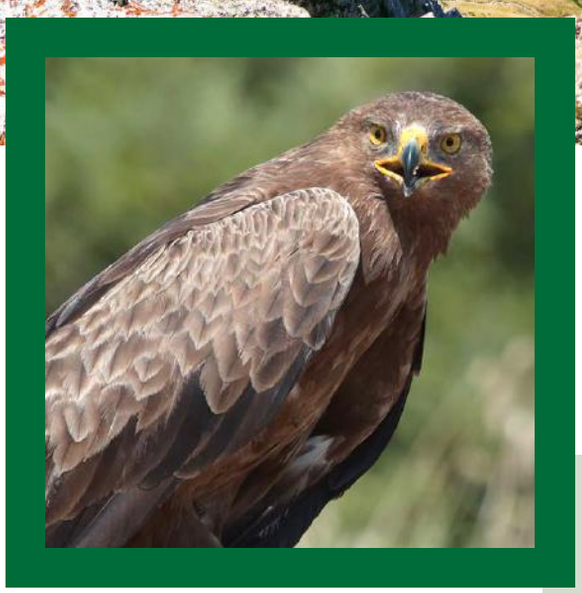
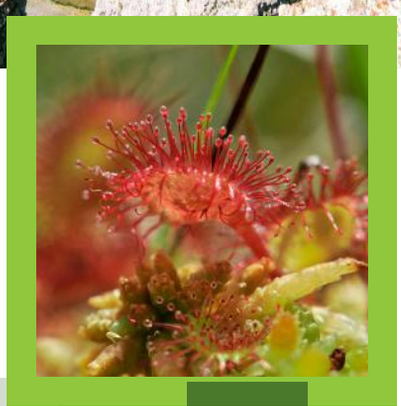
REPUBLIC OF MACEDONIA

MINISTRY OF ENVIRONMENT AND PHYSICAL PLANNING





NATIONAL STRATEGY FOR NATURE PROTECTION

(2017 - 2027)

Skopje, 2018

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ПРОГРАМА ЗА ЗАЧУВУВАЊЕ НА ПРИРОДАТА

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

HELVETAS Swiss Intercooperation

ФАРМАХЕМ PHARMACHEM

The National Strategy for Nature Protection was prepared within the Nature Conservation Programme in Macedonia, a project of the Swiss Agency for Development and Cooperation (SDC), coordinated by Helvetas Swiss Intercooperation and Farmahem.

The Government of the Republic of Macedonia, on its fifty eight session, held on 13.03.2018 adopted the National Strategy for Nature Protection (2017-2027).

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Prepared by: Geomap, DOO, Skopje

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Golden eagle (*Aquila chrysaetos*), round- leaved sundew (*Drosera rotundifolia*),
Sage (*Salvia jurisicii*) –**Ljubomir Stefanov**, Large Copper (*Lycaena dispar*) – **Dime Melovski**

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ABBREVIATIONS:

JSC	Joint Stock Company
GIS	Geographic Information Systems
GEF	Global Environment Fund
SSO	State Statistical Office
EU	European Union
EUNIS	European Information System of Nature
EEA	European Environment Agency
IMA	International Mineralogical Association
IZIIS	Institute of Earthquake Engineering and Engineering Seismology
IUCN	International Union for Conservation of Nature
MANU	Macedonian Academy of Sciences and Arts
MCS	Mercalli scale
MAFWE	Ministry of Agriculture, Forestry and Water Economy
MoEPP	Ministry of Environment and Physical Planning
MoE	Ministry of Economy
MF	Ministry of Finance
MTV	Macedonian Television
MEPSO	Electricity Transmission System Operator of Macedonia
MAK-NEN	Macedonian National Ecological Network
NGO	Non-governmental Organizations
NP	National Park
EIA	Environmental Impact Assessment
SPA	Specially Protected Areas
SAC	Special Areas of Conservation
WA	Wilderness Area
NP	Nature Park
MpA	Multi-purpose Area
RM	Republic of Macedonia
SNR	Strict Nature Reserve
NM	Natural Monument
PA	Protected Area
SDC	Swiss Agency for Development and Cooperation
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
HWRP	Hydrology and Water Resources Programme
WMO	World Meteorological Organization
WB	World Bank
WWF	World Wildlife Fund
WDPA	World Database for Protected Areas

PREFACE

Republic of Macedonia possesses an exceptional natural heritage, above all, great biological diversity and resources, characterized with high level of indigenousness and rarity.

Diverse geomorphological heritage, geological phenomena and hydrological resources and characteristics of the terrain contribute to the impressive natural values. The role of the different areas and their function as habitats for wildlife is of special importance in the context of environmental protection.

Yet, a great challenge to the sustainability of the natural wealth is the threat coming from other sectors: Forestry, agriculture, energy, transport, industry, mining, construction, tourism, etc.

In order to respond to these threats on a national level, we have developed tools and mechanisms for protection, preservation and sustainable use of natural resources. The development and promotion of management of the protected areas (covering around 9% of the territory of the country), establishment of the concept of ecosystem services, identification of the areas, identification and mapping of ecosystems, drafting National Red Lists for different taxonomic categories, preparation of an inventory for the European Ecological network Natura 2000, through the identification of potential areas to be included in Natura 2000, drafting of an inventory of the geological heritage, are just part of the activities which contribute to the promotion of the activity for environmental protection.

Mr. Sadulla Duraki,

Minister of Environment and Physical Planning

On an international level, the Republic of Macedonia participates in the global activities and initiatives for environmental protection, especially protection of biological diversity. The Republic of Macedonia has ratified the international conventions and agreements in the field of protection of the environment, such as the Convention on biological diversity, the Convention on the conservation of European wildlife and natural habitats, the Ramsar Convention, the World Heritage Convention (UNESCO), etc., and through their implementation actively contributes to the fulfillment of the global goals for environmental protection.

Emphasis should be put on the activities of the Ministry of Environment and Physical Planning in the segment of harmonization of the national legislation on protection of the environment with the relevant EU legislation, i.e. the Directive on conservation of natural habitat and wild fauna and flora and the Directive on conservation of wild birds, as the two most important instruments of the EU for environmental protection. The identification and selection of habitats, types of birds important for the EU, and identification of potential future areas for Natura 2000 is one of the top priority activities in the field of environmental protection.

In order to respond with concrete action and measures to the potential threats to the nature, as it is stipulated with the Law on protection of the environment, and with the support of the Swiss Agency for Development and Cooperation (SDC), we have prepared a National Strategy for Protection of the Environment with an Action Plan (2017-2027).

The Strategy includes the most important aspects related to the natural values in the field of geology, geomorphology, hydrology, biological diversity and areas/regions. Through analysis of the conditions and identification of the threats we have incorporated adequate measures and activities for protection and sustainable environmental management. The Strategy unifies actions based on a synthesis of analysis of strategies for waters, biological diversity, mineral raw materials, tourism, energy and other fields, as well as actions arising from the obligations from international ratified documents (conventions and agreements) by the Republic of Macedonia in the field of environmental protection and the relevant EU legislation.

Provision of an integral protection of the environment requires a holistic approach involving all stakeholders.

The Ministry of Environment and Physical Planning shall be the driving force and creator of policies for environmental protection and it shall put efforts to always involve all stakeholders.

We hereby invite you to join us on our mission to jointly contribute to the fulfilment of the strategic vision for protection of nature i.e. sustaining a diverse and preserved nature in Macedonia, as the baseline for a healthy and prosperous society.

GENERAL INFORMATION ABOUT THE PROJECT

NATIONAL STRATEGY FOR NATURE PROTECTION

The Republic of Macedonia, based on its area of 25,713 km^2, has a very diverse nature, represented by various elements of geodiversity, biodiversity and landscape. Some of the geological and geomorphological forms, hydrological objects, natural habitats and wild species, because of their diversity and uniqueness, not only are they significant at the national level, but also regionally and worldwide. The question often arises as to how to provide protection, conservation and sustainable use of these natural resources. In a series of documents which have been prepared in the past period, the domain of nature has been dealt with separately. Hence, it is necessary to develop an integral strategic document for the protection and sustainable use of nature which will cover all components of nature, as well as the objects and areas that are characterized by special natural values and therefore deserve to be treated with appropriate degree of protection.

In order to achieve this goal, the Ministry of Environment and Physical Planning (MoEPP) in July 2015 launched activities for the preparation of the National Strategy for Nature Protection.

The National Strategy for Nature Protection has been developed within the Project: "Nature Conservation Programme of Macedonia", which is being realized with financial assistance by the Swiss Agency for Development and Cooperation (SDC). The Strategy has been developed on the basis of an Agreement (No. 11-3562/8 of 29.07.2015) for the Preparation of a National Strategy for Nature Protection, which regulates the cooperation between the MoEPP as the contractor of the strategy, the Trade company for publishing, cartography, construction and services GEOMAP DOO-Skopje, as the developer of the National Strategy for Nature Protection and the Trading and Consulting Company Farmahem DOOEL, Skopje, as a programme coordinator of the Nature Protection Programme of Macedonia. This agreement is based on the already signed agreements between the Swiss Agency for Development and Cooperation (SDC) and Helvetas Swiss Intercooperation (HSI), the agreement between HSI and Farmahem, the Memorandum of Understanding for the Nature Conservation Programme in Macedonia, signed between the Government of the Swiss Confederation represented by the Foreign Affairs Department acting through the SDC and the Government of the Republic of Macedonia represented by the Ministry of Environment and Physical Planning, as well as the agreement for the preparation of the National Strategy for Nature Protection and the Strategic Environmental Assessment Report of the National Strategy for Nature Protection, concluded between MoEPP and Farmahem Skopje, (No. 02-11469/1 of 03.12.2013) and Annex No. 1 to this agreement (No. 11- 903/2 of 28.01.2015).

The national legislation requires the preparation and adoption of a National Strategy for Nature Protection. According to Article 159 of the Law on Nature Protection ("Official Gazette of the Republic of Macedonia" No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16), the Government of the Republic of Macedonia, on the proposal of the Minister of Environment and Physical Planning, adopts a National Strategy for Nature Protection. The strategy is valid for 10 years and contains long-term foundations of the nature protection policy.

The need for preparing a National Strategy for Nature Protection has been noted in the Work Programme of the Government of the Republic of Macedonia for the period 2014-2018, with a deadline for the preparation of this strategic document by March 2017. At the same time, the Plan of Activities of the Department of Nature at the Ministry of Environment and Physical Planning for 2016 also encompasses activities for the preparation

of the National Strategy for Nature Protection as one of the most important priority issues.

The need for preparing the strategy has been noted in the Second National Environmental Action Plan (2006), the National Programme for the Adoption of the Acquis (Revision-2016) and the European Commission Progress Report on the Republic of Macedonia (2015).

From the methodological point of view, within the Project: Preparation of a National Strategy for Nature Protection, through which the strategy in question has been developed by the Trade company for publishing, cartography, construction and services GEOMAP DOO-Skopje in cooperation with experts, MoEPP and Farmahem, two basic documents have been prepared:

- Study on the State of Geodiversity and Geological Heritage of the Republic of Macedonia and other Components of Nature (Biological and Landscape Diversity) and
- National Strategy for Nature Protection with Action Plan

These documents should be considered integrally and serve as the basis where the objects of nature protection interest are identified, thus forming a complete picture of the state of nature protection in the Republic of Macedonia.

In the past period, the natural values in the area of hydrology and biodiversity have been separately managed, and the area of geology and geomorphology, as well as the areas in the Republic of Macedonia are subject to the first integral consideration within this Study on Geodiversity and Heritage of the Republic of Macedonia and other Components of Nature (biological and landscape diversity). The study has been prepared through several separate parts that form a single whole.

In the context of the above, the Study deals with geodiversity, i.e. geology, geomorphology and hydrology, as well as with biodiversity and landscape in the Republic of Macedonia. All data are subject to integral consideration, whereby the data are organized at the appropriate level of the GIS environment.

The study covers the general geographical characteristics of the Republic of Macedonia such as the geographical position and frontiers, general features of tectonics, geology, relief, climate, hydrography, pedological composition and population on the territory of the Republic of Macedonia. In addition, the Study includes the following separate parts:

- Geology with the characteristics of tectonics and the geological structure of the territory with all the features of the lithological stratigraphic units;
- Geomorphology with a more detailed description of the geomorphological types of structural relief, paleo-volcanic relief, fluvial, karst, abrasive (coastal), glacial and periglacial relief;
- Hydrology with water treatment in the Republic of Macedonia including groundwater, springs, rivers and lakes with their hydrometric characteristics and significance;
- Biodiversity covering a large number of flora and fauna species present on the territory of the Republic of Macedonia;
- Landscapes on the territory of the country with areas with distinctive features, which are separately covered (forests, pastures, urban areas, industrial areas, etc.).
- Geographic information systems are a separate whole covered in the study, and there is an explanation of how GIS is organized and established at the objects and areas of nature protection interest in the Republic of Macedonia.

The specified separate parts of the Study are the basis for identifying the objects of nature protection interest.

The National Strategy for Nature Protection has been developed on the basis of the data and information of the Study on the State of Geodiversity and Geological Heritage of the Republic of Macedonia and other Components of Nature (biological and landscape diversity), which includes the most important aspects related to the natural values in the field of geology, geomorphology, hydrology, as well as biodiversity and landscapes. The Strategy, by means of analysis of the situation and identification of threats, proposes appropriate

measures and activities for protection and sustainable management of nature.

The Strategy also summarizes actions based on synthetic analysis of the strategies related to water, biodiversity, mineral resources, tourism, energy and other areas, as well as actions arising from the obligations of the international ratified documents (conventions, agreements and protocols) of the Republic of Macedonia, in the field of nature protection and the relevant EU legislation.

The stated goals only reflect the global concept of the Strategy. The practical realization implies covering a number of other details, which are defined in the Action Plan, in order to enable sustainable development of nature.

PART 1

1. VISION, MAIN OBJECTIVES AND ROLE OF THE STRATEGY FOR NATURE PROTECTION

1.1. VISION

The vision of the Strategy for Nature Protection until 2027 has been established in the process of drafting the National Strategy for Nature Protection, taking into account the vision of the European Union for biodiversity as well as the ratified international agreements of the Republic of Macedonia in the field of nature protection and the national needs, through the process of involving the relevant stakeholders:

MACEDONIA'S DIVERSE AND PROTECTED NATURE IS THE BASIS FOR A HEALTHY AND PROSPEROUS SOCIETY

1.2. MAIN OBJECTIVES OF THE STRATEGY

The main objectives of the National Strategy for Nature Protection are identification, study, protection and permanent monitoring of the implementation in the protection of objects and phenomena of protection interest in the area of geodiversity and geological heritage of the Republic of Macedonia and other components of nature (biological and landscape diversity). In the context of the aforementioned, the objectives encompass understanding of:

- the situation and problems in the realm of nature protection,
- the guidelines for establishing an integrated system for protection of geodiversity and geoheritage of the Republic of Macedonia and other components of nature (biological and landscape diversity), preservation and management of protected areas,
- the responsibilities of all nature protection stakeholders,
- the legal and financial mechanisms for the protection and management of nature, etc.

The National Strategy also defines a number of specific goals that cover:

- preservation of the natural entities in terms of the geological and geomorphological properties of nature,
- rational use of mineral resources,
- ensuring the sustainable use of wild species and ecosystems,
- strengthening and improving the system of protected areas,
- preservation of landscape diversity in accordance with the requirements of the Landscape Convention,
- strengthening the institutional capacities for nature protection at the central and local level,

- establishing and developing ecological networks for effective protection and management of natural heritage,
- aligning the Strategy for Nature Protection with other strategic development documents of other sectors (forestry, agriculture, animal husbandry, fisheries, transport, energy, industry, mining, tourism, civil engineering, etc.) by integrating the nature protection policy,
- achieving integrated nature protection by promoting a holistic approach to protecting biodiversity, geodiversity and landscape diversity.

1.3. GENERAL ROLE OF THE STRATEGY

This Strategy is the result of the efforts to create conditions for increasing public awareness of the need for nature protection in the Republic of Macedonia in a clear, complete and long-term concept that will be consistently applied.

The consideration of the situation and the analyses demonstrate the need for improvement of the conditions related to the protection of geodiversity and geoheritage of the Republic of Macedonia and other components of nature (biological and landscape diversity) as well as all the interacting elements of the ecological system, i.e. the soil, water and air.

Two interconnected aspects are very important for meeting this need: (1) adapting the conditions in the Republic of Macedonia to the concept of sustainable development of the society as a whole and (2) approximating and integrating the Republic of Macedonia in the European Union (EU). In both cases, nature protection is an important link which would contribute to the development of the country as a whole.

The National Strategy for Nature Protection will contribute to more efficient implementation of the national legislation and the obligations arising from the EU legislation, that is, the implementation of the EU Birds and Habitats Directives.

Undoubtedly, the strategy will also have a positive impact on the implementation of the three UN Framework Conventions (Convention for the Protection of Biodiversity, the Convention on Climate Change and the Convention to Combat Desertification), as well as the international ratified documents in the area of nature protection.

In terms of establishing integral nature protection (geodiversity and biodiversity), the strategy will contribute to the promotion of the implementation of the UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage and the European Landscape Convention aimed at protection, management and planning of landscapes and the organization of European cooperation on landscape issues.

1.4. ROLE OF THE STRATEGY WITHIN THE NATURE PROTECTION POLICY

The role of the strategy is in accordance with the concept defined by the needs of the Republic of Macedonia, as well as the obligations arising from the EU directives, regulations and recommendations in the process of accession of our country to the EU. The Ministry of Environment and Physical Planning should identify the needs and strengthen its capacities for programming and implementation of projects and activities for the protection of geodiversity and geoheritage of the Republic of Macedonia and other components of nature (biological and landscape diversity). In that sense, the adoption of strategic de-

velopment documents as instruments for improving the state of nature protection at the national level is a priority objective of the Ministry of Environment and Physical Planning. In this respect, the National Strategy for Nature Protection is an important document that will determine the priorities, measures and activities for integral nature protection.

The Strategy for Nature Protection in general explains the vision, main objectives and strategic goals for nature protection and represents an integrated framework based on a series of strategic components and approaches.

The Strategy defines the guidelines for nature conservation, the manner of its implementation in accordance with the overall economic, social and cultural development of the Republic of Macedonia, and is prepared on the basis of the Study on the State of Geological Diversity and Geological Heritage of the Republic of Macedonia and other Components of Nature (biological and landscape diversity).

By applying the benefits defined in the Strategy, it has been assessed that, if consistently implemented, it will play a significant role in the following areas:

- determining the basic guidelines in the field of nature protection in the upcoming period, guided by the idea that inadequate management of the ecosystem elements, in the past or in the present, can bring about serious consequences for nature in the future;
- determining the basic guidelines for the gradual establishment of a nature management system in the coming period, taking into account the opportunities for economic development;
- setting out the basic principles for the sustainable use of natural mineral resources, as well as waste management
- guiding the system of activities regarding the harmonization of legislation as an inevitable process in Macedonia's approximation to EU membership;
- determining the basic nature management competencies, the significance and the role of the ownership of capital, and the roles and tasks of the individual stakeholders in society;
- establishing the framework of the activities in the field of management of environmental elements and nature as part of the environmental protection policy for economic and social development;
- setting out the main objectives in the management system for a period of 10 years, and then, through institutional, organizational, technical and economic measures reducing, mitigating and ceasing the impacts on nature;
- providing guidelines for solving the problem of already deposited tailings as an ongoing strain on nature, so-called "environmental hot spots" that cause negative impacts on nature and require special remediation measures;
- roughly representing an estimate of the required investments for the realization of the strategic goals.

1.5. SIGNIFICANCE OF THE STRATEGY IN RELATION TO THE ECONOMIC DEVELOPMENT POLICY

The Strategy for Nature Protection introduces a number of fundamental principles that are essential for achieving the nature protection objectives of the Republic of Macedonia, which means that through the sustainable use of mineral resources and the valorization of geodiversity and geoheritage and other components of nature (biological and landscape diversity) it will provide an optimal balance for reducing the sources of degradation and pollution of nature.

All recommendations in the Strategy should contribute to the process of approximation of the Republic of Macedonia to the EU, development of the national economy and quality of the environment.

In accordance with the Law on Nature Protection, the strategies for protection and use of natural resources and natural heritage are harmonized with the National Strategy for Nature Protection.

In the early stages of planning the use of mineral resources, it is important to include measures for nature protection. It is necessary to further increase the incorporation of nature protection measures into national legislation on the use of mineral resources and in the Strategy on Geological Research, Sustainable Use and Exploitation of Mineral Resources (2010-2030), as well as to follow recommendations and guidelines from the Strategy for Nature Protection and other strategic documents in the field of nature protection. It is certainly necessary to make efforts to also include nature protection measures in the strategic documents of other sectors in the area of forestry, agriculture, fisheries and aquaculture, infrastructure, energy, tourism, etc.

2. ANALYSIS OF THE LEGAL AND INSTITUTIONAL FRAMEWORK FOR NATURE PROTECTION

2.1. LEGAL FRAMEWORK FOR NATURE PROTECTION

The natural resources on the territory of the Republic of Macedonia were recognized as early as in the 1950s. Hence, one can freely state that nature protection in the Republic of Macedonia has a very long tradition. Consequently, in 1948, due to the exquisite beauties of nature, the historical and scientific significance of the forests and forest areas, part of Pelister Mountain was proclaimed a national park, which is also the first protected natural resource in Macedonia and the former Yugoslavia. Furthermore, in 1949, the forest landscapes around Mavrovo Lake were proclaimed a national park, followed by the proclamation of Mount Galichica as a national park in 1958.

Until the adoption of the Law on Nature Protection in 2004, the protection of nature was regulated in accordance with the Law on Protection of Natural Rarities (1973) and the Law on Protection of National Parks (1980). In 1996, the Law on Environment and Nature Protection and Promotion (“Official Gazette of the Republic of Macedonia” No. 69/96, 13/39/41/00, 96/00 and 45/02) was adopted.

In the Republic of Macedonia, the grounds for nature protection have been established in the **Constitution of the Republic of Macedonia** (“Official Gazette of the Republic of Macedonia” No. 52/91 and Amendments I-XXXII). The Constitution provides for the right to a healthy environment (Article 43, paragraph 1); every citizen is obligated to promote and protect the environment and nature (Article 43, paragraph 2); and determines the natural resources of the country, flora and fauna as goods of general interest that are under special protection (Article 56, paragraph 1); and certain goods of general interest for the country can be devolved to use in a manner and under conditions determined by law (Article 56, paragraph 3).

In the last decade, the Ministry of Environment and Physical Planning has worked on the development of a number of environmental laws, including the Law on Environment

as a framework law in the area of the environment, which has been transposed into the segment of the Acquis Communitaire, known as horizontal legislation in the process of approximation of national legislation to EU legislation.

The Framework **Law on Environment** ("Official Gazette of the Republic of Macedonia" No. 53/05, 81/05, 24/07, 159/08, 83/09, 48/10, 124/10, 51/11, 123/12, 93/13, 187/13, 42/14, 44/15, 129/15, 192/15, 39/16) includes the basic principles of environmental protection on the basis of which the appropriate environment management procedures are regulated. The Law regulates the rights and obligations of the Republic of Macedonia, the municipality, the City of Skopje and the municipalities in the City of Skopje, as well as the rights and duties of the legal entities and natural persons in providing conditions for protection and promotion of the environment, aimed at exercising citizens' right to a healthy environment. In addition to this law, the provisions of the separate laws regulating certain environmental media and areas also apply to the protection and promotion of the quality and condition of the environmental media: soil, water, air; as well as the areas in the environment, biodiversity and other natural resources, and the protection of the ozone layer and protection against negative anthropogenic impacts on the climate system.

The Law also regulates the procedure for environmental impact assessment (EIA) and the procedure for strategic environmental assessment of certain strategies, plans and programmes, which include measures and activities for protection and sustainable use of nature. These procedures (SEA and EIA) are particularly important for preventing the fragmentation of habitats in the implementation of road construction projects, dams, airports, etc.

The **Law on Nature Protection** ("Official Gazette of the Republic of Macedonia" No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16) regulates the protection of nature through protection of biological and landscape diversity and protection of natural heritage, in protected areas including outside protected areas, as well as protection of natural rarities. The main objectives of the law are the following:

- Establishing and monitoring the state of nature;
- Preserving and restoring the existing biological and landscape diversity in a state of natural balance;
- Establishing a network of protected areas for permanent protection of the properties on the basis of which they have acquired the status of natural heritage;
- Ensuring the sustainable use of natural resources in the interest of current and future development, without significant damage to the parts of nature and as few as possible disruptions of natural balance;
- Prevention of harmful activities by natural and legal persons and disruptions in nature as a consequence of technological development and performance of activities, i.e. providing as favorable conditions as possible for the protection and development of nature and ensuring the right of citizens to a healthy environment.

The Law on Nature Protection regulates the protection of wild species of plants, fungi and animals, natural habitats and ecosystems, as well as the protection of the landscape, minerals and fossils. A separate portion of the law refers to the system of protected areas established for the protection of biodiversity within natural habitats, processes occurring in nature, as well as abiotic characteristics and landscape diversity. The Law contains provisions that refer to the categories of protected areas, the manner of their proclamation, zoning and management.

The Law transposes the provisions of the EU Directive on the Conservation of Natural Habitats and Wild Fauna and Flora (92/43/EEC), the EU Directive on the Conservation

of Wild Birds (2009/147/EC), as well as the Regulation on the Protection of Species of Wild Fauna and Flora by Regulating Trade Therein (338/97/EEC).

In separate chapters, the Law contains provisions that refer to the organization of nature protection, the records on nature protection (the Register of Protected Areas and the Register of Natural Heritage), the monitoring of the state of nature, provisions related to the National Biodiversity Information System, the National Strategy for Nature Protection, provisions related to financing nature protection with special emphasis on protected areas, inspection supervision and penal provisions.

In accordance with Article 187 of the Law on Nature Protection, the competent body for carrying out expert activities for nature protection is obliged to revalorize the protected areas protected before the date of the application of this Law (2005) and to draft new proclamation acts.

List of enacted laws for proclaiming protected areas

- Law on the Proclamation of Smolare Falls as a Natural Monument ("Official Gazette of the Republic of Macedonia" No. 35/06);
- Law on the Proclamation of the Site of Markovi Kuli as a Natural Monument ("Official Gazette of the Republic of Macedonia" No. 49/06);
- Law on the Proclamation of Part of Pelister Mountain a National Park (Official Gazette of the Republic of Macedonia No. 150/07);
- Law on the Proclamation of the Site of Kuklica as a Natural Monument ("Official Gazette of the Republic of Macedonia" No. 103/08);
- Law on the Proclamation of the Site of Lokvi-Golemo Konjari as a Natural Monument ("Official Gazette of the Republic of Macedonia" No. 124/10);
- Law on the Proclamation of the site of Ploche Litotelmi as a Strict Nature Reserve ("Official Gazette of the Republic of Macedonia" No. 145/10);
- Law on the Proclamation of a Part of Galichica Mountain as a National Park ("Official Gazette of the Republic of Macedonia" No. 171/10);
- Law on the Proclamation of the Cave Slatinski Izvor as a Natural Monument ("Official Gazette of the Republic of Macedonia" No. 23/11);
- Law on the Proclamation of Prespa Lake as a Natural Monument ("Official Gazette of the Republic of Macedonia" No. 51/11, 79/13);
- Law on the Proclamation of Dojran Lake as a Natural Monument ("Official Gazette of the Republic of Macedonia" No. 51/11);
- Law on the Proclamation of the Site of Ezerani at Prespa Lake as a Nature Park ("Official Gazette of the Republic of Macedonia" No. 24/12);
- Law on the Proclamation of Vevchani Springs as a Natural Monument ("Official Gazette of the Republic of Macedonia" No. 39/12);

The Law on Nature Protection provides a legal basis for certain natural sites to be proclaimed natural rarities. Certain rare, endangered and endemic species of flora and fauna, their parts and communities, relief forms, geological profiles, paleontological and speleological objects can be proclaimed natural rarities. In accordance with this Law, a Decision was adopted for the Proclamation of the Dona Duka Cave as a Natural Rarity ("Official Gazette of the Republic of Macedonia" No. 182/11) and the Decision for the Proclamation of Sycamore Trees (*Platanus orientalis*) - Morodvis as a Natural Rarity ("Official Gazette of the Republic of Macedonia" No. 65/16).

The **Law on Protection of Ohrid, Prespa and Dojran Lake** ("Official Gazette of the SFRY" No. 45/77, 8/80, 51/88, 10/90 and "Official Gazette of the Republic of Macedonia" No. 62/93), the waters of these three lakes, coastal areas, springs and watercourses,

due to their characteristic features and beauties of nature, have been proclaimed natural monuments of particular importance to the community and are placed under special protection.

The **Law on the Management of the World Natural and Cultural Heritage in the Ohrid Region** ("Official Gazette of the Republic of Macedonia" No. 75/10) regulates the management of the natural and cultural heritage in the Ohrid region, recorded in the World Natural and Cultural Heritage List of the Convention Concerning the Protection of the World Cultural and Natural Heritage (UNESCO Convention). The Law regulates the rights and duties of the Republic of Macedonia, the municipalities of Ohrid, Struga and Debarca, as well as the rights and duties of the legal entities and natural persons in relation to the management of the world natural and cultural heritage in the Ohrid region. In accordance with this Law, a Plan for Natural and Cultural Heritage Management in the Ohrid Region has been prepared.

In addition to the aforementioned laws, provisions that apply to nature issues have been prescribed by other laws and by-laws. A summary of these is provided in Annex 3 of this Strategy.

RATIFIED INTERNATIONAL AGREEMENTS IN THE AREA OF NATURE PROTECTION

- Convention on Biological Diversity (Rio, 1992);
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity (Cartagena, 2000);
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971);
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 1979);
- Convention on the Conservation of European Wildlife and Natural Habitats (Berne, 1979);
- Convention Concerning the Protection of the World Cultural and Natural Heritage (UNESCO, 1972);
- Convention on International Trade in Endangered Species of Wild Fauna and Flora - CITES Convention (Washington, 1972);
- European Convention for the Protection of Vertebrate Animals used for Experimental and Other Scientific Purposes (Strasbourg, 1986);
- European Landscape Convention (Florence, 2000);
- Agreement on the Conservation of Bats in Europe (London, 1991);
- African-Eurasian Migratory Waterbird Agreement (The Hague, 1995);

Other relevant conventions

- Convention on Access to Information, Public Participation in Decision-Making and Access to Justice on Environmental Matters (Aarhus, 1998);
- United Nations Framework Convention on Climate Change (New York, 1992);
- United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (Paris, 1994).

EU DIRECTIVES AND REGULATIONS

The Law on Nature Protection includes provisions transposed from the two most important EU instruments for nature protection, i.e. biodiversity, namely: The Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) and the

Directive on the Conservation of Wild Birds (147/2009/EC). The Law also transposes the Regulation on the Protection of Species of Wild Fauna and Flora by Regulating Trade Therein (338/97/EC).

Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitat Directive). The purpose of the Directive is to contribute to the conservation of biodiversity through the conservation of natural habitats and of wild fauna and flora on the territory of EU Member States. Measures taken in accordance with this Directive are intended to maintain or restore to a favorable conservation status of natural habitats and of species of wild fauna and flora of Community interest.

In accordance with this Directive, EU Member States are obliged to establish the European ecological network Natura 2000, which includes “Specially Protected Areas” (SPAs) - defined in accordance with the Birds Directive and “Special Areas of Conservation” - defined in accordance with the Habitats Directive.

Around 55% of this Directive has been transposed into the national legislation.

The **Directive on the Conservation of Wild Birds** provides a framework for the conservation and management of wild birds in Europe and their interaction with humans. It sets out broad goals with many activities, although specific legal mechanisms are the discretion of each member state. The Directive applies to birds, their eggs, nests and habitats. In accordance with this Directive, EU Member States are obligated to take all necessary measures to maintain the population of bird species at a level appropriate primarily to the environmental, scientific and cultural requirements, taking into account economic and recreational requirements, or adapt the population of those species to that level.

For the EU Member States, the most important obligations arising from the Birds Directive are:

- To identify “Special Protected Areas” (SPAs) that are most suitable for survival of bird species as per Annex 1 to the Directive,
- To regulate the hunting of bird species as per Annex 2 and
- To regulate the trade in bird species as per Annex 3 to the Directive.

Around 84% of the Directive on the Conservation of Wild Birds has been transposed in the national legislation.

The Zoos Directive aims to protect wild animals and preserve biodiversity in EU Member States by implementing measures, issuing permits and inspection of zoos in the community, thereby enhancing the role of zoos in conserving biodiversity.

The purpose of the **Regulation on the Protection of Species of Wild Fauna and Flora by Regulating Trade Therein** is to provide protection of the species of wild fauna and flora and guarantee that they will be preserved through regulation of trade therein. The Regulation applies only to EU Member States and applies in accordance with the objectives, principles and provisions of the Convention on International Trade in Endangered Species of Wild Fauna and Flora - the CITES Convention.

The Law on Waters transposes the requirements of the following **EU Directives in the field of water resources management**:

- Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy;

- Directive of the European Parliament and of the Council 98/83/EEC on the quality of water intended for human consumption;
- Directive of the European Parliament and of the Council 76/160/EEC on the bathing water quality;
- Directive of the European Parliament and of the Council 1991/271/EEC concerning urban waste-water treatment;
- Directive of the European Parliament and of the Council 86/278/EEC on the protection of the environment, and in particular the soil, when sewage sludge is used in agriculture;
- Directive of the European Parliament and of the Council 91/676/EEC on the protection of waters against pollution caused by nitrates from agricultural sources.

STRATEGIC DOCUMENTS, PLANS AND PROGRAMMES RELATED TO THE NATURE PROTECTION STRATEGY

List of adopted strategic documents in the field of environment

- Spatial Plan of the Republic of Macedonia (2002-2020);
- National Water Strategy (2012-2042);
- Water Management Master Plan of the Republic of Macedonia;
- Waste Management Strategy of the Republic of Macedonia (2008-2020);
- Plan for the Management of Waste Electric and Electronic Equipment in the Republic of Macedonia with Feasibility Study for the period 2013-2020;
- National Plan for the Ambient Air Quality Protection in the Republic of Macedonia for the period 2013-2018;
- National Strategy for Sustainable Development (2009-2030);
- Prespa Lake Watershed Management Plan;
- Third National Communication/Climate Change Plan (2014);
- Communication Strategy and Action Plan on Climate Change (2013);
- Programme for the Gradual Reduction of Emissions of Certain Polluting Substances in the Republic of Macedonia (2012);
- National Implementation Plan for Reducing and Removing Persistent Organic Pollutants (POPs) in the Republic of Macedonia (2004) (2014-second-updated);
- National Action Plan for the Strategic Management of Chemicals in the Republic of Macedonia (2010);
- Spatial Plan of the Ohrid-Prespa Region 2005-2020 (“Official Gazette of the Republic of Macedonia” No.22/2010).

List of strategic documents in the field of environment which are under preparation or pending adoption

- Strategy and Action Plan for the Protection of Biodiversity in the Republic of Macedonia – the adoption of a new strategy is in progress;
- National Strategy on Environment and Climate Change – pending adoption;
- National Action Plan to Combat Desertification – under preparation;
- Spatial Plan for the East Planning Region – under preparation;
- Management Plan for Bregalnica River Watershed – under preparation;
- Management Plan for Strumica River Watershed – under preparation;

List of strategic documents in the field of environment the timeframe of which has expired

- National Strategy for Environmental Approximation (2008);
- Strategy with an Action Plan for the Implementation of the Aarhus Convention in the Republic of Macedonia (2005);
- National Waste Management Plan (2009-2015);
- Second National Environmental Action Plan (NEAP II) (2006-2012);
- National Strategy for Environmental Investment (2009-2013);
- National Strategy for the Clean Development Mechanism for the first commitment period under the Kyoto Protocol (2008-2012);
- Environmental Data Management Strategy (2005);
- Environmental Monitoring Strategy (2004);
- Environmental Awareness Raising Strategy (2003).

List of planning documents from other sectors related to the Nature Protection Strategy

- Strategy for Geological Exploration, Sustainable Use and Exploitation of Mineral Resources (2010-2030);
- National Programme for Development of Agriculture and Rural Development for the period 2013-2017;
- Strategy for Energy Development in the Republic of Macedonia for the period 2008-2020 with vision until 2030 (update underway);
- Strategy for the Utilization of Renewable Energy Sources in the Republic of Macedonia until 2020;
- Strategy for the Promotion of Energy Efficiency in the Republic of Macedonia until 2020;
- National Transport Strategy (2007-2017) – a new one is underway;
- Strategy for the Sustainable Development of Forestry in the Republic of Macedonia (adopted in 2006 for a period of 20 years);
- National Strategy for Tourism Development in the Republic of Macedonia – a new one is underway;
- National Strategy for Rural Tourism (2012-2017);
- Strategy for Regional Development of the Republic of Macedonia (2009-2019);
- Strategy for the Adaptation of the Health Sector to Climate Change in the Republic of Macedonia with an Action Plan (2011).

2.2. INSTITUTIONAL FRAMEWORK FOR NATURE PROTECTION

2.2.1. COMPETENT AUTHORITIES FOR NATURE PROTECTION

The existing institutional set-up for the conservation of nature in the Republic of Macedonia is mainly centralized within the government institutions. Although the decentralization process started in 2005, only a limited number of competences in relation to environmental and nature protection have been transferred to the local level.

The Assembly of the Republic of Macedonia (through the Committee on Transport, Communications and Environment) and the **Government of the Republic of Macedonia** (through the ministries and through the Secretariat on Legislation, the General Secretariat and the Commission on Economic System and Current Economic Policy) play a major role in the adoption of the legislation and strategic documents in the field of nature protection.

In accordance with the Law on Nature Protection, the **Ministry of Environment and Physical Planning (MoEPP)** is the governmental authority responsible for carrying out the activities in the field of environment and nature protection. The MoEPP carries out activities related to the implementation and creation of the policy of nature protection, protection of biological and landscape diversity and protection of natural heritage; management of biological and landscape diversity and natural heritage and control and supervision over the implementation of the provisions of this law. The structure of the MoEPP by bodies, departments and divisions is presented in more detail in the Organogram, included in Annex 4 to this Strategy.

The Administration of Environment is the competent authority for performing expert activities in the field of nature protection; it performs the activities related to keeping a register of protected areas, a register of natural heritage and records of trade and other activities with protected species, monitors the situation in nature and performs other activities in accordance with the provisions of the Law on Nature Protection. The Administration of Environment was established in 2008 as a competent authority for carrying out expert activities in the area of environment and nature protection, the main purpose of which is to establish an efficient and integrated system of environmental and nature protection, which would improve the quality of the environment in the Republic of Macedonia. The structure of the Office, along with sectoral responsibilities, is presented in Annex 4 to this Strategy.

The State Inspectorate of Environment and Nature *performs inspection supervision over the application of technical and technological measures for the protection of the air, water, land, flora and fauna against degradation and pollution, protection of geo and biodiversity, special natural resources (national parks, natural monuments, forest parks, ornithological reserves and other areas protected by law), protection of the ozone layer, protection against harmful noise in the environment and protection against non-ionizing radiation in protected areas, prevention of environmental incidents.* **Since 2014, the State Inspectorate of Environment and Nature at the MoEPP operates as a separate legal entity.**

Table 1. National Committees, Councils and Working Groups on Nature Protection[1]

Name of the committee/council	Establishment and activities
National Committee on Biological Diversity	• established in 1997, in accordance with the requirements of the Convention on Biological Diversity • composed of about twenty scientists and experts
National Committee for the Protection of Migratory Species of Wild Animals	• established in 2001, in accordance with the requirements of the Bonn Convention • includes 13 members from relevant institutions • it is necessary to ensure its operability
National Ramsar Committee	• established in 1994, in accordance with the requirements of the Ramsar Convention • includes 7 members, representatives of line ministries, scientific institutions and the non-governmental sector
National Nature Protection Council	• established in accordance with the Law on Nature Protection (Article 145, paragraph 1) • advisory body of the minister • includes a total of 8 members from relevant institutions appointed for a period of 4 years (2009-2013) • it is necessary to update the members of the council and to ensure its operability
National Biosafety Coordination Committee	• established in September 2012 for the implementation of the GEF/UNEP Project "Support for the Implementation of the National Biosafety Framework of the Republic of Macedonia" • includes 18 members from relevant ministries and scientific institutions and non-governmental organizations
National Council for Sustainable Development	• established in 2010 by the Government of the Republic of Macedonia • includes 16 members from relevant state and scientific institutions, chairman, the Deputy Prime Minister of the Government of the Republic of Macedonia responsible for economic affairs • an advisory body of the Government of the Republic of Macedonia • holds regular sessions, looks at issues and gives opinions on sustainable development policies in the country, monitors the implementation of the Strategy for Sustainable Development, gives opinions on documents in the field of economy, social development, environmental protection, agriculture and other relevant documents, cooperates with relevant institutions within the country and abroad on issues related to sustainable development and
National Commission for UNESCO	• holds regular meetings and monitors the implementation of the Convention Concerning the Protection of the World Cultural and Natural Heritage (UNESCO, 1972)
National Committee on UNESCO Man and Biosphere Programme, or MAB Committee	• National Committee on UNESCO Man and Biosphere Programme, or MAB Committee. The Committee has been established by a Decision of the Government (“Official Gazette of the Republic of Macedonia” No. 118/13). The Committee is composed of 11 members of relevant institutions and a president.
Expert Interdepartmental Group for the Assessment of Advantages and Disadvantages of Proclaiming New Protected Areas	• established in 2013 by a decision of the Minister of Environment and Physical Planning in accordance with the mandate of the Government of the Republic of Macedonia of 2011 • the working group includes 9 members of relevant state institutions • the working group is responsible for filling out the List for the Assessment of Advantages and Disadvantages of Proclaiming a New Protected Area
Councils for river watershed management on the Vardar, Bregalnica, Strumica and Crn Drim rivers	• comprised of representatives of relevant state bodies • participates in the preparation and implementation of river watershed management plans

1 Source: Fifth National Report to the Convention on Biological Diversity (MoEPP, 2014)

Ministry of Agriculture, Forestry and Water Economy. It plays a significant role in the conservation and sustainable use of biodiversity, in particular through:

- protection and sustainable use of forests and other forest products, regulation of hunting and fishing (Department of Forestry and Hunting, State Inspectorate of Forestry and Hunting),
- development of organic agricultural production (Department of Agriculture, Division of Organic Production, State Agriculture Inspectorate),
- protection of agrobiodiversity (Department of Animal Husbandry, Seed and Planting Material Directorate),
- rural development (Department of Rural Development),
- protection of animals and plants from diseases and pests (Veterinary Directorate, Phytosanitary Directorate, State Veterinary Inspectorate, Plant Protection Directorate),
- management and consolidation of agricultural land (Department for the Registration and Management of Agricultural Land, Department for the Consolidation of Agricultural Land, Exchange and Identification of Land Plots), etc.

Ministry of Economy. It plays a significant role in the conservation and sustainable use of natural resources through activities of the Department of Mineral Resources. Furthermore, through the Energy Department, this ministry can play an important role in the provision of nature protection measures, and this also applies to the Tourism Department.

Ministry of Transport and Communications. It has significant competences in the construction of infrastructure facilities, road corridors, tourist infrastructure, etc. Also, due to certain construction activities, it is imperative to implement the measures of nature protection consistently.

Ministry of Culture, Cultural Heritage Protection Directorate. It was established in 2004, in accordance with the Law on Protection of Cultural Heritage. The Directorate has significant competences in the area of studying, protection and promotion of cultural heritage in the Republic of Macedonia.

Bearing in mind that there is an interaction between natural and cultural heritage and they represent an integral whole, the role of the Cultural Heritage Protection Directorate is very important in safeguarding and protecting nature, especially in the areas that are part of UNESCO World Heritage.

Geological Survey of Macedonia. It was re-established in 2012. It conducts research, expert analytical and other activities in the field of basic geological research that are of public interest to the Republic of Macedonia, and refer to the preparation of the basic geological, hydrogeological, engineering geological, geochemical and seismotectonic maps and other geological maps and prepares their printing; determines the regularity of concentration and displacement of natural mineral resources in the earth's crust; prepares geological bases for physical planning, construction, water supply, agriculture, forestry, urbanization and construction of infrastructure facilities; participates in the development of the strategy for geological research, sustainable use and exploitation of mineral resources; proposes the programme for basic geological research on the territory of the Republic of Macedonia to the Government of the Republic of Macedonia; archives, manages and publishes data from basic and detailed geological research; archives, manages and publishes data from scientific and prospecting geological research and creates and develops the single geological information system and provides information and data to users of the results of geological research.

Agency for Spatial Planning. It implements the policy of spatial planning and arrangement of the Republic of Macedonia by carrying out the following tasks:

- developing and monitoring the implementation of the Spatial Plan of the Republic of Macedonia;
- elaborating the Spatial Plan of the Republic of Macedonia;
- carrying out a study on the conditions for spatial planning;
- maintaining and updating the single spatial-information system of data;
- developing urban plans and urban planning documentation;
- preparing urban plans, regulation plans of general urban plans, urban planning documentation and urban-design documentation, which is defined in the annual programme for financing the preparation of urban plans, regulation plans of general urban plans, urban planning documentation and urban-design documentation;
- developing architectural-urban projects and infrastructure projects; and
- preparing expert analyses and information on the planning situation for the needs of the state bodies and the state administration bodies.

Local Self-Governments. In accordance with the Law on Nature Protection, local self-governments have competences in the area of nature protection and management. Consequently, they can make proposals for proclaiming a protected area and a natural rarity.

They can also be designated as protected area management entities and in that case, they are obliged to develop management plans and annual programmes for nature protection.

Regarding the management of the National Parks, the municipality is directly involved through its representative in the National Park Steering Committee. The municipalities may be involved in procedures for conducting the EIA and SEA for various projects and activities, in accordance with the Law on Environment and thus to participate in the planning and protection of natural heritage

Public institutions/enterprises involved in nature protection and management:

- Public institution “Pelister” National Park, Bitola;
- Public institution “Mavrovo” National Park, Mavrovi Anovi;
- Public institution “Galichica” National Park, Ohrid;
- Public enterprise for the management and protection of the multipurpose area – “Jasen”, Skopje;
- Public Enterprise for the Management of Pastures, Skopje
- Public Enterprise “Makedonski Shumi”, Skopje.

Public scientific institutions involved in the study and protection of nature
Scientific institutions directly involved in the study and protection of nature are:

- Natural History Museum of Macedonia, Skopje;
- National Museum – “Dr. Nikola Nezlobinski”, Struga
- Hydrobiological Institute, Ohrid.

2.2.2 SCIENTIFIC AND TECHNICAL INSTITUTIONS INVOLVED IN THE STUDY AND PROTECTION OF NATURE

- Macedonian Academy of Sciences and Arts (MANU);
- Faculty of Natural Sciences and Mathematics, Institute of Biology, Skopje;
- Faculty of Natural Sciences and Mathematics, Institute of Geography, Skopje;
- Faculty of Natural and Technical Sciences, University “Goce Delchev”, Shtip;
- Faculty of Forestry, Skopje;
- Faculty of Agricultural Sciences and Food, Skopje;
- Faculty of Veterinary Medicine, Skopje;
- Institute of Animal Husbandry, Skopje and
- Agricultural Institute, Skopje

2.2.3 NON-GOVERNMENTAL ORGANIZATIONS INVOLVED IN ACTIVITIES FOR THE PROTECTION AND PROMOTION OF NATURAL HERITAGE

The civil sector plays a very important role in promoting the environment and nature. Numerous activities and environmental events, workshops, forums and seminars indicate the involvement of non-governmental organizations in national environmental and nature protection activities. No less important is the role of the civil sector internationally through the participation of events of particular importance to the environment and nature.

Particularly important is the role of the non-governmental sector in the area of nature protection, that is, the activities aimed at promoting and raising the public awareness of nature protection, as well as the activity of individual expert NGOs aimed at improving the scientific database of geodiversity and biodiversity.

2.3. STAKEHOLDERS’ AWARENESS

The protection of nature, where, among other things, the overall social, economic, cultural and spiritual life of people is carried out, implies high awareness among citizens, professionalism of the staff in the institutions and respect for the values of nature on the part of the administrative institutions, and accordingly, adoption of the necessary legislation.

Awareness of nature protection must be raised comprehensively – covering social, educational, health, cultural and spiritual aspects. Awareness of nature protection is a benefit that nature repeatedly reciprocates.

2.4. ECONOMIC ISSUES

In the context of nature protection, and in accordance with the situation of disruption of its components, concrete investments in prevention and remediation of the situation in nature are absolutely necessary. In the light of the aforementioned, in the Republic of Macedonia, there have been concrete investments thus far. However, given the importance and benefits of nature protection, it is estimated that the investments should significantly increase. It is important to note that in the field of nature protection, significant funds from foreign donations are allocated; however, it is necessary to invest more national funds (Annex 5).

3. ANALYSIS AND ASSESSMENT OF THE CURRENT SITUATION WITH RESPECT TO NATURE PROTECTION IN THE REPUBLIC OF MACEDONIA

3.1. GEOGRAPHY OF THE REPUBLIC OF MACEDONIA

3.1.1. GEOGRAPHIC POSITION, BORDERS AND SIZE OF THE REPUBLIC OF MACEDONIA

Geographic position. - Republic of Macedonia is a country with an area of 25,713 km^2 geographically located in the central part of the Balkan Peninsula. After the Second World War, it acquired the status of an independent state of the Republic of Macedonia.

a b

Figure 1. Geographic position of the Republic of Macedonia

a) in Europe, b) on the Balkan Peninsula

The territory of the Republic of Macedonia geographically extends between the coordinates 40^0 51' and 42^0 22'N and 20^0 27' and 23^0 02'E. This means that it is located north of the Equator and east of the Greenwich Meridian. The territory lies in the temperate zone, with pronounced four seasons; hence, there are favorable conditions for the existence of a diverse flora and fauna, and accordingly for human life.

It is mainly connected with neighboring countries by roads that extend over the river valleys and basins. Such are the roads along the valley of the Vardar River, through which the Republic of Macedonia connects with Thessaloniki and the Aegean Sea in the south, and through the Kumanovo-Presevo pass in the north, it connects with Serbia and further with Central Europe and beyond. Along the valleys of Kriva Reka, Bregalnica and the Strumica River, it connects with Bulgaria, in the Dojran, Pelagonia and Prespa Valleys, it connects with Greece, then in the Prespa Valley, Ohrid-Struga Valley and the valley of the Crn Drim River, it connects with Albania, and along the valley the Radika River, the Polog Valley and along the valley of the Pchinja River, it connects with Kosovo.

Borders. – The Republic of Macedonia borders Kosovo and Serbia in the north, Bulgaria in the east, Greece in the south and Albania in the west.

Territory size. – Within its borders, the Republic of Macedonia covers a statistical area of 25,713 km^2.

3.1.2. PHYSICAL AND GEOGRAPHICAL CHARACTERISTICS OF THE REPUBLIC OF MACEDONIA

3.1.2.1. Geological structure and tectonics

Geological structure. – The Republic of Macedonia, although having a relatively small territory, is characterized by a complex geological structure. Geological formations are found almost from all geological periods, starting from the Precambrian to the latest quarter, hence the various types of rocks.

The geological structure on the territory of the Republic of Macedonia is very diverse; however, the following prevails: spaces with Precambrian high-grade metamorphic rocks; granitoids; amphibolites and marbles; Riphean-Cambrian shale and metabasites; Paleozoic shale; volcanites and limestones; Mesozoic clastic and carbonate sediments and basic magmatites; Cenosoic-tertiary sediments; volcanites and quaternary sediments, as well as other geological stratigraphic formations.

Tectonics. – The territory of the Republic of Macedonia is characterized by a complex tectonic structure. The oldest tectonic zones were formed in the Precambrium, and the final tectonic assembly was formed in the Alpine orogeny.

With the final formation of the tectonic assembly on the territory of the Republic of Macedonia, there are 6 separate tectonic zones (Arsovski, 1997), as follows: Tsukali-Krasta zone; West-Macedonian zone; Pelagonian horst anticlinorium; Vardar zone; Serbian-Macedonian massif, and Kraishtid zone.

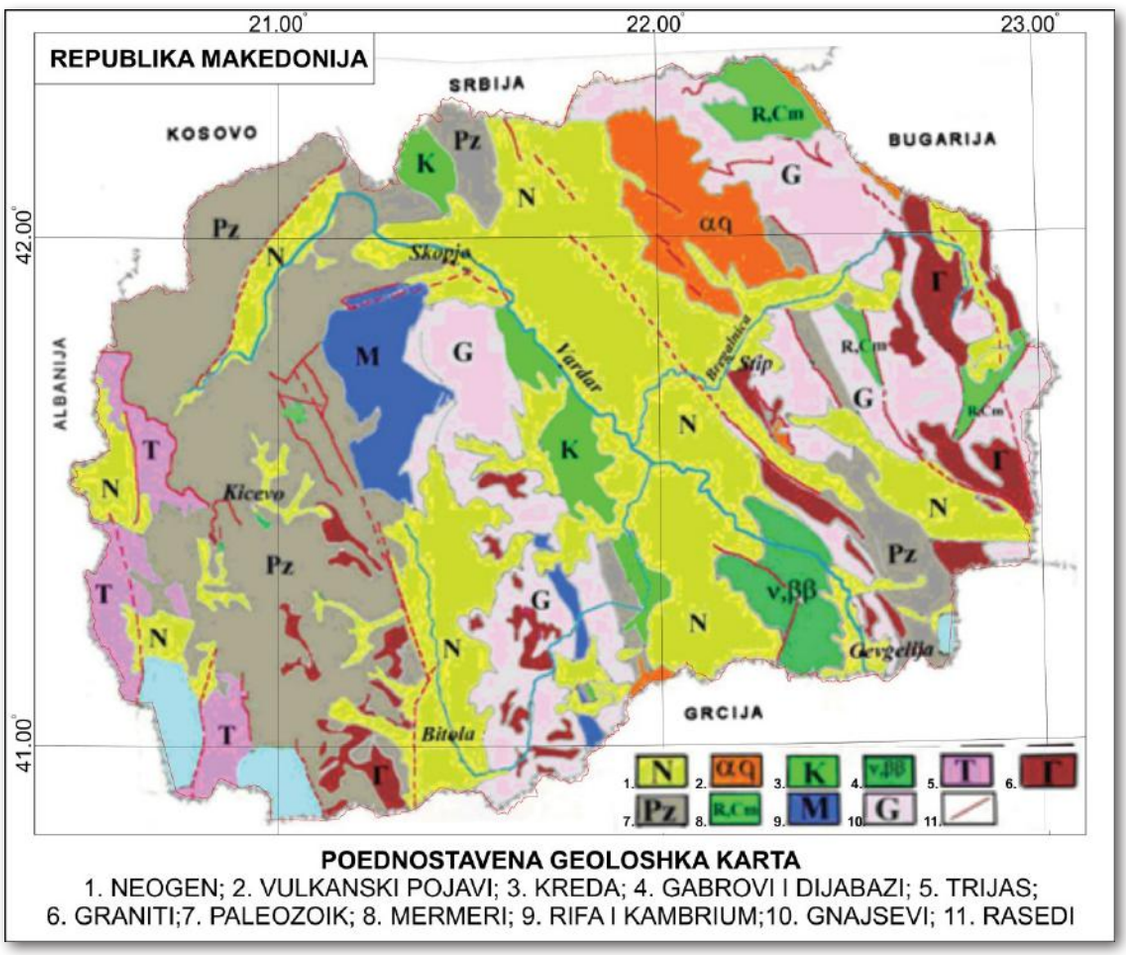

Figure 2. Simplified geological map of the Republic of Macedonia (Source: BGM-500)

3.1.2.2. Relief structure

The territory of the Republic of Macedonia, in accordance with the complex geological structure and tectonic structure, is characterized by a very complex and varied relief. It consists of mountains, basins, valleys, gorges, passes and other landforms.

Mountains. – On the territory of the Republic of Macedonia, there are as many as about 40 mountains and mountain ranges, which extend in height from about 50 m to 2753 m above sea level (Korab peak). A typical mountainous area occupies 50% of the total territory of the country. Of this number of mountains, 13 are higher than 2000 m, which in the context of Macedonia, and even the Balkans, they are considered high mountains. Those are the following: Korab (2753 m), Shar Mountain (2747 m), Pelister (2601 m), Mount Mokra (Jakupica-2539 m), Nidje (2520 m), Galichica (2288 m), Stogovo (2268 m), Jablanica 2257 m), Osogovo Mountains (2252 m), Kozuf (2165 m), Bistra (2163 m), Dobra Voda (2061 m) and Belasica (2029 m). By highest prominence, the 5 first-mentioned mountain ranges are higher than 2500 m and are considered to be extremely high mountains.

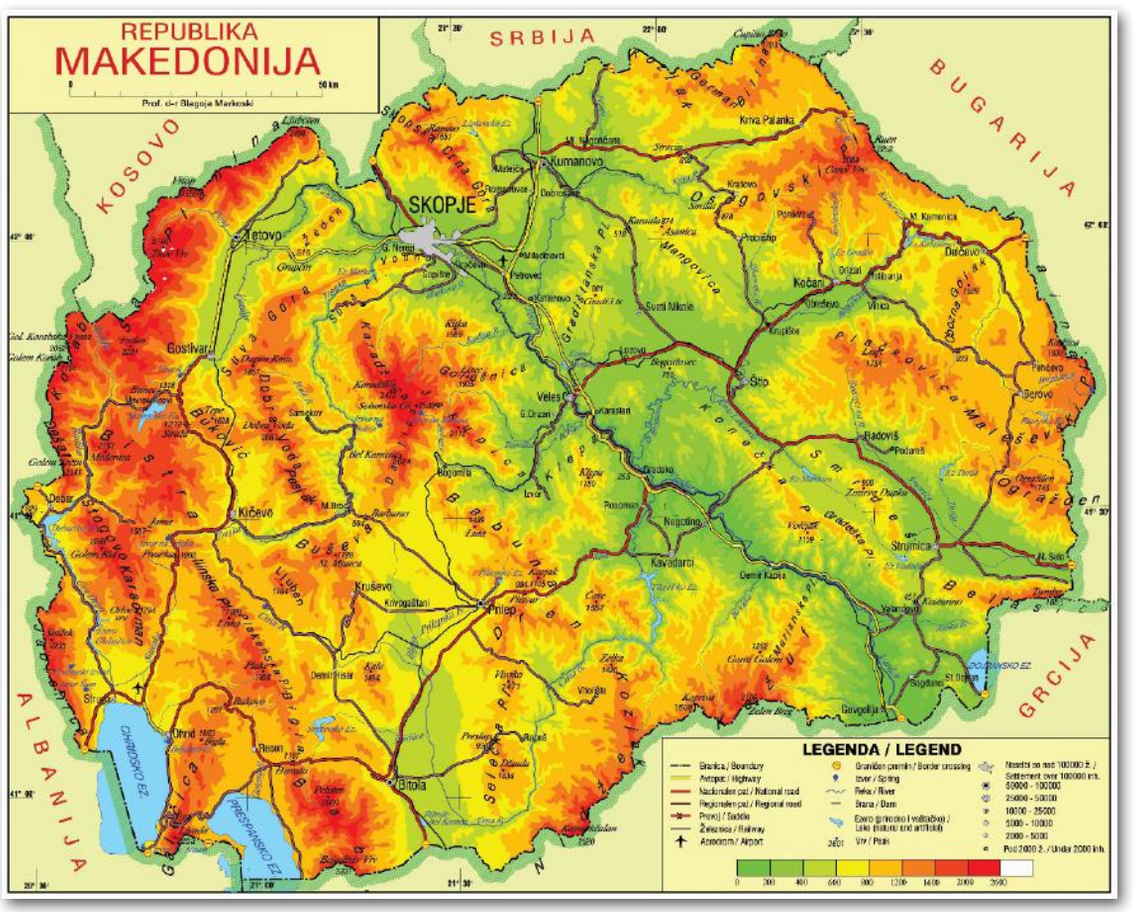

Figure 3. Relief structure of the territory of the Republic of Macedonia, mountains, basins, valleys, gorges, passes (Markoski, 2003)

Thirteen mountains and mountain ranges in the Republic of Macedonia are higher than 1500 m and are considered medium high mountains. This group includes the mountain range of Ilinska, Plakenska and Bigla (1998 m), the mountains of Vlaina (1932 m), Suva Gora (1857 m), the Maleshevo Mountains (1803 m), Mount Busheva (1791 m), Plachkovica (1754 m) Babuna (1746 m), Ograzden (1744 m), Bilino with German and Kozjak (1703 m), Mount Selechka with Dren (1664 m), Skopska Crna Gora (1651 m), Golak with Obozna (1538 m) and Bukovikj (1528 m).

Twelve mountains are lower than 1500 m and fall into the group of low mountains. Those are the following: Drevenik (1494 m), Oblakovska Mountain (1430 m), Bejaz Tepe (1348 m), Zheden (1264 m), Konecka with Gradeshka and Plaush (1159 m), Klepa (1149 m), Vodno (1066 m), Smrdesh (971 m), Ruen (968 m), Gradishtanska Mountain (861 m) and Mangovica (875 m).

Basins. – Among the mountain ranges in the Republic of Macedonia, as macrorelief spatial units, there are 24 basin units with a large number of fields, landscapes and regions. According to the time and conditions of formation, the Republic of Macedonia features the following: typical basins (areas limited by water divides that cut river flows in the most suitable places on the gorges and straits); river-basin erosive extensions and fields. They have different territorial location, size and altitude. Basins are mainly located along the composite river valleys.

Polog Basin, Skopje Basin, the Veles river erosive hollow, Tikvesh Basin, Gevgelija-Valandovo Basin are located along the composite valley of the Vardar River, starting from the spring area.

Demir Hisar Basin, Pelagonia with Prilepsko Pole and Bitolsko Pole and Mariovo Basin are located along the valley of Crna Reka.

Berovo-Delchevo Basin, Kochani Basin, Ovchepole Basin, the Shtip region and the watershed of Kriva Lakavica are located along the valley of the Bregalnica River.

Kumanovo Basin and Krivapalanka Basin with Slavishte are located along the valley of the Pchinja River.

Kichevo Basin and Porech Basin extend along the Treska valley.

Ohrid-Struga Basin and Debar-Reka Basin are located along the valley of the Crni Drim, reaching the state border with Albania.

Strumica-Radovish Basin, Dojran Basin and Prespa Basin are distinguished as separate basin spatial units.

The spring area of the Binachka Morava, the spring areas of the Dvorska and the Lebnichka River and the section of the Pchinja river watershed that gravitates towards Serbia, and belongs to the Republic of Macedonia, are parts of other basins that extend in the neighboring countries.

Gorges. – In the Republic of Macedonia, the mountain ranges are most often divided by river valleys, which are usually deeply rifted and in the form of gorges. In fact, due to the alternation of mountains and basins, the valleys of the larger rivers are composite, with a number of gorges and extensions. The most typical gorges in Macedonia are the Demir Kapija, the Taor and the Derven Gorge on the Vardar River, the Great (Shishevo) Gorge with the Matka Canyon on the Treska, the gorge on the Radika (with the Barich Canyon), the Skochivir Gorge on the Crna Reka etc. Apart from the typical gorges longer than 5-10 km, in the Republic of Macedonia, numerous small (short) gorges known as straits have been formed. More distinctive are Smokvica and Gjavato Strait on the Vardar River in the Gevgelija-Valandovo Basin, then the Peshti Gorge at the estuary of the Babuna River into the Vardar, the strait on the Topolka River also at the estuary into the Vardar, the Shtip Strait between Merit and Isar on the Bregalnica River, etc.

Passes. – The mountain ranges as macrorelief forms along with the valleys, are separated from each other by depressions known as passes or passages. The passes are very important for communication between the basin spatial units.

