschampsia flexuosa*, *Festuca airoides*, *Festuca halleri*, *Gentiana lutea*, *Gentiana punctata*, *Geum montanum*, *Homogyne alpina*, *Jasione orbiculata*, *Juncus trifidus*, *Ligusticum mutellina*, *Linum capitatum*, *Luzula spicata*, *Minuartia recurva*, *Nardus stricta*, *Potentilla aurea* and *Sesleria comosa*.

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In the Pelister National Park many of these species are often found among others in Oro-Moesian acidophilic grasslands: *Antennaria dioica*, *Armeria alpina*, *Botrychium lunaria*, *Calamagrostis arundinacea*, *Campanula rotundifolia*, *Carex curvula*, *Carex kitaibeliana*, *Deschampsia flexuosa*, *Dianthus integer, Dianthus myrtinervius*, *Euphrasia pectinata*, *Festuca airoides*, *Festuca paniculata*, *Geranium cinereum* subsp. *subcaulescens*, *Geum montanum*, *Hieracium hoppeanum*, *Juncus trifidus*, *Lilium albanicum*, *Luzula spicata*, *Linum capitatum*, *Luzula spicata*, *Minuartia recurva*, *Nardus stricta*, *Pimpinella saxifraga*, *Poa variegata*, *Potentilla ternata*, *Primula minima*, *Sesleria comosa*, *Thymus jankae*, *Trifolium pilczii*, *Veronica bellidifolia* and *Viola doerfleri*. Scattered shrubs including *Vaccinium myrtillus* and *Vaccinium uliginosum* can be found in low numbers among grasses and herbs at alpine grasslands.

Habitat directive and other important species

Alpine grasslands of Pelister are important summertime pastures for the Balkan Chamois (*Rupicapra rupicapra balcanica*) that has currently a very small population at the Pelister National Park due to history of pouching. The Chamois is listed in Annexes II and IV of the Habitat Directive. The Pelister population is valuable because it can be connected to Greek populations and all attempts to increase the population viability of the Balkan chamois at the Pelister National Park are welcome. Alpine grassland communities of the Pelister include many local, Macedonian and Balkan endemic vegetation communities which support high diversity of species, including several endemic, relict and rare plant and animal species (Avramovski 2006a). These plants include e.g. *Crocus pelistericus*, *Dianthus myrtinervius*, *Trifolium pilczii*, *Viola doerfleri* and *Viola eximia*. This habitat type is also important for Annex V species *Gentiana lutea* and *Gentiana punctata.*

Inventory and Monitoring

Standard Field Inventory Form for grasslands should be used in inventories and during monitoring. Inventory information should be collected on GPS marked polygons/ sampling plots inside the studied grassland stands. Repeated visits and iteration of inventory at the same site is a basic method of monitoring. Suitable monitoring period is between 5-10 years for this habitat type. Different subtypes should be taken into account during monitoring. Both managed and unmanaged (grazed) stands should be monitored at different altitudes and at different successional stages.

Threats and pressures

At lower parts of alpine grasslands juniper bushes are spreading actively. *Pinus peuce* is also spreading to alpine grasslands, where individual trees remains stunted and dwarf due to wind exposed conditions at higher altitudes. Grazing and management is needed to keep up this habitat type, but overgrazing is a threat and can increase erosion. Overgrowth of this habitat type is a rather slow process because of harsh wintertime wind-exposed conditions and summer droughts. Climate warming can increase change and degradation of the habitat. Uncontrolled large scale fires can also damage this habitat, but grasslands have a natural tendency to recovery from this kind of disturbances. Road constructions, buildings and tourism can be a threat to this habitat type (see also Matevski et al. 2017).

Range

This habitat type is often found at alpine parts of the Pelister National Park and also in several other places along the North Macedonian mountains e.g. in Jakupica, Shar Planina, Bistra, Korab, Desat, Stogovo, Jablanica, Dobra Voda, Ilinska Planina, Galichica, Nidze, Kozuf and Osogovo (Matevski et al. 2017). The Republic of North Macedonia has a clear European responsibility to conserve and maintain this central Balkan habitat type.

Area

Area of this habitat type is assumed to be stable or slowly decreasing in the Pelister National Park. At lower parts of alpine grasslands boreal heaths, shrubs and trees are spreading and currently the grazing pressure is too low to maintain this habitat type. The total area of grasslands in the Pelister National Park was estimated earlier (see Avramoski 2006a) to be 3500 hectares, where approximately 2600 hectares are alpine or subalpine grasslands

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and pastures. Around 11 511 hectares of mountain pastures are estimated to exist on the Baba massif. During the

Twinning project the estimation was done together with experts of Macedonian Ecological Society and is about 1800 hectares. This is much less than previously and may be a consequence of overgrowth or different kind of interpretation of habitat type.

Structure and function

These extensive alpine grasslands of Pelister are partly due to long continuity of grazing since before the Ottoman period. At Yugoslavian time the grazing pressure was dropped in a dramatic way. According to Avramoski (2006a) grazing around Mt. Baba has been traditionally sheep grazing and there were around 3200 sheep in the Park at that time, grazed by nearby villages. Grazing pressure during the past decades is considered to be way below the capacity of the pastures, which is about three sheep per hectare making it 8400 sheep in total (Avramovski 2006a). There is also natural grazing in the area (red deer, roe deer, Chamois and wild horses). Traditionally livestock breeding at Mt. Baba included a system of pasture management, that included regular and controlled burning of the pastures, cutting of bushes and young trees and other measures that are almost non-existing nowadays (Avramoski 2006a).

Management principles

Recommendations were given in the 2006 management plan (Avramoski 2006a). It is important to have a grazing and management plan for the subalpine and alpine grasslands of the Pelister National Park (also boreal and alpine heaths should be regarded at the same time). Grazing is often beneficial at highland ecosystems (Zagbi 2008) and controlled sustainable grazing regime is clearly needed to maintain the alpine grasslands in the long run, while avoiding overgrazing. In addition to sheep grazing, other nature management measures such as clearing of bushes (especially junipers) and young trees (mainly *Pinus peuce*) should be implemented at alpine and subalpine grasslands and heaths. Targeted burning of overgrown grasslands and former meadows can be also function as a possible management action. At species-rich sites mowing and raking might be beneficial. These management actions need careful planning and should be implemented on small plots at a time.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	FV
Structure and function	U1
Future prospects	U1
Overall assessment of Conservation Status	**U1**

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6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels

Status in Europe		
Habitats directive, Annex I	Habitat type:	6430
Threat status in Europe EU28+	Least concern (IUCN)	LC
Threat status in EU28	Least concern (IUCN)	LC
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Atlantic	Unfavourable-Bad	U2
Black Sea	not present	-
Boreal	Unfavourable-Inadequate	U1
Continental	Unfavourable-Inadequate	U1
Macaronesian	not present-	-
Mediterranean	Unfavourable-Inadequate	U1
Pannonian	Unfavourable-Bad	U2
Steppic	Favourable	FV

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *1) 37.7 - Wet and nitrophilous tall herb edge communities, along water courses and woodland borders belonging to the Glechometalia hederaceae and the Convolvuletalia sepium orders (Senecion fluviatilis, Aegopodion podagrariae, Convolvulion sepium, Filipendulion). 37.8 - Hygrophilous perennial tall herb communities of montane to alpine levels of the Betulo-Adenostyletea class.*

2) Plants: 37.7 - Glechoma hederacea, Epilobium hirsutum, Senecio fluviatilis, Filipendula ulmaria, Angelica archangelica, Petasites hybridus, Cirsium oleraceum, Chaerophyllum hirsutum, Aegopodium podagraria, Alliaria petiolata, Geranium robertianum, Silene dioica, Lamium album, Lysimachia punctata, Lythrum salicaria, Crepis paludosa; 37.8 - Aconitum lycoctonum (A. vulparia), A. napellus, Geranium sylvaticum, Trollius europaeus, Adenostyles alliariae, Peucedanum ostruthium, Cicerbita alpina, Digitalis grandiflora, Calamagrostis arundinacea, Cirsium helenioides.

The interpretation Manual also states “Similar communities to 37.8, with a weak development, occur at lower altitude along rivers and forest borders (in Wallonia -Belgium for example). Nitrophilous edge communities comprising only basal, common species in the region have no conservation priority. These tall herb communities could also develop in wet meadows, let lie fallow, without any cutting. Large areas of wet meadows let lie fallow and neophyte communities with Helianthus tuberosus, Impatiens glandulifera, should not be taken into account.”

Description according to EUNIS (Evans & Roekaerts2015): **E5 Woodland fringes and clearings and tall forb stands E5.4** Moist or wet tall-herb and fern fringes and meadows. Tall-herb and fern vegetation of the nemoral and boreal zones, including stands of tall herbs on hills and mountains below the montane level. Tall herbs are often dominant along watercourses, in wet meadows and in shade at the edge of woodlands.

Plant communities: Aegopodion podagrariae, Althaeion officinalis, Archangelicion litoralis, Arunco-Petasition albae, Cynancho-Convolvulion sepium, Deschampsion cespitosae, Dorycnio recti-Rumicion conglomerati , Euphorbion palustris, Filipendulo-Petasition, Impatienti noli-tangere-Stachyion sylvaticae, Ipomoeo acuminatae-Ageratinion adenophorae, Lythro-Euphorbion, Nardosmion laevigatae, Petasition officinalis, Senecionion fluviatilis, Senecionion samniti.

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Fig. 41. 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels are typical along brooks and streams of the Pelister National Park. In montane and alpine areas there are species rich habitats of this type with high representativity. A tall herb fringe on the side of a brook at the Sapundica river valley. *Veratrum album, Cirsium appendiculatum, Doronicum austriacum* and *Angelica pancicii* can be seen in the photo. Photo: Kimmo Syrjänen.

E5.5 Subalpine moist or wet tall-herb and fern stands

Luxuriant tall herb formations of deep, humid soils in the montane to alpine, but mostly subalpine, levels of the higher mountains.

Plant communities: Adenostylion alliariae, Cirsion appendiculati, Cirsion flavispinae, Delphinion elati, Doronicion corsici, Dryopterido-Athyrion distentifolii, Mulgedion alpine, Polemonio acutiflori-Veratrion lobeliani, Rumicion alpine, Triseto sibiricae-Aconition septentrionalis

Species: *Cicerbita alpina*, *Cicerbita alpina plumieri*, *Cirsium helenioides*, *Cirsium spinosissimum*, *Cirsium flavispina*, *Geranium sylvaticum*, *Polygonatum verticillatum*, *Ranunculus platanifolius*, *Aconitum vulparia*, *Aconitum napellus*, *Aconitum nevadense*, *Adenostyles alliariae*, *Senecio elodes*, *Veratrum album*, *Trollius europaeus*, *Peucedanum ostruthium*, *Doronicum austriacum*, *Pedicularis foliosa*, *Eryngium alpinum*, *Leuzea rhapontica (Centaurea rhapontica)*, *Valeriana pyrenaica*, *Tozzia alpina*.

EUNIS includes the following EU Habitats Directive Annex I habitat types in this same type E5.4 Moist or wet tall-herb and fern fringes and meadows: 3280 constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of Salix and Populus alba and 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels. 6430 is divided into two EUNIS type, E5.5 Subalpine moist or wet tall-herb and fern stands.

Technically all the tall herb fringes surrounding springs and at shoreline of streams of the Pelister National Park and riparian habitats along rivers running into the Prespa Lake belong into this habitat type. Stream and river mainly belongs to 3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-

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Batrachion vegetation. The lower parts of rivers running from the Pelister National Park and along the Golemo Reka are nitrified and without conservation priority.

Vascular plant communities and typical species of 6430 in the Pelister National Park

The Tall Herb Fringe Community habitats on the Pelister mountain develop along the mountain streams, in the vertical belt of 1280 m a.s.l. (Prespa side of Pelister - Brajcinska Reka) to 2180 m a.s.l. (Golemo Ezero). This habitat on Mount Pelister is represented by the following phytosociological communities (Čarni & Matevski, 2010):

1. *Doronico austriacae-Cirsietum appendiculati* Horvat ex Čarni et Matevski 2010 subass. *typicum* (Diagnostic species: *Cirsium appendiculatum*, *Angelica pancicii, Heracleum sphondylium* subsp. *verticillatum, Anthriscus fumarioides*). Ecological circumstances: tall herb vegetation along brooks from the montane to the subalpine zone in the Pelister Mountain, between 1375 to 1960 m a.s.l.. This community is present beside Crvena Reka, Nizhepole, Ezerska Reka, Caparska Reka and Magarevska Reka.
2. *Doronico austriacae-Cirsietum appendiculati* Horvat ex Čarni et Matevski 2010 subass. *telekietosum* (Diagnostic species: *Brachythecium rivulare, Equisetum arvense, Geranium reflexum, Geranium robertianum, Mentha spicata* subsp. *spicata, Pellia epiphylla, Telekia speciosa, Vicia sepium*). Ecological circumstances: the subassociation is found at lower altitudes, between 1230 to 1675 m a.s.l.. This community is present beside Brajcinska River, Shemnica, Caparska River, Sapundzica.
3. *Geo coccinei-Rumicetum alpini* Čarni et Matevski 2010 (Diagnostic species: *Rumex alpinus*, *Cirsium appendiculatum, Alchemilla indivisa, Angelica pancicii, Geum coccineum*). Ecological circumstances: tall herb vegetation along streams in the altimontane and the subalpine zones, between 1500 to 2180 m a.s.l.. This community is present beside Sapundzica, Crvena Reka, Ezerska Reka, Magarevska Reka and Golemo Ezero.

The vegetation is thus well developed on Pelister, where the bedrock is silicate and there are quite a few strong springs. Syntaxonomically, these communities belong to the alliance *Cirsion appendiculati,* order *Adenostyletalia* and classis *Mulgedio-Aconitetea* Hadac et Klika 1944.

Characteristic species of the alliance, order and classis are the follow: *Angelica pancicii*, *Alchemilla indivisa*, *Caltha palustris* subsp*. laeta*, *Carduus personata*, *Cirsium appendiculatum*, *Doronicum austriacum*, *Geranium sylvaticum*, *Geum coccineum*, *Rumex alpinus, Rumex arifolius, Scrophularia scopolii, Veratrum album*.

Tall herb fringe communities of plains differ from those at mountains and alpine areas. For example along river Semnica between Kazan and Maloviste there are tall herb communities including *Epilobium hirsutum*, *Phalaris arundinacea*, *Mentha aquatica*, *Lythrum salicaria* and *Athyrium filix-femina* but also *Urtica dioica* that prefers increased amount of nutrients in water (Fig. 42). *Convolvulus sepium* is a natural species of this habitat, but it also benefits of eutrophication. Invasive alien species *Robinia pseudacacia* colonizes shoreline habitats of rivers effectively and can change the original habitat type. In Prespa at the Ezerani shoreline the habitat of Golemo Reka is nitrified and contains *Urtica dioica*, *Artemisia vulgaris*, *Amorpha fruticosa* and the invasive *Bidens frondosa* together with native species *Phalaris arundinacea*, *Iris pseudacorus*, *Phragmites australis*, *Beckmannia eruciformis* etc.

Habitat directive and other important species

This habitat type is very rich in vascular plant species and it includes vegetation types with high conservation value. *Tozzia carpathica* is a species of this habitat type. This type can contain several endemic species to Balkan e.g. *Alchemilla peristerica*, *Cardamine raphanifolia* subsp. *acris*, *Pedicularis limnogena*, *Pinguicula balcanica*, *Carex rigida var. macedonica* as well as *Geum coccineum*, *Angelica pancicii* and *Alchemilla indivisa* (Čarni & Matevski 2010). On these plant species *Alchemilla peristerica* is endemic for North Macedonia and the only known population is located in the Pelister National Park. Amphibians and reptiles are also present in this habitat type (*Rana dalmatina*, *Rana graeca*, *Salamandra salamandra*).

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Fig. 42. Shoreline tall herb fringes at the Semnica River between Kazan and Molovishte villages. This habitat belongs to type 6430, but its representativity is low. Human influenced eutrophicated fringes with only common species in the shoreline habitats have no conservation priority. Hydrology and species composition of the River Semnica are also disturbed because of a hydropower plant inside the Pelister National Park. Photo: Kimmo Syrjänen.

Inventory and Monitoring

Inventory and monitoring of hydrophilous tall herb fringe communities should be done simultaneously with 3260 "Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion" vegetation so that an entire stream with its shoreline vegetation is covered. So far there is no Standard Field Inventory Form for riparian habitats. Inventory information should be collected on GPS marked polygons/transects along a river or sampling plots inside the studied river. Information on parts belonging to 6430 should be documented separately from the 3260. Repeated visits and iteration of inventory at the same site is a basic method of monitoring. Suitable monitoring period is between 5-10 years for this habitat type. Transects along different altitudinal parts of river should be taken into account during monitoring. In addition to stream and fringe the surrounding vegetation as well (usually forests) and the topography of the site should be described. The methodology used by Vrahnakis & Fotiadis (2009) for land use analyses and vegetation would be a good method for monitoring streams and should be applied also for 6240.

Threats and pressures

Technically there are no severe threats of this habitat type inside the Pelister National Park in montane or alpine parts. In certain streams and springs there is uptake of water that can have a negative impact especially during dry years or on a long run. At lower parts of streams and outside of the park land use (forest cutting, building activities, eutrophication, hydropower plants) has affected negatively to this type. Climate warming can cause detoriation of this habitat type at alpine and montane areas.

Range

This habitat type is present along several mountain streams in North Macedonia. In addition to the Pelister National Park there are high quality alpine tall herb fringe communities at the Mavrovo National Park.

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It is questionable whether this habitat type is present at lowlands in the study area. Tall herb fringes are suffering from eutrophication and increased amount of nitrogen especially at the Prespa lake area and this shoreline vegetation is no more included into this habitat type.

Area

There are some tens of streams with sidebrooks of this type of vegetation at the Pelister National Park. The length of the intermittent streams is 118 km and streams 188 km, totalling 306 km in the Pelister National Park. There is approximately 40 hectares of tall herb fringes along the streams. In the Prespa Lake area this habitat type has been altered and is very small in size.

Structure and function

The basic structure and function of this habitat type is in good condition at alpine and montane conifer parts of the Pelister National Park. In the lower part of these streams the structure has been changed by dredging, building and management of shorelines. In addition, eutrophication, pollution and water uptake has affected negatively on this habitat type at lower parts of the streams.

Management principles

Management includes the restoration of altered environments, and road constructions and tree cuttings in the vicinity of rivers should be avoided both inside and outside of conservation areas by establishing a wide enough buffer zone.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	FV
Structure and function	U1
Future prospects	U1
Overall assessment of Conservation Status	**U1**

References:

Avramoski, O. (ed.) 2006: The Plan of Management for Pelister National Park. – Pelister National Park & Pelister Mountain Conservation Project. Swiss Agency for Development and Cooperation (SDC) through the Pelister Mountain Conservation Project. 67 pp.

Čarni, A. & Matevski, V. 2010: Vegetation along mountain streams in the southern part of the Republic of Macedonia. Braun-Blanquetia 46:157-170.

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https://www.spp.gr/report_text_vrahnakis_fotiadis_dec2009_mv_gf_final.pdf

More information on Project: “Inventory of the riparian forest vegetation along rivers hosting the endemic trout in Prespa”

https://www.spp.gr/index.php?option=com_content&view=article&id=75&Itemid=75&lang=el?&lang=en

Tryfon, E. 2016: E5.5 Subalpine moist or wet tall-herb and fern fringe

https://forum.eionet.europa.eu/european-red-list-habitats/library/terrestrial-habitats/e.-grasslands/e5.5-subalpine-moist-or-wet-tall-herb-and-fern-fringe

Raised bogs and mires and fens

7140 Transition mires and quaking bogs

Status in Europe		
Habitats directive, Annex I	Habitat type:	**7140**
D2.2b Relict mire of Mediterranean mountains		
Threat status (D2.2b) in Europe EU28+	Near threatened (IUCN)	NT
Threat status (D2.2b) in EU28	Vulnerable (IUCN)	VU
EU conservation status by biogeographical region		
Alpine	Favourable	FV
Atlantic	Unfavourable-Bad	U2
Black Sea	Not present	-
Boreal	Unfavourable-Inadequate	U1
Continental	Unfavourable-Inadequate	U1
Macaronesian	Not Present	-
Mediterranean	Unfavourable-Inadequate	U1
Pannonian	Not present	-
Steppic	Not present	-

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *"1) Peat-forming communities developed at the surface of oligotrophic to mesotrophic waters, with characteristics intermediate between soligenous and ombrogenous types. They present a large and diverse range of plant communities. In large peaty systems, the most prominent communities are swaying swards, floating carpets or quaking mires formed by medium-sized or small sedges, associated with sphagnum or brown mosses. They are generally accompanied by aquatic and amphibious communities. In the Boreal region this habitat type includes minerotrophic fens that are not part of a larger mire complex, open swamps and small fens in the transition zone between water (lakes, ponds) and mineral soil.*

These mires and bogs belong to the Scheuchzerietalia palustris order (oligotrophic floating carpets among others) and to the Caricetalia fuscae order (quaking communities). Oligotrophic water-land interfaces with Carex rostrata are included."

Plants: *Eriophorum gracile*, *Carex chordorrhiza*, *Carex lasiocarpa*, *Carex diandra*, *Carex rostrata*, *Carex limosa*, *Scheuchzeria palustris*, *Hammarbya paludosa*, *Liparis loeselii*, *Rhynchospora alba*, *R. fusca*, *Menyanthes trifoliata*, *Epilobium palustre*, *Pedicularis palustris*, *Sphagnum* spp. (*S. papillosum*, *S. angustifolium*, *S. subsecundum*, *S. fimbriatum*, *S. riparium*, *S. cuspidatum*), *Calliergon giganteum*, *Drepanocladus revolvens*, *Scorpidium scorpioides*, *Campylium stellatum* and *Aneura pinguis*.

Macedonian occurrences of 7140 do not fit to the EUNIS categories easily. In Evans & Roekaerts (2015) Annex I type 7140 in located into D2.3 Transition mires and quaking bogs with following description: "Incompletely terrestrialized wetlands occupied by peat-forming vegetation with acid groundwater or (for vegetation rafts) acid underlying pool or lake water. Included in this habitat type are rafts of Sphagnum spp. and Eriophorum spp. (D2.38) and quaking rafts of Molinia caerulea (D2.3D). Excluded are stands of vegetation fringing water bodies (C3.2) unless the vegetation raft is sufficiently extensive to count as a habitat in its own right." Habitat Directive habitat types 7140 Transition mires and quaking bogs and 7150 Depressions on peat substrates of the Rhynchosporion are both included into this EUNIS type.

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Fig. 43. Oligotrophic alpine mire with tussocks of *Sphagnum* spp. and sedges (*Carex* spp.), close to the Golemo Ezero. Type 7140 "Transition mires and quaking bogs" is a common and widespread habitat type in Europe, but is considered favourable only at the alpine zone. These vegetation communities have high conservation value in North Macedonia (and Europe), because this type of habitat consist mainly of EUNIS habitat type "Pelagonide Macedonian sedge fens" which is endemic for Balkan. Photo: Kimmo Syrjänen.

However, Macedonian alpine mires should be in EUNIS classification in D2 Valley mires, poor fens and transition mires; D2.2 Poor fens and soft-water spring mires; D2.22 *Carex nigra, Carex canescens, Carex echinata* fens. EUNIS description for D2.2812 "Pelagonide Macedonian sedge fens" is not included in Evans & Roekaerts (2015). These D2 habitats have no corresponding Habitat directive habitat types in EUNIS.

