Project “Support to the Republic of Macedonia for revision of National Biodiversity Strategy and Action Plan and development of the Fifth National Report to the Convention on Biodiversity”

Republic of Macedonia
Ministry of environment and physical planning

NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN

For the period 2018 - 2023

Skopje, 2018

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The Government of the Republic of Macedonia on its 58th session hold on 13th of March 2018 has adopted the National Biodiversity Strategy and Action Plan for the period 2018-2023. The National Biodiversity Strategy and Action Plan of the Republic of Macedonia was developed in the framework of the project "Support to the Republic of Macedonia for revision of the National Biodiversity Strategy and Action Plan (NBSAP) and development of the Fifth National Report to the Convention on Biological Diversity (CBD)".

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List of abbreviations

SSO	State Statistical Office
Bern Convention	Convention on the Conservation of European Wildlife and Natural Habitats
Bird Directive	Directive 2009/147/EC on the conservation of wild birds
Bonn Convention	Convention on the Conservation of Migratory Species of Wild Animals
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CORINE	Coordination of information on the environment
ECPGR	European Cooperative Programme for Genetic Resources
EIA	Environmental Impact Assessment
Emerald Network	Ecological network to conserve wild flora and fauna and their natural habitats of Europe
ELEM	Electric Power Plants of Macedonia, Joint Stock Company
EU	European Union
EUNIS	European Nature Information System
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
Habitats Directive	Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora
NHS	National Hydrometeorological Service
HPP	Hydro Power Plant
IPA	Instrument for Pre-accession Assistance
IPAs	Important Plant Areas
IPBES	Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
MAFWE	Ministry of Agriculture, Forestry and Water Economy
MAK-NEN	Macedonian National Ecological Network
MAP	Medicinal and aromatic plants
MASA	Macedonian Academy of Science and Arts
MES	Ministry of Education and Science of the Republic of Macedonia
NBSAP (2004)	First National Biodiversity Strategy with Action Plan
NEAP	National Environmental Action Plan
PEBLDS	Pan-European Biological and Landscape Diversity Strategy
PGRFA	Plant Genetic Resources for Food and Agriculture
PHI	Public Health Institute
PM10	Particulate matters sized up to 10 μm
POPs	Persistent organic pollutants
RIMSYS	Rivers Monitoring System
SDC	Swedish Development Cooperation
SEA	Strategic Environmental Assessment
SEED-Net	Southeast Asia Engineering Education Development Network
SIDA	Swedish International Development Agency
SFRY	Socialist Federative Republic of Yugoslavia
SHP	Small Hydro Power Plant
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
ZELS	Association of the Units of Local Self-Government

Foreword

Environmental degradation and climate change are no longer just a hypothesis, but a harsh reality that offers new proofs of its existence on a daily basis. We live in times in which we have the knowledge to reverse these processes, but we still need to summon the courage to make the difficult, but necessary choices to save our planet and the future of our children. One of the often overlooked types of environmental destruction is the loss of biodiversity. According to expert estimates, annually we are losing about 27,000 species and, should the extinction continue at the current rate, in the next 30 years we could lose up to 25% of the living species, i.e. one quarter of all living species on earth. We are aware of how severe biodiversity loss is becoming and we understand the steps we need to take in order to reverse it. Yet, we know little of the possible implications of this catastrophic projection that according to some experts might threaten our very existence as a species.

The Republic of Macedonia is situated in the central part of the Balkan Peninsula, one of the richest European regions when it comes to biological diversity, with a high degree of endemism. However, the time has come to start seeing this richness as a pledge towards our children and the future of our planet. Such richness must become a reminder of the battle that awaits us, and every one of us has a role to play in it.

Efficient protection of biological diversity and natural heritage requires the establishment of an appropriate national policy. The Republic of Macedonia is a signatory to a large number of multilateral environmental agreements, including the Convention on Biological Diversity (CBD), ratified in 1997, which provide specific guidelines towards establishment of the national legal system for biodiversity protection. In light of the global biodiversity targets adopted during the 10th Conference of the Parties to the Convention on Biological Diversity (COP 10, also known as Aichi Targets), the Parties are obliged to translate and adopt them in their national strategic documents, including the National Biodiversity Strategy. Also, the Republic of Macedonia is a candidate country for European Union (EU) membership, and the required transposition of European legislation further enhances our strive towards better protection of our biodiversity.

The first National Biological Diversity Strategy and Action Plan (NBSAP) was developed in 2004 and, together with the Law on Nature Protection adopted in the same year, it was part of the efforts made by the Ministry towards establishing integrated protection of biological diversity and natural heritage, incorporating requirements from the CBD and EU's Acquis Communautaire. This new strategic document, developed with the support of the Global Environmental Facility and UN Environment Regional Office for Europe – Programme Office in Vienna, renews and reinforces those efforts, planting a seed for the establishment of efficient conservation and sustainable use of biological diversity in the Republic of Macedonia, thus fulfilling the country's commitments to the Convention on Biological Diversity and contributing to the achievement of the Aichi Targets.

In parallel, the Government of the Republic of Macedonia adopted the National Strategy for Nature Protection (2017-2027) integrating both geodiversity and biodiversity protection. This Strategy interconnects actions developed under the related strategies on water, biodiversity, mineral resources, tourism, energy and other sectors, as well as actions stemming from the ratified International Agreements.

In addition, the country is making efforts to identify and protect the habitats, species and birds of EU importance, as a contribution to the integrated biodiversity protection and fulfillment of the obligations deriving from the relevant EU legislation.

The newly-developed 19 national targets are fully in compliance with the Aichi Targets as well as with the Biodiversity Strategy of the European Union. These, together with the proposed Biodiversity Action Plan, are the tools to build more sustainable future for our biodiversity. However, we will not succeed if these are but isolated efforts. The Ministry will commit to involve all relevant stakeholders and enhance the inclusion of biodiversity and related issues into diverse strategic documents and policies. Our hope is that you will join us in building a sustainable future for our nature and our children.

Mr. Sadulla Duraki,
Minister of Environment and Physical Planning

Dojran Lake – the smallest of the three tectonic lakes in Macedonia

1. Introduction

1.1. Biological diversity and its importance for human well-being

Biological diversity is a broad term which, in line with the Convention on Biological Diversity (CBD), covers three different components: intraspecific genes (genetic diversity, interspecific genes (species diversity) and ecosystems (ecological diversity). Besides the official definition of biological diversity, definitions describing its linkages with human well-being have been particularly relevant for the last two decades. One of those reads: "biological diversity forms the foundation of the vast array of ecosystem services that contribute to human well-being" (MEA 2005). This indicates the fact that biological diversity is equally important in natural and human-managed ecosystems. Consequently, decisions humans make with regard to biological diversity affect, inter alia, the well-being of humankind. Biological diversity plays an important role in maintaining the ecosystems functionality, thus providing specific goods and services of vital importance to people. Provision of food, water, medicines and clean air are only few of the basic services we obtain from ecosystems, probably familiar to every human. The very processes that go on in natural ecosystems have beneficial effect on man – they protect him against floods, erosion, and climate change. Finally, an invaluable benefit offered to humans, that could not exist if normal performance of ecosystems is disrupted by any kind of factors, is the opportunity to enjoy and recreate in nature.

All changes that affect biological diversity by default affect the performance of ecosystems and by this human well-being, too. Due to this linkage exactly, the scope of biological diversity research should expand to include the aspects of human well-being and thus attract the interest of the public and also of decision makers with regard to its conservation. Lack of market prices for ecosystem services (value of the clean air that we breath or safe water that we drink) and biological diversity means that the benefits we acquire from these assets are overlooked and undervalued by decisions makers; these lead not only to actions that foster biological diversity loss, but also affect human well-being (TEEB 2009). Therefore, realizing the value of ecosystems and presenting the benefits from biological diversity and ecosystem services in front of the economic sector in the country may result in their improved management and different decisions by policies. Stressing the linkage between biological diversity and human well-being will probably change the present (non-) perception of the urgency of measures undertaking and settlement of the issue of biological diversity conservation in the Republic of Macedonia.

1.2 Strategic approach to biological diversity conservation at global level

The 1992 World Summit on Sustainable Development in Rio de Janeiro adopted the Convention on Biological Diversity (CBD) providing the framework for biological diversity conservation at global level. CBD is a multilateral agreement signed by 193 countries that have agreed that biological diversity is of common interest to mankind. They undertook to cooperate to preserve habitats, species and genes, change the use of natural resources into sustainable pattern and guarantee that benefits from genetic resources will be shared equitably on local, national and regional level.

In 2002, world leaders agreed to undertake measures towards significant reduction in the rate of biological diversity loss by 2010. However, actions undertaken and efforts of the countries were not sufficient to lessen pressures on biological diversity and thus Target 2010 was not achieved (CBD GBO3).

Annual losses resulting from deforestation and forest degradation equal a financial loss of USD 2-4.5 trillion. This can be prevented by investment of only USD 45 billion: an investment paid back hundred times.

Due to human activities, species are being extinct at a rate 100-1000 times faster than the natural one; according to FAO, 60% of the global ecosystems are degraded or used unsustainably, 75% of the fish stock is overused or severely declined, whereas 75% of the genetic diversity of agricultural plants has been lost since 1990 onwards; in livestock production, 30% of global breeds of mammals (1,200 breeds) and birds (1,500 species) were either critically endangered or lost in the second half of 20th century; around 13 million hectares of tropical forests are cut per year; 20% of tropical coral reefs have already disappeared, and as much as 95% will be severely damaged as a result of climate change by 2050.

1.2.1 “Living in harmony with nature” – Global Strategic Plan for Biological Diversity (2011-2020)

The Global Strategic Plan for Biological Diversity 2011–2020 was adopted in 2010, in Nagoya, Japan, whereby countries reaffirmed their commitment to undertake urgent measures for biological diversity conservation. It is a ten-year leading international framework for action by all countries and stakeholders to save biological diversity and enhance benefits for people. Strategic Plan incorporates the common Vision, Mission, five strategic goals and 20 ambitious though feasible targets known as Aichi Targets. These were set to make a step towards implementation of decisions taken by the Conference of Parties and achievement of measurable and tangible results at global level.

Mission

To take effective and urgent action to halt the loss of biodiversity in order to ensure that ecosystems by 2020 are resilient and continue to provide essential services, thereby securing the planet’s variety of life, and contributing to human well-being and poverty eradication.

Vision

By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services sustaining a healthy planet and delivering benefits essential for all people.

The Strategic Plan calls for the establishment of specific national targets, involvement of all stakeholders and integration of biological diversity aspects in all sectors of the society. Full and effective implementation of this strategic plan is possible to achieve only through common commitment of all Parties to the Convention throughout the decade.

Aichi Biodiversity Targets

Strategic goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society.

Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.

Target 3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.

Target 4: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

Strategic goal B: Reduce the direct pressures on biodiversity and promote sustainable use.

Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

Target 6: By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.

Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

Target 9: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

Target 10: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

Strategic goal C: Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity.

Target 11: By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

Strategic goal D: Enhance the benefits to all from biodiversity and ecosystem services.

Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

Target 16: By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.

Strategic goal E: Enhance implementation through participatory planning, knowledge management and capacity building

Target 17: By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.

Target 18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.

Target 19: By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

Target 20: By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels.

1.2.2 "Our life insurance – Our natural capital" – Strategic Plan for Biological Diversity of the European Union for 2011-2020

The European Commission, in response to setting global Aichi Targets, in May 2011, adopted an ambitious strategy to prevent the loss of biological diversity and ecosystem services in the countries of the European Union by 2020 under the title "Our life insurance – our natural capital".

Headline target of the Strategy is "Halting the loss of biological diversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss".

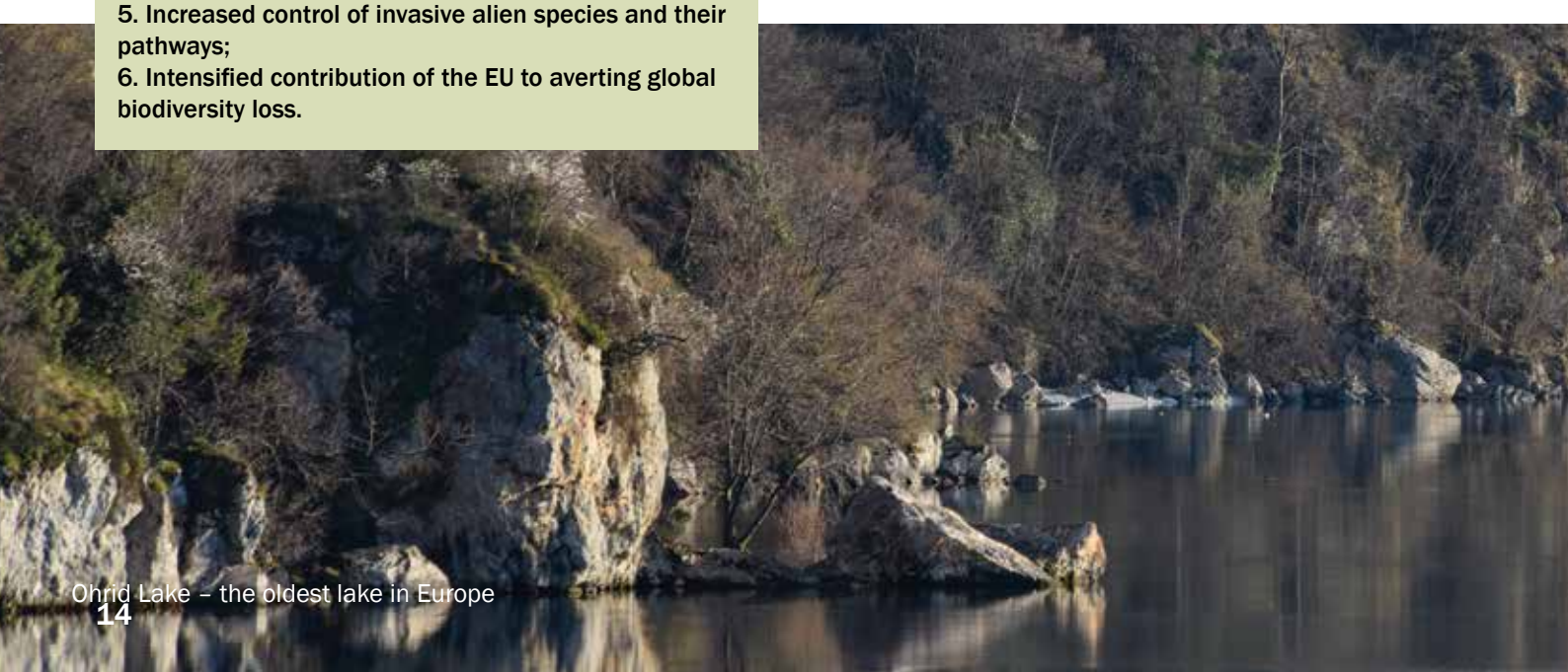
Under the EU Vision "By 2050, biodiversity in European Union and the ecosystem services it provides — its natural capital — are protected, valued and appropriately restored for biodiversity's intrinsic value and for their essential contribution to human well-being and economic prosperity, so that catastrophic changes caused by the loss of biodiversity are avoided".

The Strategy contains six mutually supportive and inter-dependent targets (and 20 actions) that correspond to the Aichi Targets:
1. Full implementation of the EU Acquis on nature conservation, especially the Birds Directive (Directive on the conservation of wild birds, 2009/147/EC) and Habitats Directive (Directive on the conservation of natural habitats and of wild fauna and flora, 92/43/EEC) aiming to preventing further loss of biodiversity;
2. Maintaining and enhancing ecosystems and their services by establishing green infrastructure and restoring at least 15% of degraded ecosystems;
3. Enhancing contribution of the agriculture and forestry to biodiversity conservation and sustainable management;
4. Improved management of fish stock and achieving maximum sustainable yield;
5. Increased control of invasive alien species and their pathways;
6. Intensified contribution of the EU to averting global biodiversity loss.

1.2.3 Pan-European 2020 Strategy for Biodiversity

The Pan-European Biological and Landscape Diversity Strategy (PEBLDS) was adopted in 1994, as support in the implementation of the Convention on Biological Diversity at Pan-European level. It has served as framework for coordination and uniting of the existing initiatives for biological diversity protection throughout the European continent. In 2011, it was replaced by the new 2020 Strategy for Biodiversity, adopted at the Sixth Conference on Biodiversity in Europe in Georgia, in line with the Global Strategy and the Aichi Targets (UNEP 2011). The Strategy highlights the importance of regional approach in biological diversity protection and supports cooperation among countries towards biological diversity conservation. Pan-European Strategy focuses on issues and problems related to biological diversity (and needs of countries) which are specific to this region, while CBD which provides instructions, guidelines and standards at global level. The Pan-European Strategy is of particular importance for non-EU countries, since it provides a platform for information exchange, harmonization of activities and involvement of the main stakeholders in biological diversity conservation. To that end, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) was established, and the Republic of Macedonia has not become its member yet.

Consequently, the main goal of the Pan-European Strategy is to facilitate cooperation and synergy among multilateral agreements in the area of biological diversity (apart from CBD, it encompasses Bonn and Ramsar Conventions, CITES, UNESCO World Heritage Convention, International Agreement on Plant Genetic Resources for Food and Agriculture, as well as Bern Convention) and contribute to the implementation of these agreements at regional level.



Ohrid Lake – the oldest lake in Europe

1.2.4 Biological diversity as part of the sustainable development policy

Following the 1992 United Nations Conference on Environment and Development ("Earth Summit") in Rio de Janeiro, a new pathway to human well-being, the path of sustainable development was identified. In 2000, the Millennium Declaration and the Millennium Development Goals placed people at the centre, generating unprecedented improvement in the lives of many around the world.

The 2012 UN Conference on Sustainable Development (Rio+20) laid the cornerstone for the post-2015 sustainable development process for the world to take historic action to transform lives and protect the planet. Hence, reaffirmed were the commitments in the outcomes of all the major United Nations conferences and summits in the economic, social and environmental fields, as well as the strengthening of international cooperation to address the persistent challenges related to sustainable development, particularly in developing countries. Each country, however, has primary responsibility for its own economic and social development, whereas the role of national policies, domestic resources and development strategies cannot be overemphasized.

The Conference outcome document entitled "The Future We Want", inter alia, set out an obligation to develop a set of sustainable development goals for consideration and appropriate action by the General Assembly. Poverty eradication, changing unsustainable and promoting sustainable patterns of consumption and production, and protecting and managing the natural resource base of economic and social development are the overarching objectives of and essential requirements for sustainable development. Following more than a year of inclusive and intensive consultative deliberations, 17 specific goals with 169 associated targets (developed on the foundation laid by the Millennium Development Goals) were proposed, all being action-oriented, global in nature and universally applicable, and taking into account different national realities, capacities and levels of development. The goals and targets integrate economic, social and environmental aspects and recognize their interlinkages in achieving sustainable development in all its dimensions.

This proposed set of global priorities for sustainable development will be used as the main basis for the post-2015 intergovernmental process.

It sought to combine aspirational global targets, with country-specific targets to be set nationally. The environmental dimension is articulated across the whole sustainable development agenda and biodiversity conservation is mostly linked to Goal 15 "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss", but (either directly or indirectly) it also tackles several other goals (e.g. goals related to sustainable agriculture, sustainable management of water, sustainable consumption and production patterns, etc.). High interlinkage with Aichi biodiversity targets is evident, thus the National Biodiversity Strategy with Action Plan (NBSAP) presents an important policy document supporting their implementation. Several national newly identified biodiversity targets, for example, National Target 11, as well as Targets 7, 5, 2, 6, etc. (see subchapter 11.1), directly refer to sustainable development goals. Implementation of proposed actions in the Biodiversity Action Plan developed to reach biodiversity targets will directly support implementation of sustainable development goals.

1.3 National Biodiversity Strategy and obligations for its revision

The Convention on Biological Diversity (Article 6) obliges the countries to prepare national strategies, whereas, in accordance to Article 26, Parties are required to submit regular national reports containing information on the measures taken towards the implementation of the Convention and their effectiveness. National strategies are defined as integrative cross-sectoral instrument for biological diversity protection planning at national level, developed through involvement of all stakeholders.

NBSAP preparation is a process through which countries plan actions necessary to overcome obstacles to biological diversity conservation and make the necessary changes, while conservation planning is a cyclic and adjustable process. Each country develops its own approach to NBSAP preparation depending on specific circumstances and resources in the country. At the same time, this Strategy is ever more relevant for the implementation of other multilateral agreements in the area of nature protection providing significant input in biological diversity sustainable management and use. NBSAP should be harmonized with the requirements of other conventions, such as: Bonn Convention, CITES, Ramsar Convention, UNESCO Convention on World Heritage, Bern Convention, etc.

Republic of Macedonia ratified the Convention on Biological Diversity in December 1997, thereby undertaking and committing itself to implement the obligations ensuing from it. The first Country Study on Biological Diversity in the Republic of Macedonia was developed in 2003, and the first National Biodiversity Strategy with Action Plan of the Republic of Macedonia was adopted in 2004. So far, Republic of Macedonia has prepared five national reports to the CBD, as well as several thematic reports.

2. Basic characteristics of the Republic of Macedonia

The Republic of Macedonia is situated in the central part of the Balkan Peninsula. To the north it borders Kosovo and Serbia, to the east, Bulgaria, to the south, Greece, and Albania to the west. It covers an area of 25.713 km2. The southernmost point is at Markova Noga (eastern shore of Prespa Lake), the northernmost one at the locality Anishte (north of Kriva Palanka), the westernmost at the locality Kestenjar (southwest of Debar) and the easternmost point is positioned at the locality Chengino Kale (east of Berovo). Airline distance from its northern to its southern borders is 155 km, and 210 km from western to eastern ones.

Shar Planina mountain

Glacial relief in Shar Planina mountain

2.1 Geographical characteristics

Modern geological evolution of the Republic of Macedonia's space has resulted in differentiation of four tectonic zones: Vardar zone, Pelagonian horst-anticlinorium, West Macedonian zone and Serbia-Macedonian massif. As centrally positioned axis, the Vardar zone extends in north-south direction from Belgrade to Thessaloniki Bay, and in Macedonia it occupies the Valley of Vardar River. Pelagonian horst-anticlinorium is situated between Vardar zone, to the east, and Western Macedonian zone, to the west and north, from which it is separated by regional and profound faults.

The oldest geological strata in Macedonia originate from Precambrian times. In this era, the Serbia-Macedonian massif, Vardar zone and Pelagonian horst-anticlinorium used to make one unit, built of metamorphic rocks of different composition. Serbia-Macedonian massif, represented in the areas of Kozjak, German, Osogovo, Plachkovica, Maleshevo Mountains and Belasica, is characterized with gneisses, mica schists and shales.

Macedonia's contemporary relief has essentially tectonic character. Due to the dominance of radial (vertical) processes of elevation, the main feature of the relief is marked by the many horsts (mountains) and graben depressions (valleys), almost always separated one from another by edge dislocations (Kolchakovski 2004). To a minor extent, sinking was present during the Neotectonic Era resulting in valley formation.