In the Republic of Macedonia, the most important are the following passes: Presека (1082 m), Strazha (1212 m), Pletvar (994 m), Gjavato (1167 m), Bukovo (1207 m), Grupchin (515 m), Stracin (692 m) Prisad (1093 m), Jama (1507 m), Bunec (1318 m), Deve Bair (1162 m), Smilat (678 m), Obel (1291 m), Suvi Laki (1394 m), Kosturino (457 m) Barbaras (846 m), Preslap (936 m), Kjafasan (931 m), etc.

3.1.2.3. Climate

The extreme differences in altitudes, the interweaving of the area with composite river valleys, the differences in the size of basin areas and lake surfaces, in the relatively small area of the Republic of Macedonia bring about specific climatic conditions. According to Lazarevski A. (1993), there are several climate types:

Modified Mediterranean climate is typical of the Gevgelija-Valandovo Basin, extending to Demir Kapija and Dojran Basin. Summers are warm and clear with about 2400 hours of sunshine, with a mean annual temperature of 14.5 ^{0}C and a mean annual amount of precipitation of about 650 mm.

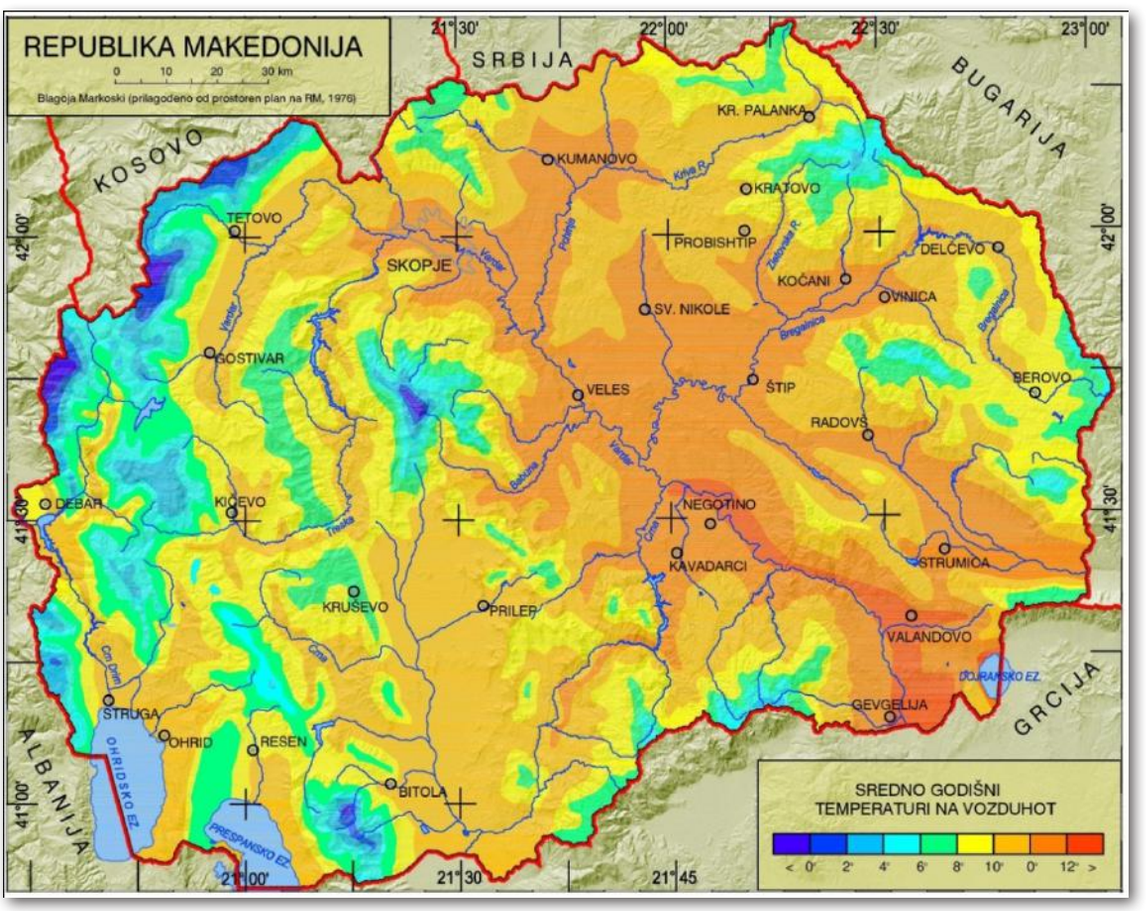

Figure 4. Mean annual air temperatures

Mixed Mediterranean and continental climate is felt in the valleys of the Vardar with tributaries, more specifically, in the areas of Tikvesh, Veles, Skopje, Ovche Pole, Shtip and Kochani Basin, along the valleys of the Struma and the Strumica in Strumica-Radovish Basin and along the valley of the Crn Drim in the Debar Basin. In these regions, the mean annual air temperature is around 12 ^{0}C, and the average annual precipitation amounts are about 500 mm.

The continental climate is typical of isolated basins such as the Ohrid-Struga and Prespa Basin with influences on the lake basins, and it is typically pronounced in the Kichevo Basin, the Poreche area, the Pelagonia, Polog, Kumanovo, Kriva Palanka and the Berovo-Delchevo Basin. In these basins, there are cool summers and cold and longer winters. The mean annual temperature is around 11 ^{0}C. The average amount of precipitation tends to exceeds 700 and 800 mm.

The mountainous climate in the Republic of Macedonia is typical of the mountainous areas, more precisely of the territories with altitude of above 1000 m. Typical

mountainous climate is found in the high mountains such as Shar Mountain, the Korab Range, Bistra, Stogovo, Jablanica, Baba with Pelister, Mount Mokra, Nidje, Kozhuf, Osogovo Mountains, the Maleshevo Mountains, etc. The mean annual air temperatures range from around 8 ^{0}C at an altitude of 1200 m to about 0 ^{0}C in the highest parts (over 2500 m). The average amount of precipitation tends to range from 1000 to 1300 mm.

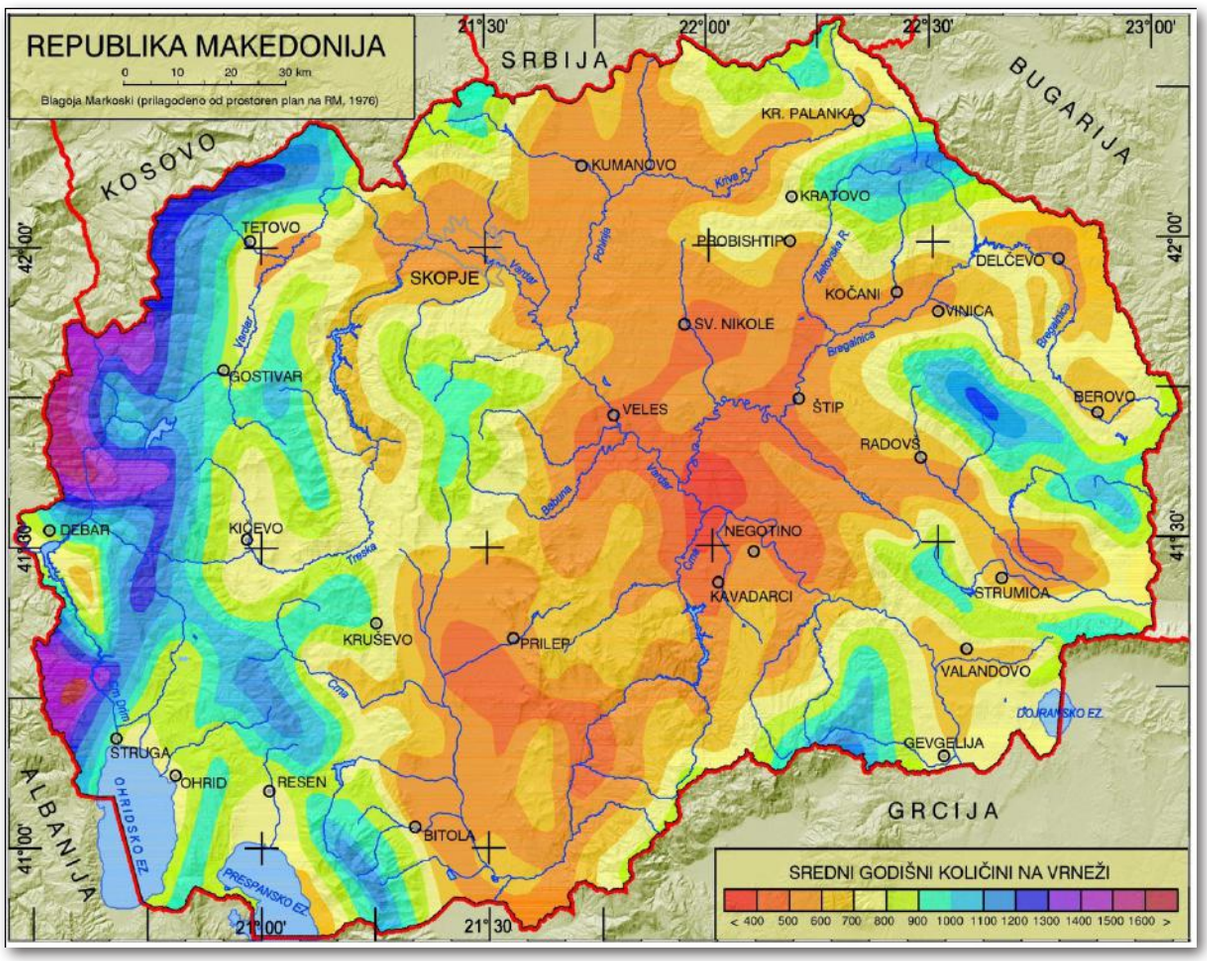

Figure 5. Mean annual amount of precipitation in the Republic of Macedonia

The mean annual air temperatures measured at meteorological stations at different altitudes range from 14.5 ^{0}C in Nov Dojran and Gevgelija at about 48 m asl. up to 6.7 ^{0}C in Lazaropole at about 1000 m asl. on Mount Bistra.

The mean annual amounts of precipitation range from 440 mm in Veles to 1068 mm in Lazaropole, and in the valley of the Radika River reach up to 1400 mm.

3.1.2.4. Hydrography

The hydrographic characteristics of the Republic of Macedonia principally cover groundwater, rivers and lakes.

Groundwater and springs

The waters that lie in the porous part of the land beneath the earth surface are called groundwater. In the Republic of Macedonia, groundwater is present almost all over the territory, and from a hydrogeological point of view, it is located both in confined and unconfined aquifers.

Confined aquifers may be phreatic and artesian and are mainly accumulated in

flatland basins (in basins such as Skopsko Pole, Kochansko Pole, Strumichko Pole, Valandovsko Pole, Gevgelisko Pole, Prilepsko Pole, Bitolsko Pole, Prespansko Pole, Strushko Pole and other fields).

Unconfined aquifers may be fissure and karst aquifers. They manifest on the land's surface as springs. More than 4400 springs with varied capacity are recorded in the Republic of Macedonia. Particularly distinctive are the springs with capacity greater than 100 l/s, such as the springs of Saint Naum (5-10 m^3/s), Rashche (1-6 m^3/s), Rosoki (2.5 m^3/s), Vrutok (0.5-5 m^3/s), the spring of the Beleshnica (1.5 m^3/s), Vevchani Springs (0.2-1.5 m^3/s), the spring of the Treska (0.28-3.5 m^3/s), Pitran (0.2-0.7 m^3/s), Biljanini Springs (0.05-0.3 m^3/s), the spring of Shum (0.5 m^3/s), Belichki Springs (0.32-1.0 m^3/s), the springs of the Studenchica (0.5-4.3 m^3/s) and so on. (Ilijoski Z. 2015).

Thermo-mineral springs are also present in the Republic of Macedonia. Some of them are adapted as spas, such as Katlanovo Spa, Kumanovo Spa, Kochani Spa, Shtip Spa, Bansko Spa, Negorci Spa, Debar Spa (Kosovrasti and Banjishte) and there are other thermo-mineral springs used for other purposes.

Figure 6. Groundwater and springs. Vevchani Springs (photo: Bl.Markoski)

Surface waters

Surface waters are mainly found as streams or rivers and accumulated waters or lakes.

Rivers: At present, the river network in the Republic of Macedonia branches into three watersheds:

- Aegean,
- Adriatic and
- Black Sea watershed.

Table 2. Sea and river watersheds in the Republic of Macedonia

watershed/watershed area	km²	river watersheds
Adriatic watershed CRN DRIM WATERSHED	3320	The Crn Drim with the waters of Prespa Lake, Ohrid Lake, the Sateska River and the Radika River.
Black Sea watershed MORAVA WATERSHED	36	The spring area of Binachka Morava
Aegean watershed STRUMA WATERSHED	1616	The Strumica (the waters of Strumica-Radovish Basin), the Dvorska River and Dojran Lake
VARDAR WATERSHED	20459	The Vardar with tributaries Lepenec, Pchinja, Bregalnica, Boshava, Crna Reka, Babuna, Topolka, Kadina Reka and Treska
Aegean watershed	22075	
TOTAL (RM)	25432	(The data is not statistical)

Source: Markoski B. (1995)

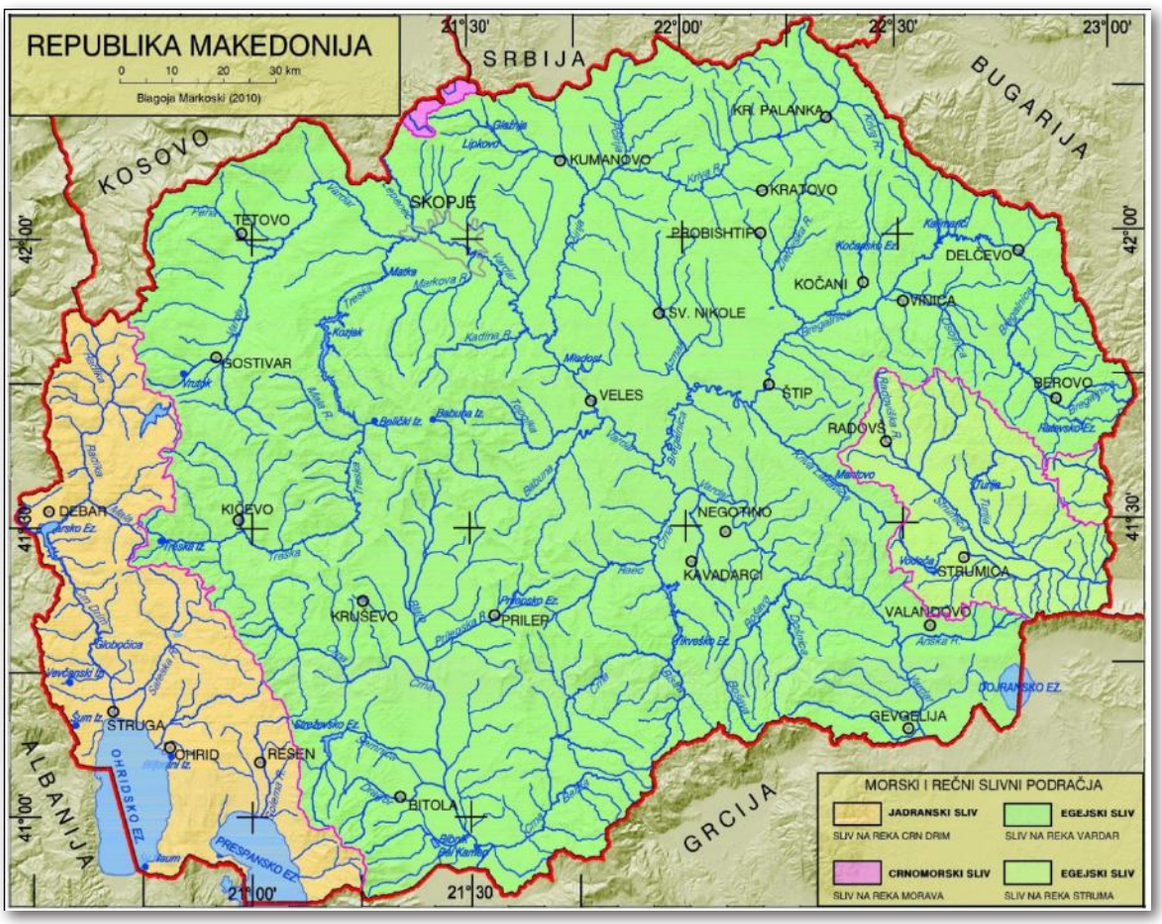

Figure 7. Hydrographic network of the Republic of Macedonia

Lakes in the Republic of Macedonia. – According to the place and date of lake basins, lakes in the Republic of Macedonia are principally classified into: natural and artificial lakes.

Natural lakes. – Natural lakes are classified into: tectonic, glacial and other natural lakes.

Table 3. Overview of natural and artificial lakes in the Republic of Macedonia

Classification	Name/location
Natural lakes	
Tectonic lakes	Ohrid, Prespa and Dojran Lake
Glacial lakes	on Shar Mountain (18), Korab (8), Deshat (5), Jablanica (4), Stogovo (3), Pelister (2) and Mount Mokra (2)
Landslide lake	Moklishko Lake (v. Vatasha near Kavadarci)
Riparian-shore lake	Ostrovo Lake (on the southern shore of Ohrid Lake, near the monastery of St. Naum)
Marshy lakes	Belchiski Sin Vir, Novoselski Vir 1, Novoselski Vir 2 and Edeglav Lake in the area of Debarca, Katlanovo Lake in Skopje Basin and Stenjsko Lake – Marsh in Prespa, Monospitovo Marsh
Cave lakes	the lake in Bela Voda Cave near Demir Kapija
Artificial lakes	
Constructed (larger) reservoirs	Mavrovo Lake, Debar Lake, Globochica Lake, Poreche Lake – Kozjak, Sveta Petka Lake and Matka Lake, Strezhevo Lake, Tikvesh Lake, Prilep Lake, Lisiche Lake, Glazhnja Lake, Lipkovo Lake, Kalimanci Lake, Ratevsko Lake, Mantovo Lake, Turija Lake, Vodocha Lake, Paljurci Lake on the Bogdanska River and more than 100 small reservoirs with monofunctional purpose
Formed reservoirs	by excavating the land by man for different purposes
Reservoirs for special purposes (landfills)	reservoirs at the Sasa mines near Makedonska Kamenica, Toranica near Kriva Palanka, the landfill near Probishtip, the landfill at the Buchim mine near Radovish, etc.

3.1.2.5. Pedogeography

In the Republic of Macedonia, based on the geological composition, relief structure, climatic conditions, hydrographic features and characteristics of the flora and fauna, a mosaic of various types of soils was formed.

The pedological foundation of the land surface is formed depending on the location of a particular site, through the processes of physical decomposition, chemical dissolution and biological decomposition. It is influenced by numerous erosive and accumulative processes. According to the pedological map, 24 basic types of soils with 66 soil types and varieties are found on the territory of the Republic of Macedonia (Filipovski et al., 2015).

The geographical distribution of the soil types in the Republic of Macedonia is largely dependent on the geological substrate, hence one can identify pedogeographic areas with soils on carbonate substrate (on the mountains of Bistra, Bukovikj, Suva Gora, Karadjica, Dautica, Demir-Hisar region, Mount Plakenska and Galichica) and areas with soils on silicate substrate (they are located in most of the western region, almost the entire Vardar and East region of the country).

Soils on mountain terrains, soils on hilly terrains, soils on slopes and soils on flatlands are identified as separate pedogeographic regions. The most distinctive soil types are:

Leptosols or screes are most widespread in the highest parts of the mountains in the western part of the Republic of Macedonia (Korab, Shar Mountain, Bistra, Suva Gora, Mount Mokra, Jablanica, Galichica and Pelister); the region of Mount Babuna, Mount Selechka, Dren and the Mariovo area.

Rankers or humus silicate soils are formed mainly in the areas of high mountain

pastures on Shar Mountain, Stogovo, Baba with Pelister and the higher parts of the Osogovo and the Maleshevo Mountains. They are found in combination with brown forest soils and regosols and as such prevail on Skopska Crna Gora, Gloshnica, Jakupica, Babuna, Mount Selechka, Mount Busheva, Stogovo and Mount Ilinska.

Brown forest soils are prevalent mainly on the territories with forest vegetation on Shar Mountain, Bistra, Dobra Voda (Cheloica), the eastern slopes of Pelister, Mount Mokra (especially the Dautica, Jakupica and Gonesnica branches), Nidje, Kozhuf, Mount Konechka, Belasica, Plachkovica, Ograzhden, the Maleshevo Mountains, Osogovo Mountains and Mount German with Bilina. Practically on the same territories, they appear in combination with regosol and leptosol, but this combination is more prevalent on Mount Busheva, the branches of Ilinska, Plakenska and Mount Bigla and the northeast parts of Galichica.

The dolomite limestone soil is a type of soil widespread in limestone terrains such as Bistra, Zheden, Suva Gora, Karadjica, Dautica, the western branch of Mount Busheva (Baba Sach, Luben and Cersko Pole), Galichica and Jablanica.

Brown soil on limestones and dolomites is present in the lower parts of the mountains of Karadjica, Bistra, Baba Sach with Cersko Pole, Mount Ilinska and Galichica. Specifically, it covers the forested territories of the listed mountains.

Cinnamon forest soil is typical of the mountainous sides of Dobra Voda with Suva Gora, Bistra, Stogovo, the western slopes of Galichica, the northern parts of Plachkovica and the western slopes of Mount Selechka.

Vertisol is a type of soil that prevails in Kumanovo Basin (especially in the lower parts of the basin), and in combination with regosol and cinnamon forest soils also occurs in the northern parts of Ovche Pole.

Rendzina and combinations of rendzina and regosol are types of soils that prevail in the Tikvesh region, Mount Konechka and the southwestern branches of Plachkovica.

Colluvial soil is typical of the foothills of the mountains which touch the larger fields in the Republic of Macedonia. Such are the foothills of Shar Mountain with parts of the plain in Polog, the foothills of Jablanica, Karaorman and Mount Ilinska in the Ohrid-Struga Field, the foothills of Galichica and Pelister in the Prespa Basin, the foothills of the mountains around the Pelagonija Plain, the foothills of the Osogovo Mountains and Plachkovica in Kochani Basin, the foothills of Plachkovica, Ograzhden, Belasica and Smrdesh in the Strumica-Radovish Basin and the foothills of the mountains around the Gevgelija-Valandovo Basin.

Fluvial soils are typical of the territories along the currents of the larger rivers and the flatlands of the basins. They are present in the plains of Polog, Kichevsko Pole, Strushko Pole, Prespansko Pole, Pelagonia plain, Skopsko Pole, Ovche Pole, Kochansko Pole, Strumichko Pole, Valandovsko Pole, Gevgelisko Pole and along the Vardar River and the Crna Reka River in Tikvesh.

Humogley is found in the plain of Prilepsko Pole.

Fluvial meadow soil is present in the flatlands of the territory of Prilepsko Pole and Bitolsko Pole in Pelagonija.

Wetland soils in the Republic of Macedonia are found in the lakeside areas of Prespa Lake, Struga Lake, large parts of Bitolsko Pole, Dojransko Pole, Monospitovo Marsh in Strumica region, Katlanovo Marsh and the swamps in Debarca.

Saline soils are found in Ovche Pole and Prilepsko Pole and Bitolsko Pole (especially along the western slopes of Mount Selechka).

Other types of soils are also found, such as peat soils, luvic soils, red soils and so on.

In the Republic of Macedonia, there are a number of other soil types and combinations (www.maksoil.ukim.mk/masis) that are typical of smaller enclaves throughout the territory, but as such, in this case, they will not be covered in more detail.

3.1.2.6. Biogeography

Various climatic types and geological composition on silicate and carbonate substrate are present in the Republic of Macedonia, hence the variety of flora and fauna. The geographical distribution of plant and animal species varies vertically and horizontally.

3.1.3. POPULATION AND SETTLEMENTS

3.1.3.1. Population

On the territory of the Republic of Macedonia, the prevailing relief is mountainous (12,254 km^2) and hilly (7,599 km^2) (flatlands occupy 5,065 km^2), with various climatic and hydrographic features; therefore, there has been distinctive population development over time.

The data point to the fact that the number of households recorded in the population censuses is ever-increasing, with a relatively faster pace than the population dynamics.

In regard to the sex structure, the population in the Republic of Macedonia is characterized by about 0.5% higher representation of the male population.

The age structure of the population amid intergenerational transfers is characterized by a certain degree of population aging. The share of the elderly population is significantly above the theoretical figure of 12% (when the population is considered an elderly nation). The natural movement of the population is below 5 per mile.

In regard to the economic structures, in the Republic of Macedonia, the number of economically inactive population is decreasing or is at least stagnant, and the number of economically active population is still relatively large, but there is growing tendency towards its reduction due to the transfer into persons with personal income.

3.1.3.2. Settlements

The population was located in 1752 settlements (RGA, 1976) of which 1723 rural and 29 urban settlements. The rural settlements were distributed throughout the territory; hence the more even population distribution throughout the country. With the processes of industrialization and urbanization, there was a great disproportion in the population concentration. The regions of Skopje, Polog and Kumanovo were immensely inhabited, and the Mariovo region with Raec, Poreche, Debarca, Kozjachija, Lakavica, the river basins of the Babuna and Topolka and other areas were almost completely unpopulated.

Based on the field observations and surveys, it can be concluded that there are about 750 rural settlements with less than 100 inhabitants, of which about 400 have less than 50 inhabitants. The remaining circa 1000 settlements do exist, yet with a reduced level of activities and a tendency of population reduction.

The reasons for this should be sought in the absence of utility, commercial and institutional infrastructure. Sustainable management is abandoned, and mass utilization of various natural resources has commenced; hence the growing pressure on the environment.

3.1.4. ECONOMIC AND GEOGRAPHIC CHARACTERISTICS

3.1.4.1. Primary activities

The economic and geographical development of the Republic of Macedonia mainly depends on the agrarian industrial complex. Of the total territory (25713 km^2) according to the cadastral records, 7075 km^2 are arable land. Therefore, the population is mainly engaged in agricultural activity in all agricultural branches.

Farming is mainly developed in the Pelagonia Basin, Polog, Ovche Pole, Kumanovo Basin, Kochani Basin, Strumica-Radovish Basin and the Gevgelija-Valandovo Basin.

Pomiculture prevails in the Prespa Basin and Tikvesh.

Viticulture is present in the Tikvesh Basin, Gevgelija-Valandovo Basin, Veles region and Ovche Pole.

Animal husbandry is practiced in the high mountainous pastures of Shar Mountain, Bistra, Mount Mokra, the Osogovo Mountains, the Maleshevo Mountains, Mariovo and other areas.

Forestry relies on the exploitation of wood almost in all forest areas in the Republic of Macedonia. It is oriented towards the exploitation of firewood.

In the context of primary activities and based on the field observations, there is a clear decrease in the interest in engaging in these activities, thereby abandoning sustainable development, and putting emphasis on the exploitative irreversible development process.

3.1.4.2. Secondary activities

After the Second World War, the primary activities were the basic sources of raw materials for the beginning of the development of industrial production. In the Republic of Macedonia, there were also a large number of industrial enterprises in the field of the heavy industry.

Today, special industrial zones are being established in different regions of the country, such as Bunardzik in Skopje, Shtip, Prilep and other places. In this process, there is a severe degradation of the environment, as it mainly affects agricultural land, which is rendered permanently unproductive.

Mining facilities for lead and zinc, copper, iron, nickel and chromium continue to operate. Many facilities are oriented towards the exploitation of mineral resources such as marble, dolomites, construction separation materials, and the like. This causes severe degradation of the environment.

In the energy sector, the power plants of Suvodol near Bitola and Oslomej near Kichevo and all hydropower plants on the larger reservoirs in the Republic of Macedonia are operational.

3.1.4.3. Tertiary activities

Nearly all of the tertiary activities (traffic, trade, tourism) are operational, yet with inadequate capacity and reduced functionality.

All activities have an impact on the environment in their own way; therefore, their impacts must be taken into consideration in their treatment.

3.2. GEODIVERSITY AND GEOHERITAGE

3.2.1. GEOLOGY

The territory of the Republic of Macedonia features very specific geological phenomena and processes that can rightly be treated as rarities in the world scientific and cultural heritage. Details of the geological structure are shown in part 1 of the National Strategy for Nature Protection, i.e. in the Study on Geodiversity and Geoheritage of the Republic of Macedonia and other Components of Nature (biological and landscape diversity) which should be considered as an integral part of the Strategy. It is worth noting that in the analyzed area, at a relatively short distance, there are a multitude of different geological and geomorphological phenomena, which indicate that this region has undergone significant and very complex changes throughout the geological history, thus, one can find rock masses ranging from geologically oldest to youngest dated.

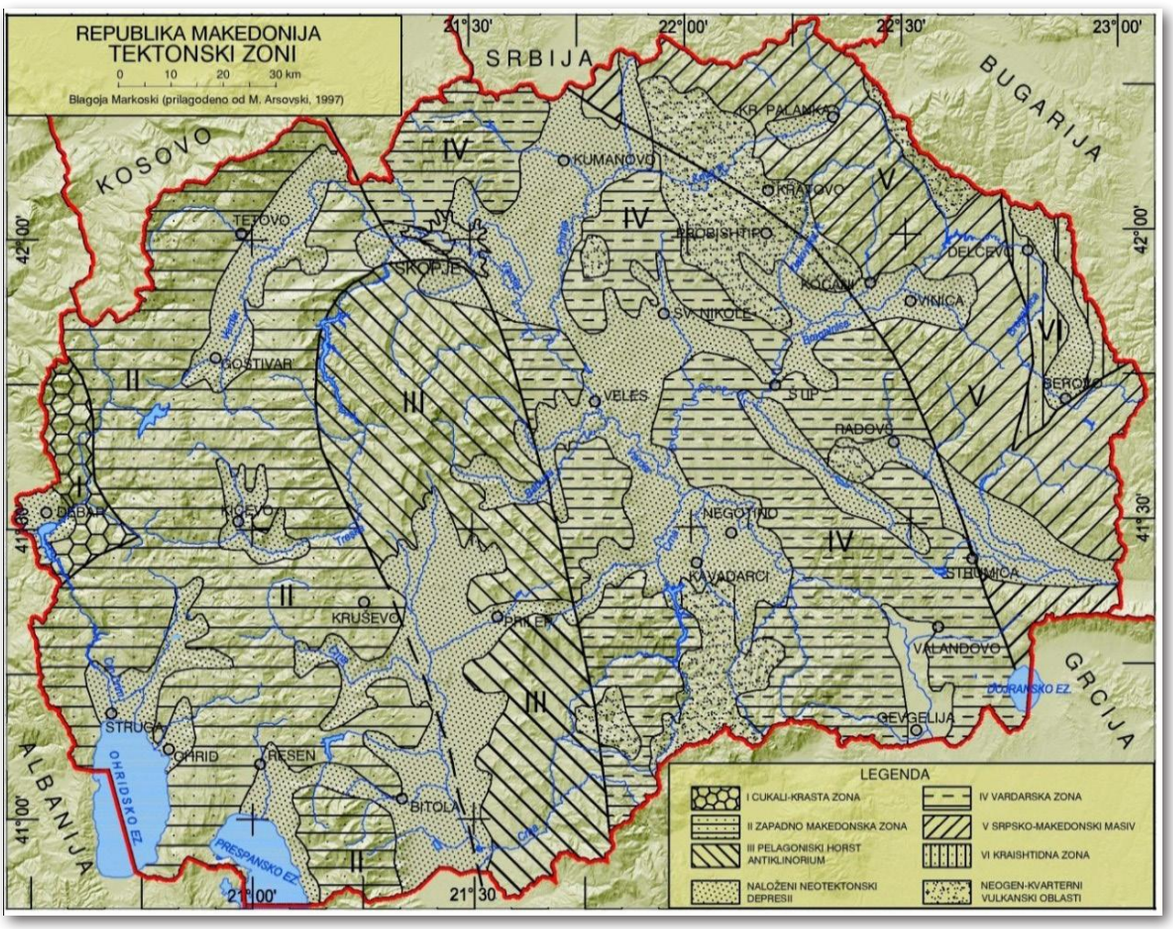

Figure 8. Map of Geotectonic Reonization of Macedonia (M. Arsovski, 1997)

It should be noted that some of the geological phenomena are considered unique in the world. One important example is the antimony mine, Alshar, located on Mount Kozhuf, where unique thallium minerals have been discovered. Certain mineral associations, in the area of the village of Nezhilovo, are also sites where new minerals have been discovered, which have been recognized by the International Association of Mineralogy (IAM). Within the so-called Serbian-Macedonian and Pelagonian massifs, the oldest metamorphic and magmatic rocks are preserved aged **eight hundred million to one billion years**.

Generally speaking, on the territory of the Republic of Macedonia, there are regions with very distinctive development and structure, which enables their division in sev-

eral special large first-order geotectonic units such as: Tsukali-Krasta zone; West-Macedonian zone; Pelagonian horst anticlinorium; Vardar zone; Serbian-Macedonian massif and Kraishtid zone.

In addition to the above geotectonic units, the figure depicts ordered neotectonic valleys-graben depressions (1) and neogene-quaternary volcanic regions (2).

3.2.1.1. Occurrence of volcanism during the Neogene

During the Neogene, the territory of the Republic of Macedonia was characterized by significant volcanic activity. Certain volcanic activities date back to the time of the Oligocene, Miocene, Pliocene, and the Quaternary.

Geological literature identifies the following areas of extinct volcanic activity:

- Osogovo-Maleshevo volcanic area;
- Kratovo-Zletovo volcanic area;
- Kumanovo-Sveti Nikole volcanic area;
- Buchim-Borov Dol volcanic area;
- Kozhuf volcanic area;
- Mariovo-Kajmakchalan volcanic area and
- Ohrid-Kosel volcanic area.

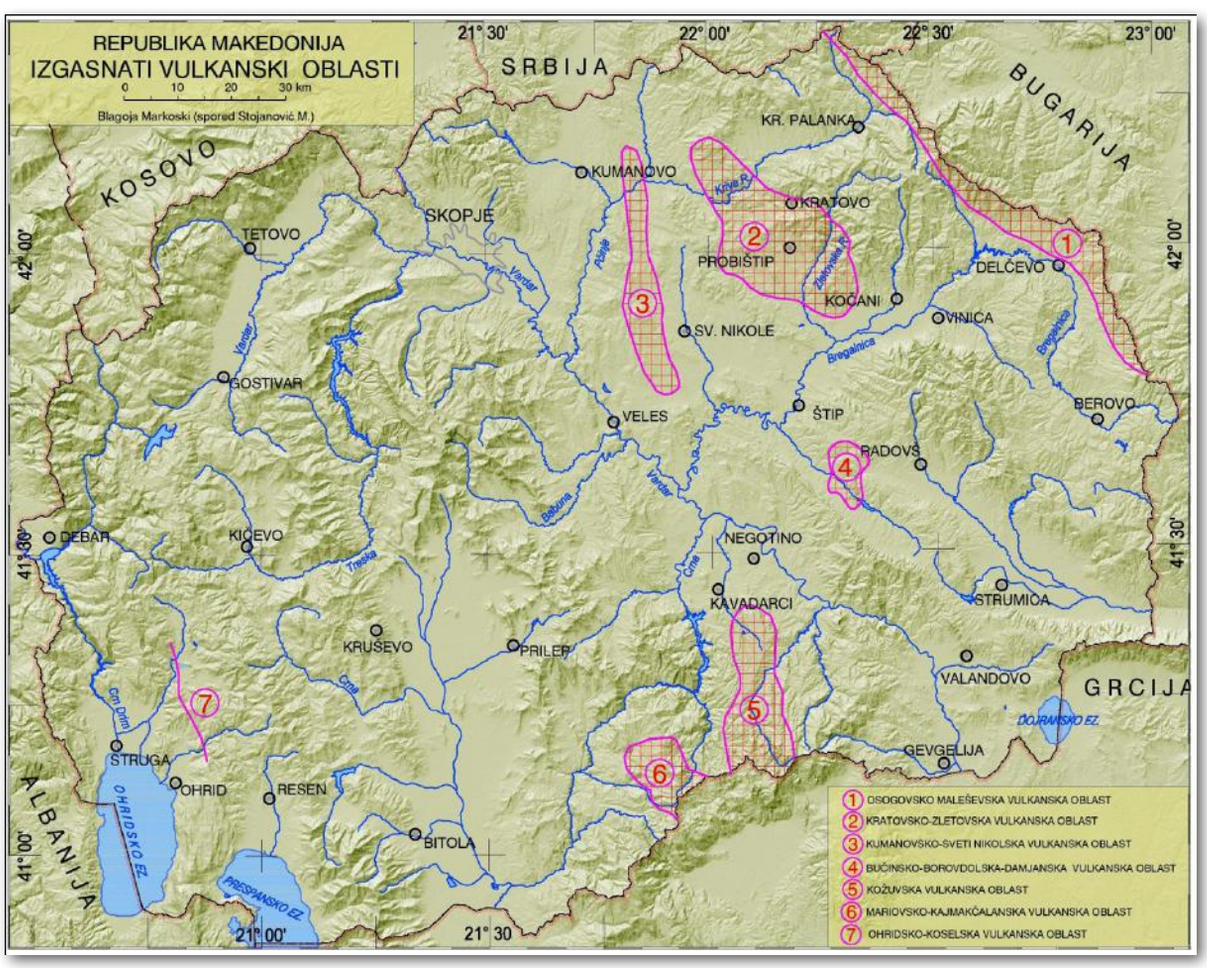

Figure 9. Areas of extinct volcanoes in Macedonia (according to M. Stojanovikj)

3.2.1.2. Neotectonic development stage and earthquakes

In the neotectonic development stage, the territory of Macedonia was exposed to intense destructive processes manifested by fault dislocations. These processes were typical of the entire territory of the Balkan Peninsula. During this period, the territory of Macedonia was exposed mainly to the regime of dominant gravity faulting and the emergence of morphostructures of elevation and sinking. From a practical point of view, the analyses of J. Janchevski (1987), who classified the faults and gave a review of their seismicity, are worth noting.

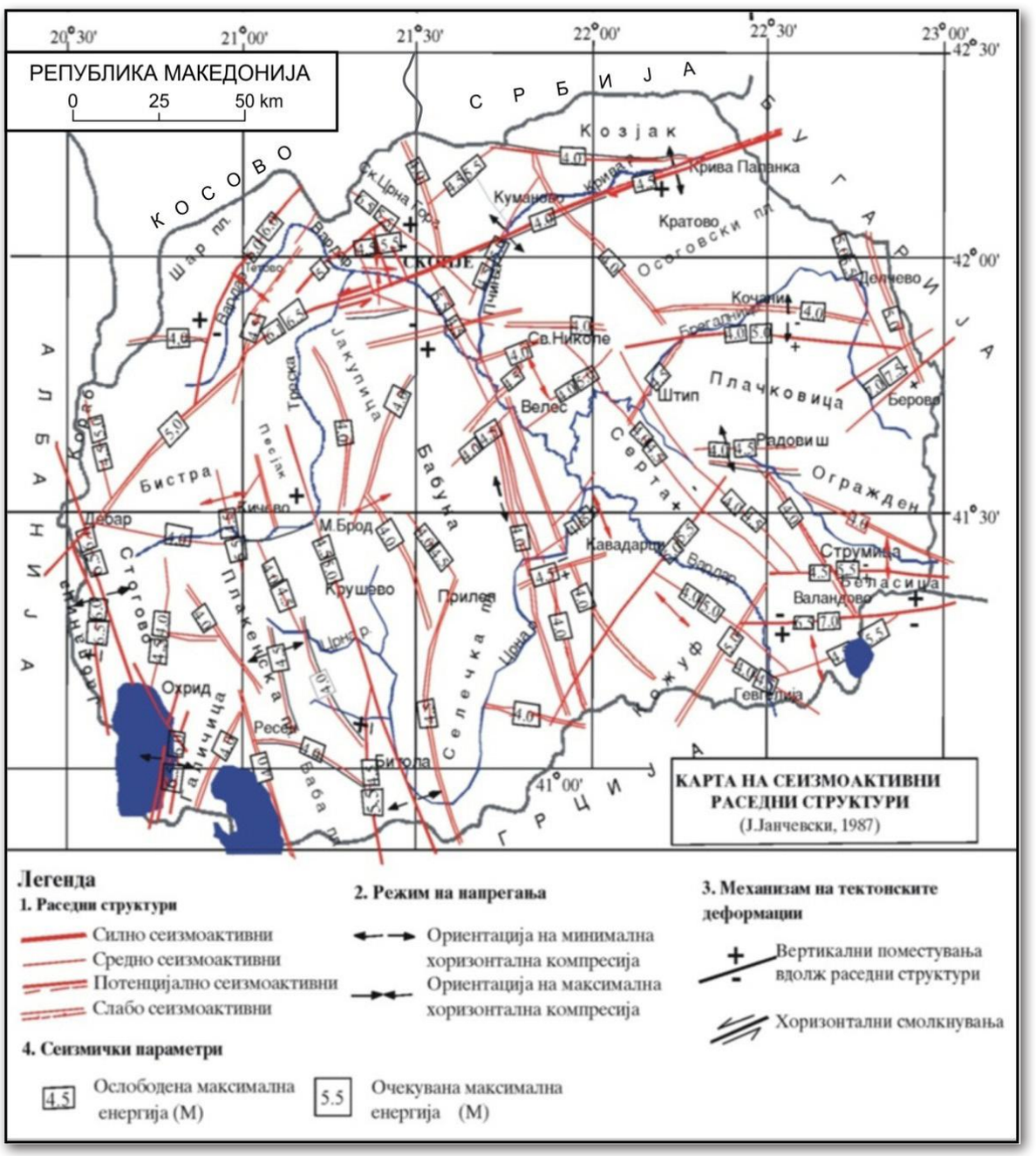

Figure 10. Classification of fault structures and their seismicity

(according to J. Janchevski, 1987)

The territory of the Republic of Macedonia is part of the seismically active area on the Balkan Peninsula, i.e. the Alpine-Himalayan Seismic Belt. This has been confirmed by

the numerous catastrophic earthquakes that have taken place over the last 1500 years. It is characterized by high seismic activity and relatively frequent occurrence of strong and catastrophic earthquakes. The magnitude typically reaches up to M = 5.5 and the intensity of I-VIII on the MCS scale. There are less frequent occurrences of stronger earthquakes.

The emergence of earthquakes in Macedonia is related to movements along the active tectonic structures, which means that they are largely tectonic in nature. There are several epicenter areas of strong earthquakes, namely: Skopje, Valandovo, Pehchevo, Tetovo, Bitola, Debar, Ohrid, Mrezhichko, etc. In addition to the above areas of strong earthquakes, there are many other epicenter areas on the territory of Macedonia where weaker earthquakes occur, and it is exposed to strong seismic effects, originating from the epicenter areas in the wider region of the Balkans. The following figure shows epicenter locations measured in the last 40 years.

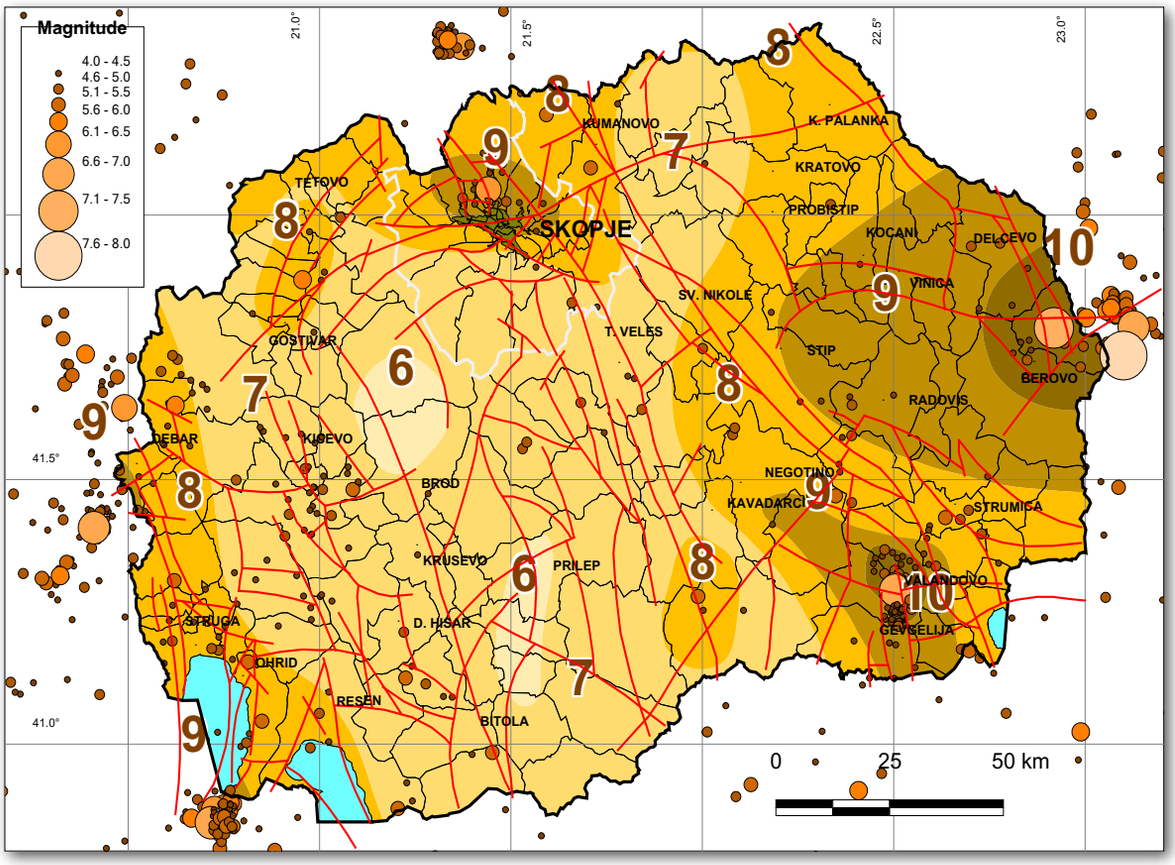

Figure 11. Epicentral map of the Republic of Macedonia with an overview of the basic fault structures (IZIIS, Skopje)

3.2.1.3. Minerals

The complex geological processes that formed the structure of the Republic of Macedonia have led, among other things, to the creation of distinctive minerals, which is one of the significant components of our geological heritage. A review of the important minerals in our country is presented in the paper: Minerals from the Republic of Macedonia with an Introduction to Mineralogy (Jovanovski G., Boev B. and Makreski P., 2012).

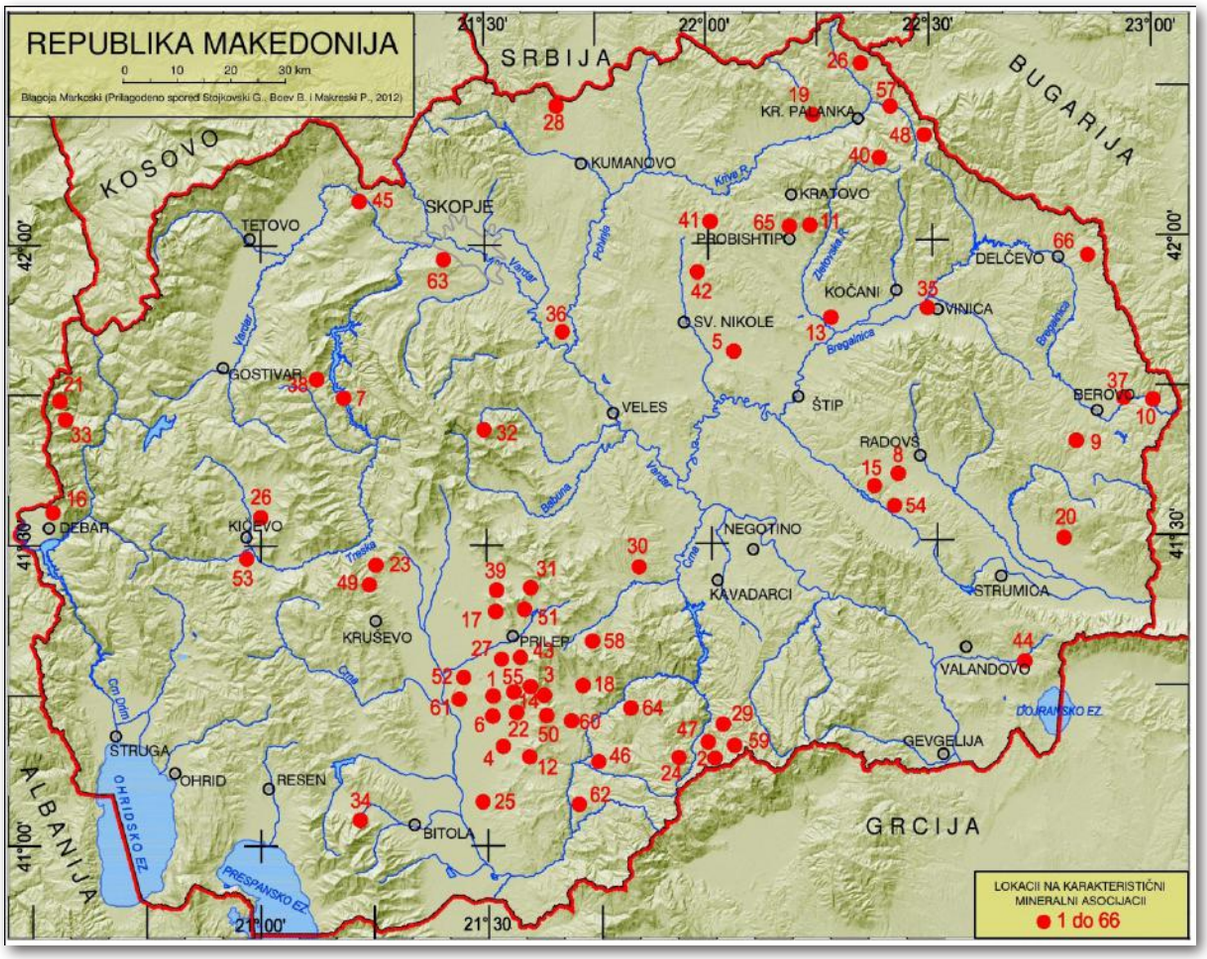

Figure 12. Main locations of distinctive mineral associations in the Republic of Macedonia (according to G. Stojkovski, B. Boev and Makreski P., 2012):
1. Alinci, 2. Alshar, 3.Belutche, 4.Beshishte, 5.Bogoslovec, 6.Bonche, 7.Brest, 8.Buchim, 9.Budinarci, 10.Bukovik, 11.Crni vrv, 12.Chanishte, 13 .Cheshinovo, 14.Chumovo, 15.Damjan, 16.Debar, 17.Drenovci, 18.Dunje, 19.Ginovci, 20.Ilovica, 21.Kobilino Pole, 22.Kokre, 23.Koshino, 24.Kozjak, 25. Krastov Kamen, 26. Krstov Dol, 27.Lagovo, 28. Lojane, 29. Mrezhichko, 30. Mrzen, 31. Nebregovo, 32. Nezhilovo, 33. Nistrovo, 34. Nizhe Pole, 35. Osojnica, 36. Pchinja, 37. Pehchevo, 38. Peklishte, 39. Pelagon, 40. Petrova Reka, 41. Plavica, 42. Pleshenci, 43. Prilepec, 44. Rabrovo, 45, Radusha, 46. Ramna Niva, 47. Rzhanovo, 48. Sasa, 49. Sazhdevo, 50. Mount Selechka, 51. Sivec, 52. Staro Bonche, 53. Strelci, 54.Shopur, 55. Shtavica, 56.Tajmishte, 57.Toranica, 58. Trojaci, 59. Vasov Grad, 60. Veprchani, 61. Veselchani, 62. Vitolishte, 63. Vodno, 64.Vrbsko, 65. Zletovo, 66.Zvegor.

There are various minerals in our country, and more important are the mineral associations of our metal mines and some crystals of non-metallic raw materials. For the world and national geological heritage, the examples of the Alshar mine and the site of Nezhilovo are worth noting. It should be emphasized that for several years, the Alshar mine has been treated as an antimony-arsenic-thallium mine. In the last two decades, the US Company Nassau has identified Carlin-type gold mineralization. It is especially important that rare metals of **thallium** have been discovered, of which 5 are present exclusively at this site. **A new mineral** of epidote-piemontite series near the village of Nezhilovo, Macedonia, has been registered by IMA under No. 2011-087. The major locations of the more significant mineral sites are shown in Figure 17.

3.2.1.4. Fossils

In the Republic of Macedonia, fossil remains are found on numerous locations, and the most important are fossil sites near: Veles, Tikvesh, Skopje and Delchevo with the so-called "**Pikermian fauna**". More distinctive are the sites of Karaslari, Bashibos, Bashino Selo, Belushka, Brca, Veshe and others. A more extensive list is given in Annex 1 to this Strategy.

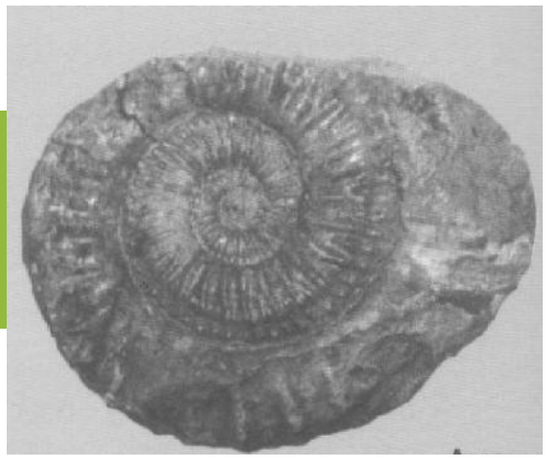

Figure 13 (left) A fossils example: - ammonite in the Upper Cretaceous sediments at the site of Mocharnik-Shtip;

Figure 14 (right) Elephant teeth in the Upper Miocene sediments at the site of v. Veshje-Negotino

Figure 15. Remains of Pikermian fauna in the Republic of Macedonia

3.2.1.5. Mineral resources in the Republic of Macedonia

From the period after the 1950s until 1980, as a result of intensive research in the Republic of Macedonia, a total of 697 sites and deposits of solid mineral resources were registered and established. These include numerous sites and deposits of metals, non-metals and energy raw materials. A large number of the total number of sites and deposits are still found only as registered deposits, and are underresearched, even though they are a good potential. Moreover, only 47 sites of solid mineral resources are of greater significance nowadays. Some of these sites are also active mines such as Zletovo, Buchim, Sasa and other metal mines, then Opalit, Bentomak, Ograzhden, Sivec and other non-metallic mines, while the uranium sites are still considered as merely a potential with identified qualitative-quantitative features. In this group, the most prominent are the uranium sites of Zletovska Reka and Podaresh.

Figure 16. The most important ore sites and coal deposits

It should be emphasized that in the process of preparation of the Study, detailed and intensive research of copper and gold in the vicinity of Kadiica, Ilovica, Kazan Dol, Plavica, Alshar and others is being carried out, which in the near future may result in new mining capacities which will carry out exploitation of a particular mineral resource. According to official data from the web site of the Ministry of Ecology, where the Department of Mineral Resources is in charge, at present, for the protection of nature, there are **375** concessions awarded for the exploitation of various mineral resources, and another **45** contracts have been awarded for detailed geological research. In the course of certain sedimentation processes, the geohistorical development of our country was predetermined by the uneven regional layout of tertiary basins and **coal** sites, some of which in present time are also active mines with surface exploitation (Figure 9).

In addition to coal, **oil shale** deposits have been identified in several places on the territory of the Republic of Macedonia, some of which have been subject to more research, namely, those near the village of Pleshinci, Probishtip. These deposits are also known in literature as bituminous or charcoal shales. Their low calorific value was probably the reason for the halt of the geological research of this energy resource on the territory of the Republic of Macedonia. However, bearing in mind that oil shale is a significant energy resource in the world, and these are found on the territory of the Republic of Macedonia, these resources may be subject to more detailed research in the future.

Metallic and non-metallic mineral resources are of great importance to the Republic of Macedonia in two basic aspects. The first is the economic and social aspect because

they are the basis for the development of industry, while the second aspect is that with their exploitation, there might be certain consequences for nature.

3.2.2. GEOMORPHOLOGY

The Republic of Macedonia features rich and diverse geomorphological heritage as part of its overall heritage. Above all, it is a result of the extremely turbulent geotectonic activity and dynamics of this part of the Balkan Peninsula, which is in the collision zone of the vast African and European (Eurasian) continental plate and their sub-segments. Additionally, the significant climate change, especially in the last several hundred thousand years, has had an impact on the diversity of geoheritage. Therefore, almost all genetic types of relief are present, with the exception of typical eolian forms. Regarding geodiversity, mountains, which occupy half of the total area of the country, are especially important, and the rest of the territory is occupied by fields, valley plains, and the hilly and wavy relief in some basins. Given the differences in surface area, height, position, geotectonic structure and dominant geomorphological processes, mountains are the “basis” of geodiversity in the Republic of Macedonia. Regardless of all these differences, each mountain has its own geomorphological values and features. For some mountains, it is the karst relief, for others it is the fossil glacial and periglacial relief, or the fluvioweathering, and there are also those that are characterized by several different geo-values.

3.2.2.1. The situation with geodiversity

Of almost 40 mountains and mountain ranges, 12 are higher than 2000 m (13 with Mount Belasica whose highest peak is in Bulgaria), and 5 are even higher than 2500 m: Korab (2753 m), Shar Mountain (2747 m), Baba (2601 m), Mokra (2539 m) and Nidje (2520 m). Considering that during the Pleistocene glacial period, the lower snow limit was about 2000 m, the high-mountain areas of most of the mentioned (high) mountains are characterized by a highly pronounced **fossil-glacial** relief complex. This is especially true for the Korab range, Shara Mountain, the Mokra range (Jakupica), Jablanica and Mount Baba (Pelister), and somewhat less for the mountains of Bistra, Stogovo, Galichica (Stara Galichica) and Kozhuf. This geocomplex is represented by cirques, valley glaciers, moraines, sharp cliffs and peaks, traces of the movement of the former glaciers, glacier beds, and so on.

Figure 17. The valley of Leshnica river in Shar Mountain, with the site Leshnica and Titov Vrv in the background (Photo by: Milevski I.)

The glacial geocomplex is followed by the **periglacial** (subglacial), which descends slightly lower, that is, to the heights of 1800-1700 m. It is present in all high mountains, even in those where there are no clearly expressed glacial forms (Nidje, Dobra Voda, the Osogovo Mountains) and represented by nivation cirques, rocky glaciers, rivers and seas from rocks, sliding blocks, etc. The larger forms are mainly fossil, and the smaller ones, like solifluction lobes and sheets, are still active, especially in cold and long-lasting winters or climate cooling. The preserved glacial and periglacial forms (complexes, geo-landscapes) on our high mountains are especially important for our heritage, not only due to their attractive morphoplasty, but also as a testimony to paleogeographic (especially paleoclimatic) changes in these regions in the last hundred thousand years. They are hence interesting for research and attractive internationally geotourism-wise. Therefore, the areas with a clearly expressed glacial-periglacial relief should be protected as areas of special importance for the geoheritage and geodiversity of the Republic of Macedonia, especially, bearing in mind that most of the high mountains are typical morpho-landscapes of above 2000 m, with numerous unique and significant forms. Thus, on Shar Mountain, the Korab Range, the Mokra Range and Jablanica, above 2000 m, there is a series of cirques, valley glaciers, moraines, together with periglacial forms of different kind (periglacial sheets, rocky glaciers, stone streams, etc.).

Figure 18. The highest parts of Mount Galichica, with glacial relief (Photo by: Milevski I.)

On Mount Baba (Pelister), beside the cirques, there are striking seas of rocks and stone rivers, and on Stara Galichica there are two cirques, valley glacier between them, periglacial sheets, sliding blocks, and so on. Due to the carbonate geological base, on several mountains, the glacial-periglacial forms are combined with the karst, creating a distinctive glaciokarst complex. Such is the case with Mount Bistra, where cirques with small karst fields and doline intertwine, and the high mountain landscape of Mokra (Jakupica and Karadjica) is a similar case.

Under the fossil glacial and periglacial relief on the high mountains, as well as the lower mountains below 2000 m, depending on geotectonic and other factors, different geomorphological phenomena, landscapes and complexes occur. Thus, due to the presence of large masses of carbonate rocks (mainly marble and limestone), the **karst process** with numerous surface and underground forms is very pronounced on ten moun-

tains. These are Bistra, Galichica, Suva Gora, the western part of the Mokra Range (Jakupica), Luben with Kafchal, Zheden, Bukovikj, etc.

There are typical karst forms on the above-mentioned mountains: karst fields, uvalas, doline, karren, caves, precipices, some of which are significant at the national level and beyond. Particularly important are the karst systems of the Jakupica Range and the terrains to the west and north, with deep precipices (Slovachka Jama, the deepest precipice in Macedonia), the deepest underwater cave in Macedonia, Matka Vrelo (Koritishte), the deep cavern system, the Krapa-Peshna, the longest cave, Slatinski Izvor and a number of various surface karst forms. The karst system of Galichica is also distinctive, through which Prespa Lake fills Ohrid Lake, as well as the specific occurrences of hypogene karst, which were further explored in Mariovo, where caves formed with hydrothermal and sulfur speleogenesis (Provalata) were registered.

Figure 19. Location of caves in R. Macedonia (according to the data from the registry of SC "Zlatovrv" - Prilep) and the location of some of the more significant caves: 1 - Jaorec; 2 - Provalata; 3 - Karshi Podot; 4 - Budimirica; 5 - Makarovec; 6 - Krapa; 7 – Slatinski Izvor ; 8 - Solunska 5; 9 – Izvor na Babuna (Golema Peshtera); 10 - Slovachka Jama; 11 - Golema Pesht; 12 - Matka Vrelo (Koritishte)
Source: SC "Zlatovrv" – Prilep, 2015.

On the other hand, the karst terrains are also of hydrological significance, given their waterproofing and accumulation of rich groundwater reserves, which often gushes out in the form of springs. Some of these springs are used for water supply of cities and rural settlements in the Republic of Macedonia (Rashche, Rosoki, Kazani, etc.). Given the aspects stated above, these mountains, more precisely, their karst areas, are very important for the geoheritage of the Republic of Macedonia. Considering its specificity, according to the recommendations of IUCN (Watson et al., 1997), the development of a strategy for karst protection is a complex task, which should primarily emphasize the characteristics of the karst and the related need of a special (holistic) treatment for karst protection.

In the geological structure of some mountains, prevalent forms are the gneisses, granites, granodiorites, andesites, ignimbrites and other rocks that are susceptible to the so-called “selective erosion” or weathering. Therefore, they feature **weathering relief**, which is strikingly pronounced in a number of places. There are particularly significant occurrences of weathering relief (boulders, rock masses, small weathering forms, scattered stone blocks, etc.) on Mount Selechka, Mount Babuna with Zlatovrv, the eastern branches of the Mokra Range, the southern slopes of Ograzhden, the southern slopes of Kozjak towards Stracin and others. The weathering relief of these mountains, especially on Mount Selechka and Zlatovrv, constitutes a large morphocomplex with numerous and exceptionally varied forms. Due to the vastness and diversity of forms, it is considered unique not only at the national level, but beyond. These and other areas with a typical weathering relief are very important for the geoheritage of the Republic of Macedonia, and as such should be comprehensively protected and promoted.