Plant communities according to EUNIS (Evans & Roekaerts 2015) include: *Caricion canescenti-fuscae*, *Sphagno-Caricion canescentis*, *Caricion lasiocarpae*, *Rhynchosporion albae.*

Typical plant species (Evans & Roekaerts 2015): *Eriophorum gracile*, *Carex chordorrhiza*, *C. lasiocarpa*, *C. diandra*, *C. rostrata*, *C. limosa*, *Scheuchzeria palustris*, *Hammarbya paludosa, Liparis loeselii, Rhynchospora alba*, *R. fusca, Menyanthes trifoliata, Epilobium palustre, Pedicularis palustris*, *Sphagnum* spp. (*S. papillosum, S. angustifolium*, *S. subsecundun*, *S. fimbriatum*, *S. riparium*, *S. cuspidatum)*, *Calliergon giganteum*, *Drepanocladus revolvens*, *Scorpidium scorpioides*, *Campylium stellatum*, *Aneura pinguis*, *Dactylorhiza curvifolia*, *Ophrys insectifera*, *Orchis palustris*, *Cladium mariscu*.

Vascular plant communities and typical species of 7140 in study area

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In Avramoski (2006b), the Pelister National Park has Valley mires, poor fens and transition mires D2; Poor fens and soft-water spring mires [Caricetalia fuscae W.Koch 1926 emend. Nordhagen 1937] D2.2; Illyrio-Moesian acidic fens D2.28; Pelagonide fens [Caricion canescentis-nigrae Nordhagen 1937] D2.281, Pelagonide Macedonian sedge fens [Caricetum macedonicae Ht. 1936] D2.2812.

Class: Scheuchzerio-Caricetea fuscae (Nordh. 1936) R. Tx. 1937; Order: Caricetalia fuscae W.Koch 1926 emend. Nordhagen 1937 Alliance: Caricion canescentis-nigrae Nordhagen 1937 ass. Caricetum macedonicae Ht. 1936. EUNIS habitat type code D2.2812 Pelagonide Macedonian sedge fens contains following description: “Acidic fen communities of the Jakupica and Bistra ranges of the F.Y.R. of Macedonia, and of the Varnous and Voras ranges of northern Greece, dominated by Carex macedonica.” These vegetation communities seem to belong most closely to 7140.

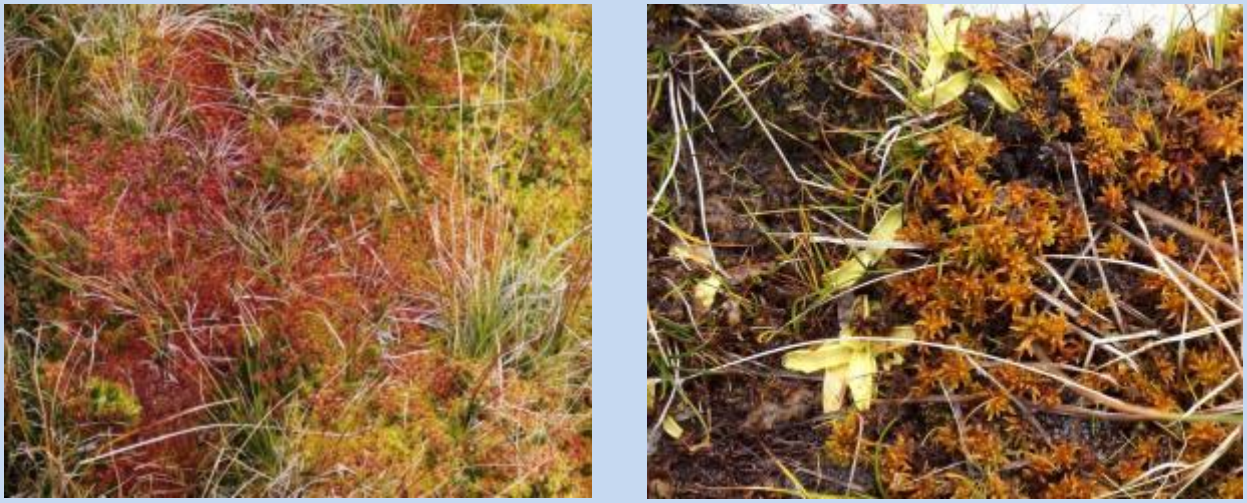

Fig. 44. 7140 Transition mires and quaking bogs can contain areas with **a)** almost ombrotrophic nutrient poor vegetation with *Sphagnum capillifolium*, *Nardus stricta* and *Carex macedonica* as well as **b)** oligo-mesotrophic flarks with *Pinquicula balcanica*, *Sphagnum subsecundum*, *Sphagnum contortum, Eleocharis quinqueflora*, *Carex serotina* and *Warnstorfia exannulata*. Photo: Kimmo Syrjänen.

In the study area 7140 Transition mires and quaking bogs is a rare habitat type with few occurrences in the alpine part of the Pelister National Park close to the Malo Ezero and Golemo Ezero. These habitats are associated with mountain springs and spring brooks and contain spring fen vegetation. These mires are peat forming ecosystems with Sphagnum mosses and sedges. They are representing characteristics of both ombrotrophic and oligo-minerotrophic mire habitats. At springs and along spring brooks that are connected to these mires there are species and characteristics of “7160 Fennoscandian mineral-rich springs and spring-fens” and “6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels.”

Typical species of 7140 “Transition mires and quaking bogs” in the Pelister National Park include: *Allium sibiricum*, *Aulacomnium palustre*, *Bruckenthalia spiculifolia*, *Carex echinata*, *Carex macedonica*, *Carex serotina*, *Dactylorhiza cordigera*, *Deschampsia cespitosa*, *Eleocharis quinqueflora*, *Epilobium palustre*, *Juncus effusus*, *Luzula sudetica*, *Nardus stricta*, *Oenanthe fistulosa*, *Parnassia palustris*, *Pedicularis limnogena*, *Pinguicula balcanica*, *Sphagnum angustifolium*, *Sphagnum capillifolium*, *Sphagnum compactum*, *Sphagnum contortum*, *Sphagnum inundatum*, *Sphagnum platyphyllum*, *Sphagnum subsecundum*, *Sphagnum teres*, *Vaccinium uliginosum* and *Warnstrofia exannulata*.

In springs that are connected to these mires *Saxifraga stellaris* subsp. *alpigena*, *Philonotis* spp., and *Epilobium alsinifolium* are typically found and tall herbs such as *Caltha palustris*, *Geum coccineum*, *Cirsium*

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appendiculatum, *Veratrum album*, *Doronicum austriacum* and *Rumex alpinus* are commonly found along the outflows of springs and spring books (see Čarni & Matevski 2010).

Habitat directive and other important species

This habitat type is important for Sphagnum species. All Sphagnum spp. belong to Annex V of Habitat Directive. However, there is no commercial use of Sphagnum in the Pelister National Park and regulation of use is not needed.

These alpine mires with a vegetation community of a Balkan endemic vegetation type have a high conservation value. In a floristic composition, there are certain Balkan endemic and boreal species in more or less isolated positions at the southernmost part of their distribution range.

Fig. 45. 7140 Transition mires and quaking bogs at the Pelister National Park. **a)** Oligo-mesotrophic spring-fen as part of a larger transition mire complex below the Golemo Ezero. **b)** Oligotrophic *Sphagnum-Carex* mire with small oligo-dystrophic pools close to the Malo Ezero. Photos: Kimmo Syrjänen.

Inventory and Monitoring

All mires and fens at the Pelister National Park should be inventoried (as already proposed by Avramoski 2006a). There is no Standard Field Inventory Form for mires but a modified grassland form can be used in inventories and monitoring. Description of the site, area, types of vegetation and species compositions should be done for each site of this habitat type. Inventory information should be collected on GPS marked polygons/ sampling

plots inside the studied mire system. Drone photos may also be useful while following vegetation changes and analysing monitoring results. Repeated visits and iteration of inventory of vegetation at the same site is a basic method of monitoring. Suitable monitoring period is between 5-10 years for this habitat type. All occurrences of this habitat type should be taken into account during monitoring.

Threats and pressures

There are no severe threats identified so far. Increasing tourism, trampling or overgrazing can pose a risk in the future. Climate warming can also pose a threat by decreasing the outflow of springs or through other indirect effects (warming of waters, desiccation, and competition between species).

Range

This habitat type is most likely present in a few of places at the western and northern mountains in North Macedonia. Range is presently unknown and may need inventories at mountain areas. In the study area this type is currently found only at the alpine part of the Pelister National Park.

Area

In the Pelister National Park this habitat type is present in the alpine area. Known occurrences are very small and the total cover is approximately 1-2 hectares.

Structure and function

This habitat type is typically present at the northern slopes of Mt. Pelister at places with groundwater seepage. Habitat is at least partly dependent on springs and spring brooks. Occurrences are in natural condition and they have representative vegetation structure and species composition.

Management principles

There is no need for management. In the Golemo Ezero mires are located close to hiking tracks, but there are no marks of trampling or other destruction so far.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	FV
Structure and function	FV
Future prospects	XX
Overall assessment of Conservation Status	**FV**

References:

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EUNIS Fact Sheet: Pelagonide Macedonian sedge fens. https://eunis.eea.europa.eu/habitats/5238

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7160 Mineral-rich springs and springfens (Fennoscandian mineral-rich springs and springfens)

Status in Europe		
Habitats directive, Annex I	Habitat type:	7160
C2.1a Base-poor spring and spring brook		
Threat status in Europe	Vulnerable (IUCN)	VU
Threat status in EU	Near threatened (IUCN)	NT
EU conservation status by biogeographical region		
Alpine	Favourable	FV
Atlantic	Not present	-
Black Sea	Not present	-
Boreal	Unfavourable-Bad	U2
Continental	Unfavourable-Bad	U2
Macaronesian	Not present	-
Mediterranean	Not present	-
Pannonian	Not present	-
Steppic	Not present	-

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *".*Springs and springfens are characterized by continuous flow of ground-water. The water is cold, of even temperature, and rich in oxygen and minerals, due to the rapid percolation. Springs may have a basin where the water wells up and an adjacent outflow with typical vegetation. In springfens the water seeps up through the ground and the accumulated peat, enhancing the growth of specialized vegetation. Since the water originates from deeper layers, these springs often have running water during the winter even if the surrounding areas are frozen and snow-covered. The invertebrate fauna is often very specific to this habitat and the flora rich in northern species."

Plants: *Cardamine amara*, *Chrysosplenium* spp., *Carex appropinquata*, *C. capillaris*, *C. paniculata*, *Epilobium hornemanni*, *E. davuricum*, *E. laestadii*, *E. alsinifolium*, *Montia fontana*, *Poa alpigena*, *P. remota*, *P. trivialis*, *Ranunculus lapponicus*, *R. hyperboreus*, *Stellaria alsine*, *S. calycantha*, *S. nemorum*.

Bryophytes: *Brachythecium rivulare*, *Bryum weigelii*, *B. pseudotriquetrum*, *B. schleicherii*, *Calliergon giganteum*, *C. sarmentosum*, *Philonotis* spp., *Pohlia wahlenbergii*, *Plagiomnium undulatum*, *Rhizomnium* spp., *Scapania* spp., *Warnstorfia exannulata*.

Description according to EUNIS (Evans & Roekaerts 2015) C2.1 Springs, spring brooks and geysers C2.111 Fennoscandian mineral-rich springs and spring fens.

This habitat type is reported from alpine, boreal and continental Europe (see EUNIS Fact Sheet). Although originally considered as Fennoscandian, the type has wide distribution especially in montane Europe but also in the lowlands i.e. in the Baltic States. In the Balkan Peninsula there are representatives of this habitat type with high conservation values especially at the alpine zone of mountains. In the Pelister National Park mineral rich springs and spring fens are usually found at the alpine areas of Mt. Pelister usually above 2000 m. a.s.l., but scattered occurrences are found at lower altitudes. For example there are springs and spring brooks of this habitat type along the slopes of Mt. Pelister in the forest zone.

Alpine springs and spring fens often form complex habitat types. Spring and spring brook borders are usually the habitat type 6430 "Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels". The

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role of tall herbs is often high in relation to bryophytes when comparing sites of this type at lower elevations to those at the alpine elevations. In the alpine areas close to springs and spring brooks there may be *Sphagnum* spp. dominated peat that forms more or less oligotrophic mire vegetations that belong to the 7140 "Transition mires and quaking bogs". In the Pelister National Park forest zone small springs are occasionally fens with *Eriophorum latifolium*, *Blysmus compressus* and *Carex davalliana*. These probably belong to type 7230 "Alkaline fens".

Fig. 46. 7160 Mineral-rich springs and spring fens are common especially at the alpine zone of the Pelister National Park (Mt Baba /Pelister) at sites where mountain brooks and rivers starts to run. There are also springs and spring brooks of this habitat type along the slopes of Mt. Pelister. These habitats have specific flora with boreal and alpine species and several endemic species to Balkan. This habitat type is very important for river ecosystems and hosts typical invertebrate species. Photo: Kimmo Syrjänen, Golemo Ezero.

Vascular plant communities and typical species of 7160 in Macedonia

Čarni & Matevski (2010) have collected information on the vegetation of springs and brooks in the Pelister National Park. Typical vascular plants of spring affected environments include *Alchemilla indivisa*, *Angelica pancicii*, *Cardamine raphanifolia* subsp. *acris*, *Carex rigida* var. *macedonica*, *Carex echinata*, *Chrysosplenium alternifolium*, *Dactylorhiza cordigera*, *Equisetum arvense*, *Epilobium* spp., *Geum coccineum*, *Montia fontana*, *Parnassia palustris*, *Pedicularis limnogena*, *Pinguicula balcanica*, *Saxifraga stellaris* subsp. *alpigena*, *Silene asterias*, *Stellaria alsine* (see Čarni & Matevski 2010) and bryophytes *Brachythecium rivulare*, *Bryum pseudotriquetrum*, *Chiloscyphus polyanthos*, *Marchantia aquatica*, *Philonotis* spp., *Pellia epiphylla*, *Plagiomnium undulatum*, *Pohlia wahlenbergii*, *Scapania undulata* and *Warnstorfia exannulata*. In the tall herb fringe along springs there are often *Angelica pancicii*, *Athyrium filix-femina*, *Caltha palustris*, *Cirsium appendiculatum*,

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Deschampsia cespitosa, *Doronicum austriacum*, *Myosotis scorpioides*, *Rumex alpinus* and *Veratrum album* among others (Čarni & Matevski 2010).

Habitat directive and other important species

Angelica pancicii, *Carex macedonica*, *Dactylorhiza cordigera* subsp. *bosniaca*, *Pinguicula balcanica* and *Silene asterias* are all endemic species to the Balkans. This habitat type is also important for several rare invertebrates. Springs and spring brooks are important also as a drinking place for many mammals.

Fig. 47. a) *Dactylorhiza cordigera* is an orchid species that typically grows along springs and spring fens at the Pelister National Park. **b)** *Silene asterias* is a tall herb that grows in springs at the Pelister National Park. Both of these species are subendemic vascular plants of the Balkan Peninsula. Photo: Kimmo Syrjänen.

Inventory and Monitoring

There is no standard Field Inventory Form for springs available as of yet. Collected data should include GPS coordinates, description of the vegetation types and information on their area. A list of typical plants with abundance information is needed. Repeated visits and iteration of inventory at the same site is a basic method of monitoring. Suitable monitoring period is between 5-10 years for this habitat type.

Threats and pressures

Inside the Pelister National Park there are no severe threats to this habitat type. In several places there are constructed structures for water uptake for hikers and other people moving in the national park. These well structures are for the most part not harmful for this habitat type. Trampling can cause minor damage to small springs. Groups of wild boar (*Sus scrofa*) may cause damage to springs by disturbing the typical vegetation, but can also decrease the water quality, an important aspect especially for humans. So far the uptake of ground water is not going on at the alpine part of the Pelister National Park. Warming climate can cause warming of ground water and decrease the outflow in the future. Construction of roads can be harmful locally.

Range

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This habitat type is found in several sites in the Macedonian mountains. In addition to the Pelister National Park it occurs in most mountain chains, especially in the west where precipitation is higher.

Area

Area is stable in the Pelister National Park. There can be as many as a hundred springs at the alpine area of the Pelister National Park. Total area is 0,2 – 2 hectares.

Fig. 48. a) Well structures from Yugoslavian era are common in springs at the Pelister National Park. For the most part these are not harmful for spring biodiversity and can even decrease human trampling pressure. **b)** Tall herb fringe vegetation is common in springs especially at the subalpine parts of the Pelister National Park. Species in the photos are *Silene asterias*, *Veratrum album* and *Angelica pancicii* among others. Photos: Kimmo Syrjänen, Jorgov kamen.

Structure and function

Springs are dependent on the continuous formation of ground water. Accumulation and slow melting of north exposed snow beds are important for some springs. Climate warming can affect negatively on the spring vegetation and biodiversity.

Management principles

Keeping springs in a natural condition is important. Restoration may be needed if hydrology of a spring has been changed due to contractions or ditching. Most of the springs at the Pelister National Park are in a natural condition and management is not required.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	FV
Structure and function	FV
Future prospects	FV
Overall assessment of Conservation Status	**FV**

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7220* Petrifying springs with tufa formation (Cratoneurion)

Status in Europe			
	Habitats directive, Annex I	Habitat type:	7220*
	C2.1b Calcareous spring and spring brook		
	Threat status in EU28+	Vulnerable (IUCN)	VU
	Threat status in EU28	Vulnerable (IUCN)	VU
EU conservation status by biogeographical region			
	Alpine	Unfavourable-Inadequate	U1
	Atlantic	Unfavourable-Bad	U2
	Black Sea	Unfavourable-Inadequate	U1
	Boreal	Unfavourable-Inadequate	U1
	Continental	Unfavourable-Inadequate	U1
	Macaronesian	Not present	-
	Mediterranean	Unfavourable-Bad	U2
	Pannonian	Unfavourable- Inadequate	U1
	Steppic	Not present	-

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *"*Hard water springs with active formation of travertine or tufa. These formations are found in such diverse environments as forests or open countryside. They are generally small (point or linear formations) and dominated by bryophytes (Cratoneurion commutati)."

Plants: *Arabis soyeri*, *Cochlearia pyrenaica* (in sites with heavy metals), *Pinguicula vulgaris*, *Saxifraga aizoides*. Mosses: *Catoscopium nigritum*, *Cratoneuron commutatum*, *C. commutatum* var. *falcatum*, *C. filicinum*, *Eucladium verticillatum*, *Gymnostomum recurvirostrum*. In the Boreal region also *Carex appropinquata*, *Epilobium davuricum*, *Juncus triglumis*, *Drepanocladus vernicosus*, *Philonotis calcarea*, *Scorpidium revolvens*, *S. cossoni*, *Cratoneuron decipiens* and *Bryum pseudotriquetum*.

Description according to EUNIS (Evans & Roekaerts 2015) C2.12 Hard water springs. Springs rich in calcium, typically due to calcareous tufa formation. Species-rich habitats with high moss cover, a high dominance of the moss *Cratoneuron commutatum* is typical. Plant communities: Cratoneurion commutati, Lycopodo-Cratoneurion commutati. Subtype C2.121 Petrifying springs with tufa or travertine formations is 7220: Petrifying springs with tufa formation (Cratoneurion).

This habitat type is widespread in Europe (see EUNIS Fact Sheet). However, habitat conservation status is unfavourable through the range of this habitat. In the Pelister National Park and at the Prespa Lake this type is found in small occurrences. Based on literature *Cratoneuron filicinum* and *Palustriella commutata* grows on several places in North Macedonia and there are several occurrences with better representation of this type in the country.

Vascular plant communities and typical species of 7220 in Macedonia

In the Pelister National Park and at the Prespa Lake this habitat is characterized by the presence of *Cratoneuron filicium* and/or *Palustriella commutata* and *Palustriella falcata*. Size of these habitats are usually 10 m^2 or less.

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Accompanying species include *Bracythecium rivulare*, *Bryum pseudotriquetrum*, *Carex remota*, *Conocephalum conicum*, *Dactylorhiza cordigera*, *Epipactis palustris, Ranunculus ophioglossifolius*, *Scirpus sylvaticus*, *Silene asterias*, *Veronica anagallis-aquatica* and *Veronica beccabunga*.

Fig. 49. 7220 * Petrifying springs with tufa formation (Cratoneurion) are rare both at the Pelister National Park (Sapundiza, Gjavato) and at the Prespa Lake (Oteshevo, Sirhan). These sites are characterized by the presence of *Cratoneuron filicinum* or *Palustriella* spp. moss species and hard alkaline water. Tufa formation is not strong and these sites are not very representative. **a)** *Cratoneuron* -spring close to lake Prespa, Oteshevo. **b)** *Cratoneuron filicinum* growing at the Pelister National Park. Photos: Kimmo Syrjänen.

Habitat directive and other important species

This habitat contains species of calcareous springs and may include rare mollusks.

Inventory and Monitoring

There is no standard Field Inventory Form for springs available so far. Collected data should include GPS coordinates, description of vegetation types and information on their area. A list of typical plants with abundance information is needed. Assessment of threats should be determined. Repeated visits and iteration of inventory at the same site is a basic method of monitoring. Suitable monitoring period is between 5-10 years for this habitat type.

Threats and pressures

Inside the Pelister National Park there are no severe threats to this habitat type. In several places there are constructed structures for water uptake for hikers and other people moving in the national park. These well structures are not harmful for the most part for this habitat type. Trampling can decrease water quality in small springs. Groups of wild boar (*Sus scrofa*) can damage the typical vegetation including bryophytes and decrease water quality, an important aspect for hikers and other people. So far the uptake of ground water is not going on in the alpine part of the Pelister National Park, but it can pose a threat in the future. Warming climate can cause warming of ground water and subsequently decrease the outflow during summertime. Construction of roads or buildings can be harmful locally. At the Prespa Lake one location is very close to a road at Sirhan.

Range

This habitat type is probably present in several sites in North Macedonia. It can occur in all of the calcareous areas that have springs. In literature there are more data on occurrences of *Palustriella* spp. and *Cratoneuron filicinum* in North Macedonia. These observations can give a hint for the presence of Cratoneurion. For example, A. Martinčič (2009) lists *Palustriella commutata* from 1) Baba near Pletvar, 1200–1300 m a.s.l.; 2) Korab, 2100 m a.s.l.; Korab, peak, 2700 m a.s.l.; 3) V. Krčin, 1800 m a.s.l.; 4) valley of river Radika between Mavrovo and Žirovnica village, 900 m a.s.l. and *Palustriella decipiens* from 1) Korab, 2100 m a.s.l. and 2600 m a.s.l.; 2) V. Krčin,

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1800 m a.s.l. and more sites for *Cratoneuron filicinum*, which are areas that may host the 7220 habitat type. *Palustriella falcata* is also found in Macedonia, based on Papp et al. (2015) "Towards Galičnik, at Toni voda meadows on the way to Lazaropole village".

Area

Area of this type is stable in the Pelister National Park. At the Prespa Lake occurrences should be confirmed. In both sites the total area is very small, only a couple of 10 m^2.

Structure and function

Springs are dependent on the continuous formation of ground water. Water uptake and climate warming can affect negatively on the spring vegetation and biodiversity.