Mountains in Macedonia belong to three groups by their altitude:

- high (above 2000 m): Korab (Golem Korab, 2753 m), Shar Planina (Titov Vrv or Golem Turchin, 2748 m), Pelister (Pelister, 2601 m), Jakupica (Solunska Glava, 2540 m) and Nidze or Kajmakchalan (Kajmakchalan, 2520 m), as

High altitude zone of Koran mountain

well as Bistra, Stogovo, Jablanica, Galichica, Kozhuf, Osogovo Mountains, Belasica;

- medium (1500-2000 m): mountains Plakenska and Ilinska, Vlaina, Maleshevo, Suva Gora, Kozjak, Karaorman, Busheva Planina, Plachkovica, Babuna, Ograzhden, German, Selechka Planina, Skopska Crna Gora, Dren, Golak, Bukovikj and some others; and
- low mountains (up to 1500 m): Zheden, Serta, Klepa, Gradeshka Planina, Plaush, Smrdesh, Mangovica, Gradishtanska Planina, etc.

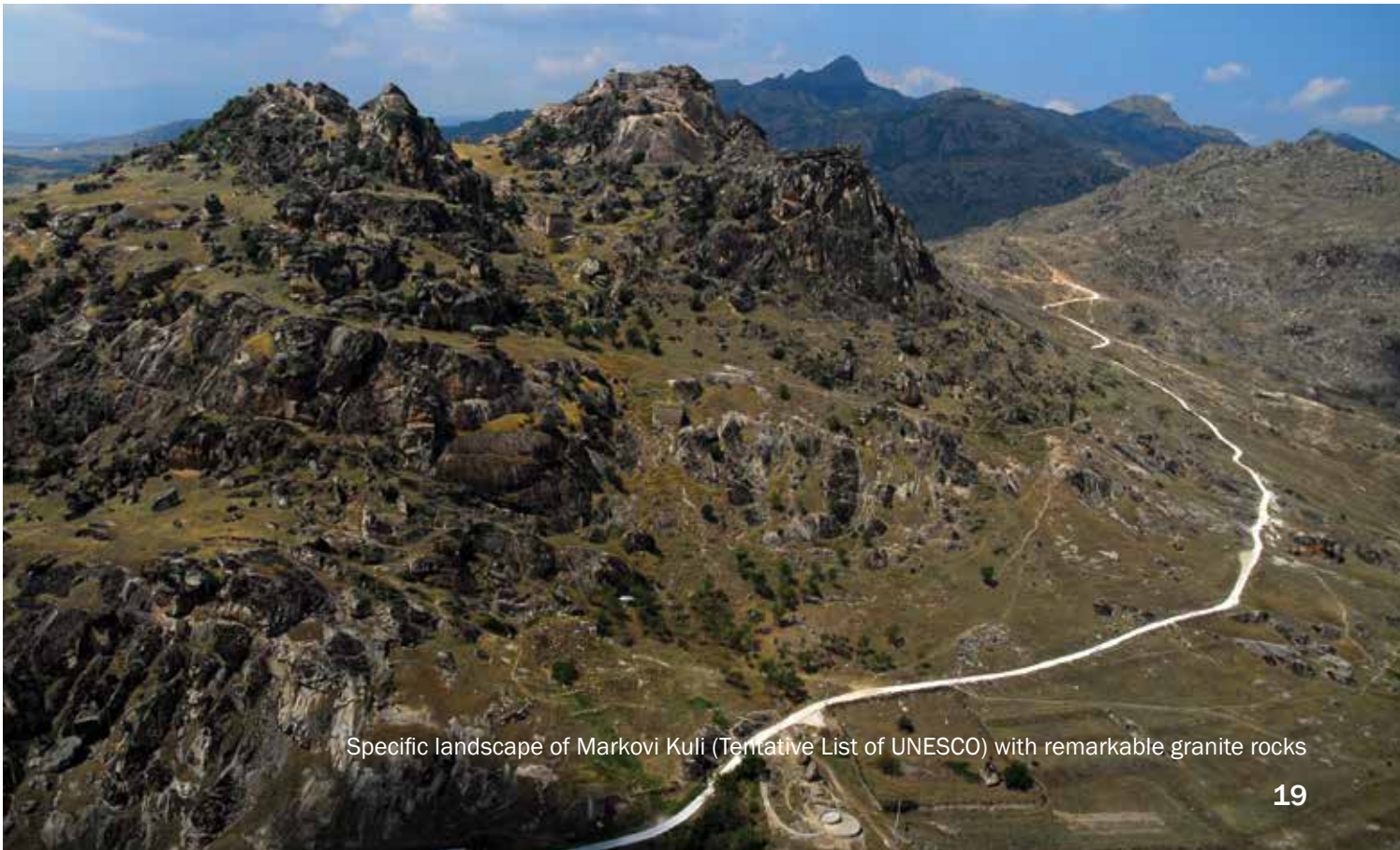

Mrenoga village


Pelagonija plain

Valleys have acquired their morpho-structural physiognomy through endeogean neotectonic processes. Eleven valleys can be distinguished in Macedonia which differ greatly in their area. Pelagonia, with an area of 3682 km2, is the largest valley in Macedonia, followed by Tikvesh (2518 km2) and Ovche Pole (2162 km2). Other prominent valleys also include Skopje, Radovish-Strumica, Polog, Ohrid-Struga, Kumanovo, Veles, Delchevo-Berovo, Kochani and Gevgelia-Valandovo valleys (Kolchakovski 2004).

Recent relief is represented by abrasive (on the shores of the natural lakes), fluvial (river), karstic, periglacial and glacial relief forms. Karstic relief is the most represented on the mountains of Zheden, Bistra, Galichica, Jakupica, in Poreche Basin, springs section of the river Crna Reka, in Mariovo, along the valley of Vardar and small parts of the mountains Plachkovica and Vlaina. Underground karstic forms are represented by caves and precipices. The highest number of precipices has been registered on the mountain Jakupica. Periglacial relief is represented by fossil (rocky rivers – Pelister, rocky glaciers – Jablanica) and recent forms (grass terraces – Jablanica, Pelister).

Paleorelief is represented by paleovolcanic relief (volcanic plug, neck, volcanic craters, and plates), especially in


Specific landscape of Markovi Kuli (Tentative List of UNESCO) with remarkable granite rocks

Glacial lake Malo Ezero on Pelister Mountain

2.2 Climate characteristics

Climate in the Republic of Macedonia is heterogeneous and strongly diverse in its various parts. Its distinctive feature is that there are no climate influences in pure form, but certain combined influences predominate everywhere resulting in major climate modifications on a relatively small area.

Macedonia is under the influence of two zonal climates, namely: Mediterranean and moderate continental, as well as local mountainous climate occurring in mountainous areas. Influence of the European continent is well manifested from eastern and northern side, and Mediterranean (Aegean Sea) from the southern side, while the influence from west (Adriatic Sea) is much weaker. The well-developed mountainous relief characterizing Macedonia is a great modifier of different climate influences. Distinctive feature of Macedonian climate is that climate influences from zonal climates combine with local climate influences, thus contributing to a wide and heterogeneous spectrum of climate types.

Great heterogeneity of climate results in major variations of all climate elements. The average annual temperature varies between -0.4 and 14.2oC, and annual precipitation ranges from 460 to 1103 mm. The highest annual precipitation (more than 1400 mm) has been recorded in the valley of the river Radika (Rostushe, Zhirovnica), while the lowest one in the area of Gradsko, Ovche Pole and Veleshko Pole (less than 500 mm). Precipitation occurs mainly as rain, and as snow during. Snowfall occurs in November and even earlier on high mountains. The average period of snow cover duration is December-March and November-April, and even May on high mountains.

Significant characteristic of the climate in Macedonia relates to dry periods lasting for more than 30 days, though the duration of maximum dry periods exceeded as much as 80 days in certain years (Lazarevski 1993).

The influence of modified Mediterranean (sub-Mediterranean) climate is distinguished in the lowest parts of the Republic of Macedonia (areas of Strumica, Gevgelia, Valandovo to Demir Kapija) with an altitude of 40 to 500 meters. The average annual temperature in this area is 14.2oC. These climate characteristics contribute to the condition in this area where winter is mild, with high relative humidity, and summer is hot, dry, and clear with low relative humidity.

Areas positioned between 500 and 600 meters above sea level (in Povardarie and valleys around the rivers Pchinja, Bregalnica, Strumeshnica, Treska, Drim and Radika) are under the combined influence of sub-Mediterranean and continental climate. The average annual temperature in this area is 12.7oC, and quantity of precipitation ranges from 460 to 583 mm per year.

As altitude increases, the area from 600 to 900

Riparian belts of Oriental plane, willows and poplars along river Vardar

Macedonian fir (Abies borisii-regis) on Shar Planina

meters above sea level (Polog, Kichevo, Debar, Belchishte, Struga, Ohrid, Prespa, Pelagonia, Kriva Palanka, Kratovo and Delchevo areas) is dominated by the influence of warm continental climate. The average annual temperature in this area is 10.9oC, and annual sum of precipitation ranges between 515 and 890 mm.

The influence of cold continental climate is more intensive in areas between 900 and 1100 meters above sea level, in lower mountainous parts (Resen, Maleshevo). The average annual temperature in this area is 9.0oC, and annual sum of precipitations ranges between 800 and 850 mm.

With increasing altitude, the influence of mountainous climate rises in areas between 1100 and 1300 meters above sea level. In these areas, ass. Festuco heterophylae-Fagetum (Em 1965) (forest community of sub-montane beech forest) occurs with climate zonal distribution. The average annual temperature in this area is 8.5oC, and annual sum of precipitation ranges between 808 and 900 mm.

Mountainous climate has more dominant influence at altitudes of 1300 to 1650 meters. In this part, ass. Calamintho grandiflorae-Fagetum (Em 1965) (forest community of montane beech forest) grows with climate zonal distribution. The average annual temperature in this area is 6.4oC, and annual sum of precipitation ranges between 1044 and 1103 mm.

Areas at higher altitude, from 1650 to 2250 meters above sea level, are dominated by the influence of mountainous climate. Several climate zonal forest communities (sub-alpine beech, fir, spruce, Macedonian pine and dwarf pine) are represented in this part. The average annual temperature in this area is 3.5oC, and annual sum of precipitation ranges between 1074 and 1001 mm.

The influence of Alpine climate is distinguished in the highest parts of the Republic of Macedonia, exceeding 2250 meters above sea level (Kozhuf, Nidze, Baba, Deshat, Korab, Shar Planina and Jakupica). This alpine belt occurs above the zone of forest vegetation and only grass alpine vegetation spreads there. The average annual temperature in this area has a negative fore sign and amounts -0.4oC, while annual sum of precipitation ranges around 791mm. Winters in this part are long, cold, wet and snowy, and summers are short and fresh.

Mazdracha river valley on Shar Planina

2.3 Hydrographic characteristics of Macedonia

There are different types of waters on the territory of the Republic of Macedonia, such as ground waters, springs, sources, running waters, streams and rivers, as well as natural and artificial lakes. The overall water resources in the Republic of Macedonia have been estimated at around 26 billion m3 (Figure 1). According to these values, Macedonia could be categorized among medium rich in water countries. Water resources are unevenly distributed on the territory of the Republic of Macedonia, which results from diverse geological composition, relief structure and climate characteristics. It should be pointed out that 84% of the waters in the Republic of Macedonia are domicile, while only 16% originate outside of the country.

The total amount of ground waters is estimated at around 0.52 billion m3. The greatest quantities occur in Skopje, Strumica, Kumanovo and Gevgelia-Valandovo Valleys. These waters are especially important for water supply to people, as it has been estimated that around 60% of the rural settlements and around 50% of the urban settlements use such waters to satisfy the demand.

Springs are natural flow of aquifer water to the surface of the earth. It is considered that Macedonia is not rich in springs. Most of them (around 80%) are located in the watershed of Vardar River, while few are in the watersheds of Crn Drim (around 15%) and Strumica (5%). Around 4400 springs are registered in Macedonia, 1100 of which have capacity bigger than 1 l/s. Among these, around 90 springs have capacity above 30 l/s, and 58 springs have capacity bigger than 100 l/s. The largest rivers in Macedonia originate from karst sources, such as Vardar, Treska, Babuna, Crna Reka, and other rivers. The biggest karst springs in Macedonia is Ostrovo near the monastery St. Naum on the southern shore of the Lake of Ohrid, with overall capacity of 11 m3/s, and Rashche (6 m3/s) is the second in capacity.

Also, more than 50 springs of mineral and thermo-mineral waters of overall capacity of around 1500 l/s are registered in Macedonia. The biggest springs include the spas of Katlanovo, Kumanovo, Kochani, Shtip, Debar, Podlog, etc. Macedonia has numerous mineral springs as well (Skopje Valley, Pelagonia, Polog, Kozhuf, Veles and Radovish areas).

Rivers in Macedonia belong to three watershed areas: Aegean, Adriatic and Black Sea. The Aegean river watershed area is the largest in Macedonia covering an area of 22319 km2 or 87% of the total national territory. It is composed of the watershed of Vardar River (80% of the territory), and watersheds of the rivers Strumica and Cironska. The river of Vardar is the longest and the most important river in Macedonia. The total length of the river amounts 388 km, of which the Republic of Macedonia possesses 301 km. Along its flow through the Republic of Macedonia, Vardar River receives 37 tributaries longer than 10 km in total (Pena from Shar Planina Mt., Treska, Markova Reka, Lepenec and Serava in Skopje Valley, Pchinja and Kadina Reka in Taor Gorge, Topolka and Babuna in the area of Veles, Bregalnica in its middle course, Crna Reka and Boshava in the area of Tikvesh). In its upper flow, the river is enriched with additional 8 m3/s from Mavrovo water reservoir, diverted from the watershed of the river Radika.

The Adriatic river watershed in Macedonia consists of

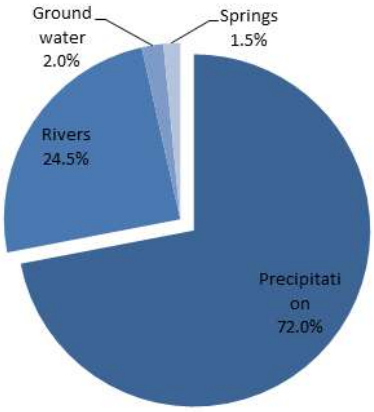


Figure 1. Water resources in Macedonia

the watershed of the river Crn Drim (56 km). Western and southwestern parts of the Republic of Macedonia or 13% of the country's territory drain through it. Crn Drim flows out of Ohrid Lake, runs through Strushko Pole (fields) and then enters the reservoir of Globochica, and continues further down into the next reservoir – Debar Lake (Shpilje). The most significant tributary is the river Radika (64.7 km). Part of the upper watershed of the river Radika has been transferred, artificially, through Mavrovo Lake (reservoir) to the watershed of Vardar.

The Black Sea watershed area covers insignificant part of Macedonia's territory or 44 km2. It is situated on the northern slope of Skopska Crna Gora, where the river Binechka Morava has its springs; this river takes the waters from this area to Black Sea through Juzhna Morava and Danube rivers.

There are also a number of rivers continuing their course underground in Macedonia, such as the rivers Krapa, Lazaropolska and Mala Reka, which sink in limestones; the water of the rivers Cerska, Patishka, Ocha and Pekolnikchija sinks in the river sediment and several small watercourses soak into karst fields (Begovo Pole, Toni Voda).

The Republic of Macedonia has around 160 lakes with a total area of around 500 km2, or around 2% of the total area of Macedonia. Of those, 50 are natural and the rest of 111 are artificial lakes – reservoirs. There are three tectonic lakes in Macedonia, Ohrid, Prespa and Dojran Lakes.

Ohrid Lake is situated in the furthest southwestern part of Macedonia and it covers an area of 348.8 km2 (30.35 x 14.5 km), of which the Republic of Macedonia owns 229.9 km2, and the other part belongs to the Republic of Albania. The average depth is 144.8 m, and the greatest one 287 m. At normal lake water level, this lake basin accumulates 50,683 km3 of water. The Lake is fed with water through numerous riparian and sublacustric springs. Springs on the southern shore line (springs near the monastery St. Naum and springs near the village Tushemishte in Albania) are the most abundant and most numerous. Other major springs are Biljanini Izvori, the springs in the village Kalishta and springs Vodenche near the village Lin in Albania.

Prespa Lake is situated in southwestern part of Macedonia. The Lake covers an area of 274 km2 (28.6 x 16.9 km), of which 176. 8 km2 belong to Macedonia, and the rest belongs to Greece and Albania. The average depth of the Lake is 18.8 m while the biggest depth is 54 m. The overall water stored in (Greater) Prespa Lake amounts to 3.6 km3 (Albrecht et al. 2012). There are two islands in the Greater Prespa Lake, that is, one located in Macedonia – Golem

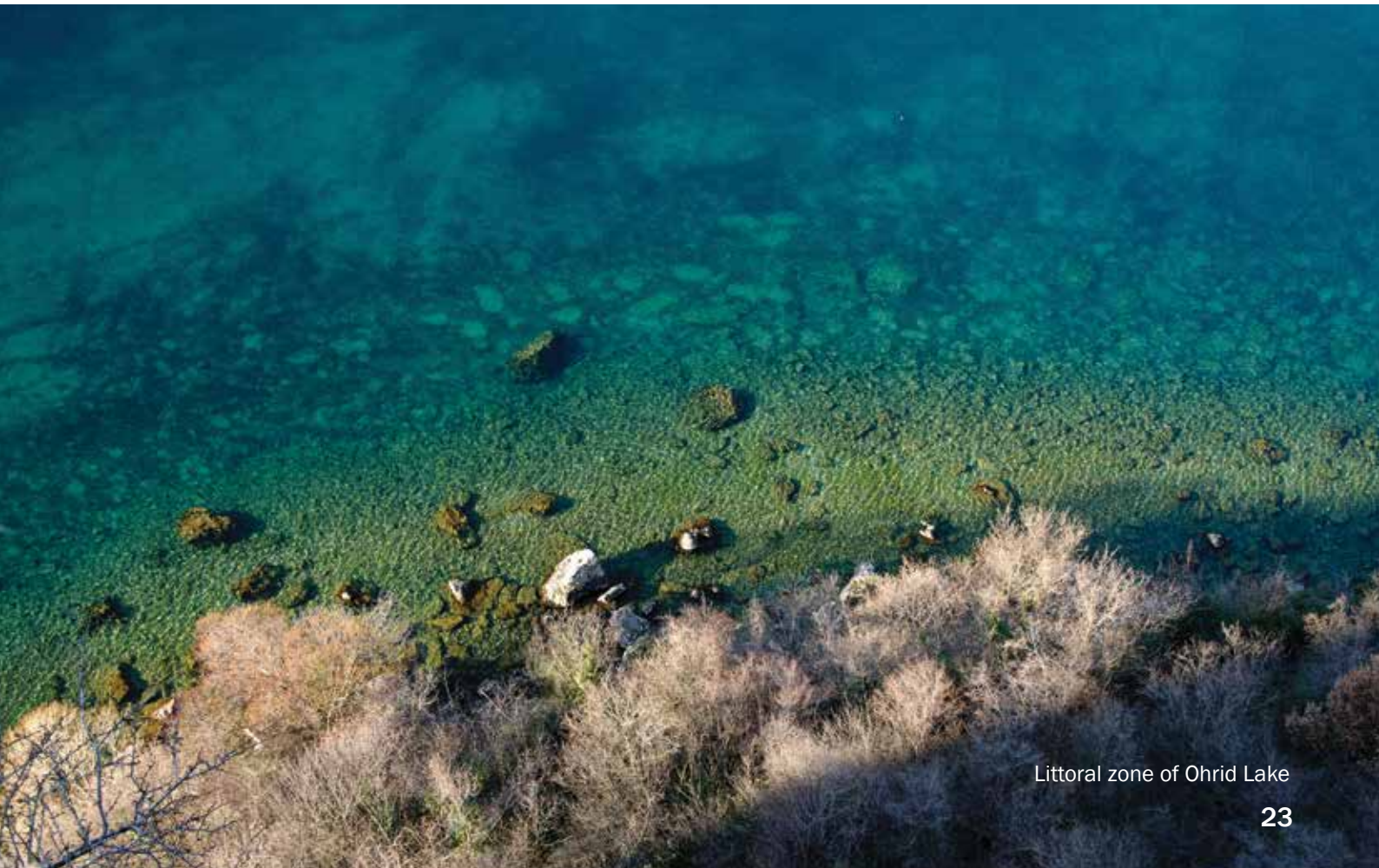
Dojran Lake with the surrounding wetlands and agricultural land

Grad. Prespa Lake is supplied with water from a number of small tributaries, such as Golema Reka, Kranska and Brajchinska, as well as several sublacustric springs. The Lake does not have surface outflow, but it loses its water through evaporation and the sink Vragodupka in the bay of Zavir.

Dojran Lake is situated in southeastern part of Macedonia and covers an area of 43 km2. Its biggest depth of 10 m is in the southeastern part. It is fed with water from several small rivers from a few sublacrustic springs. Starting in 1988, the water level dropped dramatically resulting in decrease of lake's surface area by 600 ha and water volume by around 110 million m3. As of 2002, a project for Lake recovery through replenishment of water from the alluvial aquifer Gjavato near Bogdanci has been implemented.

Apart from tectonic lakes, the Republic of Macedonia also has one landslide lake (Moklishko Lake), one riparian-shore (Ostrovo near St. Naum), six marshy lakes, several cave lakes and 43 glacial lakes (most of which – 21 – are located on Shar Planina Mt., and the rest on the mountains Korab, Deshat, Jablanica, Stogovo, Pelister and Jakupica).

There are more than 110 artificial lakes – reservoirs in Macedonia. Of these, 22 reservoirs have a volume bigger than 1 million m3, and the rest are of smaller volume. Such larger lakes include Tikvesh on the river Crna Reka, Kozjak on the river Treska, Mavrovo Lake on Mavrovo River, Shpilje on the river Crn Drim, Kalimanci on the river Bregalnica, Strezhevo on the river Shemnica, etc.



Littoral zone of Ohrid Lake

Tobacco cultivation by Yuruk community in Radovish area

2.4 Demographic characteristics

According to the latest estimates of 2012, the number of population living in Macedonia is 2062294 inhabitants, which is a slight increase by 1.97% compared to 2002, when the last Census of Population was conducted (2022547 inhabitants). Some statistical planning regions have experienced certain drop in the number of population, while other regions (Skopje and Polog) have had significant growth.

According to the Census of 2002, Macedonia has 1715 villages, which cover 86.7% of the national territory, and 43% of the total population live in there. Urban population is primarily concentrated in the capital of Skopje (around 30%). The average density of population of 81 persons per km2 in 2002 increased by 2 persons (83) per km2 in 2012. Vardar planning region (38) and Pelagonia planning region (49) have the lowest number of inhabitants, while drastic changes in the density of population is noted in Skopje (from 319 to 336 inhabitants per km2) and Polog (from 126 to 131 inhabitants per km2) regions. Increased density of population assumes increased pressure on natural environment as well, especially on biological diversity on local level.