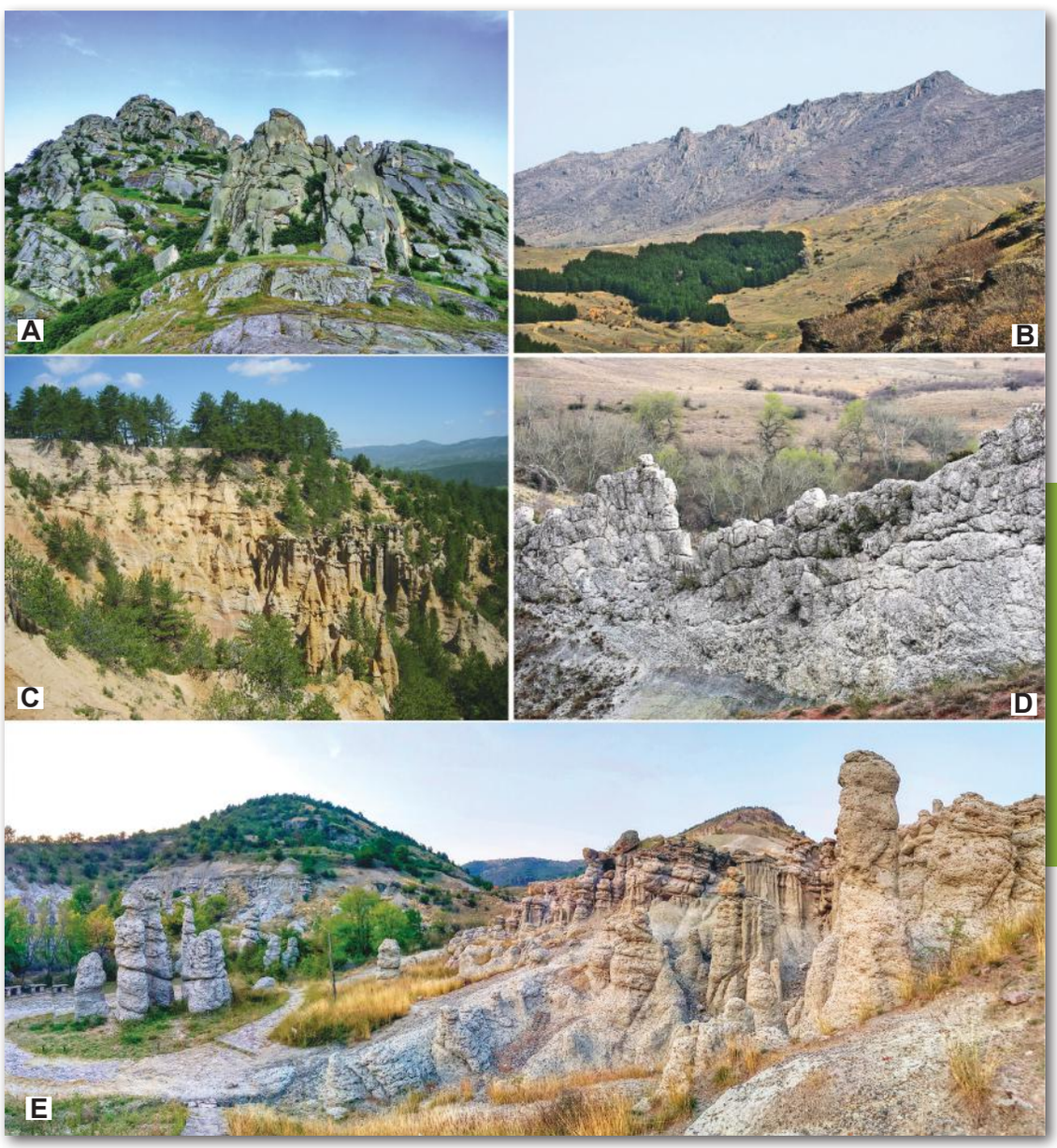

Figure 20. Some of the more typical weathering phenomena in the Republic of Macedonia: A. Markovi Kuli, B. Mount Selechka, C. Kukulje, D. Gjavolski Dzid, E. Kuklica (Photo: Milevski I.)

Most mountains, in the central and eastern part of the Republic of Macedonia, are characterized by a pronounced fluvioweathering relief, due to their position, deforestation, inclination, geological structure and so on. In some places on these mountains, especially at the foot, accelerated erosion has created exceptional geo-landscapes, such as the western slopes of Plachkovica and Vlaina, the southern slopes of Bilino with German and Kozjak, the southern slopes of Ograzhden, Osogovo Mountains, etc. There are typical occurrences of badland terrains – "melovi", earth pyramids, landslides, alluvial fans, and some of them, in terms of their dimensions and morphology, are important geo-objects at the national level. Such are the earth pyramids in Kukulje (on Mount Bejaz Tepe), the "melovi" near Pehchevo and Crnik (at the foot of Vlaina), the badland terrains, alluvial fans and the landslides in the valley of the Kamenichka River (Osogovo Mountains) and the valley of the Radanjska River (Plachkovica), etc.

Apart from the mountains, the numerous forms and landscapes formed with river erosion are also of great importance to the geodiversity of the Republic of Macedonia: deep valleys, gorges (in some places of canyon nature), waterfalls, alluvial fans, river islands, etc. Gorges, as a larger form of fluvial relief, have a special geomorphological significance. There are particularly deep and striking gorges in places where rivers cut across powerful layers of solid rocks (marbles, limestones, quartzites, volcanites).

Such are the gorge on the Radika with its canyon areas (Barich), the Great (Sishevo Gorge) Gorge on the Treska (with the canyon Matka), the gorges on the Vardar (especially Demir Kapija Gorge, Taor Gorgeand Derven Gorge), the Bregalnica (Razlog Gorge, Istibanja Gorge), the Pchinja (Bislim Gorge, Bader Gorge), etc. Along the river basins where there is an abrupt change of rocks with different resistance or fault structures, some watercourses have formed waterfalls.

Figure 21. The lower part of Krivosija waterfalls in Shar Mountain (Dolno Cokle) (Photo by: Milevski I.)

Most of the waterfalls are of low height or low water flow, but about 50 are considered genuinely significant phenomena. Such are the waterfalls of a number of watercourses on Mount Belasica (Koleshino Falls, Smolare Falls, Gabrovo Waterfall), then on the Korab Range (Projfel Waterfall, Duf Waterfall), on Bistra (Tresonche-Biljana Fall) and others.

Figure 22. Some geomorphologically important gorges in the Republic of Macedonia: A. Demir Kapija, B. Bislim, C. Istibanja, D. Zletovo. (Photo: Milevski I.)

Due to the torrential nature of most watercourses, the valleys are highly eroded, and in the downstream areas there is an excessive accumulation of sediment. Both processes pose a serious threat to the relief, water, soils, and human activities in the area. With the high accumulation of sediment, some relief forms are created, which are valuable in terms of geodiversity. Such are the river islands and meanders of the Vardar, the cut off fossil and recent meanders of the Vardar and the Bregalnica, the alluvial fans in the valley of the Radanjska River, the Kamenichka River and others.

Former (Pliocene) and existing larger natural lakes have created numerous forms and occurrences of coastal (abrasive) relief. Of the fossil type, the larger lake terraces that are still well preserved in some basins (Skopje, Berovo, Tikvesh etc.) are especially important. Today's coastal processes and shapes are mainly connected with the three largest natural lakes: Ohrid, Prespa and Dojran. Particularly valuable for the geodiversity in the Republic of Macedonia are the typical shores with cliffs, sandy beaches, peninsula, Golem Grad Island and so on. Certain coastal microforms occur even on older and larger artificial lakes, such as Tikvesh, Mavrovo, Kalimanci and others, and especially interesting are the few small islands in them (Gradishte, Kalata, etc.).

In the last several hundred years, the human factor has a major direct and indirect impact on the relief in the Republic of Macedonia. By degrading and changing the natural

vegetation, and especially by deforestation, the favorable, predisposed and already bare terrains become exposed to excessive erosion. It causes a strong modification of the previous normal (natural) relief, in certain places to the degree of destruction, thereby forming a whole system of erosive furrows, slopes, gullies, erosion pavements, landslides, badland terrains, ”melovi”, earth pyramids, alluvial fans, etc. The territory of the Republic of Macedonia became among the most endangered by erosion in Europe, which is evident from the map of erosion of the Republic of Macedonia (Djordjevic et al., 1993). In addition to the destructive effect on the relief, the soils, the waters, the vegetation and the geological substrate, the excessive erosion has caused the creation of some unique forms, which are significant as geoheritage.

3.2.2.2. List of national geoheritage

The previous review shows that the territory of the Republic of Macedonia has numerous, significant and unique geomorphological areas, phenomena and objects. In fact, rarely does it happen for a country to feature such rich relief diversity on the relatively small area it occupies. However, regardless of this richness of geomorphological geodiversity, in the past period, in our country, insufficient attention has been paid to its protection and promotion (as geo-values). Attention has been mostly paid to biological diversity, which may be justified given the dramatically increased threats to it and the irreversible damage to the biosphere. Perhaps this is the reason why the existing strategies for the protection of certain elements of nature have not covered protection of the geodiversity, i.e. the non-living nature of the Republic of Macedonia; instead, those elements have been mentioned merely as part of other documents and action plans, mostly through the preservation of landscapes and the protection of habitats. In the last decades, one of the EU’s top priorities, along with biodiversity, is the protection (geo-conservation) and promotion of geoheritage, as well as sustainable exploitation of geo-values.

According to the analyses of the available data, as well as our own research, the Republic of Macedonia features important sites, areas, phenomena and objects as significant geoheritage. In Annex 1 to the Strategy, there is a list of selected significant geoheritage sites in the field of geology, geomorphology and hydrology that should be taken into account in the preparation of the new Spatial Plan of the Republic of Macedonia.

3.2.3. HYDROLOGY

The main objective of the *Hydrology* Component in the *Nature Strategy* is to assess the state of waters in the country and to provide guidelines for long-term practical steps for achieving sustainable development of water resources, satisfying all users in the social community and nature.

3.2.3.1 General hydrographic characteristics

There are numerous **springs, rivers and lakes** on the territory of the Republic of Macedonia. Surface waters are the most important part of ecosystems in the country.

Springs. In the Republic of Macedonia, a total of 4414 **springs** have been registered with a total capacity of 991.9 million m^3/per annum, of which 58 have a capacity exceeding 100 l/s.

Table 4. Main watersheds in the Republic of Macedonia

River/Lake		Watershed area (km^2)	Watershed area (%)
1	Main watersheds:		
	Vardar	6,813	26.5
	Treska	2,068	8.0
	Pcinja	2,373	9.2
	Bregalnica	4,307	16.8
	Crna	4,985	19.4
	Total: 1	20,546	79.9
2	Crn Drim	3,355	13.0
3	Strumica	1,520	5.9
	Total: 1 to 3	25,421	98.8
4	Smaller watersheds:		
	Dojran Lake	120	0.5
	Cironska and Lebnica	128	0.5
	the South Morava	44	0.2
	Total: 4	292	1.2
	Total: 1 to 4	**25,713**	**100**

Source: *Integrated Water Resources Development and Management Master Plan in the Republic of Macedonia, Nippon Koei Co., Ltd. KRI International Corporation, Japan International Cooperation Agency - JICA, (1999)*

Rivers. The **rivers** penetrate the mountains in a general direction northwest-southeast or perpendicularly to this direction. From the northeast to the southwest run the river courses of the Vardar (middle and low flow), the Lepenec, the Strumica and the middle course of the Crna Reka. From the south to the north flow the rivers of the Crn Drim, the upper course of the Vardar and the Treska. From the southwest towards the northeast flow the Babuna and the lower course of the Crna Reka, and the Pchinja and the Bregalnica run opposite of the northeast towards the southwest.

The Vardar is the longest and largest river in Macedonia (301.6 km) with an average altitude of 793 m with amplitude of 2748 m at Titov Vrv to 48 m near Gevgelija. The spring is located on the Sharplanina Range near the village of Vrutok near Gostivar at an altitude of 683 m. Annual precipitation is between 500 mm in the central part up to more than 1000 mm in the west. The average amount of precipitation mostly range from 600 to 900 mm. The total annual outflow near Gevgelija is 4.56 million m^3. Due to the hydrographic features of the Vardar River watershed, it is divided into the upper part (above Skopje), central (between Skopje and Veles) and the lower part (between Veles and Gevgelija). The main tributaries of the Vardar are the Treska, Pchinja, Bregalnica and Crna Reka rivers.

The remaining rivers that drain the territory of the Republic of Macedonia are the Crn Drim and the Strumica. The rest are with insignificant watershed surface.

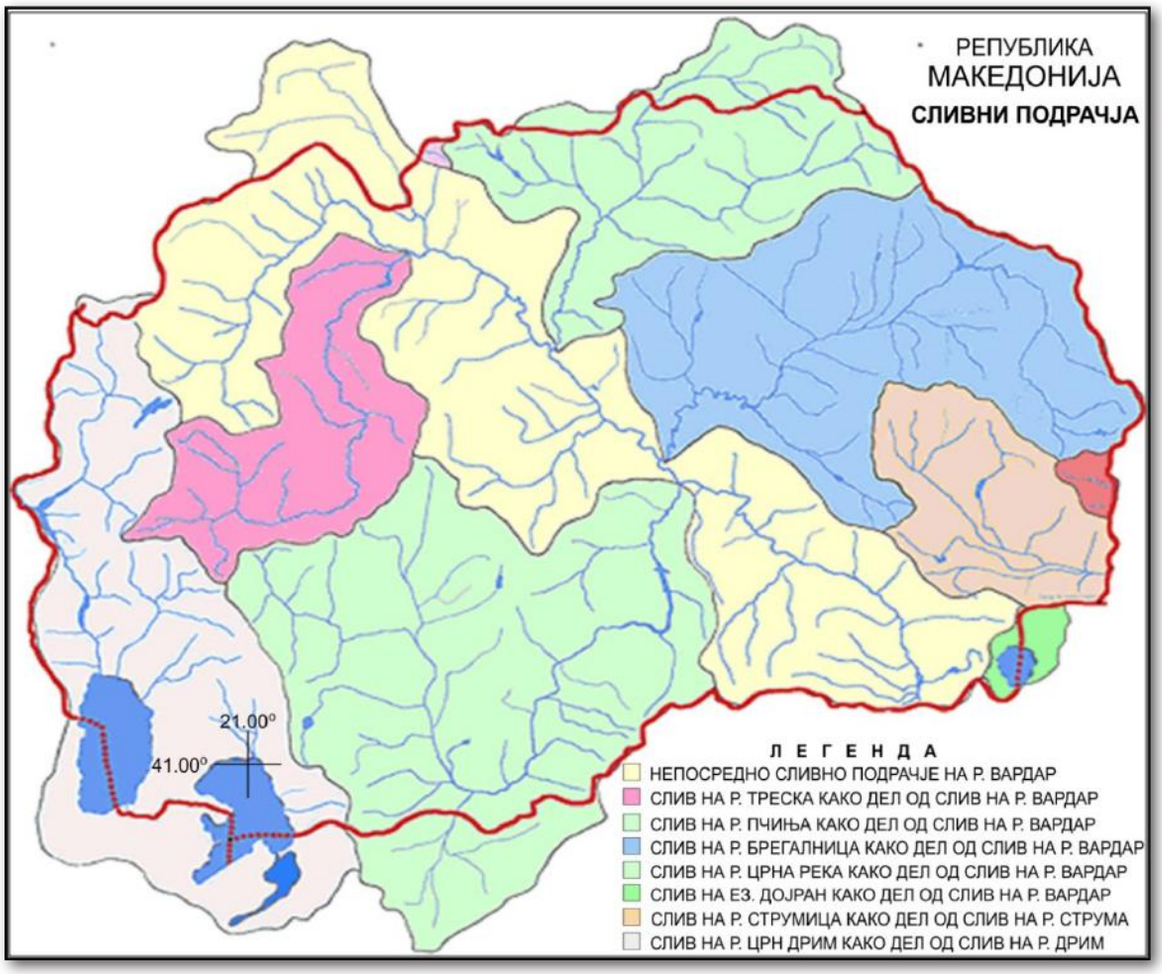

Figure 23. Larger watershed areas in the Republic of Macedonia

Lakes. Lakes are primarily divided into natural and artificial. The **natural** lakes in the Republic of Macedonia are extremely important hydrographic objects. Such are Ohrid, Prespa and Dojran Lake. They originated in the Mid-Tertiary.

Ohrid Lake is one of the most important aquatic ecosystems in Europe whose age is estimated at 2-3 million years. In 1980, Ohrid Lake and the city of Ohrid were proclaimed World Heritage Sites and are under the protection of UNESCO. The lake has an area of 358 km^2 of which 251 km^2 belong to Macedonia, and 107 km^2 to Albania.

Prespa Lake is the second largest lake. Great Prespa Lake has an area of 278 km^2 at a lake level of 844 m, of which 65.7% belong to Macedonia. The mean depth of the lake is 15 m, and the maximum is 54 m.

Dojran Lake is the smallest tectonic lake and is located at an altitude of 148 m. It is almost circular in shape. The surface of the lake at a normal level is 42.2 km^2, of which 63.6% belong to Macedonia, and the lake watershed is 271.8 km^2, of which 32% belong to Macedonia.

In the Republic of Macedonia, there are **glacial lakes** as a subcategory of the natural lakes, of which 44 are permanent. They are located on the high mountains at an altitude of 1500 to 2500 m. They are located in cirques of diluvial glaciers: on Shar Mountain (19), Korab (8), Deshat (5), Jablanica (4), Stogovo (3), Pelister (3) and Karadjica (2).

On the rivers in the Republic of Macedonia, more than 20 large and more than 120 small dams with **reservoirs** have been built. The oldest reservoir is “Matka” (1938), and “Kozjak” (2004), “Lisiche” (2008), “Knezhevo” (2013) and “Sveta Petka “(2014) were more recently built.

Table 5. Dams built in the Republic of Macedonia with basic characteristics

Dam/reservoir	River	Dam height (m)	Type of dam	Volume of reservoir (m^3)10^6	Purpose
The Vardar watershed:					
Kozjak*	The Treska	114.0	rock-fill embankment	550.0	E, R
Matka	The Treska	29.5	concrete	2.6	E
Sveta Petka*	The Treska	47.5	concrete	9.1	E, R
Glazhnja	The Lipkovo	74.0	concrete	23.6	I, W, E
Lipkovo	The Lipkovo	32.2	concrete	1.2	I, W, E
Mavrovica	The Mavrovica	25.0	earthfill	2.8	I, W
Kalimanci	The Bregalnica	85.0	rock-fill embankment	127.0	I, W, E
Knezhevo*	The Zletovo	75.0	rock-fill embankment	23.5	W, I, E, R
Gradche	The Kochni	29.0	concrete	1.8	I, W
Ratevska	The Ratevo	46.0	concrete	10.5	I, W
Paljurci	The Luda Mara	21.1	earthfill	2.9	I, R
Otovica	The Otovica	27.0	concrete	8.0	I, W
Prilep	The Oreovo	36.0	concrete	6.0	I, W
Tikvesh	The Crna Reka	104.0	rock-fill embankment	475.0	I, E
Strezhevo	The Shemnica	76.0	earthfill	119.0	I, W, E
Suvodol	The Sonovirska	33.9	earthfill	7.9	W, P
Lisiche*	The Topolka	65.0	rock-fill embankment	26.8	W, I, E
The Strumica watershed:					
Turija	The Turija	77.5	earthfill	50.3	I, W, E
Vodocha	The Vodocha	44.0	earthfill	27.0	I, W
Mantovo	The Kriva Lakavica	37.5	earthfill	47.5	I, W
The Crn Drim watershed:					
Globochica	The Crn Drim	82.0	rock-fill embankment	58.0	E
Shpilje	The Crn Drim	101.0	rock-fill embankment	520.0	E, I
Mavrovo	The Crn Drim	54.0	earthfill	357.0	E, I

Explanation: E-energy, I-irrigation, W-water supply, R-retention
Source: Water management of the Republic of Macedonia (1999)
Note: The dams and reservoirs marked with (*) are not listed in the data source given the fact that they have been built after 1999

The waters in the Republic of Macedonia are also used for electricity generation by means of **small hydropower plants**. For this purpose, "*Feasibility study about justification of concession for the use of water for electricity generation by constructing small hydropower plants*" was prepared (Civil Engineering Institute MACEDONIA, 2008). In this study, a total of 406 locations have been identified. Their immediate construction may pose a threat to nature.

Even more so if we take into account that the economic benefits are quite limited not only for the population but also for the economy. Namely, all small HPPs are planned

on small tributaries, mostly in the upper parts of their watersheds where the streams are small, and the vulnerability of the natural terrain and ecosystems is very high. Moreover, taking into consideration the low environmental awareness for the implementation of the measures for protection and restoration of the river beds and their watersheds, it is necessary to re-examine the possible locations for the construction of small HPPs and strengthen the control over awarding concessions.

Figure 24. Glacial lakes, Podgorci Lake (left) and Bogovina Lake (right)
Source: *Samir Demishi, 2014 and MoEPP, 2015*

The Republic of Macedonia features **thermal waters** as well. Such are found in the v. Bansko (Strumica), v. Banja (Kochani), v. Negorci (Gevgelija), v. Katlanovo (Skopje), v. Kezhovica (Shtip), Banjishte and Kosovrasti (Debar), which are intended for balneological purposes, and there are other thermal waters for other purposes.

In the Republic of Macedonia, adequate meteorological and hydrological **monitoring** is carried out. It is mainly managed by the National Hydrometeorological Service (NHMS), where, among other things, water quality is registered.

For the purpose of the Strategy for Nature Protection, the term **environmental flow** has been defined, which is a flow regime that is provided in a given water system (river, water habitat, coastal zone) in order to maintain the ecosystems and the benefits thereof, when there are competing purposes of the water and where the flow is regulated. In most EU countries, the concept of environmental flow, its interpretation and implementation are part of different guidelines or regulations.

The introduction of environmental flow requires consideration of all aspects of the river and its watershed area. This involves analyzing the watershed of the spring to the estuary of the river and includes mud systems, floodplains and associated groundwater. It also involves taking into account the environmental, social and cultural values associated with the given system. Therefore, in determining the environmental flows, consideration should be given to a whole range of possible effects – from environmental protection to meeting the needs of the economy and people.

However, environmental flows are not the only characteristic of a healthy river ecosystem. There are other objectives, such as reducing pollution and controlling activities in the river bed, such as fishing and recreation. Therefore, environmental flows should be considered an integral part of a contemporary approach to river watershed management.

3.2.3.2. Significant geology in the area of hydrology in the Republic of Macedonia

The Republic of Macedonia has a very rich geoheritage in the field of hydrology. In Annex 1 there is a list of selected significant geoheritage sites in the field of geology that should be taken into account in the preparation of the new Spatial Plan of the Republic of Macedonia.

3.3. LANDSCAPE DIVERSITY

Landscapes are a mosaic of anthropogenic and natural ecosystems shaped by the long-standing interaction of man and nature. Thousands of years ago, man played an important role in shaping natural ecosystems in Macedonia and contributed to the specific characterization of landscapes (landscape patterns).

In the context of nature protection in the Republic of Macedonia, the roles of the landscapes in the **sustainable use of natural resources** and their role as **habitats for wild species**, in addition to the remaining roles, are of particular importance. Therefore, the identification and characterization of landscape diversity on the territory of the Republic of Macedonia will result in data that will complement the current knowledge of natural resources and will make a significant contribution to the integrated and sustainable preservation of natural values in the region. The analysis of human-induced changes at the landscape level in recent history should be an integral part of the national strategy for nature protection in order to determine the ecosystems' suitability for supporting the preserved biodiversity, revitalizing the degraded components and providing the necessary ecosystem services. Structural analysis of landscapes should be the basis for integrated spatial planning that would ensure sustainable community development without serious damage to natural ecosystems and the overall biodiversity.

Hence, it is necessary to make a detailed analysis of the landscapes in Macedonia that will include typification of landscape types, analysis of their structural characteristics and their functionality in terms of biodiversity and ecosystem processes.

Scientific data on the type and characteristics of the landscapes in Macedonia thus far are virtually non-existent. The only exceptions are a single defended doctoral dissertation and a scientific paper, as well as several professional studies.

The ultimate goal of the action plan for landscape conservation, within the nature strategy, would be the development of an effective natural resource management plan in the country (through the implementation of landscape values in the country's spatial plan), which will include action plans for the conservation of the most significant "distinguished" species, ecosystems and habitats along with traditional and other human activities.

3.3.1. IDENTIFIED LANDSCAPE AND LANDSCAPE TYPES IN MACEDONIA

According to research thus far, eight basic groups of landscapes are identified in Macedonia:

1. Urban and industrial and mining landscapes (with two landscape types: urban landscape and industrial and mine landscape)
2. Agricultural landscapes [with 11 landscape types: Plain sub-Mediterranean agricultural landscape, Plain sub-Mediterranean-continental agricultural landscape – typical shape, Plain sub-Mediterranean continental agricultural landscape of saline soils (Ovche Pole plain landscape), Plain sub-Mediterranean-continental agricultural landscape of rice paddies (Kochani landscape), Plain-hilly sub-Mediterranean-continental agricultural landscape of vineyards (Tikvesh landscape), Plain subcontinental

agricultural landscape of cereals (Pelagonia landscape), Plain sub-continental agricultural-rural landscape of mixed crops (Polog landscape), Plain-hilly subcontinental agricultural-rural landscape, Plain-hilly continental rural-agricultural landscape (Maleshevo-Pijanec landscape, Hilly sub-Mediterranean-continental agricultural landscape (Hilly agricultural landscape) and Hilly sub-Mediterranean-continental agricultural-rural landscape (Hilly agricultural-rural landscape)

3. Rural landscapes [with six landscape types: Hilly sub-Mediterranean-continental rural landscape (Hilly rural landscape), Hilly sub-Mediterranean-continental rural landscape with borderlines (Hilly rural landscape with borderlines), Hilly subcontinental rural landscape (Hilly rural landscape), Hilly sub-Mediterranean-continental rural landscape with hilly pastures (Mariovo landscape), Mountainous continental rural-forest landscape (Osogovo mountainous rural landscape or Osogovo landscape) and Mountainous continental rural landscape (including Maleshevo mountainous rural landscape)]
4. Landscape of hilly pastures [with five landscape types: Hilly subcontinental landscape of hilly pastures on a silicate substrate (Hilly pasture landscape on a silicate surface), Hilly subcontinental landscape of hilly pastures on a limestone substrate (Hilly pasture landscape on a limestone substrate), Hilly sub-Mediterranean-continental landscape of hilly pastures on a marl substrate (Hilly pastures landscape on a marl substrate), Hilly subcontinental landscape of hilly pastures on granite screes (Treskavec landscape) and Hilly sub-Mediterranean-continental landscape of hilly pastures on serpentinite (Hilly pasture landscape on serpentinite)]
5. Forest landscapes [with seven landscape types: Hilly sub-Mediterranean landscape of sclerophilic shrubs (Pseudomacia landscape), Hilly sub-Mediterranean-continental landscape of thermophilic degraded forests (Landscape of thermophilic degraded forests), Hilly-mountainous subcontinental landscape of mixed forests with coniferous plantations (Mixed forest landscape with coniferous plantations), Mountainous continental landscape of mesophilic broadleaf forests (Landscape of mesophilic broadleaf forests), Mountainous subcontinental-continental landscape of pine forests (Pine forest landscape), Mountainous continental landscape of fir-spruce forests (Landscape of fir-spruce forests) and Mountainous landscapes of Krivobor shrubland (Landscape of Krivobor shrubland)]
6. Landscapes of high mountain pastures [with two landscape types: Mountainous landscape of pasture on a silicate substrate (Landscape of high mountain pastures on a silicate substrate) and Mountainous landscape of pastures on a carbonate substrate (Landscape of high mountain pastures on a carbonate substrate)]
7. High mountain landscapes and screes [with two landscape types: High mountain landscape of silicate rocks and screes (Landscape of silicate rocks and screes) and High mountain landscape of carbonate rocks and screes (Landscape of carbonate rocks and screes)]
8. Lake landscapes [with three landscape types: Sub-Mediterranean lake landscape (Dojran landscape), Sub-Mediterranean continental lake landscape (Ohrid landscape) and Subcontinental lake landscape (Prespa landscape)].

A total of 38 types of landscapes identified on the basis of the applied methodology have been identified. Each of them may contain different variants, but generally they feature certain common structural and functional characteristics. Some of the landscape types are distributed discontinuously in many areas in Macedonia, and some are a compact whole only in some part of the country. The main reasons for such conditions are the specific climatic and biogeographical characteristics of certain areas, the zonal schedule of climate-biogeographical characteristics along the vertical gradient in most of the coun-

try, all in combination with the intensity of anthropogenic activities in the past and present. The distribution of individual landscapes and landscape units in Macedonia is shown on the map.

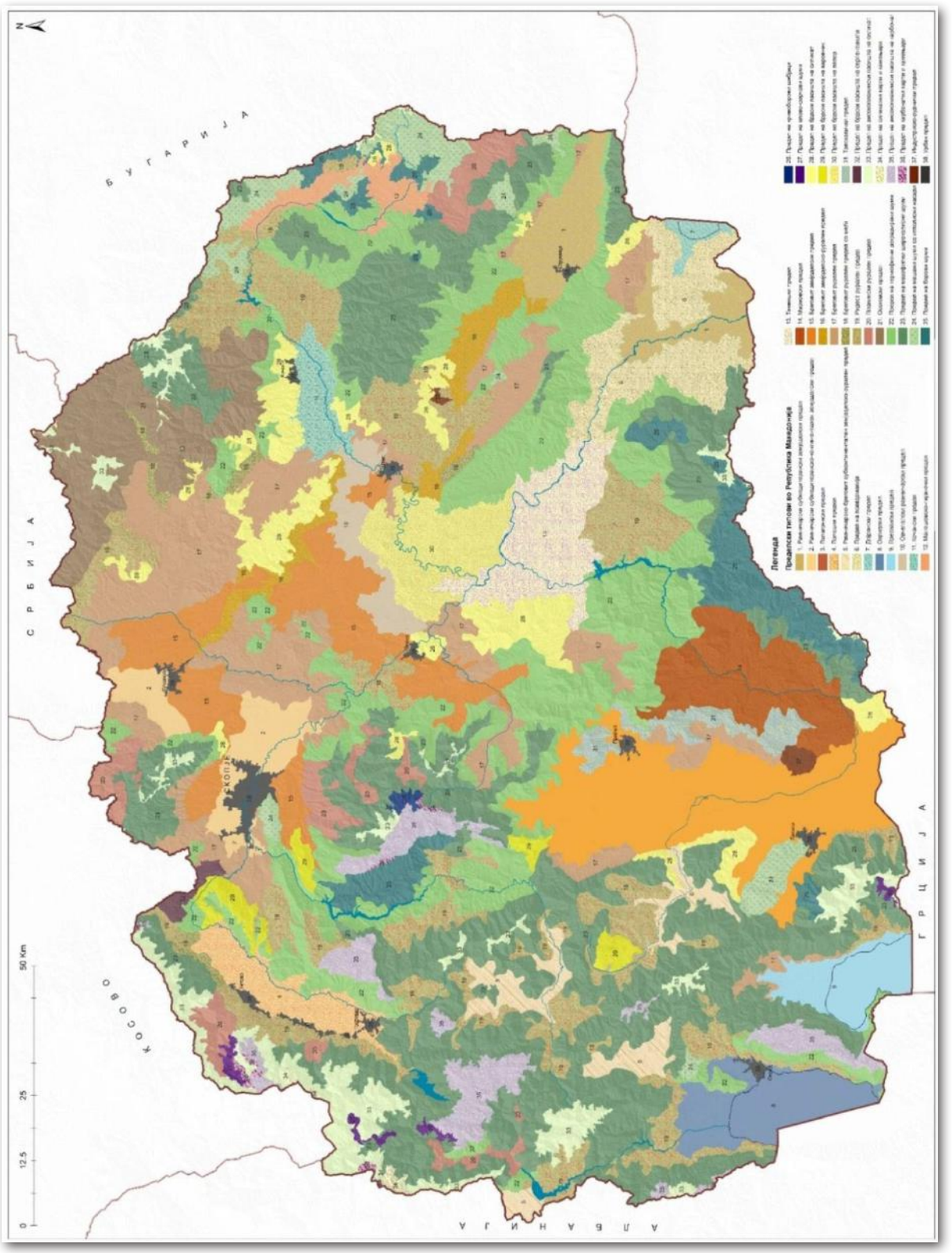

Figure 25. Landscapes in the Republic of Macedonia (Melovski, 2016)

3.3.2. LANDSCAPE SIGNIFICANCE IN THE CONTEXT OF NATURE PROTECTION

Valorization of landscapes can be defined as the process of "determining the significance of a particular landscape or landscape characteristic, by reference to specified value criteria". Valuation criteria on the basis of which valorization of the landscape is done vary depending on the needs for which the valorization is carried out. In this study, landscapes are valued mainly in terms of their functional value for the conservation of biodiversity. In addition, landscape values are also valorized, as well as the cultural values and landscape uniqueness.

Valorization is carried out in two steps: first, landscape types were evaluated, and then within the landscapes that have high importance for biodiversity or have high aesthetic value, the landscape units were evaluated in different parts of Macedonia.

The following value criteria were selected as the basic criteria for valorization based on the needs of this study: landscape character, landscape status, landscape value in relation to biodiversity, landscape value in relation to people, landscape sensitivity, connectivity of core patches in the landscape and landscape uniqueness in Macedonia.

Value assessment according to the above criteria was made by awarding 0 to 3 points for each criterion separately, and separately for each landscape. In this case, 0 indicates that the landscape has no value for the given criterion, while 3 denotes a very high value. The basic principle in assigning the scores was the preservation and representativeness of the landscape structure shown tabularly for each landscape separately in Chapter 3 of the Study on Nature. For a fully objective assessment of this kind, especially with regard to the connectivity and significance of each landscape unit to biodiversity, much more thorough analysis is needed in the course of a much longer period. Therefore, for some criteria, assessment was based on expert judgment.

According to the results of the valorization of the landscape types (Table 6.40 of the Study on Nature), in accordance with the above-explained valorization criteria, several significant landscapes can be identified in Macedonia: *Landscape of fir-spruce forests* (the highest valued landscape units are the landscapes of fir-spruce forests of Shar Mountain and Bistra)*; Pine forests landscape* (the highest valued landscape units are the pine forests landscapes on Pelister, Karadjica and Kozhuf-Kajmakchalan); *Sub-Mediterranean lake landscape (Dojran landscape), Landscape of hilly pastures on a marl substrate; Mountainous landscape of Krivobor shrubland (Landscape of Krivobor shrubland); Landscape of carbonate rocks and screes; Landscape of high mountain pastures on a carbonate substrate* (the highest valued landscape units are Karadjica-Dautica, Bistra, Galichica and Shar Mountain)*; Hilly rural landscape with borderlines* (the highest valued landscape units are Serta, Osogovo-Kriva Palanka and Shar Mountain)*; Subcontinental lake landscape (Prespa landscape), Hilly pasture landscape on serpentinite, Osogovo mountainous rural landscape, Plain agricultural landscape of rice paddies (Kochani landscape); Mariovo landscape; Landscape of hilly pastures on granite screes; Mountainous rural landscape* (where Reka, Ograzden, Shar Mountain-Mazracha and Karadjica are identified as more significant landscape units); *Sub-Mediterranean-continental lake landscape (Ohrid landscape)* and *Landscape of hilly pastures on limestone.*

The group of significant areas may also include Hilly rural landscape (with Plachkovica, Ljuboten, Shar Mountain and Porechje as highly valued landscape units); *Hilly sub-Mediterranean area of sclerophilic shrubs* (*Pseudomacia landscape*); *Plain*

subcontinental agricultural landscape of cereals (Pelagonia landscape); *Landscape of mesophilic broadleaf forests; Landscape of high mountain pastures on a silicate substrate* (with Shar Mountain-Korab, Shar Mountain, Pelister and Deshat as more significant landscape units) as well as the *Maleshevo-Pijanec rural-agricultural landscape; Plain-hilly subcontinental agricultural-rural landscape; Plain sub-Mediterranean-continental agricultural landscape (Ovche Pole landscape).*

Figure 26. Plain sub-Mediterranean-continental agricultural landscape of rice paddies (Kochani landscape) – Kocansko Pole (photo: Lj. Stefanov)

Figure 27. Hilly sub-Mediterranean-continental agricultural landscape (Hilly agricultural landscape – Ovche Pole hilly agricultural landscape with field-protective belts) – Ovche Pole, near Sveti Nikole (photo: Bl. Markoski)

Many of these important landscapes are under various threats that degrade them both structurally (overgrowing of open landscapes, deforestation by means of illegal felling, uncontrolled urbanization, etc.) and functionally (disruptions in the circulation of matter and energy in ecosystems, and hence the degradation of basic ecosystem services, especially the regulating ecosystem services).

3.4. BIODIVERSITY
3.4.1. GENERAL INFORMATION ON BIODIVERSITY

Biodiversity of the Republic of Macedonia is characterized by great heterogeneity and high degree of relictness and endemism and is at the very top of the list of European countries, designated as “European Hotspots”. This is due to its central geographical position on the Balkan Peninsula, as well as the impacts on its territory in the past, especially during Pleistocene. Great temperature oscillations before, during, and after the end of the ice age, have caused multiple dramatic migrations of wildlife, which have greatly affected these areas. Such mass movements have left deep traces on the recent flora and fauna on the wider European area, including on the area of the Republic of Macedonia.

Biodiversity research on the territory of Macedonia started about 180 years ago. Since the beginning of floristic and faunistic studies, which began with Frivaldsky (1835, 1836) and Grisebach (1843, 1844) to date, more than 3500 scientific papers have been published.

According to today’s knowledge of the study of individual taxonomic groups that are part of the species biological diversity, thus far about 2000 algae species, over 2000 fungi and 450 lichens, 3200 types of vascular plants, about 500 moss taxa, 13000 invertebrate taxa, 85 species of fish and cyclostomata, 14 species of amphibians, 32 species of reptiles, 335 bird and 89 mammal species have been registered on the territory of the Republic of Macedonia. Of particular importance are the endemic species – about 150 endemic algae, about 120 endemic vascular plants, over 700 invertebrates and 27 endemic fish species.

The vegetation diversity of higher plants is represented by over 30 vegetation classes, 60 vegetation orders, 90 alliances, and about 300 plant associations.

About 120 types of habitats are present on the territory of the Republic of Macedonia, of the third level of the EUNIS classification, which belong to 28 types of ecosystems. Some of them, such as Ohrid and Prespa Lakes, are of exceptional significance not only nationally, but also globally.

Given that the knowledge about certain biodiversity components (taxonomic groups, syntaxons, habitats, etc.) is limited, the image of the rich biodiversity in the Republic of Macedonia is not yet complete.

Figure 28. *Fritillaria macedonica*

3.4.1.1. Status and trends of biodiversity in the Republic of Macedonia (2003-2014)

The first Study on the State of Biodiversity in the Republic of Macedonia was prepared and published in 2003 as the First National Report to the Convention on Biological Diversity, while the Strategy and Action Plan for the Protection of Biodiversity of the Republic of Macedonia was prepared in 2004.

In the period 2003-2014, three national reports to the Convention on Biological Diversity were prepared, and in 2014 the process of revision of the National Strategy on Biological Diversity with an Action Plan was initiated. In 2014, the Fifth National Report to the Convention on Biological Diversity was prepared, which was adopted by the Government of the Republic of Macedonia, and at the same time the process of revision of the National Strategy on Biological Diversity with an Action Plan was initiated.

In the period between the First and the Fifth National Report (2003-2014), there has been an increase in the quantum of knowledge about biodiversity, especially in some of its components. For example, in the past period, about 250 new taxa have been described for science (6 higher plants, over 170 diatomaceous algae taxa, and 69 species of invertebrates). For the first time, hundreds of previously unregistered species have been registered on the territory of the Republic of Macedonia (23 higher plants, 237 fungi species, a dozen vertebrates, and the estimation of the number of invertebrates has been raised from about 10000 to over 13000 species). Quantitative estimates have been made of the populations of some of the most endangered species (for example, the Balkan lynx, a number of bird species) and the trends of the populations of some bird species (white-headed vulture, Egyptian vulture, lesser kestrel, eastern imperial eagle) have been documented.

In the past couple of years, significant progress has been made in the knowledge of algae diversity, primarily the diversity of silica algae (diatoms). In 2007, a monograph on diatoms of Ohrid and Prespa Lakes was published (Levkov et al., 2007), describing 75 new species for science. Thus far, the results show that over 900 diatom taxa (Levkov & Williams 2012) have been registered in Ohrid and Prespa Lakes only, while about 1200 diatoms are known on the territory of Macedonia.

With the latest research on the diversity of fungi in Macedonia, especially the macromycetes, over 2000 taxa have been found, making the Republic of Macedonia one of the better explored European countries today. Several new papers have been published covering numerous new and rare species of fungi in Macedonia (Karadelev et al. 2007a, 2007b, 2008b, 2009; Karadelev & Murati 2008a, Dogan & Karadelev 2009). Separate systematic studies on the mycodiversity have been carried out in the mountains of Ograzhden, Jablanica, Jakupica, Korab and Dobrova Voda (Karadelev et al. 2009 d, e, f). At the same time, intensive work is being done on the protection of fungi and a basic Red List of fungi of Macedonia has been prepared (Karadelev & Rusevska 2012), in which 213 species of fungi were categorized according to the IUCN criteria.

Synthetic review of the bryophora of the Republic of Macedonia has been published (Cekova 2005), supplemented with the data of Martinchić (2009) and Papp & Erzberger (2012), according to which the bryoflora of the Republic of Macedonia consists of over 500 taxa. Of these, 400 taxa belong to genuine mosses (Musci), while about 100 taxa belong to representatives of the Hepaticae class.

In the area of plant diversity, the publication of two new issues of the edition “Flora of the Republic of Macedonia” is worth noting (Micevski and Matevski, 2005; Matevski, 2010), as well as two monographic studies on the Macedonian steppe (Matevski et al., 2008) and the forest vegetation on the mountain range of Galichica (Matevski et al. 2011), as well as the monographs on the natural values of Monospitovo Marsh and Shar Mountain covered by Melovski et al. (2008, 2010). Over 20 vegetation articles and two mono-

graphs have been published – Flora and Vegetation of the Macedonian Steppe (Matevski et al., 2008) and Forest Vegetation of the Galichica Mountain Range in Macedonia (Matevski et al., 2011). They describe over 15 plant communities (associations) which are new to science, 3 new alliances and suballiances, and syntaxonomic and nomenclature revisions of over 15 plant communities have been made, which have not been harmonized yet with the provisions of the International Code for Phytocenological Nomenclature.

In addition, a Report with Analysis and Valorization of Biodiversity as well as a Catalog of Species in digital format have been prepared (Petkovski, 2009).

Biodiversity of invertebrates in Macedonia in the last 10 years has been covered in over 300 scientific papers. An attempt has been made to catalog the fauna of Macedonia (Petkovski, 2009), lists of species of snails (Stanković et al. 2006), Orthoptera (Chobanov & Mihajlova, 2010) and ants (Karaman, 2009) have been prepared. Among the most important publications related to invertebrates in Macedonia are the editions on Orthoptera (Micevski et al., 2003) and Rhopalocera in NP Pelister (Micevski & Micevski, 2005) and Rhopalocera in NP Galichica (Krpač et al., 2011).

Quantitative research of herpetofauna on the island of Golem Grad on the Prespa Lake has been carried out, with an emphasis on Hermann's tortoise, the dice snake and the horned viper, as well as the distribution of reptiles in Macedonia (Sterijovski et al., 2011, 2014; Ajtić et al., 2013).

Velevski et al. (2016) provide data on 89 species of mammals in Macedonia, while comments on the distribution and review of endemism are given by Krystufek & Petkovski (2003, 2006).

The database on biological diversity at the national level in the last 10 years is significantly enhanced with new scientifically verified information and data on biodiversity within the developed studies of valorization/revalorization of protected areas: (Pelister, Mavrovo, Prespa Lake, Ezerani, Tikvesh, Matka Canyon, Alshar, Jasen, Vodno and Gazi Baba and Katlanovo landscape), as well as part of the unprotected areas (Osogovo, Belasica, Zheden, Studenchishte Marsh, etc.). It is also important to mention the thematic reports on biodiversity which have been prepared for the purposes of the preparation of the management plans for NP Galichica and NP Mavrovo, as well as the gap analysis report of the environmental data and preparation of an environmental sensitivity map for the Bregalnica river watershed area (2015).

According to the Law on Nature Protection in the Ministry of Environment and Physical Planning in 2011, a National Information System for Biological Diversity (NISB) was established with a web application. The NIBS Central Database contains a large number of data on species and habitats, threats as well as spatial and other data on protected areas.

3.4.1.2. Diversity of species in the Republic of Macedonia

Bacteria are very poorly studied in terms of taxonomy. According to data thus far, there are about 100 identified taxa (together with pathogenic bacteria).

Algae are considered a group whose diversity on the territory of the Republic of Macedonia is still considered to be insufficiently known. In the period 2004-2015, over 160 new types of silica algae, mainly from Ohrid and Prespa Lakes, have been described, and more intense research has been done in these lakes on the group of Chari (*Charophyceae*).

Fungi in the Republic of Macedonia are relatively well researched, with over 2000 registered fungi. Of the lichens that are relatively poorly researched, about 450 species are known.

The flora of the higher plants is represented with over 3700 species. The most numerous groups are the angiosperm plants with about 3200 species and mosses with about 500 species, while the other groups (lycopodium, equisetopsida, ferns and gymnosperms) are represented with fewer species.

Invertebrates are the largest fauna group, which is represented on the territory of the Republic of Macedonia with over 13000 species.

Sponges are studied only in our three natural lakes. A total of 10 taxa have been identified, of which 6 taxa are endemic. The endemic species of sponges of Ohrid Lake (*Ochridaspongia rotunda, Ochridaspongia interlithonis, Spongilla stankovici, Ohridospongilla stankovici*), as well as the endemic species of Prespa Lake (*Spongilla prespensis*) are especially interesting.

The *Nemathelminthes* type is represented with about 870 species, of the *Mollusca* type, a total of 320 taxa (of which 92 are endemic) have been registered, while *Annelida* type consists of about 180 taxa (53 endemics).

The most numerous group among them is the *Arthropoda* type with 11800 species. Of the *Arachnida* class, 560 species are known, and 825 taxa have been identified of the *Chelicerata*. The *Crustacea* class is one of the best studied groups of organisms in Macedonia, with about 490 taxa, while of the class of insects (*Insecta*), among the better studied groups is the order *Lepidoptera* (butterflies), with a total of 2295 taxa registered thus far. A catalog of *Coleoptera, Carabidae* has been published featuring data on 571 species and 234 subspecies (Hristovski & Guéorguiev, 2015).

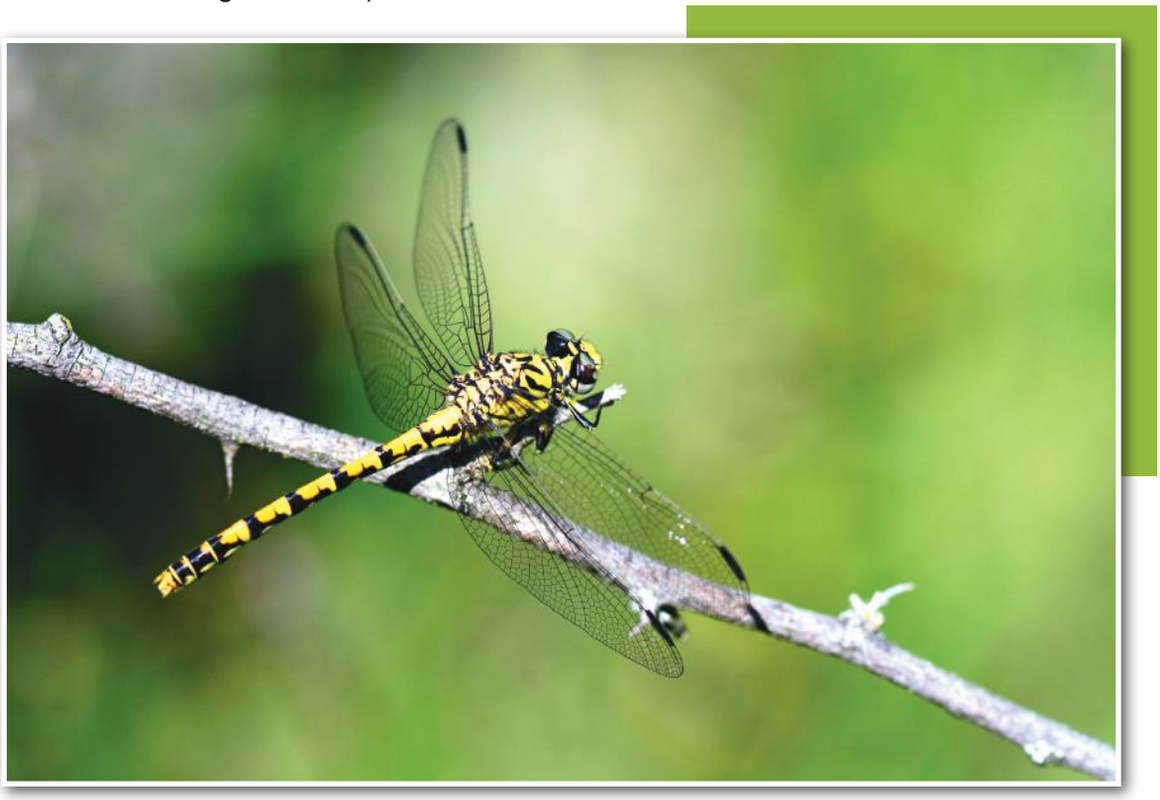

Figure 29. Onychogomphus forcipatus Photo by: MES

The underground fauna of the Republic of Macedonia is poorly explored and, according to the data available, it is more deficient compared to the fauna of the Western Balkan countries, but it is characterized by a high percentage of endemism (about 90%). Stigobionts (troglohydrobionts) are represented with 57 species. Of the other troglobionts, pseudoscorpiones (14), beetles (12) and woodlouse (10) are represented with more species, and in the last decade, 6 new species of troglobionts (2 types of woodlouse, 3 pseudoscorpiones and 2 beetles) have been described. The richest cave fauna is encountered in the caves in western Macedonia, especially the caves of the Radika River watershed, on the mountains of Galichica and Jakupica, as well as in Porechje.

Figure 30.A Green toad (Pseudepidalea viridis) B. Greek frog (Rana graeca) C. Ursini's viper (Vipera ursinii) D. Hermann's tortoise (Testudo hermanni) Photo by: Bogoljub Sterjovski

Vertebrates in the Republic of Macedonia are represented with 552 species, 28 of which are allochthonous. *Lampreys* are represented with two species, while fish with about 85 species (19 introduced). *Amphibians* are represented with 14 species, while 32 species are known of *reptiles*. The fauna of *birds* consists of 349 taxa (335 species and 14 subspecies), 10-11 species of which are considered uncertain, and the number of resident nesting and migratory nesting species is 215. On the territory of the Republic of Macedonia, 90 species of *mammals* have been confirmed, 81 species of which are autochthonous, while nine species are considered allochthonous.

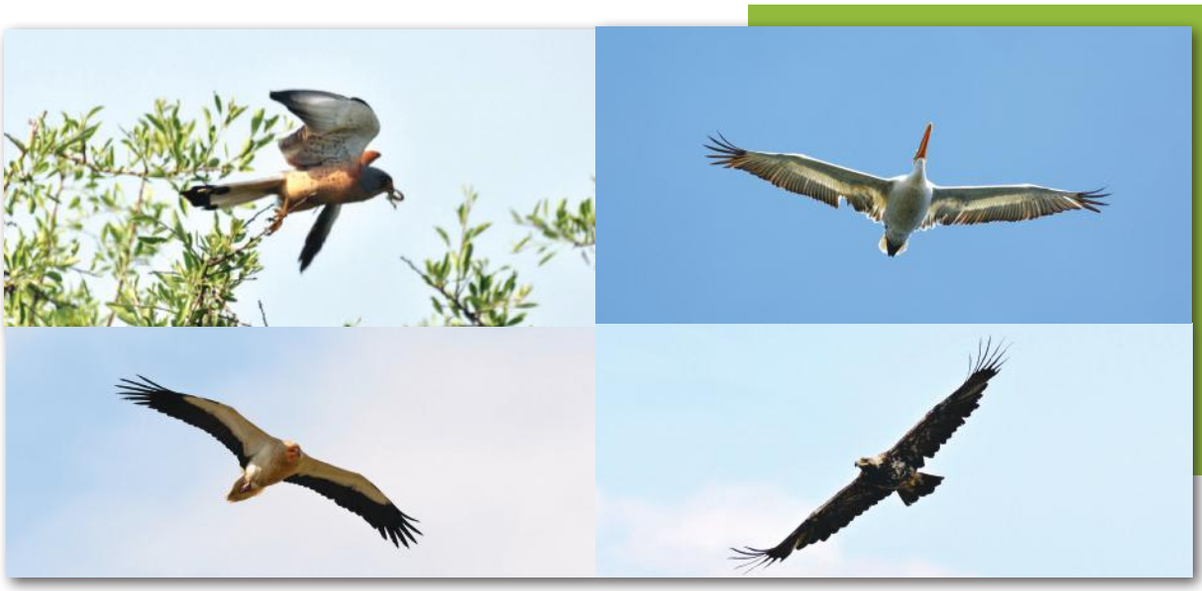

Figure 31.A Lesser Kestrel (Falco naumanni), B. Pelecanus crispus C. Neophron percnopterus D. Aquila heliaca Photo: MES

Figure 32.A. Brown bear – Mavrovo B. Lynx (Balkan Luynx, site Rosoki)
C. Wild goat – Mavrovo, Photo by: MES

3.4.1.3. Endemism

In addition to the presence of numerous Balkan endemics in almost all plant and animal groups of organisms, on the territory of the Republic of Macedonia, there is a large number of local endemics that exclusively develop on its territory.

Among the lower plants, the group with the highest degree of endemism is algae with about 200 endemic taxa. Most of them are registered in Ohrid and Prespa Lakes, and a smaller number in Dojran Lake and on Shar Mountain. About 158 taxa are considered endemic to Ohrid Lake.

Higher plants have numerous Balkan and southern Balkan endemics, as well as many local endemics and subendemics. The highest number of (sub)endemics have been registered in angiosperm plants (over 110 species). The most important centers of endemism are the high mountains – Galichica, Jakupica-Karadjica, Korab, Pelister, Shar Mountain, the gorges of the rivers of Vardar, Treska, Crna Reka, Pchinja, Babuna, as well as some parts of the lowland belt – Mariovo, the area of Prilep-Treskavec, Kozjak, Pletvar, Sivec, the area of Kavadarci – Alshar and the steppe-like area, between Veles, Shtip and Negotino.

Figure 33.A Viola alshariensis B. Viola kosaninii Photo by: Ljupcho Melovski

With around 550 endemic faunistic taxa, the Republic of Macedonia, with its small territory, is one of the most important centers of faunistic endemism in Europe. Of the group of sponges, there are 6 known endemic taxa. Of the type *Mollusca*, there are 92 known endemics – 88 of the class of *Gastropoda* (snails) and four of the *Bivalvia* class (shells). Within the *Annelida* type, 38 endemics of the *Oligochaeta* class have been registered, and 11 endemics of the *Hirudinea* class, all limited to Ohrid Lake. Of the type *Arthropoda* – the *Pseudoscorpiones* orders with 16 endemics, *Opiliones* with 19 endemics and Chelicerata with 60 endemics have a markedly high degree of endemism. The *Crustacea* class is represented with 113 endemics, with the degree of endemism being most pronounced in benthic organisms. Eighteen endemics are known of the *Diplopoda* order (*Myriapoda* class).

One of the largest centers of endemism of aquatic invertebrates is Ohrid Lake. According to the data available on endemism in Ohrid Lake, 30 endemic species *Ciliophora*, 4 *Porifera* species, 35 endemic species *Platyhelminthes*, 3 endemic species *Nematoda*, 17 endemic taxa *Oligochaeta*, 12 endemic species *Hirudinea*, 1 endemic species *Cladocera*, 33 endemic species *Ostracoda*, 6 endemic species *Copepoda*, 3 endemic species *Isopoda*, 9 endemic species *Amphipoda*, 56 endemic species *Gastropoda* and 2 endemic species *Bivalvia* have been registered.

In Prespa Lake, there are 7 known endemic species of snails, as well as the endemic shell *Pisidium maassani*. For other groups of invertebrates, there are incomplete data.

Within the fauna of vertebrates, endemism in fish is distinctive. In Ohrid and Prespa Lakes, there are 8 endemic fish species, while in Dojran Lake, there is an endemic species. A number of endemics are also found in river ecosystems belonging to the Adriatic and Aegean watersheds. Amphibians and reptiles on the territory of the Republic of Macedonia have two Balkan endemics each.

According to the existing data (Krystufek & Petkovski, 2003; Kryštufek, 2004; Kryštufek & Petkovski, 2006), large parts of the areas of four Balkan endemic species (*Apodemus epimelas*, *Dynaromis bogdanovi*, *Microtus felteni* and *Talpa stankovici*) are present on the territory of the Republic of Macedonia, while two Balkan endemics (*Spalax leucodon* and *Spermophilus citellus*) are localized on its territory. Endemism is higher at the subspecies level (there are two subspecies of the European souslik *Spermophillus citellus gradojevici* and *S. citellus karamani*, the core population of the Balkan lynx *Lynx*

lynx balcanicus and the Balkan chamois *Rupicapra rupicapra balcanica*). Species diversity is highest in the mountains of western Macedonia.

3.4.1.4. Diversity of ecosystems/habitats

Main (key) ecosystems

In defining the most important (key) types of ecosystems in the Republic of Macedonia, the EUNIS classification of habitats was taken as the foundation in the Draft Study on the State of Biological Diversity (2014). The Habitats Directive (Annex I) and Resolution no. 4 of the Berne Convention (1996) are important international legal instruments for the protection of habitats at the European level.

According to the EUNIS classification, there are 11 habitat groups of the first level (A-X), of which the following are found on the territory of Macedonia: C: Inland surface waters, D: Mires, bogs and fens, E: Grasslands and lands dominated by forbs, mosses and lichens, F: Heathland, scrub and tundra, G: Woodland, forest and other wooded land, H: Inland unvegetated or sparsely vegetated habitats, I: Regularly or recently cultivated agricultural, horticultural and domestic habitats, J: Constructed, industrial and other artificial habitats and X: Habitat complex.

The first six habitat groups (C, D, E, F, G, H) and to a lesser extent the last one (X), cover natural habitats, while groups I, J and most of the X group are habitats created by human activity. Natural habitats are of particular significance for autochthonous biodiversity, and anthropogenic habitats most commonly appear as cores where allochthonous species population begins.

Genetic diversity

The genetic diversity of flora and fauna, as one of the biodiversity components, has not been sufficiently studied in the Republic of Macedonia. In the chromosome atlas of angiosperm plants of the flora of Macedonia, about 600 species and subspecies taxa belonging to 30 families have been processed, which is a good basis for developing a database. Certain genetic studies of the fauna have been carried out on some species of Ohrid and Prespa Lakes, including the Ohrid trout (*Salmo letnica*). The molecular studies of the gastropod fauna, which have shown the existence of several types of complexes with a high degree of endemicity, are of particular importance.

Agro-biological diversity

The National Institution with a mandate for managing, preserving and protecting the genetic resources used in food production is the Ministry of Agriculture, Forestry and Water Economy (MAFWE).

The activities for preserving *plant agro-biological diversity* in the Republic of Macedonia have been initiated long ago, as part of the selection programmes for the creation of new varieties. Most of the samples collected during 1969-1971 are still stored in the United States gene banks; however, repatriation is not considered a priority, as it requires funds, which are lacking.

In the last decade or so, institutional activities have been undertaken to improve the protection of agro-biological diversity – a database has been developed, the equipment and infrastructure at the Gene Bank at the Agricultural Institute in Skopje has been upgraded, and in accordance with the Law on Seeds and Seedlings, a National Gene Bank Division has been established. A Rulebook has been prepared on the quantities, conditions and manner of keeping reference samples of species and varieties of agricultural plants, as well as the manner of operation of the gene bank (Official Gazette No. 144/11). In MAFWE, there is a Commission for the Protection of Autochthonous Varieties as of 2012, and a Programme for the Protection of Autochthonous Varieties according to the EU Regulation 870/2004 is currently being developed.

The goals and priorities for the protection of *biodiversity in domestic animals* in the Republic of Macedonia are based on the Global Action Plan and the Law on Animal Husbandry of the Republic of Macedonia (2008/2013). Their specific definition has been adopted by the Programme for the Protection of Biodiversity in Animal Husbandry (2011-2017). Although the Law on Animal Husbandry (Article 54) confirms the presence of several indigenous autochthonous breeds or types, the information is indicative, because the work protocol is currently being developed. In accordance with the Programme for the Protection of Biodiversity in Animal Husbandry (2011-2017), characterization and inventorization of biological diversity in animal husbandry, monitoring in the field of biodiversity conservation in animal husbandry, In-situ and Ex-situ protection and conservation - gene banks are underway.

3.5. SYSTEM OF PROTECTED AREAS IN THE REPUBLIC OF MACEDONIA

3.5.1. LEGAL FRAMEWORK

Protected areas as part of the natural heritage are an important tool for the protection and management of geodiversity, biodiversity and landscapes.

According to Article 65 of the Law on Nature Protection ("Official Gazette of the Republic of Macedonia" No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16), the protected area system is established for the protection of biodiversity within natural habitats, processes occurring in nature, as well as abiotic features and landscape diversity. By proclaiming the protected area, it acquires the status of natural heritage.

Pursuant to Article 66 of the Law on Nature Protection, six (6) categories of protected areas have been accepted, in line with the categorization of the International Union for Conservation of Nature (IUCN):

1) **Category I - (Ia) Strict Nature Reserve (SNR)**
   (Ib) Wilderness Area (WA).
2) **Category II – National Park (NP)**
3) **Category III – Natural Monument (NM),**
4) **Category IV – Nature Park (NP),**
5) **Category V – Protected Area (PA) and**
6) **Category VI – Multi-purpose Area (MpA)**

In the period until the adoption of the Law on Nature Protection (2004) and its entry into force (2005), the proclamation of protected areas was carried out in accordance with the 1973 Law on Protection of Natural Rarities (out of force) and under the old categorization of protected areas.

The procedure for proclamation of protected areas, manner of management and financing is prescribed by the Law on Nature Protection.

In accordance with Article 92 of the Law on Nature Protection, strict nature reserves, wildlife areas, national parks, natural monuments and nature parks are proclaimed protected areas by law, while protected landscapes and multi-purpose areas are proclaimed protected areas by the Government of the Republic Macedonia.

For the purpose of determining the real situation and providing an expert basis for the preparation of the act proclaiming protected areas, a Study for the Valorization or Revalorization of a Protected Area is being prepared. The preparation of the study is required by law and is the basis for initiating a procedure for proclaiming a protected area. The con-

tent and the chapters of the study are prescribed in accordance with the bylaw - Rulebook on the Content of the Study of Valorization or Revalorization of a Protected Area ("Official Gazette of R.Macedonia" No. 26/12).

The act proclaiming a protected area contains: protected area name, protected area category, geographical characteristics and other basic features, cartographic representation with boundaries of the protected area, types of zones in the protected area, boundaries of the zones that exist in the protected area within the protected area, the protection regime, the entity that will manage the protected area and other issues determined by the proclamation act.

Pursuant to Article 187 of the Law on Nature Protection, the MoEPP is obliged to carry out revalorization of the protected areas protected before the date of application of this Law and to draft new acts. Furthermore, the Law on Nature Protection stipulates in Article 184 that protected areas, protected before the date of entry into force of this Law (2005) as natural rarities, continue to enjoy the protection of protected areas in accordance with the provisions of this Law.

For these reasons, the protected area system is in a transitional state and includes areas:

- proclaimed under the old categorization in accordance with the Law on Protection of Natural Rarities and
- proclaimed under the new categorization in accordance with the Law on Nature Protection (re-proclaimed areas, newly proclaimed areas and areas in the stage of proclamation and re-proclamation).