Management principles

There is a need to assess the presence of this habitat type in entire North Macedonia based on literature information, herbarium materials and field surveys. All representative springs of this type should be protected, if they are not already inside nature conservation areas. It is important to keep springs in a natural condition. Restoration may be needed if hydrology of a spring has been changed due to building, road construction or ditching. Most of the springs at the Pelister National Park are in a natural condition and management is not required.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	FV
Structure and function	U1
Future prospects	U1
Overall assessment of Conservation Status	**U1**

References:

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Rocky habitats

8220 Siliceous rocky slopes with chasmophytic vegetation

Status in Europe		
Habitats directive, Annex I	Habitat type:	8220
H3.1c Temperate, lowland to montane siliceous inland cliff		
Threat status in Europe	Least concern (IUCN)	LC
Threat status in EU	Least concern(IUCN)	LC
EU conservation status by biogeographical region		
Alpine	Favourable	FV
Atlantic	Unknown	xx
Black Sea	Favourable	FV
Boreal	Favourable	FV
Continental	Unfavourable-Bad	U1
Macaronesian	Unfavourable-Bad	U2
Mediterranean	Unknown	XX
Pannonian	Unfavourable Inadequate	U1
Steppic	Not present	-

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *"1) Vegetation of fissures of siliceous inland cliffs, which presents many regional sub-types, described under point 2."*

This habitat type consists of several subtypes. One of the most relevant for Balkan and Macedonia:

"2) Plants: 62.25 - Helleno-Carpatho-Balkanic siliceous cliff vegetation (Silenion lerchenfeldianae): *Silene lerchenfeldiana*, *Silene dinarica*, *Senecio glaberrimus*, *Jovibarba heuffelii*, *Veronica bachofenii*, *Potentilla haynaldiana*, *Saxifraga juniperifolia* ssp. *juniperifolia (Saxifraga pseudosancta)*, *Saxifraga pedemontana* ssp. *cymosa*, *Rhodiola rosea (Sedum rosea)*, *Dianthus henteri*, *Minuartia bulgarica*, *Haberlea rhodopensis*, *Symphyandra wanneri*, *Carex kitaibeliana (Carex laevis)*."

Description according to EUNIS (Evans & Roekaerts 2015): *"Dry non-calcareous inland cliffs. Specific plant associations colonize montane and Mediterranean cliffs. Most of the subdivisions refer to them. Northern lowland cliffs usually support fragments of other less specialized communities."*

Occurrence of the habitat type and its subtypes in the Pelister National Park and the Prespa Lake

The habitat type 8220 "Siliceous rocky slopes with chasmophytic vegetation" is common and characteristic for the Pelister National Park. There are different sizes of siliceous cliffs in this vegetation type and it includes sun exposed and shaded cliffs which differ in species composition. It includes siliceous rocks in the forest zone as well as in the alpine cliffs and rocks. Most of the siliceous rocks are acidophilic but some are mesotrophic with *Homalothecium sericeum*, *Cystopteris fragilis* and *Asplenium trichomanes*.

Vascular plant communities and typical species of 4060

Typical species of 8220 in Pelister National Park include: *Asplenium trichomanes*, *Asplenium septentrionale*, *Sempervivum marmoreum*, *Sempervivum octopodes*, *Silene lerchenfeldiana*, *Silene waldsteinii*, *Jovibarba heuffelii*, *Centaurea deustiformis*, *Sedum stefco* and *Anthemis cretica* subsp. *carpathica*.

Fig. 50. 8220 Siliceous rocky slopes with chasmophytic vegetation is a common habitat type at the Pelister National Park. **a)** Sun exposed siliceous rock outcrops near Kazan. **b)** Siliceous cliff wall at Yorgov Kamen. Photos:

Habitat directive and other important species

8220 is important for floral and vegetational biodiversity. The floral composition of this specific chasmophytic habitat (8220) is relatively poor. Its composition includes plant species and plant communities, adapted to extreme environmental conditions. The limited genetic exchange between taxa from different mountains also has a significant influence on the floral composition; hence there are favorable conditions for endemic speciation, leading to the presence of North Macedonian and Balkan endemic species within this habitat type.

The vegetation on silicate rocks is united in one Dacian-Balkan alliance *Silenion lerchenfeldianae* (Androsacetalia vandellii, Asplenietea trichomanis) (Horvat et al., 1974) that occurs in a very wide vertical range, from the mountain foothills (700–1000 m a.s.l.) up to 2700 m a.s.l.. The floristic composition of the coenoses differs according to the altitude and the exposure.

Many vascular plants of conservation value live in the chasmophytic communities on silicate rocks icluding: *Athyrium distentifolium*, *Cerastium decalvans*, *Clematis alpina*, *Gentiana acaulis*, *Jovibarba heuffelii*, *Silene lerchenfeldiana*, *Ranunculus incomparabilis*, *Sempervivum marmoreum* and *Sempervivum octopodes*.

Siliceous cliffs are also important for several lichen and bryophyte species. *Mannia triandra* is a Habitat directive annex II bryophyte species that has been found on soil on a slope of siliceous cliff at Golemo Ezero.

8220 is important for several birds by providing nesting sites. Especially raptors prefer high silicate cliffs that are difficult to access by potential predators. The red-billed chough (*Pyrrhocorax pyrrhocorax*) nests in this habitat type at the Pelister National Park. Habitat is important also for the chamois (*Rupicapra rupicapra*) population of the Pelister National Park.

Inventory and Monitoring

There is no Field Inventory Form for rocky habitats. Inventories and monitoring should include description of the habitat type and area of inventoried surface, list of chasmophytic plant species with abundance information and list of litophytes and their abundances (by functional groups if species identification is not possible). There are little changes to be expected in these habitats inside conservation areas. Monitoring can be repeated in a 10-20 year period. However, these is a clear need to get more information on species composition of this habitat type at different parts of the Pelister National Park. There are endemic and rare species living in this habitat type.

Threats and pressures

In the Pelister National Park no severe threats exist for this habitat type. Yorgov Kamen is a popular vantage point and there are considerable amount of trampling, but that does not affect the representativity of this habitat type. Construction projects such as building of roads may affect some sites. Growing tree cover in front of an open siliceous rock cliff can change the species composition of chasmophytic vegetation. At alpine parts

climate warming can cause changes in the dynamics and species composition of siliceous cliffs during a long time span.

Fig. 51. **a)** Siliceous rocks have diverse flora of chasmophytic vascular plants, lichens and bryophytes at alpine parts of the Pelister National Park. Species composition is different when compared to siliceous rocks at lower altitudes. **b)** *Sempervivum octopodes* is a Crassulacean species with extremely limited range at North Macedonia and Northern Greece. Type locality of the species is from Pelister National Park, where this endemic plant grows as chasmophyte at siliceous rock walls above the Golemo Ezero Lake. Photos: Kimmo Syrjänen.

Range

This habitat type is found in several sites in the Pelister National Park and in North Macedonia. In addition to the Pelister National Park it occurs in several places both inside and outside conservation areas ranging from 1300-2600 m a.s.l..

Area

Area of this habitat type is stable in the Pelister National Park and the total area is about 915 hectares.

Structure and function

Structure of vegetation at siliceous rocks consists mainly on chasmophytes on cracks with mineral soil and litophytes (mainly lichen and bryophytes) attached directly to the stone surface. Dynamics at siliceous rocks are mainly related to disturbance dynamics caused by weathering, flow of rain water and biotic activities of different animals including herbivores.

Management principles

This habitat does not normally need management. Possible stands of alien tree species (mainly *Robinia pseudacacia)* at front of siliceous walls should be removed.

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Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	FV
Structure and function	FV
Future prospects	FV
Overall assessment of Conservation Status	**FV**

References:

EUNIS Fact Sheet: Siliceous rocky slopes with chasmophytic vegetation

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8150 Medio-European upland siliceous screes

Status in Europe		
Habitats directive, Annex I	Habitat type:	8150
H2.5 Temperate, lowland to montane siliceous scree		
Threat status in EU28	Least concern (IUCN)	LC
Threat status in EU28+	Least concern (IUCN)	LC
EU conservation status by biogeographical region		
Alpine	Unknown	XX
Atlantic	Unknown	XX
Black Sea	Not present	-
Boreal	Not present	-
Continental	Unfavourable-Inadequate	U1
Macaronesian	Not present	-
Mediterranean	Unknown	XX
Pannonian	Favourable	FV
Steppic	Not present	-

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *"Siliceous screes of hills of western and central Europe, with Epilobium collinum, Galeopsis segetum, Senecio viscosus, Anarrhinum bellidifolium, Cryptogramma crispa. Upland siliceous screes, often resulting from quarry activity, and colonised by very impoverished forms of the Alpine communities, usually rich in mosses, lichens and sometimes ferns, notably Cryptogramma crispa, are included, but should not be taken into account. Plants: Epilobium collinum, Galeopsis segetum, Senecio viscosus, Anarrhinum bellidifolium, Cryptogramma crispa"*

Description according to EUNIS (Evans & Roekaerts2015): "H2.3 Temperate-montane acid siliceous screes. Plant communities Androsacion alpinae, Chaerophyllion humilis, Dryopteridion oreadis, Scrophulario minimae-Symphyolomion graveolens, Senecionion leucophylli" H2.31: Androsace alpina, Achillea nana, Oxyria digyna, Geum reptans, Saxifraga bryoides, Ranunculus glacialis, Linaria alpina, Oreochloa disticha, Silene acaulis H2.32: Epilobium collinum, Galeopsis segetum, Acetosella vulgaris, Dalanum ladanum, Petasites albus, Tussilago farfara, Senecio viscosus, Anarrhinum bellidifolium, Cryptogramma crispa H2.33: Saxifraga bryoides, Saxifraga adscendens, Saxifraga oppositifolia, Oxyria digyna, Androsace hedraeantha, Poa cenisia, Cryptogramma crispa, Vaccinium spp., Polygonum alpinum, Pleuropteropyrum undulatum, Lerchenfeldia flexuosa, Senecio rupestris."

In EUNIS EU Habitats Directive Annex I 8110 "Siliceous scree of the montane to snow levels" (Androsacetalia alpinae and Galeopsietalia ladani) and 8150 "Medio-European upland siliceous screes" are both included into H2.4. It seems that characteristics of these two habitat type are somewhat overlapping also in the Pelister National Park.

Occurrence of the habitat type and its subtypes in the Pelister National Park

The habitat type 8150 "Medio-European upland siliceous screes" is a common and characteristic to the Pelister National Park. All boulder scree habitats at the slopes and at the summit area of Baba mountains are included into habitat 8150. Stone rivers of the Pelister National Park also belong to this habitat type. There are differences in the species composition at the alpine summits when compared to the subalpine slopes but more work is needed to define vegetation types in more detail. Boulder scree habitats are very important especially for lichens and bryophytes and this habitat type includes rare species with boreal and alpine distribution. In the summit

area siliceous screes were affected by constructions during World War I which increased cultural and historical value of these sites.

Siliceos boulder screes are related and sometimes connected to 8220 “Siliceous rocky slopes with chasmophytic vegetation” and can occasionally have same species. They may also get species of surrounding habitat types including 95A0 “High oro-Mediterranean pine forests”, 4060 “Alpine and boreal heaths” and 62D0 “Oro-Moesian acidophilous grasslands”.

Fig. 52. 8150 Medio-European upland siliceous screes. **a)** A siliceous boulder scree at Magarevska river valley close to the path to Jorgov kamen. **b)** Medio-European upland siliceous scree at alpine part of the Pelister National Park close to the Malo Ezero. Photos: Kimmo Syrjänen.

Vascular plant communities and typical species of 8150 in Macedonia

At lower elevations screes are surrounded by forests, mainly *Pinus peuce* forests with scattered beeches, *Acer heldreichii* and *Sorbus aria* at borders of these screes. *Juniperus communis* can also be present at borders or scattered at screes. At lowermost parts of screes *Geranium macrorrhizum* can be found on a boulder of a scree. *Calamagrostis arundinacea* and *Lerchenfeldia flexuosa* are often present. *Rubus idaeus* and several fern species are also typical. Ferns include *Polypodium vulgare*, *Dryopteris filix-mas*, *Dryopteris expansa*, *Athyrium filix-femina*, *Phegopteris connectilis*, *Gymnocarpium dryopteris*, in alpine areas also *Athyrium distentifolium*, *Cryptogramma crispa* and *Polystichum lonchitis* can be found among boulders.

The following list of bryophytes and vascular plants were collected from a boulder scree at the Magarevska river valley close to the path to Jorgov Kamen: *Racomitrium heterostichum*, *Pterigynandrum filiforme*, *Hypnum cupressiforme*, *Polytrichum piliferum*, *Polytrichum juniperinum*, *Grimmia artmanii*, *Barbilophozia hatcheri*, *Barbilophozia lycopodioides*, *Grimmia muehlenbeckii*, *Dicranum scoparium*, *Isothecium alopecuroides*, *Pseudoleskea saviana*, *Hymenoloma crispulum*, *Pohlia cruda*, *Ceratodon purpureus*, *Athyrium filix-femina*, *Polypodium vulgare*, *Dryopteris filix-mas*, *Cystopteris fragilis*, *Asplenium trichomanes*, *Polystichum lonchitis*, *Geranium macrorrhizum*, *Geranium robertianum*, *Silene vulgaris*, *Rubus idaeus*, *Calamagrostis arundinacea*, *Poa nemoralis*, *Milium effusum* and *Poa* sp.

Habitat directive species and other important species

8150 is important for several rare lichen, bryophyte and vascular plant species. Among these is *Andreaea rupestris* moss that is nationally protected and rare in Macedonia. According to the literary data, this species was known only of the mountains Jakupica and Shar Planina (Цекова, 2005) and the Pelister National Park (Papp & Erzberger 2012). It is a rather typical inhabitant of siliceous boulder screes in the Pelister National Park. They also provide shelter for mammals and birds. South facing sun exposed screes are important habitats for lizards and snakes.

Inventory and Monitoring

So far there is no Standard Field Inventory Form for siliceous screes, but a form for grasslands can be applied for this habitat type. Borders of this habitat type are rather easy to limit. Inventory information should be collected on GPS marked polygons/ sampling plots inside the studied siliceous scree area. Repeated visits and iteration of inventory at the same site is a basic method of monitoring. Suitable monitoring period is 10 years for this habitat type. Different subtypes should be taken into account during monitoring with different altitudinal positions.


Fig. 53. a) *Cryptogramma crispa* is a small fern that grows in the alpine parts of the Pelister National Park at siliceous rocks and screes. **b)** Siliceous boulder scree is an important habitat for many bryophytes and lichens such as *Arctoparmelia centrifuga.* Photos: Kimmo Syrjänen.

Threats and pressures

Many screes are affected by World War I are constructions in the alpine area in the Pelister National Park. Chains of trenches with stony dugouts are running through summit screes. These constructions have not affected the species composition much but provide historical and cultural values to these habitats. Screes are now in a natural stage at the alpine area and currently there are no pressures. In the forest zone there is also some evidence of World War I era construction. There seems to be accumulation of organic material from surrounding habitats and slow overgrowth locally and the change into a forest habitat is going on at certain sites at lower altitudes. Atmospheric nitrogen can also increase accumulation of organic material on screes.

Range

This habitat type is found in several sites in the Pelister National Park and other North Macedonian mountains. However, this habitat in its most typical form is present on Pelister Mt.

Area

Area of this habitat type is probably staying quite stable in the Pelister National Park despite the occasional overgrowth. The total area in the Pelister National Park is about 2100 hectares.

Structure and function

Slopes and summit areas of the Pelister National Park contain extensive siliceous boulder screes. In some parts of the area there is a slow overgrowth going on and this trend may be increased by climate warming.

The overgrowth of this habitat, mainly with individual trees of *Pinus peuce*, is more pronounced in the lower parts of the “stony rivers” (like between Pali snopje and Kopanki), as well as along the river Magarevska. However, the impact is not assumed to be so quick that conservation status would deteriorate. However, this change needs to be monitored.

Management principles

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It is possible to remove accumulated litter and plant biomass to prevent overgrowth in particular screes. Management requirements should be evaluated.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	FV
Structure and function	FV
Future prospects	FV
Overall assessment of Conservation Status	**FV**

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Forests

91E0* Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

Status in Europe		
Habitats directive, Annex I	Habitat type:	91E0*
G1.2a Alnus woodland on riparian and upland soils		
Threat status in EU28+	Least concern (IUCN)	LC
Threat status in EU28	Least concern (IUCN)	LC
EU conservation status by biogeographical region		
Alpine	Unfavourable-Bad	U2
Atlantic	Unfavourable-Bad	U2
Black Sea	Unfavourable-Inadequate	U1
Boreal	Unfavourable-Bad	U2
Continental	Unfavourable-Bad	U2
Macaronesian	Unknown	XX
Mediterranean	Unfavourable-Inadequate	U1
Pannonian	Unfavourable-Inadequate	U1
Steppic	Favourable	FV

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): "Riparian forests of Fraxinus excelsior and Alnus glutinosa, of temperate and Boreal Europe lowland and hill watercourses (44.3: Alno-Padion); riparian woods of Alnus incanae of montane and sub-montane rivers of the Alps and the northern Apennines (44.2: Alnion incanae); arborescent galleries of tall Salix alba, S. fragilis and Populus nigra, along medio-European lowland, hill or sub-montane rivers (44.13: Salicion albae). All types occur on heavy soils (generally rich in alluvial deposits) periodically inundated by the annual rise of the river (or brook) level, but otherwise well-drained and aerated during low-water. The herbaceous layer invariably includes many large species (Filipendula ulmaria, Angelica sylvestris, Cardamine spp., Rumex sanguineus, Carex spp., Cirsium oleraceum) and various vernal geophytes can occur, such as Ranunculus ficaria, Anemone nemorosa, A. ranunculoides, Corydalis solida."

"This habitat includes several sub-types: ash-alder woods of springs and their rivers (44.31 – Carici remotae-Fraxinetum); ash-alder woods of fast-flowing rivers (44.32 - Stellario-Alnetum glutinosae); ash-alder woods of slow-flowing rivers (44.33 - Pruno-Fraxinetum, Ulmo-Fraxinetum); montane grey alder galleries (44.21 - Calamagrosti variae-Alnetum incanae Moor 58); sub-montane grey alder galleries (44.22 - Equiseto hyemalis-Alnetum incanae Moor 58); white willow gallery forests (44.13 - Salicion albae). The Spanish types belong to the alliance Osmundo-Alnion (Cantabric atlantic and southeast Iberia peninsula)."

Description according to EUNIS (Evans & Roekaerts2015): G1.1 Riparian and gallery woodland, with dominant Alnus, Betula, Populus or Salix. G1.11 Riverine Salix woodland. Bush or arborescent formations dominated by willow (Salix spp), lining flowing water and submitted to periodic flooding, developed on recently deposited alluvion. Willow brushes are particularly characteristic of rivers originating in major mountain ranges. Shrubby willow formations also constitute an element of lowland and hill riverine successions in all major biomes, often making the belt closest to the water course. Taller arborescent willow formations often constitute the next belt landwards in riverine successions of lowland western nemoral, eastern nemoral and warm-temperate humid

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forest regions, and a large part of the less diverse riverine systems of the steppic, mediterranean and cold desert zones. These habitats may be affected by the invasive alien species such as *Solidago canadensis*, *Aster novi-belgii*, *Aster novi-anglii* and *Impatiens glandulifera.*

Fig. 56. Alluvial forests 91E0* in Gjavato at the Pelister National Park. Springy forests with *Scirpus sylvaticus*, *Carex remota*, *Filipendula ulmaria*, *Lycimachia vulgaris* etc. In the Pelister National Park this priority habitat type is connected with springs and spring brooks. Photo:

This priority habitat type is present both at the Pelister National Park and at the Prespa Lake. In the Pelister National Park it is characterized by springs inhabited by *Alnus glutinosa* stands mainly at lower parts of slopes of Mt. Pelister and always at springy sites from the lower border of the park to about 1600 m a.s.l.. The modest communities of this habitat type consist of stripes of *Alnus glutinosa* along spring brooks, whereas several more large *Alnus glutinosa* stands are present in the northern slopes of Mt. Pelister at the Gjavato region. At the Prespa Lake there are several stands of alluvial forests that belong to this habitat type. For example in the Ezerani protected area there are representative examples of both alluvial *Salix alba* galleries and of *Alnus glutinosa* woods as well as their admixtures. Along the eastern shore of the Prespa and beside the Golemo Reka there are some woods belonging to this type also. Most stands at the eastern shore of the Prespa have suffered from decreased water table levels and are changing into other type of vegetations.

Vascular plant communities and typical species of 91BA in Pelsiter and Prespa

Typical species of 91E0* in the Pelister National Park include at least *Alnus glutinosa*, *Carex remota* and *Brachythecium rivulare.* At one site in Gjavato, Turska Cesma (lat. 41.063750, long. 21.111312) following species were listed: *Athyrium filix-femina*, *Lysimachia punctata*, *Rubus* spp., *Carex remota*, *Stachys sylvatica*, *Equisetum*

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pratense, *Telekia speciosa*, *Lythrum salicaria*, *Prunus* spp., *Oxalis acetosella*, *Circaea lutetiana*, *Mentha aquatica*, *Pyrus pyraster* and *Brachythecium rivulare*. In the same region at the NW corner of the National Park Pelister these is a representative springy *Alnus glutinosa* forest of this HD habitat type with the following species: *Carex remota*, *Scirpus sylvaticus*, *Mentha aquatica*, *Veronica beccabunga*, *Ranunculus ophioglossifolius*, *Lythrum salicaria*, *Solanum dulcamara*, *Juncus effusus*, *Lysimachia vulgaris*, *Filipendula ulmaria*, *Glyceria fluitans*, *Rubus discolor*, *Rubus caesius* and *Ranunculus repens*. In the surrounding alder wood there is usually *Viburnum opulus*, *Crataegus monogyna*, *Acer campeste*, *Sorbus torminalis*, *Cornus mas*, *Euonymus europaeus*, *Circaea lutetiana*, *Viola odorata*, *Primula vulgaris*, *Galeobdolon luteum*, *Polygonatum multiflorum*, *Brachypodium sylvaticum* and in trees climbing vines including *Clematis vitalba*, *Humulus lupulus* and *Lonicera periclymenum*.

Fig. 57. Alluvial forests 91E0* at the Prespa Lake in the Ezerani protected area near the village Dolno Perovo consist of both *Salix alba* dominated forests (in the photo) and *Alnus glutinosa* dominated stands. Also *Populus alba* and *Populus nigra* are present in these forests. Photo: Kimmo Syrjänen.

Alnus glutinosa comm. is a mesophilic forest community that has formed a compact population in the Prespa region (on the locality Korija, in the vicinity of the village Ezerani). It should be noted that *Alnus glutinosa* on the territory of the Republic of North Macedonia has a fairly high vertical distribution (100-1500 m a.s.l.) (Em, 1964, 1967) and forms several communities in combination with various species (*Periploca graeca*, *Geum coccineum*, *Fraxinus angustifolia*, *Carex* spp. etc.) Plant species composition is quite different in the springy sites at the Pelister when compared to the lowland alluvial forests of the Prespa region. In recent inventory part of these alluvial forests with *Salix alba* were included in 92A0 *Salix alba* and *Populus alba* galleries (Fotiadis et al. 2018). Here all alluvial forests of the Prespa region are included in 91E0*.