Migration of the population from rural to urban areas, especially from smaller towns to the City of Skopje, is widely present. External migration has been undergoing a constant increase, too.

Following the turbulent period upon the independence and up to the conflict in 2001, the Republic of Macedonia has strived to build stable macro-economic policy and is still attempting to make improvements on all economic fields. Throughout the years, gradual improvement to the performance has been seen in different sectors. As of 2008, the Republic of Macedonia has been recording constant growth in the gross domestic product (GDP) per capita, number of employed people, as well as final consumption per capita.

Economic development is one of priority and strategic commitments of the Republic of Macedonia for the forthcoming period. State institutions endeavour to present the Republic of Macedonia as an attractive destination for foreign investments through promotion of advantages for business management. To a modest degree, comparative advantages offered by the Republic of Macedonia (inexpensive and qualified labour, the Government with friendly attitude towards foreign investments, low costs, single-window system, tax reliefs and subsidies, solid infrastructure, etc.) attract foreign companies that wish to expand their businesses and invest in Macedonia. The state encourages the export of Macedonian products comprehensively with an intention to contribute to the strengthened position of the country as trustworthy business partner and destination. Finally, the economic development potential of the Republic of Macedonia also encompasses its promotion as an attractive tourist destination towards continuous increase in the number of tourists visiting the country.

Among the total working-age population (1 672 961 inhabitants) in the Republic of Macedonia, 657849 inhabitants are employed which indicates high unemployment rate amounting to 29.9% at the beginning of 2013. Unemployment is worse in urban than in rural areas, or where there is an increased need for agricultural labour, the employment rate is higher. Furthermore, the extent of poverty is high and amounted 27.1% for 2011. The overall unemployment rate in the Republic of Macedonia has noted mild decrease during the last several years.

The most frequent income of the population comes from engagement of their own labour, i.e. salary and other compensations. Major part of the citizens earns additional income through various engagements of their own labour and skills. Thus, the most common situation among citizens, especially in rural areas, is to earn incomes from their own engagement in agricultural activities, besides salary (own agricultural production, cattle breeding, leasing of fertile agricultural land or seasonal hired workers). In urban areas (especially Skopje and Ohrid), flats rental, management of small-scale businesses like mechanic, car, electrical and other workshops and services are frequent cases, and sometimes they do not comply with the stipulated standards.

Different construction projects in the country which support indirectly around 20 other sectors and provide sustenance to numerous families are growing. Construction activities include linear infrastructure (roads, bridges and railways), city parking facilities, new structures in culture, health care institutions, administrative buildings, schools, kindergartens, sports grounds and buildings, trade centres, new factories, public infrastructure is under improvement throughout the country, storehouses and purchase and distribution points, accommodation facilities, petrol stations, etc.

Lifestyle of the population, if not among socially vulnerable categories, determines to a great extent their attitude towards biological diversity and environment. Contemporary Macedonian citizen has at an average higher purchasing power, increased consumption of material goods and greater amount of free time. Therefore, they generate huge amounts of waste of industrially made products, mainly food, on daily basis.

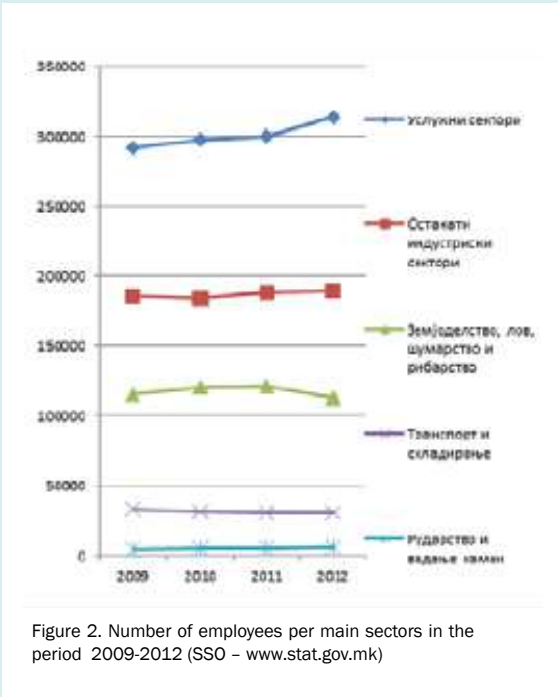


Figure 2. Number of employees per main sectors in the period 2009-2012 (SSO – www.stat.gov.mk)

In 2012, there was significant decrease in the number of workers in the sector Agriculture, hunting, forestry and fisheries by 6.8% (8270 workers), in the sector Water supply; waste waters removal, waste management and environment rehabilitation by 20% (2558 workers), as well as the sector Financial and insurance activities by 14% (1478 workers).

Number of workers in the sector mining and stone extraction has continued the general growth, counting 320 new job positions in 2012 (6%). Manufacturing industry has recorded growth by 1686 new job positions (1.3%). Sector construction has grown by 1063 workers (2.7%), as well as the sector wholesale and retail trade; motor vehicles and motorcycles repair by 1931 workers (2.1%). The growth in the number of employments for 2012 was composed of the following service activities: information and communications (1633), professional, scientific and technical activities (1238), administrative and related service activities (3494), education (2181), other service activities (3120), as well as activities of health care and social welfare (861).

Pelister mountain

3 Status of biological diversity

3.1 Macedonia as a part of the Balkan Peninsula

Macedonia occupies the central part of the Balkan Peninsula, one of the richest European regions for biological diversity (Kryštufek & Reed 2004). One of the main reasons for the high biological diversity is weak glaciations and existence of continuous forest vegetation in southern parts which has enabled these areas to preserve biological diversity, but also to attain many new species (Tzedakis 2004).

According to the division of biomes in zonebiomes and orobiomes, (Matvejev 1995, in: Lopatin & Matvejev 1995), nine biomes occur on the Balkans, namely: 1. The zonebiome of Mediterranean maritime woodlands and maquis, 2. the zonebiome of Mediterranean semi-deserts; 3. the zonebiome of Ponto-Caspian steppes; 4. the zonebiome of sub-Mediterranean-Balkan forests; 5. the zone- and orobiome of Balkan-Central-European forests; 6. the oro¬biome of European forests of the taiga type; 7. the orobiome of European high-mountain rocky grounds, tundra and pastures, 8. The orobiome of Mediterranean forests on rocky grounds, and 9. the orobiome of South Balkan mountain rocky grounds and arid pastures. Eight out of these are represented in Macedonia (only Ponto-Caspian steppes do not occur).

Stevanović et al. (2007) identified several regions on the Balkan Peninsula exceptionally rich in endemites, such as southern and northern Peloponnese, Pindhos, Olympus and mountains in Central Greece, the island of Crete, mountains Pirin and Slavjanka, Rila, Rhodopes, Prokletije, Durmitor, as well as mountains on the border between Macedonia and Greece (Pelister, Kajmakchalan and Kozhuf) and border between Macedonia and Albania (Shar Planina and Korab).

The species richness of the Balkan Peninsula can be illustrated through the following data:

- Balkan Peninsula hosts more than 120 species of mammals – highest index of diversity in Europe (Kryštufek & Reed 2004);
- More than 500 bird species (Michev et al. 2012), though many of them are threatened and represented by small populations;
- 33 species of amphibians and 71 species of reptiles, of which 28% and 21%, respectively are endemic (Savić 2008);
- 288 species of butterflies (Jakšić 1998).

One feature of the biological diversity of Balkan Peninsula is the presence of rich underground and cave fauna. More than 1000 terrestrial and nearly 700 aquatic underground species have been recorded. The most numerous among them are insects, snails, centipedes, pseudoscorpiones, harvestmen and other groups of terrestrial invertebrates, whereas the most interesting among aquatic ones include sponges, cnidarians, aquatic snails, fish and the amphibian olm (Proteus anguinus) (Gueorgiev 1977; Kryštufek & Reed 2004). Smaller part of this rich Balkan underground fauna is represented in Macedonia as well, especially in the western limestone mountains.

	Flora	Mammals	Birds	Amphibians and reptiles	Freshwater fish	Sea fish	Freshwater algae	Marine algae	Lichens	Fungi	Invertebrates
Albania	3250+mosses	70	326	35	64	249					
Bosnia and Herzegovina	3572				138				3000-5000		
Bulgaria	3900	94	421	54	218		6500				27000
Greece	5500	111	442	83	108	447					
Kosovo	1800	46	225								
Macedonia	3500 (4540 taxa)	85	334	46	85	0	2095	0	450	2000	13379
Romania	3700	102	364	50	191		600	700			33000
Serbia	4130 taxa	96	360	46	98	0	1400	0		1300	
Croatia	5347 taxa	101	375	58	150	433			930	3800	23000
Montenegro	3840	65	333	56		407	1200	300		2000	

Table 1. Estimate of species number status in the countries of Balkan Peninsula.

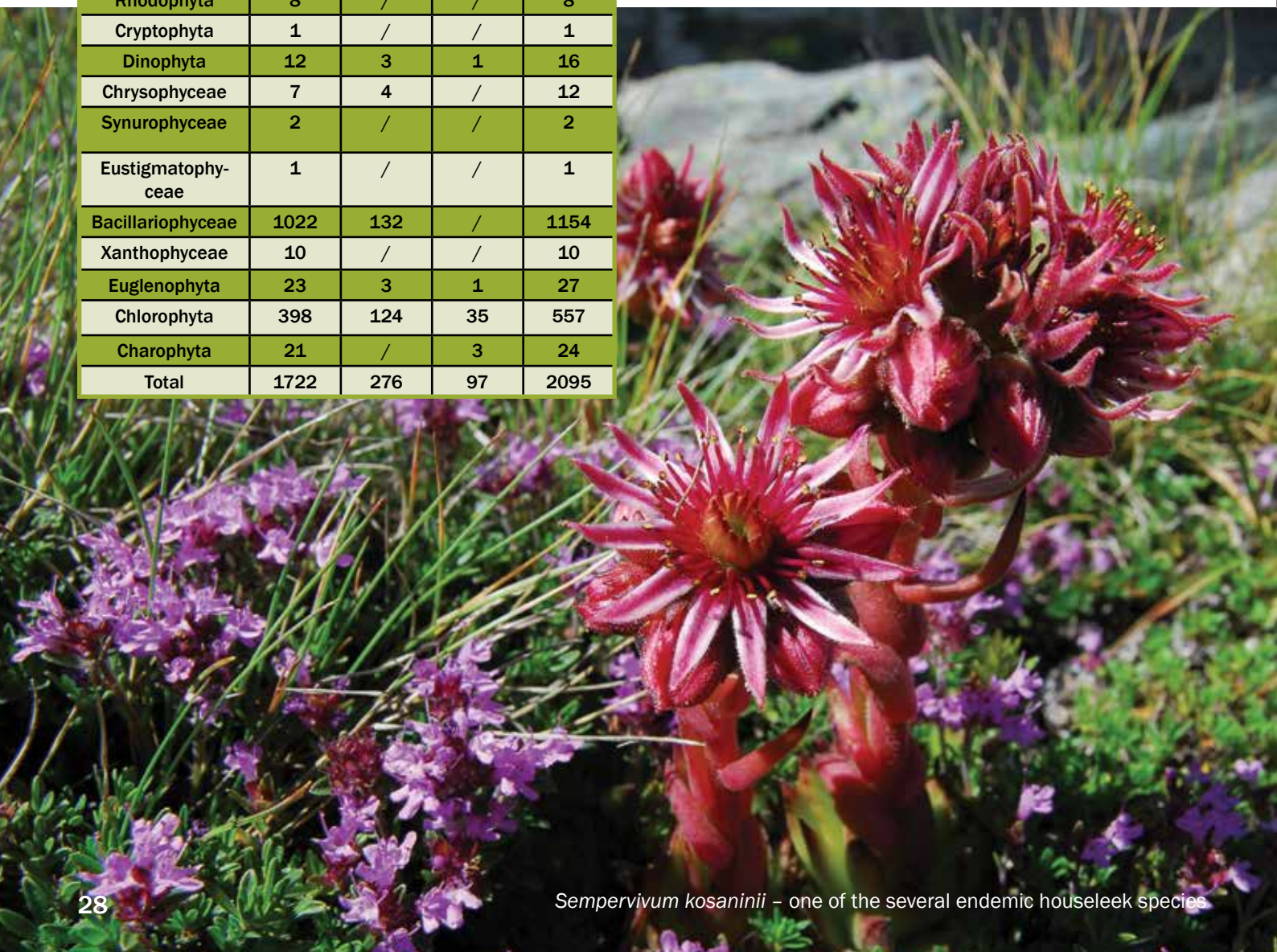
3.2 Diversity of species
3.2.1 Diversity of algae

Knowledge of algae diversity in Macedonia is sparse. According to existing data (period following the production of the First National Report on Biological Diversity Status on the territory of the Republic of Macedonia in 2003), we may conclude that the largest known diversity is identified in the group of silicate algae (Table 2). This situation is a result of several years of research of this group of organisms by several authors, leading to the publication of around 30 papers. Other groups are poorly explored, data is old and it probably does not reflect the real picture of diversity. Reasons lie primarily in the lack of researchers (there has been no research of the flora of other algae for the last 40 years), as well as changes in the habitats during the last 50 years (the swamps Katlanovsko Blato, Stensko Blato, Belchisko Blato, Prespa Lake, Dojran Lake, the spas Katlanovska Banja, Negorci, etc.). Exception from this conclusion is charophytes (Charophyceae), which have been subject of detailed research in Ohrid and Dojran Lakes, with the outcome of 24 identified taxa solely in Ohrid Lake.

Table 2. Total number of registered and published algal taxa in Macedonia.

Group	Species	Varieties	Forms	Total
Cyanophyta	213	10	59	282
Glaucophyta	1	/	/	1
Rhodophyta	8	/	/	8
Cryptophyta	1	/	/	1
Dinophyta	12	3	1	16
Chrysophyceae	7	4	/	12
Synurophyceae	2	/	/	2
Eustigmatophyceae	1	/	/	1
Bacillariophyceae	1022	132	/	1154
Xanthophyceae	10	/	/	10
Euglenophyta	23	3	1	27
Chlorophyta	398	124	35	557
Charophyta	21	/	3	24
Total	1722	276	97	2095

With the beginning of the new millennium, more profound research of the taxonomy and the ecology of diatoms in Ohrid and Prespa Lakes begun. As a result of these research efforts, 162 new species were described by 2007, most of which are considered endemic. Research of diatoms in Ohrid and Prespa Lakes lasting for decades was summarized in a list (catalogue) of confirmed diatoms. According to the catalogue, lakes with their watersheds host 919 taxa in total, 789 of which occur in Ohrid Lake. 117 of these are considered endemic for Ohrid Lake (≈14%), and 15 taxa (≈2%) as relict. Nevertheless, it should be mentioned that among the 789 taxa registered, around 80 taxa have not been identified in full (i.e. marked as "cf", "aff" or "sp."), and around 20 are uncertain species. Diatomean flora of Ohrid Lake possesses a number of important features: (1) high level of diversity, (2) high level of endemism, (3) relictness, and (4) high diversity of genera which are generally of greater diversity in marine environments. Several studies indicate that endemic diatoms most probably originate from multifold invasions by freshwater and maritime species, as well as intralacustric speciation. Besides Ohrid and Prespa Lakes, attention during the past period was been paid to other aquatic ecosystems in Macedonia as well, though of lower intensity. The research mainly concerned the review of certain genera or sections of individual mountains.



Sempervivum kosaninii – one of the several endemic houseleek species

Scarlet elf cup (*Sarcoscypha coccinea*)

3.2.2 Diversity of fungi and lichens

Republic of Macedonia is mycologically well studied. Foundation of the mycological laboratory at the Faculty of Natural Science and Mathematics in Skopje, in 2001, established conditions for continuous research of fungi diversity on the territory of Macedonia. The national fungi collection – Macedonian Collection of Fungi (MCF) – is accommodated here. Today, it counts around 20000 specimens. Also, the database MACFUNGI containing information on 36000 collected specimens.

Based on the research conducted so far, presence of more than 2000 species of fungi (without lichens) has been confirmed so far. Among those, more than 200 species belong to the phylum Ascomy¬cota (sac fungi), and more than 1800 species to phylum Basidiomycota (club fungi). From the latter, the highest number of species has been registered from the orders Aphyllophorales (450) and Agaricales (550).

The number of known lichen species, which area relatively less studied, is around 450.

As far as edibility or toxicity of fungi is concerned, 500 species can be used for human consumption as food, and 76 species are toxic. From among toxic species, 17 are fatally poisonous and cause different syndromes of poisoning. Through research conducted so far, data was completed and maps of distribution were elaborated for 313 species of macromycetes belonging to 33 genera.

For the purpose of fungi conservation, in 2000, a preliminary Red List of Fungi was published, comprising rare and threatened species in the Republic of Macedonia. This list of species served as supplement in the development of the basic Red List of Fungi of Macedonia in 2012. This List contains 213 species belonging to phyla Ascomycota and Basidiomycota. Species are categorized in accordance with the criteria of IUCN, and category of critically endangered (CR) has 21 species, endangered (EN) – 30 species, vulnerable (VU) – 71 species, near threatened (NT) – 40 species, least concern (LC) – 9 species and data deficient (DD) – 42 species.

Crocus scardicus – an endemic plant species from Shar Planina mountain range. It grows on high altitudes, next to the snow patches.

3.2.3 Diversity of plants

During the past period following the development of the First National Report on biodiversity status in the Republic of Macedonia, intensive flora research has continued on the whole territory of the Republic of Macedonia.

In the past period, synthetic review of the brioflora of the Republic of Macedonia (Cekova 2005) was published for the first time, to encompass 397 taxa; furthermore, this paper included all literature data published by a number of authors on the brioflora of Macedonia by that time. Later, 118 more species were reported for Macedonia (Martinčić 2009; Papp & Erzberger 2012). Accordingly, brioflora of the Republic of Macedonia consists of over 500 taxa, more than 400 taxa of which are true mosses (Musci), while around 100 taxa are representatives of the class Hepaticae. Further research is necessary of the taxonomy and horology of the taxa of this group in the Republic of Macedonia, to conclude the information of the real number of taxa on its territory.

The continuous research within the project "Flora of the Republic of Macedonia", implemented by the Macedonian Academy of Science and Arts (MASA), resulted in publication of around 50 scientific papers and monographs. With reference to vascular plants, several monograph publications have been issued, elaborating 27 families with 544 taxa in total. In the past period, around 2800 taxa have been analysed, and it has been estimated that around 1470 taxa have remained, including 39 families that should be elaborated further (Table 19).

Numerous Balkan endemites and local Macedonian endemic plant species growing on the territory of the Republic of Macedonia are of particular importance – around 120 local endemic species are known. Some of the endemites are characterized with great evolution age, they are of Tertiary origin and are denoted as paleondemites (endemorelicts), such as: Thymus oehmianus, Viola kosaninii, Crocus cvijici, Crocus scardicus, Colchicum macedonicum, Narthecium scardicum, etc.

Important floristic data has been also obtained through research of the vegetation of Macedonian steppe, forest vegetation on the mountain of Galichica and flora on the mountain of Suva Gora. Furthermore, 42 smaller or larger Important Plant Areas have been identified on the territory of the Republic of Macedonia, and initial assessment of the threats affecting the survival of plant species and habitats on these areas has been made. Based on the established methodology, identification of important species and habitats was made for each of the prior identified Important Plant Areas.

In the period 2004-2013, a total of six taxa new to science were described from the territory of the Republic of Macedonia, namely, Helianthemum marmoreum (Cistaceae), Jurinea micevskii (Asteraceae), Anchusa procera var. alboprocera (Boraginaceae), Erodium absinthoides subsp. glandulosum var. kavadarcensis (Geraniaceae), Cerastium decalvans subsp. decalvans var. kitanovii (Caryophyllaceae) and Festuca jakupicensis (Poaceae). Besides these, the presence of 23 species was detected which were previously not registered for the flora of the Republic of Macedonia. New localities have been detected for more than 80 rare species in the flora of the Republic of Macedonia.

Nevertheless, despite the extensive research of the Republic of Macedonia's flora, statements that the species Acorus calamus (Struga Swamp), Sagitaria sagitifolia (village Novaci), Lysimachia thyrsiflora (Mavrovo Pole) and Aldrovan-

Mountain tea of Shar Planina (*Sideritis scardica*)

Stenoendemic species of Pelister carnation (*Dianthus myrtinervius*)

Yellow water lily (*Nuphar lutea*) is present in very small patches on Ohrid Lake

da vesiculosa (Prespa Lake, village Ezerani) have become extinct on the territory of the Republic of Macedonia stands. Only a small population of the species Gentiana pneumonanthe, thought to have become extinct, was detected. Population of Nymphaea alba from the shore area of Dojran Lake (village Nikolich) is still considered extinct. Species Senecio paludosus and Ranunculus lingua are close to extinct or already extinct, as they have been not registered for years on the localities of Studenchishte and Struga Swamps.

Surveys of the flora of the Republic of Macedonia revealed strong threats against the populations of 14 species. The species threatened status results from habitat degradation or fragmentation, as is the case of Carex elata, (Studenchishte Swamp), Nuphar lutea (Ohrid Lake, village Kalishta), Menyanthes trifoliata (Deshat-Lokuf), Nymphoides peltata (Prespa Lake, villages Ezerani and Dolno Perovo), Trapa natans (Prespa Lake, village Ezerani, Pretor), Cladium mariscus (Negorci Spas), Thymus oehmianus (river Ocha), Viola kosaninii and Dianthus kapinaensis (village Nova Breznica), Phyllitis scolopendrium (Gorge on the river Treska) or from uncontrolled and mass collection, as in the case of Gentiana lutea subsp. symphiandra, Arctostaphyllos uva ursi, Sideritis scardica and Sideritis raeseri. Yet, the species Salvina natans from the shore area of Dojran Lake, between Star and Nov Dojran, which were threatened by the water level reduction, has gradually recovered and biologically vital population of this species has been registered.

The IUCN 1997 Global Red List contained 70 taxa from the Republic of Macedonia (19 of which local endemites). Among them, 1 had the status of “extinct” (EX) – Thymus oehmianus. Still, there are small populations of this spe-

Macedonian pine

The great yellow gentian (*Gentiana lutea*) is under strong pressure due to the collection for medicinal purposes

Dolichopoda remyi – a highly evolved troglophilous cricket species

3.2.4 Diversity of fauna
3.2.4.1 Diversity of invertebrate fauna

The Study of the Status of Biological Diversity in the Republic of Macedonia states that the number of invertebrate species is 8833. Later, this information was supplemented and it was estimated that the number of invertebrates amounted to 9706 (excluding the 113 species of Protozoa). On the other hand, the overall number of animal species (invertebrate and vertebrate) from Macedonia in the Fauna Europaea (www.faunaeur.org) is 10635. These three sources of information, together with around 200 more scientific papers published during the last ten years, served as basis for the assessment of invertebrate diversity in Macedonia.