3.5.2. NATIONAL SYSTEM OF PROTECTED AREAS

Beginning in 1948, when due to the exquisite beauties of nature, the historic and scientific importance of forests and forest landscapes, part of the Pelister Mountain was proclaimed as a national park, which at the same time is the first protected natural resource in Macedonia; continuing with the proclamation of forest landscapes around the Mavrovo Lake as a national park (1949) and the proclamation of Mount Galichica as a national park (1958); encompassing the period before and after the adoption of the Law on Nature Protection, the number of protected areas is increasing at the national level. The figure shows the trend of increasing the number of protected areas for the period 1990-2013.

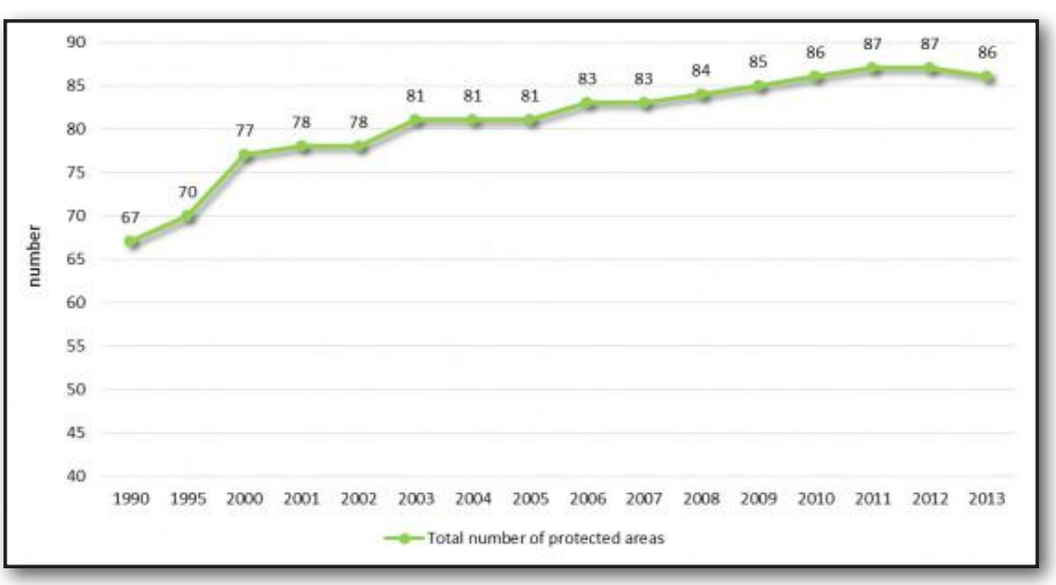

Figure 34. Number of protected areas in the Republic of Macedonia for the period 1990-2013 (MoEPP, http://www.moepp.gov)

Table 6. Number and area of protected areas by categories of protection

Categories of protection according to IUCN	Number of areas	Area (ha)	% of the territory of RM
Ia. Strict Nature Reserve (SNR)	2	7787	0.3
Ib. Wilderness Area (WA)	-	-	-
II. National Park (NP)	3	114870	4.48
III. Natural Monument (NM)	67	78967.5	3.0
IV. Nature Park (NP)	12	3045	0.12
V. Protected Area	1	108	0.004
VI. Multi-purpose Area	1	25305	0.98
Total	**86**	**230083**	**8.9**

Source: Fifth National Report to the Convention on Biological Diversity (MoEPP, 2014)

According to the Law on Nature Protection, the protected area system consists of protected areas and areas proposed for protection.

The protected area system includes 86 areas, covering an area of 230083 ha or about 8.9% of the territory of the Republic of Macedonia (Table 6). National parks occupy about 4.5% of the territory of the Republic of Macedonia, followed by natural monuments with 3.0%, while all other categories of protected areas cover about 1.4% of the territory of the country.

The Study on the Protection of Natural Heritage (1999), prepared for the needs of the Spatial Plan of the Republic of Macedonia ("Official Gazette of the Republic of Macedonia" No. 39/04) includes 193 areas proposed for protection, distributed according to the old categories of protection.

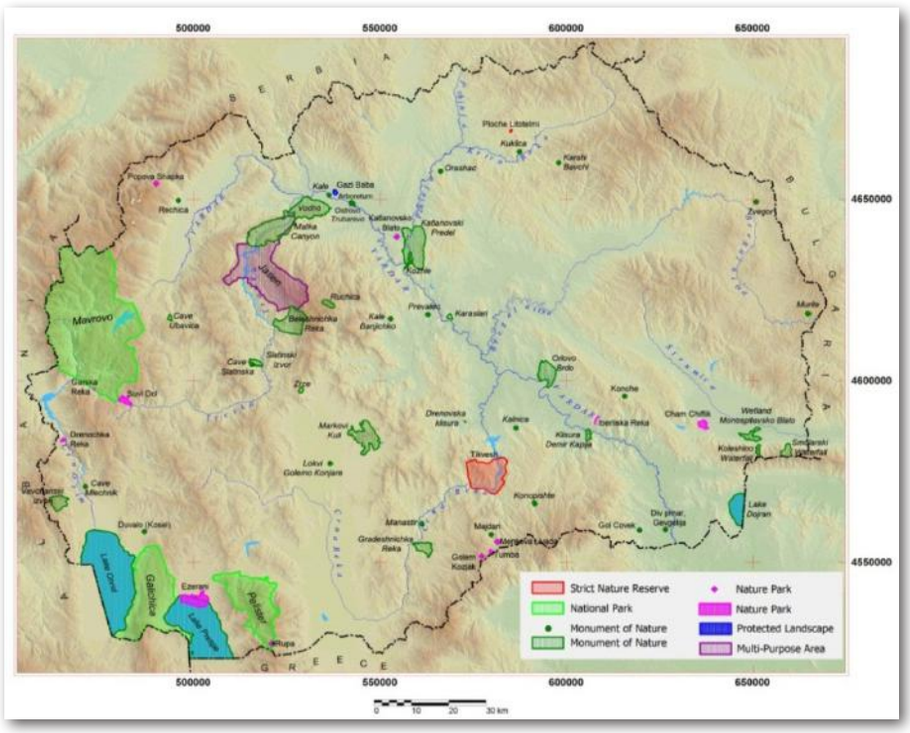

Figure 35. Distribution of protected areas (without individual plants) in the Republic of Macedonia (MoEPP, 2015)

The Sectoral Study for the Protection of Natural Heritage for the Period until 2020 stipulates an increase of the percentage of protected areas of the current around 9% to 11.5% of the territory of the Republic of Macedonia.

Aichi Global Target 11 of the Convention on Biological Diversity regarding protected areas is incorporated in the Action Plan of the Biodiversity Protection Strategy (in the phase of adoption). In line with this target, it is proposed that the area of protected areas be increased to 15%, ensure their functional connectivity as an ecological network and establish effective management of protected areas in cooperation with local communities.

In the period 2009-2011, an analysis of the existing protected area system was made on the basis of the proposals given in the Spatial Plan of the Republic of Macedonia, the initiatives for the proclamation of protected areas arising from the local or state level, as well as on the basis of new identified areas for protection. Arising from this analysis, the Representative Network of Protected Areas in Macedonia (Macedonian Ecological Society, 2011) has been proposed. The network includes 99 areas, 34 of which are representative protected areas, 42 representative areas selected from a total of 193 proposed areas for protection listed in the Spatial Plan of the Republic of Macedonia and additionally identified 23 more important areas for protection (Table 7).

Table 7. Draft Representative Network of Protected Areas

	Category	Number of areas by category	% of the territory of RM
Protected areas	SNR	2	
	NP	3	
	NM	20	
	NP	7	
	MpA	2	
Total		**34**	**9.19**
Proposed areas for protection (according to the Spatial Plan of RM)	NP	2	
	NM	21	
	NP	17	
	PA	2	
Total		**42**	**5.90**
Newly proposed areas for protection	NP	1	
	NM	10	
	NP	8	
	PA	4	
Total		**23**	**5.15**

Within the project: “Gap Analysis of the Environmental Data and Preparation of an Environmental Sensitivity Map for the Bregalnica River Watershed Area”, which is part of the Programme for Nature Conservation, financed by the Swiss Agency for Development and Cooperation, a thematic report on the status of protected areas in the East Planning Region was prepared in the course of 2015. The report presents the state of the existing protected areas. Moreover, an analysis has been made according to different planning and strategic documents and research aimed at defining proposed areas for protection.

The proposed protected area system in the Bregalnica region covers 36 areas, of which five (5) areas are already protected. Twelve (12) areas have been proposed to be proclaimed natural rarities.

3.5.3. PROTECTED AREAS WITH INTERNATIONAL PROTECTION REGIME

3.5.3.1. Ramsar sites

In accordance with the obligations of the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971), the Ramsar List includes two protected areas of the Republic of Macedonia: Prespa Lake (1995) and Dojran Lake (2007) – Figure 35.

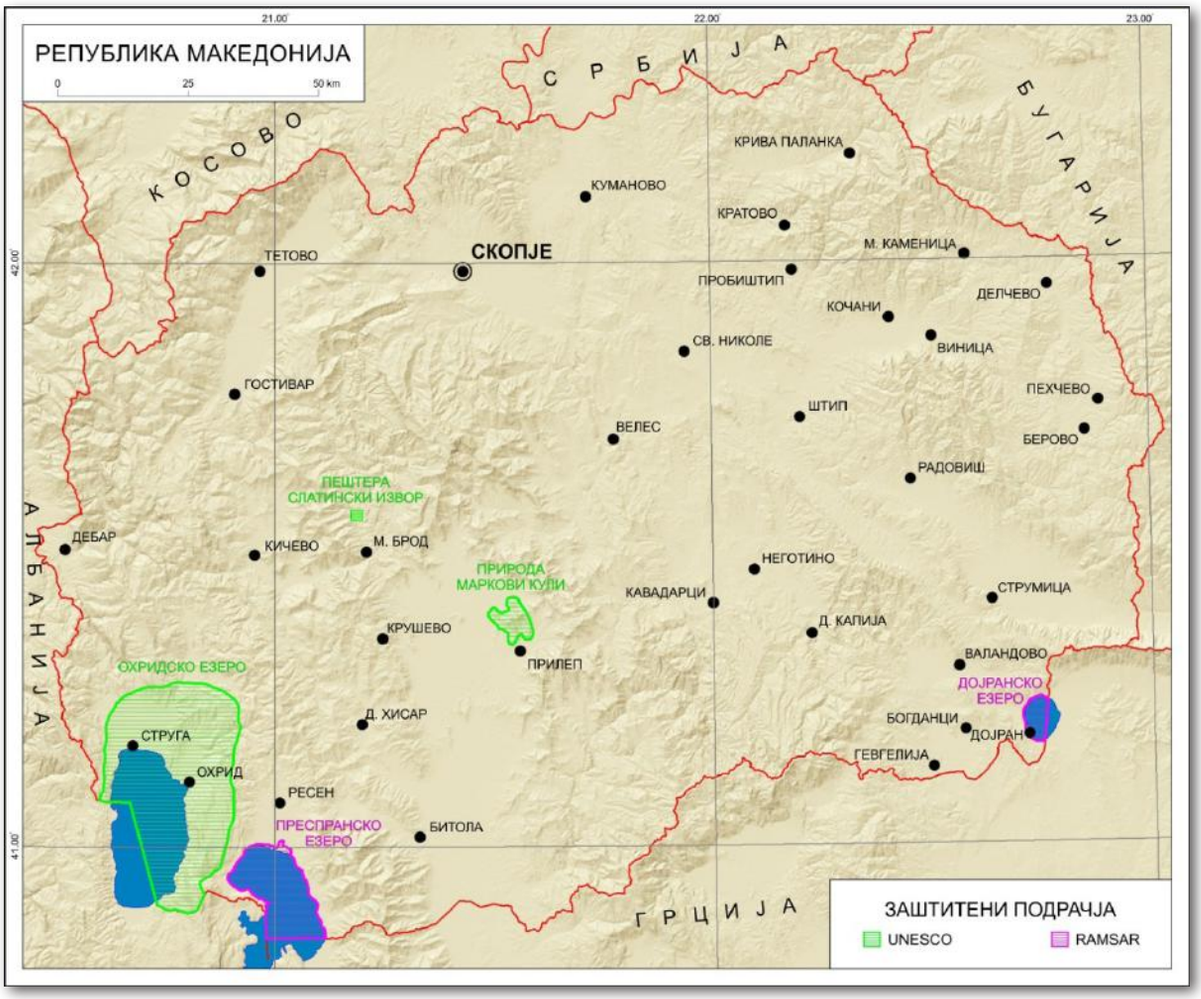

Figure 36. World heritage sites and Ramsar sites in the Republic of Macedonia (GEF/ UNDP/MoEPP Project “Strengthening the Ecological, Institutional and Financial Sustainability of Macedonia’s National Protected Areas System”)

3.5.3.2 World Heritage Sites (UNESCO)

World Heritage Sites are established as part of the implementation of the Convention Concerning the Protection of the World Cultural and Natural Heritage (UNESCO, 1972).

Of the Republic of Macedonia, the UNESCO World Heritage List includes the natural monument - Ohrid Lake (1979), while the preliminary list of UNESCO in 2004 included the natural monuments Markovi Kuli and the Cave Slatinski Izvor.

Pursuant to Article 67 of the Law on Nature Protection, there may be transbound-

ary connection of categories of protection with protected areas on the territories of the neighboring countries of the Republic of Macedonia.

In the past few years in the Ohrid-Prespa region, there has been significant cooperation between the Republic of Macedonia and the Republic of Albania for the nomination and establishment of a transboundary biosphere reserve Ohrid-Prespa. In 2014, UNESCO proclaimed a transboundary biosphere reserve "Ohrid-Prespa" according to the criteria of the UNESCO Man and Biosphere Programme. The Ministry of Environment and Physical Planning participates in the implementation of the Convention Concerning the Protection of the World Cultural and Natural Heritage in the area of natural heritage.

3.5.4. MANAGEMENT OF PROTECTED AREAS

The management and protection of protected areas is carried out by entities in charge of management under conditions and manner determined by the Law on Nature Protection and the proclamation act. Supervision over the management and protection of protected areas is carried out by the MoEPP. The management, supervision and protection of national parks are carried out by public institutions - National Park, which are established for this purpose by the Government of the Republic of Macedonia.

Bodies of the public institution - National Park are: Steering Committee, executive body, expert collegial body and material and financial control board. The Steering Committee consists of five members, two representatives of the MoEPP, a representative of the municipalities in the area where the national park is located and two representatives of the expert body.

The National Park Management Board adopts a statute of the Public Institution - National Park and a plan for managing the National Park, monitors their execution, determines the amount of fees, defines the financial plan and adopts a final account and elects a president from among its members.

The management and protection of the multi-purpose area is performed by a public enterprise established by the Government of the Republic of Macedonia.

In accordance with the Law on Nature Protection, the local self-governments have competences in the area of protection and management of protected areas. They can also be designated as protected area management entities and in that case they are obliged to develop management plans and annual programmes for nature protection.

In the Republic of Macedonia, there are several examples where local self-governments are designated to manage a protected area. These are the following: Municipality of Resen, which is assigned to manage the Nature Park - Ezerani and the Natural Monument - Prespa Lake. Municipality of Dojran is assigned to manage the Natural Monument - Dojran Lake; Municipality of Kratovo to manage the Strict Nature Reserve - Ploche Litotelmi and the Natural Monument - Kuklica; Municipality of Novo Selo manages the Natural Monument - Smolare Falls; Municipality of Vevchani to manage the Natural Monument - Vevchani Springs; Municipality of Prilep to manage the Natural Monument - Lokvi Golemo Konjare, Municipality of Makedonski Brod to manage the cave Slatinski Izvor, etc.

Regarding the management of the National Parks, the municipality is directly involved through its representative in the National Park Steering Committee.

3.5.5. COMPETENCES OF ENTITIES FOR THE MANAGEMENT OF PROTECTED AREAS

For the purpose of efficient management of the protected area, the entity in charge of protected area management, in accordance with Article 135-a of the Law on Nature Protection, is obliged within three months of its appointment to establish:

- Stakeholder Council and
- Scientific Council, as consultative bodies

The Stakeholder Council is composed of different stakeholders that are related to the protected area and can give opinions and suggestions regarding the proposal of the protected area management plan, the proposal for the revision of the protected area management plan and the implementation of the individual programmes of the protected area management plan taking into consideration the interests of the stakeholders.

The Scientific Council is established for all categories of protected areas except for protected areas with an area of less than 100 ha and for a multi-purpose area. The Scientific Council provides opinions and suggestions from a scientific point of view regarding the proposal of the protected area management plan, the proposal for the revision of the protected area management plan and the implementation of the individual programmes of the management plan for the protected area.

The Law on Nature Protection prescribes that the entities in charge of protected area management manage the whole protected area integrally. Article 135-a of the Law gives a legal basis for the entities in charge of protected area management, in order to achieve integral management, to conclude agreements for regulating mutual rights and obligations with entities performing an activity in the protected area, who are granted consent by the Government of the Republic of Macedonia.

3.5.6. PROTECTED AREA MANAGEMENT PLANS

Article 98 of the Law on Nature Protection stipulates that for the purpose of protection of protected areas, the entities responsible for the implementation of management and protection activities shall adopt management plans and annual programmes for nature protection. The Rulebook on the Content of the Protected Area Management Plans and the Annual Nature Protection Programmes ("Official Gazette of the Republic of Macedonia", No.26/2012) have been adopted, as stipulated by the law. Management plans for NP Pelister, NP Galichica and Nature Park Ezerani have been developed and adopted, while the plan for NP Mavrovo has been developed, yet it has not been adopted. For other categories of protected areas (SNR Tikvesh, NM Canyon-Matka, NM Markovi Kuli, MpA Jasen, NM Smolare Falls and NM Koleshino Falls), draft management plans have been prepared, and a Management Plan for the NM Prespa Lake is under preparation.

3.5.7. FINANCING OF PROTECTED AREAS

The financing of the protection and management of protected areas is regulated by the Law on Nature Protection ("Official Gazette of the Republic of Macedonia" No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16).

Article 161 of the Law covers the fees through which nature protection, that is, protected areas can be financed. In this respect, as the Law stipulates, funds for the protected areas may be provided from:

- protected area entrance and visit fee,
- parking fee in the protected area,
- fee for visits to special facilities in the protected area,
- fee for collection of wild plant species, fungi and animals and their parts and sustainable use of natural resources (management of forest habitats and ecosystems in protected areas),
- fee for the stay in a protected area,
- funds acquired through activities in a zone of active management (Article 105 of the Law) and a zone of sustainable management (Article 106 of the Law),
- fee for performing an activity in a protected area,

- fee for the use of the logo of a protected area on products and services for commercial purposes,
- fee for sailing in a protected area,
- fee from ecosystem services
- other sources (donations, grants, loans, renewable loans, gifts, etc.).

In addition, Article 141-a of the Law on Nature Protection specifies the same fees, but refers to the financing of public institutions – national parks. Article 162 of the Law prescribes that the funds for nature protection, and therefore for the protected areas, may be provided from the Budget of the Republic of Macedonia and the budgets of the local self-government units.

In 2013, in accordance with the Law on Nature Protection, the public institutions NP Pelister, NP Mavrovo and NP Galichica prepared Decisions for determining the amount of entrance, visit and parking fees at a national park, fees for the stay in the park at special designated places for that purpose, fees for the visit of special facilities and collection of wild plant species. The Government of the Republic of Macedonia has adopted the decisions for granting consent to the decisions for determining the amount of fees at the NP Pelister, NP Galichica and NP Mavrovo. This has enabled national parks to generate revenues from alternative funding sources, which is realized in practice through the collection of national park entrance fees.

This example with national parks regarding the provision of funds for the protection, management and sustainable use of nature should also be applied to other proclaimed protected areas.

The Law on Nature Protection provides a legal basis for the collection of fees to be performed by the entities that manage the protected areas. The funds from the fees are the income of the entities in charge of the management of the protected area, and are used for performing the activities of nature protection and management in the protected area in which they are collected.

3.5.8. ENVIRONMENTAL INVESTMENT PROGRAMME

Funding activities in the field of environment and nature is carried out on the basis of the Annual Environmental Investment Programme (Article 172 of the Law on Environment). The programme is prepared in accordance with NEAP, Spatial Plan of the Republic of Macedonia, other strategies, programmes and acts in the field of environment and in accordance with international agreements ratified by the Republic of Macedonia.

The programme includes the preparation of educational, research and development studies, programmes and projects for the protection and improvement of the environment and nature, including projects for the protection of biological diversity and nature, supporting scientific research and raising public awareness and education. The beneficiaries of the programme funds are municipalities or associations of municipalities, legal and natural persons, universities and other scientific institutions, non-profit and non-governmental organizations, non-governmental organizations that implement programmes and projects in the field of environment and nature protection.

3.5.9. FINANCIAL MODELS FOR SUSTAINABLE FINANCING OF PROTECTED AREAS

In order to ensure sustainable financing of nature protection, and thus of protected areas at the national level, it is necessary to develop various models for providing funding.

Payment for ecosystem services is a good opportunity for providing funding for protected areas. Pursuant to Article 164-a of the Law on Nature Protection, the payment for ecosystem services is regulated by means of negotiations and is carried out on the basis of a contract. The entity that manages the protected area concludes contracts for collecting

ecosystem service fee with all operators who benefit from the ecosystem services. The payment for ecosystem services is, in fact, the implementation of the “User pays” principle.

Payments for ecosystem services have two main objectives

- mobilization of funds for the entities in charge of protected area management and
- providing financial incentives for land owners to engage in the preservation of ecosystems.

In order to ensure efficient and sustainable financing of protected areas, it is necessary to introduce the following additional financial instruments:

- payments for carbon emissions,
- establishment of a Renewable Nature Fund,
- various types of trusts,
- redistribution of existing revenues from taxes, fees and payments from the production and trade in fossil fuels, from the registration of vehicles, water management, etc.,
- Public Private Partnership,
- compensation for damage caused to ecosystems in protected areas,
- fees for bioprospecting, i.e. for the use of resources, paid by companies that cultivate wild species, intended for commercial purposes, etc.
- Using funding opportunities from Prespa-Ohrid Nature Trust

3.6. ECOLOGICAL NETWORKS

3.6.1. NATIONAL EMERALD NETWORK

In accordance with the provisions of the Convention on the Conservation of European Wildlife and Natural Habitats (Berne, 1979) and the Law on Nature Protection, in the period 2002-2008, four projects were implemented for the identification of the National Emerald Network of Areas of Special Conservation Interest (ASCI).

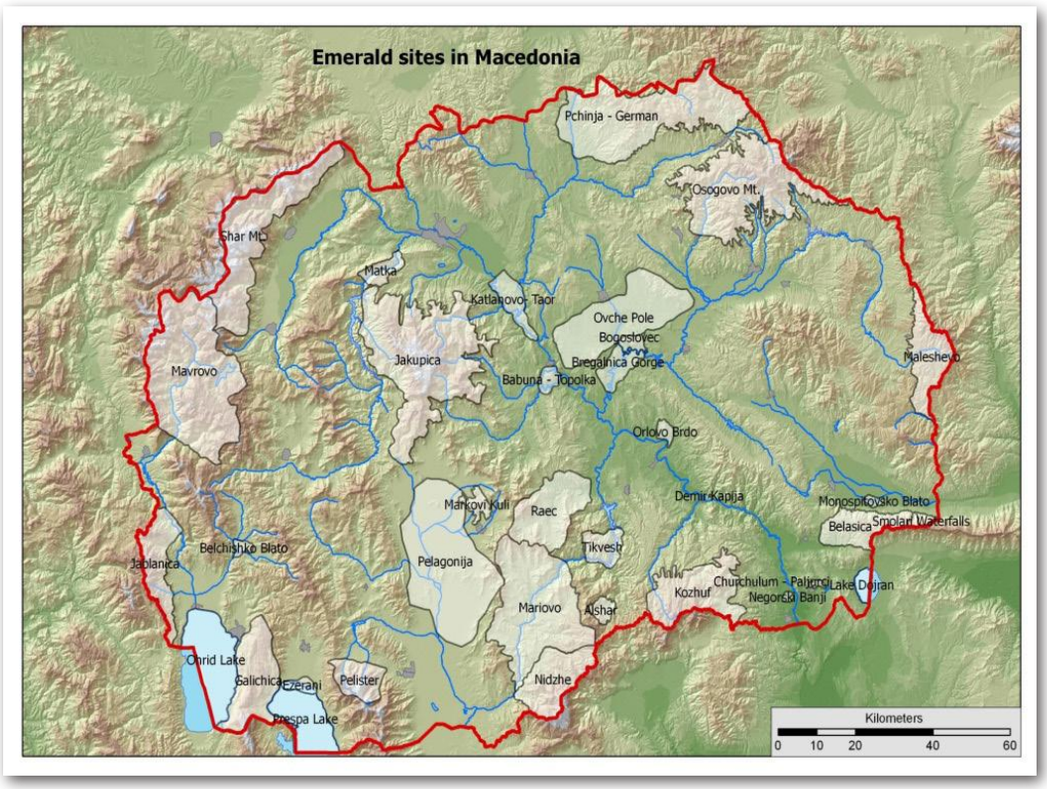

Figure 37. National Emerald Network (2011 GEF/UNDP/MoEPP Project “Strengthening the Ecological, Institutional and Financial Sustainability of Macedonia’s National Protected Areas System”)

The National Emerald Network covers 35 areas, which make up 29% of the territory of the Republic of Macedonia. It is necessary to update the data on the species and habitats in the areas of the National Emerald Network, in accordance with the resolutions of the Berne Convention.

3.6.2. MACEDONIAN NATIONAL ECOLOGICAL NETWORK (MAK-NEN)

In 2011, a Draft National Ecological Network (MAK-NEN) was prepared for the brown bear (*Ursus arctos*), which is considered a protected and distinguished species.

A map of the Draft National Environmental Network has been prepared, which includes

- 13 core areas (crucial for maintaining a stable bear population),
- corridors (12 line, 11 landscape and 3 corridors with crossings) and
- protective belts and areas for revitalization have been identified

In 2013, the Government of the Republic of Macedonia reviewed the Information on the Establishment of a National Ecological Network as information material.

3.6.3. BALKAN GREEN BELT

The Balkan Green Belt is an initiative of the International Union for the Conservation of Nature (IUCN) to establish an ecological network along the former iron curtain in order to protect and preserve natural values, taking into account the economic, social and cultural needs of local communities. The aim of the initiative is to connect protected areas in the region of Southeast Europe for the purpose of integral protection of nature and biodiversity and improvement of the cooperation among countries for nature protection.

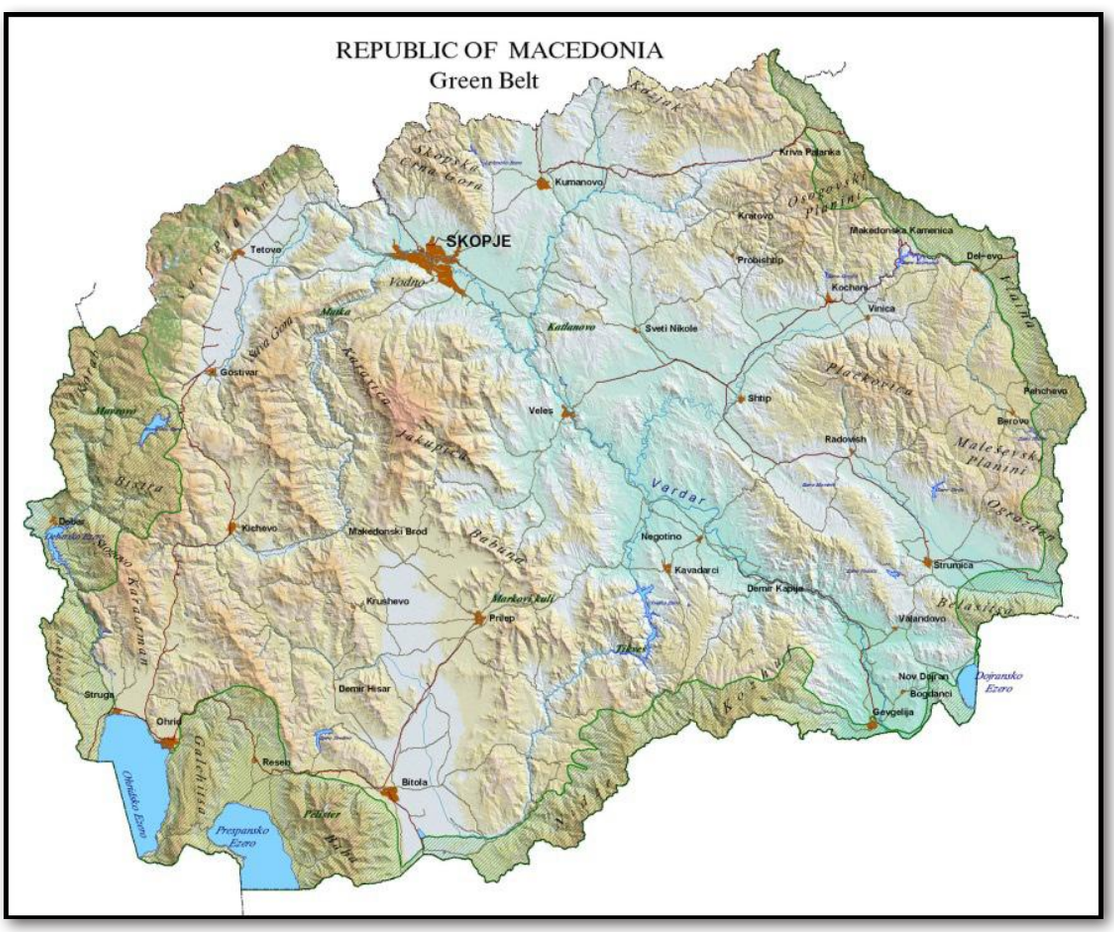

Figure 38. Map of the Balkan Green Belt in the Republic of Macedonia (MoEPP, 2004)

The Balkan Green Belt covers the border regions of the Republic of Macedonia with the neighboring countries (Albania, Greece and Bulgaria) and includes 11 protected areas including the three national parks Pelister, Mavrovo and Galichica; natural lakes (Ohrid, Prespa and Dojran Lakes) which are proclaimed protected areas in the category of natural monument; then the nature park Ezerani on the Prespa Lake; the natural monuments – Vevchani Springs, Smolare Falls, Koleshino Falls and the floristic site of Majdan.

3.6.4. NATURA 2000 ECOLOGICAL NETWORK

Natura 2000 ecological network has been established on the territories of the EU Member States in order to ensure biodiversity by conserving natural habitats and wild fauna and flora.

The requirement to establish Natura 2000 stems from Article 3 of the Directive on the Conservation of Natural Habitats and Wild Fauna and Flora (92/43/EEC). Measures taken under this Directive are intended to maintain/or restore to a favorable conservation status of natural habitats and of wild plant and animal species which are in the interest of the EU.

Natura 2000 ecological network includes “Specially Protected Areas” (SPC) – defined in accordance with the Directive on the Conservation of Wild Birds and “Special Areas of Conservation” (SAC) – defined in accordance with the Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitat Directive).

Article 52 of the Law on Nature Protection provides a legal basis for the establishment of Natura 2000 Ecological Network.

In 2016, the MoEPP started implementing the IPA Project: “Strengthening Natura 2000 Capacity for Implementation”.

The aim of the project is to achieve further harmonization and coordination of the national legislation on nature protection with EU legislation, that is, with directives on habitats and birds; to launch the inventorization of data on natural habitats and species of interest for EU protection and the initial selection of several potential areas of the Republic of Macedonia to be included in the Natura 2000 network; to develop GIS for Natura 2000, to strengthen administrative capacities and to carry out public awareness activities for Natura 2000.

3.6.5. NATURAL RARITIES

The Law on Nature Protection in Article 90-a provides a legal basis for the protection of certain parts of nature as natural rarities. Certain rare, endangered and endemic species of flora and fauna, their parts and communities, relief forms, geological profiles, paleontological and speleological objects may be proclaimed natural rarities.

Relief forms, geological profiles, paleontological and speleological objects may be proclaimed a natural rarity if their surface is less than 100 hectares.

According to Article 92 of the Law on Nature Protection, natural rarities are proclaimed by the Minister of Environment and Physical Planning, and with the proclamation of parts of nature a natural rarity, they acquire the status of natural heritage. Pursuant to Article 94 of the Law, proposals for the proclamation of a natural rarity may be given by the state administration bodies, the municipal council, the municipal council of the City of Skopje and the Council of the City of Skopje on the territory of which they are located, as well as other scientific institutions, other bodies, organizations, institutions and associations of citizens and legal and natural persons.

In order to protect the natural rarity, in the act of proclaiming a natural rarity, the MoEPP prescribes the manner of protection and management of the natural rarity.

The proposals for the proclamation of a natural rarity should include the basis

for submitting the proposal, a cartographic representation and a study of valorization or revalorization of the natural rarity containing a description of the natural rarity, a description of the value of the natural rarity for which protection of the natural rarity is proposed, proposal of measures of protection and promotion of the natural rarity.

Figure 39. Weathering relief forms in Mariovo, an example of a natural rarity
(Photo: Bl.Markoski, 2015)

Pursuant to the Law on Nature Protection, the Dona Duka Cave ("Official Gazette of the Republic of Macedonia" No. 182/2011) and sycamore trees (*Platanus orientalis*) in Morodvis ("Official Gazette of the Republic of Macedonia" No. 65/2016) have been proclaimed natural rarities.

The project activity for the development of the Representative Network of Protected Areas in Macedonia, which has been implemented by the Macedonian Ecological Society (2011) as part of the GEF/UNDP/MoEPP Project "Strengthening the Ecological, Institutional and Financial Sustainability of Macedonia's National Protected Areas System", has proposed a total of 91 areas to be proclaimed natural rarities, namely:

- 27 protected areas which are proposed to be proclaimed natural rarities,
- 53 proposed areas for protection according to the Spatial Plan of the Republic of Macedonia, which are proposed to be proclaimed a natural rarity and
- 11 newly identified areas for protection as natural rarities,

These are mainly individual or group of stems (sycamore, pin oak, pubescent oak, Hungarian oak, etc.), speleological objects, small sites of geomorphological (volcanic bombs, Pilav Tepe, etc.), hydrological (Studenchica, Popolzhani Spring) or paleontological significance (Stamer, Belushka, Dechki Kamen, etc.), or small forest stands (Golem Kozjak – Scots pine reserve, Gornjan – Turkey oak reserve, Murite – mixed stand of fir, beech, Scots pine and spruce, Temniot Andak – black pine reserve, etc.).

In the Bregalnica river watershed, a total of 16 areas are proposed for protection as natural rarities of which Kiselica Cave and the Pehchevo River are newly identified.

3.7. GEOGRAPHIC INFORMATION SYSTEMS

3.7.1. GENERAL INFORMATION ABOUT GIS

Geographic information systems are a relatively new scientific methodology and technology which is also functional in the field of nature protection.

Geographic information systems as a concept encompass the realization of the following operations: cartographic preparation, database creation and establishment of interactional connection between cartographic and alphanumeric data on objects of interest for nature protection. In this sense, in addition to the existing digital-cartographic and alphanumeric documentation, regarding nature protection, it is necessary to raise the level of treatment by organizing and establishing a more complex geographic information system.

The development of GIS for the purposes of the Strategy for Nature Protection is based on cartographic and alphanumeric data on the identified objects of interest for protection in the area of:

- geology,
- geomorphology,
- hydrology,
- biological diversity and
- landscape diversity.

However, as the issue of nature protection is quite complex (that is, it goes beyond the objects of interest for protection), the organization and the establishment of GIS on nature should also include objects that pose a threat to nature and the environment, enabling automated monitoring of the situation and spatial analysis of the situation. For that purpose, a special approach and development of a dedicated geographic information system with significantly more complex contents is needed. Such a Geographic Information System should encompass:

1. Establishment of a unified large-scale cartographic base in the process of organization of geographic information systems through the realization of:
   - establishment of a cartographic electronic raster base for the territory of the Republic of Macedonia and
   - establishment of a cartographic georeferenced base of the locations of all identified objects and areas in the field of geodiversity and geoheritage with other components of nature (landscape and biological diversity) of interest for protection, but also of the objects and areas that endanger nature, in electronic vector format,
2. Organization of a relational database in the specific Geographic Information System of nature through the realization of:
   - identification of the necessary attribute data for establishing a relational database for objects of interest for protection, but also for objects that endanger nature,
   - immediate establishment of a database for each identified object in the area of geodiversity and biodiversity.
3. Establishment of identification numbers for interaction links between digital-cartographic and alphanumeric data; thus care must be taken of:
   - the system of identification numbers and
   - compatibility of the system with pre-established other (separate and dedicated) systems in order to make the appropriate adjustment.

GIS for natural values in the Republic of Macedonia should provide various functionalities such as searching, reading of terms and values, generating new data, data analysis, etc., enabling the Ministry of Environment and Physical Planning of the Republic of Macedonia (and other institutions) to prepare valid documentation regarding the utilization

of natural resources.

The efficiency of geographic information systems depends on the promptness of data related to nature protection in the Republic of Macedonia according to professional standards.

It is common knowledge that in the current practice of organization and establishment of certain (mostly separate) GIS in the sphere of geodiversity and biodiversity in the Republic of Macedonia, various institutions, organized groups and individuals apply different GIS-oriented software packages. This leads to communication distortion, compatibility problems and incomplete application of such systems.

In the context of the aforementioned, the direct organization and establishment of GIS on nature, should be oriented towards the most used software packages in the Republic of Macedonia, as well as (considering the conditions) towards free software packages as the most affordable solution.

A separate option is the orientation towards the Quantum GIS software package (Q-GIS), which is free software and as such available to a wider range of users, and according to its performance, it almost does not lag behind the strictly commercial GIS software packages.

It is particularly important that in most cases, the design companies use Auto CAD-oriented software packages, which, for the purposes of GIS, have developed a dedicated Auto CAD Map software package, which besides the standard cartographic graphic drawing capabilities provides organization and establishment of GIS for various specific areas, with connectivity options and external databases.

There are other high-performance software packages, which are consequently less affordable and more difficult to maintain and upgrade. On the other hand, there are GIS software packages that supposedly have lower performance, but they are not established in practice in the Republic of Macedonia, hence full compatibility can not be established in the operation of the institutions.

4. MAIN THREATS TO NATURE AND ANALYSIS OF IDENTIFIED ISSUES

4.1. SOCIO-ECONOMIC ASPECTS (IMPACT OF ECONOMIC SECTORS ON NATURE)

In the Republic of Macedonia, protection of nature primarily depends on the social and economic conditions in the country.

Social aspects have an impact through the education level of the population on the one hand, and through the social and economic security of the citizens on the other hand.

The education of the population directly impacts the understanding of nature protection, as the better one understands nature and the laws governing it, the more one appreciates the significance and value of natural goods in the area of geodiversity and heritage with the accompanying elements of biological and landscape diversity. In this context, special attention should be paid to critical natural resources such as water, land and ecosystems. Accordingly, the institutions of education, health, culture, information and science, in their programmes and plans, are obliged to envisage and realize content for acquiring knowledge and building an active attitude towards the protection of nature and biological resources.

The social and economic security of the citizens impacts the protection of nature in that in conditions of unorganized and inadequately secured economic livelihood and well-being, citizens turn to the exploitation of natural goods and resources to the degree of their destruction. Therefore, in society, in accordance with the constitutional principles of the state, it is necessary to organize and provide adequate work and earnings for each entity, thereby providing the conditions for safe livelihood and well-being.

The analysis by individual economic sectors shows that nature protection affects the areas of agriculture, forestry, water economy, civil engineering, mining, industry, energy, transport, tourism and other activities.

In *agriculture*, there is a decrease in the utilization of productive agricultural land, so pressure is made on the more accessible agricultural land instead. As a result, the areas under the pastures are growing. A particular problem arises when industrial facilities are built on agricultural land, contaminating these areas on the long term.

In *forestry*, the problem is more pronounced, since in the absence of real work engagements and adequate earnings in some of the economic sectors, the population turns to illegal exploitation of forests.

In the area of *water economy*, there is increased exploitation and pollution of clean waters along the river flows.

Civil engineering has an impact in that through the construction of various residential and infrastructure facilities, fertile agricultural areas are taken away, at the same time destroying entire ecosystems, causing unstable terrains, and so on.

Mining is a separate activity that negatively affects nature in that through the exploitation of metallic raw materials on the land surface, large amounts of harmful materials are deposited, and in the exploitation of non-metallic raw materials, multiple disruptions of nature occur both landscape and ecology-wise.

Industry, especially the industry based on non-renewable sources, has an impact through the permanent destruction of certain resources, as well the contamination of many productive areas with various materials and physical objects or waste. Therefore, the development aspects of the industry which is based on renewable sources, non-polluting industry and the like are significant.

Energy is a sector that due to exploitation of energy fuels greatly endangers nature by land degradation, as well as by immersion of certain areas (for the purposes of hydropower) and so on. Therefore, the approach must be directed towards the exploitation of renewable and alternative types of energy.

Transport is an activity that in long line-infrastructure routes, in addition to the construction, permanently affects the natural setting through various failures.

Tourism is a separate activity where the mass movement of people in nature causes the deposition of various materials in all states of matter. Construction of various facilities is carried out in the most attractive natural settings, etc.

4.2. DIRECT AND INDIRECT THREATS TO NATURE

4.2.1. THREATS TO GEODIVERSITY (GEOLOGY)

Nature, in terms of geological values, is under direct and indirect threats from: landslides; exploitation of mineral resources; erosion; landfills; immersion or overloading of significant geological sites; abandoned mines or tailings dams.

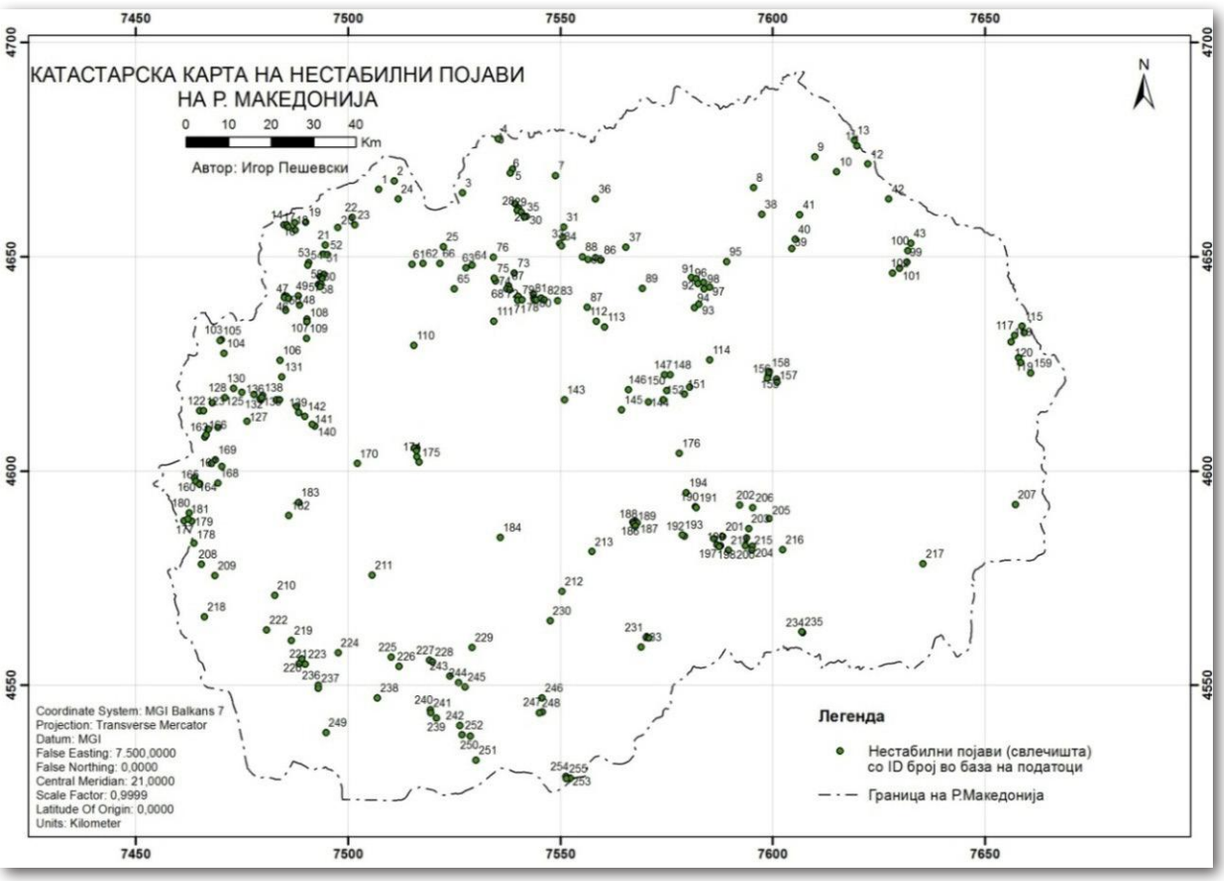

Figure 40. Locations of landslides in the Republic of Macedonia

Landslide hazards

Landslides have a great impact on the natural environment, most often as a factor that negatively affects it and leads to disruption of natural processes and flows. In our country, landslides can occur as a result of earthquakes, intense and long-lasting precipitation, or as a result of human activity. Cases of past landslides in our country indicate huge losses in nature and society; such are the landslides of Pehcevo, Gradot, Poroj, etc.

Hazards arising from the exploitation of mineral resources

In the exploitation of mineral resources, as a result of complex activities, there is a great potential for damage to nature. Some of the many hazards are the following:

- Opening of new or expansion of existing surface pits (quarries, pits for metallic or non-metallic ores, for coal, exploitation of mineral and thermomineral waters, etc.), especially if it is on or near geologically significant objects;
- Granting concessions for the exploitation of sites of special geological significance;
- Granting concessions for the exploitation of sites of special paleontological significance;
- Transport and processing of mineral resources;
- Filtration of harmful materials from landfills and tailings sites (tailings dams) in the underground;
- Major failures at a landfill or tailings sites;
- Air pollution;
- Pollution of underground and surface waters;
- Excessive drainage of groundwater (for various purposes) and disruption of the natural hydrological cycle of water in nature;
- Disruption of the natural setting of flora and fauna;
- Negative impact on soil quality in wider zones around mines;

Hazards arising from the illegal exploitation of mineral resources

The illegal exploitation of mineral resources has multiple negative effects on geological values and on nature. As a result of such exploitation, the following adverse impacts arise in terms of geological values and nature:

- Illegal exploitation of all solid metallic and non-metallic mineral raw materials, as well as natural gas (CO_2) and groundwater.
- Disruption of natural river banks or lake shores and the conditions of natural animal and plant species due to illegal exploitation of sand and gravel.
- Illegal exploitation and sale of rare minerals of important mineralogical sites

Landfill hazards

- Landfills as waste storage sites pose a significant threat to the geological environment, especially as a potential source of pollution of the underground water and soil resources.
- Construction of landfills near significant geological sites or rarities.

Hazards arising from immersion or overloading of significant geological sites

- As a result of the formation of artificial reservoirs or artificial immersion of terrains on which there is an established occurrence of metallic or non-metallic mineral resources, loss of significant geological values may occur.
- Construction of tailings sites, tailings dams or landfills of useless mass on terrains having geological potential (for research/exploitation of mineral resources)

Hazards arising from abandoned mines or tailings dams

- As a result of the abandonment of some mines after the period of exploitation and their inadequate closure (recultivation), natural environment can be endangered in many respects.
- The same threat occurs due to the abandonment of old tailings dams, tailings sites and landfills of useless material.

Erosion hazards

Hazards arising from erosion are presented in more detail in the section geomorphology and hydrology.

4.2.2. THREATS TO GEODIVERSITY (GEOMORPHOLOGY)

Apart from its great values, our geoheritage is exposed to numerous threats, and some of it has already been destroyed or degraded. More notable threats are the following:

Construction-technical and exploitation hazards

- Opening of new or expansion of existing surface pits (quarries, pits for metallic or non-metallic ores, for coal, etc.), especially if they are on or near significant objects or areas of geodiversity;
- Transport and processing of mineral resources;
- Construction of buildings and structures in areas with significant geo-values (buildings, factories, power plants),
- Construction of roads with numerous clefts, through areas with particular geo-values or in an unstable terrain,
- Adaptations and construction interventions on significant geo-objects or their immediate surroundings (caves, canyons, weathering forms, etc.)
- Partial or complete immersion of significant geomorphological objects and areas with the construction of artificial reservoirs,
- Construction of canals, inlets, drains through, from or towards valuable geomorphologic objects and phenomena (glacial lakes, cirques),

Hazards arising from direct mechanical, chemical and biological pollution

- Setting up landfills and tailings sites near or on significant geomorphologic objects,
- Dispersal and disposal of waste in geo-valuable or geoheritage areas,
- Discharge of wastewater and pollutants on karst terrains.

Geohazards (directly or indirectly caused by man)

- Excessive, anthropogenic accelerated erosion, which destroys geo-values (geo-landscapes), activating landslides, floods, and poses a threat to the man himself,
- Occurrence/activation of landslides by improper use of potentially unstable terrain, which can disrupt/destroy part of the geoheritage,
- Floods, which may temporarily immerse, pollute or destroy valuable geo-objects (caves, precipices, weathering forms, alluvial fans, etc.).
- Fires, which may disturb certain geo-values, forms and sites.
- Local quakes caused by strong mining, collapses and other phenomena, which endanger geo-values.

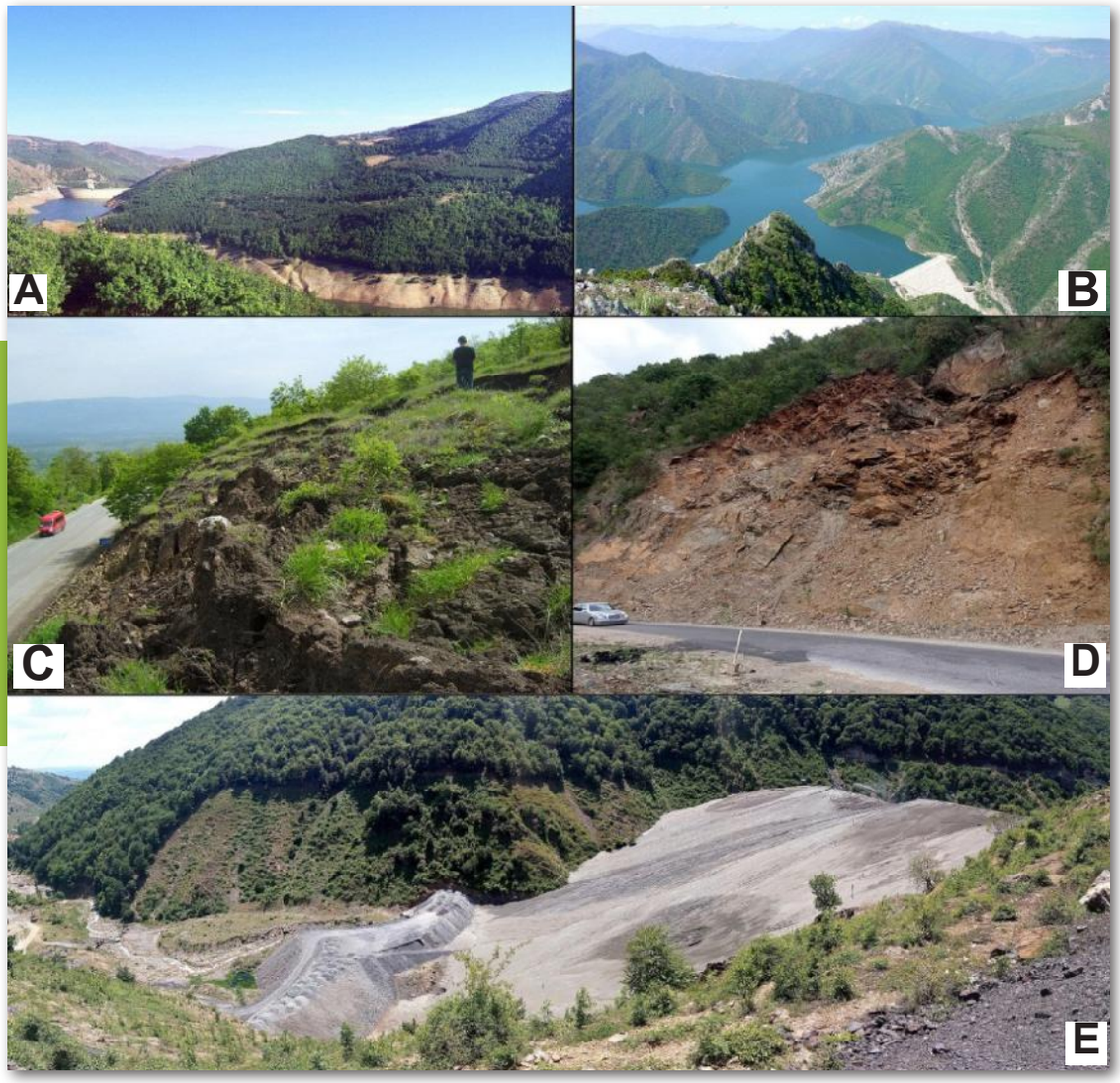

Figure 41. Threats to geodiversity through: A. enhanced erosion along a newly formed coastal zone (Glazhnja reservoir); B. immersion of gorge and canyon parts with karst relief (Kozjak reservoir); C. activation of landslide on clefts at v. Stracin; D. activation of rockfall of distinctly cleft shale at v. Kalimanci; E. formation of tailings site in the valley of the Kamenichka River. Photo: Milevski I.

Climate change hazards

- Hazards arising directly or indirectly from climate change (increased erosion, destruction of fossil glacial and periglacial forms, changes in the karst process, etc.).

Tourism hazards

- Constructing or erecting tourist facilities and complexes in areas with significant geo-values (ski centers, catering and accommodation facilities, cable cars, fisheries),
- Inadequate or excessive visit and stay at geomorphologically significant objects (due to the limited capacity of a cave, an island, a weathering form, etc.)
- Inadequate tourist organization of significant geomorphologic objects and sites (inadequate trails, bulletin boards, fences, panoramas, signposts, etc.)
- Performing tourist activities in geo-sensitive areas (on alluvial fans, river terraces, landslides, erosive terrains, moraines, etc.).

In fact, the stated numerous threats to geodiversity cause the following adverse effects:

- Mechanical disruption, degradation, immersion or destruction of the natural geo-landscape. In many cases, these processes are irreversible, that is, the loss is permanent. These consequences are most often associated with construction-technical (roads, dams, facilities) and exploitation hazards (pits, mines), but also with tourism hazards (tourist centers, ski and other trails), geohazards (rockfalls, avalanches, floods), etc.
- Accelerating the intensity of erosion and accumulation of eroded sediment, with anthropogenic (destructive) relief forms (furrows, gullies, badland terrains, rockfalls), as well as loss, degradation, complete sweeping away or overloading of soils. These processes are widespread in the Republic of Macedonia, with markedly adverse effects on nature, but also on the socio-economic and demographic conditions.
- Increased occurrence of landslides that negatively affect nature itself, but also cause great harm, and in some cases even human losses. In that sense, it is necessary to determine the zones of potential landslides, and then implement preventive and offensive measures (construction-technical, biotechnical and hydrotechnical), education, etc.
- Pollution of geo-valuable phenomena and sites – mechanical, chemical or biogenic pollution (through water, solid waste, landfills, tailings sites, construction waste, etc.). Carbonate terrains, through which pollutants can easily and almost directly penetrate the groundwater, are particularly sensitive to such pollution. The effects of pollution in the karst can be catastrophic, both for the karst (especially speleo) objects, and for the groundwater and karst springs, which are often used for water supply.
- Destructions and losses arising from total and excessive exploitation (legal or illegal) of rare and unique mineral phenomena, loss of fossil sites (through construction work, illegal or inadequate excavations and trade, etc.)
- The end effects include not only the loss of geo-values and geoheritage, but also reduced possibilities for the utilization of the area for any purpose. This reduces the national natural wealth, with numerous long-term negative consequences.

  The degradation and destruction of geoheritage, either by natural processes or by anthropogenic influences, permanently changes landscape appearance and reduces geodiversity. Certain parts of the geoheritage in the Republic of Macedonia are indeed very important phenomena not only at the national level, but beyond (Markovi Kuli, Cave Provala, Alshar mine, Matka Canyon, tectonic lakes with their coastal zones, etc.). Regardless of the various documents at the local, regional and national level for the protection of certain geo-phenomena, the protection of geoheritage thus far has lacked a particular idea and strategy.

Since certain areas of geoheritage serve as the foundation for various buildings, the exploitation of mineral resources and other natural goods (tourist exploitation, etc.), the comprehensive protection of this heritage is related to almost all areas of human activities. Geological and geomorphological phenomena and objects can be very attractive for tourism purposes. Such are the huge rocky rifts, prominent mountain peaks, caves and precipices, “melovi”, etc. Key problems for the protection and preservation of geodiversity i.e. geoheritage in the Republic of Macedonia are the insufficient knowledge of their values and importance and their non-renewability, i.e. easy and rapid damage, destruction and permanent loss. In the past period, some of the significant geo-values have already been protected in the respective category, within the national parks or as part of the protected areas on another basis (biological significance and diversity). Of those which have not been covered by any protection, the significant geo-objects in the sparsely populated

areas are best preserved, which are far from the main communications, and most endangered are those in the urban areas and their surroundings.

To prevent, reduce or remediate the aforementioned hazards and effects, more activities and measures are needed (which are also listed in the strategic objectives and action plans). They refer to:

- Preparing a Strategy for the Protection of Geodiversity, with a previous study in which all significant geo-values in the Republic of Macedonia will be clearly and thoroughly identified, as well as a set up GIS of the identified and inventoried geo-objects, areas and sites. The impact of certain sectors and activities on geodiversity and geoheritage (mining, agriculture, industry, tourism, etc.) should be particularly covered in this strategy.
- Preparing a Strategy for the Protection of the karst in the Republic of Macedonia, considering its importance, especially for current and future water supply of almost ½ of the population, as well as for certain important speleo-objects, karst hydro-objects (St. Naum Springs, Vevchani Springs, springs of the Crna, Babuna, Vrelo-Koritishte and many others) with an appropriate National Cadastre.
- Preparing a preliminary expert study and/or providing expert opinion by appropriate experts on the impact on geoheritage before the start of construction and hydro-technical, exploitation and any other activities in areas that have been identified as significant or have had indications to be significant for the national geoheritage. In addition, the study and/or opinions should be publicly presented and widely available.
- Improving the institutional and human resources in the institutions in the area of geodiversity protection in the Republic of Macedonia, which will enable to adequately and timely address potential threats.
- Improving the inter-institutional cooperation among the ministries and bodies (MoEPP, MAFWE, MTC, Crisis Management Center, etc.), as well as with the scientific institutions in the area of geodiversity protection from the mentioned threats.
- Connecting with international organizations (governmental, non-governmental, scientific, educational, etc.) that deal with geodiversity protection.
- Preparing a Study on Potential Geohazards, Sensitive and Risk Areas, i.e. a Cadastre of Areas Threatened by Geohazards in the Republic of Macedonia with an assessment of the degree of risk and zoning.
- Preparing a new erosion map-model (and accumulation of sediment) of the Republic of Macedonia, since the existing one is more than 25 years old (mainly prepared in the period from the 1960s to the 1980s, under different conditions).
- Preparing a map of landslides and map-model of potential landslide zones in the Republic of Macedonia.
- Introducing an SOS number for detected illegal disruptions of geoheritage, with the possibility of prompt intervention on the field by the relevant services
- Increasing the level of education about the meaning and possibilities of permanent loss of a phenomenon or object of geoheritage.
- Preparing a publicly available GIS web portal with marked valuable geo-objects, phenomena and areas, as well as potential threats to them, etc.
- Activities and works for remediation of degraded significant geo-landscapes (excavations, quarries, illegal landfills, tailings sites, etc.).
- Activities and works for the protection against excessive erosion, accumulation of sediment, landslides, floods, fires and other geohazards.
- Maximum control, monitoring and prevention of potential pollution of national geodiversity, or, geoheritage.
- Sustainable use of national geoheritage and prudence regarding tourism or other exploitation.

For efficient protection and preservation of geoheritage, it is necessary to supplement the legal regulations and to support the staff of institutions and units for the protection of geodiversity. It is also necessary to intensify professional and scientific research, to raise media awareness of the public regarding the value and significance of the geoheritage of the Republic of Macedonia and to ensure long-term support to the public and the institutions in the protection of geoheritage. In this regard, it is necessary to monitor processes and activities that endanger geodiversity and ensure mechanisms for preservation and protection of geoheritage. It is important to note that **karst**, as the most sensitive part of geoheritage, has been least studied so far, and therefore, it is necessary to significantly expand its detailed and comprehensive research.

4.2.3. THREATS AND CHALLENGES TO HYDROLOGICAL VALUES

Threats to nature by water use-related activities may be identified as large, medium, and small. They may occur due to climate change, activities on large and small dams, small hydropower plants, irrigation and water supply systems, river channeling, flood protection activities, mining, use of rivers for sand and gravel extraction, tourism, etc. The assessment of the threat level from some activities depends on the location and the implementation of projects.

Water bodies (rivers, lakes, marshes) are an extremely important and vulnerable part of nature and the pressures on them violate ecosystem balance in nature. Pressures on water bodies can be assessed as *natural* (climatic conditions, climate change, meteorological characteristics, geological structure), and *anthropogenic* (human activities). The biggest threats to water bodies are, indeed, anthropogenic, which not only disturb the balance of aquatic ecosystems and nature, but also trigger adverse implications in many sectors (climate change, forestry, agriculture, water management, health).

In the last decade, the floods that have occurred in the region have increased in frequency and intensity. As a result of intense rainfall and increase in the level of groundwater, combined with inadequate maintenance of river basins, floods occur in Polog, Pelagonija, Skopsko Pole and Strumichko Pole. The frequency, affected population and high economic losses indicate that the country is vulnerable to floods, in terms of their size and intensity.

The use of river basins for sand and gravel extraction also poses a major threat to the ecological status of water bodies and the sustainable river watershed management. This phenomenon is a common cause for the demolition of bridges and other infrastructure such as water supply, gas pipelines and telecommunication systems, which is particularly prominent in combination with the occurrence of floods.

Precipitation and floods are associated with another threat – erosion. According to the erosion map of the Republic of Macedonia, 9423 km^2 or 36.65% of the total area belong to the highest categories of soil erosion. The total annual erosion is about 17 million m^3 or 685 m^3/km^2 per year, with 7.5 million m^3 or 303 m^3/km^2 of annual eroded materials being lost from the place of its occurrence (*Blinkov et al. 2006*). A significant portion of these deposits, about 3 million m^3 per year, is not transported downstream along the rivers, but is retained in natural lakes and reservoirs.

The assessment of the threat level is an extremely complex procedure and is most often based on the analysis of indicators that depend on the monitoring of a number of parameters. In the water sector, the basic indicators are mostly: land use, population density in the watershed area, water capacity/balance, river flow, annual rainfall, outflow ratio, water use, ecological status of surface waters, chemical status of surface waters, groundwater quality and water management.