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At the Prespa lake in the Ezerani protected area below Dolno Perovo village in *Salix alba* forest following species are present: *Salix alba*, *Salix cinerea*, *Salix fragilis*, *Salix amplexicaulis*, *Populus alba*, *Rubus caesius*, *Rubus sanguineus*, *Phragmites australis*, *Humulus lupulus*, *Iris pseudacorus*, *Carex* sp., *Epilobium hirsutum*, *Carex pseudocyperus*, *Alisma plantago-aquatica*, *Pulicaria dysenterica*, *Lysimachia vulgaris*, *Lythrum salicaria*, *Mentha aquatica*, *Hypericum tetrapterum*, *Mentha longifolia*, *Solanum dulcamara*, *Rumex hydrolapathum*, *Galium palustre*, *Lycopus europaeus*, *Polygonum amphibium*, *Ranunculus repens*, *Ulmus minor*, *Ligustrum vulgare*, *Cornus sanguinea*, *Cucubalus baccifer*, *Drepanocladus aduncus* and *Amblystegium serpens*.

Habitat directive and other important species

91E0* is important for amphibians including *Rana dalmatina* and *Rana graeca* in both conservation areas and for *Hyla arborea* at the Prespa Lake. This habitat type is important also for many birds including the Turtle Dove (*Streptopelia turtur*) that has been decreasing widely in Europe but has a viable population at the Prespa Lake area.

Inventory and Monitoring

Standard Field Inventory Form for forests should be used in inventories and monitoring. Inventory information should be collected on polygons inside the studied forest stands. Stands are often small and the entire stand can be placed inside a monitoring polygon. Repeated visits and iteration of inventory at the same site is a basic method of monitoring. Suitable monitoring period is between 5-10 years for this habitat type.

Threats and pressures

Inside the Pelister National Park selective cuttings can be a threat if these habitats are not took into account in a management plan. There are no natural threats for this habitat type in the Pelister National Park. At the Prespa Lake this habitat type has been suffering from drainage, decrease of water level in the lake, uptake of groundwater and dredging of the river Golemo Reka. The sandy banks along the shore of the Prespa at Ezerani that naturally keep water in alluvial woods have been ditched. Cutting of firewood and illegal burnings of dried wetlands will also affect negatively on the quality of this habitat in the Prespa Lake conservation areas.

Range

This habitat type is found in several sites in the study area and also elsewhere in North Macedonia along river valleys and mountains.

Area

Area of this type is stable in the Pelister National Park but probably decreasing in the Prespa Lake. Area at the Pelister National Park is about 10-20 hectares. In the Prespa Lake there are 128.76 hectares of 91E0* and 491.71 hectares of 92A0 observed in a recent inventory (Fotiadis et al. 2018) whereas in the Pelister National Park the area of 91E0* is estimated to be around 70 hectares.

Structure and function

Alluvial forests 91E0 * depend on ground water that discharges through springs or on regular annual changes in the water table level due to flooding (especially in winters and springs). Tree species composition include flood tolerant species like *Alnus glutinosa*, *Salix alba*, *Salix fragilis*, *Populus nigra*, *Populus alba* and bush forming *Salix* spp. Forests in low elevations or near pools typically have wetland vegetation and sometimes floating hydrophyte communities. In natural and near-to-natural conditions there can also be old deciduous trees, coarse dead wood and regeneration at mounds and tussocks of old trees.

Management principles

Inside the Pelister National Park black alder (*Alnus glutinosa*) stands should be left aside from all forestry actions and if their hydrology has been altered then restoration of hydrology should be performed. In the Prespa Lake some stands will deteriorate in a long run because of the decreased water table of the Prespa Lake. There are still possibilities to enhance the situation e.g. at the Ezerani by restoration (filling ditches between alluvial woods

and the lake) and by directing waters of the Golemo Reka through this habitat type. As a long term management plan it is important to create near to natural dynamics with old trees and decaying wood. Cutting of alluvial forests for firewood or other purposes inside conservation areas should be prohibited.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	U1
Structure and function	U1
Future prospects	U2
Overall assessment of Conservation Status	**U2**

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91AA* Eastern white oak woods

Status in Europe		
Habitats directive, Annex I	Habitat type:	91AA*
G1.Aa Carpinus and Quercus mesic deciduous woodland		
Threat status in EU28+	Near threatened (IUCN)	NT
Threat status in EU28	Near threatened (IUCN)	NT
EU conservation status by biogeographical region		
Alpine	Unknown	XX
Atlantic	Not present	-
Black Sea	Unfavourable-Inadequate	U1
Boreal	Not present	-
Continental	Unfavourable-Bad	U2
Macaronesian	Not present	-
Mediterranean	Unfavourable-Bad	U2
Pannonian	Not present	-
Steppic	Unfavourable-Inadequate	U1

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *"1) Azonal white-oak dominated woods with a submediterranean flora, occupying thermic oases within the sub-continental Quercion frainetto and Carpinion illyricum zones. Includes the subtypes: 41.7371 Thracian white oak-oriental hornbeam woods Quercus pubescens - Quercus virgiliana woods of the Black Sea plains and hills of Turkey in Europe, and of the northern Thracian plain of southern and southeastern Bulgaria, where they are represented by mostly insular patches, particularly in the middle Maritsa and Tundja hills, the eastern and northern Rhodope foothills. The oaks are accompanied by Carpinus orientalis, Fraxinus ornus, Acer campestre or Tilia tomentosa and by sub-Mediterranean floral elements.*

41.7372 Moesian white oak woods Thermophilous, sub-Mediterranean Quercus pubescens and Quercus virgiliana woods of the southern Dinarides, the Balkan Range, and neighbouring regions including south eastern and southern Romania. 2) Plants: Quercus pubescens, Q. virgiliana, Ostrya carpinifolia, Carpinus orientalis, Carpinus betulus, Fraxinus ornus, Gallium dasypodium, Paeonia peregrina."

Description according to EUNIS (Evans & Roekaerts 2015): "*Description: Forests or woods of submediterranean climate regions and supramediterranean altitudinal levels, and of western Eurasian steppe and substeppe zones, dominated by deciduous or semideciduous thermophilous Quercus species or by other southern trees such as Carpinus orientalis and Ostrya carpinifolia . Thermophilous deciduous trees may, under local microclimatic or edaphic conditions, replace the evergreen oak forests in mesomediterranean or thermomediterranean areas, and occur locally to the north in central and western Europe. Plant communities: Aceri granatensis-Quercion fagineae, Aceri tatarici-Quercion, Genisto germanicae-Quercion, Junipero excelsae-Quercion pubescentis, Quercion broteroi, Quercion ilicis, Quercion pyrenaicae, Quercion pubescenti-sessiliflorae, Querco rotundifoliae-Oleion sylvestris."*

"*Species G1.73: Ostrya carpinifolia, Carpinus orientalis, C. betulus, Fraxinus ornus, Quercus pubescens, Quercus virgiliana. G1.74: Quercus cerris, Q. petraea, Ostrya carpinifolia, Carpinus orientalis, C. betulus, Fraxinus ornus. G1.7C2: Carpinus orientalis, Fraxinus ornus, Cotinus coggygria, Oryzopsis holciformis, Oxytropis virescens, Stachys leucoglossa, Paeonia peregrina, Salvia ringens, Cornus mas, Quercus pubescens."*

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Several EU Habitats Directive Annex I types with thermophilous oak woods are included into this wide EUNIS type: 91AA* Eastern white oak woods, 91B0 Thermophilous Fraxinus angustifolia woods, 91H0 Pannonian woods with Quercus pubescens, 91I0 Euro-Siberian steppic woods with Quercus spp, 91M0 Pannonian-Balkanic turkey oak –sessile oak forests, 91N0 Pannonic inland sand dune thicket (Junipero-Populetum albae), 91Z0 Moesian silver lime woods, 9230 Galicio-Portuguese oak woods with Quercus robur and Quercus pyrenaica, 9240 Quercus faginea and Quercus canariensis Iberian woods, 9250 Quercus trojana woods, 9310 Aegean Quercus brachyphylla woods and 9350 Quercus macrolepis forests.

Fig. 58. 91AA *Eastern white oak woods above Brajcino. Old trees especially have a great importance for biodiversity. Photos: Kimmo Syrjänen.

Occurrence of the habitat type in the Pelister National Park

European White oak woods contain species of *Quercus* section *Quercus* with non-bitter acorns that ripe within 6 months and leaves of the species have rounded leaf lobes. These species include the sessile oak *Quercus petraea*, the pedunculate oak *Q. robur*, the Pyrenean oak *Q. pyrenaica* and the downy oak (or pubescent oak) *Q. pubescens*. *Q. pyrenica* does not grow in the Balkans. *Q. robur* grows in a few places in Macedonia but it is very rare in the Pelister National Park. On the other hand, *Quercus petraea* and *Q. pubescens* are rather common in the Park. White oak woods are located in lower altitudes and close to the borders of the Pelister National Park. They are characterized by the presence of *Quercus pubescens* and *Quercus petraea*, but the Turkey oak (or Austrian oak)(*Quercus cerris*) and the Hungarian (or Italian) oak (*Quercus frainetto*) occur often in these forests.

In the Pelister National Park the Eastern white oak woods are connected and partly mixed/overlap with 9280 "Quercus frainetto woods" that are mainly present at the more higher elevation of the oak zone just below and sometimes mixed with the Moesian beech forests 91W0. These woods with several *Quercus frainetto* tree individuals in a stand belong to the 9280 "Quercus frainetto woods". The Hungarian oak is typical for the Balkans and it grows on acidic soils that are common at the Pelister National Park. This may be the reason for the typical mixed stands with white oaks in the region. *Ostrya carpinifolia*, *Fraxinus ornus* and *Carpinus betulus* can sometimes be characteristic for the Eastern white oak woods. *Ostrya* and *Fraxinus* are specific in most thermophilic slopes with more or less stunted white oaks in surroundings.

In an article by Čarni (2016) on the Balkan deciduous forests these both HD habitat types are handled among thermophilous forests dominated by *Carpinus orientalis*, *Ostrya carpinifolia*, *Quercus cerris*, *Q. frainetto*, *Q. petraea* and *Q. pubescens*. According to Čarni (2016) these forests are classified within *Quercetea pubescentis* and *Quercetalia pubescenti-petraeae*. During 2018 Twinning and UNDP experts visited an oak wood above the village Rotino with *Quercus petraea* (and *Q. cerris*) living on acidic soil. In Čarni (2016) acidophilous oak dominated forests are classified into the group of acidophilous oak and birch-oak forests on nutrient poor soils, Quercetea roboris-petraeae. We include this stand of Rotino also into the Eastern white oak woods based on definition of Čarni (2016) "…while in the eastern part acido-thermophilous oak forests belong to the group of

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thermophilous deciduous forests and are classified within the class Quercetea pubescentis." Technically all oak woods at the Pelister National Park could be described as Eastern white oak woods. This would be a practical solution while mapping, monitoring and managing oak woods.

Fig. 59. Old, large and hollow living or dead oak trees have a very high conservation value and importance for biodiversity. These "habitat trees" produce habitats for birds, mammals (including bats), lichens, bryophytes, fungi and a vast amount of invertebrate species. Oak woods have a lot of specialist species including insects, fungi (mycorrhizal, saprophytes) and lichens. Maintenance and formation of forests with old trees and decaying wood should be improved by management planning and actions. Photo: Kimmo Syrjänen.

Vascular plant communities and typical species of 91AA* in Macedonia

In the past, some of the plant communities of the cl. *Quercetea pubescentis* are taxonomically revised and harmonized with the Code for Phytocenological Nomenclature (Matevski et al., 2008, 2011).

Plant communities: *Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959, *Quercetalia pubescenti-petraeae* Klika 1933, *Carpinion orientalis* Horvat 1958 (ass. *Querco cocciferae-Carpinetum orientalis* Oberd. 1948

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em. Ht. 54, ass. *Querco-Carpinetum orientalis* Horv. 1954*, ass. Quercetum trojanae* Horvat 1959*, ass. Phillyreo latifoliae-Carpinetum orientalis* Bergmeier & Dimopoulos 2008, ass. *Querco pubescentis-Ostryetum carpinifoliae* Horvat 1938); *Fraxino orni-Ostryion* Tomažič 1940 (*Seslerio robustae-Ostryetum* Matevski et al. 2011); *Quercion confertae* Horvat 1958 (ass*. Carpino orientalis-Quercetum frainetto* (Rizovski 1978) Matevski et al. 2008, ass. *Quercetum frainetto-cerris* Horvat 1954); *Quercion petraeo-cerridis* Lakušić et B. Jovanović in B. Jovanović et al. ex Čarni et Mucina 2015 (ass. *Fraxino orni-Quercetum petraeae* Em 1968, ass. *Ostryo carpinifoliae-Quercetum cerris* Redžepi et Ružić ex Matevski et al. 2011, ass. *Fraxino orni-Quercetum cerris* Stefanović 1968.)

Typical species: *Quercus pubescens*, *Quercus cerris*, *Quercus virgiliana*, *Quercus frainetto*, *Quercus petraea*, *Cornus mas*, *Malus florentina*, *Ostrya carpinifolia*, *Sorbus torminalis*, *Melica uniflora*, *Acer tataricum*, *Aremonia agrimonoides*, *Clinopodium vulgare*, *Fraxinus ornus*, *Galium pseudoaristatum*, *Geum urbanum*, *Lathyrus niger*, *Lathyrus venetus*, *Poa nemoralis*, *Potentilla micrantha*, *Helleborus odorus*, *Lychnis coronaria*, *Silene italica*, *Symphitum tuberosum*, *Tamus communis* and *Trifolium pignantii*.

Fig. 60. An oak wood at an acidic soil above the Rotino village. Tree layer includes *Quercus petraea* and *Q. cerris. Pinus peuce* and *Abies borisii-regis* are spreading into this forest. This stand is included into the Eastern white oak woods. Photo: Kimmo Syrjänen.

Habitat directive species and other important species

91AA* is important for many insect species of the Habitat Directive including *Morimus funereus*, *Cerambyx cerdo*, *Rosalia alpina* and *Lucanus cervus*. It is important for many epiphytic lichens and bryophytes such as *Lobaria pulmonaria*, *Peltigera colllina*, *Pertusaria flavida* and *Collema* spp. Old hollow trees are important also for bats and oaks host a large amount of mycorrhizal, polypore and many other fungi. *Cephalanthera longifolia* orchid seems to favour white oak woods at the Pelister National Park.

Inventory and Monitoring

The Standard Field Inventory Form for forests should be used in inventories and monitoring. Inventory information should be collected on GPS polygons/monitoring plots inside the studied forest stands. These polygons should be based on a forestry plan of the Pelister National Park. Repeated visits and iteration of

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inventory at the same site is a basic method of monitoring. Suitable monitoring period is between 5-10 years for this habitat type. Forests stands with different ages, management history, forestry activity and altitudinal position should be taken into account during monitoring.

Fig. 61. *Cephalanthera longifolia* grows in oak woods at the Pelister National Park. Photo: .

Threats and pressures

Present oak woods usually have a historical background as being more open due to grazing. In some places the dispersal of more shade tolerant species like *Abies borisii-regis* can slowly change the oak wood stands. At the northern slope of the Pelister National Park *Pinus peuce* and *Fagus sylvatica* also produce saplings under oak stands and can replace oaks given long enough. Formations of oak stands with large trees and the accumulation of dead trees are prevented by selective and sanitary cuttings and sites with ancient woodland characteristics are nowadays scarce. At the northern part of the Pelister National Park in Gjavato there are planted conifer stands at sites that are typically oak woods. Even selective cuttings can be harmful to oak woods because mainly large trees are removed and no big old trees are formed, and decaying logs and dead standing trees are easily smashed in cuttings if they are present.

Range

This habitat type is found scattered at several parts of the Pelister National Park. It is not present at the Prespa Lake conservation area, but is found in the vicinity of the Galitcitca National Park. There are also stands of the Eastern white oak woods at the western slopes of the Baba massif that are outside of the Pelister National Park.

Area

Area of this habitat type seems to be stable in the Pelister National Park. The total area of oak woods in the Pelister National Park is about 1400hectares and about 1100 hectares belong to 91AA* and 300 ha to 9280.

Structure and function

Oak forests are present at the lower part of the Pelister National Park and they have been used intensively since prehistorical and historical times and even after the establishment of the Park. Old management of oak forests

may have included coppicing, pollarding and trimming of oak trees (Ellenberg 1988). Oak woods at the Pelister National Park may be of ancient origin, but primary forests with very long continuity of canopy forming trees do not exist and also old-grown secondary forests are rare. Oaks need light to grow into large individuals with a wide canopy. Growth of these trees has usually taken place at a more open location than is possible inside the present stands. The number of old stands with large dead trees, very old, big and living or partly decaying individuals is very small at the Pelister National Park. Oak woods with old growth characteristics are mainly present nearby monasteries and these sites have a high importance for biodiversity.

There are no severe threats to this habitat type at the Pelister National Park, excluding forestry.

Oak woods that have old trees that are either dead or alive should be left intact or managed in a way that supports formation of old oaks in the Pelister National Park.

Management principles

Highest priority should be given to management plans that encourage the formation of old oak woods with ample amount of decaying wood. All forestry actions in oak woods should be based on plans to increase biodiversity. At the northern part of the Pelister National Park in Gjavato coniferous plantations should be removed and let to change into oak woods naturally or by planting oaks in order to speed up the natural succession. (this measure need special attention)

There are stands of Eastern white oak close to the borders of the Pelister National Park that should be included into the Natura 2000 area. Some naturally formed young stands are also present between the Prespa Lake and the Pelister National Park that form corridors between these two conservation areas.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	U1
Structure and function	U2
Future prospects	U1
Overall assessment of Conservation Status	**U2**

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EUNIS Fact Sheet: Eastern white oak woods

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91W0 Moesian beech forests

Status in Europe		
Habitats directive, Annex I	Habitat type:	91W0
G1.6b Fagus woodland on acid soils		
Threat status in EU28+	Near threatened (IUCN)	NT
Threat status in EU28	Near threatened (IUCN)	NT
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Atlantic	Not present	-
Black Sea	Not present	-
Boreal	Not present	-
Continental	Unfavourable-Inadequate	U1
Macaronesian	Not present	-
Mediterranean	Not present	-
Pannonian	Not present	-
Steppic	Not present	-

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *"1) Fagus sylvatica or Fagus moesiaca forests of the Balkan Range, the southern Dinarides, the Moeso-Macedonian mountains, the Pelagonids and the Rhodopids of the alliance Doronico orientalis-Fagion moesiaci (syn. Fagion moesiacum). Fagus sylvatica is accompanied, at the higher altitudes and latitudes, by Abies alba and Picea abies. The forests have, even in the south of their range, a pronounced medio-European character, marked by the frequency of species such as Acer pseudoplatanus, Quercus petraea, Fragaria vesca & Oxalis acetosella."*

"2) Plants: Fagus moesiaca, Fagus sylvatica, Luzula luzuloides, Luzula sylvatica, Lerchenfeldia flexuosa, Calamagrostis arundinacea, Prenanthes purpurea, Festuca drymea, Dicranum scoparium, Galium odoratum, Cardamine bulbifera, Lamiastrum galeobdolon, Impatiens noli-tangere, Pulmonaria rubra, Mercurialis perennis, Symphytum tuberosum, Sanicula europaea, Lunaria rediviva, Oxalis acetosella, Allium ursinum."

There is already a fact sheet available of this habitat type for the Republic of Macedonia (Matevski et al. 2017). Presented here is the situation for the Pelister National Park.

Occurrence of the habitat type and related types in the Pelister National Park

Habitat type 91W0 "Moesian beech forests" is very common and abundant in the Pelister National Park covering approximately 30% (3286 ha) of the territory of the Park (Avramoski 2006a). Beech mainly grows in pure stands at Pelister but also in mixed forests with beech as a co-dominant species. Mixed beech-oak forests (Fagus–Quercus) and beech-silver fir forests (Fagus–Abies borisii-regis) are present at the Pelister National Park. Beech forests form mosaics with oak forests especially at the southern and western slopes of the Pelister Mountain, where in the upper parts of the oak zone mixed stands exist. Some of these stands belong to the habitat type 9280 "Quercus frainetto woods". Mixed stands with fir are rare in the Pelister National Park. Due to the presence of *Abies borisii-regis* as the only fir species in the area, these mixed forests belong to the type 9270 "Hellenic beech forests with *Abies borisii-regis*". In ravines and brook valleys beech forests integrate into forests with *Carpinus betulus, Acer* spp., *Tilia cordata* or more rarely with scattered elms *Ulmus glabra* and *Ulmus laevis.* These stands belong often to the 9180* "Tilio-Acerion forests of slopes, screes and ravines." At sun exposed rocky slopes there are small stands of low growing *Ostrya carpinifolia*, *Fraxinus ornus* (Ostryo-Carpinion orientalis) and *Quercus pubescens* in middle of the beech forests. The latter stands belong mostly into the 91AA*

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"Eastern white oak woods". Occasional trees and more often saplings of beech are found widely at coniferous forests of Pelister. Sometimes there are stands of aspen (*Populus tremula*) inside a Moesian beech forest in the Pelister National Park. With old and decaying trees also these aspen stands have a high conservation value.

Fig. 62. Old and large living, hollow or dead beech trees are extremely important for biodiversity. These "habitat trees" produce habitats for birds, mammals (including bats), lichens, bryophytes, fungi and a vast amount of invertebrate species. These structural components are commonly present in beech forests with natural dynamics. Their formation in selectively cut stands should be enhanced by leaving retention trees and retention tree groups in forestry planning and practices. Photos: Kimmo Syrjänen.

Vascular plant communities and typical species of 91W0

In accordance with the new classification system presented in the monograph "Vegetation of Europe: hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities" (Mucina et al., 2016) the belonging of beech forests from the territory of the Republic of Macedonia is within the class Carpino-Fagetea sylvaticae Jakucs ex Passarge 1968 (Syn.: Querco-Fagetea Br.Bl. et Vliegar 1937), order Fagetalia sylvaticae Pawl. 1928; alliance Geranio striati-Fagion Gentile 1970 and Fagion sylvaticae Luquet 1926. The sub-mountain Beech region is present between 1100-1300 m a.s.l. (area of the climate-zonal community, ass. *Festuco heterophyllae-Fagetum*) while the mountain Beech belt spreads between 1300 and 1800 m a.s.l. (the area of the climatogenic ass. *Calamintho grandiflorae-Fagetum*) and is formed by various communities of Beech and Beech-Fir forests.

The "Beech region" covers the mountainous areas between 1000-1700 m a.s.l. (about 22% of the total forested area in Republic of North Macedonia). It may be differentiated into a sub-mountain and a mountain belt. The sub-mountain Beech region is present between 1000-1300 m a.s.l. (an area of the climate-zonal community, ass. *Festuco heterophyllae-Fagetum*), but on warmer sites they can reach up to 1500 m a.s.l. and on shaded sites up to 800 m a.s.l.. According to Matevski et al. (2011), forests of ass. *Festuco heterophyllae-Fagetum* grow on deep, fresh soil with plenty of nutrients over carbonate or silicate bedrocks. Only on sites where bedrock comes to the surface is it replaced by *Aceri obusati-Fagetum*. In *Festuco heterophyllae-Fagetum* the dominant species is beech, but sometimes it is codominated by *Acer obtusatum* (Rizovski & Džekov 1990). Typical vascular species

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in the sub-mountain Beech region are: *Fagus sylvatica*, *Festuca heterophylla*, *Brachypodium sylvaticum*, *Euphorbia amygdaloides*, *Melica uniflora*, *Poa nemoralis*, *Doronicum columnae*, *Cephalanthera damasonium*, *Anemone nemorosa*, *Aremonia agrimonoides* and others.