Table 3 shows the status of the number of invertebrates in Macedonia. At the moment, the overall number of invertebrates in Macedonia is over 13000 species. One may safely say that this number is underestimated, because many scientific works, especially papers published before 2000, have not been taken into account. Furthermore, this estimate does not include diversity of subspecies, which is a gap requiring greater attention in the future. During the last period, 56 invertebrate species and subspecies from Macedonia have been described.

Ohrid Lake is one of the biggest hotpots of aquatic invertebrate diversity and endemism. According to published data on diversity in Ohrid Lake, the following species have been registered: 14 Rhizopoda species, 30 endemic Ciliophora species, 4 Porifera species, 75 species of Plathelminthes (≈35 endemic species together with aquatic ecosystems around Ohrid Lake), 49 Rotatoria species, 24 Nematoda species (3 endemic), 36 Oligochaeta taxa (17 endemic), 24 Hirudinea species (12 endemic), 43 Acari species, 31 Cladocera species (1 endemic), 52 Ostracoda species (33 endemic), 36 Copepoda species (6 endemic), 2 Decapoda species, 4 Isopoda species (3 endemic), 10-11 Amphipoda species (9 endemic), more than 100 species of insects, 72 Gastropoda species (56 endemic) and 13 Bivalvia species (2 endemic).

So far, lesser attention has been devoted to Prespa Lake compared to Ohrid Lake, and therefore no sufficient database has been developed to enable more comprehensive picture of the overall biological diversity and individual diversity within taxonomic groups. The total number of mollusks in Prespa Lake is 36 (27 snails and 9 shells), of which 7 snails, or around 20%, and the shell Pisidium maassani Kuiper, 1987 are endemic. According to several sources, only incomplete data exists on other groups (Porifera – 3, Platyhelminthes ≈50, Rotifera ≈60, Annelida – 35, Crustacea ≈90, Insecta – over 100 species).

Underground fauna of Macedonia is poorly explored and, according to existing data, it is poorer than the fauna of Western Balkan countries, but still, it is characterized by high extent of endemism reaching 90%. The situation is slightly better when it comes to stygobionts (troglohydrobionts), where 57 species are known. From among other troglohydrobionts, higher representation has been recorded for pseudoscorpiones (14), beetles (12) and isopods (10). In the course of

Helix dormitoris

Osmoderma eremita – a priority Natura 2000 species connected to old trees and preserved forests

Triloba thaumasia talevi – an endemic species from north-west Macedonia

Lindenia tetraphylla

Taxonomic category (group)	Macedonia	% of European fauna
Phylum Porifera	10	55.6
Phylum Cnidaria	3	5.6
Phylum Platyhelminthes	229	7.4
Phylum Nematoda	~600	14.7
Phylum Nemertea	1	8.3
Phylum Rotifera	269	20.9
Phylum Acanthocephala	8	5.7
Phylum Nematomorpha	2	2.9
Phylum Annelida	175	15.9
Phylum Mollusca	320	~9
Phylum Arthropoda	11781	10.7
Total	13379	~11

Table 3. Number of invertebrates in Macedonia.

Rosalia alpina – another Natura 2000 priority species

the last decade, 6 species of troglohydrobionts have been described: 2 species of isopods, 3 pseudoscorpiones, and 2 beetles. The richest cave fauna occurs in the caves in Western Macedonia, especially the caves in the watershed of the river Radika, Galichica, Jakupica and Poreche.

Deltomerus (Paradeltomerus) paradoxus – an endemic and relict ground beetle species from Shar Planina mountain

Pelecanus onocrotalus

3.2.4.2 Diversity of vertebrate fauna

The vertebrate fauna in Macedonia is much better explored than the invertebrate fauna. According to the latest estimates, there are 552 vertebrate species in Macedonia, 28 of which are native (Table 4). The most numerous are birds with 334 species (64% of the species regularly found in Europe), followed by mammals with 77 native species (34% of the European native terrestrial mammals) and fish with 66 native species (around 12% of the fauna of freshwater fish in Europe or around 20% if introduced species are taken into account). Fauna of lampreys is represented with only 2 species (from among 13 in Europe), amphibians with only 14 species (19% of the European batrachofauna), and reptiles are represented by 32 species (21% of the European herpetofauna).

Group	Total	Native	Non-native
Lampreys	2	2	0
Fish	85	66	19
Amphibians	14	14	0
Reptiles	32	32	0
Birds	334	333	1
Mammals	85	77	8
Total	552	524	28

Table 4. Number of native and non-native vertebrate **species in Macedonia.**

3.2.5 Lampreys

Lamprey fauna (order Petromyzontiformes, class Cephalaspidomorphi) is very sparse in Macedonia, represented with only two species: Eudontomyzon mariae distributed in Vardar River watershed and Eudontomyzon stankokaramani – in Adriatic watershed. Both species are globally unthreatened (IUCN 2014), but strictly protected under the national legislation.

3.2.6 Fish

The assessment of the real status of fish diversity in Macedonia is aggravated by series of unsolved taxonomic problems, especially among trout (Salmonidae). Presence of several species in Macedonia is problematic: Squalius squalus (Ohrid Lake), Pungitius platygaster (Vardar River watershed), Acipenser sturio, etc. Fish fauna in Macedonia counts about 85 species (19 introduced) from 15 families. Prespa Lake is the richest in endemic fish species (8 out of 11 native species are endemic), followed by Ohrid Lake with 8 endemic species (out of 21 native species). Ichthyofauna of these two lakes has been severely endangered by the introduction of non-native species (12 in Prespa and 7 in Ohrid Lake). Ichthyofauna of Dojran Lake is composed of 14 species, only one of which is endemic and two species are introduced.

Among the native species, three are considered critically endangered (Acipenser sturio, Anguilla anguilla and Alburnus macedonicus), two are endangered (Pelasgus prespensis and Salmo peristericus), 10 are vulnerable, one near threatened and 10 are data deficient with regard to their level of threat (IUCN 2014).

Under the national legislation, 10 fish species are strictly protected, and 20 protected (two species have been included in both lists).

Prespa barbell (*Barbus prespensis*)

3.2.7 Amphibians

This is a relatively small faunal group in Macedonia for which we may arbitrarily say that it counts only 14 species: 9 tailless (frogs) and five tailed (salamanders and newts). Macedonia's fauna has two Balkan endemites (Triturus macedonicus and Rana graeca), and at subspecies level as taxa of limited Balkan natural range, we distinguish Lissotriton vulgaris graecus, Pelobates syriacus balcanicus and Bombina variegata scabra.

There are no globally threatened species among amphibians in Macedonia (IUCN 2014), seven are listed in Appendix 2 of the Bern Convention, while the remaining eight are included in Appendix 3. Three species (Triturus carnifex, Triturus karelinii and Bombina variegata) are included in Annex 2 to Habitats Directive, whereas the same species and five more are included in Annex 4.

European pond turtle (*Emys orbicularis*)

Balkan whip snake (*Coluber gemonensis*)

3.2.8 Reptiles

Latest data reveals information on the distribution of 32 species (four chelonian species, 12 lizard species and 16 snake species). Among these, 11 species have wide distribution in the country, 10 species are limited to individual habitats and regions, and the rest of 11 are of very limited range. Three Balkan endemites (Podarcis erhardii, Algyroides nigropunctatus and Hierophis gemonensis) are present. Despite the relatively low number of species, reptiles belong to as many as nine zoogeographic regions. The most numerous are the representatives of Eastern Mediterranean zoogeographic region, followed by representatives of Turano-Mediterranean (six species) and South European region (five species). Quantitative research is almost non-existing, except those conducted on the island of Golem Grad.

Orsini's viper is considered a globally vulnerable species (IUCN 2014), and is listed in Appendix 1 to CITES. Near threatened species include European pond terrapin Emys orbicularis, Hermann's tortoise Testudo hermanni and four-lined snake Elaphe quatuorlineata. 24 species are included in Appendix 2 to the Bern Convention, and the rest of eight are included in its Annex 3. Seven species are included in Annex 2 of the Habitats Directive, and these species and 18 more are included in Annex 4.

According to the national lists of strictly protected and protected wild species, Orsini's viper is strictly protected species, and 22 other species are protected.

Orsini's viper (*Vipera ursinii*) – one of the three viper species in Macedonia

3.2.9 Birds

Macedonian bird fauna counts 334 species (10 of which are considered uncertain). Number of resident nesting and migratory nesting bird species is 215 species. Subspecies diversity is modest – only 14 species have more than one subspecies or total of 348 taxa has been registered. As expected, there are no taxa that are national endemites.

Minimum eight nesting species are fully extinct from Macedonia, and at least seven more (and probably 12-15 species) are lost as nesting species from the fauna of Macedonia. Two species (Egyptian vulture Neophron percnopterus and saker falcon Falco cherrug) are globally threatened, and two more that are regularly present (Dalmatian pelican Pelecanus crispus and imperial eagle Aquila heliaca) have been categorized as vulnerable (IUCN 2014).

Annex 1 to the EU Bird Directive includes 65 bird species from Macedonia in their reproductive period, also to be the basis for the definition of Natura 2000 in Macedonia. Fifteen species are included in Appendix 1 to the Bonn Convention. Four species (Dalmatian pelican, white-tailed eagle, imperial eagle and peregrine falcon) are listed in Appendix 1 to the CITES.

The national lists of strictly protected and protected wild species include 28 and 79 species, respectively, but there is a lot of room for improvement to the content of these lists.

At national level, critically endangered species is at least the Egyptian vulture. Number of griffon vultures Gypsus fulvus and lesser kestrels Falco naumanni plummets, whereas sparse (albeit stable) are the populations of the imperial eagle Aquila heliaca, golden eagle Aquila chrysaetos, peregrine falcon Falco peregrinus, several species of herons and ducks, and the number of species with national population below 100 couples is high. For many species, including priority ones for conservation on national level (lesser spotted eagle Aquila pomarina, ural owl Strix uralensis), there is no quantitative data on the number and the trend.

Clanga pomarina

Microcarbo pygmeus

Egyptian vulture (*Neophron percnopterus*) has continuous drop of its population in Macedonia

The European ground squirrel subspecies (*Spermophilus citellus karamani*) has peculiar high-altitude population on Jakupica Mountain

3.2.10 Mammals

Published data exists on 83 species, and two more bat species were registered in 2011 and 2013 (Pipistrellus pygmaeus and Myotus bechsteini, I. Budinski, A. Pušić & M. Hođić). Of these, eight are considered non-native and 77 species of mammals are native for the Macedonian fauna.

According to the data, there are no strictly national-level endemic species, though four species that are endemic for the Balkan Peninsula (Apodemus epimelas, Dynaromis bogdanovi, Microtus felteni and Talpa stankovici) have large parts of their natural ranges within the Macedonian borders, and two more Balkan (near) endemites (Spalax leucodon and Spermophilus citellus) have localized distribution in Macedonia. Endemism is also high on subspecies level, with two localized subspecies of Souslik, Spermophillus citellus gradojevici and S. c. karamani, core population of the Balkan lynx Lynx lynx balcanicus and Balkan chamois Rupicapra rupicapra balcanica. Species diversity is the highest in the mountains of Western Macedonia.

On subspecies level, five mammalian species registered in Macedonia are regarded vulnerable (IUCN 2014): Rhinolophus mehelyi, Myotis capaccinii, Vormela peregusna, Spermophilus citellus and Dinaromys bogdanovi. Four other native species are considered near threatened (Rhinolophus euryale, Barbastella barbastellus, Miniopterus schreibersii and Lutra lutra). On subspecies level, Balkan lynx is considered critically endangered, with an overall estimated population in the Balkans of around 22-40 adult individuals. Thirty species are included in Appendix 2 to the Bern Convention and additional 25 in Appendix 3. Twenty-five species (all bats) are included in Appendix 2 to Bonn Convention. Fourteen species are included in Annex 2 of the Habitats Directive, three in Annex 3, and these 17, together with 16 other species, are included in Annex 4.

According to the national lists of strictly protected and protected wild species, 10 mammal species are protected, and the category of strictly protected species includes: Felis silvestris, Lynx lynx, Lutra lutra, Ursus arctos, Spermophilus citellus and Dinaromys bogdanovi.

Balkan lynx is critically endangered with a stronghold of its population in Macedonia

Alshar mine near village of Majdan is one of the richest sites with endemic plant species in Macedonia

3.3 Ecosystem diversity

Ecosystem diversity in the conservation practice worldwide is a frequent topic of discussion, usually to attribute value to an area worth of conservation. In fact, ecosystem diversity has emerged as a term from the very definition of biological diversity contained in CBD. Nevertheless, the term in time has been less and less used owing to the fact that there is no comprehensive, detailed and accurate classification of ecosystems or ecosystem types. Moreover, given the fact that description and systematization of ecosystem types should also include the basic feature of ecosystems – their mass-energy balance, the development of such classification is not expected.

Yet, the need to define and classify ecosystem types has been constantly growing nowadays, especially upon the introduction of the new concept for biological diversity valuation and conservation – ecosystem services (see Chapter 5). Thus, depending on the purpose, ecosystems in practice are grouped on different levels, but mostly rather roughly: marine, lake, river, forest, grassland, mountainous, etc. These divisions cannot meet the requirements for the purpose of presentation of ecosystem diversity of an area, and they can hardly serve as basis for valuation of ecosystem services either.

Contrary to ecosystems, habitats in the world and in Europe, especially, are covered by detailed and mostly comprehensive classification. The text below uses all three terms and they have equal meaning (synonyms). The most frequently used classification of habitats in Europe is the one of the EUNIS database (http://eunis.eea.eu.int/index.jsp).

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

A total of 28 basic sets of habitats have been identified in Macedonia. Some of these habitats are of anthropogenic origin, but still have certain significance for biological diversity and are therefore part of this classification. The number of thus generalized ecosystem types reflects great ecosystem diversity in Macedonia.

Studenchishta wetlands – an integral part of Ohrid Lake

1. Lake ecosystems (ecosystems of surface standing water bodies, including accumulations, larger ponds and glacial lakes)
2. River ecosystems (ecosystems of surface running water bodies, including streams)
3. Mountainous peaty ecosystems (acid peats)
4. Mountainous fen ecosystems (base peats)
5. Marsh and swamp ecosystems (including saline marshes)
6. Ecosystems of dry montane grasslands
7. Ecosystems of mesophilous and seasonally wet grasslands and meadows
8. Ecosystems of mountainous grasslands (including subalpine and alpine grasslands, as well grasslands on rocky grounds)
9. Saline steppe ecosystems
10. Alpine dwarf scrub ecosystems
11. Alpine scrub ecosystems
12. Degraded forest ecosystems (including pseudo-macquis, arborescent matorral, Thermo-Mediterranean thickets and garrigues)
13. Ecosystems of phrygana and hedgehog-heaths
14. Riparian and fen scrub ecosystems
15. Anthropogenic scrub ecosystems
16. Deciduous forest ecosystems (broadleaved woodlands)
17. Coniferous forest ecosystems
18. Mixed deciduous and coniferous forest ecosystems
19. Cave ecosystems (including water bodies therein)
20. Rocky and stone ground ecosystems (including rocks, rocky terrains and screes)
21. Ecosystems without or with sparse vegetation (including eroded areas)
22. Farming agro-ecosystems
23. Aquatic agro- ecosystems (fishponds)
24. Urban ecological systems
25. Ecological systems of rural settlements
26. Ecological systems of mining and industrial excavations
27. Ecological systems of entirely artificial water bodies
28. Ecological systems of waste deposits and landfills

3.3.1 Key ecosystems

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

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

3.3.2 Habitat types

In ecological context, a habitat is ecological category introduced to explain and define conditions in which a species lives and exercises all relations stemming from biotic and abiotic factors of the environment in which it develops. As conditions in the habitat (their status, quality) are vital for species survival, the concept of "habitat" is essential in biological diversity conservation. Moreover, habitats are physiognomically well determined through floral component typical of them and they can be used as concept both in conservation biology and legislation regulating biological diversity protection. In this regard, knowledge of the type of ecosystems present in Macedonia and of their status is essential to the protection of our biological diversity. Legal instruments for protection of habitats of European importance are Habitats Directive (Annex I) and Resolution no. 4 under the Bern Convention (1996).

EUNIS classification

Under the EUNIS, a "habitat" is defined as a place where plants and animals live normally characterized primarily by their physical features, as well as by plant and animal species living there. At higher level, habitats can be grouped in habitat groups. There are also undefined habitat complexes which are usually combinations or mosaics of individual habitat types. EUNIS classification of habitats introduces agreed criteria for identification of each habitat unit enabling correspondence with other classification systems.

EUNIS classification, as some other former systems (especially CORINE), is based on classical phytocenology, but it also uses simple often physical descriptions of habitats by including abiotic characteristics of habitats. The system applies defining habitat parameters to distinguish habitats from descriptive parameters in order to outline geomorphology, salinity, anthropogenic influence, etc., characterizing the habitat.

Pseudosteppe in central Macedonia (Bregalnica river valley)

EUNIS classification of habitats in the Republic of Macedonia

All habitat groups of first level under EUNIS classification are represented in Macedonia, except marine (A and B):

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
X: Habitat complexes

The first six habitat groups (C, D, E, F, G, H) and to a lesser extent the last one (X), include mostly natural habitats, while groups I, J and most of X are habitats created by man activity. As a rule, natural habitats are of particular importance native biological diversity, while anthropogenic habitats occur very often as cores where accumulation of non-native species starts.

The text below offers brief analysis of the main habitat types and detailed overview of the habitats in Macedonia (habitat groups up to third level) is presented in Table 1.

Pasture and beech forests on Jakupica Mountain

C: Inland surface waters

Inland surface waters refer to aboveground open fresh or brackish water bodies (rivers, streams, springs, lakes) away from the coastline. These also include the littoral zones of these bodies, as well as built water bodies which support semi-natural biocenoses. Significant elements of biological diversity are endemic forms, particularly specific to the three natural lakes.

Inland surface waters are divided into three habitat groups of second level: surface standing waters (C1), surface running waters (C2) and littoral zone (C3), which are in turn differentiated into three lower habitat levels.

Surface standing waters include lakes, ponds and pools of natural origin, which contain fresh, brackish or saline water. Based on the extent of trophicity, they are divided into five groups of habitats of third level, and temporary standing water bodies are distinguished as specific types. In Macedonia, this habitat group is composed of three large /basin/ natural lakes, higher number of small glacial lakes, ponds and (growing number) accumulations used for irrigation and electricity generation.

Surface running waters (C2) comprise running waters, including springs, streams and temporary watercourses. At the third level, three habitat types are distinguished by the speed of the flow. Divisions into lower habitat levels are based mainly on the presence of limestone and quantity of nutrients.

Littoral zone of the inland surface water bodies (C3) refer to riparian herbal vegetation and other edge aquatic edge vegetation of lakes, rivers and streams; as well as exposed bottom of dried out rivers and lakes; stones, gravel, sand and mud by or in river and lake beds. In the frames of this habitat group, seven habitat groups at third level are distinguished in Macedonia.

D: Mires, bogs and fens

This habitat group incorporates fen habitats with water level at or above the soil surface for at least half a year, dominated by forbs or ericoid vegetation. The group covers salt marshes and wetlands with frozen ground water. Water bodies and rock structures of springs (C2.1), as well as wetlands dominated by woody vegetation and tall scrubs are excluded (those are included in F9.2, G1.4, G1.5, G3.D, G3.E).

Based on the current knowledge, this basic habitat group in Macedonia is represented by four groups of second level: D2: Valley mires, poor fens and transition mires, D4: Base-rich fens and calcareous spring mires, D5: Sedge and reedbeds, normally without free-standing water, and D6: Inland saline and brackish marshes and reedbeds.

The territory of Macedonia is characterized by several typical marsh habitats. Thus, from among Illyrian/Mesic acid fens/mires habitat group (D2.28), Plagonide fens/mires with Narthecium (D2.2811) occur on the mountains Shar Planina, Korab and Jablanica, and Pelagonide fens with Macedonian sedge (D2.2812) are present on the mountains Jakupica and Bistra and other high western mountains. These habitats, besides the prevailing species Carex bigelowii ssp. dacica (syn. Carex macedonica) and Balkan tertiary relict Narthecium scardicum, also accommodate Carex viridula, Carex sempervirens, Nardus stricta, Parnassia palustris, Pinguicula leptoceras, etc. From among fen habitat type around hard water springs (D4.1N), the Illyrian-Balkan calcareous mire springs habitat (D4.1N3) has been identified for Macedonia, three groups of marsh habitats (with reeds, sedges and rush) are recognized in habitat group D5, while habitat group of salt grass lawns (D6.16) in Macedonia is represented by the habitat of Pelagonian grass lawns with Suaeda (D6.1614).

Wetlands in the karst field of Begovo Pole on Jakupica Mountain

The glacial lake of Belo Ezero on Shar Planina

E: Grasslands and lands dominated by forbs, mosses and lichens

This group of habitats is a complex group comprising six smaller groups in Macedonia, namely: Dry montane grasslands (E1), Mesic grasslands – meadows (E2), Seasonally wet and wet grasslands (E3), Alpine and subalpine grasslands (E4), Woodland fringes and clearings and tall forb stands (E5), and Inland salt steppes (E6).

Distribution of dry montane grasslands (E1) is bound to oak forest region. They occur in altitudinal belt from 60 to 1200 m, on different geological grounds, mostly on secondary habitats. Phytocenological affiliation of syntaxa encompassed by these habitats has not been definitely resolved, but the most frequent community in question is the one of the class Festuco-Brometea. High number of endemic plant species in Macedonia is specific for this group of habitats exactly.

The groups of mesic grassland stands/habitats (E2) and seasonally wet and wet grasslands (E3) refer to more or less wet pastures and meadows from lowland and lower mountain belt within boreal, amoral, moderately warm humid and Mediterranean zone. Contrary to habitats in the group E2, which are exposed at bigger anthropogenic intervention (regular grazing, mowing, agricultural improvement, use for sporting, etc.), habitats in E3 incorporate pastures and meadows with no significant human influence. Both habitat groups are characterized by communities of the class Molinio-Arrhenatheretea.

Habitats of alpine and subalpine grasslands (E4) most often occur above the upper forest boundary. They include primary and secondary grassland formations in boreal, amoral, moderately warm humid and Mediterranean zone, which is dominated by species from the families Poaceae or Cyperaceae. Compared to previous groups, climate here is characterized with higher humidity and lower temperatures in the course of the year. Three major subgroups of this habitat group can be distinguished in Macedonia: Acid alpine and subalpine grasslands (E4.3), Calcareous alpine and subalpine grasslands (E4.4) and Alpine and subalpine enriched grasslands (E4.5).