Table 8. Threat level from various water-related activities

Activity/object	Location		Threat level		
	micro	macro	large	medium	small
Climate change		•	• the impact may be reduced by implementing action plan measures		
Big dams		•	•		
Small dams		•	•		
Small hydropower plants	•		• cumulatively		
Water supply systems		•	•		
Irrigation systems		•	•		
River channeling	•		•		
Traversing river meanders	•		• biological and morphological		
Flood protection		•	• no integrated flood management at the level of the river basin		
Mining	•		•		
Use of river basins for the extraction of materials (sand, gravel)	•		• cumulatively		
Pollution, diffuse and point source	•		• no wastewater treatment		• with wastewater treatment
Groundwater use	•		• cumulatively		
Use of the upper parts of mountain rivers and glacier lakes (capture, diversion, animal husbandry)	•		• cumulatively		
Use of rivers for the extraction of materials (sand, gravel)	•		• biological, morphological, social		
Tourism and recreation	•	•	•		
Management of watershed areas		•	•		• integrated management according to FWD
Planning, development and implementation of projects	• DUP	• GUP	•		
Institutional and regional cooperation		•	• no cooperation		

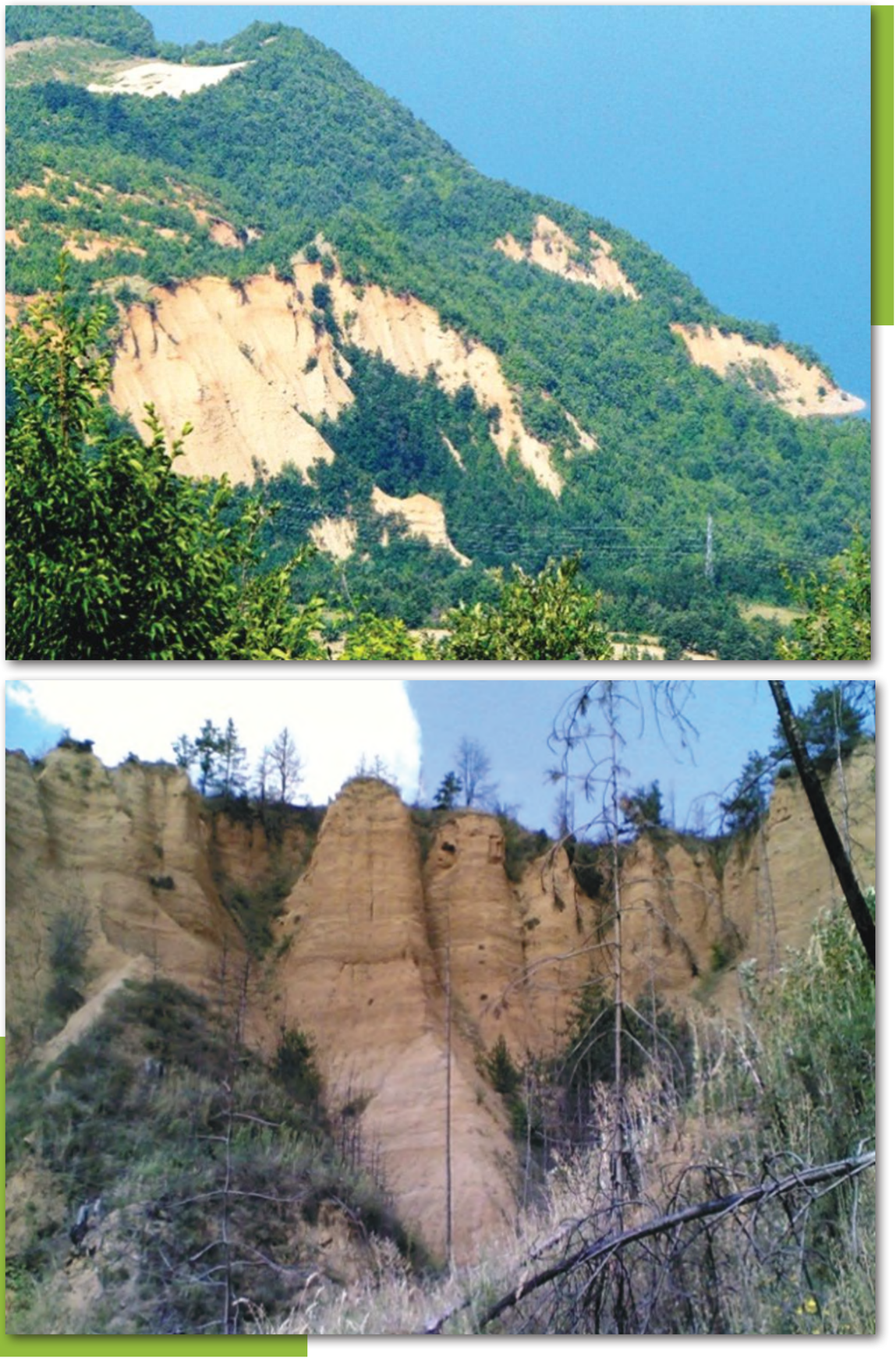

Figure 42. Formation of gullies from surface erosion on the mountain landscapes
In Debar (up) and Pehchevo (down).
(Source: I. Minchev, 2016, and I. Blinkov, 2013)

In addition to these, for the purposes of identifying the strategic goals, it is very often necessary to assess the conditions of erosion in the watershed area, the amount of sediment, the production of wastewater, wastewater treatment, irrigated surfaces, water traffic and the number and the extent of modified water bodies.

4.2.4. THREATS TO LANDSCAPE DIVERSITY

Threats to the landscapes are complex and stimulated by socio-economic and political-development policies at the local and national level. This complexity is reflected in the fact that each landscape consists of a number of ecosystems that are affected by a series of specific processes for each ecosystem separately.

The following may be identified as key threats to the landscapes:

- Overgrowing of the areas of high mountain pastures, as well as of screes with shrub and forest vegetation, which is a consequence of the abandonment of traditional practices of sheep grazing. In this way, the areas under high mountain pastures are reduced;
- Overgrowing of hilly pasture landscapes with shrub vegetation and thermophilic oak forests. This process is similar to that taking place in the high mountain zone;
- A special problem is the afforestation of hilly pasture landscapes, which is most often done with allochthonous coniferous species that completely change the landscape appearance, reduce biodiversity and increase the danger of fire;
- Overgrowing of rural landscapes due to the abandonment of traditional agricultural practices leading to loss of visual values and degradation of some components of biological diversity – habitats, plant species and invertebrates;
- Overgrowing of the borderlines in the hilly rural landscape with borderlines with natural forest vegetation due to the abandonment of agricultural practices (emigration) leading to loss of visual values;
- Overgrowing of meadows in the mountainous rural landscapes due to the abandonment of traditional practices – loss of visual values or loss of areas for feeding wild animals – ungulates, especially roe deer;
- Intensifying agricultural practices by expanding parcels and loss of borderlines leading to loss of visual values and loss of corridors for some types of organisms;
- Reducing rice paddies – rice areas have significantly varied over the last few decades due to a change in the market price of rice (Kochani region);
- Urbanization and industrialization are processes that reduce the visual and functional characteristics of landscapes, which particularly depend on their absorption capacity. In this context, the construction and operation of overground mines and quarries may also be relocated;
- Fragmentation of forest landscapes is the result of the construction and operation of line infrastructure (especially highways), often associated with improper forest management (deforestation, erosion) and forest fires;

The table shows the landscapes and the manner in which the threats affect them.

Table 9. Connection between major threats and significant landscape types

Type of threat	Type of landscape	Type of disruption
Overgrowing of landscapes with shrub and mesophilic forest vegetation	• *Landscape of high mountain pastures on a carbonate substrate* • *Landscape of high mountain pastures on a silicate substrate*	Structural and functional disruptions
Overgrowing of hilly pasture landscapes with shrub vegetation and thermophilic oak forests	• *Landscape of hilly pastures on granite screes* • *Landscape of hilly pastures on limestone*	Structural and functional disruptions
Afforestation in hilly pasture landscapes, which is most often done with allochthonous coniferous species	• *Landscape of hilly pastures on a marl substrate* • *Landscape of hilly pastures on granite screes* • *Landscape of hilly pastures on limestone*	Structural and functional disruptions
Overgrowing of rural landscapes due to the abandonment of traditional agricultural practices	• *Osogovo mountainous rural landscape* • *Mariovo landscape* • *Maleshevo-Pijanec rural-agricultural landscape* • *Hilly rural landscape* • *Plain-hilly subcontinental agricultural-rural landscape*	Structural and functional disruptions
Overgrowing of borderlines	• *Hilly rural landscape with borderlines*	Structural and functional disruptions
Overgrowing of meadows in the mountainous rural landscapes	• *Osogovo mountainous rural landscape* • *Mountainous rural landscape*	Structural and functional disruptions
Intensifying agricultural practices by expanding parcels and loss of borderlines	• *Hilly rural landscape with borderlines*	Structural and functional disruptions
Reducing rice paddies	• *Kochani landscape*	*Aesthetic disruptions*
Urbanization and industrialization; Intensive tourism, including winter sports	• *Dojran landscape* • *Prespa landscape* • *Ohrid landscape* • *Pelagonija landscape* • *Landscape of fir-spruce forests* • *Plain-hilly subcontinental agricultural-rural landscape (partially)*	*Aesthetic disruptions*
Fragmentation of forest landscapes	• *Landscape of mesophilic broadleaf forest*	Structural and functional disruptions
Illegal felling	• *Landscape of mesophilic broadleaf forest*	Structural and functional disruptions
Quarries and mines	• *Hilly pasture landscape on serpentinite* • *Landscape of carbonate rocks and screes* • *Landscape of hilly pastures on limestone* • *Landscape of hilly pastures on granite screes*	*Mainly aesthetic disruptions*
Fires	• *Landscape of Krivobor shrubland*	Structural and functional disruptions

4.2.5. MAIN THREATS TO BIODIVERSITY

4.2.5.1. The impact of economic sectors on biodiversity

In the first couple of decades after the Second World War, the melioration and the drying out of the majority of swamps, as well as the expansion of agricultural lands, posed serious threats to biodiversity, which significantly reduced the areas of relict marshy vegetation, that is, the belts with natural vegetation along the borders of fields were destroyed, thereby losing significant biocoridors. The existing threats to biodiversity related to the agriculture sector derive from the abandonment of traditional ways of utilizing the meadows and pastures, resulting in a change in the landscape through successions, and changes in the composition of biodiversity.

By means of the activities in the industry sector, large areas were degraded by deposition of tailings, technological waste, industrial landfills of harmful and hazardous waste and the absence of re-cultivation of abandoned pits and landfills. All this has caused permanent loss of habitats of many specific plant and animal species.

One of the priority threats to biodiversity is mining, that is, the utilization of mineral and non-mineral raw materials. These activities cause permanent loss of habitats of a number of specific plant species, as well as invertebrates, typical of limestone geological substrate. The situation of the wider Prilep area is alarming particularly in this respect, where a number of areas have been granted concession for marble exploitation (Pletvar, Sivec, Belovodica, Kozjak, etc.). This part of the territory of the Republic of Macedonia is known for its endemism, with several floristic endemics described, such as *Stachys iva* (Trojaci), *Seseli vandasii* (Kozjak), *Armeria vandasii* (Kozjak), *Centaurea kozjakensis* (Kozjak), *Silene prilepensis* (Kozjak), *Allium bornmulleri* (Drenovo), *Potentilla pletvarensis* (Pletvar), *Centaurea marmorea* (Sivec) *Centaurea grbavacensis* (Grbavec, Kozjak, Pletvar, Sivec), *Astragalus sericophyllus* (Kozjak), *Helianthemum marmoreum* (Pletvar, Kozjak), and others. Populations of these endemic species have been recorded in the vicinity of all old marble mines, as well as in the mines which have been granted concession more recently. The expansion of the exploitation area and the deposition of waste, unused raw materials is a serious problem in the conservation of this endemic plant genetic fund. The situation is similar with the Alshar site, where several local endemics have been developing - *Viola arsenica*, *Viola allchariensis*, *Thymus alsarensis*, *Centaurea leucomala*, *Onobrychis degenii*, *Knautia caroli-rechingeri* and several others, which are under permanent threat from taking future mining activities in this area.

The threats associated with the development of urbanization are manifested in the direct occupation of habitats and harassment of species, caused by frequently uncontrolled and discontinuous urbanization and the discharge of untreated wastewater into water bodies.

Civil engineering, through the conversion of agricultural land with high grade credit rating for non-productive purposes, especially in the vicinity of larger settlements and cities on the one hand, and leaving arable land in rural areas on the other, leads to loss of productive land, which is significant to the agro-biological diversity.

The priority threats in the hunting sector are related to all forms of poaching, enclosing hunting grounds, introduction of alien species and the like, which directly or indirectly cause the reduction of populations of many species of special interest. Furthermore, the illegal use of poison baits has led to the disappearance of the bearded and black vulture, and to a drastic reduction in the populations of the Egyptian and white-headed vulture. Given that all of these species have a significant share in the circulation of biomass and energy in ecosystems, the consequences of their extinction (or decrease in population) will undoubtedly affect the functioning of the entire related ecosystems.

Fisheries, especially illegal fishing, as well as the introduction of allochthonous fish species pose a serious threat to fish diversity in our natural lakes, especially in Ohrid Lake.

The impact of tourism on biodiversity leads to a number of adverse consequences. One of the threats is related to tourism activities (recreation or targeted observation of nature) in protected areas, which are not regulated by protected area management plans, or there are insufficient resources to deal with them successfully, or the prescribed measures are insufficiently implemented. The cases of unplanned construction of certain tourist facilities, which degrade neighboring ecosystems (intensive infrastructure activities in the coastal areas of Ohrid, Prespa and Dojran Lakes) pose a much more serious threat.

Biodiversity is adversely affected by the energy sector in several aspects: air, water and land pollution in the production of electricity (REK Bitola and REK Oslomej); disruption and change of the total landscape and biodiversity in the construction of transmission lines; change of pH and increase of concentrations of heavy metals in groundwater (landfills of ash and slag); reducing the areas of plant communities, as well as relict, endemic and rare species.

The construction of hydropower reservoirs in the river gorges leads to immersion of large areas of the gorges, which are refugiums of relict flora and vegetation, resulting in degradation and partial destruction of the existing phytocenoses of the lower vertical river profiles, as well as to the reduction of the area of relict, endemic and rare plant species. The *loci classici* of about 15 plant species are found in the gorge of the Treska river, where the hydro accumulations of Kozjak and Sveta Petka were built, as well as Matka prior to that. Of these, the endemo-relict species of *Thymus oehmianus* and *Viola kosaninii* are particularly endangered. The envisaged construction of the Chebren hydropower reservoir in the strait of the Crna Reka in Mariovo will likely result in the immersion of the majority of habitats of the stenoendemic species of *Silene paeoniensis*. The construction of Mavrovo Lake has resulted in the extinction of one species - *Lysimachia thyrsiflora*, which previously existed in Mavrovsko Pole.

The intensive development of the *transport sector* in the Republic of Macedonia often leads to the fragmentation of habitats, thereby being one of the most significant threats to biodiversity.

4.2.5.2. Other threats to biodiversity

Natural ecosystems may be modified under the influence of certain threats that have no sectoral origin, or it is not clearly expressed, such as, for example, fires, which often pose a real threat to protected areas, then the spread of invasive plant and animal species that are intentionally introduced or spread spontaneously on the territory of the Republic of Macedonia, etc.

The loss of natural habitats (their conversion) is most pronounced in aquatic habitats (marshes and swamps). In the course of several decades after the Second World War, almost all larger marshes and swamps dried up, mainly for two reasons - the acquisition of new agricultural areas and the fight against malaria. Thus, marsh biocenoses became particularly endangered, and some of them are fragmented and threatened with extinction.

Due to the widespread use of chemical protective agents in agriculture, as well as the lack of sanitary landfills with an impermeable layer, the fact that our natural lakes and rivers receive such wastewater is a widespread and irreversible problem, especially in relation to certain fauna groups of organisms. By utilizing these waters (for example, for irrigation) or because of their connection to lake basins (for example, Prespa Lake), the risk is transmitted to a number of aquatic organisms.

The impact of *climate change* on biodiversity has been assessed in the three national reports to the United Nations Framework Convention on Climate Change, with action plans for adaptation to change (MoEPP 2003, 2008, 2014). These reports have identified the refugiums and refugium areas that are susceptible to climate change impacts, and have provided expert assessment of the vulnerability of vulnerable habitats and species, identifying a total of 18 vulnerable habitats, 58 plant and 224 animal species. According to the expert assessments provided, one can expect changes in the distribution and even extinction of some habitats (lowland marshes) and species (plant and animal species related to mountain, marshy and coastal habitats).

Conservation of biological diversity in the Republic of Macedonia is facing certain challenges as well. Coordination between sectoral strategies and the Biodiversity Protection Strategy should be strengthened, and ensure capacity building by providing expert staff in the local and central government, responsible for environmental and nature issues, etc. Due to the intertwined threats, negative trends may be changed only by integrating the principles of sustainable development into other sectoral policies, without slowing down the projected economic growth. They will contribute to the improvement of the quality of life and will enable long-term survival of the most important components of biodiversity.

4.2.6. THREATS TO PROTECTED AREAS

The threats to protected areas may be of different origin, duration and impact on the integrity of natural values of protected areas. Some of the threats may occur inside the protected areas or come from the outside. However, the threats to protected areas generally coincide with the threats to geodiversity, biodiversity, and landscape (explained in previous chapters on threats). Furthermore, not all sectors affect protected areas equally.

Pursuant to the Law on Nature Protection, the threats to a protected area are elaborated in more detail in the preparation of the Study on Revalorization of a Protected Area and its management plan.

For threat assessment in protected areas, internationally, the World Bank and the World Wildlife Fund (WWF) tool is used.

4.2.6.1. Endangered ecosystems

In the past period, the biggest changes in biodiversity have been registered within water and marshy ecosystems. Macrophytic floating vegetation, in a large portion of Ohrid Lake, is found only in a fragmentary state, while in terms of fauna, fish are the most endangered. The constant oscillations in the water level in Prespa Lake have led to disruptions of the conditions of the floating and submersed vegetation, as well as the faunistic communities in the littoral zone of the Lake. In the past nearly 30 years, the state of Dojran Lake has been most alarming due to the drastic decrease in water level in 1988. The introduction of additional quantities of water as a result of the efforts and activities of the Ministry of Environment and Physical Planning has led to improvement of the hydrological state, and therefore, the situation of the biological communities is expected to improve as well. Comparative research is needed to show what the state of biodiversity in the Lake is, compared with previous comparative research conducted in 1989 and 2001.

The situation with river ecosystems in the Republic of Macedonia is also alarming. The most frequent causes are the inflow of wastewater, the construction of reservoirs, inadequate stocking and utilization, and the like. Benthic communities in river ecosystems are with markedly reduced abundance, leading to a reduction in populations in different fish species.

Figure 43. *Caricetum elatae* - a relict community in Studenchishte Marsh (photo: Hristovski S.)

The marshy vegetation in the Republic of Macedonia has suffered serious disruptions resulting from the ameliorative activities after the Second World War, when the former marshes and swamps were converted into arable land. The most vulnerable are the relict marshy communities that today are mainly found in fragmentary state (Negorci Spa, Gostivar Marsh, Katlanovo Marsh, Struga Marsh, Studenchishta Marsh, Monospitovo Marsh, Pelagonija, v. Chepigovo, etc.), or are under continuous pressure (Monospitovo Marsh, Belchishta Marsh, etc.). The marshy habitats (Struga Marsh, Monospitovo Marsh, Studenchishta Marsh, Belshishko Marsh, Katlanovo Marsh, etc.) are under continuous pressure. The marshy vegetation of the mountain swamps and fens, which is often dried by the impoundment of water from mountain springs and streams (Shar Mountain, Mount Mokra (Jakupica), Korab, Pelister, etc.) is also under serious threat.

Almost all forests in the Republic of Macedonia are affected by the wide range of natural or anthropogenic threats which *forest ecosystems* are exposed to, such as forest fires, uncontrolled felling, inadequate afforestation, unplanned construction and exploitation activities and so on.

Some forest communities may be disrupted by specific threats, such as drying forests (Tetovo RIver, Bistra – Senechka Mountain and Pelister – Brajchino RIver).

Nine forest communities are very rare, as well as endangered – *Ephedro-Prunetum tenellae* (Kavadarechko-Ljubash, due to afforestation), *Juglando-Aesculetum hippocastani* (Suv Dol at Izvor, Gari River, Crn Drim), *Tilio cordatae-Fagetum* (Drevenichka Mountain), *Aceri heldreichii-Fagetum* (Jakupica, Shar Mountain), *Periploco-Alnetum glutinosae* (Monospitovo Marsh) *Periploco-Fraxinetum angustifoliae-pallisae* (Negorci Spa), *Carici elongatae-Alnetum glutinosae* (Polog, Debarca), *Alnetum viridis* (Belasica), *Daphno-Cytisanthetum radiate calcicolum* (Galichica, Jablanica).

Ecosystems in the hilly pasture belt (dry grassland ecosystems) show different trends in different plant communities – while some are constantly expanding, other communities are highly endangered and are in a fragmentary state. Typical examples of endangered plant communities are halophytic communities that develop on saline soils (small areas in Ovche Pole and in the steppe-like area between Veles, Shtip and Negotino in central Macedonia), communities that develop on an arsenic and antimony substrate (Alshar near Kavadarci) and the communities on limestone and dolomite (the wider area of Prilep).

Mountain ecosystems are not, as a rule, endangered to such an extent as lowland ecosystems. The most common causes that lead to the degradation of some plant communities of this belt are excessive grazing, frequently uncontrolled exploitation of individual species, the construction of ski lifts, mountain top towers, TV repeaters and other transmission, antenna systems, and the like.

4.2.6.2. Rare, endangered and extinct species

According to the information so far, **three** floristic species are considered extinct: *Acorus calamus* (Struga area, Crn Drim), *Sagittaria sagitifolia* (Pelagonija Marsh near the village of Novaci), *Lysimachia thyrsiflora* (former Mavrovo Pole), while extremely endangered and on the brink of extinction are *Senecio paludosus* and *Carex elata*, which only develop in the coast of Ohrid Lake (Studenchishta and Struga Marsh). Inadequate protection is the main reason for the fragmentation of the populations of some rare and/or endemic plant species - *Nuphar lutea* (Ohrid Lake, near v. Kalishta), *Thymus oehmianus* and *Viola kosaninii* (the Kozjak reservoir) and *Phyllitis scolopendrium* (the Svetka Petka reservoir).

The most endangered species of fish in Ohrid Lake are salmonid species, while in Prespa Lake it is a carp (*Cyprinus carpio*), which according to IUCN, is included in the category of critically endangered species (CR). Of the ornithofauna of Macedonia in the last 60 years, at least 20 species of nesting birds have disappeared, including the bearded and black vulture, the white-tailed eagle, the glossy ibis, the Eurasian spoonbill, the wild goose, the western capercaillie, the common crane, the little bustard and others (Velevski M. et al., 2013).

In the spacious forest and mountain ecosystems in the western part of the country, there is a small population of the Balkan lynx (*Lynx lynx balcanicus*). The species has been classified by IUCN as “critically endangered species” (CR (C2a (i, ii) D) (Melovski et al., 2015).

On the other hand, positive changes have been observed in some species. Namely, the species of *Gentiana pneumonanthe*, which was considered to be extinct, has been registered on the coast of Mavrovo Lake. The species of *Ranunculus lingua*, whose population near Ohrid Lake is on the brink of extinction, has also been registered near the village of Bansko (Strumica area) (Matevski, 2005). With the gradual normalization of the situation with Dojran Lake, the populations of the floating plants *Salvina natans* and *Nuphar lutea* that were destroyed on the coast of Dojran Lake after the discharge of the water from the lake in 1988 have been gradually revitalized so that biologically vital populations have already been registered at the sites where these plants were previously developed.

A positive example in the past 10-year period in terms of taking timely measures for the preservation of endangered ecosystems and species is the Lokuf swamp, on Deshat Mountain, where the species of *Menyanthes trifoliata* is developed, which has limited distribution on the territory of the Republic of Macedonia. The swamp and this species were endangered due to its eutrophication by the sheepfold that was located in its vicinity, which in the meantime was dislocated.

In order to protect the Prespa trout, the necessary actions have been identified that are to be undertaken to document the current ecological status of this species' populations, estimate the density and the number, assess the threats and propose measures to improve the situation and promote sustainable use and species protection (Crivelli et al., 2008).

A series of protection activities (BIOEKO 2008) have been proposed for the critically endangered subspecies of the European ground squirrel found in Macedonia (*Spermophillus citellus karamani*) on Mount Mokra, among which are the protection and management of natural habitats and raising public awareness.

Regarding the fauna of bats, a report "Research on the Status and Action Plan for the Protection of Bats and Caves in Prespa" was prepared in 2012, within the GEF/UNDP/MoEPP Project for Prespa Basin Management, which presents data on the status and distribution of bats in all three countries that enter the Prespa region, as well as a list of priorities for research and protection in order to achieve favorable conservation status of bats in Prespa.

Measures have been taken by the municipality of Pehcevo and a part of the local population for improvement and preservation of the population and habitat of the rare plant species of *Drosera rotundifolia*, which exists at the site of Judovi Livadi in the municipality of Pehchevo, which until recently was the only site of this species on the territory of Macedonia (in 2015 it was found at several other nearby sites).

Preliminary studies were carried out on the marshy terrains in the region of Debarca during 2007 by the Macedonian Limnological Society (through the Environmental Investment Programme for 2007). In addition, special attention was paid to the site of Belchishte Marsh and a recommendation was given for the proclamation of Belchishte Marsh as protected area (Talevski, 2007).

In 2002, a decision was adopted by the Municipality of Negotino to proclaim the floristic site of "Orlovo Brdo" as a natural monument, due to the abundance of significant flora consisting of endemic and rare plants such as the following species: *Tulipa mariannae* Lindt., H*edysarum macedonicum* Bornm., *Salvia jurisicii* Kos., *Convolvulus holosericeus* M.B., *Capparis sicula* Duh., *Morina persica* L.), *Astragalus parnassi* Boiss. and others.

The assessment of the state of biodiversity of Dojran Lake as a transboundary area was made in 2004 (Katsavouni & Petkovski, 2004) within a cross-border project with neighboring Greece.

For the protection of Prespa Lake, as of 2004, a comprehensive programme (GEF/UNDP/MoEPP Project for Prespa Basin Management) is being implemented to improve the ecological status of aquatic and other related ecosystems and to preserve the globally significant biodiversity. At the transboundary level, key plans, programmes and strategies have been developed that now provide the basis for the implementation of specific measures to protect biodiversity. At the national level, the activities have been aimed at improving the active protection and management of "Ezerani" Nature Park and "Prespa Lake" Natural Monument, the management of which was assigned to the Municipality of Resen.

The valorization of the natural values of the former Strict Nature Reserve of Ezerani has established the need to change the level of its protection, aimed at its proper management and zoning, and the management plan includes measures for rehabilitation of ecosystems and species. This resulted in the need to change the category from the Strict Nature Reserve to the Nature Park. On the basis of the valorization of the protected area of Ezerani, in 2012, it was proclaimed a Nature Park. The activities were aimed at improving the active protection and proper management (zoning) and providing conditions for undertaking specific measures for rehabilitation of ecosystems and habitats.

Aimed at nature preservation and local development of the Bregalnica region, during 2013, activities within the SDC/MoEPP Nature Conservation Programme started to be implemented as an umbrella programme that unites all the activities carried out in the Bregalnica region for the conservation of nature and sustainable local development. During 2014/15, an analysis was made of the shortcomings in the ecological data and a map of the ecological sensitivity of the Bregalnica river watershed was prepared, which enabled the identification and valorization of the biodiversity in the region and gives directions and recommendations for its preservation (including establishment of a system of protected areas) and sustainable use.

At the same time, a draft Bregalnica River Watershed Management Plan (SECO/MoEPP Project) was drafted, through which the implementation of the Law on Waters would be promoted and the protection and sustainable management of water resources, rational use of waters, and improvement of the water quality and sanitation would be achieved.

4.2.5.3. Ecosystem services

Since the end of the 1990s, in the Republic of Macedonia, there has been a growing interest of the expert public in applying the principles of the ecosystem approach in the management of natural resources in the country. The first attempts have been recorded within the projects for integral management of Prespa and Ohrid Lakes, and more recently the Bregalnica river watershed.

The term “ecosystem services” encompasses the instrumental value of ecosystems as a means of achieving human well-being-related goals (Costanaza, 2008). As a result of the approach whereby problems are treated comprehensively, the concept of ecosystem services has great potential for application in the management of natural resources and the environment. The application of the concept of ecosystem services in the management of ecosystems in the Republic of Macedonia is, however, modest. Thus far, two studies have been prepared based on the concept of ecosystem services and economic valuation of the environment - the “economic value” of the natural resources of Shar Mountain (Melovski & Hristovski, 2008) and “Ezerani” Nature Park. The “Ezerani” Nature Park management project provides a good example of how the concept of ecosystem services can be applied in the management of degraded ecosystems in protected areas.

However, the conservation of biodiversity in our country can not be achieved only through measures and activities in protected areas. Namely, significant parts of ecosystems that are particularly important for human well-being (which provide services related to food, drugs, drinking water, raw materials, erosion control, circulation of substances, etc.) are under significant human influence and are not covered by the system of protected areas. A typical example is the forest and agricultural ecosystems that are actively managed. By applying the ecosystem approach in some of these ecosystems, basic environmental processes and functions can be renewed, especially those providing services that are essential to humans.

Therefore, it is necessary to identify the pressures on ecosystems that provide essential services for the well-being of people. For the critical ecosystems that provide important services, it is necessary to take measures for conservation or revitalization. Indeed, protection is preferred to revitalization, which is usually more expensive and longer.

Activities to reduce pressures on ecosystems, such as those from the agriculture and forestry sectors, will help in the spontaneous renewal of some of the degraded

ecosystems. In certain cases, however, coherent and coordinated activities and measures are needed to restore their functions, that is, the services they produce. Restoration efforts should focus, above all, on ecosystems whose services have a crucial or critical impact on human well-being.

The inclusion of key stakeholders in the activities for identifying key ecosystem services and in the implementation of the revitalization activities of the ecosystems that provide them will contribute to a more equitable approach to ecosystem services. The revitalization of these ecosystems will undeniably contribute to the preservation of biodiversity in the country.

4.2.6.4. Endangered economically significant species

Collection and trade in threatened and protected wild species of plants, fungi and animals and their parts is prescribed in the Law on Nature Protection and is performed only after previously obtained collection permit (Article 23) or trade permit/certificate (Article 30), issued by the Minister of Environment and Physical Planning.

Pursuant to the Law, the total quantity of threatened and protected wild species of plants, fungi, animals and their parts collected for commercial purposes should be established on the basis of the previous assessment of the species status and the opinion of scientific and professional organizations regarding the density of populations of endangered species in natural habitats for each year.

Concerning the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora - CITES Convention, on the proposal of the Ministry of Environment and Physical Planning, the Government of the Republic of Macedonia has adopted a Decree on the manner and procedure for issuing the permit or certificate, as well the type of permit or certificate and determining the border crossings through which the trade in threatened and protected wild species of plants, fungi, animals and their parts can be performed (“Official Gazette of the Republic of Macedonia” No.135/10), Decree on the manner of handling the trade in threatened and protected wild species of plants, fungi, animals and their parts by the customs authorities, other competent authorities and offices at the border crossings and scientific and expert institutions, as well as the authorized depositor of seized samples in illicit trade (“Official Gazette of the Republic of Macedonia” No.177/11), Rulebook on the issuing a permit for the collection of threatened and protected wild species of plants, fungi and animals and their parts (“Official Gazette of the Republic of Macedonia” No.102/09) and Lists of threatened and protected wild species of plants, fungi and animals and their parts were adopted in 2012 (“Official Gazette of the Republic of Macedonia” No. 15/12). The last by-law includes:

- the threatened and protected wild species of plants, animals and their parts contained in CITES Appendices 1, 2 and 3 whose trade is regulated by a certificate of import and/or export and/or transit and/or re-export (List 1)
- the wild species of plants, fungi and animals and their parts proclaimed as being threatened and/or protected at the level of the European Union whose trade is regulated by a trade permit (List 2) and
- the wild species of plants, fungi and animals and their parts of the Republic of Macedonia whose trade is regulated by a D4 or CITES trade permit (List 3).

However, despite the recommendations of scientific experts, the species of *Gentiana lutea* and *Gentiana punctata* continue to be illegally collected. Population depletion also occurs in the species of *Sideritis scardica* and *Sideritis raeseri*, due to their mass and inappropriate collection. To overcome this situation, it is necessary to extend the period of prohibition to collect these species, as well as to prohibit the purchase of this plant.

Populations of the species of pinemat manzanita (*Arctostaphylos uva-ursi*) are endangered due to mass and inappropriate collection of this plant in the area of the villages of Patishka Reka, Elovo, Drzhilovo and Crn Vrv (Karadjica), despite the recommendation by scientific experts to temporarily stop the collection of this plant, according to the study on the condition of the population of this species on the territory of Macedonia (Matevski, 2003), which was prepared at the request of the MoEPP.

Further population depletion of the species of *Sideritis scardica* (on Mount Bistra) and *Sideritis raeseri* (on Mount Galichica) is evident due to the traditionally mass and inappropriate collection of these plants.

The development of biopotential assessment studies for the wild species of plants, fungi, animals and their parts, which are used for commercial purposes at the national level, is an important issue aimed at establishing quotas for the sustainable use of these species.

4.2.6.5. Protection of species

The Law on Nature Protection prescribes measures for the protection of species that include adopting a red list of species based on the extent to which they are threatened, declaring strictly protected and protected wild species, controlling the collection and trade in threatened and protected wild species of plants, fungi and animals, and the breeding of wild animal species in captivity, introduction and reintroduction of species in nature.

4.2.6.6. RED LISTS AND RED BOOKS

Red Listing provides scientific information and analyzes of the status, trend and extent to which the species are threatened in order to draw the attention of the public, especially decision-makers (at national and global level) to the endangered species, in order to design appropriate strategies/programmes and take actions to preserve biodiversity. It is prepared according to the evaluation criteria developed by IUCN, whereby the species are categorized into 7 categories according to the extent to which they are threatened: extinct (EX), extinct in the wild (EW), critically endangered (CR), endangered (EN), vulnerable/sensitive (VU), near threatened (NT), least concern (LC), and additionally the data deficient (DD) category. These categories have been accepted in the Law on Nature Protection (Article 34).

In recent years, several attempts have been made to make red list proposals. An application has been prepared and in the course of 2015 it was submitted to UNEP.

In the meantime, a Red List of fungi has been proposed by the scientific experts Karadelev & Rusevska (2012). This list contains 213 species of the Ascomycota and Basidiomycota groups. The species are categorized according to IUCN criteria, with 21 species in the critically endangered category, endangered (EN) – 30 species, vulnerable (VU) - 71 species, near threatened (NT) – 40 species, least concern (LC) – 9 species and 42 species are data deficient (DD).

Krpač & Darcemont (2012) have proposed a red list of Rhopalocera of the Republic of Macedonia. This list includes 69 species, of which 1 is classified as endangered (EN), 15 are classified as vulnerable (VU), 24 as near threatened (NT), and the remaining 27 are not assigned status according to IUCN, but are considered of conservation significance due to endemism or the small area of distribution.

Lemonnier-Darcemont et al. (2014) have developed a red list of Macedonian orthoptera according to IUCN criteria. The guiding criterion for assessing the status is an estimate of the population size and the trend, but also the area of distribution. The list includes 17 taxa (about 10% of the total Macedonian fauna): 1 critically endangered - CR (*Bradyporus macrogaster macrogaster*), 4 endangered - EN (*Saga pedo, Brady-*

porus oniscus, Paracinema tricolor and *Stethophyma grossum*), 8 vulnerable - VU, as well as 4 threatened - NT. Additionally, 10 taxa are categorized as "data deficient" - DD. All other species of orthoptera of Macedonia are considered least concern - LC.

4.2.6.7. STRICTLY PROTECTED AND PROTECTED WILD SPECIES

According to Article 35 of the Law on Nature Protection, wild species can be proclaimed strictly protected or protected wild species, thus acquiring the status of natural heritage.

Within the GEF/UNDP/MEPP Protected Areas Project in 2010, a List indicating the conservation status of the species of the Republic of Macedonia was prepared as a comparative review of the species which are on the lists of international conventions, EU directives on habitats and birds and IUCN Red List of globally endangered species. Based on the list, the by-law - Lists for establishing strictly protected and protected wild species has been prepared.

In 2011, pursuant to Article 35 of the Law on Nature Protection, the by-law - Lists for establishing strictly protected and protected wild species was adopted ("Official Gazette of the Republic of Macedonia" No.139/2011). The adoption of this by-law was an obligation arising from the National Programme for the Adoption of the Acquis (NPAA). Despite the negative reaction of the scientific public in relation to the by-law, this legal act is a good mechanism for legal protection of the species. In the coming period, it is necessary to revise the Lists for establishing strictly protected and protected wild species on the basis of previous scientific researches and analyzes of the state, trend and the extent to which the species are threatened. In this regard, the preparation and adoption of national red lists is a priority issue.

4.2.6.8. Biodiversity monitoring

The MoEPP is responsible for conducting the monitoring of the state of biodiversity and geoheritage and undertaking measures for protection and conservation. The entities responsible for protected area management should be included in biodiversity monitoring, and expert assistance should be provided by the faculties, institutes and museums. The entities responsible for biodiversity monitoring tend to lack sufficient capacity; therefore, it is necessary to strengthen the capacities both from the technical and expert point of view. In addition to the necessary knowledge of biology and ecology of target species and habitats/ecosystems, appropriate knowledge of spatial and temporal statistical analyzes is necessary. Monitoring data is not collected in an integral database.

In practice, specific monitoring activities of components of biological diversity are carried out only within various projects, implemented by various organizations. Since 2010, the Public Institution National Park "Galichica" has implemented activities of the Programme for long-term monitoring in the park, which consists of 5 thematic units: 1) monitoring the non-living nature; 2) monitoring of forest plant communities/habitats; 3) monitoring of herbaceous plant communities/habitats; 4) monitoring of plant species; and 5) monitoring of animal species.

As far as aquatic ecosystems and their biodiversity are concerned, the competent institution is the National Hydrometeorological Service (NHMS). The Hydrobiological Institute of Ohrid participates in the monitoring of the lakes, especially Ohrid, Prespa and Dojran Lakes. In addition, measurements have been made of the rivers flowing into the lakes, their littoral, and one measuring point in the pelagic zone of each of the two lakes. There is a monitoring network established on Prespa Lake consisting

of 8 monitoring points in the rivers of surface water bodies and 5 monitoring points in the lake itself. According to the data, the surface waters of the lake are classified as acceptable, and the upper courses of the Brajchinska and the Kranska are assigned excellent status, while poor status is noted in the lower course of the Golema Reka and the Istochka Reka.

Within the various projects, certain studies are carried out following certain specific changes that affect the state of the forests. For instance, in "Pelister" National Park, the revitalization of the old Macedonian pine forest has been observed by monitoring the course of the renewal process of the Macedonian pine. The Diagnostic-Prognostic Reporting Service (DPR service) at the Faculty of Forestry in Skopje, at the state level, through a network of bioindicating points, monitors the changes in the health condition of the forests. For the purpose of protection of forests and forest lands, on the entire territory of the Republic of Macedonia, measures and activities are undertaken which are intended for protection from biotic, abiotic and other factors that can cause harmful consequences in the forest.

Complete monitoring of forest habitats and species living in them (forest biodiversity) is not fully implemented because the monitoring is directed primarily toward forest diseases and insects causing calamitous events and more serious damage to the forest, that is, it mainly refers to the forest as a resource. In the future, it is necessary to extend the monitoring to cover biodiversity.

Aimed at the improvement of the monitoring of forest fires, preventive measures, factors and causes, type and size of the fire, participants in the extinguishing and costs of extinguishing, caused damages, the body of the state administration responsible for the affairs of the forestry is planning to establish and lead a Single Information System and Register of Forest Fires.

The monitoring of some important species is carried out within the project activities. Thus, since 2003, the continuous monitoring of vultures in Macedonia has been carried out by the Macedonian Ecological Society within the *Vulture Conservation Project in Macedonia*. Lynx monitoring has been carried out continuously since 2006 (photo traps method) within the *Balkan Lynx Recovery Programme* by the Macedonian Ecological Society.

The winter census of waterfowl of the three natural lakes, as well as some artificial lakes and fishponds, is not carried out continuously, but with interruptions depending on the funding opportunities, although the intensity has increased in the last couple of years. The winter census of the waterfowl of Prespa Lake in Macedonia has also not been carried out continuously, but valuable data exist for 1987-1990, 1997-2002, 2004-2006 and 2009-2012 (Micevski & Schneider-Jacoby, 1997; Velevski et al., 2010; Catsadorakis et al., 2013). According to the monitoring results for 2010-2012, the total number of wintering waterfowl by far exceeds the Ramsar criterion of 20000 individuals; therefore, the lakes qualify as water habitats of international importance (Catsadorakis et al., 2013).

In the "Galichica" National Park, 22 standard operational procedures (SOP or monitoring protocols) have been developed for monitoring the components of biological diversity, of which 5 refer to the following habitats: peony forest with foya, Helleno-Moesian *Quercus frainetto* forests, southwestern Moesian fir-beech forests, Balkan bare pastures and Helleno-Balkan bare pastures. Plant species monitoring includes 4 protocols relating to endemic plant species (*Crocus cvijicii, Centaurea tomorosii, Nepeta ernesti-mayeri* and *Sideritis raeseri*) and 1 protocol for incidental observation of significant species of vascular plants. Animal species monitoring includes 2 protocols for invertebrates (*Helix secernenda schlaeflii* and *Parnassius apollo*), 7 protocols for vertebrates (*Triturus macedonicus, Algyroides nigropunctatus, Phalocrocorax car-*

bo, Mergus merganser, Alectoris graeca, Pyrrhocorax graculus and *Caprimulgus europaeus*), a protocol for monitoring frequent species of bats (*Pipistrellus spp., Nyctalus leisleri* and *Eptesicus serotinus*) and protocols for incidental observation of significant species of mammals and birds.

Hunting associations and hunting concessionaires monitor the game's quantity.

PART 2

5. STRATEGY FOR NATURE PROTECTION

5.1. IDENTIFICATION OF THE STATE-OF-PLAY, WEAKNESSES AND STRENGHTS, OPPORTUNITIES AND THREATS IN THE AREA OF NATURE PROTECTION

(SWOT ANALYSIS)

The working team composed of experts from various fields and representatives of the Ministry of Environment and Physical Planning of the Republic of Macedonia, by using the experiences and applying modern analysis methods for comprehensive overview of the nature protection issue, conducted SWOT analysis where strengths, weaknesses, opportunities and threats of the geodiversity and geoheritage were presented, together with the other components of the nature protection (biological and landscape diversity).

The direct analysis identified several numerous strengths related to the values of the geodiversity, landscape and biodiversity. The analysis also identified certain weaknesses which encompass the capacities of the institutional framework, national legislation, adopted strategic documents, research, monitoring and treatment of protected areas.

Opportunities and threats were identified during the conducted SWOT analysis, that is, the gaps which exist in view of the nature protection (Annex 6).

5.2. PRINCIPLES, NATIONAL TARGETS, MEASURES AND ACTIONS OF THE NATIONAL STRATEGY FOR NATURE PROTECTION

5.2.1. PRINCIPLES OF ENVIRONMENTAL PROTECTION

The National Strategy for Nature Protection is based on and in compliance with the principles of environmental protection, as defined in the Environmental Law, as follows:

1. Principle of high level of protection;
2. Principle of integration;
3. Principle of sustainable development;
4. Precautionary principle;
5. Principle of prevention;
6. User pays principle;
7. Public participation principle; and
8. Principle of cooperation

5.2.2 NATIONAL TARGETS

In order to identify and define the national targets of the Strategy for Nature Protection of the Republic of Macedonia, a process of consultations with the relevant stakeholders was conducted and numerous strategic documents in the field of environmental protection and other sectors, values of the nature, as well as the threats to the geodiversity, geoheritage, biological and landscape diversity were reviewed and considered.

Based on the analysis, 7 national targets were identified, and they are integral to separate thematic areas (geodiversity, geoheritage, biological and landscape diversity) and they are further elaborated through activities within the Action Plan of the Strategy for Nature Protection. National targets are:

NATIONAL TARGET 1. **To protect, conserve and monitor the components of the geodiversity, geoheritage, biological and landscape diversity.**

NATIONAL TARGET 2. **To properly identify, research, monitor and make inventory of the geodiversity and geoheritage and other components of nature (biological and landscape diversity).**

NATIONAL TARGET 3. **By 2022, to embed the nature protection policies into the strategies, plans and programmes of other sectors.**

NATIONAL TARGET 4. **To establish and practice sustainable use of the geodiversity and geoheritage and other components of nature (biological and landscape diversity) through the use of traditional knowledge, innovations, best practices and positive incentives related to conservation and sustainable use of the nature.**

NATIONAL TARGET 5. **To improve the legislation framework in accordance with the EU legislation and relevant ratified international treaties for nature protection and to provide adequate institutional framework by strengthening the administrative capacities.**

NATIONAL TARGET 6. **To raise the level of information, education and promotion of the value of the geodiversity and geoheritage and other components of nature (biological and landscape diversity).**

NATIONAL TARGET 7. ***To provide continuous and increased financing of the nature protection by budget finances at central and local level, by investments and other sources of financing, through establishment of appropriate sustainable and efficient financing models for protection and sustainable use of nature.***

5.2.3 MEASURES FOR IMPROVEMENT OF NATURE PROTECTION

In lieu of the main objective of the strategy for protection of the geodiversity and geoheritage and other components of nature (biological and landscape diversity), national targets in these areas are further presented in more details. In the context of previously defined national targets, concrete measures to improve the nature protection are accentuated as follows:

1. Measures for research and monitoring of the state of the nature;
2. Strengthening the measures for inclusion of the nature protection in other sectors;
3. Measures for amending the institutional and legal frameworks;
4. Measures for education and education improvement in order to protect the nature;
5. Measures for inclusion of the local population in the process of nature protection and advancement; and
6. Measures for usage of mechanisms to stimulate external financing in the area of nature protection;

5.2.4 ACTION PLAN

Vision and national targets of the Strategy are elaborated in details in the Action Plan.

Action plan contains numerous actions to be undertaken in order to meet and achieve the Vision and national targets of the Strategy.

Actions in the Action Plan integrally refer to the whole nature, that is, the geodiversity and geoheritage and other components of nature (biological and landscape diversity), and they include:

1. protection, conservation and monitoring;
2. identification, research and inventory of objects of interest for protection;
3. sustainable use of the geodiversity and geoheritage and other components of nature (biological and landscape diversity);
4. embedding of nature protection policies into the strategies, plans and programmes of other sectors;
5. improvement of legal framework and strengthening the institutional capacities;
6. raising the level of information, education and promotion of the value of the geodiversity and geoheritage and other components of nature (biological and landscape diversity); and
7. provision of continuous and increased financing of the nature protection.

The Plan for realization of the actions related to each national target is provided in the table containing the following information:

1. denomination/number of the action;
2. implementing institution;
3. implementation timeframe;
4. Funding (possible sources of finances - Budget of the RM, foreign grants, EU funds and other sources);
5. draft indicator (s) to monitor the implementation progress.

Budget assessment

Assessment of the amount of required finances for each action in the action plan is determined though approximate finances divided into three categories:

I Category budget to MKD 10,000,000.00
II Category budget from MKD 10,000,000.00 to MKD 30,000,000.00
III Category budget over MKD 30,000,000.00

Detailed financial plan shall be broken down in five-year implementation plan of the Strategy drafted by the MoEPP.

ACTION PLAN

NATIONAL TARGET 1

"To properly identify, research, monitor and make inventory of the geodiversity and geoheritage and other components of nature (biological and landscape diversity)"

Numerous areas, sites and phenomena of nature conservation interest, that is, related to geodiversity and geoheritage and other components of nature (biological and landscape diversity) have been identified in the Republic of Macedonia. Various objects from various areas, such as geology (volcano objects and phenomena, minerals, fossils), geomorphology (various reliefs, fluvial, abrasive, karst, glacial and denuvolcanoforms) and hydrology (wells, rivers, lakes, waterfalls) have been identified.

So far, 1,700 species of algae, 3,200 vascular plants, over 2,000 fungi and 450 lichens, 13,000 invertebrates, 85 fish and cyclostomata, 15 amphibians, 32 reptiles, 333 birds and 84 species of mammals have been registered in different ecosystems and types of habitats in the country. There is a multitude of endemic species among them: at least 150 endemic algae, 120 endemic vascular plants, over 700 invertebrates and 27 endemic species of fish. Considering that knowledge for certain taxonomic groups is modest or lacking, the real image of the rich biodiversity in the country is still incomplete.

If values of the geodiversity and geoheritage are added to the values of the eco-systems and species, we can say the Republic of Macedonia possesses extremely rich and unique natural resources.

As is the case with the biodiversity, other thematic areas, such as geodiversity, geoheritage, hydrology and landscapes are not fully explored and researched.

As regards the biodiversity, a very important monitoring tool is introduction of biodiversity indicators to monitor the trend of certain wild animals and plants populations, as well as the trend of protected areas in the Republic of Macedonia.

It is essential to conduct monitoring of other components of nature in order to identify integral measures and actions to protect and to conserve the geodiversity, geoheritage, biological and landscape diversity.

National target 2 contains concrete actions intended to study, research, monitor and inventorize the geodiversity and geoheritage and other components of nature (biological and landscape diversity), and it is linked to National target 1 and 5 of the present Action Plan.

Actions in order to accomplish National target 1:

NATIONAL TARGET 1 To properly identify, research, monitor and make inventory of the geodiversity and geoheritage and other components of nature (biological and landscape diversity).						
No.	**Action**	**Responsible institution**	**Implementation period**	**Funding**	**Category**	**Action implementation indicator**
1. 1 Geodiversity and geoheritage (geology, geomorphology and hydrology)						
1.1.1	Inventorize and assess geodiversity and geoheritage	MoEPP in cooperation with scientific institutions and experts	2017-2027	Budget of the RM, various donations	III	Elements of geodiversity and geoheritage are inventoried and assessed
1.1.2	Development geodiversity and geoheritage monitoring programme	MoEPP in cooperation with scientific institutions and experts	2017-2020	Budget of the RM, various donations	I	Geodiversity and geoheritage monitoring programme is adopted
1.1.3	Establishment and implementation of geodiversity and geoheritage national monitoring	MoEPP in cooperation with scientific institutions and experts	2020-2027	Budget of the RM, various donations	III	Geodiversity and geoheritage national monitoring is established
1.1.4	Development of geodiversity and geoheritage database	MoEPP in cooperation with Geological Survey, scientific institutions and experts	2017-2027	Budget of the RM, various donations	II	Geodiversity and geoheritage database is established
1.1.5	Development of geodiversity and geoheritage national cadastre	MoEPP in cooperation with Geological Survey, scientific institutions and experts	2017-2027	Budget of the RM, various donations	II	Geodiversity and geoheritage national cadastre is developed
1.1.6	Creation of a map of geo-objects and sites with important natural values	MoEPP in cooperation with Geological Survey, scientific institutions and experts	2020-2022	Budget of the RM, foreign donations	I	Map of geo-objects and sites with important natural values is created
1.1.7	Creation of a map of rare minerals, rocks, fossils	MoEPP, ME in cooperation with Geological Survey, scientific institutions and experts	2020-2022	Budget of the RM, foreign donations	I	Map of rare minerals, rocks, fossils is created
1.1.8	Conducting study on the utilization potential of thermal and petrothermal energy	MoEPP, ME in cooperation with Geological Survey, scientific institutions and experts	2020-2022	Budget of the RM, various donations	II	Study on the utilization potential of thermal and petrothermal energy is conducted

1.1.9	Creation of a national map of sites subject to landslides	MoEPP in cooperation with Geological Survey, scientific institutions and experts	2017-2018	Budget of the RM, various donations	II	National map of sites subject to landslides is created
1.1.10	Development of a dossier of geo-objects and sites on European and World Cultural and Natural Heritage sites and their promotion	Government of the RM, MoEPP in cooperation with scientific institutions and experts	2022	Budget of the RM, various grants	II	Dossiers of at least 2 geo-objects and sites on European and World Cultural and Natural Heritage sites and promotion have been developed
1.1.11	Development of a study to determine the hydrological state of mountain rivers and glacial lakes	Government of the RM, Ministry of Finance and MoEPP	2023	Budget of the RM, various donations	III	Study is developed
1.1.12	Development of a study to determine the characteristics of groundwaters resulting from pollution, particularly in mountain and rural areas	Government of the RM, Ministry of Finance and MoEPP, Geological Survey of RM	2019	Budget of the RM, various donations	II	Study is developed
1.1.13	Environmental assessment of the characteristics of urban rivers aimed at protection of the eco-systems	Government of the RM, Ministry of Finance and MoEPP	2019	Budget of the RM, various donations	II	Assessment is conducted
1.1.14	Study of environmental flow of mountain aquatic eco-systems	Government of the RM, MoEPP, MAFWE	2021	Budget of the RM, various donations	III	Study of environmental flow of mountain aquatic eco-systems is developed
1.1.15	Creation of national speleological cadastre with continuous updating programme	MoEPP in cooperation with speleological organizations, scientific institutions and experts	2017-2027	Budget of the RM, various donations	I	National speleological cadastre with continuous updating programme is established
1.1.16	Development of a programme for speleological research	MoEPP in cooperation with scientific institutions, experts and speleological organizations	2017-2020	Budget of the RM, various donations	I	Programme for speleological research is adopted
1.1.17	Identification of rare, unique and endangered soil types in the Republic of Macedonia and proposed measures for their protection (conservation).	MoEPP in cooperation with scientific institutions	2017-2020	Budget of the RM, various donations	II	Study is developed
1.1.18	Establishment of national cadaster – landslides database	MoEPP in cooperation with Geological Survey, scientific institutions and experts	2017-2027	Budget of the RM, various donations	I	National cadastre – landslides database is established
1.1.19	Programme to determine the suitability of geological environments for developmental projects	Government of RM, MoEPP, ME in cooperation with Geological Survey, scientific institutions and experts	2023	Budget of the RM, various donations	I	Programme to determine the suitability of geological environments for developmental projects is adopted

1.2 Landscape diversity						
1.2.1	Development of a comprehensive study on structural and functional features of identified landscape types	MoEPP in cooperation with scientific institutions and experts	2024	Budget of the RM, various donations	III	Study on the features of identified landscape types is developed
1.2.2	Establishment of spatial arrangement of landscape elements	MoEPP in cooperation with scientific institutions and experts	2025	Budget of the RM, various donations	II	Spatial arrangement of landscape elements is established
1.2.3	Determination of connectivity of each identified landscape type	MoEPP in cooperation with scientific institutions and experts	2025	Budget of the RM, various donations	II	Connectivity of each identified landscape type is determined
1.2.4	Determination of the capacity of a given landscape type to support biodiversity; flow (movement) of matter and energy;	MoEPP in cooperation with scientific institutions and experts	2026	Budget of the RM, various donations	II	Capacity of a given landscape type to is determined
1.2.5	Development of management plans for the most important landscape types	MoEPP in cooperation with scientific institutions and experts	2027	Budget of the RM, various donations	III	Management plans for the most important landscape types are developed
1.2.6	Identification of landscapes at national level	Government of the RM, MoEPP, ME, MAFWE	continuous	Budget of the RM, various donations	I	Identification and explored landscapes
1.3 Biodiversity						
1.3.1	Development of red lists	MoEPP in cooperation with scientific institutions	2017-2023	Budget of the RM, various donations	III	Red lists developed
1.3.2	Development of red books	MoEPP in cooperation with scientific institutions	2017-2023	Budget of the RM, various donations	III	Red books developed
1.3.3	Revision of the Lists of strictly protected and protected wild species	MoEPP in cooperation with scientific institutions	2017-2020	Budget of the RM, various donations	I	Lists revised
1.3.4	Preparation and implementation of action plans for conservation of threatened species identified in red lists	MoEPP in cooperation with scientific institutions	2024-2027	Budget of the RM, various donations	II	Action plans are implemented
1.3.5	Development of assessment studies of the biopotential of wild plants species, fungi, animals and commercially significant parts thereof	MoEPP in cooperation with scientific institutions	2017-2020	Budget of the RM, various donations	II	Number of developed studies
1.3.6	Development of action plans for *ex-situ* conservation of indigenous wild species	MoEPP in cooperation with scientific institutions	continuous	Budget of the RM, various donations	I	Action plans for *ex-situ* conservation of indigenous wild species are developed
1.3.7	Development of Database of national biodiversity indicators	MoEPP, scientific institutions, experts, MAFWE	2018-2023	Various grants, EU funds	II	Indicators are developed

1.3.8	Development of national action plans deriving from the obligations under international treaties and initiatives (e.g. Birds and bats under the Bonn Convention)	MoEPP in cooperation with scientific institutions, CSOs	2018-2022	Budget of the RM, various grants	II	Plans are developed
1.3.9	Establishment of national register and bird ringing	MoEPP in cooperation with scientific institutions, CSOs	continuous	Budget of the RM, various grants	II	Register is established
1.3.10	Development of studies on valorisation/revalorization of protected areas	MoEPP in cooperation with institutions responsible for data gathering	continuous	Budget of the RM, various grants, EU funds	III	Number of studies
1.3.11	Development of protected areas management plans	MoEPP in cooperation with institutions responsible for data gathering	continuous	Budget of the RM, various grants, EU funds	III	Number of management plans
1.3.12	Development of spatial plans for the national parks	MoEPP in cooperation with institutions responsible for data gathering, national parks	2020	Budget of the RM, various grants, EU funds	II	Number of developed spatial plans
1.3.13	Development of sectoral studies on Spatial Plan of the RM	MoEPP in cooperation with institutions responsible for data gathering, national parks	2019	Budget of the RM, various grants, EU funds	III	Number of developed spatial plans
1.3.14	Identification of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) within the process of establishment of Natura 2000	MoEPP in cooperation with scientific and expert institutions, CSOs	2017-2022	Budget of the RM, various grants, EU funds	II	Identified areas for NATURA 2000
1.3.15	Development of study on allochthonous species, particularly invasive species	MoEPP, scientific institutions, Hydrobiological institute, PAs	2024	Budget of the RM, various grants	III	Study is developed
1.3.16	Development of draft national list of habitat types as referred to in Annex I of the Habitats Directive, for each of the two bio-geographical regions (continental and alpine region)	MoEPP, scientific and expert institutions, international and national experts	2017	IPA funds	I	Draft list is developed

1.3.17	Development of draft national list of animal and plant species as referred to in Annex II of the Habitats Directive, for each of the two bio-geographical regions (continental and alpine region)	MoEPP, scientific and expert institutions, international and national experts	2017	IPA funds	I	Draft list is developed
1.3.18	Development of draft national list of birds as referred to in Annex I of the Birds Directive (birds and other regularly occurring migratory birds), for each of the two bio-geographical regions (continental and alpine region)	MoEPP, scientific and expert institutions, international and national experts	2017	IPA funds	I	Draft list is developed
1.3.19	Selection/identification of proposed potential pilot areas for Natura 2000 network at national level	MoEPP, scientific and expert institutions, international and national experts	2017-2022	IPA funds, various donors	III	Proposed potential pilot areas for Natura 2000 network are selected/identified
1.3.20	Completion of Standard Data Form for Natura 2000 data regarding the potential pilot areas in the RM	MoEPP, scientific and expert institutions, international and national experts	2017-2022	IPA funds, various donors	II	Standard Data Form for Natura 2000 data regarding the potential pilot areas in the RM is completed
1.3.21	Development of evaluation, sorting and storing methodology for Natura 2000 data	MoEPP, scientific and expert institutions, international and national experts	2017	IPA funds	I	Evaluation, sorting and storing methodology for Natura 2000 data is developed
1.3.22	Development of Monitoring Guidelines for population of the most important habitats and taxonomic groups relevant to Habitats and Birds Directives	MoEPP, scientific and expert institutions, international and national experts	2017	IPA funds	I	Monitoring Guidelines for population of the most important habitats and taxonomic groups relevant to Habitats and Birds Directives are developed
1.3.23	Conducting Study on the development of Geographic Information System (GIS) for protected areas related to Natura 2000 network	MoEPP, scientific and expert institutions, international and national experts	2017	IPA funds	I	GIS study is conducted
1.3.24	Development of digital GIS map for proposed potential pilot areas for Natura 2000 network at national level	MoEPP, scientific and expert institutions, international and national experts	2017	IPA funds	I	Digital GIS map for proposed potential pilot areas for Natura 2000 network at national level is developed
1.3.25	Inventarization and updating of data on identified environmentally important areas for birds, plant and butterflies, etc.	MoEPP, national parks, scientific and expert institutions, experts	2020	Budget of the RM, various donations	II	Data on identified environmentally important areas are updated
1.3.26	Conducting monitoring of selected key habitats of wild species at national level	MoEPP, national parks, other entities mandated to manage protected areas, scientific and expert institutions, expert	continuous	Budget of the RM, various donations	II	Monitoring of selected key habitats of wild species at national level is conducted Number of drafted reports on key habitats and wild species

1.3.27	Development of national bird atlas	MoEPP, national parks, other entities mandated to manage protected areas, scientific and expert institutions, expert	2023	Budget of the RM, various donations	II	Atlas is developed
1.3.28	Establishment of national monitoring system for the Balkans lynx	Government of the RM, MoEPP, national parks, other entities mandated to manage protected areas	2017-2027	Budget of the RM, various donations	III	National monitoring system for the Balkans lynx is established
1.3.29	Valorisation study of natural values of the Ohrid Lake	Government of the RM, MoEPP, Hydrobiological Institute, national parks, other entities mandated to manage protected areas	2017-2019	Budget of the RM, various donations	II	Valorisation study of natural values of the Ohrid Lake is developed
1.4 Geographic Information System						
1.4.1	Updating of data on objects and phenomena of nature conservation interest (revision of object number, location and data)	MoEPP in cooperation with scientific institutions and experts	continuous	Budget of the RM, various donations	I	Data are updated
1.4.2	Creation and updating of Geographic Information System on territories, objects and phenomena of nature conservation interest	MoEPP in cooperation with scientific institutions and experts	continuous	Budget of the RM, various donations	II	Geographic Information System is created and updated
1.4.3	Development of a map with R-1:200000 with location of objects and sites of nature conservation interest	MoEPP in cooperation with scientific institutions and experts	2017-2018	Budget of the RM, budget of MoEPP, various donations	I	Map with location of objects and sites of nature conservation interest is developed
1.4.4	Development of a map with R-1:200000 with location of objects and sites where nature is degraded	MoEPP in cooperation with scientific institutions and experts	2017-2019	Budget of the RM, Budget of MoEPP, various donations	I	Map with location of objects and sites where nature is degraded is developed
1.4.5	Development of digital maps for projects by economy-related sectors (minerals and mining resources, hydroenergy, wind energy etc.) for preventive identification of areas of nature conservation interest.	Government of the RM, MoEPP, MAFWE, ME	2017-2020	Budget of the RM, various grants	II	Digital maps for projects of economy-related sectors are developed
1.4.6	Development of complete GIS with relational database with inter-institutional relations	scientific institutions and experts	2020	Budget of the RM, various donations	II	Natural heritage GIS is established and harmonized

NATIONAL TARGET 2

"To protect, conserve and monitor the components of the geodiversity, geoheritage, biological and landscape diversity"

The Republic of Macedonia, with its modest area of 25.713 km2, owns extremely diverse nature, represented with various elements of geodiversity, geoheritage, biological and landscape diversity. Due to their diversity and uniqueness, certain geological and geomorphological forms, hydrological objects, habitats and wild species go beyond their national importance and they have regional and global importance.

The issue of provision of long-term protection of such natural riches is often posed. Therefore, the need of planning the nature protection and embedding it in the policies of other sectors is imposed.

Implementation of nature protection and conservation measures is one the highest priorities of the Action Plan related to the Strategy for Nature Protection.