The mountain belt spreads between 1300 and 1700 m a.s.l. (the area of the climatogenic ass. *Calamintho grandiflorae-Fagetum*) with the next species composition: *Fagus sylvatica*, *Clinopodium grandiflorum*, *Festuca drymea*, *Galium odoratum*, *Cardamine bulbifera*, *Neottia nidus-avis*, *Secale montanum*, *Actea spicata*, *Sanicula europaea*, *Lamium galeobdolon*, *Rubus hirtus*, *Lathyrus venetus* and others.

According to Matevski et al. (2011), *Calamintho grandiflorae-Fageteum* is the most widespread beech forest community. It forms the montane forests in North Macedonia in a vegetation belt from 1300 to 1700 m a.s.l.. On northern slopes it can be found even lower, as well as at higher altitudes on southern sites. In the montane vegetation belt, dry periods do not appear during summer, and the winter frost is not so hard either. Fogs often appear and snow lies till late spring. These are the right site conditions for beech forests. These forests can be found in all aspects and on various bedrocks. The only requirement is that the soil layer is deep and fresh and that there are sufficient amount of nutrients. These forests are very productive, fairly well preserved and easy to approach; they rejuvenate successfully and are an important source of wood (Rizovski & Džekov 1990). As already said, it has been decided to follow the widely accepted syntaxonomical scheme in the region, and therefore we validate the name in current use.

Typical vascular plant species of beech forests in the Pelister National Park include *Fagus sylvatica*, *Rubus* spp., *Symphytum tuberosum*, *Euphorbia amygdaloides*, *Sanicula europea*, *Lamium (Lamiastrum) galeobdolon*, *Galium odoratum*, *Lapsana communis*, *Prenanthes purpuraea*, *Neottia nidus-avis*, *Lathyrus laxiflorus*, *Helleborus odorus*, *Mycelis muralis*, *Dryopteris filix-mas*, *Aremonia agrimonioides*, *Fragaria vesca*, *Corylus avellana*, *Sedum magellense*, *Cyclamen hederifolium*, *Brachypodium sylvaticum*, *Milium effusum*, *Epilobium montanum*, *Calamagrostis arundinacea*, *Poa nemoralis*, *Festuca altissima*, *Luzula sylvatica* and *Hedera helix.*

Habitat directive and other important species

Especially beech woods with old and decaying trees are of high ecological importance due to their role as significant habitats for a number of threatened species. These forests together with old oak forests host for example the Habitat Directive beetle species *Morimus funereus* and *Rosalia alpina* in the Pelister National Park. These extensive beech forest stands are also important for large carnivores like the brown bear (*Ursus arctos*) and the wolf (*Canis lupus*) and their prey species at the Pelister National Park. Old trees are important for many lichens and fungi and old hollow trees are important for bats.

Inventory and Monitoring

Standard Field Inventory Form for forests should be used in inventories and monitoring. Inventory information should be collected on GPS polygons/monitoring plots inside the studied forest stands. These polygons should be based on a forestry plan of the Pelister National Park. Repeated visits and iteration of inventory at the same site is a basic method of monitoring. Suitable monitoring period is between 5-10 years for this habitat type. Forest stands with different ages, management history, forestry activity and altitudinal position should be taken into account during monitoring.

Threats and pressures

Beech is a shade tolerant climax tree that is a good competitor at montane and subalpine areas. There are no severe threats to this habitat type at the Pelister National Park, excluding forestry. Even selective cuttings can be harmful to this habitat type because large trees are removed preventing big old trees to form, while decaying logs and dead standing trees are easily smashed if they are present. Beech forests managed with traditional shelterwood systems are of relatively low value for the conservation of most species groups (Brunet et al. 2010). In addition to forest cuttings, construction of forest roads and hydroelectric powerplants has negatively impacts to this habitat type at the Pelister National Park. Effects of climate warming on this habitat type are not entirely known, but it seems likely that water deficiency during the growing period will limit the distribution in the southern European lowlands (see Peters 1997). This may cause reduction of the habitat type especially at lower

parts of the Pelister National Park if it is not compensated by increased precipitation and spreading of beech forests to higher altitudes.

Range

This habitat type is found throughout the Pelister National Park and in several other places along North Macedonian mountain slopes and subalpine areas. In addition to the Pelister National Park stands, it occurs naturally along the mountain ranges of Macedonia both inside and outside conservation areas (see Matevski et al. 2017).

Area

Area of this habitat type seems to be quite stable in the Pelister National Park. Beech can colonize oak and *Pinus peuce* forests, but there are no big negative changes going on. The total area of Moesian beech forests in the Pelister National Park is a bit over 500 hectares. It is the most common forest habitat type in the National Park.

Structure and function

Natural regeneration of European beech forests is based on gap-dynamics. In natural conditions primeval beech forests stands are not even-sized, but unevenly structured (Rugani et al. 2013). According to Rugani et al. (2013), this is due to the fact that the disturbance regime is characterized by low intensity, small-scale disturbances. Stand structure, mean tree age, deadwood amount and microclimate are different in primeval and managed stands of beech forests. In a study made in Slovakia it was observed that all development stages of the primeval beech forests were more species-rich in epiphytes and, when investigating larger plot numbers, also in vascular plants than the cultivated forests (Kaufmann et al. 2018). Mixed forests with silver fir (*Abies alba*) are also found in middle and Southeast Europe in natural conditions (Brunet et al. 2010, Nagel & Svoboda 2008) and these stands are also very valuable for biodiversity. In the Pelister National Park beech forests are managed with selective cuttings, so that large individuals or biggest stems of stem groups are removed from the forest stand leading eventually to an even-sized forest structure. Selective cuttings at slopes are good to prevent erosion and the vascular plant composition remains quite stable. However, several structural forest characteristics (including formation of old big trees and coarse woody debris) and species typical for primeval and near-natural beech forests are lost also in selective cuttings. It is probably the selectively harvested stands with many retention trees that approach the overall biodiversity of an old-grown beech forest (Brunet et al. 2010).

Management principles

Forestry at beech forests has a very high socio-economic importance in the Pelister National Park (Avramoski 2006a) by producing firewood and timber for local municipalities and for the economy of the National Park. There are some beech forest stands with old-growth characteristics near Vrteshka, southeast of the St. Ana monastery (Avramoski 2006a). Also at the upper reach of the Brajzino river valley there is a near-natural beech forest with plenty of decaying wood at a strictly protected zone of the Park. Along Stara Buka there also seems to be small beech forest fragments with near-natural conditions. Inventories at beech forests along slopes and ravines at the Pelister National Park should be done as soon as possible. All sites with old-growth characters or occurrences of rare and threatened species should be protected and left completely aside from forestry. The same recommendation was already given in the 2006 management plan (Avramoski 2006a).

In managed even-sized and even-aged stands there are several possibilities to increase biodiversity and the natural function of a beech forest ecosystem (Brunet & Isacsson 2009, Brunet et al. 2010), while cutting wood for economic purposes. These forestry management technics include e.g. retention trees and retention tree groups. Special attention during cuttings should be placed on maintaining existing dead trees and at the same time for the production of dead wood e.g. by girdling and by producing high stumps/snags. In addition to large enough number of retention trees, natural regeneration can be enhanced by cutting gaps. Gap size analysis of primeval beech forests by Rugani et al. (2013) showed that gaps smaller than 500 m^2 are the dominant driving force of stand development at natural beech forests. The amount of coarse dead wood should be over 20 m^3 per hectare to keep saproxylic species viable (Brunet et al. 2010). Inside the conservation areas sanitary cuttings are not needed. Naturally formed dead wood should be saved. These technics increase conservation values and

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allow timber production at the same time for several decades inside the conservation areas. The final goal is to have natural beech forests without forestry and other management plans for the most part of the Pelister National Park.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	FV
Structure and function	U1
Future prospects	U1
Overall assessment of Conservation Status	**U1**

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91BA Moesian silver fir forests

Status in Europe		
Habitats directive, Annex I	Habitat type:	91BA
G3.1b Temperate mountain Abies woodland		
Threat status in EU28+	Least concern (IUCN)	LC
Threat status in EU28	Near threatened (IUCN)	NT
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Atlantic	Not present	-
Black Sea	Not present	-
Boreal	Not present	-
Continental	Unfavourable-Inadequate	U1
Macaronesian	Not present	-
Mediterranean	Not present	-
Pannonian	Not present	-
Steppic	Not present	-

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *"*Forests of *Abies alba* or of *Abies alba* mixed with *Fagus sylvatica, Picea abies, Pinus sylvestris* or *Pinus nigra* of the Rhodopides, the Balkan Range and the Meso-Macedonian mountains within the geographical range of Fagion moesiacum forests. Located mainly on the northern slopes of the mountains on acidic well-drained soils with high moisture, they occur as a relatively thin line between the beech and the coniferous vegetation belts." Subtypes include 42.162 Moeso-Macedonian fir forests (PAL.CLASS).

Description according to EUNIS (Evans & Roekaerts 2015) Moesian *Abies alba* forests Forests of *Abies alba* or of *Abies alba* mixed with *Fagus sylvatica*, *Picea abies*, *Pinus sylvestris* or *Pinus nigra* of the Rhodope Mountains, the Balkan Range, the Moeso-Macedonian mountains and the Pelagonids, within the geographical range of Fagion moesiacum forests. Stands where Fagus sylvatica is co-dominant are treated under 61.6 Fagus woodland.

In Macedonia silver fir trees almost exclusively belong to *Abies borisii-regis* species. Thus into the habitat type 91BA are included forests that are dominated by *Abies borisii-regis* and are often in the Pelister National Park as a result of natural succession of *Pinus peuce* forests. This type is present in the Pelister National Park, mainly at the northern slopes of Mt. Pelister at altitudes from 1200 to 1800 m a.s.l.. There are only a couple of old-growth stands, but instead several successional stages with still a lot of *Pinus peuce* individuals. Sometimes scattered individuals of *Fagus sylvatica* and *Acer* spp. including *Acer heldreichii* are found in these forests. In the upper parts of *Abies borisii-regis* forests it is possible to find fixed stands with *Fagus moesica*. These stands belong to the type 9270 "Hellenic beech forests with *Abies borisii-regis*". However, in the future it will be necessary to define the boundaries of these two habitat types (9270 and 91BA) more precisely. Namely, the question is whether the community with *Abies borisii-regis* should be included in the habitat 9270 "Hellenic beech forests with Abies borisii-regis" or to the habitat 91BA "Moesian silver fir forests".

Vascular plant communities and typical species of 91BA in the Pelister National Park.

In these forests both temperate and boreal species are found, but at lower elevations temperate species are dominant whereas boreal species dominate the upper elevations. Typical species of the 91BA in Pelister National

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Park include *Sanicula europaea*, *Melica uniflora*, *Aremonia agrimonioides*, *Euphorbia amygdaloides*, *Helleborus odorus, Rubus hirtus*, *Sorbus aucuparia*, *Brachypodium sylvaticum*, *Mycelis muralis*, *Prenanthes purpurea*, *Galium rotundifolium*, *Geranium macrorrhizum*, *Cardamine bulbifera*, *Doronicum columnae*, *Oxalis acetosella*, *Hieracium* sp., *Geranium robertianum*, *Milium effusum*, *Calamagrostis arundinacea*, *Vaccinium myrtillus*, *Rhytidiadelphus triquetrus*, *Dicranum polyphyllum*, *Dicranum scoparium* and *Hylocomium splendens.* In the upper parts boreal species such as *Vaccinium myrtillus* are prevailing.

Fig. 63. 91BA Moesian silver fir forests is present especially at the northern slopes of the Pelister National Park (Mt Baba /Pelister) and above Magarevo, Rotino and Capari villages.This habitat type is successional climax phase of coniferous forests at subalpine growing sites with moist microclimate and mesic soils. In near-to-natural stands there is a lot of coarse deadwood. Photos:

Habitat directive species

One Moesian silver fir forest stand close to Pali Snopje hosts a viable population of Green Shield moss (*Buxbaumia viridis*) and *Cucujus cinnabarinus* beetles. This site is also important to woodpeckers such as the Black Woodpecker (*Dryocopus martius*).

Inventory and Monitoring

Standard Field Inventory Form for forests should be used in inventories and monitoring. Inventory information should be collected on polygons inside the studied forest stands. Repeated visits and iteration of inventory at same site is a basic method of monitoring. Suitable monitoring period is between 5-10 years for this habitat type.

Threats and pressures

Inside the Pelister National Park selective cuttings can be a threat if not taken into account in the management plan. There are no natural threats for this habitat type. Sporadic insect outbreaks belong to successional dynamics of coniferous forests and increase the biodiversity at the National Park. Climate warming can increase tree mortality.

Range

This habitat type is found in a few sites in Macedonia. In addition to the Pelister National Park it occurs in Šar Mountain, Rudoka, Bistra, Jakupica, Karadzica, Korab, Galichica, Pelister, Nidze, Dudica, Kozuf, Belasica (Micevski, 1985). Matevski et al. (2011) consider in their monograph on forest vegetation on Mount Galichica,

that the community with the fir trees (*Abies boris-regs*) should be validated in accordance with the previous proposal from Em and give the following combination - *Abieti borisii-regis-Fagetum* (Em 1985) Matevski et al. 2011.

Area

Area of this type is stable or naturally increasing in the Pelister National Park. Estimated area of this habitat type is at Pelister National Park about 700 hectares that includes also some planted (sown) fir forests.

Structure and function

Natural structure consists of old-growth stands with plenty of decaying wood, but also of the continuous regeneration in gaps. Because *Abies borisii-regis* is a shade tolerant species it can replace other tree species and forest habitat types in successional dynamics. Due to the complex land-use history at the Pelister area the present amount of old-growth or near to natural stands of Moesian silver fir forests are low and far from the natural situation. It is already noted in the Plan of Management (Avramoski 2006) that within the old forest stands the fir (*Abies borisii-regis*) is gradually outcompeting the Macedonian Pine (*Pinus peuce*). Also in many middle aged Macedonian Pine stands at the northern slope of Pelister there is usually a more or less dense undergrowth formed by young Moesian silver firs and saplings.

Fig. 64. 91BA Moesian silver fir forests. **a)** Regeneration of *Abies borisii-regis* at gaps (created by windfalls and/or dead standing trees). **b)** Near-to-natural forests are characterized by multi-aged stands with uneven distribution of trees. Photos: Kimmo Syrjänen.

Management principles

Inside the Pelister National Park selective cutting or other forestry practices of Silver fir forests with old-growth characteristics should not be allowed even during insect outbreaks. Without management some *Pinus peuce* forests at Pelister will change in time to *Abies borisii-regis* forests. This is a natural process and should allowed in selected sites. However, it is important to make the selection of which stands are let to develop naturally and which are artificially kept in different habitat type (e.g. *Pinus peuce* forests) by management actions. These decisions are important in management and forestry plans.

Conservation status (a draft based on the Twinning project study area)

Range (of the distribution area)	FV
Area	FV
Structure and function	U1
Future prospects	FV
Overall assessment of Conservation Status	**U1**

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95A0 High oro-Mediterranean pine forests

Status in Europe		
Habitats directive, Annex I	Habitat type:	95A0
G3.6 Mediterranean and Balkan subalpine Pinus heldreichii-Pinus peuce woodland		
Threat status in EU28+	Least concerned (IUCN)	LC
Threat status in EU28	Near threatened (IUCN)	NT
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Atlantic	Not present	-
Black Sea	Not present	-
Boreal	Not present	-
Continental	Not present	-
Macaronesian	Not present	-
Mediterranean	Unfavourable-Inadequate	U1
Pannonian	Not present	-
Steppic	Not present	-

Definition

The Interpretation Manual of European Union Habitats (EU Commission 2013): *"1) Balkan endemic forests of Pinus heldreichii or Pinus peuce, restricted to the southern Balkans, Northern Greece and Southern Italy. Accompaning species are Picea abies, Pinus sylvestris, Pinus mugo with understory including Juniperus sibirica, Vaccinium myrtillus, Calamagrostis arundinacea, Brachypodium pinnatum, Luzula luzuloides, Luzula sylvatica, Geranium macrorhizum.*

Subtypes:

42.71 White-barked pine forests

Local treeline formations of Pinus heldreichii restricted to the southern Balkans, northern Greece and southern Italy, usually open and with an undergrowth formed by stripped grasslands on dry, often stony or rocky soils.

42.72 Macedonian pine woods

Pinus peuce formations (Pinion peucis), restricted to the subalpine zone of the high mountains of the Balkan peninsula south to extreme northern Greece (Voras, Varnous, Rhodope)."

The description according to EUNIS (Evans & Roekaerts 2015): "G3.6 Subalpine mediterranean Pinus woodland with the same contents. Plant communities: Pinion peucis, Pinion heldreichii. Species: G3.61: *Pinus heldreichii*, *Pinus leucodermis*, *Brachypodium pinnatum*, *Festuca penzesii*, *Calamagrostis arundinacea*, *Orthilia secunda*. G3.62: *Pinus peuce*, *Vaccinium myrtillus*, *Luzula sylvatica*, *Calamagrostis arundinacea*, *Pinus mugo*."

There is already a fact sheet available of this habitat type for the Republic of Macedonia (Matevski et al. 2017). Presented here is the situation for the Pelister National Park.

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Fig. 65. 95A0 High oro-Mediterranean pine forests are typical for the Pelister National Park. Conservation value of this habitat type with the Macedonian Pine (*Pinus peuce*) is high. Conservation of natural occurrences of 95A0 at the Pelister National Park is globally important. Photo:

Occurrence of the habitat type and its subtypes in the Pelister National Park

95A0 High oro-Mediterranean pine forests are very common and characteristic for the Pelister National Park. The extensive Macedonian Pine (*Pinus peuce*) forests at Pelister National Park are the most important habitats of this type in the Balkans and globally as well (Avramoski 2006). The Macedonian Pine – Molika – has been described by August Grisebach in 1846. Type specimen is based on material collected by him from an area of the present Pelister National Park near Hotel Molika above Magarevo village. At that time trees were young and low. Now at the same place grows probably the oldest Macedonian Pine forests of the Pelister National Park with some large trees over 200 years old. In the Pelister National Park Macedonian Pine forests are most common on the northern slopes on siliceous soils. In addition to the natural regeneration and dynamics, these forests have been increased by forestry actions during the Yugoslavian era and all the forests are not of natural origin. Undergrowth varies from herb-rich sites to rather species poor even-aged stands. In some planted stands undergrowth is almost non-existing because of dense needle litter.

Vascular plant communities and typical species of 95A0 in Pelister National Park

In the National Park Pelister two communities of the Macedonian Pine stand out: the mountain molika forest (Digitali viridiflorae – Pinetum peuces) and the sub-alpine molika forest (Gentiano luteae – Pinetum peuces) (Avramoski 2006). Typical species of mountain forests with temperate distribution at lower altitudes of the Pelister National Park can include: *Melica uniflora*, *Sanicula europaea*, *Cardamine bulbifera* (Syn.: *Dentaria bulbifera*), *Anemone nemorosa*, *Corylus avellana*, *Symphytum tuberosum*, *Euphorbia amygdaloides*, *Clinopodium*

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grandiflorum (Syn. *Calamintha grandiflora*), *Helleborus cyclophyllus*, *Carex* sp., *Galium odoratum* and *Digidalis viridiflora*. Both in lower and subalpine forests the following species can be found: *Prenanthes purpurea*, *Galium rotundifolium*, *Oxalis acetosella* and *Mycelis muralis*. At some sites *Rubus discolor*, *Rubus hirtus* and *Pteridium aquilinum* are dominant in the undergrowth at lower altitudes, but also *Rubus hirtus* is typical. At upper subalpine altitudes undergrowth has a more boreal influence with *Vaccinium myrtillus*, *Calamagrostis arundinacea* and *Juniperus communis* common at the forest bottom. Boreal mosses such as *Rhytidiadelphus triquetrus* can also be found. *Pleurozium schreberi* and *Hylocomium splendens* can occur in these stands.

Habitat directive and other important species

The habitat 95A0 is important for woodpeckers, rare insects, polypores and other fungi living on dead coniferous wood. These forests provide shelter and food for brown bears, wolves and lynxes and for smaller species that serve as their prey. Two occurrences of the Annex II bryophyte *Buxbaumia viridis* has been observed *Pinus peuce* forests in the Pelister National Park. One collection of Habitat Directive Annex beetle *Cucujus cinnabarinus* is from a dead *Pinus peuce*.

Fig. 66. a) *Vaccinium myrtillus* is often dominant at the bottom of subalpine *Pinus peuce* forests. **b)** Dead wood, both standing dead trees and decaying logs, are important for forest biodiversity and an integral part of the natural structure and function of Macedonian Pine forests. Photo: Kimmo Syrjänen.

Inventory and Monitoring

Standard Field Inventory Form for forests should be used in inventories and monitoring. Inventory information should be collected on GPS polygons/monitoring plots inside the studied forest stands. These polygons should be based on a forestry plan of the Pelister National Park. Repeated visits and iteration of inventory at the same site is a basic method of monitoring. Suitable monitoring period is between 5-10 years for this habitat type. Forest stands with different ages, management history, forestry activity and altitudinal position should be taken into account during monitoring.

Threats and pressures

In several places Moesian silver fir (*Abies borisii-regis*) trees are regenerating under *Pinus peuce* and will slowly replace *Pinus peuce* stands with Moesian silver fir forests. Beech (*Fagus sylvatica)* can also be competitively superior over Macedonian Pine, but although altitudinal ranges of these species are partly overlapping there does not seem to be severe competition. In some stands there are scattered young beech trees, but young sweet

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chestnut (*Castanea sativa*) trees or saplings can be found in Molika forests. This can be more common in the future due to changing climate. Warming climate can also enhance insect outbreaks in aging old *Pinus peuce* forests or inside self-thinning younger successional stands. According to Avramoski (2006) occasional avalanches destroy large areas of the Macedonian pine forests. Forestry with sanitary cuttings is also a threat to the biodiversity of these forests. In North Macedonia and also in the Pelister National Park an invasive alien insect Western Conifer Seed Bug (*Leptoglossus occidentalis*) that eat the seeds of coniferous trees is very common. This invasive North American insect can be a threat for the regenerative ability of Macedonian pine and fir in the future.

Range

This habitat type is found in several sites at the Pelister National Park (Em & D`ekov, 1969) and in a couple of other places in North Macedonia. In addition to the Pelister National Park it occurs naturally in Planina - Plat, Jablanica and Nižje - Belo Grotlo (Matevski et al. 2017).

Area

Area of this habitat type is stable or slightly increasing in the Pelister National Park. Due to natural succession new areas are colonized, but at the same time some old stands are decreasing. The total area of Macedonian Pine forests in the Pelister National Park is about 1820 hectares. This is the largest complex of *Pinus peuce* forests in North Macedonia. Only relatively small stands are present on Nidze and Shar Planina, and on Jablanica there are registered individual stems (Matevski et al. 2017).