Habitat group E5 – Woodland fringes and clearings and tall forb stands is ecologically one of the most heterogeneous habitat groups. It includes stands with tall grass or ferns which grow on abandoned urban and agricultural lands, along watercourses, on woodland fringes or in pastures inhabited with species from adjacent habitats. Besides native communities specific to woodland fringes (E5.2) and subalpine wet tall-herb and fern stands (E5.5), it also incorporates various weed communities on abandoned urban, suburban and rural structures, industrial sites, arable lands, etc. (E5.1).

Habitats of inland salt steppes (E6) refer to saline soils on which grass plants resistant to high concentrations of salts are predominant. Salt steppes from Macedonia, under the EUNIS classification, belong to E6.215: Pelago-Vardar salt steppes, comprising halophyle communities from the southwestern part of the Balkan Peninsula, in the area surrounded by Pelagonides and Meso-Macedonian mountains, in the arid zone of the rivers Vardar and Gorna Morava. Several habitat types of the sixth level are mentioned for Macedonia.

High mountain pastures on Shara Mountain'

F: Heathland, scrub and tundra

According to EUNIS definition, habitat group F comprises inland habitats which are dry or temporarily flooded, with more than 30% vegetation cover of semi-scrubs or scrubs. The tundra, as a habitat characterized with permafrost occurrence, does not occur in Macedonia. Heathland and scrub habitats are defined as vegetation dominated by dwarf scrubs or scrubs not taller than 5 m. These also include scrub orchards, grapevine plantations, hedgerows, and communities with climate limited trees lower than 3 m, as well as stands with scrub willows (Salix spp.) and alder buckthorn (Frangula) on humid grounds.

In Macedonia, this habitat group comprises eight subgroups of the second level: Arctic, alpine and subalpine scrubs (F2), Temperate and Mediterranean-montane scrub (F3), Maquis, arborescent matorral and thermo-Mediterranean brushes (F5), Garrigues (F6), Mediterranean heaths (phrygana, hedgehog-heaths and related coastal cliff vegetation) (F7), Riverine and fen scrubs (F9), Hedgerows (FA) and Shrub plantations (FB).

Arctic, alpine and subalpine scrub habitats (F2) continue from the upper forest boundary, beyond permafrost zone. In terms of vegetation, this habitat type is characterized with different communities of the classes Erico-Pinetea and Vaccinio-Piceetea – community of billberry, rhododendron, Bruckenthalia spiculifolia, common bearberry, dwarf willows, mountain pine and other scrub communities.

Habitat group F3 comprises high number of phytocenoses of various syntaxa represented by deciduous and evergreen scrub communities of amoral zone and deciduous scrubs of sub-Mediterranean and supra-Mediterranean zone.

Habitats of Pseudomaquis (F5.3) comprise mixed sclerophyll evergreen and deciduous scrub formation on the periphery of Mediterranean macquis natural range. These include scrub formations of Balkan and Apennine Peninsula, with intermediary position between Mediterranean macquis and shruberry (southwestern sub-Mediterranean deciduous dense scrub communities – thickets, groves), formed by degradation of thermophyll deciduous forests, with mixture of evergreen anddeciduousscrubs.

Habitats of garrigues (F6), evergreen sclerophyll or laurophylle scrub vegetation with open structure from the region of Mediterranean, Pont and Macaronesia resulted from degradation of broadleaved evergreen forests. In Macedonia, this habitat group is represented by two types of the fifth level under the EUNIS classification – Balkan supra-Mediterranean scrub garrigues (F6.661) and Balkan supra-Mediterranean garrigues with dwarf scrubs (F6.662).

Habitat group of Mediterranean heaths (F7) comprises primary pillow-shaped heaths of the high and dry mountains in Mediterranean and Anatolia, with low, pillow-shaped, often thorny scrubs, mostly from the genera Acantholimon, Astragalus, Bupleurum, Genista, Anthyllis, together with species of the families Asteraceae and Lamiaceae. According to EUNIS classification, Macedonia is included with the habitat of Mesic thorny heaths (F7.482) with Astragalus angustifolius. Stands are mainly secondary, scattered, in most cases in xerothermal oak belt, on sited which are under the influence of Mediterranean.

Riverine and fen scrubs habitat (F9) comprises vegetation by lakes, rivers, fens and marshes, composed of trees that do not exceed 5 m in height. Habitats with diverse willow species are specific of Macedonia.

Habitats of hedgerows (FA) in a form of band separate grassland areas, pastures and arable land or extend along roads. They are made of scrubs and trees which do not exceed five meters in height and are used for livestock control, delineation of boundaries or shelter provision. Differentiation at the third level includes four groups, which are distinguished by species nativeness and by richness in local species. The habitat does possess certain ecological importance (earth stabilization, habitat for other species, corridor), though it is usually not featured with rich and specific floral diversity.

Scrub plantations (FB) are specific habitat types comprising plantations of dwarf trees, scrubs, espaliers or perennial tree-like creeping plants, mainly cultivated for fruits or flowers generation, or intended to provide permanent plant cover.

Mixed beech-fir forests on Jakupica Mountain

G: Forests and other wooded land

This habitat group comprises woodland where vegetation dominates or has until recently been represented by trees with their crown coverage of at least 10%. Trees are defined as woody plants able to reach height of (above) five meters, regardless of climate and edaphic conditions. It includes lines and belts of trees, low-trunk forests, regularly cultivated tree nurseries, cultural plantations of trees and orchards, as well as marshy woodlands with alder, poplar and riparian willow woodlands and small wood stands. In the frames of the first level, four habitat groups of the second level occur in Macedonia, namely: Broadleaved deciduous woodlands (G1), Coniferous woodlands (G3), Mixed deciduous and coniferous woodland (G4) and Lines of trees, small anthropogenic woodlands, recently felled woodland, early-stage woodland and coppice (G5).

Broadleaved evergreen and deciduous broadleaved trees, with deciduous broadleaved trees having larger coverage than evergreen ones. Phytocenological composition of this habitat group is rather complex, which induces its differentiation to lower habitat levels. It comprises riparian and gallery woodlands dominated by Alnus, Betula, Populus or Salix and boreo-alpine riparian galleries (represented by insignificant area – Alnus viridis on Belasica Mt., which is at the margin of the definition of habitat by the area it occupies) (G1.1), then Mixed riparian floodplain woodland (G1.2) and Mediterranean riparian woodlands (G1.3). Areas of these habitat groups in Macedonia have been mainly destroyed and represent one of the most endangered habitats in the country. Woodlands with plane tree (G1.381) are exceptionally important habitat type form biodiversity point of view, present in the southeastern region of Macedonia. Broadleaved swamp woodlands that do not grow on acid peats are included in habitat type G1.4 and in Macedonia they are represented by communities dominated by alder (Alnus glutinosa) with a single find of well-preserved stands near Belchishko Blato (swamp).

One of the ecologically and economically most important habitat types are beech woodlands (G1.6) which build complex vegetation cover in the area of western, central and southern Europe and Pont region, belonging to different communities of the class Querco-Fagetea. Habitats of beech forests in Macedonia belong to two groups of the fourth level – Mesic beech forests (G1.69) and Mediterranean-Mesic beech forests (G1.6B) with several habitat types.

Thermophilous deciduous woodlands are also important vegetation formations included in habitat type G1.7. These are forests from sub-Mediterranean climate regions and sub-Mediterranean altitudinal levels dominated by thermophilous oak species, together with other southern wood species (oriental hornbeam Carpinus orientalis, chestnut Castanea sativa or Hop-hornbeam Ostrya carpinifolia). Mixed thermophilous woodlands are specific habitat type (G1.7C) of Ostryo-Carpinion alliance. Chestnut woodland is one of the specific habitats (G1.7D1).

G1.C and G1.D are anthropogenic habitat types with no major importance for native floral diversity, though they might be important as sites for preservation of native cultivated varieties or as habitats with specific segetal phytocenoses.

Habitats with coniferous species belong to habitat type G3. These include smaller woodlands, forests and plantations with coniferous, mostly evergreen (Abies, Picea, Pinus, Taxus, Cedrus, Cyperaceae), but also deciduous (Larix) trees which exceed deciduous ones by at least 25%. There are several habitat types of lower levels in Macedonia, consisting of fir, spruce, white pine, black pine, Bosnian pine (only individual specimens of Bosnian pine can be found on the territory of Macedonia and they do not make distinctive habitat), Macedonian pine, wild Greek juniper, cultivated Greek juniper and red juniper. Plantations of coniferous species make distinctive habitat type and they may be with native or non-native (exotic) species.

Habitat group of mixed deciduous and coniferous woodlands (G4) comprises woodlands of mixed deciduous and coniferous woody species of amoral, boreal, moderately warm humid and Mediterranean zone. Neither coniferous nor deciduous species cover more than 75% of crowns coverage. Several habitat types of lower level are present in Macedonia. Mixed forest plantations make specific habitat type.

Specific habitats of the type lines of trees, small anthropogenic woodlands, recently felled woodland, early-stage woodland and coppice are included in habitat type G5 (parks are excluded). The second level comprises eight habitat types of the third level that may occur in Macedonia.

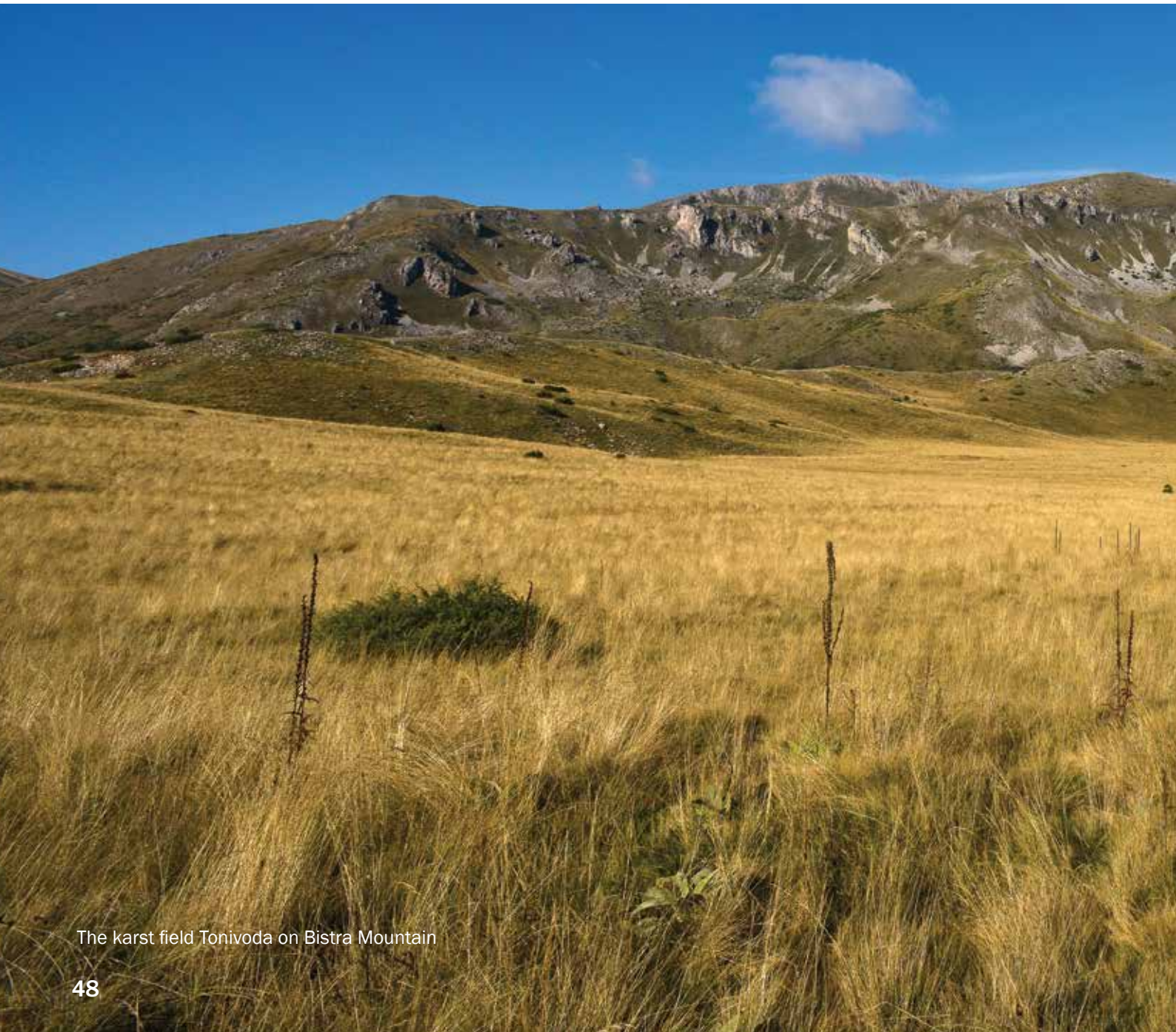
H: Inland unvegetated or sparsely vegetated habitats

Habitats belonging to this group are characterized with low vegetation cover which does not exceed 30%. They are dry or seasonally wet. The second level includes five distinctive habitat groups: Terrestrial underground caves, cave systems, passages and water bodies (H1), Screes (H2), Inland cliffs, rock pavements and outcrops (H3) and Miscellaneous inland habitats with very sparse or no vegetation (H5). All of them are exceptionally sensitive to external anthropogenic impacts.

Habitat group H1 includes natural caves and cave systems, ground waters and interstitial areas. Organisms inhabiting them are either limited to them only (troglobionts) or physiologically and ecologically adapted to their conditions (troglophiles) or spend only part of their life cycle there (subtroglophiles). The third classification level includes seven distinctive habitat types: cave entrances and interior, dark underground passages, underground running and standing waters, and abandoned underground mines and tunnels. All of those, to a lesser or bigger extent, are present on the territory of Macedonia.

Screes (H2) are accumulations on rocks, coarse and smaller stones, gravel or finer material, without vegetation or colonized by lichen and moss or with sparse grass and scrub species, usually highly specialized plant communities. Several lower level habitats are represented in Macedonia, namely: Temperate-montane acid siliceous screes (H2.3), Acid siliceous screes of warm exposures (H2.5) and Calcareous and ultra-basic screes of warm exposures (H2.6).

Habitats in (H3) group that are without vegetation or have sparse scattered vegetation in Macedonia belong to five groups of third level.



The karst field Tonivoda on Bistra Mountain

I: Regularly or recently cultivated agricultural, horticultural and domestic habitats

Habitats belonging to this group are typical anthropogenically conditioned habitats maintained by ploughing and digging or occur upon recent abandonment of cultivated land. Two habitat groups are distinguished on the second level: Arable land and market gardens (I1) and Cultivated areas of gardens and parks (I2). The first group usually includes crops collected regularly in the course of the year, and not plantations of trees or scrubs. Cereals and leguminous crops, fields under sunflower, potatoes and similar crops are included here. The quality of the biodiversity depends on the intensity of agricultural exploitation and presence of edges of natural vegetation between fields.

The second group encompasses small scale (domestic) ornamental gardens and urban parks. Besides cultivated, some wild species can be found there, too.

J: Constructed, industrial and other artificial habitats

This group includes habitats established under the direct influence of man. At the second level, specific habitat groups include habitats covering more than 30% of the area in cities (J1) and habitats where buildings are with low density (J2). Furthermore, this group includes active and abandoned mines (J3), Transport networks, parts of airports, pavements, recreational areas, constructed parts of cemeteries (J4), fully artificial water bodies and related structures (J5) and landfills.

X: Habitat complexes

Habitat complexes on EUNIS list are of preliminary character and are not elaborated fully. From among them, 11 could be distinguished in Macedonia with certainty.

The great cormorant (*Phalacrocorax carbo*) colony on the Golem grad island in Prespa Lake

Status of exploration of habitats in Macedonia

The long history of biological diversity exploration on the territory of the Republic of Macedonia has resulted in valuable data on the composition and distribution of species and communities. However, the available literature contains almost no data on specific habitats. Although the complex system of EUNIS contains precise data on certain habitat types from Macedonia, it is safe to say that there are gaps in the knowledge of habitat diversity in Macedonia. Besides, we may note incompatibility of data on biological diversity, distribution and state of threat of certain habitats. The review enclosed above is an initial attempt for habitats identification in Macedonia.

Finally, it has to be stressed that current and future legal documents need more precise tasks for exploration, monitoring and protection of vulnerable habitats. This is of particular importance, considering the differences among habitats with regard to their species composition, presence of rare species, their ecological and economic significance, etc.

The habitats in NBSAP

The analysis of gaps in NBSAP of 2004 has indicated that it does not cover habitats in narrow terms, though 17 points of the action plan refer to them directly or almost directly. They incorporate measures aimed at improving the system of protected area management, establishment of network of protected areas, expansion of the system of protected areas, revitalization of protected areas, revitalization and in situ protection outside protected areas, promotion of sustainable use of forests and maintenance of forest resources, fostering of traditional use of biological diversity and eco-tourism, establishment of adequate capacities, establishment of research facilities, monitoring activity, establishment of database, raising the level of public awareness, education, advising management structures of the problems of biological diversity (H1 –initiatives and programmes), adoption of new regulations, harmonization of sectoral regulations, etc.

This Strategy should make a step forward in terms of more directly addressing habitats in conservation activities given their importance as an important component of biological diversity. Activities proposed under all four strategic goals should directly or indirectly have positive reflections on all types of habitats and contribute to their improved functionality.

The large copper (*Lycaena dispar*) is Natura 2000 species connected to wetland

3.4 Genetic diversity

Genetic diversity of wild species in Macedonia is insufficiently documented.

Genetic research of wild species in the Republic of Macedonia has been generally targeted at determining phylogenetic (relational) links between species. Most often, such research is carried out for species complexes in Ohrid and Prespa Lakes.

Molecular studies of gastropode fauna (mollusks) have indicated existence of several species complexes with high level of endemism. Genetic research based on genes of mitochondrial DNA of representatives of the genus Ancylus (snails, mollusks) in the Lake of Ohrid have indicated that species form monophyletic group (originating from common ancestor) as a result of intralacustrine speciation. Molecular study of the species from the genus Radix (snails, mollusks) indicates close relationship of endemic species from Ohrid and Prespa lakes (sister species), but also existence of endemic species in the springs of St. Naum which are not related with the species in the lakes. Analysis of shells from the genus Pisidium indicated existence of nine species some of which still unknown to science. Similarly, analysis of isopod crayfish (Proasellus) in Ohrid indicates two phylogenetically related species complexes in the lake sharing the same ancestor. Molecular studies of the genus Dina (leeches) indicate that all species are monophyletic and occurred by intralacustrine speciation. Preliminary DNA analysis of the species from the genus Cyclops (copepods) in Ohrid Lake manifests unusual relationships with other species in the genus. Preliminary analysis of DNA of endemic species complex Ochridagammarus (amphipod crayfish) suggests existence of high level of genetic differentiation. Monophylic nature of Ohrid trout (Salmo letnica) was demonstrated through several genetic studies. It is interesting that molecular studies of salmonid fish showed that no taxon in this group was endemic to individual ecosystem, but they were endemic for Ohrid-Drim-Scadar system.

In our knowledge, there are no systematic studies of genetic diversity in the sphere of flora, except that 600 species of angiosperm plants have been cytologically elaborated.

An attempt towards preservation of genetic diversity is the establishment of facility for ex situ growing of certain endemic and rare plant species in the Botanical Garden of the Institute of Biology at the Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University – Skopje. For only one year, nearly thirty endemic and relict species – Astragalus mayeri, Cladium mariscus, Hedysarum macedonicum, Osmunda regalis, Ramonda nathaliae, Sambucus deborensis, Sempervivum octopodes, Thymus alsarensis, Thymus oehmianus, Tulipa mariannae, Viola allchariensis, etc., as well as fragments of aquatic, marshy, meadow and steppe vegetation, were accommodated in this facility. However, the project has stagnated during the last years due to lack of financial resources. The possibility for renewal of seeds collection in a new facility, which in time may grow into a gene bank for native wild flora of Macedonia, and the need to develop a practice for preservation of significant plant species by application of the method of in-vitro culture of plant tissues, are under consideration.

With reference to fauna, several systematic groups have been elaborated in order to clarify taxonomic status of “species” and phylogenetic relations (trout, amphipod and isopod crayfish). So far, activities for conservation of genetic diversity of wild fauna have not been carried out.

3.5 Agro-biological diversity

Genetic resources used in food production are among the most important components of the whole biological diversity. The Ministry of Agriculture, Forestry and Water Economy (MAFWE) is the national institution holding adequate mandate for management, preservation and protection of genetic resources (native species and varieties of agricultural plants and livestock breeds) in cooperation with other relevant institutions, primarily scientific and academic institutions, but also public and private enterprises, farmers and non-governmental organizations.

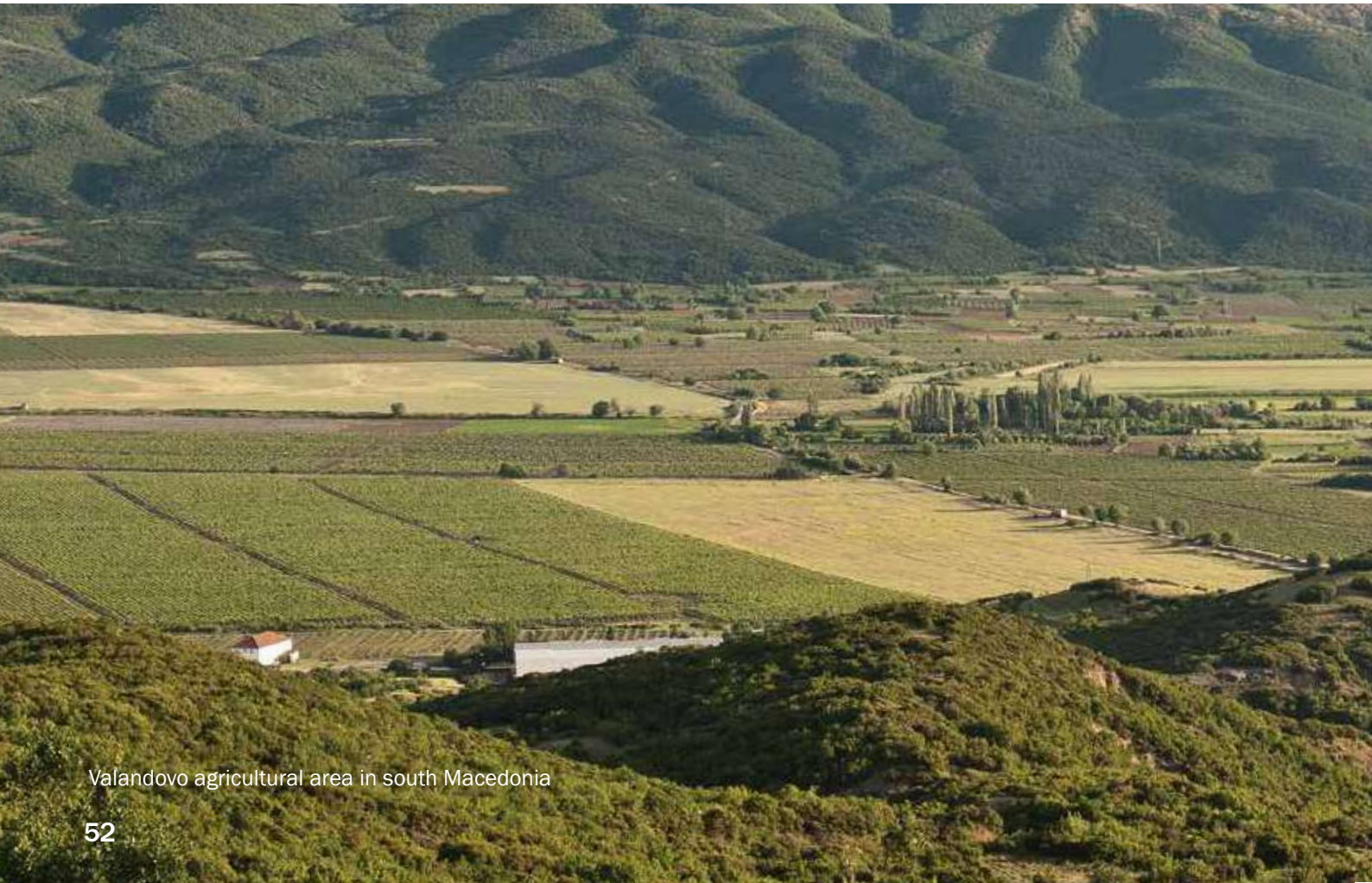
Significant progress has been achieved in the legal framework concerning genetic resources protection. The Law on Agriculture and Rural Development, in its Article 78, stipulates assistance in the preservation of genetic diversity of native agricultural plants and native livestock breeds. It can be granted in a form of direct payment per area of cultivated agricultural land on which native agricultural plants are reproduced and grown and per breeding cattle head of native livestock breeds. For the purpose of providing such assistance, a list of native agricultural plants and native livestock breeds was published in 2011 (Official Gazette of the Republic of Macedonia no. 71/11). Based on this list, the Minister specifies the manner of monitoring and analysing the status of native agricultural plants and native livestock breeds in terms of the extent of their being threatened and stipulates additional measures for preservation, collection and keeping of compulsory genetic reserves and their use in agricultural production. This Article also prohibits eradication of native agricultural plants and native livestock breeds. Financing of these activities is provided under Article 7, which refers to the national programme for agriculture and rural development.