Furthermore, one of the vital activities to ensure nature protection and conservation is to conduct continuous state monitoring of geodiversity, geoheritage, biological and landscape diversity. Establishment and implementation of a national monitoring system should be regulated with the national legislation, where the methodology and entities mandated to implement the monitoring will be precisely defined.

In this context, the National Target 1 contains actions which ensure protection, conservation and monitoring of the components of the geodiversity, geoheritage, biological and landscape diversity.

Actions under the National target 2 are linked to the actions under all national targets presented in the Action Plan.

Actions in order to accomplish National Target 2:

NATIONAL TARGET 2 **To protect, conserve and monitor the components of the geodiversity, geoheritage, biological and landscape diversity**						
No.	**Action**	**Responsible institution**	**Implementation period**	**Funding**	**Category**	**Action Implementation Indicator**
2.1 Geodiversity and geoheritage (geology, geomorphology and hydrology)						
2.1.1	Development of a Strategy for Geodiversity (Geology and Geomorphology) Protection in the RM	Government of the RM, MoEPP in cooperation with scientific and competent institution and experts, Geological Survey	2020-2021	Budget of the RM, various grants	II	Strategy for Geodiversity (Geology and Geomorphology) Protection in the RM is developed
2.1. 2	Development of a Strategy for Karst Protection in the RM	Government of RM, MoEPP, Geological Survey, scientific and competent institutions and experts	2021-2022	Budget of the RM, various grants	II	Strategy for Karst Protection in the RM is developed
2.1.3	Nomination of geo-objects and sites for European and World Cultural and Natural Heritage lists and their promotion	Government of the RM, MoEPP in cooperation with scientific institution and experts	2020-2022	Budget of the RM, various grants	I	At least 2 geo-objects and sites are nominated for European and World Cultural and Natural Heritage lists and their promotion
2.1.4	Development of a Programme for preventive protection of unique or endangered geoheritage (locations of rare minerals, rocks, fossils, caves and other geomorphological phenomena)	MoEPP in cooperation with Geological Survey, scientific institution and experts	2020	Budget of the RM, various grants	I	Programme for preventive protection of unique or endangered geoheritage (locations of rare minerals, rocks, fossils, caves and other geomorphological phenomena) is adopted
2.1.5	Development of a programme for mineralogical exploration in rare mineral areas in order to identify new minerals or mineral associations	MoEPP, ME in cooperation with Geological Survey, scientific institution and experts	2022-2025	Budget of the RM, various donations	II	Programme for mineralogical exploration in rare mineral areas in order to identify new minerals or mineral associations is adopted
2.1.6	Projects by nature protection stakeholders	Government of the RM, MoEPP, national parks, other protected areas, municipalities, NGOs	2017-2020	Budget of the RM, various grants	I	Nature protection capacities are strengthened

2.1.7	Implementation of best water management practices and their promotion	Government of the RM, MoEPP	2022	Budget of the RM,	II	Best practices are implemented
2.1.8	Introduction and implementation of actions aimed at landscape protection, management and planning through implementation of concrete measures;	Government of the RM, MoEPP	2022	Budget of the RM,	I	Actions for landscape protection are implemented
2.1.9	Improvement of the protected areas management system and mitigation of climate changes adverse impacts.	MoEPP in cooperation with scientific institutions and experts	2022	Budget of the RM, various grants	III	Management is improved
2.1.10	Strengthening the capacities of the judiciary to tackle environmental crime.	MoEPP in cooperation with scientific institutions and experts	2022	Budget of the RM, various grants	II	Capacities are strengthened
2.1.11	Identification of valuable sites and phenomena which are, or might be, affected by climate changes	MoEPP, ME in cooperation with scientific institutions and experts	2025	Budget of the RM, various donations	II	Valuable sites and phenomena which are, or might be, affected by climate changes are identified
2.1.12	Protection of upper portions of mountain rivers and glacial lakes against improper and excessive utilization.	Government of the RM, Ministry of Finance and MoEPP	continuous	Budget of the RM,	II	Upper portions of mountain rivers and glacial lakes are protected
2.1.13	Protection of ground waters against pollution, particularly in mountain and rural areas	Government of the RM, Ministry of Finance and MoEPP	2020	Budget of the RM, various donations	II	Ground waters are protected against pollution
2.1.14	Protection of urban rivers aimed at protection of the eco-systems	Government of the RM, Ministry of Finance and MoEPP	2020	Budget of the RM, various donations	II	Urban waters are protected
2.1.15	Identification of environmental flow of mountain aquatic eco-systems	Government of the RM, MoEPP, MAFWE	2020	Budget of the RM, various donations	I	Environmental flow of mountain aquatic eco-systems is identified
2.1.16	Development of summaries for protection of unprotected significant karst phenomena	MoEPP in cooperation with scientific institutions and experts	2017-2027	Budget of the RM,	I	At least 10 new summaries for protection of unprotected significant karst phenomena are developed
2.1.17	Development of a programme for cave monitoring (air, ground waters, cave decorations) particularly aimed at paleoenvironmental research.	MoEPP in cooperation with scientific institutions and experts	2017-2020	Budget of the RM, various donations	I	Programme for cave monitoring (air, ground waters, cave decorations) particularly aimed at paleoenvironmental research is adopted.

2.1.18	Development of study for protection and conservation of rare, unique and endangered soil types in the Republic of Macedonia (saline and halomorphic soils, red soils and eolian soils).	MoEPP in cooperation with scientific institutions	2017-2020	Budget of the RM, various donations	II	Indicator: Study is developed
2.2 **Landscape diversity**						
2.2.1	Detailed assessment of identified landscapes (taking into consideration special values attributed to landscapes by stakeholders and population)	Government of the RM, MoEPP, ME, MAFWE	continuous	Budget of the RM, various donations	II	Detailed landscape assessment is conducted
2.2.2	Definition of implementation guidelines related to biodiversity protection criteria at the level of landscape without limitations to borders of a certain protected area	Government of the RM, MoEPP	continuous	Budget of the RM, various donations	I	Criteria are set
2.2.3	Evaluation of biocorridors and undertaking measures for their revitalization through analyses of the state in the habitats,	Government of the RM, MoEPP, ME, MAFWE	continuous	Budget of the RM, various donations	I	Biocorridors are evaluated
2.2.4	Development of monitoring indicators related to the state in biocorridors and implementation of monitoring	Government of the RM, MoEPP, ME, MAFWE	continuous	Budget of the RM, various donations	II	Indicators are developed and monitoring is implemented
2.2.5	Economic and social study on the needs of rural areas/landscapes aimed at conservation of landscape features	Government of the RM, MoEPP, ME, MAFWE	2025	Budget of the RM, various donations	I	Study is developed
2.2.6	Maintenance of the traditional appearance of the settlements and conservation of ingenuousness of rural areas	Government of the RM, MoEPP, MAFWE	continuous	Budget of the RM, various donations	II	Traditional appearance is maintained
2.2.7	Integration of cultural values in landscapes of nature conservation interest	Government of the RM, MoEPP, MAFWE	continuous	Budget of the RM, various donations	I	Cultural values of important landscapes are integrated
2.3 **Biodiversity**						
2.3.1	Protection and revitalization of wetlands/aquatic habitats and riparian habitats	Government of the RM, MoEPP	continuous	Budget of the RM, various donations	III	Number of protected wetlands
2.3.2	Implementation of action plans for conservation of threatened species identified in red lists	MoEPP in cooperation with scientific institutions	2024-2027	Budget of the RM, various donations	II	Action plans are implemented

2.3.3	Implementation of *ex-situ* conservation of indigenous wild species	MoEPP in cooperation with scientific institutions	continuous	Budget of the RM, various donations	II	*Ex-situ* conservation is implemented
2.3.4	Development of national biodiversity indicators	MoEPP, scientific institutions, experts, MAFWE	2022-2024	Various grants, EU funds	II	Indicators are developed
2.3.5	Implementation of action plans deriving from international treaties and initiatives (e.g. birds and bats under Bonn Convention)	MoEPP in cooperation with scientific institutions, CSOs	continuous	Budget of the RM, various grants	II	Plans are implemented
2.3.6	Maintenance of (clearing house monitoring) CHM mechanism	MoEPP in cooperation with institutions responsible for data gathering	continuous	Budget of the RM, various grants	II	CHM mechanism updated
2.3.7	Update and maintenance of the national information system with biological diversity database and its upgrading to include monitoring data	MoEPP in cooperation with institutions responsible for data gathering	continuous	Budget of the RM, various grants	II	National Information System is updated
2.3.8	Update of national register of natural heritage and cadastre of protected areas	MoEPP, scientific institutions, Macedonian Museum of Natural History	2017-2026	Budget of the RM, various grants, EU funds	I	National register of natural heritage and cadastre of protected areas is updated
2.3.9	Procedures for designation of protected areas and natural rarities	Assembly of the RM, Government of the RM, MoEPP	continuous	Budget of the RM, various grants, EU funds	I	Number of designated protected areas and natural rarities
2.3.10	Implementation of protected areas management plans	MoEPP in cooperation with institutions responsible for data gathering	continuous	Budget of the RM, various grants, EU funds	II	Number of plans
2.3.11	Establishment of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) within the process of establishment of Natura 2000	MoEPP in cooperation with scientific and expert institutions, CSOs	2022 -	Budget of the RM, various grants, EU funds	I	Established NATURA 2000 areas
2.3.12	Detailed mapping and modelling of changes of certain mountain pastures, as a pilot-study on climate changes	Scientific institutions, MoEPP, other stakeholders	2017-2026	Budget of the RM, various grants	II	Number of regions mapped

2.3.13	Identification, monitoring and control of allochthonous species, particularly invasive species	MoEPP, scientific institutions, Hydrobiological institute, PAs	continuous	Budget of the RM, various grants	II	Number of identified species
2.3.14	Establishment of national monitoring system on the state of nature in protected areas and beyond them	Government of the RM, MoEPP	2018 -	Budget of the RM, various donations	II	National monitoring system is established
2.3.15	Opening reproduction centres for large wild animals	Government of the RM, MoEPP, national parks	2020	Budget of the RM, various donations	II	Reproduction centre is opened
2.3.16	Opening rescue and rehabilitation centres for large wild animals	Government of the RM, MoEPP, NGOs	2021	Budget of the RM, various donations	II	Rescue and rehabilitation centres for large wild animals is opened

NATIONAL TARGET 3

To embed the nature protection policies into the strategies, plans and programmes of other sectors by 2020.

Establishment of balance between the need for social growth and nature conservation poses a great challenge for responsible policy-makers and implementing institutions both at state and local level.

In 2012, the cornerstone of the post-2015 sustainable development process was set on the UN Conference on Sustainable Development (Rio + 20) and the world should undertake a historical action to change people's lives and protect the planet. Commitments deriving from all major UN conferences and summits related to economic, social and environmental issues were once again reaffirmed and strengthening of the international cooperation when tackling the existing challenges related to sustainable development, in particular, in the developing countries, was emphasized. Nevertheless, each country bears a primary responsibility for its own economic and social development, and the role of national policies, national resources and development strategies cannot be emphasized enough.

Integration of issues related to conservation and sustainable utilization of natural resources in the relevant sectoral policies and plans is one of the main requirements of the Convention on Biological diversity of the parties thereof.

Inclusion of the stakeholders links the planning and the implementation process; it enables access to larger number of necessary information and knowledge; it raises public awareness; consensus is built and policy on nature conservation issues is fully harmonized.

Seven main groups of stakeholders have been identified: state institutions (various ministries, agencies, institutes), state companies, public enterprises, scientific community, non-governmental organizations, private sector and local communities.

Actions in order to accomplish National Target 3:

NATIONAL TARGET 3 **To embed the nature protection policies into the strategies, plans and programmes of other sectors by 2020.**						
No.	**Action**	**Responsible institution**	**Implementation period**	**Funding**	**Category**	**Action Implementation Indicator**
3.1	Development of study on economic values of eco-system values of protected areas in the Republic of Macedonia	Government of the RM, MoEPP in cooperation with scientific institution and experts, national parks	continuous	Budget of the RM, Various grants	III	Study on economic values of eco-system values of protected areas is developed
3.2	Introduction of procedures for assessment of ecosystem services within individual sectors and their implementation in the process of adopting strategies, plans and programmes	Government of the RM, MoEPP, MAFWE, ME	2018-2022	Budget of the RM, various grants	II	Ecosystem services assessment procedures within separate sectors are introduced
3.3	Incorporation of procedures for assessment of ecosystem services in the legislation	Government of the RM, MoEPP, MAFWE, ME	2017-2022	Budget of the RM,	I	Procedures for assessment of ecosystem services are incorporated in the legislation
3.4	Incorporation of environmental accounting procedures at national level and for the business sector	Government of the RM, MoEPP, MF	2019-2022	Budget of the RM,	II	Environmental accounting is incorporated
3.5	Incorporation of procedures for green public procurement	Government of the RM, MoEPP, MF	2019-2020	Budget of the RM,	I	Procedures for green public procurement are incorporated
3.6	Harmonization of procedures for issuance of concessions for mineral raw materials with the legal environmental regulations	Government of the RM, MoEPP, ME	2017-2020	Budget of the RM,	I	Procedures for issuance of concessions for mineral raw materials are harmonized
3.7	Fostering use of green funds in all sectors	Government of the RM, MoEPP, MAFWE, ME	2018-2020	Budget of the RM, various grants	I	Increased percentage of use of green funds in all sectors
3.8	Inter-sectoral approach when drafting the new Spatial Plan	Government of the RM, MoEPP, MAFWE, ME, Space Planning Agency, scientific and competent institutions, experts	2018-2022	Budget of the RM	II	Spatial Plan of the RM

3.9	Establishment of proper environmental impact assessment in the national legislation in accordance with the EU directives	MoEPP	2020	Budget of the RM	I	Proper environmental impact assessment in accordance with the EU directives is established
3.10	Identification of opportunities for development of alternative tourism and its implementation in concrete areas of environmental importance	Government of the RM, MoEPP, ME, Agency for Promotion and Support of Tourism, national parks	2020	Budget of the RM, various grants	II	Opportunities for development of alternative tourism are identified
3.11	Development of study on renewable energy sources and cumulative environmental effects	Government of the RM, MoEPP, ME	2020	Budget of the RM, various grants	I	Study on renewable energy sources and cumulative environmental effects is developed
3.12	Harmonization of SEA and EIA procedures related to nature protection with EU directives	MoEPP	2020	Budget of the RM,	I	SEA and EIA procedures are harmonized
3.13	Encouraging the use of environmentally-friendly solutions in order to reduce natural disasters	Government of the RM, MoEPP, MAFWE	2017-2020	Budget of the RM, various grants	III	Use of environmentally-friendly solutions in order to reduce natural disasters
3.14	Establishment of partner relation between the government institutions, local self-governance, planning regions, non-governmental organizations, economy etc. in view of nature protection and conservation	Government of the RM, MoEPP, MAFWE, municipalities, planning regions, NGOs	2020	Budget of the RM, various grants	II	Partnerships for nature protection and conservation are established
3.15	Harmonization of forest ecosystems management and utilization of forest fruits	MoEPP, national parks, MAFWE, PE Macedonian Forests	2017-2020	Budget of the RM, various grants	II	Forest ecosystems management and utilization of forest fruits are harmonized
3.16	Creation of a green lobby group among all stakeholders	Government of the RM, MoEPP, protected areas, municipalities, NGOs	2020	Budget of the RM, various grants	I	Green lobby group is created
3.17	Establishment of a national body to control the exploitation and quality of ground water in areas where it is intensively used for agricultural purposes	Government of the RM, MoEPP, MAFWE	2020	Budget of the RM	II	National body to control the exploitation and quality of ground water in areas where it is intensively used for agricultural purposes is established
3.18	Development of measures and guidelines for development of cave tourism	Government of the RM, MoEPP, Agency for Development and Support of Tourism	2022	Budget of the RM, various grants	I	Measures and guidelines are developed

3.19	Integration of the concept of landscape into the policies for regional and urban planning, social and economic policies, cultural, environmental, agricultural policies, as well as other policies whose implementation may directly or indirectly impact the landscape;	Government of the RM, MoEPP	2022	Budget of the RM,	II	Sectoral landscape policies are harmonized
3.20	Establishment of integrated geographic information system with relational database about objects and phenomena of nature conservation interest to be used by the competent services and departments in state institutions, as well as public planning and design organizations.	MoEPP, ME, MAFWE, MTC in cooperation with scientific institutions and experts	2020	Budget of the RM, various grants	II	Geographic Information System is established
3.21	Integration of Geographic Information System on territories, objects and phenomena of nature conservation interest with the Geographic Information System on anthropogenic cultural and traditional heritage.	MoEPP, MC in cooperation with scientific institutions and experts	2020	Budget of the RM, various grants	II	GIS is integrated

NATIONAL TARGET 4

"To establish and practice sustainable use of the geodiversity and geoheritage and other components of nature (biological and landscape diversity) through the use of traditional knowledge, innovations, best practices and positive incentives related to conservation and sustainable use of the nature"

Improper use of natural resources often leads to their depletion and it poses a direct threat to their survival. The ecosystem approach in the utilization of natural resources is still insufficiently understood and accepted. Improper utilization of mineral resources leads to degradation of landscapes, destruction of natural habitats and wild species. Traditional agricultural practices are abandoned and improper practices are used, and herbicides, hormones and chemical substances are applied, while, in the forestry sector, illegal logging practices may be noticed. Also, improper gathering of medicinal herbs, fungi and animals often occurs.

Therefore, one of the priority issues to be solved is to eliminate such occurrences and to establish sustainable utilization of natural resources. In that context, in the recent years in Macedonia, various incentives through various forms of support have been provided for the agricultural sector.

Actions in order to accomplish National Target 4:

NATIONAL TARGET 4 **"To establish and practice sustainable use of the geodiversity and geoheritage and other components of nature (biological and landscape diversity) through the use of traditional knowledge, innovations, best practices and positive incentives related to conservation and sustainable use of the nature"**						
No.	**Action**	**Responsible institution**	**Implementation period**	**Funding**	**Category**	**Action Implementation Indicator**
4.1 Sustainable use of natural resources						
4.1.1	Identification of areas for European and World Geoparks Network	MoEPP in cooperation with scientific institutions and experts	2021	Budget of the RM, various donations	I	2-3 areas are identified and applications for European and World Geoparks Networks, which are bases for geodiversity conservation and promotion, are completed
4.1.2	Inclusion of the geoheritage into the tourist offer of the Republic of Macedonia and promotion of the geotourism	MoEPP in cooperation with scientific institutions and experts	2018-2025	Budget of the RM, various donations	I	Various forms of geotourism are developed and promotes, including visits to attractive geo-sites, extreme sports tourism, speleo-tourism, etc.
4.1.3	Setting national quotas for sustainable gathering of wild plants species, fungi, animals and commercially significant parts thereof	MoEPP in cooperation with scientific institutions and experts	2021	Budget of the RM, various donations	II	National quotas for sustainable gathering of wild plants species, fungi, animals and commercially significant parts thereof, are set
4.1.4	Setting quotas for national and international trade with wild plant species, fungi and commercially significant animals	MoEPP in cooperation with scientific institutions and experts	2017-2023	Budget of the RM, various donations	I	Quotas for national and international trade with wild plant species, fungi and commercially significant animals are set
4.1.5	Wildlife harvesting licenses	MoEPP, MAFWE, national parks, PE Macedonian Forests, other entities mandated to manage protected areas, wild species purchase companies	2017-2019	Budget of the RM, various grants	I	Number of issued licenses

4.1.6	Support to the management of forests of high biological diversity	MAFWE, MoEPP, PE Macedonian Forests, national parks and other protected areas, scientific institutions	2017-2019	Budget of the RM, various grants	II	Management of forests of high biological diversity is improved
4.1.7	Setting quotas for sustainable use of fish stock	MAFWE, MoEPP, Hydrobiological Institute in Ohrid	2017-2020	Budget of the RM, various grants	I	Quotas for sustainable use of fish stock are set
4.1.8	Setting quotas for sustainable use of pastures	MoEPP, MAFWE, national parks, PE of Pasture Management in cooperation with scientific and expert institutions	2017-2021	Budget of the RM, various donations	I	Quotas for sustainable use of pastures are set
4.1.9	Updating annual programmes for protection, breeding and management of wildlife in national parks	MAFWE, MoEPP, national parks, scientific and expert institutions, experts	continuous	Budget of the RM	I	Annual programmes for protection, breeding and management of wildlife in national parks are updated
4.1.1.0	Determination of List of areas to be avoided when opening mines and quarries for mineral resources exploitation	MoEPP, Ministry of Economy, scientific and expert institutions, experts	2017-2019	Budget of the RM, various donations	I	List of areas to be avoided when opening mines and quarries for mineral resources exploitation is determined
4.2 Usage of traditional knowledge, innovations and best practices						
4.2.1	Transfer of knowledge, innovations and good practices in sustainable use of natural resources (water, forests, soil, pastures and minerals)	MAFWE, MoEPP, national parks, PE Macedonian Forests, PE of Pastures Management, protected areas, scientific and expert institutions, experts	continuous	Budget of the RM, various donations	II	Number of delivered trainings on sustainable use of natural resources (water, forests, soil, pastures and minerals)
4.2.2	Support to implementation of good agricultural practice in areas with significant natural values	MAFWE, MoEPP, national parks, scientific and expert institutions, experts	continuous	Budget of the RM, various donations	II	Activities for implementation of good agricultural practice in areas with significant natural values are supported
4.2.3	Transfer of knowledge and international practices in the management and sustainable use of forests	MAFWE, MoEPP, PE Macedonian Forests, national parks, scientific and expert institutions, experts	continuous	Budget of the RM, various donations	I	Number of delivered trainings for transfer of knowledge and international practices in the management and sustainable use of forests

4.2.4	Transfer of knowledge and international practices in the landscape management	MoEPP, Ministry of Culture, scientific and expert institutions, experts	continuous	Budget of the RM, various donations	I	Number of delivered trainings for transfer of knowledge and international practices in the landscape management
4.3. Incentives for sustainable use of nature						
4.3.1	Introduction of incentives for poverty reduction through sustainable use of nature and payment of ecosystem services	MoEPP, MAFWE, national parks, other entities mandated to manage protected areas	2017-2023	Budget of the RM, various donations	II	Incentives are introduced Number of introduced measured for payment of ecosystem services
4.3.2	Introduction of agri-environment measures in agriculture	MAFWE, MoEPP, farmers, local population	2018-2022	Budget of the RM, various grants, EU funds	III	Agri-environment measures are introduced
4.3.3	Encouraging sustainable use of natural resources and creation of green jobs	Government of the RM, MoEPP, MAFWE	2020	Budget of the RM, various grants	II	Sustainable use of natural resources and creation of green jobs
4.3.4	Encouraging traditional use of biodiversity	MAFWE, MoEPP, farmers, local population	continuous	Budget of the RM, various grants, EU funds	II	Traditional use of biodiversity
4.3.5	Encouraging measures for maintenance and improvement of environmental values of rural landscapes	MoEPP, MAFWE, Federation of Farmers, farmers	2018-2023	Budget of the RM, various grants, EU funds	II	Measures for maintenance and improvement of environmental values of rural landscapes are introduced

NATIONAL TARGET 5

„To improve the legislation framework in accordance with the EU legislation and relevant ratified international treaties for nature protection and to provide adequate institutional framework by strengthening the administrative capacities"

In order to provide integral protection and conservation of the geodiversity, geoheritage, biological and landscape diversity, it is important to enhance the national legislation on nature protection and to systematically strengthen capacities at central and local level. Undertaking concrete actions is a priority in view of provision of long-term nature protection and conservation.

National Target 5 contains actions whose implementation will result in more efficient implementation of the national legislation on nature protection, its harmonization to EU acquis in the area of nature protection and adoption of the most important strategic documents.

Moreover, National Target 5 contains actions aimed at establishment of a new national competent body for nature protection, nature protection fund, as well as strengthening the MoEPP's capacities, other ministries, agencies, public enterprises, national parks and other entities mandated to manage protected areas, self-government units, non-governmental organizations and civil society organization and local population.

This Target also contains actions on strengthening the capacities of existing bodies, as well as establishment of new committees/bodies on nature protection related issues.

Actions in order to accomplish National Target 5:

NATIONAL TARGET 5 **"To improve the legislation framework in accordance with the EU legislation and relevant ratified international treaties for nature protection and to provide adequate institutional framework by strengthening the administrative capacities"**						
No.	**Action**	**Responsible institution**	**Implementation period**	**Funding**	**Category**	**Action Implementation Indicator**
5.1 Promotion of national legislation						
5.1.1	Adoption of new Nature Protection Law, harmonized with EU acquis in the area of nature protection and adopted conventions, as well as with the provisions of the European Landscape Convention	Assembly of the RM, Government of the RM, MoEPP in cooperation with scientific institution and experts	2017	Budget of the RM, various grants	/	New Nature Protection Law is adopted
5.1.2	Adoption of special Law on Protection of Karsts and Caves	Assembly of the RM, Government of the RM, MoEPP in cooperation with scientific institution and experts	2018	Budget of the RM, various grants	I	Special Law on Protection of Karsts and Caves is adopted
5.1.3	Adoption of laws for designation of protected areas	Assembly of the RM, Government of the RM, MoEPP in cooperation with scientific institution and experts	continuous	Budget of the RM, various grants	/	Number of adopted laws for designation of protected areas
5.1.4	Adoption of by-laws for protection and sustainable management of geodiversity, geoheritage, biological and landscape diversity	Government of the RM, MoEPP in cooperation with scientific institution and experts	continuous	Budget of the RM, various grants	/	Number of adopted by-laws
5.1.5	Adoption of acts for designation of certain parts of nature as natural rarities	MoEPP in cooperation with scientific institutions and experts	continuous	Budget of the RM, various grants	/	Number of adopted acts for designation of certain parts of nature as natural rarities
5.1.6	Harmonization of national legislation of forestry, pastures, agriculture, hunting, fishery and aquaculture, use of mineral resources and protection of cultural heritage with the nature protection legislation	MoEPP in cooperation with Ministry of Agriculture, Forestry and Water Economy, Ministry of Economy and Ministry of Culture	2017-2018	Budget of the RM, various grants	I	National legislation from other sectors is harmonized with nature protection legislation Number of adopted and amended laws and bylaws
5.1.7	Adoption of National Biodiversity Strategy with Action Plan	Government of the RM, MoEPP in cooperation with scientific institution and experts	2017	Budget of the RM, various grants	/	National Biodiversity Strategy with Action Plan is adopted

5.1.8	Adoption of National Strategy for Geodiversity Protection with Action Plan	Government of the RM, MoEPP in cooperation with scientific institution and experts	2022	Budget of the RM, various grants	I	National Strategy for Geodiversity Protection with Action Plan is adopted
5.1.9	Adoption of National Strategy for Karst Protection with Action Plan	Government of the RM, MoEPP in cooperation with scientific institution and experts	2023	Budget of the RM, various grants	I	National Strategy for Karst Protection with Action Plan is adopted
5.1.10	Adoption of national red lists	Government of the RM, MoEPP in cooperation with scientific institution and experts	2024	Budget of the RM, various donations	/	Number of adopted national red lists
5.1.11	Adoption of national red books	Government of the RM, MoEPP in cooperation with scientific institution and experts	2024	Budget of the RM, various donations	/	Number of adopted national red books
5.1.12	Adoption of protected areas management plans	MoEPP in cooperation with other entities mandated to manage protected areas, scientific institutions and expert	continuous	Budget of the RM, various donations	/	Number of protected areas management plans
5.1.13	Adoption of new Spatial Plan of the Republic of Macedonia	Assembly of the RM, Government of the RM, MoEPP in cooperation with scientific institution and experts, Space Planning Agency	2020-2021	Budget of the RM, various donations	I	Spatial Plan of the RM is adopted
5.1.14	Adoption of spatial plans for all planning regions	Assembly of the RM, Government of the RM, local self-government units from planning regions, MoEPP in cooperation with scientific institution and experts, Space Planning Agency	2017-2022	Budget of the RM, various donations	/	Spatial plans for all planning regions are adopted
5.1.15	Adoption of spatial plans for Pelister, Galilchica and Mavrovo national parks	Assembly of the RM, Government of the RM, MoEPP in cooperation with scientific institution and experts	2017-2020	Budget of the RM, various donations	/	Three spatial plans for the national parks are adopted
5.1.16	Adoption of National Ecological Network	Government of the RM, MAFWE, MoEPP, ME, MTC	2017-2020	Budget of the RM,	I	National Ecological Network is adopted

5.1.17	Adoption of representative national protected areas network	Government of the RM, MoEPP	2017-2020	Budget of the RM,	I	Representative national protected areas network is adopted
5.1.18	Adoption of National List of invasive species	Government of the RM, MoEPP	2025	Budget of the RM, various donations	I	National List of invasive species is adopted
5.2 Strengthening the institutional capacities at central and local level						
5.2.1	Establishment of Bureau/Agency for Nature Protection based on developed study	Government of the RM, Ministry of Finance and MoEPP	2017-2018	Budget of the RM,	III	Bureau/Agency for Nature Protection is established and functional
5.2.2	Establishment of Nature Conservation Fund	Government of the RM, Ministry of Finance, MoEPP	2018	Budget of the RM, various donations	III	Nature Conservation Fund is established and functional
5.2.3	Strengthening the institutional capacities of the MoEPP	Government of the RM, Ministry of Finance and MoEPP	continuous	Budget of the RM, various donations	III	Capacities of MoEPP are strengthened Number of newly employed persons in the Department of Nature and other departments in the MoEPP Number of delivered trainings, workshops, seminars, etc. Number of trained and educated persons from MoEPP related to nature protection issues
5.2.4	Strengthening the capacities of other ministries, agencies and public enterprises for nature management	Government of the RM, Ministry of Finance, agencies and public enterprises	continuous	Budget of the RM, various donations	II	Capacities of ministries, agencies and public enterprises are strengthened Number of newly employed persons in nature protection related jobs Number of delivered trainings, workshops, seminars, etc. Number of trained persons
5.2.5	Strengthening the capacities of national parks and other entities mandated to manage protected areas	Government of the RM, Ministry of Finance, public enterprises national parks and other entities mandated to manage protected areas, MoEPP	continuous	Budget of the RM, public enterprises national parks and other entities mandated to manage protected areas, various donations	II	Capacities of national parks and other entities mandated to manage protected areas are strengthened Number of newly employed persons Number of delivered trainings, workshops, seminars, etc. Number of trained persons

5.2.6	Strengthening the capacities of scientific and expert institutions working in the field of nature exploration, study and protection	Government of the RM, Ministry of Finance, Ministry of Education, scientific and expert institutions	continuous	Budget of the RM, Budget of scientific and expert institutions, various donations	III	Capacities of scientific and expert institutions are strengthened Number of newly employed persons Number of delivered trainings, workshops, seminars, etc. Number of trained persons
5.2.7	Strengthening the capacities of non-governmental organizations, civil society organizations and local population	Non-governmental organizations, civil society organizations and local population	continuous	Budget of the RM, various donations	II	Capacities of non-governmental organizations, civil society organizations and local population are strengthened Number of delivered trainings, workshops, seminars, etc. Number of trained persons
5.2.8	Establishment of nature protection departments within the units of local self-government units (ULSG)	Government of the RM, Ministry of Finance and ULSG	2017-2020	Budget of the RM, budget of ULSG	III	Nature protection departments within the units of local self-government (ULSG) are established.
5.2.9	Strengthening the nature protection capacities of units of local self-government (ULSG)	Government of the RM, Ministry of Finance, ULSG, Association of units of local self-government	continuous	Budget of the RM, budget of the ULSG various donations	II	Nature protection capacities of units of local self-government (ULSG) are strengthened Number of newly employed persons in nature protection related jobs Number of delivered trainings, workshops, seminars, etc. Number of trained persons
5.2.10	Provision of operability and functionality of the National Council for Nature Protection	MoEPP in cooperation with scientific institutions and experts	continuous	Budget of the RM, various donations	I	National Council for Nature Protection is operational and functional Number of issued opinions related to various nature protection issues
5.2.11	Provision of operability and functionality of the National Committee for Biological Diversity	MoEPP in cooperation with MASA, scientific institutions and experts	continuous	Budget of the RM, various donations	I	National Committee for Biological Diversity is operational and functional Number of issued opinions related to various biodiversity protection issues Number of developed national and thematic papers

5.2.12	Provision of operability and functionality of national committees for ratified international biodiversity-related treaties	MoEPP in cooperation with scientific institutions and experts	continuous	Budget of the RM, various donations	I	National committees for ratified international biodiversity-related treaties (Ramsar, Bern, Bonn Convention, UNESCO, etc.) are established Number of issued opinions related to various biodiversity protection issues Number of developed national and thematic papers
5.2.13	Establishment and operability National Geodiversity Committee	MoEPP in cooperation with scientific institutions and experts	continuous	Budget of the RM, various donations	I	National Geodiversity Committee is established and operational Number of issued opinions related to various geodiversity protection issues Number of developed reports
5.2.14	Establishment of National Expert Council for Protection of Karst and Karst Phenomena	MoEPP in cooperation with scientific institutions and experts	continuous	Budget of the RM, various donations	I	National Expert Council for Protection of Karst and Karst Phenomena is established and operational Number of issued opinions related to various issues on protection of karst and karst phenomena
5.2.15	Establishment of a national body to control the exploitation and quality of ground of water in areas where it is intensively used for agricultural purposes	MoEPP in cooperation with scientific institutions and experts	continuous	Budget of the RM,	I	National body to control the exploitation and quality of ground of water is established and operational Number of issued opinions related to various issues on the control of exploitation and quality of ground water
5.2.16	Strengthening the capacities of the Geological Survey of the Republic of Macedonia	Government of the RM, Ministry of Finance	continuous	Budget of the RM	II	Geological Survey of the Republic of Macedonia is functional Number of newly employed persons Number of delivered trainings, workshops, seminars, etc. Number of trained persons Number of developed expert studies, reports etc. Geology related papers Number of issued opinions related to various geology issues

5.2.17	Functional Councils for management of river watersheds of Vardar, Bregalnica, Strumica and Crn Dim rivers	Government of the RM, Ministry of Finance	continuous	Budget of the RM,	I	Establishment of Councils for management of river watersheds of Vardar, Bregalnica, Strumica and Crn Dim rivers Number of held and adopted decisions
5.2.18	Construction of a Centre for geodiversity/geoheritage within the Museum of Natural History	Government of the RM in cooperation with scientific institution and experts	2020	Budget of the RM, various donations	II	Centre for geodiversity/geoheritage is constructed
5.2.19	Establishment of a body to check, process and disseminate information in real-time at national and international level (World Meteorological Organization –WMO, Hydrology and Water Resources Programme – HWRP).	Government of the RM, MoEPP	2022	Budget of the RM,	I	Coordinative body is established
5.2.20	Increase the inclusion of local communities and stakeholders in the protected areas management	MoEPP, national parks, local communities, other entities mandated to manage protected areas, NGOs	continuous	Budget of the RM, various donations	I	Inclusion of local communities and stakeholders in the management of protected areas is increased
5.2.21	Intensify cooperation with international institutions and organizations working in the field of nature protection (EEA, secretariats of conventions, IUCN, WWF, WDPA, UNEP, UNDP, SDC, GEF, etc.)	MoEPP, national parks, local community, other entities mandated to manage protected areas, NGOs	continuous	Budget of the RM, various donations	II	Cooperation is intensified
5.2.22	Development of training plan for strengthening administrative capacities required for Natura 2000 implementation	MoEPP, international and national experts	2017	Budget of the RM, various grants, IPA funds	I	Training plan is developed
5.2.23	Implementation of long-term training plan on Natura 2000 intended for stakeholders	MoEPP, national parks, other entities mandated to manage protected areas, municipalities, MAFWE, MTC, ME, MC, agencies and public enterprises, scientific and expert institutions, AD Elem, MEPSO, EVN, NGOs, and CSOs, business sector	continuous	Budget of the RM, various grants, IPA funds	I	Long-term training plan on Natura 2000 intended for stakeholders is implemented

NATIONAL TARGET 6.

“To raise the level of information, education and promotion of the value of the geodiversity and geoheritage and other components of nature (biological and landscape diversity)”

The main goal is to improve the level of information, education and promotion of values, of conducting exploration activities, as well as to raise the public awareness in the country, in order to include target groups at national and local level and to raise the awareness on nature protection related issues. Detailed actions in the Action Plan will enable MoEPP to improve communications and to conduct serious of targeted, tailored communication activities to raise the public awareness level on nature protection among the key target groups, and to encourage further activities initiated by various stakeholders. Joint activities with other sectors (in particular, the tourism sector) will contribute to promotion and rising of public awareness of the values of the geodiversity and geoheritage and other components of nature (biological and landscape diversity).

Actions in order to accomplish National Target 6:

NATIONAL TARGET 6. To raise the level of information, education and promotion of the value of the geodiversity and geoheritage and other components of nature (biological and landscape diversity).						
No.	**Action**	**Responsible institution**	**Implementation period**	**Funding**	**Category**	**Action Implementation Indicator**
6.1 Education and promotion of nature protection						
6.1.1	Development of a Strategy and Communication Action Plan for nature protection at national level	MoEPP in cooperation with scientific institutions and experts	2017-2019	Budget of the RM, various donations	I	Strategy and Communication Action Plan for nature protection at national level is adopted
6.1.2	Implementation of Strategy and Communication Action Plan for nature protection at national level	MoEPP in cooperation with scientific institutions and experts	2019-2027	Budget of the RM, various donations	II	Strategy and Communication Action Plan for nature protection at national level is implemented
6.1.3	Strengthening the capacities for communication on nature protection (at national and local level)	MoEPP in cooperation with scientific institutions and experts, public institution National Parks, municipalities and other entities mandated to manage protected areas	continuous	Budget of the RM, various donations	II	Capacities for communication on nature protection are strengthened
6.1.4	Determination of the knowledge and public awareness of the values of the geodiversity and geoheritage and other components of nature (biological and landscape diversity) of various target groups.	MoEPP in cooperation with public institution National Parks, municipalities and other entities mandated to manage protected areas, scientific institutions and experts,	continuous	Budget of the RM, various donations	I	Knowledge and public awareness of the values of the geodiversity and geoheritage and other components of nature (biological and landscape diversity) is increased
6.1.5	Preparation of a plan for education in the area of biological diversity (for formal and informal education)	MoEPP in cooperation with Ministry of Education, scientific institutions and experts	2019-2020	Budget of the RM, various donations	I	Plan for education in the area of biological diversity (for formal and informal education) is developed
6.1.6	Introduction of topics related to geodiversity and geoheritage and other components of nature (biological and landscape diversity) in kindergartens	MoEPP in cooperation with Ministry of Education, scientific institutions and experts	2021-2027	Budget of the RM, various donations	I	Topics related to geodiversity and geoheritage and other components of nature (biological and landscape diversity) in kindergartens are introduced

6.1.7	Introduction of topics related to geodiversity and geoheritage and other components of nature (biological and landscape diversity) in primary and secondary schools	MoEPP in cooperation with Ministry of Education, scientific institutions and experts	2021-2027	Budget of the RM, various donations	I	Topics related to geodiversity and geoheritage and other components of nature (biological and landscape diversity) in primary and secondary schools are introduced
6.1.8	Delivery of thematic and educational lectures on topics related to geodiversity and geoheritage and other components of nature (biological and landscape diversity) in primary and secondary schools	MoEPP in cooperation with Ministry of Education, scientific institutions and experts	continuous	Budget of the RM, various donations	I	Number of delivered thematic and educational lectures in primary and secondary schools
6.1.9	Organization of educational field trips on topics related to geodiversity and geoheritage and other components of nature (biological and landscape diversity) for primary and secondary schools	MoEPP in cooperation with Ministry of Education, public institutions national parks, municipalities, scientific institutions and experts	continuous	Budget of the RM, various donations	II	Number of realized field and educational trips
6.1.10	Creation and maintenance of web portals for promotion of the geodiversity and geoheritage and other components of nature (biological and landscape diversity).	MoEPP in cooperation with Ministry of Economy – Department of Tourism, Ministry of Culture, Agency for Promotion of Tourism, municipalities, scientific institutions and experts	continuous	Budget of the RM, various donations	I	Number of created web portals for promotion of the geodiversity and geoheritage and other components of nature (biological and landscape diversity) Number of uploaded and promoted materials
6.1.11	Electronic promotion of the importance and values of the geodiversity and geoheritage and other components of nature (biological and landscape diversity)	MoEPP in cooperation with Ministry of Economy – Department of Tourism, Ministry of Culture, Agency for Promotion of Tourism, municipalities, scientific institutions and experts	continuous	Budget of the RM, various donations	I	Importance and values of the geodiversity and geoheritage and other components of nature (biological and landscape diversity) are promoted
6.1.12	Celebration of international days related to nature protection	MoEPP in cooperation with public institution National Parks, municipalities and other entities mandated to manage protected areas, scientific institutions and experts, NGOs and CSOs, media, etc.	continuous	Budget of the RM, various donations	I	International days related to nature protection are promoted

6.1.13	Preparation and publication of vocational and popular books/manuals/brochures on the values of the geodiversity and geoheritage and other components of nature (biological and landscape diversity)	MoEPP in cooperation with scientific institutions and experts, Ministry of Education and Science, Ministry of Culture, MASA	continuous	Budget of the RM, various donations	II	Vocational books/manuals/brochures are published
6.1.14	Organization and implementation of national campaign on preservation of values of the geodiversity and geoheritage and other components of nature (biological and landscape diversity) are promoted	Government of the RM, MoEPP	continuous	Budget of the RM, various donations	II	National campaigns are conducted
6.1.15	Establishment of association of stakeholders (lobby group) – nature protection supporters	Government of the RM, MoEPP, Association of journalists (journalists, hunters, gatherers of medicinal plants, fungi and animals, CSOs and local population, etc.	2020	Budget of the RM, various donations	II	Association of stakeholders (lobby group) – nature protection supporters is established
6.1.16	Opening of regional info centres for promotion of the importance and values of the geodiversity and geoheritage and other components of nature (biological and landscape diversity)	MoEPP, Association of Units of Local Self-Government, Centres for regional development	2021-2027	Budget of the RM, various donations	II	Number of regional info centres for promotion of the importance and values of the geodiversity and geoheritage and other components of nature (biological and landscape diversity)
6.1.17	Participation in domestic and international events for nature promotion (conferences, workshops, seminars, round tables, fairs, etc.)	MoEPP	continuous	Budget of the RM,	II	Value of nature is promoted at national and international events
6.1.18	Filming and presentation of documentary films on values of the geodiversity and geoheritage and other components of nature (biological and landscape diversity)	MoEPP, MoTC, scientific institutions	continuous	Budget of the RM,	II	Number of filmed shows on nature values Number of presented shows on nature values
6.1.19	Encouraging and providing incentives for establishment of educational eco-parks	MoEPP, MoES, scientific institutions	2020	Budget of the RM,	I	Incentives provided

6.1.20	Development of tools and guidance for definition, recognition and promotion of values of mountain/upstream river flows	MoEPP, scientific institutions, experts	2023	Budget of the RM, various donations	I	Guidance is developed
6.1.21	Implementation of public awareness raising campaign about the significance of Natura 2000	MoEPP, National Parks, and other entities mandated to manage protected areas, municipalities and other stakeholders	continuous	Budget of the RM, various grants, IPA funds	I	NATURA 2000 campaign is implemented
6.1.22	Maintenance and update of interactive Natura 2000 web portal	MoEPP	continuous	Budget of the RM, various donations	I	Interactive Natura 2000 web portal
6.1.23	Production of informative tools on Natura 2000 (leaflets, brochures. posters, CDs, etc.)	MoEPP, National Parks, and other entities mandated to manage protected areas, municipalities, experts, etc.	continuous	Budget of the RM, various grants, IPA funds	I	Natura 2000 informative tools are produced

NATIONAL TARGET 7

"To provide continuous and increased financing of the nature protection by budget finances at central and local level, by investments and other sources of financing, through establishment of appropriate sustainable and efficient financing models for protection and sustainable use of nature"

Provision of funds both at central and local level is one the main prerequisites priorities for implementation of all national targets and actions prescribed within the Action Plan of the Strategy for Nature Protection. In accordance of the Law on Nature Protection („Official Gazette of the RM" no.67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16) funds for nature protection shall be provided by the Budget of the Republic of Macedonia and budgets of the units of local self-government.

Funding nature protection is related to „user-pays" principle as referred to in Article 7 of the Law on Nature Protection, meaning that the user of natural capital bears the costs for maintenance of ecological balance when utilizing and benefiting from the natural heritage, as well for repair of environmental degradation accompanying exploitation and enjoyment of natural heritage.

Article 161 of the Law on Nature Protection stipulates compensations that may be used for funding nature protection, or protected area, while Article 141-a stipulates the same compensations, but they refer to funding public institutions national parks.

National Target 7 contains actions whose main goal is to provide continuous and increased funding of nature protection from the Budget of the Republic of Macedonia, budget of the municipalities and various donations, as well as by introduction of additional financial instruments for nature protection.

Actions in order to accomplish National Target 7:

NATIONAL TARGET 7 **"To provide continuous and increased financing of the nature protection by budget finances at central and local level, by investments and other sources of financing, through establishment of appropriate sustainable and efficient financing models for protection and sustainable use of nature"**						
No.	**Action**	**Responsible institution**	**Implementation period**	**Funding**	**Category**	**Action Implementation Indicator**
7.1 Continuous increase of financial assets for nature protection from the Budget of the Republic of Macedonia, budgets of the units of local self-government and various donations						
7.1.1	Provision of financial assets for operations of Nature Conservation Fund	Government of the RM, Ministry of Finance and MoEPP	2020	Budget of the RM, various donations	III	Nature Conservation Fund is established and functional
7.1. 2	Increased funding of nature protection projects through the Programme for Environmental Investments	Ministry of Finance and MoEPP	Continuous	Budget of the RM	III	Number of financed nature protection projects
7.1.3	Increased financial support for scientific exploration, research and inventarization in the area of geodiversity and geoheritage and other components of nature (biological and landscape diversity).	Ministry of Finance, Ministry of Education and Science and MoEPP	Continuous	Budget of the RM, various donations	III	Increased number of financed scientific exploration, research and inventarization in the area of geodiversity and geoheritage and other components of nature (biological and landscape diversity).
7.1.4	Increased financial support for monitoring of geodiversity and geoheritage and other components of nature (biological and landscape diversity) are promoted	Ministry of Finance, MoEPP, National Parks, municipalities and other entities mandated to manage protected areas	Continuous	Budget of the RM, various donations	II	Increased financial support for monitoring of geodiversity and geoheritage and other components of nature (biological and landscape diversity)
7.1.5	Increased financial support for management of protected areas	Ministry of Finance, MoEPP, National Parks, municipalities and other entities mandated to manage protected areas	Continuous	Budget of the RM, various donations	II	Financial support for management of protected areas is increased

7.1.6	Mobilization of assets from payments for ecosystem services in protected areas and beyond them	Ministry of Finance, MoEPP, National Parks, municipalities and other entities mandated to manage protected areas	2018-2027	Legal and natural persons in protected areas and beyond them	II	Assets from payments for ecosystem services are provided
7.1.7	Provision of nature protection funds by sustainable use of nature resources (exploitation of mineral resources, use of land, forests, collection of medicinal plants, fungi, etc.)	Ministry of Finance, Ministry of Agriculture, Forestry and Water Economy, Ministry of Economy, MoEPP, municipalities, etc.	Continuous	Budget of the RM, municipality budget	I	Funds for nature protection are provided by sustainable use of nature resources
7.1.8	Strengthening national capacities for development of EU-funded nature protection projects (Life + Programme), as well projects funded by other international donors	MoEPP in cooperation with national parks, municipalities and other entities mandated to manage protected areas, agencies, public enterprises, scientific and expert institutions, NGOs and CSOs	Continuous	EU funds	I	National capacities for development of EU-funded nature protection projects are strengthened
7.1.9	Organization of fundraising donor conferences for protection, study, monitoring and promotion of the geodiversity and geoheritage and other components of nature (biological and landscape diversity).	MoEPP in cooperation with national parks, municipalities and other entities mandated to manage protected areas, agencies, public enterprises, scientific and expert institutions, business sector and NGOs	Continuous	International donors	I	Number of organized fundraising donor conferences for protection, study, monitoring and promotion of the geodiversity and geoheritage and other components of nature (biological and landscape diversity).
7.1.10	Opening of Ohrid-Prespa Nature Trust	MoEPP	2017-2025	Various donors (KWf and MAVA foundation)	I	Ohrid-Prespa Nature Trust is opened

7.1.11	Purchase of hardware and software equipment compatible to the most used software application used by beneficiary institutions	MoEPP	2020	Budget of the RM, various donations	II	Adequate IT equipment is procured
7.2 Introduction of additional financial instrument for nature protection						
7.2.1	Introduction of incentive mechanism and reinvestment allowance in nature protection	Ministry of Finance, MoEPP, National Parks, municipalities and other entities mandated to manage protected areas, scientific and expert institutions	2018-2019	Budget of the RM	II	Incentive mechanism and reinvestment allowance in nature protection are introduced
7.2.2	Introduction of tax incentives and subsidies for services and products from protected areas	Ministry of Finance, tax authorities and MoEPP	2018-2023	Budget of the RM	I	Tax incentives and subsidies for services and products from protected areas are introduced
7.2.3	Introduction of tax alleviations for financing nature protection measures undertaken by the business sector	Ministry of Finance, tax authorities and MoEPP	2018-2023	Budget of the RM	I	Tax alleviations for financing nature protection measures undertaken by the business sector are introduced
7.2.4	Reimbursement for damages to ecosystems in protected areas and beyond them	Ministry of Finance and MoEPP	Continuous	Legal and natural persons in protected areas and beyond them	I	Funds for reimbursement for damages to ecosystems in protected areas and beyond them are provided
7.2.5	Provision of finances by implementing compensatory measures in order to compensate for or mitigate nature degradation	Ministry of Finance and MoEPP	Continuous	Budget of the RM, municipality budget	III	Finances from compensatory measures are provided
7.2.6	Provision of nature protection finances by redistribution of existing tax incomes, fees and taxes from fossil fuel production and trade, vehicle registration, water management and electricity generation	Ministry of Finance and MoEPP	2018-2017	Budget of the RM, municipality budget	I	Nature protection finances are provided by redistribution of existing tax incomes, fees and taxes from fossil fuel production and trade, vehicle registration, water management and electricity generation

5.2.5. MONITORING OF THE IMPLEMENTATION OF THE NATIONAL STRATEGY FOR NATURE PROTECTION AND THE ACTION PLAN (2017-2027)

An extremely important tool for continuous monitoring of the implementation of national targets' actions as referred to in the Strategy is to found a Supervisory Committee which will be approved by the Government of the Republic of Macedonia. It is crucial to provide finances for the operations of such body composed of high representatives of ministries aimed at providing funds and smooth implementation of activities by development of monitoring indicators for strategy implementation.

In accordance with Article 160 of the Law on Nature Protection, five-year plans and annual programmes are adopted to ensure Strategy's full implementation.

Five-year nature protection plans are adopted by the Minister in charge of the state administration body responsible for the pursuit of nature protection activities.

Annual nature protection programmes are adopted by the body competent to pursue expert activities in the field of nature protection.

The Department of Nature within the Ministry of Environment and Physical Planning, as a main organizational unit, shall prepare and propose annual action programmes related to the strategy implementation.

The Department of Nature shall draft annual reports on strategy implementation, in cooperation with relevant ministries, agencies, public enterprises, scientific and expert institutions, experts, NGOs and other entities involved in the implementation of the Strategy's actions and it shall inform the Government thereof.

Based on the annual reports, the Department of Nature, in cooperation with other entities implementing strategy's activities, shall draft two five-year (midterm) reports on the strategy implementation, considering that the duration of the Strategy is 10 years.

The Ministry of Environment and Physical Planning of the Republic of Macedonia, in cooperation with the Supervisory Committee, shall submit the midterm reports for approval to the Government of the Republic of Macedonia.

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6. ANNEXES

ANNEX 1.

LIST OF SELECTED SIGNIFICANT GEOHERITAGE IN THE AREA OF GEOLOGY, GEOMORPHOLOGY AND HYDROLOGY IN THE REPUBLIC OF MACEDONIA

List of selected significant geoheritage sites in the field of geology that should be taken into account in the preparation of the new Spatial Plan of the Republic of Macedonia

Name of the site	Description
Palaeontology	
Alipashica	macro and micro fossil fauna from lower Cambrian period
Babin srt	Trilobite fauna, characteristic for Ordovician period
Manastir	Important vertebrate and macroflora fossil sites
Toni voda	fauna fossils of nautiloids, shells, brachiopods, tentaculites, ostracods, conodonts. Fauna is typical of lower Devonian
Zmijarnik (Lozovo)	Upper Eocene fossils
Kale Banjichko	Fossil fauna is found in banked limestone, Upper Cretaceous
Kalnica	Fossil records of vertebrate bones, mainly from Pikermian fauna.
Karaslari	Pikermian fauna
Kale – Skopje's Fortress	Pliocene sediments with flora and fauna remains
Orashac	Mediterranean marine province from Upper Jurassic
Prevalec	Pikermian fauna
Zvegor	Thrusting of Triassic limestones through Paleogene sediments – flysch and presence of young volcano vents. 3-7 million old fossil fauna
Stamer	Paleontological significance
Bashibos	Pikermian fauna
Bashino Selo	Pikermian fauna
Belushka	Pikermian fauna
Brca	Pikermian fauna
Dechki Kamen	Facies from the Upper Cretaceous period with fauna remains
Dobovjani	Red limestone fossil site, occurring as intercalations in series of Middle Triassic sandstones, aleurolite and clays
Korica	Profile is illustrated by the development of Cenomanian and Turonian stage of Cretaceous period in Vardar zone
Miklina Cheshma	Eocene flysch – 1 meter thick sandstones highly rich in fossil fauna.
Mocharnik	Upper Cretaceous form Albian-Cenomanian period rich in marine fauna
Nemanjica	Upper Eocene flysch complex rich in fossil flora and fauna
Veshje	Pikermian fauna
Machevo	Paleontological significance

Paleo-volcanism	
Katlanovo region	volcano phenomena and thermal springs
Mramor	Parallelepiped structures of trachyandesite lava discharge in a shape of a large horn
Pillow lavas Gradec	Specific phenomenon of magmatites (spilites), so called Pillow lavas
Volcanic bombs, Probishtip	Pyroclastic deposit – volcanic bombs.
Kokino (Tatikjev kamen)	Effusion of pyroxene andesites and andensites, 32-33 million years old.
(Mlado Nagorichane)	Striking basalt plates
Pelagic profile near Demir Kapija	Transition from magmatic-sedimentary rocks into purely marine (pelagic) portion of oceanic crust in Vardar zone
Post-volcanism	
Duvalo (Kosel)	Mofetta, solfatara
Structural geology	
Pashin Most	fold forms with metre and decametre dimensions (synclines, anti-clines). Paleontological significance
Ulanci	Micro-relief forms in spherical and oval forms, and stone slabs
Shtavica Dome	Rare structural phenomenon of a dome in Macedonia
Bobishte brachysynclinal	Typical brachysynclinal made of mica minerals rich in granites, dystens and staurolites
Klepa	Tectonic block of oceanic crust of Jurassic Vardar Ocean
Veles ravine on Vardar River	Epigenetic ravine, GEOLOGICAL VALUES
Mineralogy	
Rogachevo (Plocha)	
Alshar (Maidan)	Mineral resources site of world importance
Prilepec	Pegmatite vein rich in dysten, granite, staurolite, tourmaline, apatite and rutile
Machevo	Quartz crystals – rock crystal
Karst hydrogeology	
Belchishte Marsh	Marsh with an area of 0.5 km2
Historical and geological importance	
Gramadite-Konsko	Heaps of gravel material, bundled in a form of mine dumps (tails) dating from gold exploitation in ancient times

List of selected significant geoheritage sites in the field of geomorphology that should be taken into account in the preparation of the new Spatial Plan of the Republic of Macedonia

Structural landforms	***Description***
Major ridges and peaks on Shar Mountain	Striking ridges and peaks (Titov Vrv, Mal Turchin, Bakrdan, Ljuboten)
Major ridges and peaks on Mokra Mountain	Striking ridges and peaks (Solunska Glava, Karadjica)
Major ridges and peaks on Korab, Deshat and Krchin	Ridges, Golem Korab, Kabash, Velivar, Golem Krchin
Major ridges and peaks on Jablanica	Main ridge, Crn Kamen, Strizhak
Major ridges and peaks on Kozhuf	Narrow ridge on Kozhuf, with several striking peaks
High peaks on Stogovo	Golem Rid, Kamesh, Babin Srt
High peaks on Bistra	Medenica, Kjurkov Dol
High peaks on Osogovo Mountains	Ruen (2252m) and Carev Vrv (2085m), striking, rounded, with glacial and periglacial landforms
Main ridge on Belasica	Striking, straight ridge on Belasica, 1500-1881 m high
Nezhilovski karpi	800 m high tectonic gap on the Jakupica Mountain, south of Solunska Glava
Karov Kamen	500 m high tectonic gap on the western side of Galichica
Karadjica gap	500-800 m high tectonic gap on the western side of Karadjica-Mokra
Ratkova Skala	Tectonic fluvial gap by quartzite, with ‘quartzite relief’ on Osogovo, near Zletovo
Paleovolcanic landforms	
Lesnovo cone and caldera	Fossil volcanic cone with partially preserved caldera
Basalt plates Mlado N.	8 basalt plates, remains of a single plate
Volcanic cone Pilav Tepe	Protruding fossil volcanic cone
Volcanic cone Plavica	Protruding fossil volcanic cone with traces of caldera
Volcanic neck Kokino	Volcanic neck with typical lava discharge
Volcanic neck Zdravchi Kamen	Typical volcanic neck with denudation forms
Volcanic cone Vasov Grad (western Kozhuf)	Protruding fossil volcanic cone (andesite) 500-700 m high
Vitachevo	Volcanogenic (tuff) sedimentary plain-plateau
Volcanic bombs	Volcanic bombs as stone andesite balls
Pre-graben valleys	
Kaldrmi Bogaz	Typical urstromtal
Gjavato	Preserved paleo-terraces?
Pletvar	Pre-graben pass
Coastal (abrasive) landforms	
Ohrid Lake coast	Bays, peninsulas, cliffs, sandy beaches
Prespa Lake coast	Bays, peninsulas, cliffs, sandy beaches
Dojran Lake coast	Sandy beaches, biogenic coasts

Golem Grad Island	The biggest island in RM, cliffs, karst landforms
Gradishte Island	Island in Tikvesh Lake
Kalata Island	Island in Kalimanci Lake
Fluvial landforms	
Gorge and canyon valley of Radika River	System of several deep gorges and canyon portions with karst landforms to the side walls
Golema Gorge of Treska River	Deep gorge on Treska River with canyon portions (Matka) and karst landforms to the side walls
Demir Kapija Gorge of Vardar River	Vardar river gorge with canyon portions (Demir Kapija) and karst landforms to the side walls
Taor gorge on Vardar River	Vardar river Gorge with erosive extensions
Derven Gorge of Vardar River	Vardar river gorge rifted in limestones on the northern side of Zheden, with karst landforms to the side walls
Istibanja Gorge of Bregalnica River	Bregalnica river Gorge with denudation forms to the side walls and several small 'hanging' waterfalls
Skochivir Gorge of Crna River	Long gorge of Crna River, tectonic (Mariovo)
Zletovo Gorge of Zletovo River	Zletovo river Gorge rifted in volcanic rocks and paleo-volcanic landforms; denudation forms and screes; numerous small waterfalls
Bislim Gorge of Pchinja River	Pchinja river gorge rifted in limestones; with incised meanders and karst landforms
Bader Gorge of Pchinja River	Epigenetic gorge with incised meanders and denudation forms
Pena River Gorge	Deeply rifted in gorge (up to 1500m) of the Pena river through Shar Mountain, with numerous waterfalls and glacial landforms in the top
Chelevec River canyon	Iberli River Gorge – left tributary to Vardar near Demir Kapija – rifted almost vertically into limestones
Kamnik Canyon of Radanjska River	Radanjska river canyon, shallow, yet vertically rifted in gneisses and amphibolites
Dolna Bregalnica Gorge	Gorge with many incised meanders
Zrnovo River Gorge	Deep gorge with numerous small waterfalls and giant's kettles (potholes)
Peshti Gorge of Babuna River	Short gorge on Babuna river rifted in limestones, with karst landforms to the side walls
Drenovo Gorge of Raec River	Short epigenetic gorge with caves
Belichka River valley	Gorge-like valley in the southern part of Jablanica with glacial and karst elements
Lipkovo River Gorge with Kamenica	Gorge with canyon portion, denudation and karst landforms
Turija Gorge	Gorge of Turija River – tributary to Strumica River
Lakavica River Gorge	Gorge of Lakavica River – tributary to Vardar near Gostivar
Konjska River valley	Fluvio-glacial sediment
Waterfalls	
Koleshino waterfall (Belasica)	Perpetual tectonic waterfalls on the Baba river (Belasica), 17m high

Smolare waterfall (Belasica)	Perpetual tectonic waterfalls on the Smolare river (northern Belasica), 39m high
Gjavolski waterfall (Belasica)	Perpetual tectonic waterfalls on the Bashiboska river (south-western Belasica), 17m high
Gabrovo waterfalls (Belasica)	3 waterfalls on Gabrovo River, Belasica, 4-8m high
Prsten waterfalls (Belasica)	3 waterfalls on Prsten Dere river (south-west Belasica), jointly 44m high
Belovishte waterfalls (Shar Mountain)	3 waterfalls on Belovishte river (Shar Mountain), 75m high in total
Projfel waterfall (Korab)	Intermittent tectonic waterfall on Dlaboka River, 1398m high: the highest waterfall in Macedonia
Duf waterfall (Deshat)	Perpetual tectonic waterfalls on the Rostushe river, 23m high
Biljana waterfall (Bistra)	System of several waterfalls on Tresonche River
Stanci waterfall (Osogovo Mt.)	Perpetual erosive waterfalls on Kozja river (north Osogovo), 11m high
Waterfall on Babuna River	Perpetual erosion waterfall 14m high, with 2m deep giant's kettle
River islands	
Demir Kapija Island	One of the largest, relatively perpetual river islands in Macedonia, on Vardar river
Veleshka Ada	One of the largest, relatively perpetual river islands in Macedonia, on Vardar river
Udovo island	One of the largest, relatively perpetual river islands in Macedonia, on Vardar river
Meander cutoffs (oxbow lakes) near Gevgelija	2 typical meander cutoffs near Vardar, east of Gevgelija
Karst landforms	
Jakupica Range	High mountain karst on Jakupica range (glacial-karst forms, fossil fields, slopes, sinkholes intertwine, caves, precipices)
Galichica	fossil fields, caves
Kamenica River valley	partially covered by nature reserve Tikvesh – caves, Zelen Izvor, fossil decorations
Karst near Huma (Uma) village, Kozhuf	karst field, caves, springs
Cersko Pole and springs of Crna River	karst field, springs, caves, sinkholes intertwine, slopes
Melnica (Mariovo)	Hypogenic caves, thermal spring
Podot (Crna River, Mariovo)	Hypogenic and epigenic caves, springs (cold, hot), travertine terraces
Turtel - Plachkovica	Several short caves, up to 150m long.
Gorna Slatinska cave	cave
Mlechnik	cave
Slatinski Izvor	cave
Ubavica	cave
Dona Duka	cave
Alena	cave
Alilica	cave