Structure and function

Altitude span of the habitat ranges from 1100 meters (the zone of the mountain beech) to 2200 meters above sea level (subalpine belt) in Macedonia (Matevski et al. 2017). However, *Pinus peuce* is spreading upwards in the Pelister National Park and some stunted individuals are already scattered close to the top of Mt. Pelister. The natural structure and function of the "95A0 High oro-Mediterranean pine forests" in the Pelister National Park is not well known because the present location and structure of forests are the result of historical events (forest cuttings and grazing through the Ottoman Empire era, events during the World War I and cessation of grazing and forestry measures during the Yugoslavian time era). In many forest stands signs of forestry, including tree stumps and even-aged tree structure are noticeable. The Macedonian Pine seems to have a good dispersal ability and it spreads around boulder screes, overgrowing pastures and meadows, areas of degraded forests of other habitat types or abandoned agricultural land, but can also be found outside the boundaries of the Pelister National Park (Avramoski 2006). It is less shade tolerant than *Abies borisii-regis* or *Fagus sylvatica*, but seems to be regenerating at shadier conditions than *Pinus sylvestris*. Natural dynamics of *Pinus peuce* forests may have included disturbance dynamics caused by avalanches, other snow damages, insect outbreaks, storms with windfalls and forest fires. In comparison to near-to-natural circumstances forests are presently quite young and mostly lack old, dead and decaying trees. Present spreading of *Pinus peuce* is a consequence of decreased grazing and other traditional land use.

Management principles

There are several challenges with the present forest structure and dynamics in Macedonian Pine forests. In the National Park there are relatively few very old *Pinus peuce* forests. Surrounding the hotel Molika and in the Magarevo river valley there is a roughly 200 year old *Pinus peuce* stands. The forest suffers badly from polypore fungi *Phaeolus schweinitzii* causing brown rot at basal parts of trunks. Many old large trees are hollow inside that can lead to quick changes in standing tree volume during storms. This stand can also be prone to insect outbreaks. Dead trees and trunks are important for biodiversity and should be left where they are. Dead trees can be cleared from paths but remaining logs should be left in the surroundings. Regeneration at the Molika site will probably follow when suitable gaps are present. Planting young trees is one way to prepare into future changes.

Some younger stands are even-aged and it is possible to improve the structure and natural regeneration of these stands by cutting. It is also possible to produce gaps through restoration and to create deadwood by girdling

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trees (refs). If tree die because of forest fires, insect damage or avelanches, they should be left to stay and sanitary cutting should be avoided. Deadwood is important for biodiversity and disturbances are an integral part of the natural forest regeneration dynamics.

Due to the increase of shade tolerant *Abies borisii-regis* at *Pinus peuce* forests in the northern slope of the Pelister below the subalpine areas, some forests may need active management to conserve the structure of Macedonian Pine forest, to ensure regeneration of the species and to maintain a local continuity of old large pine trees and dead wood. These stands should be selected in forest management plan and other stands should be left to develop via natural succession.

Although Macedonian Pine forests are spreading up towards the alpine zone they remain stunted at the upper elevations (Avramoski 2006). This expansion is negative to open alpine heath and grassland habitat types. Removal of colonizing *Pinus peuce* at some parts of the upper subalpine areas and maintaining lower altitude populations is one possible management goal. The future maintenance and location of the Macedonian Pine forests at the Pelister National Park depends on decisions done right now. This is an important theme for biodiversity and recreation and needs to be kept in mind while preparing a management plan and forestry plan for this Natura 2000 area.

Conservation status (a draft based on the Twinning project study area)	
Range (of the distribution area)	FV
Area	FV
Structure and function	U1
Future prospects	U1
Overall assessment of Conservation Status	**U1**

References:

Avramoski, O. (ed.) 2006: The Plan of Management for Pelister National Park. – Pelister National Park &

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Species

Mammals

Eurasian Otter (Lutra lutra)

Status in Europe		
Habitats directive, Annex II	Species code:	**4111**
Bern Convention, Annex II		
Protected in many European countries		
Threat status in Europe:	Near threatened (IUCN)	NT
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Atlantic	Unfavourable-Bad	U2
Black Sea	Unfavourable-Inadequate	U1
Boreal	Unfavourable-Bad	U2
Continental	Unfavourable-Bad	U2
Mediterranean	Unfavourable-Inadequate	U1
Pannonian	Favourable	FV
Steppic	Favourable	FV

Ecology, threats and pressures

The Eurasian Otter can be found close to a large diversity of waterbodies. Otters occupy both standing and running waters, and they can also be found along very small streams searching for food. Otters have good dispersal ability and move over long distances. Sometimes they might get killed by cars when crossing roads.

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Fig. 67. The Eurasian Otter (*Lutra lutra*). Photo: Petri Ahlroth.

Methods for the inventory and monitoring

Inventory and monitoring of the Otter is based on active searching for footprints, faeces and other sings of presence in their habitat.

Management recommendations for the sites of occurrence

The Otter is not very sensitive to human activities other than hunting and road traffic. The areas occupied by Otters should be left outside hunting activities, and important areas for Otters should be observed and evaluated when planning roads and other infrastructure.

Justifications for the assessment of conservation status

The distribution range covers the whole country. Populations are strong even though the number of suitable lakes, rivers and small waterbodies is limited. In the future, climate change may increase the risks associated with extreme weather conditions such as long periods of drought. The effects of climate change may be particularly severe on smaller waterbodies, and hence reduce the number of stable, suitable habitats. In addition, fish, crayfish and mussel species that are the typical prey for Otters, are slow colonizers making them especially vulnerable to environmental changes caused by climate change.

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Fig. 68. Observations of the Eurasian Otter (*Lutra lutra*). Its potential habitats are standing and running water habitats, including small streams.

Conservation status	
Range (of the distribution area)	FV
Population	FV
Habitat for the species (quality)	XX
Future prospects	XX
Overall assessment of Conservation Status	**XX**

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EUNIS: https://eunis.eea.europa.eu/species/1435

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Amphibians

The Yellow-bellied Toad (Bombina variegata)

Status in Europe		
Habitats directive, Annex II and IV	Species code:	1193
Bern Convention, Annex II		
Protected in many European countries		
List of protected species of North Macedonia		
Threat status in Europe:	Least Concern (IUCN)	LC
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Atlantic	Unfavourable-Bad	U2
Continental	Unfavourable-Bad	U2
Mediterranean	Favourable	FV
Pannonian	Unknown	XX

Ecology, threats and pressures

The Yellow-bellied Toad inhabits temporary ponds in several habitat types ranging from forests to forest roadsides, open lowland and highland meadows, and sides of lakes and rivers. It can also be found in slightly urbanized environments, such as artificial ponds, ditches and water-filled road trails in small villages and their surroundings. The ponds that the Yellow-bellied Toad inhabits generally lack vegetation and are free of competing species and predators. Through a quick heating-up of these small waterbodies, a rapid development of spawn and larvae is assured. The reproductive season is late spring and early summer, and active season usually continues until as late as October in North Macedonia.

Although highly adaptable and apparently resistant to extreme flooding events, the populations of The Yellow-bellied Toads can be sensitive to droughts (Cayuela et al. 2016a), which can be due to global climate change, or a consequence of direct human activities (e.g. fires, tillage etc.). These unpredictable environmental conditions may cause high variation in inter-annual fecundity and slightly lower annual survival probabilities of both adults and immatures (Cayuela et al. 2016b, c). Furthermore, typical to all amphibians, Yellow-bellied Toads are likely sensitive to pesticides and other toxic chemicals.

Management recommendations for the sites of occurrence

The species is seemingly much more common across North Macedonia, compared to Western Europe, thus urgent management activities are probably not necessary. Nevertheless, the availability of small temporary ponds is critical to its persistence and population growth, and because of their susceptibility to droughts, those ponds already inhabited by the species should be carefully monitored.

Methods for the inventory and monitoring

The Yellow-bellied Toad can actively be searched for and monitored. Potential waterbodies must be identified and mapped. The species can easily be captured by hand, but pond nets can sometimes be helpful. Monitoring Yellow-bellied Toads can also be done simultaneously while monitoring *Triturus spp*. and *Rana dalmatina*. Adult toads are easy to spot in the field and individual identification is easy due to their unique ventral decorations. Photographic identification allows efficient capture-recapture studies and can give accurate statistical estimations of population size (cf. Cayuela et al. 2016a, b, c).

Funded by the European Union

Justifications for the assessment of conservation status

The distribution range covers most of the country. The species is not very demanding and small local populations can be found in many localities with temporary ponds. The total population is thus likely large. In the future Yellow-bellied Toads could face the risk of exposure to chytridiomykosis, the wide use of pesticides and other toxic chemicals, and loss of suitable habitats (temporary ponds) caused by human activities or droughts due to climate change.

Fig. 69. a) Dorsal and ventral view of Yellow-bellied toad (*Bombina variegate*). **b)** Under a threat the animal practices the *unkenreflex* - bolting the limbs upward and exposing the belly's yellow warning colour to potential predators. Photos: Petri Ahlroth.

Conservation status	
Range (of the distribution area)	FV
Population	FV
Habitat for the species (quality)	FV
Future prospects	XX
Overall assessment of Conservation Status	**FV**

References

Cayuela, H., Arsovski, D., Bonnaire, E., Duguet, R., Joly, P., & Besnard, A. (2016a). *The impact of severe drought on survival, fecundity, and population persistence in an endangered amphibian*. Ecosphere, 7(2). https://doi.org/10.1002/ecs2.1246

Funded by the European Union

Cayuela, H., Arsovski, D., Thirion, J.-M., Bonnaire, E., Pichenot, J., Boitaud, S., … Besnard, A. (2016b). *Contrasting patterns of environmental fluctuation contribute to divergent life histories among amphibian populations*. Ecology, 97(4): 980–991. https://doi.org/10.1890/15-0693.1

Cayuela, H., Arsovski, D., Thirion, J.-M., Bonnaire, E., Pichenot, J., Boitaud, S., … Besnard, A. (2016c). *Demographic responses to weather fluctuations are context dependent in a long-lived amphibian*. Global Change Biology, 22(8): 2676–2687. https://doi.org/10.1111/gcb.13290

Fauna Europaea: https://fauna-eu.org/cdm_dataportal/taxon/30e9d19d-23ec-4af9-96a3-0e90f53fee3d

EEA / EUNIS: https://eunis.eea.europa.eu/species/638

Fig. 70. Observations of the Yellow-bellied toad (*Bombina variegate*). The species probably has small and local populations along the lowlands, in places with small waterbodies.

The Herman's Tortoise (Testudo hermanni)

Status in Europe		
Habitats directive, Annex II and IV	Species code:	1217
Bern Convention, Annex II		
Protected in all European countries		
List of protected species of North Macedonia		
Threat status in Europe:	Near threatened (IUCN)	NT
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Black Sea	Unfavourable-Bad	U2
Continental	Unfavourable-Inadequate	U1
Mediterranean	Unfavourable-Inadequate	U1
Steppic	Favourable	FV

Distribution of the species

Widely distributed across the country, up to 1000 meters above sea level.

Ecology, threats and pressures

Herman's tortoise inhabits many types of natural habitats such as meadows, open oak forests and secondary growth forests at sites where the influence of Mediterranean climate is present. They can also be found in urban parks and at the edges of urban environments. The activity period spans from mid-March to early October. Hermann's tortoises are primarily herbivores, but when food is scarce they can also feed on carrion. Mating begins in May and ends in August, with a drop in activity during June.

Tortoises are mainly threatened by habitat loss due to urbanization and agriculture. The limited locomotor capabilities of these armoured animals make them very susceptible to fires as well as vehicles, making roadkill tortoises a common site across roads in North Macedonia. Highways and other prominent roads can therefore fragment populations and reduce genetic diversity. The Hermann's tortoise is listed in CITES, but is nevertheless the target of illegal collection and trafficking. This is mostly due to their popular pet status, as well as their dinner table value in some Asian cuisines. CITES provides some legal shelter for the species, but due to the lack of proper infrastructure and motivation in some countries to implement the convention's legal acts thoroughly, its trafficking continues almost unhindered (Biennial report to the CITES office for 2013–2014;Table 1 in the appendix of Nikolić et al. 2019).

Management recommendations for the sites of occurrence

When planning land use, a mosaic structure of the Herman's tortoise's habitats should be maintained, because habitat destruction is most likely the biggest threat to this species on a national level. In order to further avoid population fragmentation, animal tunnels should be considered when constructing roads through suitable habitats. Man-made fires, particularly those initiated in order to control overgrown agricultural lands should be strictly controlled.

Methods for inventory and monitoring

Funded by the European Union

Adult Hermann's tortoises are conspicuous animals, thus active searching is an efficient method for monitoring. Capturing young individuals can be facilitated with the use of carefully placed artificial refuges, such as fibrocement slabs (Ballouard et al. 2013). Mark-recapture methods can be used for estimating local population sizes, but often repeated counting of all individuals in suitable habitats allow for the comparison of population size or density between years. Nationally, 10 sites counted using mark-recapture methods would already provide the basic data for estimating trends in the national population. For short term assessments (that cover at least one active season) the method of average abundancy index estimation can be used, because it can offer a relatively quick insight into the population status of the species.

Fig. 75. a) Back part of a Herman's Tortoise (*Testudo hermanni*). **b)** Characteristic nail at the tip of a tail. Photos: Petri Ahlroth.

Justifications for the assessment of conservation status

The distribution range of the Hermann's Tortoise covers most of the country and it is not considered rare. The total population appears to be fairly large, but man-made fires, roadkills and habitat fragmentation due to the construction of road infrastructure pose a serious threat to the species. In addition, because it is considered a desirable pet animal, a large number of adult individuals are removed from the wild, further endangering the sustainability of long-lived animal populations (Nikolić et al. 2018).

Conservation status	
Range (of the distribution area)	FV
Population	FV
Habitat for the species (quality)	U1
Future prospects	U1
Overall assessment of Conservation Status	**U1**

Funded by the European Union

Fig. 76. Observations of the Herman's Tortoise (*Testudo hermanni*). The species can be found in large areas around Prespa and Pelister.

References

Ballouard, J.-M., Caron, S., Lafon, T., Servant, L., Devaux, B., & Bonnet, X. (2013). Fibrocement slabs as useful tools to monitor juvenile reptiles: a study in a tortoise species. Amphibia-Reptilia, 34(1): 1–10. https://doi.org/10.1163/15685381-00002859

EEA / EUNIS: https://eunis.eea.europa.eu/species/811

Nikolić, S., Golubović, A., Bonnet, X., Arsovski, D., Ballouard, J.-M., Ajtić, R., … Tomović, L. (2018). *Why and apparently prosperous subspecies needs strict protection? The case of Testudo hermanni boettgeri from the central Balkans*. Herpetological Conservation and Biology, - In press.

Dragonflies

The Balkan Goldenring (Cordulegaster heros)

Status in Europe			
	Habitats directive, Annex II and IV	Species code:	**4046**
	Bern Convention, Annex I		
	Protected in many European countries		
	Threat status in Europe:	Least concern (IUCN)	NT
EU conservation status by biogeographical region			
	Alpine	Favourable	FV
	Continental	Favourable	FV
	Mediterranean	Unknown	XX
	Pannonian	Unfavourable-Inadequate	U1

Ecology, threats and pressures

The Balkan Goldenring lives in small, swift streams and in the forests surrounding them, located usually in the mountainside. It is sensitive to water quality, making the mountain streams its preferred habitat over lowland rivers and streams that are often too polluted. Unfortunately, plans to increase hydroelectric power output and an increase in tourism-caused waste water pose a serious threat to these fragile aquatic habitats.

Management recommendations for the sites of occurrence

Streams and other waterbodies inhabited by the Balkan Goldenring should be protected against hydroelectric power plants and the dumping of waste water. Strong forestry activities should be banned close to these waterbodies and pesticide-free zones should be implemented next to these vital habitats.

Methods for inventory and monitoring

Main method for the inventory and monitoring of this species is active searching of larvae and exuviae from streams and other likely habitats. Additional information can be collected from observing adult individuals. They can be found from the streams where active breeding occurs or from the surrounding forests where adults feed.

Funded by the European Union

Fig. 77. a) The Balkan Goldenring is a large dragonfly that has yellow rings around its black abdomen. This individual was photographed in Pelister NP, SW from Capari village. **b).** Adult males are often found along forest roads at the slopes of mountains. Photos: Petri Ahlroth.

Justifications for the assessment of conservation status

The current distribution covers almost the entire North Macedonia. At the moment there is no data available that would make estimations of the distribution change possible. Based on the habitat requirements of this species, nothing indicates that the size of the population is decreasing. The species' preferred habitats (clean rivers and streams in mountains slopes) are more stable than other aquatic habitats of the area. Currently no remarkable threats for the species are identified.

Conservation status	
Range (of the distribution area)	FV
Population	FV
Habitat for the species (quality)	FV
Future prospects	U1
Overall assessment of Conservation Status	**U1**

Funded by the European Union

Fig 78. Observations of the Balkan Goldenring (*Cordulegaster heros*) in the study area. Currently observations are concentrated along the areas close to Capari. There is also one observation close to the info-centre of NP. It seems likely that there are more inhabited areas for the species, but during this project no other sites were found.

References

Boudot, J.-P. 2010. *Cordulegaster heros. The IUCN Red List of Threatened Species 2010*: e.T158700A5263990. http://dx.doi.org/10.2305/IUCN.UK.2010-1.RLTS.T158700A5263990.en. Downloaded on 31 August 2018.

EEA / EUNIS: https://eunis.eea.europa.eu/species/196469

Butterflies

The Eastern Eggar (Eriogaster catax)

Status in Europe			
	Habitats directive, Annex II and IV	Species code:	1074
	Bern Convention, Annex II		
	Protected in many European countries		
	Threat status in Europe:	Not evaluated (IUCN)	NE
EU conservation status by biogeographical region			
	Alpine	Unfavourable-Inadequate	FV
	Atlantic	Unfavourable-Inadequate	U1
	Continental	Unfavourable-Inadequate	U1
	Mediterranean	Unfavourable-Inadequate	XX
	Pannonian	Unfavourable-Inadequate	U1
	Steppic	Unfavourable-Inadequate	U1

Distribution of the species

TXT

Ecology, threats and pressures

The Eastern Eggar lives in semi-open habitats, at forest edges and roadsides. It is active in late autumn. After mating females lay a few large egg clusters and covers them with the hairs of its abdomen. The larvae weave a silk tent and they live throughout the larval stage close to it. The tents are visible in the landscape; however, there are three *Eriogaster* species in MK (*E. catax, E. riminicola* and *E. lanesris*) and also other species that build "tents" in the trees. The species is nocturnal. The main pressure for the species is the wide use of pesticides close to protected areas.

Management recommendations for the sites of occurrence

Usually there is no need for active managements to maintain the habitats for this species. Use of pesticides should be avoided in areas with colonies.

Methods for inventory and monitoring

The main methods for the monitoring of species are 1) Light trap and 2) active searching of larvae:

Light traps:

The species is night active and adult individuals (mainly males) can be captured using light traps. Adult individuals are active in late autumn. Traps should be installed in semi-open habitats with potential food plants for the species.

Active searching:

Active searching concerns the colonies of larvae. The colonies are visible in spring, before leaves appear. During summer the colonies are difficult to observe behind the leaves.

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Fig. 79. a) A colony of young Eastern Eggar (*Eriogaster catax*) larvae. Colonies were found along the roadsides and from pastures in Pelister NP. **b)** One male and two Eastern Eggar females. Photos: Markus Rantala.

Justifications for the assessment of conservation status

The species has wide distribution in the country. Strong fluctuations are typical for the populations, but because the species is not especially demanding with its habitat or food plants, it is able to easily recolonise potential habitats.

Conservation status	
Range (of the distribution area)	FV
Population	FV
Habitat for the species (quality)	FV
Future prospects	FV
Overall assessment of Conservation Status	**FV**

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Fig. 80. Observations of Eastern Eggar (*Eriogaster catax*). Several colonies were found from N-W parts of Pelister NP. However, it is likely that the species lives in a much larger area in the Pelister area.

References

EEA / EUNIS: https://eunis.eea.europa.eu/species/130

The Marsh Fritillary (Euphydryas aurinia)

Status in Europe		
Habitats directive, Annex II	Species code:	1065
Bern Convention, Annex II		
Protected in many European countries		
Threat status in Europe:	Least concern (IUCN)	LC
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	FV
Atlantic	Unfavourable-Inadequate	U1
Black Sea	Unfavourable-Inadequate	FV
Boreal	Favourable	U2
Continental	Unfavourable-Inadequate	U1
Mediterranean	Unfavourable-Inadequate	XX
Pannonian	Unfavourable-Inadequate	U1

Ecology, threats and pressures

This Marsh Fritillary lives in dry or relatively dry meadows. Larvae feed on *Knautia arvense*, *Succisa pratense*, *Scabiosa columbaria* and *Dipsacus* species. It is a declining species in many European countries due to the decline in animal numbers in traditional pastures: lack of pasture animals leads to overgrowing and to the disappearance of Marsh Fritillary's food plants. Subsequently, the overgrowing of pastures is the main threat for this species.

Management recommendations for the sites of occurrence

Marsh Fritillary habitats are very often under the risk of overgrowing. Traditional animal keeping in pastures is the most cost-effective way to maintain these habitats. Occasionally, it may be necessary to remove large vegetation (bushed, trees) from the pasture when restoring a habitat for the conservation purposes of this species. Fortunately for the Marsh Fritillary, many populations live on roadside habitats that are often kept open and subsequently are not at the risk of overgrowing like old pastures and hay meadows are.

Methods for inventory and monitoring

Main method for the inventory and monitoring is active searching of adult individuals or colonies of young larvae.

Funded by the European Union

Fig. 81. Marsh Fritillary (*Euphydryas aurinia*) favours warm places like small meadow patches and roadsides. Photo: Olli Pihlajamaa.

Justifications for the assessment of conservation status

Sufficient amount of data does not exist on this species' distribution changes. The population of *Euphydryas aurinia* is still rather strong, but many suitable habitats are overgrowing due to the changes in animal keeping.

Conservation status	
Range (of the distribution area)	XX
Population	FV
Habitat for the species (quality)	U1-
Future prospects	U1-
Overall assessment of Conservation Status	**U1-**

Funded by the European Union

Fig. 82. Observations of the Marsh Fritillary (*Euphydryas aurinia*). There are suitable habitats and food plants in many parts of the lower areas. Additionally, the lowest parts of the alpine meadows are potential habitats for this species**.**

References

van Swaay, C., Wynhoff, I., Verovnik, R., Wiemers, M., López Munguira, M., Maes, D., Sasic, M., Verstrael, T., Warren, M. & Settele, J. (2010) *Euphydryas aurinia. The IUCN Red List of Threatened Species 2010*: e.T174182A7024283. Downloaded on 31 August 2018.

The Jersey Tiger (Callimorpha quadripunctaria)

Syn. *Euplagia quadripunctaria*, *Panaxia quadripunctaria*

Status in Europe		
Habitats directive, Annex II	Species code:	**1078**
Bern Convention, Annex I		
Protected in some European countries		
Threat status in Europe:	Least concern (IUCN)	NE
EU conservation status by biogeographical region		
Alpine	Favourable	FV
Atlantic	Favourable	FV
Black Sea	Favourable	FV
Continental	Favourable	FV
Mediterranean	Unknown	XX
Pannonian	Favourable	FV
Steppic	Favourable	FV

Ecology, threats and pressures

The Jersey Tiger can be found in forests, semi-open areas, parks, gardens and shrub areas. Larvae are polyphagous. They favour nettle (*Urtica dioica*), but may feed on *Plantago*, *Rubus*, *Epilobium*, *Coryllus*, *Ulmus* and many other food plants. The species is not very demanding for its habitat and currently no major threats can be identified.

Management recommendations for the sites of occurrence

Usually there are no urgent needs for management measures to maintain the populations of the species. Use of pesticides should be prevented in the areas of important populations.