3.5.1 Plant agro-biological diversity

Activities for plant agro-biological diversity protection in the Republic of Macedonia have started long time ago, as part of selection programme for creation of new varieties. Activities were intensified during 1969-71, in the frames of projects supported mainly by foreign donations, primarily from USA. Major portion of specimens collected in that time are still kept in the gene banks in USA and seeds for regeneration can be obtained therefrom. They are free for repatriation, but this does not mean that the Republic of Macedonia will be responsible for their maintenance in the future. That activity requires financial resources which lack and therefore repatriation is not considered a priority.

Intensive activities for conservation of plant genetic resources used for food and agriculture (PGRFA) started in 2004 with the initiation of the SEED-Net Project, supported by the Swedish Agency SIDA. In Macedonia, activities are organized in the frames of the working groups for: wheat, forage, industrial, vegetable, fruits and grapevine crops, as well as the group for medicinal and aromatic plants (MAP).

In the period 2004-2011, numerous activities were undertaken for PGRFA conservation, in terms of sample collection through collection missions, their categorization and evaluation, establishment of databases to keep documentation data, as well as in terms of upgrading the infrastructure and the equipment in the Gene Bank of the Institute of Agriculture in Skopje, which functions as national gene bank. Its operation is based on the standards for gene banks set by the European Cooperative Programme for Genetic Resources.



Valandovo agricultural area in south Macedonia

Besides seeds collection, the Institute, namely the Gene bank, also maintains field collections of fruit and grapevine crops. The gene bank also keeps seeds of medicinal and aromatic plants, and plants were planted in the Botanical garden of the Faculty of Natural Sciences and Mathematics. Material conserved in the Gene Bank is of different biological origin: native populations, domestic and introduced varieties, different selection material and specimens of spontaneous flora (wild relatives, weeds. All samples are recorded with 34 passport data based on the inventory list of the European List of Collections keeping plant species ex situ). At present, data on 2158 samples from Macedonia are entered in this list (http://eurisco.ecpgr.org). Besides this data, the Gene bank database also keeps records of the categorization and evaluation of the samples for which it has been completed.

In 2013, the Gene Bank maintained collection of 2666 samples of 89 different species (Table. 5). The highest percentage of this collection is occupied by fruit crops, including also grapevine, with total of 1042 samples the collection of which is maintained as field one. Among seeds collection, the biggest part belongs to wheat crops (29%). According to the status of the material, native or local populations / varieties are the most numerous (1187). Local populations are also represented in the field collection, though lots of them originate from other countries, too.

In 2008, the Administration of Seeds and Seedlings under the MAFWE established Division for national gene bank. Activities for conservation of CPGRFA of the gene bank in Skopje involve mainly researchers from the Faculty of Agricultural Science and Food (FASF) and Institute of Agriculture (IA), members of the Ss. Cyril and Methodius University – Skopje. On national level, activities for CPGRFA conservation, though at smaller scale, are also performed in two more institutions:

- Institute of Tobacco, St. Kliment Ohridski University – Bitola, responsible for tobacco collection keeping, and
- Faculty of Agriculture, Goce Delchev University – Shtip, which primarily maintains the rice collection, and several industrial crops.

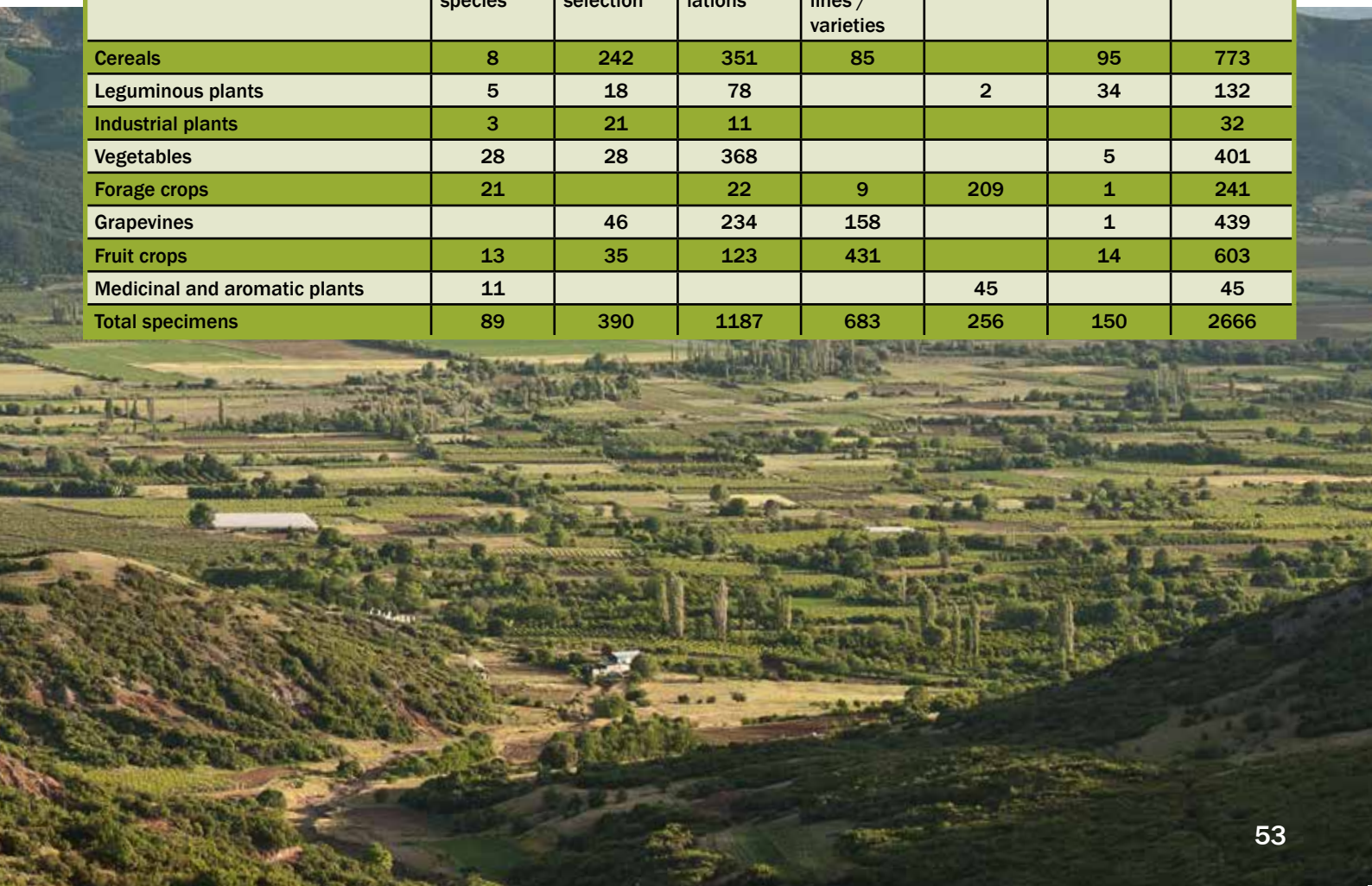
In parallel with the activities implemented for public awareness rising through different means of communication (media campaigns, radio and television programs, distribution of brochures, leaflets, etc.), as well as education about the importance of CPGRFA.

The operation of the Gene Bank is regulated by the Law on Seeds and Seedlings (Official Gazette of the Republic of Macedonia no. 55/11), where Article 54 requires that reference samples of seeding material are kept in gene bank. Under the Law, Rulebook on the quantities, conditions and manner of keeping reference samples of agricultural plants species and varieties, as well as the manner of gene-bang operation (Official Gazette of the Republic of Macedonia no. 144/11) was developed. Currently, several articles of this Law are under review in order to define native varieties, their status and possibility for their enrolment on the National list of varieties. Development of specific rulebooks to regulate this area has been envisaged, too.

The Commission for native varieties protection was established in MAFWE in 2012, and there is an ongoing work on the Programme for native varieties protection in accordance with EU Regulation no. 870/2004 (EU Programme for conservation, characterization, collection and use of genetic resources in agriculture).

Table 5. Number of specimens in the collection at the Gene Bank in Skopje.

Species/crops	Number of species	Material for selection	Local populations	Advanced lines / varieties	Wild	Unknown	Total
Cereals	8	242	351	85		95	773
Leguminous plants	5	18	78		2	34	132
Industrial plants	3	21	11				32
Vegetables	28	28	368			5	401
Forage crops	21		22	9	209	1	241
Grapevines		46	234	158		1	439
Fruit crops	13	35	123	431		14	603
Medicinal and aromatic plants	11				45		45
Total specimens	89	390	1187	683	256	150	2666



Sheep breeding is decline in Macedonia

3.5.2 Biological diversity of domestic animals

Goals and priorities of biological diversity protection concerning domestic animals in the Republic of Macedonia are based on a) Global Action Plan adopted at the First International Technical Conference on Animal Genetic Resources held in 2007 in Interlaken – Switzerland, under the auspices of FAO, and b) Law on Livestock Breeding of the Republic of Macedonia (2008/2013). They are defined in the Programme for the Protection of Biological Diversity in Livestock Breeding (2011-2017), as follows:

- Establishment of system for characterization and inventory of all species and for all species and all breeds/lines/types of domestic animals individually;
- Establishment of monitoring system for all species and all breeds/lines/types of domestic animals individually;
- Establishment of system for sustainable use and development of genetic resources in livestock breeding;
- Establishment of system for conservation, gene banks, in situ and ex situ conservation;
- Establishment of system for measures for support to genetic resources protection in livestock breeding in ex situ or in-vivo forms of conservation within the boundaries of national parks, agricultural holdings, education or research centres;
- Institutional strengthening, research and monitoring, education, legislation; and
- Increase of public awareness in all above listed areas.

Despite modest data on genetic resources in livestock breeding in the Republic of Macedonia, the expert community has affirmed the presence of several domestic breeds or types of the species of cattle, sheep, goats, pigs, bees, buffalos, dog, horse, donkey and poultry (Table7). Article 54 of the Law on Livestock Breeding defines the cattle Busha, Karakachanska, Ovchepolska and Sharplaninska sheep, Balkan goat, local primitive pig, domestic hen, domestic buffalo, domestic horse, domestic donkey, Macedonian bee and shepherd dog Sharplaninec as native breeds. Considering that the system for characterization, monitoring and recording (inventory) of local breeds and monitoring of the trends and the risks in the domain of threat extent of local breeds is under construction, some of the included information is indicative.

In accordance with the Programme for biological diversity protection in livestock breeding (2011-2017), implementation of the following activities is in progress:

- characterization and inventory of biological diversity in livestock breeding;
- monitoring in the area of conservation of biological diversity in livestock breeding;
- in situ and ex situ conservation; and
- conservation – gene banks.

Data collected from the activities implemented so far in relation to biological diversity of domestic animals are summarized in Table 7.

Table 6. State of biological diversity of domestic animals.

Species	Breed/type	Status of population	Number of confirmed heads/bee families of native breeds	Number of protected heads		Conserved biological and reproduction material	Genotypization
				Ex situ	In situ		
Cattle	Busha	Stable/ unexplored	600		x		
Sheep	Karakachanska	Critical	100	60		50	Sheep PrP genotype; ISAG DNA sheep microsatellites
	Ovchepolska	Not threatened	2800		x	2000 seed doses 14 embryos 10 egg cells	Sheep PrP genotype
	Sharplaninska	Unexplored	200		x		Sheep PrP genotype
Goats	Balkan goat (local)	Not threatened	1100		x	50 seed doses	
Pigs	Local primitive pig	Unexplored	In a process of inventory taking and phenotype characterization				
Bee	*Apis mellifera macedonica*	Not threatened	2000				
Buffalos	Local breed	Critical	60				
Dogs	Sharplaninec	Not threatened	60	x			100 samples for microsatellite DNA analysis
Horses	Local horse	Unexplored	In a process of inventory taking and phenotype characterization				
Donkeys	Local donkey	Unexplored	In a process of inventory taking and phenotype characterization				
Poultry	Domestic hen	Unexplored	460				

4 Biodiversity loss

4.1 Main threats to biological diversity

All factors and processes leading to accelerated extinction of species and reduction in their populations, loss of genetic material, degradation of ecosystems and reduction in ecosystem services can be regarded as threats to biological diversity. Analysis of threats is crucial in detecting the causes for biological diversity reduction and planning of measures for its protection.

The 2004 National Biological Diversity Strategy with Action Plan listed the threats arbitrarily and on the basis of individual opinion of experts involved in the preparation process. Considering the necessity to determine the threats precisely in order to elaborate efficient action plan for biological diversity protection, identification of threats in this instance was made in accordance with the generally recognised international terminology and by precise methodology. Attention was primarily devoted to threats prioritization to enable planning of the activities that are necessary for efficient protection of the most endangered biodiversity components in conditions of lack of financial and human resources for protection of all threatened species and ecosystems.

For the sake of conciseness and primarily for compatibility of data with those on international level, the analysis was made in accordance with the existing classification of threats of the EU used by Member States for reporting under Article 9 of the Habitats Directive.

Balmford et al. (2009) maintain that IUCN-CMP classification and terminology, upon which the one of EU has been built, combine the two key, but consecutive aspects of threats into a single and incomplete linear system. These are "mechanisms of threats" and their "sources" which in the IUCN-CMP classification are presented as "direct threats". This means that, taking the unfavourable "status" as starting point (e.g. reduced population of a species) of the "target" (the specific species), we should determine the "mechanism of threat" (e.g. overhunting) to reach the "source" (e.g. sector of hunting, that is, poaching). Then, one can also look for the "hidden" or "root cause" of the threat (e.g. absent or insufficient law enforcement), which is actually an "indirect threat". The unfavourable status of the target species or ecosystem is also defined by Salafsky et al. (2008) as "stress" (degraded condition or disordered attribute).

Definition of several terms related to threats (IUCN-CMP 2006):

The main assumption in threat identification is the "target" of protection or conservation for which the threat is identified. This can include endangered wild species, communities or ecosystems (or components of agro-biological diversity under threat for extinction). Synonyms include: "conservation target", "biodiversity target" and "focal target".

"Direct threat" is direct (essentially human) activity or process that has caused, is causing or might cause destruction, degradation and/or damage of the components of biological diversity and natural processes (e.g. clearcutting in forest ecosystem, overfishing, etc.). Synonyms include: "source of stress" and "direct pressure".

"Principal" or "hidden causes" are factors, usually social, economic, political, institutional or cultural in nature, enabling (or otherwise contributing to) the existence and duration of direct threats (e.g. trends in market prices of certain biological resources, planning of the space, etc.). There is normally a chain of hidden causes behind each direct threat. Hidden causes are basically "indirect threats", but they can also be "opportunities" (factors of positive effect). Synonyms include: "drivers" (fosterers) or "root causes".

4.1.1 Direct threats to biological diversity in Macedonia

From the list of threats under the EU classification, threats relevant for Macedonia (249 in total) were selected first. Simple methodology was used to prioritize the threats by which all threats were assessed according to five criteria based on expert judgement: (1) geographical distribution, (2) scope, (3) intensity, (4) urgency and (5) reversibility of threat, with scores 1 to 3. Grades of each threat were formed on the basis of the available data on each of the threats in Macedonia. Thus obtained grade (sum) was used to prioritize the threats according to the following scheme: from 0.5–3.5 low priority; from 4–6.5 medium priority; from 7–9.5 high priority and from 10–12 very high priority.

Following the analysis of the threats in Macedonia, identified were 17 threats of very high priority, 68 threats of high priority, 115 threats of medium priority, while the remaining 49 threats have low priority (Annex 2).

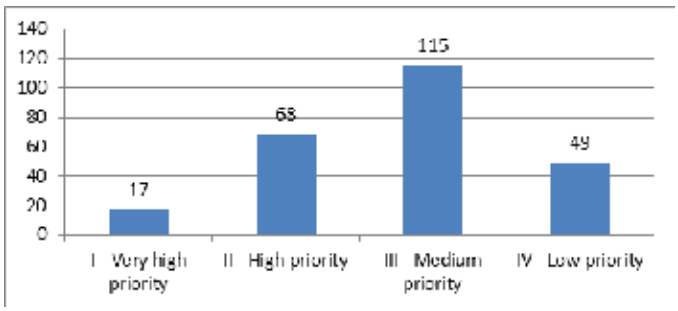


Figure 3. Categorization of threats in Macedonia by priority.

Threats of I and II priority (very high and high priority) are 85 in total, and they are priority for biological diversity protection and have been addressed accordingly in the Biodiversity Action Plan. The 17 threats assessed with highest priority, because of their importance, have been presented and commented separately (Table 7).

Table 7. List of priority threats to biological diversity with explanations and root causes for threat endurance.

	Threat	Explanation	Root causes
1	Abandonment / lack of mowing	These two threats are related to agricultural sector, as they result from abandonment of traditional modes of meadows and pastures exploitation through mowing and grazing, respectively. Root causes lie in the depopulation of rural cores and low economic cost-effectiveness of those activities without subsidies. Great village-city migration resulted in significant reduction of livestock. Former areas under meadows are no longer mowed and they are transformed into other types of habitats – montane pastures.	Wrong policies – in the past and the present
2	Abandonment of pastoral systems, lack of grazing		Wrong policies – in the past and the present
3	Open-cast mining	This threat derives from the sector of mineral and non-mineral resources exploitation (mining and quarries). It causes permanent loss of habitats of high number of important species associated with marbleized limestones, especially among plants ("marble flora") and invertebrates. Particular concern in this regard is raised by the situation in the wider surrounding of Prilep, where considerable number of areas has been awarded under concession for marble exploitation. Similar conditions occur in the site of Alshar, where several local endemic species grow (Viola arsenica, Viola allchariensis, Thymus alsarensis, etc.).	Lack of economic policies; inconsistent law enforcement and procedure implementation; unsustainable development; inadequate planning
4	Continuous urbanization	These three threats are associated with urbanization and lead to direct uptake of habitats and disturbance of species on the whole territory of Macedonia. Several plant communities are particularly affected (especially swampy) and representatives of flora (for example, Carex elata, Nuphar lutea), and entire endemic fauna in Ohrid Lake, and to a lesser extent, the problem is also relevant for Prespa and Dojran Lakes, as well as Vardar River basin. Due to the wide range, intensity and irreversibility of the threat, this group also includes disposal of municipal waste and demolition waste. Table 9. Agricultural areas in thousand hectares (Source: SSO 2012)	Lack of law enforcement and procedure implementation; inadequate planning
5	Disposal of household / recreational facility waste		Lack of law enforcement and procedure implementation; lack of awareness
6	Disposal of industrial waste		Lack of law enforcement and procedure implementation
7	Trapping, poisoning, poaching	Poaching is one of priority threats associated with hunting. It is the cause for reduction of the populations of several species of concern (roe deer, chamois), and directly (through killing) or indirectly (through reduction in the number of natural prey) of Balkan lynx as well. Hunting with live snares and traps results in regular cases of bears catching (three reported cases for the last four years). On the other side, illegal use of poisonous baits, led to extinction of bearded and black vulture and to drastic reduction in the populations of Egyptian and griffon vultures.	Poverty, lack of law enforcement; low awareness; markets
8	Missing or wrongly directed conservation measures	One of the greatest problems in nature and biological diversity protection in Macedonia is the inadequate mainstreaming of constrained available financial resources and human capacity. This was indicated by the analysis of the implementation of the Action Plan of the first biological diversity strategy, but also series of other strategic documents.	Low capacity of institutions; wrong policies; insufficient funding
9	Groundwater pollution by leakages from waste disposal sites (WFD)	Due to the wide spread use of chemical protection products in agriculture, as well as lack of sanitary landfills with water impermeable layer, entry of such waste and agricultural waters into ground aquifers is a wide spread and irreversible problem, especially with regard to endogean fauna, and the use of these waters (e.g. for irrigation) or their linkage with lake basins (e.g. Prespa Lake) transfers the risk to a great number of aquatic organisms.	Lack of law enforcement and procedure implementation
10	Diffuse groundwater pollution due to agricultural and forestry activities		Lack of knowledge, lack of awareness, law enforcement
11	Burning down existing vegetation	As many as five priority threats (11-15) concern modification of natural ecosystems. This group includes forest fires, which in the period 2003-2013 have devastated 115.240 ha under forest (MAFWE, 2014). Thermophile oak forests and shrubberies, characterized with high diversity and/or presence of species specific for Mediterranean biome of marine forests and maquis, as well as coniferous forests, are particularly affected. These fires often pose real risk to protected areas.	Lack of law enforcement, low awareness
12	Reservoirs	Construction of artificial water accumulations is a severe threat, primarily due to its irreversibility. As by rule, river gorges are the most suitable places for their construction and they are often refuge shelters rich in rare (relict), endangered or endemic flora and fauna (rivers Treska, Crn Drim). In certain cases, small hydropower plants are constructed within the boundaries of protected areas. Surface water intakes for irrigation, through construction of water accumulations, lead to the same problem, and in some cases (e.g. Dojran Lake, and especially Prespa Lake) there is direct pumping of water for the purposes of agriculture, which contributes to the reduction of water quantity in the Lakes and severe problems with vegetation and fauna (Matzinger et al. 2006; Popovska & Bonacci 2008).	Lack of law enforcement; unsustainable development; policies
13	Surface water abstractions for agriculture (WFD, e.g. irrigation)		Lack of planning
14	Surface water abstractions for hydro-energy (WFD)		Lack of law enforcement, unsustainable development, economic policies
15	Reduction of prey availability (including carcasses)	Small populations or negative trend in large herbivores (red deer, roe deer, chamois) and reduction in livestock combined lead to decline in the number of predators (especially Balkan lynx) and necrophagous species (vultures and eagles). Populations of some of these species are approaching full extinction, which is certainly due to other factors as well.	Inadequate policies in hunting; lack of awareness; poverty
16	Temperature changes	Climate change is another priority threat which concerns the expected raise in temperature and decrease in the volume of precipitation, to result in the extinction or in reduced area range of several sub-alpine and/or alpine species and habitats, as well as expansion of arid areas, increased risk of fires and increased erosion.	Climate change
17	Droughts and lower precipitation		Climate change

4.1.2 Indirect and root causes for biological diversity loss

Conservation practice in the world has shown that activities aimed at mitigating or eliminating direct threats have not produced the desired result. Despite huge funds invested in the prevention of poaching in Africa, prevention of devastation of Amazon forests, fragmentation of forests in Europe and series of other direct threats, degradation of the components of biological diversity has proceeded with equal or almost equal intensity. It is obvious that other, indirect threats lie in the basis of direct threats and they render inoperative the halt of species and ecosystem loss in modern world. It is necessary that these are identified and addressed adequately in order to enable the efforts for biological diversity conservation to achieve results.