Alchia – gypsum cave	cave
Aramiska cave	cave
Bela Voda	cave
Vrelo	cave
Gallishte Cave	cave
Gincheica	cave
Golubarnik	cave
Goren Zmejovec	cave
Damjanica	cave
Drachevo cave	cave
Zmejovica	cave
Babuna River spring (Golema cave)	cave
Jaorec	cave
Kalilna Dupka	cave
Kamenolom	cave
Konjska Dupka	cave
Krapa	caves
Krshtalna	cave
Leskovec cave	cave
Matka Vrelo (Koritishte)	cave
Makarovec	cave
Momichek	cave
Nad Vrelo	cave
Orle	cave
Peshna	cave
Lednik precipice	precipice
Samoska Dupka	cave
Svetla cave (Ledena)	cave
Budimirica cave	Cave sediments with determined Upper Pleistocene age and fossil remains.
Golema Pesht	Cave of archaeological and paleo environmental significance
Golem Grad	Cave on Golem Grad island in Prespa Lake
Kiselichka cave	Rare cave phenomenon in the eastern part of Macedonia
Chulejca	Fossil phreatic cave, aragonite decorations, underwater decorations
Simka	cave
Solunska Glava 5	precipice
Utova Dupka	cave
Hristijanova Cave	cave
Church of 'St. Marko (Markova Crkva)	cave
Crkviche	cave
Chetiri Vrati	cave
Shpela Bozguni	cave
Provalata Cave	Hypogenic cave (hydrothermal, sulphur speleogenesis)

Melnichka Cave 1 and 2	Hypogenic cave (hydrothermal speleogenesis in carbonate breccia)
Karshi Podot Cave	Hypogenic cave (hydrothermal, phantom speleogenesis)
Krapa 2	Fossil sinkhole on Krapa river Deep pit hole.
Slovachka Pit	The deepest explored precipice in Macedonia. Perpetual ice deposits.
Matka Vrelo (Koritishte)	Deep underwater (phreatic) cave.
Solunska Jama (pit)	Deep precipice. Perpetual ice deposits.
Brce	Karst field
Krchin-Kosovrasti	Gypsum karst
Suffosion sinkholes intertwine – Cersko Pole	Typical sinkholes
Slepa valley on Krapa river	Blind valley on Krapa river
Lishkov Peshter	Cave in Bislim Gorge with ornaments and artefacts
Weathering (denudation) landforms	
Markovi Kuli	Boulders, rock masses, cups, holes, rocky beds
Ploche-Stracin	rocky potholes, bedlike shallow bodies occasionally filled with water
Selchka Mountain	Boulders, rock masses, cups, holes, rocky beds
Earth pyramids - Kuklica	Earth pyramids of different forms in tuffs
Earth pyramids - Kukulje	Earth pyramids of different forms in sediments
Earth pyramids - Boshava	rocky pillars and earth pyramids in tuffs and breccia
Melovi - Crnik	amphitheatrical rifts in sands, badland terrains
Melovi - Parkach	amphitheatrical rifts in sands, badland terrains
Screes – Zletovo River	large screes along the Zletovo river valley above the village of Zletovo
Screes - Karadjica	scree belt – plot on the west side of Karadjica
Gjavolski Dzid-Bogoslovec	bare and eroded wall-shaped rocky belt
Stone balls and plates near the village of Ulanci	stone spherical and plate-like forms with dimensions – 0.5 – 1 m
South slopes of Ograzhden	Boulders, rock masses, cups, holes, rocky beds
Istibanja Gorge	boulders in gneiss, typical forms
Gradot landslide	one of the largest recent landslides-fallings in Macedonia
Alluvial fans of Radanjska River	Around 20 typical and developed alluvial fans
Glacial	
High mountain belt of Shar Mountain above 2000 m	around 50 cirques, 20 valley glaciers, moraines, glacises
High mountain belt of Korab Range above 1800 m	around 30 cirques, 16 valley glaciers, moraines, glacises
High mountain belt of Jakupica above 2100 m	around 10 cirques, 3 valley glaciers, moraines, glacises
High mountain belt of Jablanica above 1900 m	6 cirques, 1 valley glacier, moraines, glacises
High mountain belt of Galichica above 1900 m	2 cirques, 1 short valley glacier, moraines

High mountain belt of Baba-Pelister above 2100 m	5 cirques, moraines, fluvioglacial terraces
High mountain belt of Stogovo above 1900 m	5 cirques, 2 short valley glaciers, moraines, glacises
High mountain belt of Bistra above 1900 m	6 cirques, moraines, glacises
Kozhuz (not morphologically prominent)	large cirque, remnants of valley glacier, moraines and fluvoglacial
Periglacial phenomena, landforms and areas	
High mountain belt of Shar Mountain above 1900 m	nivation cirques, rocky flows, solifluction tongues, sliding blocks
High mountain belt of Korab Range above 1700 m	nivation cirques, rocky flows, solifluction tongues, sliding blocks
High mountain belt of Jakupica above 1900 m	rock glacier, nivation cirques
High mountain belt of Jablanica above 1800 m	rock glaciers, nivation cirques, polygonal soils, rocky flows
High mountain belt of Galichica above 1900 m	solifluction tongues, sliding blocks
High mountain belt of Baba-Pelister above 1800 m	nivation cirques, solifluction tongues, hollows, sliding blocks
High mountain belt of Stogovo above 1900 m	nivation cirques, solifluction tongues, hollows, sliding blocks
High mountain belt of Bistra above 1800 m	nivation cirques, solifluction tongues, hollows, sliding blocks
High mountain belt of Kozhuf above 1800 m	nivation cirques, solifluction tongues, hollows, sliding blocks
High mountain belt of Osogovo Mountains above 1800 m	nivation cirques, rocky flows, solifluction tongues, sliding blocks
High mountain belt of Dobra Voda above 1800 m	solifluction tongues and terraces
High mountain belt of Nidje above 2000 m	solifluction tongues, sliding blocks

List of selected significant geoheritage sites in the field of hydrology that should be taken into account in the preparation of the new Spatial Plan of the Republic of Macedonia

Name of the site	Location and description
Springs	
Negorci Spa	Thermo-mineral spring, v. Negorci, Gevgelija
Mokrino Springs	Springs on Belasica, near v. Mokrino
Izdeglavje Springs and marsh in Debarca	Springs and marsh in Debarca, v. Izdeglavje
Popolzhani Spring	Spring near v. Popolzhani, Kichevo
River Babuna Spring	Chashka
River Treska Spring	Kichevo
Vevchani Spring	Vevchani
Pitran Spring	Plasnica
Rosoki Spring	Mavrovi Anovi - Rostushe
Shum Spring	Struga
Belica Springs	Makedonski Brod
Biljanini Springs	Ohrid
Sveti Naum Springs	Ohrid
Zheleznec Spring	Demir Hisar
Swamps	
Belchishta Marsh with Sini Viroj	Swamp in Debarca, v. Belchista
Katlanovsko Marsh	Swamp near v. Katlanovo, Skopje
Monospitovo Marsh	Swamp near v. Monospitovo, Strumica
Kundino Lake	Swamp near v. Kundino, Probishtip
Mezdra and Gjeram (saline swamps near Sveti Nikole)	Saline swamps near v. Mezdra, Sveti Nikole
Mokro and Suvo Lake on Kozjak, near Stracin	Swamp-like lakes near v. Stracin, Kumanovo
Swamps between Chengino Kale and Klepalo	swamp near Chengino Kale, Maleshevo Mountains, Berovo
Elensko marsh on Bukovik near Pehchevo	Elensko swamp on Bukovik, between Kadiica and Maleshevo Mountains
Studenchishte marsh near Ohrid	Swamp along Ohrid Lake, Ohrid
Remnants of Struga swamp near Radolishta	Swamp along Ohrid Lake, near v. Radolishta, Struga
Peatbog near Slana Bara under Carev Vrv on Osogovo	Peatbog on Osogovo Mountains under Carev Vrv, Kriva Palanka
Kravja Mlaka on Karaorman	Swamp on Karaorman, Debarca
Lakes	
Dojran Lake	Dojran
Ohrid Lake	Ohrid
Prespa Lake	Resen
Bogovinje Lake	glacial lakes on Shar Mountain
Vevchani Lake	glacial lakes on Jablanica, v. Vevchani
Podgorci Lake	glacial lakes on Jablanica, v. Podgorci, Vevchani
Dedelbeshko Lake on Shar Mountain	glacial lake on Shar Mountain

Zendelbeshko Lake on Shar Mountain	glacial lake on Shar Mountain
Gorno and Dolno Dobroshko Lake	glacial lakes on Shar Mountain
Kazan (under Chaushica)	glacial lake on Shar Mountain
Gorno and Dolno Karanikolichko Lake	glacial lakes on Shar Mountain
Sorupa (under Klech on Shar Mt.)	glacial lakes on Shar Mountain (under Klech on Shar Mt.)
Skakalo Lake (under Skakalo Peak on Shar Mountain)	glacial lakes on Shar Mountain (under Skakalo Peak on Shar Mt.)
Krivoshisko Lake	glacial lakes on Shar Mountain
Belo Lake	glacial lakes on Shar Mountain
Bogovinje Lake	glacial lakes on Shar Mountain
Swamp lakes above Bogovinje Lake	glacial lakes on Shar Mountain
Chelepino Lake (under Chelepino peak towards Rudoka)	glacial lakes on Shar Mountain (under Chelepino Peak on Shar Mt.)
Crno Lake	glacial lakes on Shar Mountain
Rudoka Lakes (above Crno Lake on Shar Mt,. the highest lakes in the RM)	glacial lakes (above Crno Lake on Shar Mt,. the highest lakes in the RM)
Vrachansko Lake (between two Vraci)	glacial lake on Shar Mountain
Radika lakes (above Mazdracha)	glacial lakes on Shar Mountain
Gorno and Dolno Labunishta Lake	glacial lake on Jablanica
Podgorci Lake	glacial lake on Jablanica
Lokuf on Deshat	glacial lake on Deshat
Gashovi lakes on Deshat	glacial lake on Deshat
Salakovo Lake	glacial lake on Karadjica
Golemo and Malo Lakes on Pelister	glacial lakes on Jablanica
Orlova Bara on Baba - Pelister	glacial lake on Jablanica
Korab Lakes on Shkrtec on Korab	glacial lakes on Korab
Trebenishte Lake near Ohrid	Landslide lake near v. Trebenishte, Ohrid
Moklishte Lake near Ohrid	Landslide lake near v. Vatasha, Kavadarci
Rivers	
Pesochani River	River above v. Pesochani, Debarca
Beleshnica River	Samokov
Vevchani Springs	Vevchani
Gari River	Mavrovi Anovi
Adjina River	River on Bistra Mountain, Mavrovi Anovi
Trebishte River	River above v. Trebishte, Mavrovi Anovi
Crvena River	River on Osogovo Mountains, Makedonska Kamenica
Zajas River (above Tajmishte)	River on Bistra Mountain, Kichevo
Konsko River	River on Kozhuf, v. Konsko, Gevgelija
Javorica River	Demir Hisar
Gabrovnica River	River on Shar Mt., v. Dobroshte
Belovishte RIver	River on Shar Mt., v. Belovishte
Ljuboten with Vratnica River	rivers on Shar Mt., near v. Vratnica
Tearechka Bistrica with Chaushica	Rivers on Shar Mt., v. Tearce
Leshnica, Krivoshija and Pena	Rivers on Shar Mt., v. Brodec

Kovanci River	River on Kozhuf, v. Kovanci, Gevgelija
Sermenin River on Kozhuf	River on Kozhuf, v. Sermenin, Gevgelija
Drenska with Kopishte River on Kozhuf	River on Kozhuf, v. Dren, Demir Kapija
Mala and Golema Javorica	Rivers on Maryanska Mountain
Petrushka River	River above v. Miravci
Mazdracha River	River on Shar Mountain
Jelovce River	River on Shar Mountain, near Gorno Jelovce
Konjari River	River on Nidje
Trnovchica and Bela rivers	Rivers on Nidje, near v. Budimirci
Gradeshnica River	River in Mariovo, near v. Gradeshnica
Buturica River	River in Mariovo, near v. Vitolishte
Satoka River	River in Mariovo, near v. Beshishte
Maydanska River (Blashtica)	River in Mariovo, near v. Mrezhicko
Kadina River (upper portion of river basin)	River on Mokra Mountain (Karadjica), near v. Aldinci
Babuba (springs)	River on Mokra Mountain (Jakupica), near v. Bogomila
Belica River	River on Karadjica in Poreche, v. Belica
Krapa River	River on Dautica, near v. Krapa, Brod
Gari River	River on Stogovo, near v. Gari, Rostushe
Modrich River	River on Jablanica, near v. Modrich, Struga
Lakavica River	River on Jablanica with Ezerca swamp, near v. Jablanica
Belica River	River on Jablanica with Krstec peatbog, near v. Gorna Bellica
Velmej River	River with springs near v. Velmej in Debarca
Virovo River	River on Plakenska Mt., near v. Virovo in Zheleznec, Demir Hisar
Boishte River	River on Plakenska Mt., near v. Boishte
Zrnovci River with Lomija	Rivers on Plachkovica above v. Zrnovci
Smiljanci River	River on Plachkovica, near v. Smiljanci up to flow into river Plavaja
Dvorishte River	River on Ograzhden, near v. Dvorishte
Upstream Bregalnica river to Ablanica	River on Maleshevski Mt., Berovo
Durachka River	River above Kriva Palanka with its tributaries on Osogovo Mt.
Mala and Golema (Kochanska) River	Rivers above Gradche lake, near Kochani
Orizari River	River above v. Orizari, Kochani
Zletovo River	River above Knezhevo Lake on Osogovo Mountains
Chelevec River	River on Kochka Mountain near Demir Kapija
Kiselica River	River on Bilina Mountain, near v. Kiselica
Banjani River	River on Skopska Crna Gora, near v. Banjani
Smolare River	River on Belasica, near village of Smolare
Baba River	River above Koleshino, Strumica region
Vodeshnica	River on Belasica, above v. Bansko
Lakavica River	River on Dobra Voda Mountain, above v. Lakavica near Gostivar
Rabetino River	River above v. Oslomej, on Dobra Voda Mountain, near Kichevo
Mala River	River above v. Samokov on Dobra Voda Mountain
Selce River	River on Busheva Mountain, between villages of Selce and Belushino

ANNEX 2

GLOSSARY

The Glossary contains the most usual or most frequently used terms in the Study.
The Glossary is listed alphabetically, and not according to the importance and the order in which the terms occur in the text. Some of the terms that are not found in the text are explained due to their significance for natural and human resources.
Each term is explained by its meaning, in order to facilitate the reading of the Study.
Wherever several terms are used with the same meaning, both in Macedonian or English terminology, they are separated by comma.

COASTAL LANDSCAPE (RELIEF) means landforms (erosive and accumulative, recent and fossil) caused by mechanical activity of waves along seas, oceans and larger lakes.
COASTAL TERRACE means raised terrace of significant width, regardless of tectonic structures, degradation and age of layers.
AUTOCHTHONOUS refers to organisms which originate (occurred, are indigenous) in a certain area, community, habitat or ecosystem.
AGGREGATE [1]A mixture of various materials that may be separated mechanically [2]Mineralogical and petrographic material (e.g., sandy gravel, crushed stone, etc.) which may be mixed with cement, bitumen or epoxides in order to create concrete or asphalt.
AGROBIOLOGY/AGROBIOLOGICAL refers to the scientific discipline which studies the plants in the agriculture, particularly their genetics, nutrition and yield.
AGROBIOLOGICAL DIVERSITY refers to diversity and variability of animals, plants and microorganisms that, directly or indirectly) are used as food or agricultural processed products (crops, cattle, forest plants and fishery) and are necessary to maintain the structure and processed in agro-ecosystems as a support to the production and provision of food. Diversity encompasses various agro-ecosystems and species, as well as intraspecies genetic variations (breed, race). It also covers species that support agricultural production (soil microorganisms, predators, pollinators) and parts of the environment that support agro-ecosystems (agricultural areas, forests, aquatic systems and pastures).
RIVER ISLAND refers to a river island created by accumulation of river deposits on suitable places in the river: underwater obstacles, interactions with other rivers etc. (e.g., downstreams of river Vardar, Crna and Pchinja).
ADMINISTRATIVE TERRITORIAL UNITS are conventionally determined territories that belong to a certain settlement or group of settlements grouped in administrative units of higher order (municipalities, regions, etc.).
DATA ACQUISITION refers to data collection from various sources and through various methods.
ACTIVE FAULT refers to a structure along which movement occurs and where seismic energy is released as earthquakes even today.
ALLOCHTHONOUS SPECIES refers to species present in a certain area, but originating from a different area. Alien, non-native species in a certain region or ecosystem which is often introduced by human activity, either deliberate or accidental, cf. autochthonous.
ALPINE refers to species, communities, habitat and ecosystems which inhabit/pertain to alpine belt.
ALTERATION refers to alterations of the mineralogical composition of a rock, typically under the influence of hydrothermal solutions. The term also refers to alterations of crevasse walls in a form of decay.
ALLUVIAL SINKHOLE refers to a sinkhole in a deposition of sediment (alluvium) created by sinking of the ground due to newly opened crevasses in the underlying carbonate rocks.
ALLUVIAL PLAIN refers to an alluvial plain around river bed, that is, flat floor of a river valley

created by alluvial material (silt, sand, gravel). Alluvial plains usually occur in the lower course of the river where the gradient is less steep, lateral erosion is greater, and accumulation of river material is significant. In fact, alluvial plains are the lowest fluvial terraces where when the water level is high the river floods.

ALLUVIUM refers to a detritic material of various granulometric and mineralogical and petrographic composition that is transported and deposited by a river or a stream in a recent geological time.

ALPHANUMERIC SOURCES refers to a group of data sources in alpha, numeric and alphanumeric form from various hard copy and tabular presentations which may be used for the purposes of GIS to complement the cartographic basis as well as to create and to augment databases.

ALPHANUMERIC DATA refers to various data in alpha, numeric and alphanumeric form gained through different research methods and measurements.

ANALYTICAL HYDROLOGY is a part of the hydrology which studies the interrelations between hydrological phenomena with the assistance of algebraic analysis and equations.

ANALOGUE MAP is a cartographic form which mainly refers to hard copy editions of different scale, purpose and content.

APPLANATION is a process of general lowering and flattening of Earth's surface under the activity of exogenous erosive factors.

RANGE is a geographic area, part of the biosphere, where a certain taxon or vegetation unit (syntaxon) is widespread. The term usually refers to population of the same species, nevertheless, it often refers to lower (subspecies, variety), or higher taxonomic units (alliance, family, etc.)

ARTESIAN AQUIFER is an underground layer which holds groundwater under pressure.

ASSOCIATION is a plant community recognizable for its characteristic and differential species with certain floristic composition, uniform physiognomy and uniform habitat conditions. Association is defined by its characteristic combination of species which covers characteristic and differential species as well as associates with high percentage values (over 60%).

ATTRIBUTE DATA refers to descriptive non-graphical data contained in digital maps or in external databases which may be linked to the digital map.

AUTODESK MAP is AutoCAD-based automated software package for creation of cartographic and other type of products.

DATABASES (about concrete Geographic Information System) are immediate attributes related to all necessary and identified entities organized in one or several independent or interrelated tabular presentations.

BASE RUNOFF refers to the quantity of water discharged in surface streams directly from the underground or from the lakes when there are no rains or snowmelt for a longer period of time.

BATRACHOFAUNA refers to a fauna of amphibians (class of Amphibia) in a single space.

BADLAND is a term taken directly from the English language referring to steep and barren slopes with extensive erosion in softer sedimentary rocks (melovi near Pehchevo is typical example of badland).

BERN CONVENTION is a Convention on the Conservation of the European Wildlife and Natural Habitats (Bern, 1979) and it is an international legal instrument whose goal is to conserve wild flora and fauna and their natural habitats of European importance, particularly species and habitats whose conservation relies on the cooperation of several countries.

BIOGEOGRAPHY is a biological science whose goal is to describe and explain the reasons for today's taxons ranges, their distribution patterns, both in the past and today and to discover the natural regionalization of the biosphere. Today, particularly important is the so-called 'conservation biogeography' and the first three theories in the conserva-

tion biology (e.g., the theory of island biogeography) originate from it. Biogeography covers three different frameworks: time (time period from the beginning of life until today); spatial (spatial span which covers both local habitats and entire Earth); and taxonomic (span of organism variability from the simplest microbes to the largest plants and animals). Elements of numerous closely related biological (systematics, evolution, ecology) and non-biological (geography, geology, mathematics, IT) disciplines are intertwined within the complex structure of this science.

BIOGEOGRAPHIC REGION is an area of animal and plant distribution having similar or shared characteristics throughout which make it distinct from other regions. There are several classifications of biogeographic regions and mainly they are as follows: Palearctic, Nearctic, Afrotropic, Indomalaya, Oceania, Australasia, Antarctic and Neotropic realms.

BIODIVERSITY/BIOLOGICAL DIVERSITY refers to the variability of all living organisms as an integral part of ecosystems, and this includes diversity within species, between species and of ecosystems.

BIOME is a main type of environmental community or an area characterized by more or less prominent uniform physiognomy of its potential natural vegetation and characteristic flora and fauna (e.g., tropical rainforest, deserts, temperate grasslands, etc.).

BIOMASS refers to the total mass of living biological organisms (producers, consumers and reducers) or dead organic matter in a certain ecosystem in a given moment. It is usually expressed as dry mass per unit-area or volume of habitat.

BIOMONITORING, or biological monitoring, refers to the use of biological responses to assess the changes in the environment and which are mainly caused by human activities. See also: Monitoring

BIOSPHERE refers to the Earth's layer which covers all ecosystems and living organisms in the atmosphere, soil and in the oceans.

BIOSPHERE RESERVE is an area designated within the UNESCO's 'Man and the Biosphere' Programme which supports the interaction between people and their environment in order to ensure sustainable development of the area through participatory dialogue. Biosphere reserve has several functions – conservation, sustainable development, research and monitoring, training and education.

BIOTOPE refers to the non-living part of the ecosystem characterized by certain environmental conditions. cf ecosystem, bioceonosis.

BIOCENOSIS/BIOCOENOSIS is one of the three main habitats of the biosphere: sea, land and sheltered waters.

MARSH is an ecosystem with mineral soil which is intermittently flooded, with surface grass plants, without accumulated surface of peat. It is often mistaken with swamp. *cf.* peatbog.

BLOCK SIGN is a set of items that jointly create a whole, or single sign (regardless of the complexity of the sign) which is marked by a single fundamental point of the sign. The user decides which elements will be put in block. The block may be embedded into a drawing, may be rotated, rescales or unformed, remodified and once again formed as a sign.

BONN CONVENTION is a Convention on the Conservation of the Migratory Species of Wild Animals (Bonn, 1979) and it is an agreement to protect the environment under the auspices of the United Nation Environment Protection which provides for a global platform for cooperation of the countries in lieu of conservation and sustainable use of migratory species and their habitats.

DAM is a manmade facility intended for water accumulation, protection against floods and other uses.

WAVE CUT NOTCH is a flat narrow area where the destructive power of the waves is the strongest (cut notch). The wave cut notch is found at the base of the cliff.

MONTANE PASTURES refer to vegetation type which covers communities who often develop

at secondary pastures which occurred by gradual and long lasting degradation of forest phytocoenosis. Montane pastures on the territory of the Republic of Macedonia are located at the height belt of 70-1200 m and they are maintained by grazing.

WELL is a structure used to extract groundwater.

GLACIAL VALLEY is a flat valley floor with steep sides and broad and concave floor through which the glacier (fossil glacial valley) once moved.

VEGETATION refers to the assemblage of autochthonous (spontaneously growing) plant organisms which inhabit a certain area. Communities of plant species at a given area.

VECTOR refers to an ordered set of coordinate pairs which define the polygon boundaries. Polygons may be of various shapes and sizes, but minimum mapping unit (resolution) matches the size of the minimum polygon of the habitat subject to the mapping.

VECTORIZATION refers to a process in which the contents of points, linear and surface objects are written as coordinate pairs (most often rectangular), and open set of points connected through a vector form a line, while closed set of points form a plane.

VECTOR DATA MODEL refers to a model which represents the objects and phenomena in spatial signs, or components, composed of points, lines, planes and volumes written in digital (vector) forms with rectangular x and y coordinates.

FOLDED MOUNTAINS are genetic category of mountains formed by tangent orogenous movements, that is, by 'folding' process, and in the later evolutionary phase, by thrusting of the layers.

VERIFICATION OF DATA refers to matching of digitized data with the source documents. Attention should be paid in order to ensure that all necessary features to be digitized comply with a certain acceptable level of accuracy.

SPECIES is a taxonomic category lower than genus, the basic unit in the biological classification.

HIGH MOUNTAIN BELT see also: Alpine Belt

INCISED MEANDERS are meanders which have been cut deeply into solid rock mass, and they cannot develop, that is, migrate freely, but they become 'incised'. They occur in narrow, deeply cut rock valleys and gorges (e.g., Bregalnica, Pchinja, Babuna etc.).

INTERIOR may differ within the corridors and pits - it has poor or no interaction at all with the matrix.

WATER RESOURCES are natural sources of water that are potentially useful. Rivers, lakes and groundwaters are the sole source of fresh water to meet the basic needs of water supply, irrigation, energy sector, leisure, etc.

WATERFALL is a cascade of gravitational falling of river water.

WATERFALL is a morphological element in the relief of a river bed. It represents a steep or vertical rock drop set crosswise to the course of the river bed. The river water falls vertically through it. In genetic terms, waterfalls may be divided into: tectonic, erosive and accumulative.

PERMEABILITY is a trait of a rock mass to allow the groundwater to pass through its structure.

CONDUCTIVITY is a parameter used to characterize hydrological conditions, more precisely defined as hydraulic conductivity.

WATERCOURSE refers to the course of the water which serves as a natural irrigation channel of the watershed.

VOXEL DATA MODEL is a three-dimensional cell matrix and each cell stores data which define the identity, class or value of the phenomenon which is studied.

SCALING OF A CARTOGRAPHIC IMAGE refers to the scaling of a cartographic raster image into a scale, which due to various anomalies during the image scanning and processing, was disrupted/displaced in relation to the analogue source map.

HEATHS are shrubby or dwarf shrub-like vegetation which grows in the Subalpine and Alpine Belt where low mountain shrubs or dwarfs shrubs dominate (*Juniperus communis subsp. nana, Vaccinium myrtillus, Vaccinium uliginosum, Empetrum nigrum, Bruckenthalia*

spiculifolia, Erica carnea etc.).

DOLINE refers to an enclosed depression into the karst surface and its diameter may range from a few to a hundred metres. Dolines are the most characteristic and typical phenomenon of the surface karst relief.

GENE is the basic physical and functional unit of hereditary, consisted of a specific part of DNA strands, with a specific function and it is located in a characteristic position of the CHROMOSOME. Most genes contain information on the creation of a specific protein.

GENE-BANK 1. Collection of seeds, plant, pumpkin crops, etc. of potentially useful species, particularly species which contain important genes in plant breeding. 2. (agri.) A place where the entire or most of the species/varieties of cultivated plants and plants within the same family, which are of particular importance for the selection, are stored.

GENETIC DIVERSITY is one of the aspects of the biological diversity. It refers to the variability of the genetic structure of a given species, which allows to the populations to adapt and to evolve as a response to the changes in the environment and pressure of the natural selection.

GENETIC MATERIAL is each material of plants, animals, microorganisms or of other origin which contains functional units of heredity - GENES.

GENETIC MODIFIED ORGANISAMS – GMO are organisms, apart from humans, whose genetic material is changes in a manner which does not occur in the nature – by mating and/or by natural recombination.

GENETIC RESOURCES refer to the genetic material of plants, animals and other organisms which contains useful traits of current or potential importance.

LONGITUDE λ of any given point T is the angle created by the plane of a given meridian allocated as a prime meridian with the plane of the meridian where the point is located.

LATITUDE latitude at a given point T is the angle formed by the vector perpendicular (or normal) to the ellipsoidal surface from that point, and the equatorial plane, that is, latitude at a given point T of a sphere is the angle formed by the radius of the Earth and the respective point in the equatorial plane.

GEOGRAPHIC FEATURES are natural or built object presented on a map with points, lines or surfaces. They may be relief, hydrographic, vegetation, infrastructure features, names and titles, etc.

GEOGRAPHICAL INFORMATION is characterized by concrete spatial dimensions such as: geographic coordinates, rectangular coordinates, name of the place, address, description of the position, distance, angle, etc.

GEOGRAPHIC INFORMATION SYSTEM is a scientific methodology and technology which uses computer assistance to collect, enter, save, process, update, analyse, interrelate (programme) and display spatial and other data in cartographic, graphic, photographic, tabular, alpha, numeric and alphanumeric form in order to create new data and outputs in: alpha, numeric, alphanumeric, tabular, graphic and cartographic form.

GEOGRAPHIC COORDINATE SYSTEM is a system of meridians and parallels used to determine geographic coordinates of a given point.

GEOLOGICAL STRUCTURE is a fold, fault, or other structure formed as a result of internal or external geographic influences.

GEOLOGICAL INVESTIGATIONS are set of methods and techniques used in order to obtain data based on which the geological landforms of a given place on Earth are defined.

GEOLOGICAL CROSS-SECTION is a graphic representation of the lithological composition of a given cross-section, usually vertical one.

GEOMETRIC RELATIONSHIP is a geometric element which connects nodes, or lines, polylines, arch, etc.

GEOMETRIC SYMBOLS are symbols in a form of proper features (square, rectangle, triangle, circle, rhomb, or combinations of linear and curved sections).

GEO-POSITIONING is a procedure where cartographic raster image is transformed in a real coordinate system (SCS – State Coordinate System) in accordance with the applied

cartographic projection.

GEOSPHERE covers all areas of natural and geographic disciplines and their related disciplines, such as geology, geomorphology, climatology, hydrology, pedogeography, biogeography, etc.

GLACIAL LANDSCAPE (RELIEF) refers to landforms formed by the activities of the glacial mass (glaciers). Glacial landforms may be erosive (cirques, glacier valley) and accumulative (moraines), that is, recent and fossil.

GLACIAL RELICTS are boreal and arctic species which in the period of glacial activities in Pleistocene found shelter in the southern parts of the North hemisphere and are conserved until today (on adequate locations). Southern populations of those relicts are of a disjunct nature or they present single species finding sites. Glacial relicts are a type of climate relicts. They are species of Pleistocene fauna and flora which have survived, typical for limited sites or habitats (Pleistocene refugium).

GLACIAL FORMS are landforms formed as a result of the influence of glacial processes.

GLACIATION is a time interval within an ice age marked by colder average annual temperatures which allow for accumulation of large quantities of ice sheets.

GLACIOLOGY is a science which studies the ice and glaciers in all of their forms.

GLACIER is a ice mass with a specific weight higher than the specific weight of the regular ice which moves as a result of its own stress and strain and under the influence of the Earth's gravitation.

CLAY is unconsolidated material which acts as a plastic material when wet and loses its plasticity and maintains the shape when dried or heated (grains of ?;0,002mm).

TIMBERLINE refers to the upper limit of arboreal growth in mountains or high latitudes.

MONTANE refers to the beech forest belt distributed within the montane continental area and in that climate zone the community of montane beech occurs.

GRID-NETWORK refers to a properly distributed points with known three-dimensional coordinates as a network of squares, or sometimes, rectangulars.

GROHOT is an area covered with large carbonate blocks and debris formed by degradation and crushing of the rocks. According to Cvijik, it is the ultimate stage in the evolution of the karrens.

TWO DIMENSIONAL VISUALIZATION refers to a created analogue or digital image based on to dimensions, geographic, rectangular or polar coordinates.

DEGRADATION refers to any disruption of the naturality of ecosystems or other natural phenomena (geological, geomorphological, etc.). It includes destruction of habitats and species, fragmentation and modification of habitats, etc.

DELTA is a vast alluvial plain formed by larger rivers at their mouth as they empty into the lakes, seas or oceans. It usually occurs with rivers which transport larger amount of deposit, that is, there is strong erosion in their watershed.

DENUDATION is a process of wearing away the rocks from the surface due to dispersion of the surface slack layer.

WEATHERING LANDSCAPE (RELIEF) is a complex of landforms formed by the process of crushing and demolition of solid rock masses and by washing of the slack substrate.

DIGITALIZATION OF DATA is a procedure through which analogue alphanumeric, cartographic, graphic, photographic or audio files are transformed into digital electronic raster, vector and audio-visual format.

DIGITAL DATA are data which are entered into electronic textual or image raster or vector format by using the computer technique and technology.

DIGITAL-CARTOGRAPHIC PROCESSING is a procedure through which the graphic original (a map, a plan) is transformed into digital electronic (raster or vector) format.

HABITATS DIRECTIVE, the Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) as of 21 May 1992 is the base of nature conservation policy in Europe (together with the Birds). It is based on two pillars: establishment of a network of protected areas Natura 2000, and a system of strict conservation of spe-

cies. The Directive provides protection of more than 1000 animal and plant species and over 200 habitats of European importance.

BIRDS DIRECTIVE, Directive (2009/147/EC) of the European Parliament and the Council of 30 November 2009 on the Conservation of Wild Birds (replacing Council's Directive 79/409/EEC) is one of the oldest and one of the most important pieces of EU legislation in the field of nature conservation through which a comprehensive plan for protection of all species of wild birds which naturally occur in the EU is provided. It was adopted as a response to the increased concern regarding the decrease of wild birds population in Europe as a result from the pollution, habitat loss and not sustainable use.

GULLY is the largest landform created during deep erosion of the land. Gullies resemble large ditches or small valleys among mountain streams, but their width is mainly smaller than their depth, that is, they have steep and barren sides.

VALLEY GLACIER is the basic morphological type of glacier of mountain glaciation. Valley glacier contains of a snowdrift located in the cirque, ice tongue located in the glacier valley and front of the glacier located in the terminal basin.

BASE LEVEL refers to the existing level of the World Sea towards which the entire erosion of the land is directed. Local base level is the level of a given lake or a main watercourse towards which the erosion of the tributaries is directed.

BOREHOLE, DRILLHOLE is exploration work related to entering deeply into rocks or soils.

DRILLING is an exploration procedure by drilling into rocks, soil or other unconsolidated material.

EVAPORATION is a process of releasing the water back into the atmosphere as a steam.

EVAPOTRANSPIRATION is a total loss of water due to the evaporation of the water mass, soil, artificial areas and transpiration.

ECOLOGY is the interaction of the air, soil, water, animals and plants in a certain area, or a scientific study of that interaction.

ECOLOGICAL NETWORK is a system of natural or semi-natural areas which are the cores of the important species population, interrelated (ecologically or physically) with corridors in a manner which allows for exchange between populations of species and migration and expansion of populations from one to another core area. Ecological network is characterized by a specific spatial architecture with the following elements: key (core) areas, green corridors, protected belts and revitalization areas.

ENVIRONMENTAL FLOW is a flow regime that is provided in a given water system (river, water habitat, coastal zone) in order to maintain the ecosystems and the benefits thereof, when there are competing purposes of the water and where the flow is regulated.

ECOSYSTEM is an area where plants, animals and humans live together in the environment, and their mutual relationship may be considered a system. Boundaries of the system depend on the focus of interest, and the size of the ecosystem may vary from very small areas to the entire planet Earth.

ECOSYSTEM DIVERSITY is a subset of biological diversity and it refers to diversity of ecosystems in a certain area. There is a mosaic of interrelated ecosystems within any wider landscape.

ECOSYSTEM SERVICES according to the Millennium Ecosystem Assessment, ecosystems services are defined as 'benefits (goods and products) people gain from ecosystems, or contribute to the well-being of the society', and these may be grouped as follows: provisioning, regulating, supporting and cultural services.

EXPLOITATION OF MINERAL RESOURCES refers to the activity of obtaining, or extracting mineral resources from their natural state.

ELECTRONIC VECTOR FORMAT is a transfer of electronic raster format into a vector format where data are entered as coordinates (geographic or rectangular) of points which are connected via vector.

ELECTRONIC RASTER FORMAT is a transfer of a certain image analogue format into electronic format as a two-dimensional identification of the model as a matrix of cells in

the pixel network. Such transfer usually is performed with the assistance of scanners. Electronic data are entered as pixels which define the identity, class or value of the image.

ENDEMIC is a species or other taxonomic rank limited or noticed only at a certain geographic area or region. The size of the territory occupied by the endemic taxon may vary; endemic species restricted to a narrow geographical area are called stenoendemic. According to the time of occurrence, they may be paleoendemic (old endemic) and neoendemic (new endemic).

ENDEMORELICT, or paleoendemic – evolutionary old taxon formerly widespread but now restricted to a smaller area. They are taxonomically isolated species whose recent ranges present remnants of a past wider range, which was reduced as a result of the various changes that happened in the geological history of the Earth.

ENDOGEAN FAUNA is fauna which lives in the soil; the term is often used to denote specialized fauna living in the soil and micropores of the rocks - such fauna shares similarities with cave fauna; cave fauna is considered to be a part of the endogean fauna.

ENTITIES are types of information for which concrete data (attributes) are recorded. Certain traits of a phenomenon, such as total, male, female, length, width, water flow, etc., are identified as entities.

AEOLIAN DEPOSIT is a term used for landforms made by the activity of the wind.

EPIGENY is a morphological phenomenon where upper edges of the valley are higher than the neighbouring and surrounding terrains. Depending on the manner of occurrence of solid rocks, epigenies are classified as: dome-like, edge-like, and ridge-like. Most often, they are gorges cleft in rocks harder than the surrounding area.

EROSIVE WATERFALL is a waterfall formed by caving softer rocks of the slope, and above them, harder rocks are found. Due to the selective erosion process softer rocks are carried away faster which results in erosive rock section through which the water falls.

EROSION is a process of removal and transport of elements of geological origin (soil and rocks) due to exposure to natural phenomena, influence of floods, glaciers, waves, winds and groundwaters.

EPHEMERAL PLANTS are plants with a very short life cycle which may be terminated more than once during the course of a year. Such plants are also called annual plants (for example, Capsella bursa-pastoris). Compare: perennial; biennial; annual plants.

EX-SITU CONSERVATION 1. 'Off-site' conservation; process of protecting certain species or population by removing them from their natural habitat and placing it in a protected environment, such as zoo, botanical garden or nursery gardens, or their conservation in a form of a hibernated seed material or gametes in order to use them in the future. 2. Breeding programme in an artificial environment similar to the organisms' natural environment.

BEACH is a low, widespread and flat sandy shore.

HABITAT is ecological category introduced to explain and define conditions where a given species lives and enters into all relations deriving from biotic and abiotic factors in the environment where it grows. According to EUNIS it is defined as 'a place where plants or animals normally live, characterized primarily by its physical features (topography, plant or animal physiognomy, soil characteristics, climate, water quality etc.) and secondarily by the species of plants and animals that live in it'

HOT SPOT OF BIOLOGICAL DIVERSITY is used in the context of biological diversity and it refers to biologically rich restricted area.

ACCELERATED EROSION is erosion much faster than the regular erosion (natural, geological) and most often, it is a result of human activities in the space. Large areas in the Republic of Macedonia are characterized by accelerated erosion.

POLLUTION refers to the changes of the natural state of natural resources under the influence of various point-source and diffuse polluters.

COMMUNITY refers to a group of organisms which belong to different species and they all to-

gether live in the same HABITAT or area, and they are trophically and spatially closely interrelated. They are characterized by one or several typical species (see Biocenosis).

UMBRELLA SPECIES is a term taken from the conservation biology – it refers to species selected for making conservation-related decisions, typically because protecting these species indirectly protects the many other species that make up the ecological community of its habitat.

PROTECTION OF BIOLOGICAL DIVERSITY is a system of measures and procedures which regulate and implement the management and conservation of components of biological and landscape diversity.

PROTECTED SPECIES plant and animal species under legal protection and they encompass: autochthonous wild species which are affected or rare, but not in danger of extinction on the territory of the Republic of Macedonia; wild species not affected at national level, but due to their appearance they may be easily replaced by some affected wild species; and wild species for which the proper conservation manner is prescribed in the international treaties ratified by the Republic of Macedonia, including the protected species at the EU-level.

PROTECTED LANDSCAPE is a category of protected area managed mainly for the protection of the landscape and recreation. A protected area where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural values.

EARTH PILLAR/EARTH PYRAMID refers to a natural column formed by a soft substrate (sandstone, tuff) subject to sheet-wash. A solid stone block is found on its top and it protects the soft substrate underneath from washing (e.g., Kuklica, Kukulje, Konopishte).

EARTHQUAKE is a sudden and quick energy release from stress and strain in the Earth's crust formed for a longer period of time.

FLAGSHIP SPECIES refers to species which raise positive feelings with people and a strong desire to protect it; moreover, they are representative of the living conditions, and they are popular, charismatic species – they are selected due to their vulnerability, attractiveness, uniqueness, and serve as symbols and rallying points to stimulate conservation awareness and action

PRIME BUTTERFLY AREA (PBA) is an area important for protection of butterfly diversity in Europe; PBAs are identified on the basis of several target species of daily butterflies, and in Macedonia there are five species of such butterflies (*Euphydryas aurinia, Euphydryas maturna, Lycaena ottomana, Maculinea arion u Parnassius apollo*); in Macedonia, total of eight Prime Butterfly Areas have been identified: Shar Mountain, Galichica, river Radika Canyon, Struga, Ograzhden, Kozhuf, Baba Mountain and river Babuna Canyon.

IMPORTANT BIRD AREA (IBA) is an area which supports important or representative populations of one or several species of birds, identified in compliance with internationally agreed set of criteria. Such areas are also known as important birds and biodiversity areas.

IMPORTANT PLANT AREA (IPA) is globally important habitats for plant conservation. They are identified in accordance with predefined set of criteria, such as: presence of globally, European, or nationally endangered plant species or presence of endangered habitats at European level.

ZOOGEOGRAPHY is a science of geodiversity of animals and their COMMUNITIES.

ZOOGEOGRAPHIC REGION is a large world area where organisms evolved relatively independently from the neighbouring areas from which it is geographically isolated and today it is marked by a specific combination of animal species and faunal complexes.

IDENTIFICATION NUMBERS (ID) are alpha, numeric or alphanumeric entries used to identify certain objects, phenomena or processes, for the purposes of more appropriate and unique identification.

IDENTIFICATION NUMBER (ID-NUMBER) is a single identifier and it is a relation between

the spatial (cartographic) element and the respective characteristic data contained in the database.

IDENTIFICATION MARKS or codes, usually are shorter than the large texts they refer to. They may be numeric, alpha, or alphanumeric. Special codes are developed for such marks (glossary with explanation for each identification mark-code).

SPRING refers to the phenomenon where groundwater naturally emerges from the Earth's subsurface.

AQUIFER permeable layer, water-bearing.

AQUICLUDE impermeable zone (hydrogeological).

INVASIVE SPECIES is any kind of living organism that invades and prevails in a given ecosystem and causes harm to other species, often as a result of manipulation with the environment.

INVERTEBRATES see: Not vertebrate

INDICATOR SPECIES is species whose presence/absence in a given ecosystem is an indicator of its quality.

INITIAL RELIEF is the basic tectonic or structural relief which serves as a base on which exogenic processes build (or already built) various genetic categories and relief types.

INTERVAL SCALES related to data indicate the distance, remoteness or interspace or time intervals during observations.

INTERACTIVE RELATIONSHIPS are specific technical and technological procedure for connecting each cartographic object (point, linear and surface) with its respective data/ entities in the database.

INTRODUCTION is arrival of an allochthonous species or subspecies to an area (ecosystem/ habitat) where there are almost equal environmental conditions as in their natural habitat. Cultivation of allochthonous species in controlled conditions which do not allow introduction to the nature is not considered to be introduction.

INTRODUCED SPECIES are allochthonous species transferred to a certain area from other remote phytogeographic areas outside of their natural range (introduction) by various by human activities that may be described as either intentional or deliberate. Some of them have negative effect on populations of the local autochthonous species and ecosystems, therefore they are called invasive species.

INFILTRATION is the process by which water on the ground surface enters the soil up to water-bearing strata.

INFRASTRUCTURAL SYSTEMS are a network of points and linear infrastructure elements in the space. Infrastructural system may be linear and institutional. Special infrastructural systems are traffic, energy, public utilities infrastructure and various institutional infrastructural systems (educational infrastructure, health infrastructure, administrative infrastructure, etc.).

IN VITRO means 'outside a living organism' is a term for biological processes performed experimentally outside of the organism.

IN VIVO means 'inside a living organism' is a term for biological processes happening inside the organism.

IN-SITU CONSERVATION means conservation of ecosystems and habitats and restoration of vital populations of species in their natural surrounding. With regards to domesticated or cultivated species, it refers to their conservation in the natural surroundings where they have acquired their distinctive properties.

IN-SITU CONDITIONS are conditions in which genetic resources coexist in the natural ecosystems. With regards to domesticated or cultivated species, it refers to their development in the surroundings where they have developed their distinctive properties.

IUCN - INTERNATIONAL UNION FOR CONSERVATION OF NATURE is one of the major international organizations that directs and coordinates the conservation of biological diversity through programmes for conservation of species and habitats.

USE OF LAND refers to the manner how people use the land, including management and

modification of land cover: natural and seminatural habitats as well as largely changed/ anthropogenous areas.

RUNOFF is part of the stormwater which turns into surface flow.

ICHTHYOFAUNA means 'fish fauna' (class of Pisces) in a certain area/in a certain water body/watershed.

CORE (KEY) AREA is an area under certain level of protection whose goal is to conserve the biological diversity, that is, to conserve a representative group of characteristic habitats and populations of species.

NODE is a line in which two or several lines interconnect.

NODE TOPOLOGY is a description of point objects that present certain geographic objects. Such examples of node topology are road signalization, road junctions, holes, etc.

GULLY is a modern geological phenomenon created by running water, typically on a hillside.

STONE RUN, STONE RIVER is a rock mass (blocks and pieces of rocks) created by myriad freezing-thawing cycles. They usually occur in the so-called 'periglacial zone' and they may be fossil and active (recent). Stone rivers on Pelister are good example of stone runs.

CANYON is a deep cleft with almost vertical sides. Compared to its depth, the width of the canyon is rather small. Canyon is usually made of very hard (resistant) rocks with vertical incision into the river flow.

ROCK GLACIER is a landform created by slow-moving glacial ice covered in debris (blocks) along steep slope. It may be fossil (formed in past, different climate conditions) and recent in active formation phase (e.g., on Jakupica, Jablanica).

KARST is a term of Slavic origin meaning 'stone' or 'stone area'. As a scientific term it appeared in the middle of XIX century according to the region east of Trieste (Slovenia). This term was later used to mark all morphologically and hydrologically similar terrains. There are several lithological types of karst: limestone, dolomite, gypsum, cretaceous, silicate, sandstone, clastokarst, thermokarst, etc. Morphological-hydrological and genetic types of karst are: surface, underground, nude, bare, covered, fossil, pockmarked, shallow, deep, crack, holokarst, merokarst, fluviokarst, glaciokarst. Also, there are several climate types of karst: polar, high mountain, nival*, Mediterranean, desert and tropic karst.

KARST terrain is a terrain marked with the presence of karst landforms such as: uvala, dolines, caves and major underground drainage systems. It is typical of limestones and other rocks.

KARST POLJE is the largest landform of surface karst relief. It is a deep, closed or semiclosed depression in a form of elongated basin with flat floor and steep sides. The length of karst polje may be from few to over 60 km, while its width is from few hundred metres to 10-15 km. Karst polje occurs only in those area s where carbonates are significantly power (thick), widespread and very pure.

MAP is a detailed sketch of a given area presented in a certain scale (ratio).

CARTOGRAPHIC GENERALIZATION in automated cartography becomes a greater challenge and it encompasses the processes of simplification, merging and displacement of linear and surface features and reorganization of cartographic symbol in order to avoid their overlapping.

CARTOGRAPHIC PREPARATION in the context of GIS is a special and larger topic that creates the bases for the establishment of the GIS. Cartographic preparation embeds the following procedures: selection of cartographic sources, scanning of cartographic background, insertion of scanned cartographic raster backgrounds in tailormade GIS programme package, orientation of cartographic image, scaling of cartographic image, geopositioning in state coordinate system, drafting manuals for digital cartographic processing, digital processing, creation of cartographic product in digital vector format for the needs of GIS, coding of digital data and removal of mistakes in the image.

ROCK MASS is a rock body intersected by discontinuities.

IUCN SPECIES CATEGORIZATION – according to the IUCN Species Categorization, there are the following categories of threatened species: extinct, extinct in the wild, critically endangered, endangered, vulnerable, near threatened, least concern. Wild species with sufficient number of individuals in their natural range, but due to the decrease of their number (density of POPULATION), are included in one of the three categories: CRITICALLY ENDANGERED, ENDANGERED or VULNERABLE are known as 'species of concern'. A data deficient (DD) species is one which has been categorized by the International Union for Conservation of Nature (IUCN) as offering insufficient information for a proper assessment of conservation status to be made.

–Extinct species (EX) - a taxon is extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the TAXON's life cycle and life form.

–Extinct in the wild (EW) is a taxon when it is known only to survive in cultivation, in captivity or a naturalized population (or populations) well outside the past range. A taxon is presumed extinct in the wild when exhaustive surveys in the appropriate habitats and at appropriate times have failed to record an individual or other forms of life.

–Critically endangered (CR) – is a taxon facing an extremely high risk of extinction in the wild, that is, it meets the classification criteria for this category (IUCN Red List categories and criteria).

–Endangered (EN) – is a taxon facing a very high risk of extinction in the wild, that is, it meets the classification criteria for this category (IUCN Red List categories and criteria).

–Vulnerable (VU) – is a taxon facing a high risk of extinction in the wild, that is, it meets the classification criteria for this category (IUCN Red List categories and criteria).

–Near Threatened (NT) – a taxon when it has been evaluated against the IUCN Red List Criteria, but does not qualify for CRITICALLY ENDANGERED, ENDANGERED or VULNERABLE now, but is likely to qualify for a threatened category in the near future.

–Least Concern (LC) – a taxon when it has been evaluated against the IUCN Red List Criteria, but does not qualify for Critically Endangered, Endangered or Vulnerable or Near Threatened. This category includes widespread and abundant species.

–Data Deficient – refers to a taxon with insufficient data regarding: its distribution and/or population status in order to make a direct or indirect assessment of its risk of extinction. A taxon in this category may be well studied, but, appropriate data on abundance and/or distribution are lacking. Inclusion of taxa in this category indicates that there are more data and evidence needed in order to determine the necessity to include them in one of the categories of species of concern. It is crucial to collect all existing reliable data on a species. Special attention should be paid when making the choice between this category and one of the categories of species of concern. If the range of a taxon is suspected to be relatively circumscribed, if a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

IUCN CATEGORISATION OF PROTECTED AREAS – According to the IUCN Categorisation, following PROTECTED AREAS have been designated in the Republic of Macedonia: Ia Strict Nature Reserve, Ib Wilderness Area, II National Park, III Natural Monument, IV Park of Nature, V Protected landscape and VI Multipurpose Area.

– Ia. Strict Nature Reserve – protected area, mainly managed for scientific study, environmental monitoring and education; landscape and/or seascape that possesses extraordinary or representative ecosystems and/or species, as well as geological or PHYSIOLOGICAL features.

– Ib Wilderness area – category of protected area managed mainly to preserve the wilderness; large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.

– **II. National park** – protected area managed mainly for protection of ecosystems and recreation; natural land or seaside area intended for following purposes: а) PROTECT the ecological integrity of one or more ecosystems for this and future generations; б) exclude exploitation or occupation inimical to the purposes of designation of the area and; в) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally compatible.

– **III. – Ib Natural monument –** protected area managed mainly for PRESERVATION of specific natural features; area which covers one or several natural or natural cultural sites with a special or unique value due to its rarity, representativeness or due to its aesthetic and cultural features**.**

– **IV. Park of nature** – area which possesses one or more indigenous, rare and typical components of nature (plant, fungi and animal species and communities, relief features, hydrological values, etc.). The Park of nature may be botanical, zoological, geological, geomorphological and hydrological. This category is established in the national legislation, and according to the IUCN management categories, it belongs to the fourth category of protected areas.

– **V. Protected landscape** - a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. In fact, the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural values, and very often, with high biological diversity.

– **VI. Multipurpose area** – large natural landscape or seascape area, rich in waters, forests, or meadows, and it may be used for hunting, fishing and tourism, or reproduction of wild animals. It is designated in accordance with the needs for conservation of nature and implementation of economic activities and exploitation of natural resources, and particularly, to provide completeness of the ecological network as ecological corridor. According to the IUCN protected area management categories, it belongs to the VI category 'Protected area with sustainable use of natural resources'.

CLASS/CLASSES 1. Category within the taxonomic classification hierarchy; basic category between "phylum" and "order". 2. Category of phytocoenological classification which involves one or more orders, and it ends in the suffix *–ea.*

CLIMATE may be defined as average weather conditions, or more precisely, as a statistical description of relevant quantities over periods of time (from months to thousands or millions of years).

CLIMATE-ZONAL refers to the final stadium of the succession of vegetation in a given area which is characterized by a stable, long-lasting plant community which is in balance with the main climate in the area.

CLIMATE IMPACTS refer to the consequences of climate changes on the natural systems and people.

CLIMATE CHANGE refers to a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or centuries. Climate changes are result of natural processes, or external disturbances, or long-lasting anthropogenic disturbances in the atmosphere, or changes in the land use.

CLIMATE SYSTEM is consisted of the atmosphere, hydrosphere, cryosphere, lithosphere and biosphere, as well as interactions between them.

CLIMATE-VEGETATION-SOIL REGIONS (ZONES) – depending on the regional climate, arrangement of soils and vegetation, there are eight climate vegetation-soil regions in the Republic of Macedonia (Filipovski et al., 1996): 1). Sub-Mediterranean (modified Mediterranean) zone where dominant climate-zonal plant community is Coccifero carpinetum-orientalis, located at the height of 50-500 metres above the sea level, 2). Continental-submediterranean zone where prevailing community is Querco-Carpine-

tum orientalis, up to 600 m.a.s.l., 3). Warm continental zone where prevailing community is Quercetum frainetto-cerris, at 600-900 m.a.s.l., 4). Cold continental zone where prevailing community is Orno-Quercetum petraeae, at 900-1100 m.a.s.l., 5). Sub-mountainous continental-mountainous zone where prevailing community is Festuco heterophyllae-Fagetum, at 1100-1300 m.a.s.l., 6). Forest continental-mountainous zone where prevailing community is Calamintho grandiflorae-Fagetum, at 1300-1500 m.a.s.l., 7). Sub-alpine mountainous zone with forests of sub-alpine beech, the Macedonian pine, the Norway spruce and the mugo (mountain) pine, sub-alpine pastures, at 1650-2250 m.a.s.l., and 8). Alpine mountainous zone, that is, high mountainous grass communities and rocks, above 2250 m.a.s.l.

GORGE is deep cleft with steep sides, built in harder rocks. Mountainous gorges occur most often, but, epigenetic and gorges between valleys are also present.

CLIFF is a steep or vertical rock exposure which raises as a wall over a sea or lake shore (e.g., on the Golem Grad island, or, between Peshtani and Trpejca on Ohrid Lake, etc.). The cliff is formed by long and constant impact of strong waves hitting the shore.

KEY ECOSYSTEMS – in environmental context, no ecosystems may be considered to be 'key' ecosystems (unlike 'key species' – without key species the ecosystem will stop functioning). However, since there is no comprehensive classification of ecosystems, and on the other hand, there are endless ecosystem types, for practical reasons ecosystems should be generalized up to the level where conservation practices are applicable. Generalization inevitably leads to definition of so-called 'key ecosystems' (such as, beech forests, lakes, pastures, etc.).

KEY BIODIVERSITY AREAS are areas of international importance in terms of biodiversity conservation using globally standardized criteria based on the sites needs for biodiversity protection, and they are characterized by a) vulnerability (presence of endangered or critically endangered species) and/or b) irreplaceability (presence of species with limited distribution, endemites, places of gathering a great number of individuals, congregations and/or biogeographically restricted communities).

DATA CODING is a process of attributing features to all geometric objects which contain points, lines and planes.

INFILTRATION COEFFICIENT is the ratio of the infiltration rate to rainfall intensity.

COEFFICIENT OF PERMEABILITY (K) is a basic measure which quantitatively marks filtration capacities of rock masses.

COMPOSITE VALLEY is a valley composed of sequence of narrow portions - gorges and wider portions - valleys and fluviodenudation expansions. Almost all valleys of the bigger rivers in Macedonia are composite valleys.

CONVENTION ON BIOLOGICAL DIVERSITY is an international treaty signed by more than 190 countries in the world that committed to cooperate for conservation and sustainable use of biological diversity and fair distribution of the benefits of genetic resources.

CONSERVATION is a measure for protection of natural resources to the degree deemed to be satisfactory to protect them from adverse influences.

Conservation/Protection – See: Conservation

CONSERVATION BIOLOGY – is a discipline of biology which studies the threats and protection of the biological diversity.

COORDINATE SYSTEM is a sum of interrelated dependant lines and planes whose purpose is to determine the position of a point on different planes.

CORRIDORS are linear elements (for example, alley along borders between the fields).

CORROSION (KARST CORROSION; SOLUTIONAL EROSION) is a process of dissolution of rocks. Corrosion mainly occurs under the influence of the water rich in carbon carbonic and other acids. Most often it occurs on limestone, dolomite, gypsum and rock salt.

SLOPE is inclined surface of a terrain built from rocks or soils, and it is often analysed in terms of its stability.

COSMOPOLITAN is species whose distribution extends beyond geographical limits.

RIPARIAN VEGETATION, riparian zone is a vegetation belt of trees, shrubs and herbaceous plants along both sides of water masses and it touches or it is under the influence of the water body. It is a transition borderline between the land and water. In encompasses the shores and surrounding land, as well as the surfaces which are the most exposed to great floods. Typical examples are river banks, floodplains, lake shores and swamp edges.

DISCHARGE CURVE, graphic presentation of the ratio of the discharge to the water level, diagram **Q-h** of a profile of a watercourse, also called consumption curve.

FAN is detritic material deposited on locations where there is sharp gradient decrease and sharp flattening of the terrain where there are fast water flows.

MEADOW is a vegetation formation consisted of mesophilic grasslands maintained by mowing (at least once during the growing season - vegetation period). Meadows may be naturally occurring (self-seeding species) or by human intervention (mainly fodder to provide animal feed).

ROCK SLIDE is a landslide in a rock slope with volume > 10,000 m3.

LIQUEFACTION refers to the process by which water-saturated, unconsolidated sediments are transformed into a substance that acts like a liquid, often in an earthquake.

LIMNIGRAPH, WATER LEVEL RECORDER is an automatic instrument used to record the water level of a given profile.

LIMNOLOGY is a science that studies lakes and reservoirs.

LIMNOFAUNA refers to the fauna in lakes, morasses and other still waters.

LINE is one-dimensional or linear element that is intuitively imagined as length element. It is the basic term of vector data model. A node is located at the beginning and at the end of the line. Two or more lines may be connected in a node, and more lines may create a polyline. Lines are used to present rivers, roads, railways, etc.

LINE SIGN is a composition of inter-connected points in a sequence. They may be straight lines and curved lines.

LITOSPHERE refers to the Earth's crustal rocks and its thickness is approximately 120 km.

LOGICAL DATA MODEL is the manner in which the database management system arranges the conceptual models in terms of specific concepts, such as files, indices Tf0.2514 and similar.

LOCAL ENDEMIT is a native species found only in a particular area (a mountain, gorge, lake, etc.).

MAQUIS refers to sclerophyll or lauriphyll shrublands with, more or less, closed structure of the crown, and annual and geophyte plants; few trees are shrub-like plants. Prevailing species in the woodlands are species with no high growth potential. Dominant species in the high maquis belong to genus *Arbutus* spp., *Erica arborea, Erica scoparia, Juniperus oxycedrus, Phillyrea* spp. Dominant species in the low maquis belong to the genus of *Cistus* spp., *Erica* spp., *Genista* spp., *Lavandula* spp. (EUNIS)

MACROPHYTES are aquatic plants growing in or near aquatic ecosystems. They may be found on the water surface (free-floating) or may grow under the water surface (submerged).

MATRIC is a dominant and comprehensive element (for example, fields in agricultural regions).

MEANDER is a part of a river bed in a form of sinuous curves or windings. Meander is produced by a stream or river swinging from side to side as it flows across its floodplain or shifts its channel within a valley. The bed material of the affected bank is scoured by the slow and laterally shifted, and the opposite bank is slightly inclined and sedimentary deposit is accumulated there.

SOIL MECHANICS is a scientific and technical discipline which studies soils and laws of mechanics and related disciplines in the process of solving technical problems when soil are used as a foundation or as a construction material.

MYCOBIOTA refers to all fungi present in a particular geographic area (e.g., mycobiota of Macedonia).

MYCODIVERSITY refers to the diversity of fungi.

MYCOLOGY is a branch of biology which studies fungi.

MINERAL is a natural or artificial body with fixed structure and chemical composition.

MINERAL WATERS are ground waters whose mineralization, chemical and gas compositions, content of specific components, radioactive elements or increased temperature make them different from other ground waters.

MINERAL RESOURCES are all organic and inorganic mineral matters in a solid, liquid or gas state in primary and secondary borrow pits.

MODEL is an abstract presentation of a system or a process which enables more precise definition of problems and clearer perception of the concepts. Models provide tools to analyse data and communicate the results.

NETWORK-BASED MODELS are characteristic interaction between objects perceived through the network connectivity with various relations and paths that have actual distances and certain obstacles in their mutual existence and functioning.

OBJECT-BASED SPATIAL MODELLING are focused on a discrete presentation of the phenomenon and they are characterized by emphasizing special phenomena that may be studied individually.

FIELD-BASED SPATIAL MODELLING is modelling of phenomena which are manifested (treated) as constant variables in a given space. Typical examples of such modelling is the level of soil moisture, state of the same temperature on a specific territory of Earth's surface, concentration of pollutants in the atmosphere, etc.

MOSAIC is a set of patches.

MORAINE is a characteristic form of the accumulative glacial relief resembling arched and elongated elevations. Moraines are formed by eroded glacial debris deposited laterally and at the end of the glacial valley, at the site where glacier melted.

SWAMP is an ecosystem of mineral soil with one section that is permanently soaked in water, without accumulated organic matters. It is often confused with the term MARSH, cf. peatbog.

NETWORK TOPOLOGY is a network of linear elements connected in a node. Resistance, permeability and orientation of the phenomenon are added to the nodes and linear elements. For instance, network topology is used to present networks of pipelines, roads, streets, electrical lines, rivers, and similar.

MULTIMEDIA MODELS IN GIS is presentation of various information and content as audio and video files, apart from the traditional textual, numerical, photographic and graphic presentation.

FOLD is a tectonic structure formed by bending and folding of previously horizontal strata.

DEPOST, SEDIMENT is a material transported by the river flow or eroded material accumulated on appropriate sites where erosive or transportation power of the water is decreased.

BORROW PIT is an area where material has been dug to be used for various purposes.

NATIVE, see: Autochthonous

SUPRA-CATEGORICAL SETS is a term used for the processes of urbanization, regionalization, land use, environment protection and sustainable development**.**

NON-GEOGREPHIC INFORMATION is spatially undetermined information important per se, for example, clients' banking data.

NON-SPATIAL DATA are data that assume certain identification, classification and presentation of objects through their name, address or code.

NIVATION CIRQUE is a semi-circular (amphitheatrical) landform with steep sides and mild and slightly flat floor. Nivation cirque looks like glacial cirques, but they are significantly smaller, shallower and less prominent in morphological terms. They usually occur in the so-called 'periglacial zone' and in Macedonia those terrains are usually located

above 2000 m.

GROUND WATER TABLE refers to the level under which the geological formation is permanently saturated with water.

STAGE HYDROGRAPH is graphical presentation of the changes of the level over the period of time.

NOMINAL MEASURES are measures undertaken to record data under the name.

SUSTAINABLE DEVELOPMENT refers to sustaining the ecological processes in order to secure long-lasting use of renewable resources.