Methods for inventory and monitoring

The main methods for inventoring and monitoring *Callimorpha quadripunctaria* are active searching of adult individuals and larvae from suitable habitats. Larvae can be searched from potential food plants.

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Fig. 83. Female Jersey Tiger (*Callimorpha* (*Euplagia*) *quadripunctaria*). Photo: Petri Ahlroth.

** During the preparation of the Annex lists of Habitats directive there was some confusion related to the status of some taxons, which were suggested to be included in the annexes at the subspecies level. A decision was made to include part of those taxons at species level. As a result some common species were included in the Annexes. One such species is* the Jersey Tiger (*Callimorpha quadripunctaria).*

Justifications for the assessment of conservation status

The Jersey Tiger has a wide distribution in the country. It is adaptable and can inhabit several habitats, including urban areas, wastelands and other man-made environments.

Conservation status	
Range (of the distribution area)	FV
Population	FV
Habitat for the species (quality)	FV
Future prospects	FV
Overall assessment of Conservation Status	**FV**

Funded by the European Union

Fig. 84. Observations of the Jersey Tiger (*Callimorpha quadripunctaria*). There are plenty of food plants and potential habitats all around the area. Due to its adaptability and ability to disperse, if it is found in one location, it is likely found in the neighbouring areas as well.

Funded by the European Union

References

EEA / EUNIS: https://eunis.eea.europa.eu/species/54

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The Large Copper (Lycaena dispar)

Status in Europe			
Habitats directive, Annex II and IV		Species code:	1060
Bern Convention, Annex II			
Protected in many European countries			
Threat status in Europe:	Least concern (IUCN)		LC
EU conservation status by biogeographical region			
Alpine	Favourable		FV
Atlantic	Unfavourable-Inadequate		U1
Black Sea	Favourable		FV
Boreal	Unfavourable-Inadequate		U1
Continental	Favourable		FV
Mediterranean	Unknown		XX
Pannonian	Unfavourable-Inadequate		U1
Steppic	Unfavourable-Inadequate		U1

Ecology, threats and pressures

The Large Copper (*Lycaena dispar*) can be found in several types of grassland habitats. Its larvae feed on *Rumex* species. It is not especially demanding and it doesn't currently face any major threats.

Management recommendations for the sites of occurrence

Habitat management is rarely needed for this species. If there is a need to strengthen a population, it is enough to keep several small patches open that have the food plants of the larvae. This species is adapted to relatively strong fluctuations in population dynamics. Continuous local extinctions and re-colonisations are typical for this species.

Methods for inventory and monitoring

The Large Copper (*Lycaena dispar*) is a noticeable species and easy to recognize by an experienced person. It is a relatively easy species to monitor by active searching, which is why its monitoring should be carried out in parallel with other species that are active at the same time.

Funded by the European Union

Fig. 85. The Large Copper (*Lycaena dispar*) is active from midsummer to August. It can be found in different types of semi-open habitats. This individual was found on the side of a forest road in Pelister NP. Photo: Petri Ahlroth.

Justifications for the assessment of conservation status

The distribution area of the species has been increasing in many parts of Europe. In pilot areas the species was found in predictable habitats. It is relatively common inhabiting open and semi-open habitats. The species is not especially demanding and habitat destruction is not likely to occur.

Conservation status	
Range (of the distribution area)	FV
Population	FV
Habitat for the species (quality)	FV
Future prospects	FV
Overall assessment of Conservation Status	**FV**

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Fig. 86. Observations of the Large Copper (*Lycaena dispar*). There are suitable habitats for the species in the lower parts of Pelister NP.

Funded by the European Union

References

EEA/ EUNIS: https://eunis.eea.europa.eu/species/Lycaena%20dispar

Funded by the European Union

The Large Blue (*Maculinea arion*)

Syn. *Phegaris arion*

Status in Europe		
Habitats directive, Annex IV	Species code:	**1058**
Bern Convention, Annex II		
Protected in many European countries		
Threat status in Europe:	Endangered (IUCN)	EN
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Atlantic	Unfavourable-Inadequate	U1
Black Sea	Favourable	FV
Boreal	Unfavourable-Bad	U2
Continental	Unfavourable-Bad	U2
Mediterranean	Unknown	XX
Pannonian	Unfavourable-Bad	U2

Distribution of the species

TXT

Ecology, threats and pressures

The Large Blue is a species of open and warm meadows, pastures, eskers and semi-open sandy forest types that have both *Thymus* plants and *Myrmica* ant colonies. Females lay eggs on the flowers of *Thymus*. Larvae first feed on these flowers, but drop down to ground at an early stage. Then the larvae use chemical compounds to mimic *Myrmica* ant larvae therefore making adult ants to pick up the Large Blue larvae and bring it inside their nest. Once there, the young butterfly larvae turn into a predator (or a nest parasite) that feed on the larvae of the host ant.

The main threat for the species is overgrowing of habitats, because *Thymus* species are poor competitors in high vegetation patches.

Management recommendations for the sites of occurrence

Habitats should be protected from overgrowing. Usually the most cost-effective way to maintain the openness of the habitats is the maintenance of traditional animal keeping, i.e. pastures, at these sites. On the other hand, overgrazing should be avoided.

Methods for inventory and monitoring

The only applicable method for the inventory and monitoring of the species is to actively search adult individuals. Individuals can be marked and recaptured, but usually counting the adult individuals from local populations provide sufficient data. However, it is necessary to repeat the counting of individuals several times during the flight period (May to August).

Funded by the European Union

Fig. 87. The Large Blue (*Maculinea arion*) lays eggs on the flowers of *Thymus*, but they also visit them for nectar. This individual was found from the lowest parts of the alpine meadows close to Brajcino village. Photo: Petri Ahlroth.

Justifications for the assessment of conservation status

Sufficient distribution data does not exist for this species in MK. The population has most likely been decreasing as the traditional keeping of animals, i.e. the number of pastures, has been decreasing. In many areas potential habitats suffer from overgrowing.

Conservation status	
Range (of the distribution area)	XX
Population	U1-
Habitat for the species (quality)	U1-
Future prospects	U1-
Overall assessment of Conservation Status	**U1-**

Funded by the European Union

Fig. 88. Observations of the Large Blue (*Maculinea arion*). The species was found at three locations in two different areas. Two locations in the lower parts of alpine meadows are located close to each other.

References

Gimenez Dixon, M. (1996) *Phengaris arion. The IUCN Red List of Threatened Species 1996*: e.T12659A3371159. http://dx.doi.org/10.2305/IUCN.UK.1996.RLTS.T12659A3371159.en. Downloaded on 31 August 2018

Lionel G. Higgins, Norman D. Riley, (1973). suom. Olavi Sotavalta: *Euroopan päiväperhoset*. pp. 271–274. Kustannusosakeyhtiö Tammi, 1973.

EEA / EUNIS: http://eunis.eea.europa.eu/species/235

Funded by the European Union

The Clouded Apollo (*Parnassius mnemosyne*)

Status in Europe		
Habitats directive, Annex IV	Species code:	**1056**
Bern Convention, Annex II		
Protected in many European countries		
Threat status in Europe:	Least concern (IUCN)	LC
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Black Sea	Favourable	FV
Boreal	Unfavourable-Inadequate	U1
Continental	Unfavourable-Inadequate	U1
Mediterranean	Unknown	XX
Pannonian	Unfavourable-Inadequate	U1
Steppic	Unfavourable-Inadequate	U1

Ecology, threats and pressures

The Clouded Apollo favours small herb rich grasslands and semi-open habitats. Adult individuals can be seen from early to midsummer. Its larvae feed on *Corydalis* species usually favouring *Corydalis solida*. It has suffered from overgrowing of old pastures after the grazing of animals has ended. Traditional agriculture and keeping of grazing animals on the pastures and in forests has previously maintained suitable habitats for this species. In many areas, such habitats are disappearing and populations of Clouded Apollo at those sites are threatened.

Management recommendations for the sites of occurrence

Allowing animals to graze in a traditional manner maintains habitats for this species, but overgrazing should be avoided. Mowing can also function as way to maintain suitable habitats and effectively prevents overgrowing of the vegetation. In areas with Clouded Apollo any use of pesticides must be forbidden and the use of fertilizers should be avoided. Intensive forestry activities should not take place too close to the populations because they may change the microclimate of the sites. Hydrological conditions should be maintained at a natural stage.

Methods for inventory and monitoring

The main method for the inventory and monitoring is an active search of adult individuals. If the population size has to be estimated, the Clouded Apollo is a rather easy to mark and recapture. There are several mathematical methods to estimate the population size according to data from marking and recapturing the individuals (see, https://en.wikipedia.org/wiki/Mark_and_recapture, for example).

Funded by the European Union

Fig. 89. The Clouded Apollo (*Parnassius mnemosyne*) is a relatively large butterfly. Adult individuals can be seen from early to mid-summer flying in meadows and semi-open habitats. Adult butterflies frequently visit flowers. In Pelister NP the Clouded Apollo has small local populations in several locations. This individual was found in a small semi-open patch close to the Capari village. Photo: Petri Ahlroth.

Justifications for the assessment of conservation status

Data is not sufficient for distribution analysis. It seems possible that agricultural changes, especially the use of pesticides, have decreased the quality of habitats and Clouded Apollo populations. It seems likely that a similar trend in agriculture will continue in the future.

Conservation status	
Range (of the distribution area)	XX
Population	U1-
Habitat for the species (quality)	U1-
Future prospects	U1-
Overall assessment of Conservation Status	**U1-**

Funded by the European Union

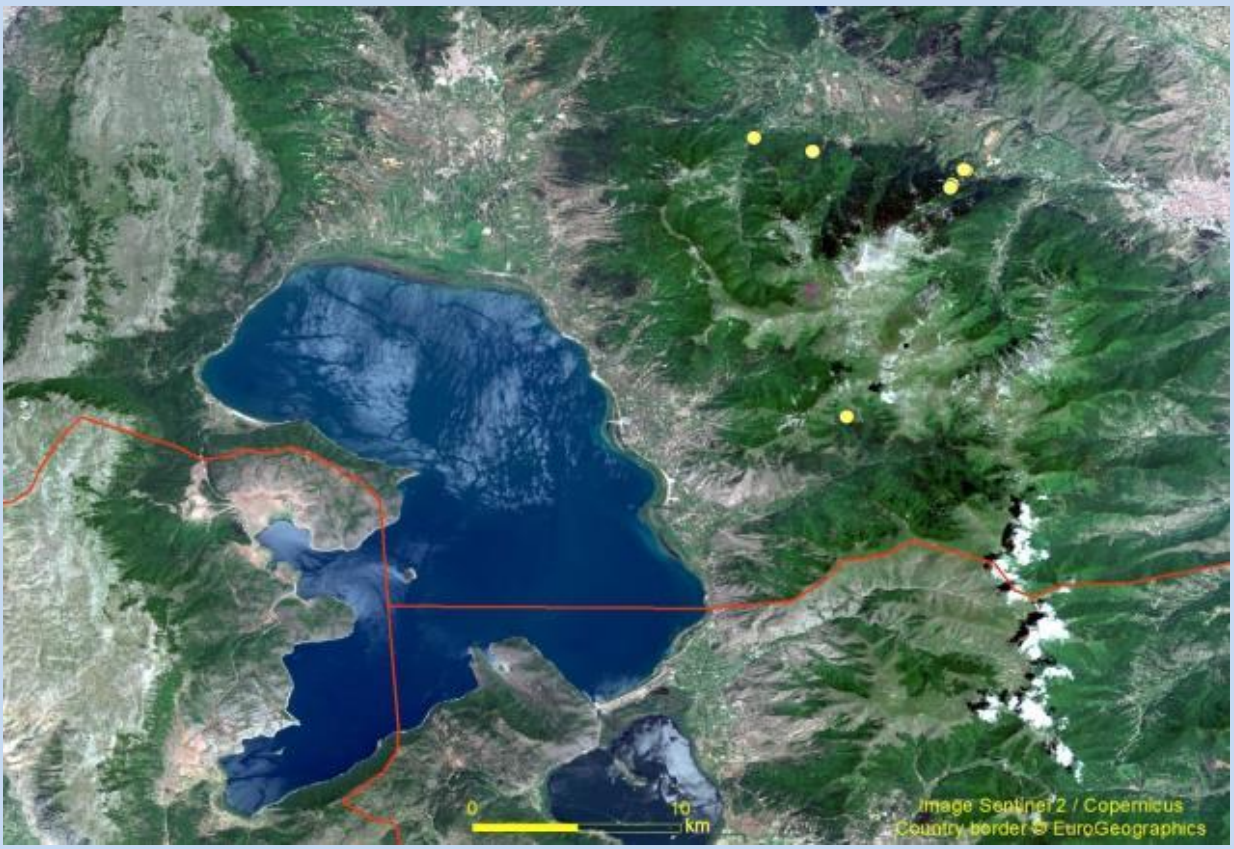

Fig. 90. Observations of the Clouded Apollo (*Parnassius Mnemosyne*). There are several potential areas for the species: they can be found both in the lower parts of the alpine meadows and in other meadows in the lower altitudes.

References

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EEA/EUNIS: http://eunis.eea.europa.eu/species/285/conservation_status;jsessionid=21741103B03CB7E899D0F6C983112250?d-49653-s=1&tab=conservation_status&d-49653-o=2&d-49653-p=1&idSpecies=285

EIONET: https://bd.eionet.europa.eu/article17/reports2012/species/summary/?period=3&subject=Parnassius+mnemosyne

Beetles (Coleoptera)

The Cerambyx Longicorn (*Cerambyx cerdo*)

Status in Europe		
Habitats directive, Annex II and IV	Species code:	**1088**
Bern Convention, Annex II		
Protected in many European countries		
Threat status in Europe:	Least concern (IUCN)	NT
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Atlantic	Unfavourable-Inadequate	U1
Black Sea	Favourable	FV
Boreal	Unfavourable-Bad	U2
Continental	Unfavourable-Inadequate	U1
Mediterranean	Unknown	XX
Pannonian	Unfavourable-Inadequate	U1
Steppic	Unfavourable-Inadequate	U1

Distribution of the species

TXT

Ecology, threats and pressures

Cerambyx Longicorn is a species of the Cerambycidae family. It favours the warm edges of forests, slopes and roadsides, but it requires habitats that have large dead Oaks (*Quercus*) for breeding. Therein lays its greatest threat: modern forest practices do not leave large or dead oak trees to the forest, and this continuum of dead oaks is vital to Cerambyx Longicorn. Subsequently, the main threat for this species is forestry and the collection of old oak trees for firewood.

Management recommendations for the sites of occurrence

Large oaks should be left out of forestry activities. Dead trees should be saved and left for the beetles. This would benefit also other saprocylic species which use oak as a food source. Active management can be done in the areas with *Cerambyx* population, if the continuum of suitable trees is at risk.

Methods for inventory and monitoring

The main method for the inventories and monitoring is active searching of signs of larvae. Due to the very large size of the species, old signs of larvae are often recognizable from the trees. However, there are several other large-sized species of *Cerambyx* in North Macedonia. Monitoring of this species should be done at the same time with other species that require active searching and share similar habitats.

Funded by the European Union

Fig. 91. a) Old signs of Cerambyx Longicorn (*Cerambyx cerdo*) larvae in a dead oak tree and **b)** the forewing of a dead individual. Photos: Petri Ahlroth.

Justifications for the assessment of conservation status

Distribution area covers the whole country and signs (including old signs) of the larvae can be seen in suitable trees. It has relatively good dispersal ability and they can colonize suitable trees in the area they live in. Suitable trees, however, are scattered in the landscape and large dead oaks are often used as firewood. Conservation status is estimated as favourable.

Conservation status	
Range (of the distribution area)	FV
Population	XX
Habitat for the species (quality)	FV
Future prospects	FV
Overall assessment of Conservation Status	**FV**

Funded by the European Union

Fig. 92. Observations of the Cerambyx Longicorn (*Cerambyx cerdo*). The species was found at several localities and there is still plenty of good habitat candidates waiting to be surveyed that may have viable populations.

References

World Conservation Monitoring Centre (1996) *Cerambyx cerdo. The IUCN Red List of Threatened Species 1996*: e.T4166A10503380. http://dx.doi.org/10.2305/IUCN.UK.1996.RLTS.T4166A10503380.en. Downloaded on 05 September 2018.

EEA / AUNIS: https://eunis.eea.europa.eu/species/69

The Cucujus cinnaberinus beetle

Status in Europe		
Habitats directive, Annex II and IV	Species code:	1086
Bern Convention, Annex I		
Protected in many European countries		
Threat status in Europe:	Near threatened (IUCN)	NT
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Atlantic	Unknown	XX
Black Sea	Unfavourable-Inadequate	U1
Boreal	Unfavourable-Bad	U2
Continental	Unfavourable-Inadequate	U1
Mediterranean	Unfavourable-Bad	U2
Pannonian	Favourable	FV

Ecology, threats and pressures

Cucujus cinnaberinus is a species of the Cucujidae family. It lives under the bark of dead trees and is therefore dependent on the continuum of dead wood. Both larvae and adults can be found under the bark of Aspen (*Populus*), Oak (*Quercus*), Birch (*Betula*) and Pine (*Pinus*) and several forest habitat types can serve as potential habitats. Due to the species' dependency on dead wood, it has disappeared from large areas in Europe as a result of intensive forestry activities. Intensive forestry is also diminishing the living conditions for the species in the only known living area of *Cucujus cinnaberinus* in MK (Pelister NP). Sanitary cuttings in the area do not allow habitats to evolve in a way suitable for the species. This is a common problem for all saproxylic species face in Pelister NP and *Cucujus cinnaberinus* is not the only Annex species suffering from the current management of the areas.

Management recommendations for the sites of occurrence

Number of dead trees should be increased in Pelister NP and valuable forest habitats should be left out of all forestry activities. Restoration activities should be carried out to increase the amount of dead wood in the area. Dense tree cultivation stands should be ecologically restored. The main target in the restoration should be in the conservation of saproxylic species.

Methods for the inventory and monitoring

The main methods for the inventory and monitoring of *Cucujus cinnaberinus* are:

1. Active searching:

   The species can be searched under the bark of dead trees. When searching for it, inventory activities should not cause too much destruction for the (micro-) habitat of the species. Not all bark should be removed from the trees the species live in.

2. Window traps:

   The species can be captured by window traps placed on dead trees. Several tree species can be used for trapping.

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Fig. 93. Adult *Cucujus cinnaberinus*. This specimen was the first individual of this species found in North Macedonia. It was found during the field works of the project in Pelister NP, under the bark of dead Macedonian Pine *Pinus peuce*. Photo: Petri Ahlroth.

Justifications for the assessment of conservation status

There were no previous records of this species before summer 2018. For this reason, the range and potential changes in the range cannot be assessed. Intensive forestry managements have clear negative impacts on the quality of the suitable habitats in Pelister NP. The number of potential trees is inadequate, and population density is low.

Conservation status	
Range (of the distribution area)	XX
Population	XX
Habitat for the species (quality)	U2
Future prospects	XX
Overall assessment of Conservation Status	**U2**

Funded by the European Union

Fig. 94. Observations of *Cucujus cinnaberinus*. The number of potential habitats for the species is limited, but it is possible that new populations can be found.

References

EEA / EUNIS: https://eunis.eea.europa.eu/species/106

Funded by the European Union

The Stag Beetle (*Lucanus cervus*)

Status in Europe		
Habitats directive, Annex II	Species code:	**1083**
Bern Convention, Annex III		
Protected in all European countries		
Threat status in Europe:	Near threatened (IUCN)	NT
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Atlantic	Unfavourable-Inadequate	U1
Black Sea	Favourable	FV
Boreal	Unfavourable-Inadequate	U1
Continental	Unfavourable-Inadequate	U1
Mediterranean	Unknown	XX
Pannonian	Favourable	FV
Steppic	Unfavourable-Inadequate	U1

Ecology, threats and pressures

The Stag Beetle (family Lucaniidae) lives in forest habitats with large oak trees. Larvae of the species require large trees with strong bark that are able to maintain humidity inside. The species has relatively good dispersal ability, but suitable trees are scattered in the landscape. Large dying oaks are often used as firewood, limiting the formation of suitable habitats.

Management recommendations for the sites of occurrence

Old oak forests should be protected. Large dead oaks should not be used as firewood but should be left for the Stag Beetle and a large number of other saproxylic species.

Methods for inventory and monitoring

Stag Beetles are relatively easy to observe during the reproductive season, because both sexes search for dead oaks and males compete over females in conspicuous fights. Females are also partly nocturnal and can be attracted to light. The main methods for the inventories are active searching and the use of light traps in suitable habitats.

Funded by the European Union

Fig. 95. A male Stag Beetle (*Lucanus cervus*) with its extremely large mandibles. Photo: Petri Ahlroth.

Justifications for the assessment of conservation status

The range of distribution covers the entire country. The population is large, but most likely scattered due to the lack of high quality habitats. Because of e.g. forestry practices, the continuum of habitats with old oaks is at risk.

Conservation status	
Range (of the distribution area)	FV
Population	FV
Habitat for the species (quality)	FV
Future prospects	FV
Overall assessment of Conservation Status	**FV**

Funded by the European Union

Fig. 96. Observations of the Stag Beetle (*Lucanus cervus*).

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References

Nieto, A. Mannerkoski, I., Pettersson, R., Mason, F., Méndez, M. & Schmidl, J. (2010) *Lucanus cervus. The IUCN Red List of Threatened Species 2010*: e.T157554A5094499. Downloaded on 05 September 2018.

EEA / EUNIS: https://eunis.eea.europa.eu/species/221

The Morimus funereus beetle

Status in Europe			
Habitats directive, Annex II		Species code:	1089
Bern Convention, Annex I			
Protected in many European countries			
Threat status in Europe:	Not evaluated (IUCN)		NE
EU conservation status by biogeographical region			
Alpine	Favourable		FV
Black Sea	Favourable		FV
Continental	Unfavourable-Inadequate		U1
Mediterranean	Unknown		XX
Pannonian	Favourable		FV
Steppic	Unfavourable-Inadequate		U1

Ecology, threats and pressures

Morimus funereus is a species from the Cerambycidae family. It lives in deciduous forest habitats, on dead deciduous trees such as Oaks (*Quercus*). It favours large trees with thick bark. In this scope, besides *M. funereus* (=*M. asper funereus*), also *M. ganglbaueri* was cited for western parts of Macedonia.

Management recommendations for the sites of occurrence

Large deciduous trees (and especially large dead or dying trees) should be left out from forestry activities. In areas lacking suitable trees, the volume of large dead trees should be increased artificially. Restoration activities should be concentrated close to known populations because of the restricted dispersal ability of the species.

Methods for inventory and monitoring

The main method for the inventories and monitoring is active searching. Because finding individuals is more or less accidental, the species should be monitored while searching for other species. The species is nocturnal and in day time adult individuals are resting on the trunks of deciduous trees, trusting on their camouflage. The effort of inventory should be standardized by working time (days/hours).

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Fig. 97. *Morimus funereus* on an oak trunk. Photo: Petri Ahlroth.

* The taxonomic status of *Morimus funereus* is unclear. Some authorities have suggested that it could be divided into five different species whereas other authors see it as a single species with large morphological and genetic variation. Regardless, Habitats Directive provides legal shelter for the taxon even if the species was split.

Justifications for the assessment of conservation status

Currently there is not enough data to make distribution change estimates of this species. However, the species appears to be widespread in the Balkan countries and it seems the distribution covers the same area as it did in the past. Population density is relatively high in suitable habitat, but the lack of suitable trees in these habitats presents a problem. The species has poor dispersal ability and if local extinctions take place, the probability for recolonization is low.