The same rules with regard to biological diversity loss that are typical for developing countries that face transition from one system of political ruling and governance to another and cope with poverty are applicable in Macedonia, too (Wood et al. 2000). There is an amalgamof indirect threats underlined with several root causes for biological diversity loss. Indirect threats are associated mainly with economic sectors and other areas of human living (see Chapter 4.2).

Several root causes lie in the essence of negative impact of sectors on biological diversity. Growing inequality between different social classes, change in lifestyle of economically stronger individuals and consolidation of agricultural land managed by a low number of economically powerfull companies will result in falling trends with many now widely spread species.

For the purpose of clearer presentation of the relation between root causes for biological diversity loss in Macedonia and direct threats, analysis was made of the 17 top-priority threats in our environment (Table 7). It can be noted that several root causes can exist for one threat or one root cause can control several threats. Thus, for example, weak implementation of the existing environmental legislation is partially or fully responsible for 10 of the 17 top-priority threats. The table shows that very prominent position is also held by root causes like low (public and institutional) awareness, lack of modern planning of space, inadequate policies and unsustainable development, etc.

We may not expect that elimination of one of the threats will divert negative trends. There is weak coordination between sectoral strategies (e.g. tourism, forestry, energy), as well as the goals of sustainable development and nature protection.

4.2 Key sectors affecting biological diversity

At present, the Republic of Macedonia is at a crossroads between more intensive economic growth and constantly increasing devastation of natural values. The focus of nature conservation has to be searched for in the integration of the principles of sustainable development into other sectors' policies, while identifying mechanisms and alternatives that will not slow down significantly the projected economic growth, contribute to the ultimate objective of poverty reduction and improve the quality of living, and at the same time enable long-term survival of (nationally and internationally) most significant components of biological diversity.

On the basis of the analysis of threats on biological diversity, the following key sectors were identified to affect the biological diversity: agriculture, forestry, hunting, transport, energy, fishery and aquaculture, water management, industry and pollution and use of natural resources, elaborated in more detail in this Chapter. Furthermore, this Chapter deals with invasive species, climate change and desertification.

The main sectors with greatest impact on biological diversity in Macedonia came out of the analysis of the threats in Chapter 4.1. Brief analysis of these sectors is presented below.

All identified threats to biological diversity in Macedonia have been grouped in 13 main sectors/areas (Table 8). For each of the sectors, cumulative sum of scores was calculated (out of all threats originating from that sector). Scores presented by sectors may provide only indication of the impact, but it cannot be used for absolute comparison of sectors. We may note that the greatest impact on biological diversity originates from the areas J. Modification of natural systems, H. Pollution, G. Intrusion and disturbance by man and A. Agriculture. The scores of area H. Pollution are high because this area also includes threats stemming from agriculture, forestry, and not only industry, transport, etc. What is really relevant is the number of priority threats occurring

Table 8. Analysis of threats by sectors/areas.

Sector/area	Sum of scores	Number of threats by priority			
		I	II	III	IV
A. Agriculture	**155.5**	**2**	**5**	**13**	**12**
B. Silviculture, forestry	**72.5**	**0**	**5**	**5**	**3**
C. Mining, extraction of materials and energy production	**77.5**	**1**	**3**	**8**	**0**
D. Transport and service corridors	**84**	**0**	**5**	**7**	**6**
E. Urbanization, residential and commercial development	**105.5**	**3**	5	6	1
F. Other use of biological resources except agriculture and forestry	103.5	1	4	8	8
G. Intrusion and disturbance by man	175	1	6	20	6
H. Pollution	**182.5**	**2**	**13**	**10**	**1**
I. Invasive, other problematic species and genes	**23.5**	**0**	**1**	**2**	**1**
J. Modification of natural systems	**230.5**	**5**	**13**	**13**	**9**
K. Natural biotic and abiotic processes (without disasters)	**122**	**0**	**5**	**14**	**2**
L. Geological events, natural disasters	**26.5**	**0**	**2**	**2**	**4**

by sectors. The highest number of threats occurs in the areas J. Modification of natural systems (18), H. Pollution (15), followed by E. Urbanization, residential and commercial development (8), A. Agriculture (7), G. Intrusion and disturbance by man (7) etc.

4.2.1 Agriculture

Republic of Macedonia has 1268000 ha of agricultural land (according to SSO's 2012 data), of which 510000 ha are arable land areas (81% – arable land and gardens, 12% – meadows, 4% – vineyards and 3% – orchards). Agricultural land is good of general interest for the Republic of Macedonia and enjoys special protection. The term agricultural land incorporates: fields, gardens, orchards, vineyards, olive and other perennial plantations, meadows, swamps and marshes, reed beds, fishponds, and other lands used or not used (uncultivated land) which upon application of agro-technical and agro-amelioration and hydro-amelioration measures can be activated for agricultural production, as stipulated in the Law on Agricultural Land. Agricultural land also incorporates 757000 ha under pastures or around 60% of the overall agricultural area, as well as 1000 ha under ponds and reed beds. The trend in agricultural land areas for the period 2006-2012 is presented in Table 9.

Plant production has been divided into five main groups: production of wheat, industrial crops, feed, garden crops production, as well as fruit orchards and viticulture.

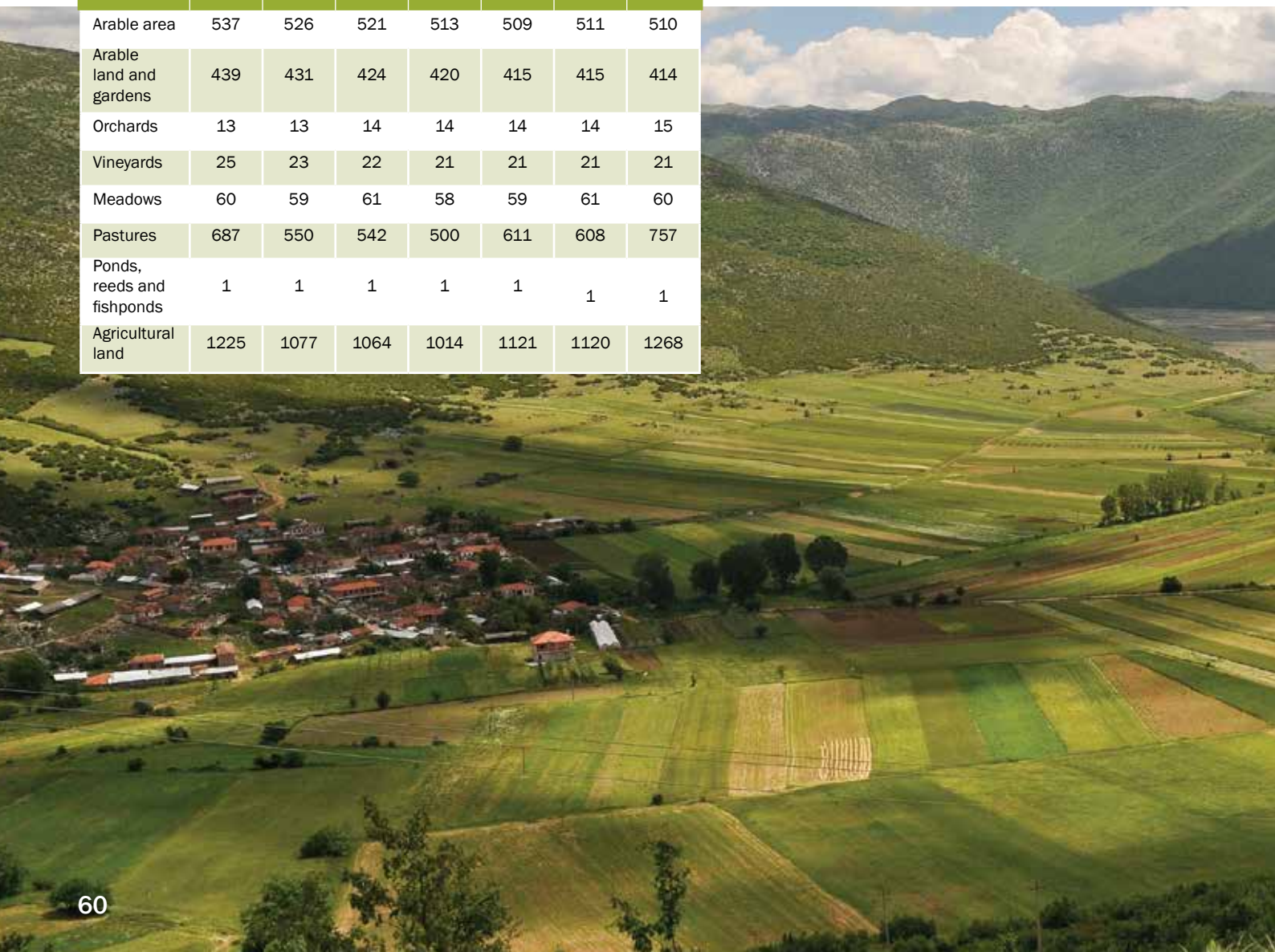
In 2012, around 67% of the overall arable land and gardens was under cultivation. Of this area, 59 % was cultivated by wheat crops, 19% garden, 12% field crops and 10% industrial crops (mostly tobacco, sunflower and poppy seed). Wheat crops were the most frequently cultivated in all planning regions in the country. Furthermore, industrial crops were also represented in Pelagonia and Southeastern regions, and feed crops in Polog, Southwestern and Southeastern regions. Vegetable crops were cultivated most efficiently in Southeastern region, followed by Skopje region. Owing to the favourable climate, Vardar region is appropriate for cultivation of almost all agricultural products.

Cultivation of fruit crops is most present in the western parts of the country, and area under orchards amounts to 15000 ha (around 3% of the overall arable area). The most represented is apple production accounting for 63% of the total fruits production, then production of plums (7.9 %), sour cherry (around 3%), pear (4%) and other fruit species (apricot, peach, quince, etc.). Fruit production is practiced mainly by individual agricultural farms, except production of sour cherries which is most represented in agricultural companies and cooperatives.

Vineyards contribute around 4% to the overall arable land, including around 30 ha nurseries for vine grafts production.

Table 9. Agricultural areas in thousand hectares (Source: SSO 2012)

Indicator	2006	2007	2008	2009	2010	2011	2012
Arable area	537	526	521	513	509	511	510
Arable land and gardens	439	431	424	420	415	415	414
Orchards	13	13	14	14	14	14	15
Vineyards	25	23	22	21	21	21	21
Meadows	60	59	61	58	59	61	60
Pastures	687	550	542	500	611	608	757
Ponds, reeds and fishponds	1	1	1	1	1	1	1
Agricultural land	1225	1077	1064	1014	1121	1120	1268



Structure of vineyards is unfavourable due to fragmentation and age (above 60% of the vineyards are older than 15 years).

Livestock production in the Republic of Macedonia is carried out mostly in hilly and mountainous areas, and the main goal is to provide high quality livestock products: milk and meat for the population. According to SSO data, the status of livestock numbers in 2012 reflected reduction, as follows: with cattle by around 5% compared to 2011, sheep by around 4.5%, and the number of pigs reduced by around 19650 heads (Table 10). Beekeeping is performed mainly in the private sector, and the number of beehives registered the greatest drop in the past period by around 18%.

Goat farming as animal husbandry branch is the most present among individual agricultural holdings (around 98%). In 2012, total of 63585 heads of goats was registered and their number was reduced by around 11% (7193 heads) compared to 2011. Around 29% of the goats in Macedonia are represented in the Eastern region, 16% in Southeastern, while goat farming is the least developed in Pelagonia and Polog regions.

Snail farming is a profitable business developed in Macedonia during the last ten years. Production is based on prior concluded contracts with foreign companies (e.g. Italy). The 25 registered farms produce around 40 tons of snails, but this is not sufficient to satisfy the growing demand of European markets.

Table 10. Number of livestock 2008-2012 (Source: SSO 2008-2012).

Type of livestock	2008	2009	2010	2011	2012
Cattle	253473	252521	259887	265299	251 240
Sheep	816604	755356	778404	766631	732 338
Pigs	246874	193840	190552	196570	176 920
Poultry	2 226 055	2 117 890	1 994 852	1 994 260	1 776 297
Bees	61705	53439	76052	65277	52 897

Agriculture (including forestry and fishery) is the third biggest sector in the economy of the Republic of Macedonia, with 12% GDP (source SSO 2014), immediately after service and industry sectors. Share of agriculture in the total gross domestic products in the period 2007-2012 ranged around 9-10%.

According to data from the 2007 Agricultural Census, there are 192675 agricultural holdings in total in the Republic of Macedonia, among which 192378 individual agricultural holdings and only 297 business entities. The total number of agricultural holdings in Macedonia in 2013 was 170885. Typology of agricultural holdings in the Republic of Macedonia was established for the first time in 2011, on the basis of 2007 Agricultural Census (Table 11). Out of the total 192675 individual agricultural holdings, predominant are those specialized for crop farming (22%), the holdings with mixed plant-livestock production (19%) and holdings specialized for perennial crops (15.8%). The lowest share belongs to holdings specialized for domestic animals fed with seeds and grain feed (4%).

Table11. Agricultural holdings by type of agricultural production (Source: SSO, Report: 5.1.11.06).

Type of agricultural production	Total number of holdings	Individual agricultural holdings	Business entities
Specialized for crops growing	42192	42143	49
Specialized for gardening	15013	14995	18
Specialized for perennial crops	30392	30347	45
Specialized for herbivorous livestock	24199	24169	30
Specialized for domestic animals fed with seed and grain feed	7760	7730	30
Mixed plant production	25456	25438	18
Mixed plant-livestock production	10556	10553	3
Mixed plant-livestock production	36552	36536	16
Unclassified holdings	555	467	88
Total	192675	192378	297

Table 12. Utilized agricultural land by categories (ha) in 2013 (Source: SSO, Report: 5.1.14.03).

Utilized agricultural land	Republic of Macedonia	Private sector
Arable land and gardens	237583	198576
Orchards	17363	15147
Vineyards	22654	161128
Meadows	30120	29750
Pastures	7785	6881
Nurseries	359	96
Total	**315863**	**266579**

An individual agricultural holding uses 1.56 hectares agricultural land and has 1.96 livestock units (SSO 2013). The overall agricultural land utilized by individual agricultural holdings in 2013 amounted 266579 hectares (Table 12). Compared to 2007 Agricultural Census, the number of individual agricultural families in Macedonia was reduced by 11.3%. Individual agricultural holdings are characterized by a general trend of decline in the number of livestock units by 2013, except for bee-hives which increased by 22.7% (Table 13). Cattle was reduced by 1%, sheep by 6.4%, goats by 27.1%, pigs by 28%, horses by 23.8%, poultry by 3%, and rabbits by as much as 41%.

Table 13. Number of livestock in the Republic of Macedonia for 2013 (Source: SSO, Report: 5.1.14.03).

Livestock	Republic of Macedonia	Individual sector
Cattle	239362	230148
Sheep	734472	701313
Goats	96281	95487
Pigs	163770	124728
Horses	24819	24798
Poultry	2055837	1355627
Rabbits	20972	20972
Beehives	133970	133778

By 2013, individual agricultural holdings reduced the scope of livestock breeding, but they increased agricultural production in several domains. The total utilized agricultural land increased by 0.8%. The greatest increase was recorded in the area under orchards – 60.8% and nurseries 29.7%. Small increase was also recorded in arable land and gardens (4.1%). On the other hand, great decrease was recorded for pastures (55.3%), vineyards (6%) and meadows (5.7%). Table 12 presents the ratio between overall utilized agricultural land in Macedonia and land utilized only by individual agricultural holdings.

The main difference between villages and cities/towns according to the definition contained in the Law on Territorial Organization of the Local Self-Government (Official Gazette of the Republic of Macedonia no. 55/2004) concerns the main activity of the community – agriculture is predominant in villages, while more than 51% of the workforce in cities/towns is employed in non-agricultural activities (secondary and tertiary sectors). The list of rural settlements and rural communities defined in accordance with seven different criteria (number of inhabitants, distance from constructed local road or urban settlement, activity of the population, etc.), was published in 2011 (Official Gazette of the Republic of Macedonia no. 89/11). A high number of rural settlements is depopulated or has exceptionally low number of inhabitants and unfavourable age structure. Workforce in the agriculture in Macedonia mainly consists of labour at the level of individual agricultural holding. Sectors agriculture, forestry, hunting and fishery employed around 17% (112623 persons in 2012) of the total number of employees, which is reduction in the number of employees in this sector by 6.8% compared with the previous period. Rural population is engaged mainly in agricultural sector, though in recent years it has manifested a trend of diversification of agricultural employment.

The institution responsible for the implementation of policies for agriculture and rural development is the Ministry of Agriculture, Forestry and Water Economy which has 33 regional offices distributed in all regions in Macedonia. Pastures occupy almost half of the total agricultural land. Most of the pastures are owned by the state and managed by the Public Enterprise for pasture management. In future, determination of actual condition of pasture (especially high mountain pastures) should be undertaken through responsible ministries, public enterprises and agencies, by introducing cadastre, aerial photos, topographic maps, linking with forest information system, digitalized and other data sources. Furthermore it is necessary to classify the pasture by type of vegetation and elevation, and establish a complete register of pastures in Macedonia.

The starting ground of the reforms in agriculture was provided for by the Law on Agriculture and Rural Development, adopted in 2007, whereas the 2010 Law provides for system-based planning of the policies and the measures of organized agricultural policy in the Republic of Macedonia. The necessity for organized approach to programming of the policies for agriculture and rural areas development has been imposed for the purpose of positioning the agriculture as one of the key economic areas and priority of the Government of the Republic of Macedonia as of 2007, when serious activities towards agriculture restructuring were initiated. This was accompanied by allocation of significantly bigger financial resources for its support and for harmonization of the legislation with the EU (common agricultural policy, agro-ecological measures, etc.) (MAFWE, 2013).The Law includes provisions for natural agricultural policy programming, measures for direct support of agriculture and rural development (as support to income of agricultural holdings), organization of markets, possibility for market interventions and forms of organization and association of agricultural producers. The goals of the national agricultural policy in Macedonia (under the law) are aimed, inter alia, at: sustainable development of rural areas and optimum utilization of natural resources through observation of the principles of

nature and environment protection.

In order to regulate the agricultural sector in full, high number of laws and bylaws has been adopted and some of them are relevant for biological diversity conservation, namely:

- Law on Quality of Agricultural Products (Official Gazette of the Republic of Macedonia no.140/2010, 53/2011 and 55/2012) regulates the protection of agricultural products and foodstuffs bearing a label of origin, geographical label and label of guaranteed traditional specialty.

- Law on Organic Agricultural Production which regulates the overall process of production, processing, storage, transport, sale, labelling and control of organic products. One of the goals of organic agricultural production is to establish sustainable system of agriculture management, which observes the systems and the cycles of nature, maintains and strengthens the health of soil, water, plants and animals and balance among them; contributes to high level of biological diversity; uses energy and natural resources in a responsible manner; observes the standards of animal welfare, etc.

- The Law on Agricultural Land regulates the use, protection and Conversion of agricultural land as limited natural resource.

- The purpose of the Law on Agricultural Land Consolidation is the establishment of larger land lots that will enable promotion of agricultural production, achievement of more cost-effective production and application of modern agro-technical measures. In the course of 2012, the National Strategy for Consolidation of Agricultural Land in the Republic of Macedonia for the period 2012-2020 with Operational Plan. Enlargement of agricultural lots leads inevitably to the establishment of single crops which have negative impact on the whole biological diversity in such areas.

- The Law on Pastures adopted in 1998 regulates the use and promotion of pastures as good of general interest, but it needs fundamental revision. Development of the new pastures legislation in accordance to the new national and EU legislation is foreseen.

- The Law on Stockbreeding defines the native domestic breeds (see Chapter 3.5.2)

For the purpose of long-term planning of the national agricultural policy, National Strategy for Agriculture and Rural Development was adopted for the period 2007-2013 (it is currently in a phase of revision). The Strategy defines the following measures related to biological diversity protection:

- measure for agro-environment and local rural development, 3 sub-measures are envisaged: Maintenance of native endangered species of domestic animals, Maintenance of local breeds and Collection and growing of endangered species of medicinal and aromatic plants.

- measure for rural economy development includes sub-measure for support to activities for rural tourism.

The policies for agricultural sector support have been set so to enable creation of favourable business environment for investment towards promotion of the competitiveness of the Macedonian agricultural production. Starting in 2007, Republic of Macedonia has been allocating huge financial resources for subsidies for agricultural production. Thus, from 7 million EUR in 2003, subsidies grew to EUR 130 million in 2012. The biggest portion of funds supporting agriculture and rural development are allocated to policies of direct payments, while the rest for the measures for rural development. For the purpose of the implementation of agro-ecological measures, the following enabling activities have been undertaken: agro-environmental programme and manual for minimum requirements for good agricultural practice have been prepared; establishment of system for land parcels identification, etc. Besides budget resources for rural development, funds of the European Union are used as well by way of implementation of IPARD Programme. The Law on Agriculture and Rural Development envisages support for agricultural activity performance in less favourable areas, support for performance of agricultural activity for environment protection and improvement, financial support to rural development, assistance for preservation of traditional landscape and architecture, assistance for agricultural land consolidation and protection, etc.