ROCKFALL is a fragment of rock that falls along steep slopes.

ABANDONED MEANDER is a meander that has been abandoned by it stream by formation of a neck cutoff and it is out of its hydrographic function. In that manner the river flow is shortened and the meander becomes fossil (e.g., abandoned meanders in the lower part of Bregalnica river).

ORDINAL MEASUREMENT SYSTEMS imply certain order of classification in terms from-to, for instance, first, second, third, etc.

ORIENTATION OF A CARTOGRAPHIC RASTER IMAGE is a process of shifting the direction North of the applied cartographic projection into direction on Y, or X-axes in the applied software package.

ORNITHOFAUNA – Birds FAUNA.

OROGRAPHY is a description of hilly and mountainous terrains.

BEDROCK is a solid rock found under soil or other unconsolidated material.

ROCK PILLAR is a single and protruding upright structure whose height may be few to several tens of metres.

PALAEARCTIC REGION (REALM) is a biogeographic area which includes almost entire Euroasia (excluding the south and southeast part of the Arabian Peninsula, Hindustan and Indochina) and North Africa (south of the Northern Tropic). It is divided into several subregions: European, Manjurian, Mediterranean and Siberian.

PASTURES are communities with secondary grassland, usually formed by forest degradation; they are used for gazing by domestic herbivores.

PAYSAGE is a visual feature of the natural characteristics of the landscape.

PERIGLACIAL LANDSCAPE (RELIEF) is a complex of landforms (nivation, cryoturbation, solifluctional) formed in the polar and high mountainous regions.

HABITAT PATCHES – habitat patches are any discrete areas distributed within the matrix (e.g., forest stands, settlements).

CAVE FAUNA is fauna found in caves. Specialised cave animals may be: 1) troglobionts (troglobites) – real cave organisms always found only in caves and never outside caves; osuch species usually possess specific adaptations (absence or reduction of eyesight, depigmentation of the body, long sense organs) which allows them to survive in cave ecosystems, troglobionts that live in groundwaters are called stygobionts or troglohydrobionts; 2) troglophiles – organisms that prefer caves, but they can be found outside caves, as well. They share similar features as troglobionts, but they are less prominent; troglophiles that spend most of their lives in caves are called eutroglophiles, and species that are only cave visitors are called subtroglophiles, and 3) trogloxenes – species that cannot live in caves perpetually, but sometimes they find shelter in the caves; typical example are bats.

PIEZOMETER is a device for measuring the groundwater level.

PENEPLAIN is a vast undulating plain where small elevations of hard rocks rise. It is the final stadium of the erosion cycle after a longer period of tectonic inactivity.

RIVER PIRACY is a geomorphological phenomenon occurring when a stream or river drainage system or watershed is diverted from its own bed, and flows instead down the bed of a neighbouring stream.

TALUS refers to screes whose upper and lower edges are almost parallel. Fine rock material is accumulated in the upper parts, while more massive debris is accumulated in the

lower parts (foot) of the taluses.

PLANAR is a geological term used to denote a flat surface without any curves or raggedness.

MOUNTAIN ECOSYSTEMS is a term sometimes used to cover all ecosystems found in the mountains (in Macedonia, usually above 1800 m.a.s.l.). In ecological context, the term is inappropriate because numerous and, often, drastically different types of ecosystems are found in the mountains.

WEED COMMUNITIES/WEEDS IN CROPS are vegetation grass communities that grow spontaneously on cultivated lands (they often grow in habitats where grains and garden crops are cultivated).

RETURN PERIOD is an estimate of the likelihood of an event, such as an earthquake, flood, landslide, or a river discharge flow to occur.

CONNECTIVITY refers to the spatial relationship between two habitat patches of the same time.

CONNECTABILITY are individuals or propagules that may move from one to another patch, even if they are distant; key factor is the propagating capacity of the individuals.

SURFACE / POLYGONAL AREA is an area encircled by a closed polyline. It is used to describe spatial elements such as houses, administrative or political units. Polygonal areas in the topology contain a centroid.

SURFACE SIGNS are signs that present a surface of an object, for instance, a lake, forest complex, plantation, etc. Surface signs are closed lines.

SUBSPECIES is a lower TAXONOMIC category than species; it is the lowest TAXONOMIC category in the zoological classification.

SUBMOUNTAIN BEECH FOREST is the lower part of beech forest belt widespread within the sub-mountainous continental-mountainous zone where the climate-zonal community of submountain beech forest is located.

GROUND WATER refers to waters found under the terrain surface.

GROUND FAUNA, see: Endogean Fauna

OCCURRENCE-BASED SEARCH is a search of unique phenomenon independent from other phenomena, or search of regions with combinations of phenomena.

LAND COVER is usually defined as vegetation (natural or anthropogenic) cover of the surface area, including significantly altered anthropogenic areas. It is distinct from the term 'land use' - the same type of land cover may be managed/used in a different manner.

POLAR COORDINATES refer to the radius vector and azimuth of a given point.

POLYGONAL TOPOLOGY is a topology consisted of polygons used to define areas. Polygonal topology contains nodes and centroids. Examples of polygonal topology are city blocks, vegetation maps, lithostratigraphic units, maps of political and administrative boundaries, etc.

SEMI-NATURAL ECOSYSTEMS is a term frequently used today to refer to ecosystems where human intervention is limited, that is, the ecosystem maintained its, more or less, natural appearance/function. The term is not supported by the ecological science.

SINK, SINKHOLE are geomorphological phenomena typical of karst relief, occurring on the terrain surface.

FLOOD refers to the increase of water level and discharge quantities. It is also defined as high water. High waters or floods occur as a result of heavy rains, long rains, sudden snowmelt and in extraordinary events of catastrophes of hydrotechnical facilities (demolition of dams and embankments, evacuation of high waters in reservoirs, etc.).

POPULATION is a group of organisms (individuals) of one species that populate a certain area which are capable of interbreeding, but, they are also ISOLATED from other similar groups.

POTAMOLOGY is a part of hydrology which studies surface river flows and their regimes, including their dynamics and occurrence of erosion.

RECTANGULAR COORDINATES SYSTEM consists of two straight coordinate axes intersecting at right angle in a point which is considered to be the origin point.

ANCIENT FORESTS / VIRGIN FORESTS are old growth forests with unique natural features, great age and a large number of live and dead trees and snags that have grown without human interference. Ancient forests are characterized by several development stages, as follows: optimal phase, aging phase, decay phase, selection phase and rejuvenation phase.

LANDSCAPE is a topographically defined territory consisted of a characteristic mosaic of interacting ecosystems, that are or may be subject to specific human activities.

LANDSCAPE TYPE is a landscape characterized by a specific structure and functional relations which make it distinct from other landscape types.

PRELIMINARY DATA PROCESSING refers to the creation of topographically structured data according to the model based on object, grid or field.

PRIMARY DATABASE is basically generated with the assistance of measuring methods, surveys and observation.

NATURAL RARITY refers to parts of living or non-living nature that are under special protection by the state due to their scientific, aesthetic, medical and other significance, cultural, educational and tourism and recreational function.

NATURAL ECOSYSTEMS are ecosystems where material and energetic metabolism is balanced and there is no visible anthropogenic modification. Today, such ecosystems do not exist in Europe, or there are only small fragments.

NATURAL HERITAGE refers to parts of nature and site that can be geological, physical-geological or biological formations or group of such formation that contain extraordinary value of aesthetic, conservation or scientific point of view. Natural heritage may be: protected area, strictly protected or protected wild species, typical minerals and fossils, speleological object or natural rarities.

PROXIMAL SEARCH refers to the search of the closest distance.

SPATIAL ANALYSIS is a procedure of extraction of information or creating new information on the set of geographical elements, or a technique for determination of the distribution of elements in the network of a given area and relation between those elements. Following may be subject to spatial analyses: position, distance, closeness and orientation of the object. Spatial analyses are useful for the assessment of opportunities and possibilities, forecasts and interpretation.

PSEUDOMAQUIS is a mixed sclerophyllous deciduous and evergreen shrub thickets of the periphery of the range of Mediterranean sclerophyllous shrublands. They include, in particular, shrub formations of the Balkan and Italian peninsulas resulting from the degradation of thermophilic deciduous woodland with a mixture of evergreen and deciduous bushes. It is an intermediate between Mediterranean maquis and schibljak (South-eastern sub-Mediterranean deciduous thickets).

PSEUDOSTEPPE (or steppe-like vegetation) refers to vegetation grasslands whose physiognomy looks like a steppe. It grows in habitats where forest vegetation grew primarily, but its longlasting destruction resulted in prevailing grasslands, but some woodlands have been preserved. According to the definition, in a real steppe, grasslands are prevailing and they grow on pedological soil chernozem and woodlands are absent. On the territory of the Republic of Macedonia, real steppe vegetation is absent, while typical areas of pseudosteppe (steppe-like vegetation) can be found in the central parts (barren regions at both banks of the river Vardar, in the area between Veles, Shtip and Negotino).

EDGE is the external (peripheral) part of habitat patch. Edges may be distinguished within the habitat patches and corridors – there is strong interaction with the matrix in the edge part.

SCALE (PROPORTIONAL) MEASUREMENTS refer to interrelations of certain sizes.

RAMSAR CONVENTION is a Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971) is an international treaty that obliges the parties to commit to protection and sustainable use of wetland.

RAMSAR SITE is a wetland site designated to be of international importance under the Ramsar Convention (adopted in 1991). Ramsar sites are important for biodiversity protection and to sustain people's lives through maintenance of components, processes and benefits / services of ecosystems.

BREED is a group of animals of the same species with clearly defined characteristics.

FAULT is a major rupture structure with width of several decimetres to several hundreds of metres, sometimes even thousand metres. Fault walls are often striated and polished as a result of the movement. The rock on both sides of the fault is degraded and modified, and so-called 'fault breccia' is often formed.

RASTER is a grid of square or hexagonal cells of equal size. The size of the cell determines the resolution.

RASTERIZATION is a process dividing well-defined dots, lines or surface objects into cells by simultaneous cutting of horizontal and vertical pieces (pixels) by their length.

RASTER DATA MODEL is a model which presents objects and phenomena as a cell grid/ pixels written down in a digital (raster) format as binary data made of zeros and ones.

LOOSE DEPOSITS is a general term used for all types of soil.

RE-VALORIZATION is renewed valorisation.

REVITALISATION, in broader sense, refers to the action of imbuing something with new life and revival from inactivity. In ecological context, it refers to the process of restoring the function of the ECOSYSTEM in its primary or undisturbed conditions.

ORDER refers to 1. taxonomic category between 'class' and 'family'; 2. Closed category in the classification of vegetation which includes one or several alliances.

GROUND WATER REGIME is a process of changes in the quality and quantity of ground waters (discharge, ground water level, speed, temperature, viscosity, chemical, radiological, microbiological and gas composition) under the influence of natural and anthropogenic factors in space and time.

RESOLUTION is a level of sharpness of an image. Resolution is defined as a matrix of pixels on a certain area.

REINTRODUCTION is the action of putting species, varieties and breeds that where extinct by the humans back into their former habitat.

RECLASSIFICATION of data is necessary in order to simplify the contents obtained from various sources, use of two or more classifications or coding schemes that refer to the same phenomenon, international differences in the practice of presenting the same content, changes in the schemes over a period of time, etc.

RECULTIVATION is a process of returning a land that was degraded by geological exploration or by exploitation of mineral resources in useful state.

RELICT SPECIES is a surviving species of extinct taxonomic group (taxonomic relict); 2. Surviving species of once diverse and widespread taxonomic group, today restricted to a small area (geographic relict).

RELICT-ENDEMIC is a surviving taxon of old taxonomic group restricted to a narrow geographic area.

REPATRIATION is a term which in his context refers to returning of genetic resources (seed, seedlings) from old local varieties and populations that where collected in Macedonia and which are kept in foreign gene-banks. Once the repatriation is executed, the country is obligated to maintain the seed material in a gene bank.

RESOURCES are phenomena or reserves with geological, hydrological and/or economic characteristics that are potentially renewable with a possibility of technological and economic development.

RARE SPECIES is a group of unusual organisms that are rarely found. The term may be used for any plant, animal or other taxon and it is necessary to make distinction between the term 'rare species' and 'endangered species'. The term is usually used without respecting the established specific criteria that are defined, for instance, in the IUCN categorization, but it is not used in the said categorization, however, it may be used in

the scientific discussions.

REFUGIAL AREA are sites with specific ecological characteristics where isolated populations of relict species with different evolutionary origin may be found, and which in the past were much more widely spread. Such refugial areas on the territory of the Republic of Macedonia are found in lower plain parts (river gorges, hill pastures), as well as in the mountainous belt (snowdrifts, steep vales, forests, etc.).

REFUGIUM is an area where the climate and the vegetation remain relatively unchanged, while the neighbouring areas change drastically, and therefore, they serve as a refuge for the endangered species. Usually, the term refers to areas in the Northern Hemisphere (North America, Europe, parts of Asia) that where not covered with glaciers in the period of Pleistocene glaciations and where species from frozen regions would find a shelter. The most famous refugiums for European species are located in the Southern Europe, Pyrenees, Apennine and Balkans Peninsula. There are numerous refugium areas on the territory of the Republic of Macedonia. A special type of refuges are small not frozen areas (mountain peaks, shore cliffs, etc.) in the region of ice sheets, known as 'nunataks' which remained unfrozen and allowed for a survival of small populations of plant and animal species.

RECENT refers to a taxon relating to, or being of Holocene epoch.

RIVER TERRACE various granulated material close to today's river beds (former river beds).

RIVER BED is the lowest point of the river floor.

RIPARIAN, see: On, of, or relating to the banks of a natural course of river

GENUS/GENERA is the basic taxonomic category between the family and species composed of one or several species.

RUDERAL refers to plant species that live near abandoned/disturbed places (roads, landfills, ruins, etc.) and they require high concentration of NUTRIENTS.

MINE is a restricted area of land, on or under its surface, where mineral resources are explored or exploited with the use of machines, equipment, mine dumps (places where mining waste is disposed) and mining infrastructure necessary for pursuit of mining activities.

BOULDERS are rocks which are larger than 200 mm.

LANDSLIDE is a modern phenomenon of downslope movement of rock and/or rock caused by natural or artificial factors.

SEISMICITY is a phenomenon resulting from vibrations or movements of the terrain because of earthquakes.

SECONDARY DATABASE mainly comprise data obtained through a certain processing, for instance, digitization, coding, scanning, calculations by combining different data, alterations, verification of various processing methods, etc.

SEMI-ARID refers to climate area with low precipitation quantities and scarce VEGETATION, and it often occurs in continental areas.

SCREE is a cone-shaped landform formed by rock material od steep slopes, and the small-size material is found on the top, and larger material near the foot of the scree.

TALUS, SCREE refers to loose deposits of broken rock fragments usually formed near inclinations or gully aggregates

SYSTEM is a set of elements connected in an active (dynamic) whole.

SYSTEMATICS (or biological systematics) is a biological science that groups the species according to their family relations. Classification of species in various hierarchical systematic category (genus, family, order, class, phylum) is a part of the systematics. Taxonomy is a tool of the systematics used to determine characteristics of species and other systematics category in order to group them, classify them and proper nomenclature.

DATA STORAGE is a procedure of creation of a spatial database.

ANGIOSPERMS/FLOWERING PLANTS is one of the most important group of land plants. REPRODUCTIVE organs (anthers and filaments) are located inside the flower and

they are enfolded with sterile petallike organ (sepals and petals). After the POLLINATION and fertilization, the closed filament turns into a fruit, where seeds grow. Haploid gametophyte generation is the most reduced among all LAND PLANTS.

RIVER BASIN, DRAINAGE BASIN, WATERSHED AREA, CATCHMENT AREA is flowing area of a stream, river or a lake. The river basin is orographic if only surface water are considered, or hydrological if ground waters are also considered.

PICTORIAL CLASSIFICATION is identification of spatial contents through colour separation of territories.

SHEETS AND LAYERS are sheets/layers that cover one or group of cartographic segments related to a specific GIS.

DATA COLLECTION refers to the process of obtaining data in a format that allows for their functional insertion into a specific GIS. They may be in alphanumeric, graphic, cartographic or photographic format.

CONTENT SEARCH OF A SPACIAL REGION refers to searching in order to find certain features, or part of them, in a given spatial region, for instance, search in: a rectangular window (4 coordinates) or two opposite angles, circle or as an existing range object (municipality, settlement, etc.).

ALLIANCE is a syntaxonomic category in the classification of vegetation which covers one or several related associations. The suffix *–ion* is added to the first word of the alliance's name.

SALINE GRASSLANDS are grassland communities that grow on saline soils and in which halophytic plants prevail.

SOLAR RADIATION is a radiant energy emitted by the Sun, also known as short-wave radiation or infrared radiation.

VARIETY, See: Variety

STAND is a segment of a certain plant community (association, subassociation) characterized by a specific floristic composition, qualitative and quantitative distribution of its typical, differential, or diagnostic species, which enable its syntaxonomic definition and recognition.

SOFTWARE / SUPPORT PROGRAM refers to all programmes contained in and executed by a personal computer.

SOCIO-SPHERE covers areas of socio-geographic and economic-geographic disciplines, such as demogeographic information, populated areas, urbanization processes, primary, secondary, tertiary and quaternary activities.

SPECIATION is the evolutionary process by which populations evolve to become distinct species.

GREENHOUSE GASES are integral part of the atmosphere, natural or anthropogenic, which absorb and emit radiation from the spectre of infrared radiation emitted from the Earth's surface, atmosphere and clouds. Such radiation causes the so-called 'greenhouse effect'. Basic greenhouse gases in the atmosphere are: steam (H_2O), carbon dioxide (CO_2), dinitrogen oxide (N_2O), methane (CH_4) and ozone (O_3).

HABITAT, See: Habitat

STATISTICAL DATA are data of the regular statistics, including data specially collected or data created for specific purpose.

STENO-ENDEMIC SPECIES refers to species with very local, restricted distribution in a defined area (for instance, violets *Viola alchariensis* and *Viola arsenica*, that grow in soils with arsenic and antimony are restricted to a very small area of several hectares, at the Alshar site near Kavadarci. Their local distribution is conditioned by the soil where they grow)

STEPPE is a semi-arid area of grassland vegetation on chernozem without trees. Steppes are spread in the eastern parts of Europe and in the central parts of Asia.

STEPPE LIKE VEGETATION, See: Pseudosteppe

STIGOBIONT, See: Cave fauna

STRATOSPHERE is a layer above the Earth's atmosphere thick 10-11 km above the sea level.

STRICTLY PROTECTED SPECIES are endangered wild plant and animals species protected by law and they include: wild species that may become extinct on the territory of the Republic of Macedonia, steno-endemic species, wild species whose protection regime is prescribed by the international treaties ratified by the Republic of Macedonia, including protected species at EU-level, and species that are sensitive to the specific changes in their habitat.

LANDSCAPE STRUCTURE is the structural pattern of the landscape consisted of three basic elements: habitat patches, corridors and matrix. These elements serve as a basis for comparison of different landscapes and development of general principles when creating policies to regulate the use of land and nature protection.

SUBALPINE, See: climate-vegetation-soil zones (regions)

SUBENDEMITE refers to species with limited distribution, whose range solely spreads in a defined geographic area, or area defined in a different manner (country, island, peninsula, lake, mountain, etc.), and some of its populations may be found beyond that defined area, however they still contact to the said area.

SUBTROGLOPHIL, See: Cave fauna

SUCCESSION refers to non-cyclic, targeted changes in the vegetation of a certain area which occur in a certain period. Depending on the conditions in which successions begin, they may be primary and secondary successions: primary succession begins on substrate without vegetations, and propagules may derive from various sources; secondary successions occur on substrates with lower of higher level of disruption of the local vegetation and they tend to re-establish the initial state of the vegetation.

DROUGHT is a natural disaster of below-average precipitation, it lasts for a longer period of time and it causes serios hydrological disruptions.

TAXON/TAXA refers to TAXONOMIC category of any rank which covers all listed categories.

TAXONOMY is a scientific discipline that sets the rules and principles for description and naming of organisms. Classification of organisms is based on hierarchical system that starts with the category SPECIES and ends with the category KINGDOM.

THERMAL WATERS are mineral waters whose temperature is higher than the average annual temperature of a defined area.

THERMOPHILIC refers to organisms adapted to live in thermal waters.

TERTIARY is a geological period from Cenozoic Era including Paleocene, Eocene, Oligocene, Miocene and Pliocene epoch.

TECHNOSPHERE covers areas related to the infrastructure (traffic, energy utilities), both linear or institutional infrastructure.

TIN-network is made up of irregularly distributed nodes and lines with three-dimensional coordinates (x, y, and z) that are arranged in a network of non-overlapping triangles, and contours of the space are created by interpolation of their values.

PHYLUM/PHYLA is a category within the biological classification; TAXONOMIC category lower than kingdom.

GROUND WATER FLOW refers to waters moving freely under the terrain surface.

TOPOLOGY, if strictly defined, is a part of the mathematics. In GIS context, it is a collection of objects and object data that define relations such as connectivity, adjacency and relative position of the point, line and area features of spatial objects. Therefore, there is particular point topology, linear bus topology, and spatial topology.

TOPOLOGICAL STRUCTURING refers to substantial segregation of data and regulation of ratios between their distinct elements.

TALUS SLOPE is a steep chute along which the (mainly gravitational) scree, or broken rock fragments flow.

POINT SIGNS are usually used to determine a location of a given object or phenomenon. Such signs may be a single point or creation of several points in a sequence or points

distributed in an area. However, the basic characteristic of the sign is one fundamental point to determine the factual location and position.

PEAT BOG refers to a peat habitat.

THREE-DIMENSIONAL VISUALIZATION is a presentation of a cartographic image by identification of the three dimensions, that is, length, width and height.

TROPOSPHERE is the lowest part of the atmosphere where clouds are located.

TUNDRA refers to a biom with grasslands in clod and dry regions in the world, mainly, in the Arctic zone, as well as in the upper slopes of high mountains around the globe, and smaller areas can also be found in the Antarctica. It covers approximately 20% of the total Earth's surface. It is characterized by perpetually frozen lower layer of the SOIL, without woody plants, and scarce VEGETATION is mainly MOSSES, LICHENS, grasses, as well as dwarf SHRUBS.

UVALA is a larger closed karst depression whose diameter may be from few hundred metres to 1 - 2 km. Uvala may also be considered a transitional form between dolines and karst fields.

URBAN HYDROLOGY is a part of the hydrology which studies hydrological conditions in urban areas.

FAMILY is a TAXONOMIC category which encompasses one or more orders with common origin and there is a distinction (more or less) from other similar groups. In the taxonomic classification, family is ranked between the taxonomic categories 'order' and 'genus.

FAUNA is the overall animal life present in a particular habitat, geological stratum or region.

SEEPAGE refers to the movement of ground water through geological environment, bam, embankment, etc.

PHYTOGEOGRAPHY is a botanical discipline which studies the distribution of certain taxons and phytocenosis, floristic composition and vegetation species of the entire Earth or certain geographical regions, as well as historical and ecological factors that determine the current dispersity of plant cover. Basic subject of phytogeography's studies is the range. Today, it is mainly considered to be a part of the biogeography.

PHYTOCOENOSIS vegetation community.

PHYTOCENOLOGY/PHYTOSOCIOLOGY is the science of plant communities.

FLORA is the overall plant taxa present in a particular habitat, geological stratum or region.

FLUVIAL LANDSCAPE (RELIEF) is a separate genetic landform type on the Earth's surface formed by erosion of rivers flowing towards the greatest downslope under the influence of Earth's gravity.

FLUVIOKARST is a relief typical of terrains composed of soluble (carbonate) and insoluble rocks. Also, typical of fluviokarst is the process of denudation of slopes and plunging of the water, that is, karstification.

FORM is the lowest taxonomic category in the hierarchy of botanical classification.

DATA INPUT FORMATS refers to a specially created window with predefined fields to enter data in database.

FOSSIL refers to remains or impression of an organism that lived in the past.

FOSSILS natural petrified remains of past animals or plants embedded in some sedimentary rocks.

HABITAT FRAGMENTATION is a division of large habitat into two or several patches, usually by human intervention (most often by infrastructural development). Generally, habitat fragmentation has an adverse impact on species because fragmentation of favourable habitat results in smaller patches which are not sufficient to sustain the survival of certain species.

PHREATIC is a term used to denote ground water in saturated zone (extensive aquifier with free level - immediately under the terrain surface).

HABITATION, See: Habitat

HABITAT COMPLEXES refers to the last habitat type in the EUNIS habitat classification (X : Habitat complexes), which is still being developed. It covers portions of the landscape

with complex habitat structure, formed by several interrelated habitats.

HALOPHYL COMMUNITIES are vegetation communities adapted to grow in habitats with high salt concentrations.

HARDWARE/TECHNICAL EQUIPMENT refers to all physical components of the personal computers.

HERPETOFAUNA refers to the fauna of amphibians and reptiles.

HYDRAULIC GRADIENT refers to the piezometric-level difference over unit horizontal distance.

DISCHARGE HYDROGRAPH is a graph showing the rate of flow (discharge) versus time past a specific point in a river, channel, or conduit carrying flow, also known as **Q-t** diagram.

HYDROGRAPHY is a science that studies the description and measurement of surface flows (oceans, seas, rivers, lakes).

TAILING DAM is a mining construction facility used to store byproducts of mining operations after separating ore from the gangue in strictly defined and controlled conditions.

HYDROLOGY is a scientific discipline concerned with the water of the Earth, including its occurrence, time and spatial distribution and circulation.

HYDROMETRICS is the part of the hydrology concerned with the water analysis and measurement methods.

HYDROSPHERE encompasses all water covering the Earth, that is, the Earth's layer of water.

HYDROTECHNICS, HYDRAULIC ENGINEERING refers to the part of the civil engineering concerned with the construction of hydro-facilities - dams, aqueducts, sewage systems, meliorations, ports, hydroelectric power plants, etc.

CHOROLOGY is a scientific discipline concerned with the spatial distribution of organisms. It covers the description and definition of the boundaries of taxa distribution.

HUMUS refers to strongly altered organic materials, usually under the terrain surface.

KINGDOM is the highest ranking taxonomic category within the classification of organisms.

AICHI TARGETS are twelve global targets on biological diversity included in the Strategic Plan for Biodiversity (2011-2020) adopted by the parties to the Convention on Biological Diversity of the parties thereof held in 2010 in Nagoya (capital of Aichi prefecture in Japan).

CENTROID is a single point centrally occurring in a certain polygon in the topology. Centroid contains information on the area and scope of the polygon.

CYCLONE, HURRICANE is a rapidly rotating storm system in the atmosphere characterized by a low-pressure centre, accompanied by heavy rains.

CIRQUE refers to a wide, amphitheatre-like valley in mountainous areas formed by glacial erosion, that is, under the influence of glacier.

CITES refers to the Convention on International Trade in Endangered Species of Wild Fauna and Flora - CITES Convention (Washington, 1972)

CORINE – LAND COVER, is a vector database with standardized land cover categories, established by the European Community (EC) as means of standardization and compliance of geographic spatial information on the environment throughout European continent.

RED DATA BOOK refers to multidisciplinary applicative papers containing comprehensive and significant information necessary to undertake measures for protection of populations and species. Each species included in the Red Book should provide the following information: scientific name of the species, vernacular name, main synonyms, national endangered status, photography or image of the species, brief description, distribution, typical habitat, negative impact factors, proposed protection measures and bibliography references.

RED LIST is a list of endangered species (within a given area – at national, regional or global level) in accordance with the IUCN criteria. The document provides the following information: scientific name of the species, vernacular name, main synonyms, national

endangered status, distribution of the species at national level, DISTRIBUTION of the species at European level, European and global endangered species status.

POTHOLE, PLUNGE POOL is a depression at the bottom of the river bed formed by swirlhole movements of the water and corrosive and erosive influence of the material brought by the river. Its walls are smooth, almost polished, and gravel material and other larger rock pieces are found at the bottom.

SHRUBLANDS refers to the shrub-like vegetation developed under the influence of modified Sub-Mediterranean climate where broadleaf deciduous shrub species are prevailing – *Carpinus orientalis, Coronilla emerus* subsp. *emeroides, Colutea arborescens, Paliurus spina-christi,* as well as individual trunks of *Quercus pubescens, Fraxinus ornus* and others.

KARREN is a small furrow on a baren rock area formed by corrosion of atmospheric water. Karrens usually do not form individually, but they contain densely spread and parallel furrows among which karren edges are found. According to their appearance and evolutionary stadium, they are divided as follows: rugged, cleftkarren, runnelkarren, etched, meander-like, pitted, etc.

HIGH NATURE VALUE (HNV) FORESTS are all natural forests those semi-natural forests in Europe where the management (historical or present) supports a high diversity of native species and habitats, and/or those forests which support the presence of species of European, and/or national, and/or regional level.

Note

Definitions of the terms related to biological, and some to landscape diversity, are taken from the glossary developed within the 'Support to the Republic of Macedonia for revision the National Biodiversity Strategy and Action Plan and Development of the Fifth National Report to the Convention on Biological Diversity' project.

ANNEX 3

OTHER LEGAL ACTS RELEVANT TO THE NATURE PROTECTION

Law on Waters ('Official Gazette of RM' no. 87/08, 6/09, 161/09, 83/10, 51/11, 44/12, 23/13, 163/13, 180/14, 146/15, 52/16) regulates the issues pertaining to surface waters, including the permanent watercourses or watercourses where the water flows occasionally, lakes, accumulations and springs, groundwaters, waterside land and water habitats and their management, including the distribution of waters, protection and conservation of waters, as well as protection against harmful effects of waters; water resources management facilities and services; organizational set up and financing of water resources management, as well as the conditions and the procedures under which the waters can be used and discharged. Water management is conducted for four river basin areas, as follows: areas of the river basins of the rivers Vardar, Crn Drim, Strumica and Juzna Morava.

Law on Waste Management ('Official Gazette of the Republic of Macedonia' no. 68/04, 71/04, 107/07, 102/08, 143/08, 124/10, 51/11, 123/12, 147/13, 163/13, 51/15, 146/15, 156/15, 192/15, 39/16, 63/16) regulates the waste management; principles and objectives of waste management; plans and programs for waste management; rights and obligations of the legal entities and natural entities related to waste management; requirements and obligations of legal and natural entities which produce products and packaging that pose environmental burden at the end of their life cycle; the manner of and conditions for waste collection, transportation, treatment, processing, storage and disposal; waste import, export and transit; monitoring; information system; financing and oversight of waste management.

Law on Ambient Air Quality ('Official Gazette of the Republic of Macedonia' no. 67/04, 92/07, 35/10, 47/11, 59/12, 163/13, 10/15, 146/15) regulates the measures for avoidance, prevention or reduction of harmful effects from ambient air pollution on human health, as well as environment as a whole, through establishment of limit values for the ambient air quality and alert thresholds, emission limit values, the establishment of unique system of ambient air quality monitoring and control and monitoring of sources of emissions, comprehensive system of ambient air quality and sources of emissions management, information system, as well as other measures aimed at protection against certain activities by legal entities and individuals having direct or indirect impact on the quality of air.

Law on Forests ('Official Gazette of the Republic of Macedonia' no. 64/09, 24/11, 53/11, 25/13, 79/13, 147/13, 43/14, 160/14, 33/15, 44/15, 147/15, 7/16, 39/16) regulates the issues pertaining to planning, management, economy, cultivation, protection, use and conservation of forests as natural resources and forest land, exercise of socially beneficial functions of forests under the principle of biological, economic, social and ecological acceptability.

Hunting Law ('Official Gazette of the Republic of Macedonia' no. 26/09, 82/09, 136/11, 1/12, 69/13, 164/13, 187/13, 33/15, 147/15, 193/15) regulates the propagation, protection, hunting and use of game and parts thereof.

Law on Pastures ('Official Gazette of the Republic of Macedonia' no**.** 3/98, 101/00, 89/08, 105/09, 42/10, 116/10, 164/13, 193/15, 215/15) regulates the management, promotion and use of state-owned pastures.

Law on Fisheries and Aquaculture ('Official Gazette of the Republic of Macedonia' no. 7/08, 67/10, 47/11, 53/11, 95/12, 164/13, 116/14, 154/15, 193/15, 39/16) regulates the management, planning, economy and aquaculture of fishes and other aquatic animals in fishing waters, fish ponds, closed-pond systems, cages, rice paddy and other fisheries, placing into use, institutions and associations in the field of fishery, record keeping, protection of fish

and other aquatic animals in the waters of the Republic of Macedonia, as well as other issues relevant to fishery and aquaculture.

Law on Mineral Resources ('Official Gazette of the Republic of Macedonia' no. 136/12, 25/13, 93/13, 44/14, 160/14, 129/15, 192/15, 39/16, 53/16, 120/16, 189/16) regulates the conditions and the manner of conducting geological explorations; the promotion and development of geological explorations with the aim of providing their optimal utilization in accordance with the principles of sustainable development and environmental protection; the promotion and the development of exploitation of mineral resources, as well as strengthening the measures for safety, environmental and human health protection; the promotion and the development of mineral processing, as well as strengthening the measures for safety, environmental protection and human health; the supervision and the conditions for conducting geological explorations, mineral exploitation and processing, and the measures and the manner in which the harmful effects on the environment and human health caused by the management of waste that is created or is already created from the explorations, mineral exploitation and processing is prevented or reduced to the lowest possible extent.

In order to provide better overview, the laws of other sectors affecting the nature protection are provided in the table below.

Area	Law
Agricultural biodiversity	Law on Agriculture and Rural Development ('Official Gazette of the Republic of Macedonia' no. 49/10; 53/11, 126/12, 15/13, 69/13, 106/13, 177/14, 25/15, 73/15, 83/15, 154/15, 11/16, 53/16, 120/16, 163/16)
	Law on Seeds and Seeding Material ('Official Gazette of the Republic of Macedonia' no. 55/11)
	Law on Quality of Agricultural Products ('Official Gazette of the Republic of Macedonia' no. 140/10, 53/11, 55/12, 106/13, 116/15, 149/15, 193/15, 39/16)
	Law on Animal Husbandry ('Official Gazette of RM' no. 7/08, 116/10, 23/13, 149/15, 39/16)
Use of natural resources	Law on Forests ('Official Gazette of the Republic of Macedonia' no. 64/09, 24/11, 53/11, 25/13, 79/13, 147/13, 43/14, 160/14, 33/15, 44/15, 147/15, 147/15, 7/16, 39/16)
	Hunting Law ('Official Gazette of the Republic of Macedonia' no. 26/09, 82/09, 136/11, 1/12, 69/13, 164/13, 187/13, 33/15, 147/15, 193/15)
	Law on Pastures ('Official Gazette of the Republic of Macedonia' no. 3/98, 101/00, 89/08, 105/09, 42/10, 164/13, 193/15, 215/15)
	Law on Fisheries and Aquaculture ('Official Gazette of the Republic of Macedonia' no. (7/08, 67/10, 47/11, 53/11, 95/12, 164/13, 116/14, 193/15, 39/16)
	Law on Mineral Resources ('Official Gazette of the Republic of Macedonia' no. 136/12, 25/13, 93/13, 44/14, 160/14, 129/15, 192/15, 39/16, 53/16, 120/16, 189/16)
	Law on Energy ('Official Gazette of the Republic of Macedonia' no. 16/11, 136/11, 79/13, 164/13, 41/14, 151/14, 33/15, 192/15, 215/15, 6/16, 53/16, 189/16)
	Law on Organic Agricultural Production (Official Gazette of the Republic of Macedonia, no. 146/09, 53/11, 149/15, 39/16, 132/16)
Land Use	Law on Spatial and Urban Planning ('Official Gazette of the Republic of Macedonia' no. 199/14, 44/15, 193/15, 31/16, 163/16)
	Construction Law ('Official Gazette of the Republic of Macedonia' no. 130/09, 124/10, 18/11, 36/11, 54/11, 13/12, 144/12, 25/13, 79/13, 137/13, 163/13, 27/14, 28/14, 42/14, 115/14, 149/14, 187/14, 44/15)
	Law on Construction Land ('Official Gazette of the Republic of Macedonia' no. 15/15, 98/15, 193/15, 226/15, 31/16, 142/16, 190/16)
	Law on Agricultural Land ('Official Gazette of the Republic of Macedonia' no. 135/07, 17/08, 18/11, 148/11, 95/12, 79/13, 87/13, 106/13,164/13, 187/13, 39/14, 130/14, 166/14, 72/15, 98/15, 154/15, 215/15, 7/16, 39/16)
	Law on Concessions and Public-Private Partnership ('Official Gazette of the Republic of Macedonia' no. 76/12, 144/14, 33/15, 104/15, 215/15)
	Law on Autocamping ('Official Gazette of the Republic of Macedonia' no. 13/13, 152/15, 31/16)
	Law on Tourist Development Zones ('Official Gazette of RM' no. 141/12)
Genetically Modified Organism (GMS)	Law on Genetically Modified Organisms (GMO) ('Official Gazette of the Republic of Macedonia' no. 35/08, 163/13, 146/15)
Food safety and animal protection	Law on Veterinary Health ('Official Gazette of the Republic of Macedonia' no. 113/07, 24/11, 136/11, 123/12, 123/15, 154/15, 53/16)
	Law on Protection and Welfare of Animals ('Official Gazette of the Republic of Macedonia' no. 149/14, 149/15, 53/16)
	Law on Food Safety ('Official Gazette of the Republic of Macedonia' no. 157/10)

BYLAWS IN THE AREA OF NATURE PROTECTION

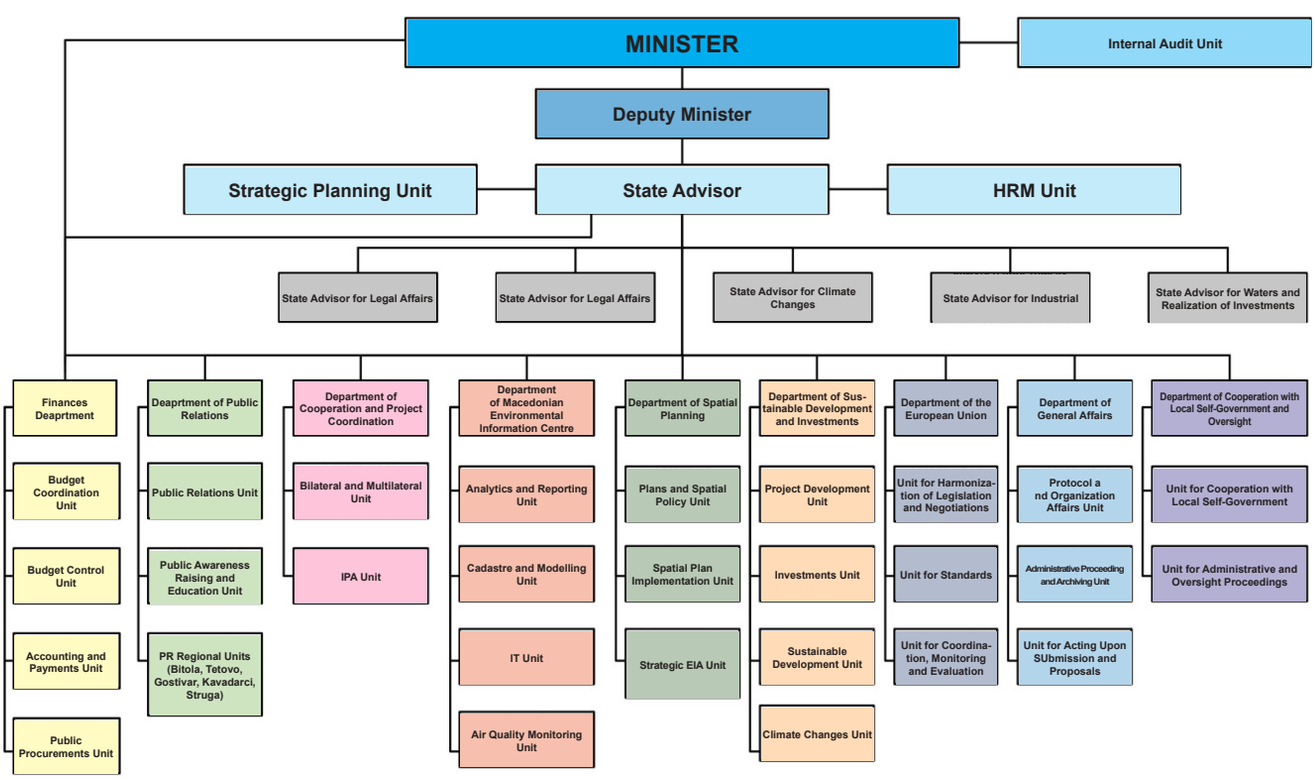
- Rulebook on Issuance of permit for conducting scientific research in the nature ('Official Gazette of the Republic of Macedonia' no 101/09, 68/14);
- Rulebook on issuance of permit for collection of concerned and protected wild plants species, fungi, animals and commercially significant parts thereof ('Official Gazette of the Republic of Macedonia' no.102/09);
- Rulebook on the measures and activities for protection of monuments of nature, format and content of the permit for conducting special measures and activities for protection and restoration of the monument of nature ('Official Gazette of the Republic of Macedonia' No. 126/10);
- Rulebook on the measures and activities for protection of the nature park ('Official Gazette of the Republic of Macedonia' no. 126/10);
- Rulebook on the content of Programme for taking professional exam for a guard in a protected area and the manner and the procedure for taking the professional exam ('Official Gazette of the Republic of Macedonia' no 126/10);
- Rulebook on the format and the content of the request form, permit and certificate for trading in concerned and protected wild plants species, fungi, animals and commercially significant parts thereof, as well as the necessary documentation attached to the request ('Official Gazette of the Republic of Macedonia' no. 134/10);
- Decree on the manner and the procedure for issuance of the permit, or certificate, as well as the type of the permit, or certificate and determination of border crossings where trading in concerned and protected wild plants species, fungi, animals and commercially significant parts thereof is undertaken ('Official Gazette of the Republic of Macedonia' no. 135/10);
- Lists for identification of strictly concerned and protected wild plants species, fungi and animals ('Official Gazette of the Republic of Macedonia' no.139/11);
- Decree on the manner for acting during the trade in concerned and protected wild plants species, fungi, animals and commercially significant parts thereof by the customs officials, other competent authorities and offices at the border crossings and scientific and competent institutions, as well as authorized depositories of specimen confiscated in the event of illegal trade ('Official Gazette of the Republic of Macedonia' no. 177/11);
- Lists of concerned and protected wild plants species, fungi, animals and parts thereof ('Official Gazette of the Republic of Macedonia' no. 15/12);
- Rulebook on the content of the study for protected area valorisation and revalorization ('Official Gazette of the Republic of Macedonia' no. 26/12);
- Rulebook on the content of protected areas management plans and nature protection annual plans ('Official Gazette of the Republic of Macedonia' no. 26/12);
- Rulebook on the record-keeping of the nature protection ('Official Gazette of the Republic of Macedonia' no. 102/12);
- Rulebook on the design and the type of the official uniform, its duration and manner of use – equipment to be carried by the guards and the content and format of the official identity document, as well as the manner of issuance and revoking of the official identification document ('Official Gazette of the Republic of Macedonia' no. 103/12);
- Rulebook on the measures and activities for protection of the speleological objects ('Official Gazette of the Republic of Macedonia' no 71/16);
- Order for prohibition of the collection of the plant species *Gentiana lutea* and *Gentiana punctata* for use and trade ('Official Gazette of the Republic of Macedonia' no. 86/06);
- Order for prohibition of the collection of the autochthonous self-grown fungi of the Morchella, Verpa and Pitchoverpa genera for their use and trade ('Official Gazette of the Republic of Macedonia' no. 161/08, 56/09, 86/10, 108/12);
- Decision for the establishment of National Council for Nature Protection ('Official Gazette of the Republic of Macedonia' no. 113/09);
- Decision for the establishment of National Committee on Biological Diversity ('Official

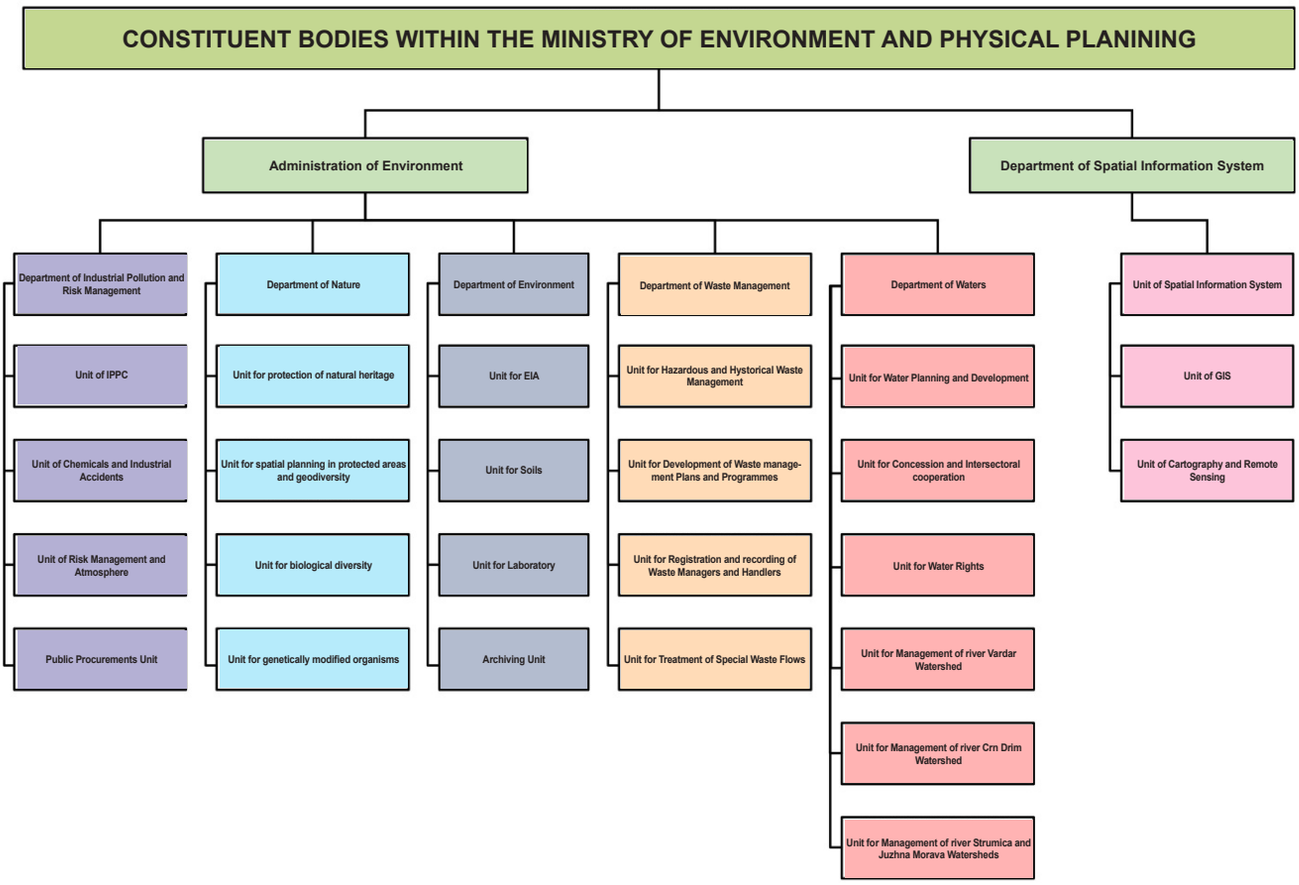
Gazette of the Republic of Macedonia' no. 36/99);

- Decision for the establishment of National Committee on Protection of Migratory Wildlife Species ('Official Gazette of the Republic of Macedonia' no. 64/01);
- Decision for establishment of a public enterprise for management and conservation of the multipurpose area 'Jasen-Skopje' ('Official Gazette of the Republic of Macedonia' no. 90/05, 101/05, 165/08, 99/12);
- Decision for establishment of a public enterprise for management and conservation of the National Park 'Mavrovo' ('Official Gazette of the Republic of Macedonia' no. 09/06);
- Decision for establishment of a public enterprise for management and conservation of the National Park 'Galichica ('Official Gazette of the Republic of Macedonia' no. 09/06);
- Decision for establishment of a public enterprise for management and conservation of the National Park 'Pelister ('Official Gazette of the Republic of Macedonia' no. 09/06).

ANNEX 4

STRUCTURE OF THE MINISTRY OF ENVIRONMENT AND PHYSICAL PLANNING AND THE ADMINISTRATION OF ENVIRONMENT





There are five sectors under the **Administration of Environment:**

- Department of Nature;
- Department of Environment;
- Department of Waste Management;
- Department of Waters, and
- Department of Industrial Pollution and Risk Management.

Department of Nature. The Department of Nature is a single organisational structure at national level which pursues professional and administrative activities in the area of nature protection. The Department implements the protection of nature through protection of biological and landscape diversity and protection of natural heritage, in protected areas including outside protected areas, as well as protection of natural rarities.

The Department of Nature is composed of four units:

- Unit for biological diversity,
- Unit for protection of natural heritage,
- Unit for spatial planning in protected areas and geodiversity, and
- Unit for genetically modified organisms.

The Department of Nature is responsible for the implementation of the national legislation and international treaties in the area of nature protection; participates in the harmonization of the national legislation to the *acquis communitaire*; coordinates the development, adoption and implementation of strategies, programmes, action plans and measures for nature protection; establishes inter-institutional cooperation in the process of development and adoption of other legal and strategic documents related to the nature

protection; initiates and executes a procedure before the Government and the Assembly of the Republic of Macedonia for designation of protected areas; conducts procedures for adoption of acts for designation of certain parts of nature as natural rarities; oversees the work of the entities mandated to manage protected areas and implementation of protected areas management plans; is in charge of the establishment and implementation of the system of measures for protection of natural heritage in order to provide sustainable use of the natural resources; establishes cross-sectoral cooperation in view of planning and arrangement of the protected areas space; cooperates with international organizations on issues related to nature protection; establishes cooperation with the state administration bodies in order to implement strategic development documents related to the nature protection; participates in the implementation of international treaties on the nature protection; keeps professional records on national heritage (register of natural heritage and cadastre of protected areas); monitors the state of the biodiversity and geoheritage and undertakes measures for protection and conservation; encourages scientific and research work in the area of nature protection; participates in activities for promotion of natural heritage and raising public awareness on nature protection; implements measures for GMO and protection against deliberate discharge of GMO in the nature, implements activities related to the clearing house mechanism (biosafety), as well as other tasks in accordance with the provisions of the GMO regulation.

In accordance with the Law on Nature Protection, the Department of Nature conducts administrative proceeding for issuance of: permit to breed and promulgate wildlife in captivity; CITES permit/certificate for regulation of international trade in endangered wild plant species, fungi, animals and parts derivatives made thereof, and permit for scientific research in the nature. Furthermore, the Department issues professional opinions for issuance of collection of concerned and protected wild plants species, fungi and animals and issuance of D4 permit (via the EXIM system) for export or import of wild plants, fungi, animals and parts thereof. As regards the protected areas, the Department of Nature issuance approval of management plans and nature protection annual programmes. Moreover, the Department issues approval on urban planning documentation; professional opinions on determination of legal status of illegally built buildings and professional opinions of detailed geological explorations and exploitation of mineral resources.

Department of Environment. The Department of Environment is responsible for the implementation of Environmental Impact Assessment procedures, implements the international conventions and laws and regulations pertaining to the natural resources protection, air protection, water protection, soil protection and environment protection.

Department of Waste Management. The Department of Waste Management is responsible for achieving the waste-related goals and priorities arising out of the strategic and planning documents, then, it participates in the process of complete transposition of the EU *acquis* into the national legislation, and at local level, it provides high level of integrated waste management in the Republic of Macedonia.

The Department participates in the process of issuance of A-integrated environmental permits, responds to the requests for information of public character, develops the cooperation with the units of self-governance and non-governmental organizations in the area of waste management, and it regularly participates in national and international conferences and workshops related to the waste management.

Department of Waters. The Department of Waters is in charge of undertaking professional activities in the water protection areas in accordance with the water legislation which incorporates the concept of integrated management of watersheds. The Department

engages and monitors the National Water Strategy, organizes and participates in the development of water economy bases, develops and monitors the realization of the Water Management Programme; participates in the procedure for issuance and awarding of concessions for water use, discharge of water, and extraction of sand, gravel and stone, as well as issuance of water economy approvals; participates in the procedure for development of water bodies management plans and in the work of the entities mandated to manage waters, etc.

Department of Industrial Pollution and Risk Management. The Department of Industrial Pollution and Risk Management implements the procedures for issuance of permits for harmonization with the operational plan and A-integrated environmental permits; keeps the register of A and B-integrated environmental permits, or A and B-permits for harmonization with the operational plan issued by the MAFWE and by the municipalities in the Republic of Macedonia, and it provides directional for implementation of the procedure for B-integrated environmental permits, or B-permits for harmonization with the operational plan, as well as processing of B-permits for installations in protected areas when the municipality lacks the capacity to process them in its own.

The role of the other departments (Department of Spatial Planning, Department of Spatial Information System, Department of Macedonian Environmental Information Centre, Department of the European Union, Department of Sustainable Development, Department of Public Relations, etc.) in the MAFWE is to protect, conserve and promote natural heritage.

ANNEX 5

ECONOMIC ISSUES

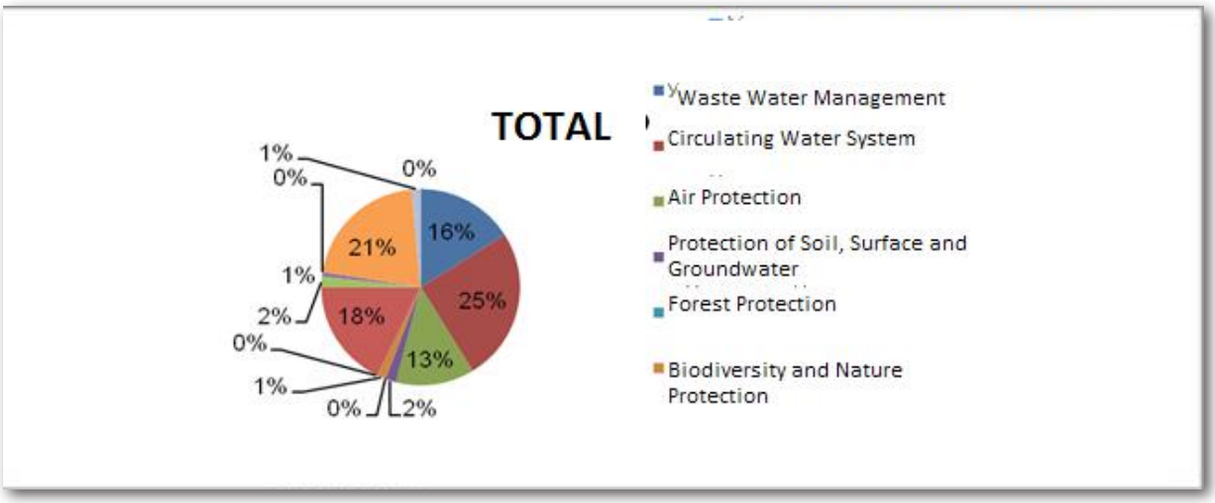
In the context of nature protection, and in accordance with the situation of disruption of its components, concrete investments in prevention and remediation of the situation in nature are absolutely necessary. In the light of the aforementioned, in the Republic of Macedonia there have been concrete investments thus far. However, given the importance and benefits of nature protection, it is estimated that the investments should be significantly larger. It is important to note that in the field of nature protection, significant funds from foreign donations are allocated, but it is necessary to invest more national funds.

Statistics on the investments and costs in the nature protection conducted by the State Statistical Office of the Republic of Macedonia are drafted since 2013.

Costs of nature protection consist of two components:

- investments in the nature protection funds, and
- costs to maintain the nature protection funds.

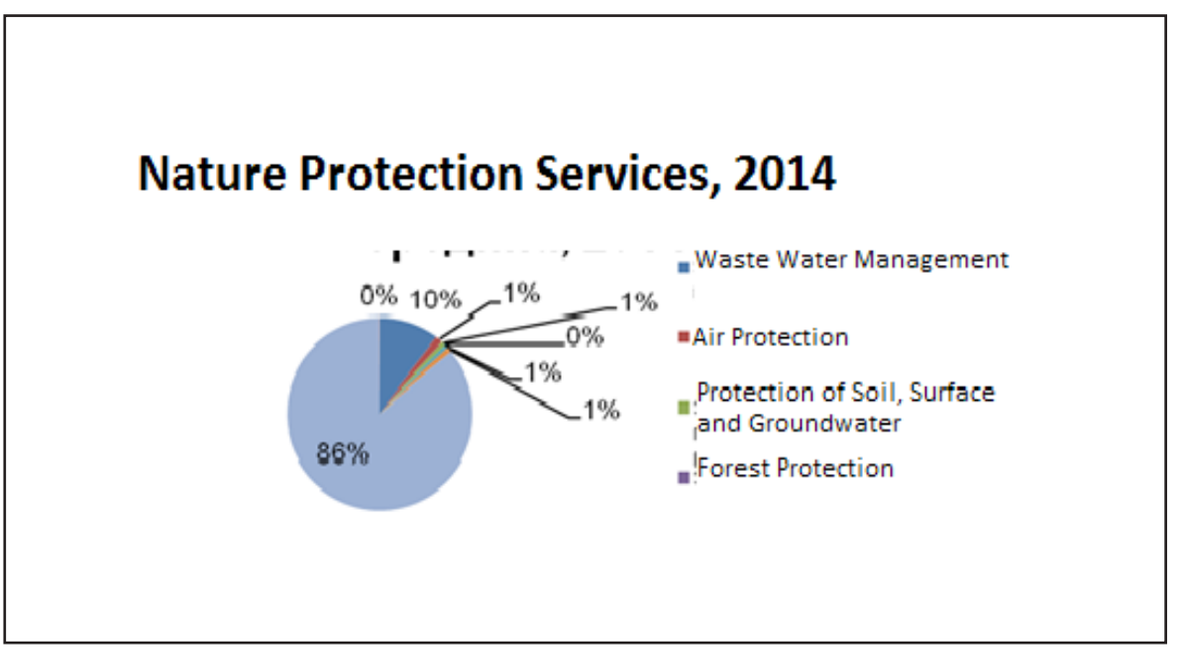
Total costs for nature protection in 2014 were lower than the costs in 2013 by approximately 13%. Investments in nature protection have been reduced by 27%, and costs to maintain the nature protection have been increased by approximately 4%.



Total costs for nature protection in 2014
Source: State Statistical Office (2014): Statistical Annual Book

The highest amount (25%) of the total costs for nature protection in 2014 was paid for the circulating water system.

The largest portion of payments and fees for delivered services in the area of nature protection for 2014 was paid for the waste treatment service.



Services for nature protection
Source: State Statistical Office (2014): Statistical Annual Book

Costs of nature protection in 2013 and 2014 (in 000 MKD)

	2013			2014		
	Total investments and costs	Investments in nature protection	Costs for maintenance of nature protection funds	Total investments and costs	Investments in nature protection	Costs for maintenance of nature protection funds
Total		4028885	3527163	6622042	2944369	3677672
Waste water management	730197	286155	444042	1062425	510054	552371
Circulating water system	2250512	1365612	884899	1668597	1170904	497694
Air protection	784894	737506	47388	844897	740947	103950
Protection of soil, surface and groundwaters	247562	83623	163939	119106	21130	97976
Forest protection	160	160	-	1478	1478	-
Nature and biodiversity protection	77457	34061	43396	93909	67478	26431
Hunting and fishery	46	46	-	-	-	-
Waste treatment	3248888	1424201	1824687	1170557	239560	930997
Protection against noise	57110	55262	1848	123066	121176	1891
Research and development activities	26173	24336	1838	44965	33601	11364
Educational and other similar activities	903	-	903	1890	-	1890
Administrative activities	2398	-	2398	1393588	-	1393588
Control and monitoring equipment, analysis and equipment maintenance costs	123721	17922	105799	92476	38042	54434
Environmental Impact Assessment and Consistency Assessment	6026	-	6026	5086	-	5086

Source: State Statistical Office (2014): Statistical Annual Book

Payments and fees for delivered services in nature protection (in 000 MKD)

	2013	2014
Total	**1653133**	**1804628**
Waste water management	348570	187924
Air protection	140765	23342
Protection of soil, surface and groundwaters	17713	13249
Forest protection	106	43
Nature biodiversity protection	5386	10202
Hunting and fishery	9810	16056
Waste treatment	1128232	1551662
Protection against noise	2552	2149

Source: State Statistical Office (2014): Statistical Annual Book

ANNEX 6

SWOT ANALYSIS

Table 10. SWOT Analysis of the Protection of geodiversity and geological heritage and other components of nature (biological and landscape diversity)

Strengths	***Weaknesses* - Funding**
- High geodiversity and biodiversity - High landscape diversity (+core areas are relatively well connected) - System of protected areas is established - Developed strategies/studies on: biological diversity, protected areas, MAK-NEN, Spatial Plan, climate changes, water strategy, mineral resources strategy, sustainable development strategy, etc. - EMERALD network is defined - Institutional legal framework is established (including numerous signed conventions) - - NGOs are involved in issues related to nature protection - - MAFWE is a member of the International Union for Conservation of Nature (IUCN)	- No sufficient finances are provided for nature protection; - Not sufficient finances and protected areas (PA) management; - Lack of Nature Conservation Fund **<u>Institutional framework</u>** - Lack of competent body responsible for nature protections, such as: Bureau or Agency for Nature Protection; - Institutional capacities at central and local level are not sufficiently strengthened; - Lack of appropriate competent stuffing potential at national and local level; - Lack of coordination among competent institutions; - Overlapping and lack of competences with relevant institutions; - Lack of stuffing of inspection services; **National legislation** - National legislation is not fully transposed and adopted; - Nature Protection Law is not fully harmonized with EU acquis in the area of nature protection - Not all by-laws are adopted - National Strategy for Geodiversity Protection with Action Plan is not adopted - National red lists are not developed and adopted - National red books are not developed and adopted - NEN (National Ecological Network) is not adopted and implemented; **Strategic papers** - Lack of compliance between the existing strategic documents; - Process of adoption of strategic documents (geodiversity, landscapes) is not fully wrapped up **Research, monitoring and inventarization** - Process of nature valorisation is not fully completed; - No continuous monitoring is established; - No monitoring methodology is developed; - Studies on commercial species and quotas are not developed; - Biodiversity indicators are not fully developed; - Surface waters and groundwaters are not sufficiently explored; - GIS data and databases are not unified; - National register of natural heritage and Cadastre of protected areas are not updated; - National Biodiversity Information System (NBIS) is not operational; **Protected areas** - Revalorization (designation and re-designation) of protected areas is not completed; - Protected areas management plans are not developed for most of protected areas; - Protected areas are not properly arranged and managed; - The concept of ecosystem services is not developed and it is not applied; - The concept of eco-tourism is still insufficiently understood and applied; - Irrational use of natural resources; - Lack of education and promotion;

Opportunities	*Threats*
- Candidate country for EU membership and availability of EU-funds (Life+) - Geo-park - Biosphere reserve (UNESCO) - Development of green economy and eco-tourism - Social responsibility - Natura 2000, IUCN Green Belt - Interested funds (Ohrid, Prespa Nature Fund, PONT, UN, GEF, donors) - Cross-border and international cooperation - Greater use of capacities of NGOs working in the area of nature protewcction	- Lack of regulation on the use of finances for exploitation of mineral resources - Monitoring in many sectors is not established - Delayed implementation of action plans in all sectors - Weak institutional capacities - Depopulation - Uncontrolled and increased urbanization - Fragmentation of habitats - Land conversion - Climate changes - Poor finances for nature protection (research, promotion), generally - Low level of awareness on nature protection - Lack of social consensus on solutions for nature issues