Conservation status	
Range (of the distribution area)	FV
Population	FV
Habitat for the species (quality)	FV
Future prospects	FV
Overall assessment of Conservation Status	**FV**

Funded by the European Union

Fig. 98. Observations of *Morimus funereus*.

References

World Conservation Monitoring Centre. (1996) *Morimus funereus. The IUCN Red List of Threatened Species 1996*: e.T13875A4359886. http://dx.doi.org/10.2305/IUCN.UK.1996.RLTS.T13875A4359886.en. Downloaded on 05 September 2018.

EEA / EUNIS: https://eunis.eea.europa.eu/species/258

The Rosalia Longicorn (*Rosalia alpina*)

Status in Europe			
	Habitats directive, Annex II and IV	Species code:	**1087**
	Bern Convention, Annex II		
	Protected in many European countries		
	Threat status in Europe:	Least concern (IUCN)	LC
EU conservation status by biogeographical region			
	Alpine	Unfavourable-Inadequate	U1
	Atlantic	Unknown	XX
	Black Sea	Favourable	FV
	Continental	Unfavourable-Inadequate	U1
	Mediterranean	Unknown	XX
	Pannonian	Favourable	FV

Ecology, threats and pressures

Rosalia Longicorn is a species from the Cerambycidae family. It lives in forest habitats favouring mountainous areas where it can be found from slope forests with dead deciduous trees. The species favours large, recently dead Beech (*Fagus*) trunks. The main threat and limiting factor for the population is the lack of suitable dead trees, which are often collected as firewood. In addition, modern intensive forestry practices prevent the creation of suitable habitats.

Fig. 99. a) An adult *Rosalia alpina* on dead beech. This individual was found in a mountain slope close to Brajcino. **b)** Habitat for *Rosalia alpina* at a mountain slope in Pelister NP. Photos: **a)** Zydrunas Preiksa, **b)** Petri Ahlroth.

Management recommendations for the sites of occurrence

Forestry activities should not take place in areas inhabited by *Rosalia alpina*. The species benefits from restoration activities, especially if suitable trees are lacking in the area.

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Methods for inventory and monitoring

Active searching is clearly the most efficient method for inventory and monitoring of this species. Evidence of *Rosalia alpina* can be observed by searching traces of larvae and hatching holes from potential host trees. Additionally, the species can be monitored using window traps, which should be placed in dying or recently died Beech (*Fagus*) trees.

Justifications for the assessment of conservation status

Distribution area of the species covers the whole country. As the species has relatively good dispersal ability, it can easily colonize suitable trees in the living area. The risk is however, that the trees where the females lay their eggs are later collected as firewood, preventing the development of larvae. In areas with forestry activities, the amount of suitable trees is limited. After tree cutting, females may lay their eggs on the log piles that are later sold as firewood.

Conservation status	
Range (of the distribution area)	FV
Population	U1
Habitat for the species (quality)	U1
Future prospects	XX
Overall assessment of Conservation Status	**FV**

Funded by the European Union

Fig. 100. Observations of *Rosalia alpina*. There are relatively large potential areas for the species. However, the species is not very visible and the proper inventory of populations would require much time and several experts in the field.

Funded by the European Union

References

World Conservation Monitoring Centre. (1996) *Rosalia alpina. The IUCN Red List of Threatened Species 1996*: e.T19743A9009447. http://dx.doi.org/10.2305/IUCN.UK.1996.RLTS.T19743A9009447.en. Downloaded on 05 September 2018.

EEA / EUNIS: https://eunis.eea.europa.eu/species/313

Bryophytes and vascular plants

The Green Shield-moss (*Buxbaumia viridis*)

(Moug. ex Lam. et DC.) Brid. ex Moug. et Nestl.)

Status in Europe		
Habitats directive, Annex II	Species code:	**1386**
Candidate at European Red List (Hodgetts 2015)		
Threat status in Europe:	Not evaluated (IUCN)	NE
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	U1
Atlantic	Unknown	XX
Boreal	Favourable	FV
Continental	Unfavourable-Inadequate	U1
Mediterranean	Favourable	FV
Pannonian	Unfavourable-Bad	U2

Ecology, threats and pressures

The Green Shield-moss is an inconspicuous moss. The green ripening capsules of about ≤1 cm height are relatively easy to detect, but for the most par the moss lives a hidden life at the surface of decaying wood as a perennial protonema or as small gametophytes. The capsules start to grow in autumn at moist conditions and they grow and ripen during the winter and spring. It is a typical species of old-growth forests with plenty of decaying wood and moist microclimate. The substratum of *Buxbaumia viridis* usually consists of dead conifers (*Abies alba*, *Picea abies*) or more rarely dead deciduous trees (*Populus tremula*, *Fagus sylvatica*) in late decay phases. However, sometimes it grows on humus or peaty soil and can even be found in managed forests or near towns with suitable substrate.

In the Czech Republic altitudinal distribution of the populations spanned 250–1200 meters above sea level, of which most were recorded at the altitudes between 600–900 m a.s.l. (Holá et al.2014). In the Czech Republic most populations are found within a 100 meters from a watercourse (Holá et al.2014). It is observed in Montenegro from 14 known sites at elevations over 1300 m a.s.l. in the northern and north-eastern parts of the country (Dragićević et al. 2012). In Pelister National Park *Buxbaumia viridis* has been found in northern slopes of mountains at elevations of 1400 - 1600 m a.s.l. on decaying logs and stumps of *Abies borisii-regis* and *Pinus peuce*. Accompanying species include other epixylic species such as *Herzogiella seligeri*, *Dicranum tauricum*, *Lophocolea bidentata*, *Brachythecium erythrorrhizon* and *Hypnum cupressiforme*.

The main threat for *Buxbaumia viridis* is forestry and ditching, especially clear cuttings that destroy habitats and change the microclimate in a very drastic way. Selective cutting can also pose a problem, if decaying logs and stumps are smashed as a by-product. Commercial or managed forests are not ideal habitats for this species because there is too little suitable decaying wood and the microclimate is too dry.

Management recommendations for the sites of occurrence

Suitable forest habitats with plenty of decaying wood should be surveyed in Macedonia. All populations should be taken into consideration while planning land use (construction of roads, forestry etc.). All sites with viable populations and forests that are able to maintain populations for a long time should be included in the Natura 2000 network. Management is rarely needed apart from protecting intact forests.

Funded by the European Union

Selective cuttings can still be a threat for *Buxbaumia viridis* even inside national parks and other conservation areas. Sites of occurrences should be left intact even if forests are damaged by insects. Amount of suitable forest habitat with old and decaying trees should be increased to favour this and other threatened species that require near-to-natural or old-growth forests. Forest management inside protected areas should not be allowed. The increase of decaying wood should be a priority in all forests of Pelister National Park.

Methods for inventory and monitoring

Inventories should be done both inside and outside of conservation areas in Macedonia to map all populations. For example, it seems likely that there are more populations in the Pelister National Park than are known at the moment. Locating all populations is vital for future management plans.

Main method for the inventory and monitoring of the species is active searching of sporophytes (capsules) in autumn or late spring. Inventories should be concentrated to suitable forest habitats. Data on each patch and locality should be collected using the Field Inventory Form. Monitoring should be based on repeated inventories of known sites. Monitoring should be repeated in 5-6 year cycles.

Fig. 101. The Green Shield-moss is an epixylic moss that lives on soft decaying wood. In Macedonia, only a few records of old and present populations exist. In the Pelister National Park, a large and viable population exists located in a Moesian silver fir forest at Pali Snopje that has plenty of decaying wood. Photos: Kimmo Syrjänen.

Justifications for the assessment of conservation status

Size of distribution area

Distribution of *Buxbaumia viridis* is circumpolar and it is mainly boreal-montane and boreal-temperate. It is not present in the middle and northern part of the boreal zone, but is somewhat common in the boreo-nemoral zone. The largest Green Shield-moss population of EU exists in Sweden, but it can be found in most of the European countries. It is found from all Southeast European countries except for the European part of Turkey (Sabovljevic et al. 2008). In South Europe the species is considered mainly boreo-montane (see ecology). In Macedonia there are observations from Pelister, Mavrovo and Šara Mountains (Cekova, 2005, Papp & Erzberger 2012, Papp et al. 2016). During the Twinning project *Buxbaumia viridis* was found from three localities at the Pelister National Park in 2018.

Size of population

Funded by the European Union

Size of the entire Macedonian population is unknown. There are old records from Pelister and Šara Mountains (Cekova, 2005) and the species has recently been found from the Mavrovo National Park (Papp et al. 2016) and from Pelister (Papp & Erzberger 2012). One of the three occurrences that were found during the Twinning project inventories from the Pelister National Park in 2018 is large and viable with several tens of colonized patches of decaying wood and with more than 100 sporophytes. It seems likely that there are viable populations present in the Pelister and Mavrovo National Parks as well.

Quality of habitat for the species

One subpopulation in Pelister has a high amount of decaying wood and this site is important for the maintenance of the population for a long time period. In other places at Pelister, known populations are small and there is a variably amount of decaying wood. The species is usually absent in tree stumps in selectively cut forests.

Future prospect

Selective cuttings inside national parks can be a threat to *Buxbaumia viridis* making future predictions difficult. Without careful management and the increase of suitable habitats the future prospects cannot be favourable. Climate warming is likely to have a negative effect on the species if aridity increases.

Conservation status	
Range (of the distribution area)	FV
Population	U1
Habitat for the species (quality)	U1
Future prospects	U1
Overall assessment of Conservation Status	**U1**

Funded by the European Union

References

Cekova, M. (2005) *Review of the Bryoflora of the Republic of Macedonia - Pregled na brioflorata na Republika Makedonija*. – Univerzitet "Sv. Kiril i Metodij", Inst. Biol., Skopje. 42 pp.

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Fritillaria gussichiae (Degen & Dörfl.) Rix

Syn. Fritillaria graeca var. gussichiae Degen & Dörfl.

Status in Europe		
Habitats directive, Annex IV	Species code:	1845
Bern Convention, Annex I		
IUCN global red list	Data Deficient (IUCN)	DD
Threat status in Europe	Data Deficient (IUCN)	DD
Threat status in EU	Near threatened (IUCN)	NT
EU conservation status by biogeographical region		
Alpine	Unfavourable-Inadequate	FV
Continental	Unfavourable-Inadequate	FV
Mediterranean	Unfavourable-Inadequate	XX

Ecology, threats and pressures

Fritillaria gussichiae is a perennial bulbous herb of the lily family (Liliaceae). Flowering takes place rather early in the spring from April to May. It is between 15-30 cm tall and it has 1-2 nodding flowers per stalk. Flowers are yellowish-green with reddish-brown shading. Dry stalks with ripe upright capsules are visible until autumn.

In Bulgaria the species grows in various types of thermophilous habitats like xerophilous pastures and rocky grounds as well as forests and scrubs at altitudes from 300 m to 1320 m, highest populations found 1800 m a.s.l. (EUNIS 2015, Petrova et al. 2011). In South Serbia, it grows in thermophilous oak forests, scrub communities and pseudo-steppe formations on all kind of bedrocks, 450-800 m a.s.l. (Petrova et al. 2011, Tomović et al. 2007). Petrova et al. (2011) mentions populations to exist between 40 and 1800 m a.s.l. In Pelister National Park this plant is found scattered in several locations at sun exposed grassland slopes both in forest zones and in lower parts of the alpine area, ranging from 1121 to 1615 m a.s.l.

In Pelister National Park the main threat to this species is overgrowth due to cessation of grazing and mowing. There has been a slow overgrowth going on in habitats of the species for the past half of century in Pelister National Park. Overgrowth is based on competition by taller herbs and scrubs and spreading of forests. Succession at present growing sites will begin by tall *Asphodelus albus* herb and *Pteridium aquilinum* grasslands to *Juniperus* and *Prunus* shrubs and further to coniferous, mixed or oak forest. It is not known whether wild boars eat its bulbs, but it is a possible threat. Without management the number of populations will decrease. Atmospheric pollutants (especially nitrogen) can enhance the overgrowth of habitats. Small populations can be also prone to stochastic events. Outside of conservation areas forestry, construction and heavy grazing can pose a threat. Climate change can enhance overgrowth at some places but increased aridity may be beneficial in other sites.

Management recommendations for the sites of occurrence

Management should begin by assessing the occurrences of *Fritillaria gussichiae* at Pelister National Park. Management is probably needed in most populations, but should be prioritized to large habitats with several individuals. Management can include clearing, mowing and raking of the sites after flowering period in late June – July, these actions and their results should be monitored and repeated in 2-year cycles. Occasional grazing of overgrown sites is recommended, but overgrazing should be avoided. Cutting of shadowing trees around habitats to increase sunlight may be good for this species and its habitats.

Methods for inventory and monitoring

Funded by the European Union

Main method for the inventory and monitoring of the species is active searching of flowering individuals during flowering season at April-May. Inventories should be done at sun-exposed grassland and meadow patches of valley slopes both in forest and lower alpine zones. Based on information from neighbouring countries, populations are likely to be present at lower elevations than oberved so far in Pelister National Park. Field Inventory Form should be filled for each locality and monitoring should be based on repeated inventories of known sites. Monitoring is needed to be repeated at managed sites in 1-2 year period and in unmanaged sites in 5-6 year period.

Fig. 102. *Fritillaria gussichiae* is a perennial bulbous herb that grows on sun exposed grasslands and meadows at forest zone and at lower parts of alpine zone in Pelister National Park. Left. This species can be recognized only during the flowering period at spring. On the left, a flower is already withering at 23.5.2018. On the right, overgrowing meadows above Brajchino village host a few individuals of the species. Photos: Kimmo Syrjänen.

Justifications for the assessment of conservation status

Size of distribution area

Fritillaria gussichiae is endemic to the Balkan Peninsula. It occurs in Serbia, Bulgaria, Greece, Albania and Macedonia (Petrova et al. 2011, EUNIS 2015). All records cited in the old literature of *Fritillaria graeca* in Bulgaria, Serbia and the majority in Macedonia refer to *F. gussichiae* (Petrova et al. 2001). According to Petrova et al. (2011) in Macedonia it is distributed in almost all parts of the country and recorded in Mt Ostri, Mt Kitka, the River Matka gorge, Mt Babuna, Mt Radobilj, Mt Pelister, the River Crni Dim gorge in the vicinity of village Lukovo, surrounding of Doiran Lake, etc. At Pelister National Park the flowering individuals of *Fritillaria gussichiae* were found from two sites in May 2018 during the Twinning project. In addition, capsules bearing *Fritillaria sp.* individuals were present at six other sites. These plants probably belong to *Fritillaria gussichiae*.

The following information on occurrences from Macedonia is available (See Matevski et al. 2019):

Skopje: Zelenikovo (Degen & Dörfler, 1897) (sub *Fritillaria graeca* subsp. *gussichiae*)

Skopje; Shishevo-Man. Sv Nikola, Ostri, Kitka, Shishevo, Babuna Mt., Drenovo, Pelister-Radobil, Dedeli, Vardar, Sveti Nikola (Bornmüller, 1928) (sub *Fritillaria graeca* subsp. *gussichiae*)

Skopje:Treska, Zelenikovo, Drenovo (Soska, 1938, 1939) (sub *Fritillaria graeca* subsp. *gussichiae*)

Dvorce, Radusha (Matvejeva, 1965) (sub *Fritillaria graeca* subsp. *gussichiae*)

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Skopje: Vodno (Drenkovski, 1969) (sub *Fritillaria graeca* subsp. *gussichiae*)

Srumica: Adzilivert, Carevi Kuli, Sveti Ilija, Dedeli (Rudski, 1943; Soska, 1953) (sub *Fritillaria graeca* subsp. *gussichiae*)

Ohrid: Sv. Naum (Černjavski, 1943) (sub *Fritillaria gussichiae*)

Prespa: Oteshevo (Micevski, 1952, herb. mat. MKNH) (sub *Fritillaria gussichiae*)

Garska Reka (Leute, 1978) (sub *Fritillaria graeca* subsp. *gussichiae*)

Dobra Voda (Matevski, 1995) (sub Fritillaria graeca var. gussichiae)

Suva Gora (Teofilovski, 2011) (sub *Fritillaria gussichiae*)

Babuna-kanjon; Dudica, Osogovo, Treska (Jovanovska et al., 2009) (sub *Fritillaria gussichiae*)

Size of population

The actual size of the Macedonian population is unknown. According to Petrova et al. (2011) there is no information available on the status of the populations in Macedonia. However, according to Matevski et al. (2019) this species has a wide distribution in Macedonia and there are a lot of old and new observations of this species. Because Macedonia is considered to be a stronghold for this species, world classification of this species is suggested to be Least Concern (Petrova et al. 2011). Number of individuals per site In Pelister National Park range from one to less than ten and the total number of individuals in the national park is 20-30. Populations are small, but probably only a small fraction of whole Pelisters population was found during the Twinning project field inventories in 2018. Populations were found above Magarevo, Rotino, Capari, Kazan and Brajchino villages.

Quality of habitat for the species

Habitats of *Fritillaria gussichiae* seem to decrease and the species has probably already disappeared from some badly overgrown grasslands. Slow decrease of habitats will continue and this can partly be enhanced by climate warming.

Future prospect

In the near future the decrease of habitats and populations will continue in Pelister National Park. Management actions are needed to improve the conservation status of *Fritillaria gusscihiae* in Pelister National Park.

Conservation status	
Range (of the distribution area)	FV
Population	U1
Habitat for the species (quality)	U1
Future prospects	U1
Overall assessment of Conservation Status	**U1**

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Carpathian Tozzie (*Tozzia carpanthica*)

Status in Europe		
Habitats directive, Annex IV	Species code:	**6244**
Bern Convention, Annex I		
Protected in many European countries		
List of protected species of North Macedonia		
Threat status in Europe:	Least concern (IUCN)	DD
EU conservation status by biogeographical region		
Alpine	Favourable	FV
Atlantic	Unfavourable-Inadequate	U1
Black Sea	Unfavourable-Inadequate	U1
Boreal	Unfavourable-Inadequate	U1
Continental	Unfavourable-Inadequate	U1
Mediterranean	Unfavourable-Inadequate	U1
Pannonian	Unfavourable-Inadequate	U1
Steppic	Unfavourable-Inadequate	U1

Ecology, threats and pressures

Tozzia carpathica is an annual hemiparasite from family *Scrophulariaceae*. It is 15-40 cm high and easiest to observe while during blooming in May-June. The species grows at shorelines of subalpine brooks and streams. In Pelister National Park it is known to occur mainly in the forest zone in Oro-Mediterranean coniferous forests. Soil and microclimate at growing sites are moist and these streams stay flowing throughout the year. Growing sites in Pelister National Park at Rorino river system are semi-shady and accompanying host-species consist mainly of tall herbs that include *Angelica pancicii*, *Geum coccineum*, *Caltha palustris*, *Alchemilla indusiata*, *Chrysosplenium alternifolium*, *Athyrium filix-femina*, *Rumex alpinus*, *Cirsium appendiculatum*, *Veratrum album*, *Geranium sylvaticum* and *Brachythecium rivulare*.

Main threats to this species are forestry and ditching. There is no information on whether the species has strong and abundant populations anywhere in its distribution area, and it is listed threatened in several national Red Lists (Biltz 2011). In Pelister National Park sides of mountain streams are mostly left intact during forestry actions and therefore there are currently no acute human induced threats at the area. Certain populations are below dams at river Sapundžica and its tributaries, increasing the likelihood that these sites dry up at late summer. Climate change can increase aridity threatening Pelister population(s) on a long run.

Management recommendations for the sites of occurrence

Assessment of populations at Pelister National Park should be a priority. All populations should be taken into consideration while planning forestry actions, which should not be allowed in the vicinity of viable populations. Effects of water uptake should be monitored. Management actions those will support populations should also be studied.

Methods for inventory and monitoring

Main method for the inventory and monitoring of the species is active searching of flowering individuals during growing season. Careful inventories should be done along all rivers and streams at Pelister National Park. Field Inventory Form for vascular plants should be filled for each locality and monitoring should be based on repeated inventories of known sites. Monitoring is needed to be repeated in 5-10 year period.

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Fig. 104. The Carpathian Tozzia (*Tozzia carpathica*) is an annual hemiparasite that grows at shorelines of subalpine -alpine streams. In North Macedonia it has four known localities at Pelister National Park. A population above Rotino, close to Kopanki-Pali Snopje hiking trail. Photos: Kimmo Syrjänen.

Justifications for the assessment of conservation status

Size of distribution area

Distribution of the species is mainly eastern Carpathian and it grows in Slovakia, Poland, Ukraine and Romania (Dité 2008). It is also known from Balkan mountain range from Bulgaria (Old Plateau, Vitosha, Rila), Serbia, northern Greece (Varnous and Pindos) and North Macedonia (Baba/Pelister). The first record about the presence of the species *Tozzia carpathica* (sub Tozzia alpina) on the territory of North Macedonia (Pelister: Rotino, 1400 m) was cited by Bornmüller (1928). *Tozzia carpathica* is known to grow in North Macedonia only at Pelister National Park (Matevski et al. 2019). There is according to present knowledge altogether five populations, but the real amount is probably somewhat higher. In Pelister National Park it was observed in two localities at Pali Snopje (Borojca and Rotino rivers by twinning project in 2018). It is met also from Caparska river (Čarni & Matevski 2010) and there is earlier information from Nižepole, where it has been observed along Sapundžica and Ezerska rivers (Matevski, 2002-2003). In 2019 there was observed a big population along Stara Buka river. During the phytosocyological investigation on Pelister mountain this species is registered within the association *Doronico austriaci-Cirsetum apendiculatae*, which develops in the belt of the tall herb vegetation along streams from the montane to subalpine zone of Pelister Mt – Capari, from 1270 to1790 m (Čarni & Matevski 2010). The most important plant species that represent part of the association, alliance Cirsion apendiculati, order Adenostyletalia and classis Mulgedio-Aconietea are the following: *Cirsium appendiculatum, Doronicum austriacum, Angelica pancicii, Geranium sylvaticum, Rumex alpinus, Geum coccineum, Athyrium filix femina, Myosotis scorpioides, Cardamine raphanipholia subsp. acris, Mentha spicata* subsp. *spicata*, and others. Until now, this species is not known for other parts of the territory of Republic of North Macedonia.

Size of population

Actual size of North Macedonian population is not known. Amount of individuals of this annual species probably varies from year to year. Data on present populations show them to be rather small, some tens or at highest about a couple of hundred individuals in each. Estimation of size of the whole Pelister NP population varies from

some hundreds to a couple of thousands. Along Stara Buka river the population seems to be viable and at least host several hundreds of individuals in a couple of tens patches.

Quality of habitat for the species

Habitat of the species seems to be rather stable at the moment. Climate warming is probably the biggest thread at long run. Uptake of water and construction of hydroelectric power plants may have had negative effects on habitats of species. However, present populations are mainly at higher levels than these power stations, despite river Sapundžica and its tributaries.

Future prospect

In near future there are no big negative changed to be expected inside Pelister National Park area. At longer time period climate warming will probably affect negatively to occurrences. Climate warming can also enhance negative effects of water uptake. The whole population and subpopulations are small in size that can cause decrease because of demographic and stochastic threats.

Conservation status	
Range (of the distribution area)	FV
Population	U1
Habitat for the species (quality)	FV
Future prospects	U1
Overall assessment of Conservation Status	**U1**

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