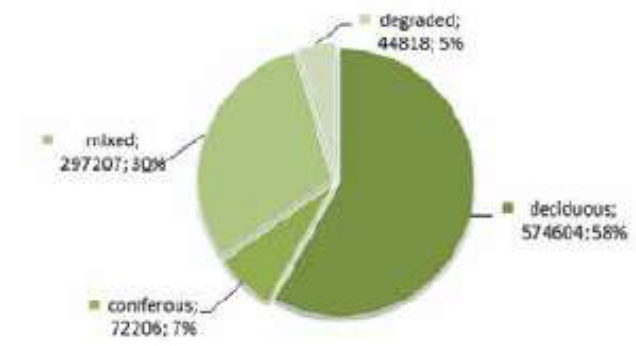
According to the 2013-2017 National Programme for the Development of Agriculture and Rural Development, direct payments measures for the period 2013-2017 include mandatory application of good agricultural practice has been introduces as a payment criterion starting from 2015. Also, in regard to rural development measures i.e. encouraging agricultural activities for improving the environment and the rural landscape (agro-environmental measures) the Programme provides policies aimed at promoting agricultural production practices for sustainable use of agricultural land, protection and improvement of environment and rural landscape in order to preserve the plant and animal diversity and improvement of soil, water and air.

Small patch of preserved oak forest around a monastery

4.2.2 Forestry

Forestry is the growing, use and protection of forests and forest crops on land areas under forest and suitable for forest, as well as the forestation and nursery production. According to 2012 statistics, the total area under forest in the Republic of Macedonia measures 988835 ha. Ninety percent of this is state-owned, while the remaining 10% is privately owned. The total area under forest during the last ten year period has increased by 3.5% (from 955294 ha).

Figure 4. Types of forests in Macedonia (area and share).



Forests and forest land in the country are managed by the Government of the Republic of Macedonia through its competent institutions. The largest part of the state owned forests is managed by the Public Enterprise "Macedonian Forests" which is spread throughout the national territory through its branch offices. Forests and forest land planning, management and operation is based on: specific plans for forests management, programmes for forests management and annual plans for forests management.

According to the planning documents, timber of around 87 million m³ is concentrated in the forests of Macedonia. The annual increment is around 1.97 million m³, and potential annual quantity available for cutting is 1.486 million m³ gross timber. During the last ten year period (2003-2013), planned commercial activities have been carried out through which timber in a gross amount of 8.7 million m³ has been harvested. During this period, there has been notable reduction in annual timber harvesting from 930 thousand m³ (in 2003) to 779 thousand m³ in 2012.

For the purposes of growing, sustainable use and permanent enrichment of the forest stock of the Republic of Macedonia, high number of forest cultivating activities have been performed. Forestation and complementing in forest and outside forest have been particularly present in the past period. In the period 2003-2013, forestation and complementing an area of 26.089 ha have been conducted on the territory of the Republic of Macedonia.

From among coniferous species, forestation was most frequently done with black pine and white pine, and acacia among deciduous species. Although Macedonia is suitable for oak forests development, their share in forestation activities is negligible. Many oak species in Macedonia have optimum conditions for development and should be favoured as such. On the other hand, large part of oak forests has been transformed into forests of sprout origin, pastures, cultivable land areas, etc., due to their overexploitation and negligible treatment in the past.

Forestation with acacia (Robinia pseudoacacia) and the (Chinese) tree of heaven (Ailanthus glandulosa) has been very successful in Macedonia. However, these two tree species are non-native and therefore forestation with these trees should be controlled and applied only on smaller areas affected by processes of erosion.

The total area under forests in the Republic of Macedonia has a trend of increase. This results from several factors, such as: capacity of the forest for natural recovery and expansion, established principle of sustainability in forests management, reduction of livestock in hilly and mountainous areas and high number of abandoned formerly cultivated agricultural land areas, which became suitable for certain pioneer wood species upon their abandonment.

Despite the positive increasing trend in areas under forest, the reduction in areas under pure natural coniferous tree species, as well as the reduction in areas under mixed forests, presents an unfavourable trend. These forest types have relatively low share in the overall forest stock in the Republic of Macedonia (7%, Figure 4) and their further reduction might assume threat (degradation) to forest diversity in general. This is further stressed by the fact that pure coniferous forests are among the most vulnerable forest ecosystems, because climate change narrows their ecological optimum and they are also sensitive to forest fires. These types of forests are also affected by natural succession processes which in Macedonia take place in favour of broadleaved species. Therefore, greater attention should be devoted to these forest types in terms of conservation, growing and revitalization.

Mixed forests composed of two or more tree species have specific value for forest diversity. They contribute 30% to the overall forest stock of the Republic of Macedonia. Forests incorporating coniferous tree species in the mixture are of particular significance. They are actually very important forest ecosystems, both in the context of biological diversity conservation and forests management, because the greatest quantity of wood mass per land area is concentrated within these forests, being at the same time of highest quality and value.

Conditions in the forestry in the Republic of Macedonia in the period 2003-2013 have been under strong influence of the general conditions related to social and political circumstances present during this period. Regardless of the fact that the Constitution of the Republic of Macedonia, as well as the Law on Forests define forests as good of general interest enjoying special protection, they have been exposed to certain negative impacts in the past period.

In many rural primarily hilly and mountainous environments, forestry and lumber industry remain the main carriers of local economic development. Therefore, forest resources are used to a significant extent and this improves the local economic standing and social welfare of the population. In such regions, the interest of the population is targeted at satisfying social and economic benefits from forests, while ecological values of forests and protection of biological diversity are often neglected.

Great negative impact on biological diversity also stems large-scale clearcutting, applied massively in oak forests of spruce origin. Such cutting have been recently also applied in beech forest ecosystems, which causes very significant negative impact on the overall biological diversity.

During the last years, illegal wood cutting have been in constant rise, causing significant damages on forest ecosystems.

Great hazards for forests and forest segment of biological diversity in Macedonia include forest fires, which in certain years reached distressing scales, with potential to destroy large areas under forest together with many habitats of animal and plant species in a short period of time. In the period 2003-2013, a total of 92.223 ha forest areas (9%) were burnt.

In order to improve the status of forestry, two important documents of strategic importance for forestry development and two laws with several bylaws were adopted in the last ten year period, namely: Spatial Plan of the Republic of Macedonia (2004) providing projections for forestry development by 2020; Strategy for Sustainable Forestry Development in the Republic of Macedonia (MAFWE, 2006), mainstreaming the priorities of action in forestry in the coming period towards generally beneficial functions of forests, as well as protection of and care for nature and environment; new Law on Reproductive Material of Forest Tree Species (2007); and new Law on Forests (2009).

Department of Forestry and Hunting under MAFWE has taken part in several projects and activities of international relevance through which the course of forestry related policies and activities are aligned with modern European trends. Despite of this, the Republic of Macedonia has remained among rare countries in the region where forest inventory and certification have not been implemented by the concepts of internationally recognized standards for sustainable forest management.

Important forest areas, important forest types and forest ecosystems in the country of fundamental importance for nature and biological diversity in the country have not been identified yet. Thus, significant areas under ancient forests (e.g. river Emerichka Reka, 482 ha) were detected in the past, while these are not differentiated at all today and most of them are transformed into commercial forests.

A number of values of forests and forest ecosystems such as aesthetic, landscape, recreational, sporting, tourist and other values remain insufficiently valued and utilized.

4.2.3 Management of waters

EU Framework Water Directive (2000/60/EC) marked a turning point in water treatment from a resource into natural good that has to be protected. Major part of this Directive has been transposed into Macedonian legislation – Law on Waters. This Law regulates issues concerning management of waters, shore land and wetlands, water distribution, protection and conservation of waters, protection against harmful effects of waters, water management facilities and services, etc. At the same time, the Law defines rules for wastewater treatment and maintenance of the relevant water management infrastructure. Its enforcement is under the competence of the Water Department under MoEPP.

Use of water for irrigation and hydrosystem maintenance is under the competence of the Administration of Water Management under MAFWE, regulated by the following laws:

- Law on Water Management Companies, providing for rational water management, use, proper operation and maintenance of hydro systems, irrigation and drainage systems through water management companies as autonomous public legal entities, etc.

- Law on Water Communities, regulating conditions, foundation, operation and supervision of water communities (association of agricultural land owners or users, associated for the purposes of use, management, maintenance, construction, reconstruction and upgrading of the systems for irrigation and/or drainage).

Besides legislation, one of the most important strategic documents addressing water management in the Republic of Macedonia is the National Strategy for Waters.

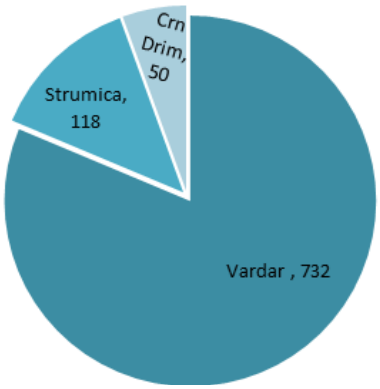
The greatest threats to biological diversity in aquatic ecosystems originate from water use for public purposes, discharge of municipal waste waters, agriculture, industry, mining and electricity production. According to available data in Macedonia, around 130 m3 water per day or around 1,047 billion m3 per year is used per capita at an average. These amounts are provided mostly from surface waters (84.5%) and smaller portion from ground waters (15.5%). This situation has significant impact on biological diversity, through modification or complete destruction of part of the aquatic habitats. High number of rare species has been registered exactly in oligotrophic spring waters which make the basis of the water supply system.

Apart from the great quantity of water used for water supply, the level of waste water treatment is a huge problem. The estimate is that only around 7% of the total waste water in the Republic of Macedonia is treated. Most of the cases do not employ modern technologies for treatment and therefore the effluent contains high content of nutrients which cause significant load of recipients. The biggest recipient of waste waters is the river Vardar. It has been estimated that around 75000 t solid particles, around 5000 t nitrogen and around 1000 t phosphorous are discharged in Vardar on annual basis. The total amount of waste water entering the river of Vardar has been estimated at around 120 million m3 per year. Numerous surveys indicate that cases like this result in drastic reduction of biological diversity in river ecosystems.

So far, more than 130 smaller and larger irrigation systems have been constructed in agriculture, covering an area of around 126000 ha. The estimate of irrigation water demand amounts around 0.9 billion m3 per year, or a quarter to a sixth of the total quantity of water existing in river basins

Crna Reka

Figure 5. Demand for irrigation in the three main river basin areas in Macedonia (in million m3).



in the Republic of Macedonia.

The main threats to biological diversity result from overexploitation (intakes), especially on smaller watercourses, which changes the water flow in river ecosystems; modification of aquatic habitats through dams development; change in physical and chemical characteristics of water through drainage of matters from agricultural areas (temperature, pH, conductivity, quantity of oxygen, nutrients, presence of toxic substances, etc.). The ultimate result of agriculture impact is significantly reduced diversity in aquatic ecosystems near agricultural areas.

Besides irrigation, five drainage systems have been built in Macedonia with an area of around 70000 ha, constructed for marshes and swamps drainage. This activity has significant negative impact on marsh ecosystems, leading to extinction or drastic reduction in the populations of a high number of species.

Industry is one of the biggest water consumers, but also waste generators. According to data available for the period up to 2008, waters taken for industry and mining supply had a share of around 92%, while the rest belongs to public water supply. In most cases, fresh water was used to meet the demand for industrial water in an amount of around 1.9 billion m3. Furthermore, the portion of recycled water is at minimum (around 0.3%). The number of industrial wastewater treatment plants is very low. In most cases, these plants have technology for mechanical treatment, and only a small portion possesses technology for chemical and biological treatment of the waste water as well. One of the greatest impacts on aquatic ecosystems is waste water discharge from mining. In the river basin area of Vardar, there are four mining ponds used for collection of waste waters from mines for lead, zinc and copper. Chemical analysis conducted on several occasions indicated strong contamination with heavy metals.

Configuration of the terrain of the Republic of Macedonia contributes to the availability of significant power potential in rivers. Therefore, the space is considered good for construction of dam and formation of small or large water accumulations. Larger hydro power systems in Macedonia include HPP Mavrovo, HPP Treska and HPP Crn Drim. For the purpose of small hydro power plants (SHPs), tenders have been announced for 121 small hydro power plants. Under the Strategy for Energy Development in the Republic of Macedonia, construction of considerable number of large and small hydro power plants is envisaged by 2020. This sector has great impact on the overall biological diversity through full modification of habitats (from river into stagnant ecosystem); modification/reduction of water flow in riverbeds; prevention of species migration; changes in physical and chemical characteristics of the water (increased temperature, conductivity, reduction in the quantity of oxygen, etc.). Additional problem is that several of the planned hydro power plants are to be located within protected areas. HPP Lukovo Pole, HPP Boshkov Most and HPP Galichka Reka enter the boundaries of the National Park of Mavrovo. HPP Brajchinska Reka falls within the boundaries of NP Pelister, and during summer it is characterized with exceptionally low water flow and it hosts the endemic fish species Pelister trout (Salmo peristericus). Part of the planned SHPPs are located within the planned protected areas (NP Jakupica, NP Shar Planina). From among planned or constructed SHPPs, 13 fall within the boundaries of the proposed Emerald sites, 23 are within the proposed important plant areas and 10 are within the boundaries of the existing bird important areas.

It should be pointed out that most of the proposed small hydro power plants are planned on small mountainous watercourses which are expected to have generally good ecological status (i.e. near natural characteristics). Such habitats are characterized with high diversity of aquatic species, which are to a great extent rare, endangered and possibly endemic. Significant portion of those are entirely unexplored and thus it is impossible to make a realistic assessment of losses that will result from the construction and operation of hydro power plants.

The implementation of the Water Framework Directive in Macedonian legislation has imposed the requirement for development of river basin management plans. In the past period, Draft Management Plan for Prespa Lake Basin has been prepared, while the development of the Draft Bregalnica River Basin Management Plan is underway. The Management Plan for Prespa Lake Basin has been designed to strengthen the capacity towards recovery of the “health” status of the ecosystem and conservation of biological diversity at local, national and transboundary levels in the three neighbouring countries in the region of Prespa.

Apart from the problems related to water exploitation for human consumption, one of the basic problems in the Republic of Macedonia concerns shortage of data, primarily in terms of water bodies monitoring. Though the Law on Waters stipulates the establishment of monitoring in accordance with the Water Framework Directive, the implementation is far from satisfactory. The main problem is the lack of capacity of the institutions responsible for the monitoring, as well as insufficient financial support for its implementation. Further problem is induced by lack of laboratories for waste water monitoring. Only few companies possess equipment and partial staff for monitoring performance. This creates conditions for part of the waste waters to be discharged directly in the recipients, causing intensive pollution and eradication of high number of species.

Lower basin of Bregalnica

4.2.4 Transport

The Republic of Macedonia invests in the development of ground and air transport infrastructure in order to promote economic development, but also the concept of transport development towards neighbouring countries, region and European Union Member States. Presently, part of the trans-national transport axes connecting Europe via Balkan with Turkey to Caucasus and Caspian Lake, as well as towards Egypt and Red Sea, crosses the territory of the Republic of Macedonia. European corridors passing through the Republic of Macedonia are corridors VIII (east – west) and X (north – south).

As in other countries, the road transport in the Republic of Macedonia has the greatest share in the overall transport of goods and passengers. The structure of transport of goods realized over the roads in the Republic of Macedonia is dominated by the national transport over international and transit transport. Also, road transport of passengers prevails over railway transport of passengers. According to statistics, the intensity of passenger and freight transport in the Republic of Macedonia in the past approximately ten years has been constantly increasing, except the fall of railway transport.

According to data of the National Transport Strategy (2007-2017), the road transport infrastructure in the Republic of Macedonia is specific by relatively high density, except the national highway network. The overall length of the road network in the country amounts 14159 km, of which 236.5 km are highways, 911 km national roads, 3771.5 km regional and 9240 km are local roads. Major part of those are in unsatisfactory condition (4629 km are asphalted, and the rest are macadam, earth or un-pierced roads).

The main axes of the national road network correspond with the two Pan-European corridors X and VIII. The existing Corridor X has a total length of 173 km, of which around 133 km comply with international standards for highways, and currently works are performed towards full completion of Corridor X (section Demir Kapija–Smokvica in a length of around 28.5 km, and Smokvica-Gevgelia with a length of around 10 km). The existing Corridor VIII has a total length of 308km, of which only 29% (90 km) (section Kumanovo-Tetovo) have been constructed in accordance with the international standards for highways.

The Ministry of Transport and Communications is the institution responsible for the transport policy of the country. Besides Ministry, several other bodies and public institutions are also responsible for different areas of the transport sector. Public Enterprise (PE) for national roads as a body is responsible for planning, construction, maintenance and financing of the national roads. The budget of PE for national roads for investments during the last years has noted continuous increase. Major part of the budget originates from loans, while the section of the budget for roads maintenance is transferred to the Public Enterprise “Macedonian Roads”, responsible for the maintenance of the main road network. This enterprise operates as direct contractor of the works for PE for national roads.

Development of road transport infrastructure will inevitably bring economic growth, improved economy and competitiveness, promoted safety in traffic, enhanced trade exchange, tourism etc. However, the development of the road infrastructure will also lead to certain negative impacts on biological diversity in the Republic of Macedonia, primarily through fragmentation of ecosystems and pollution from

emissions of noise and polluting exhaust gases. Negative impacts of road infrastructure on biological diversity can be avoided, reduced or compensated to a certain extent.

It may be concluded that roads passing through river valleys, gorges, national parks (in the western part of the country), close to water resources (lakes and springs), swamps and marshes, pose risk to biological diversity. Yet, it should be mentioned that no major changes in the distribution of road sections should be expected in future, which means that routes should be planned more carefully to avoid negative impact on important biological values. In future, to reduce fragmentation of biological diversity, the process and the methodology of spatial planning should be altered towards integrated and comprehensive definition of the space and observation of spatial plans.

4.2.5 Hunting

Under the Constitution of the Republic of Macedonia, game is treated as a common good and it therefore enjoys special protection. All activities related to hunting, i.e. breeding, protection and use of the game are regulated in the Law on Hunting.

According to the Law on Hunting, 133 species of the wild fauna of the Republic of Macedonia have been proclaimed game. These species have been determined as game under protection and game without protection. Hunting closed season, temporary and permanent prohibition for hunting are stipulated for the game under protection. During closed season, temporary and permanent prohibition for hunting, game under protection must not be hunted, chased or disturbed, if not otherwise specified in the Law.

By Decision of the Government of the Republic of Macedonia, a total of 256 hunting grounds have been designated on the territory of the Republic of Macedonia, of which 112 hunting grounds for large game (20 year lasting concession) and 144 hunting grounds for small game (10 year concession). All hunting grounds are grouped in 11 hunting management areas in accordance with the General Hunting Management Master Plan.

For the purposes of game use in hunting grounds, users prepare Specific hunting management master plan with validity for 10 years. The most practiced shooting involves small game, especially hare and grey partridge, then pheasant and other feather game. From among large game, the most frequently shot species are wild boar and chamois.

According to the data of the State Statistical Office of the Republic of Macedonia (2012),total of 762 wolfs, 76 deer, 521 chamois, over 6000 wild boar, over 32000 rabbits, 252 birds of prey (falcons and eagles), around 1500 waterfowls, etc., was shot in Macedonia, for the period 2003-2012.

Certain illegal activities, such as poaching, failure to fulfil the obligations by entities that manage hunting grounds and game, are still present and cause negative impacts both for hunting development and overall biological diversity. We should also underline the fact that inappropriate use of chemical preparations in agriculture, in certain cases, due to game poisoning, especially grey partridge and rabbit. Also, intensive application of clearcutting over large areas causes negative impacts, especially on the status of large game. Therefore, it is necessary that it be replaced, where possible, under the planning documents, by other modes of forest renewal that will not have negative impact on the game population in a given area.

The adoption of the new Law on Hunting in 2012, which defines the direction of hunting development in the forthcoming period, as well as additional activities undertaken by the Forestry and Hunting Department of the MAFWE, established the necessary conditions for improved state of hunting in the Republic of Macedonia. Furthermore, the introduction of concession-based management of hunting should overcome certain problems from the past with regard to the care for game survival and reproduction. By awarding the game in the hunting grounds under concession, concessionaires are obliged to undertake all measures for breeding, protection and use of the game in the hunting grounds in the Republic of Macedonia.

The commitment remains to achieve modern hunting as successful and attractive commercial activity, which in line with modern world trends involves, besides hunting management activities, before all the commitment for conservation and enrichment of the biological diversity in the Republic of Macedonia.

Trpejca, Ohrid Lake

4.2.6 Fishery and aquaculture
4.2.6.1 Fishery

Fishery assumes fish management and exploitation by way of fishing through the use of permissible fishing means, with no interventions in the process of fish growth and reproduction. Fishing can be commercial, recreational, sporting, ameliorative, selective and for scientific and research purposes. MAFWE is the responsible institution for planning, management and control of the fishery in Macedonia.

In the Republic of Macedonia, fishing is performed on all fishery waters within the frames and under the conditions specified in the law. Fishery waters in the Republic of Macedonia cover around 56000 hectares, around 83% of which are the fishery areas including natural lakes (Ohrid, Prespa and Dojran), around 11%are fishery zones and recreational zones on artificial lakes – accumulations, 4% are fishery areas – rivers and 1% is aquaculture facilities in which fish breeding is performed.

Fish in fishery waters are awarded under concession for performance of commercial and organization of recreational fishing for a period of 6 years. The term fishing (under the Law on Fishery and Aquaculture) means fishing for economic gain. In the past, commercial fishing was performed in the three natural lakes, certain accumulations, and before 1953 on the rivers in the Republic of Macedonia as well. The three natural lakes, including Ohrid Lake, despite exceptionally rich biological diversity and presence of high number of endemic taxa, have always been subject of exploitation through fishing in various forms of organized fishing. The number of accumulations used for commercial fishing has been decreasing with the time, to reach the current state in which most of them are used only as facilities for organized recreational and sport fishing, except accumulations “Tikvesh” and “Shpilje”.

Fishery water	Period	Average catch	Dominant fish species in catch
Ohrid Lake	1969/2001	185 tons	trout – 35.6%; belvica – 6.8% bleak – 43.7%.
Prespa Lake		93.6 tons	belvica – 65% carp – 20%, rudd – 6%, crucian carp – 5%, other – 4%.
Dojran Lake	1935-2000	368.3 tons	roach – 67.8% perch – 19.8% bleak – 7.6% carp – 4.9%
Accumulations	By 1970	176 tons	
Rivers and streams	No commercial fishing		

Table 14. Overview of average catch by commercial fishing in fishery waters in Macedonia (source: Programme for promotion of fishery and aquaculture in the Republic of Macedonia, 2011).

For the period 2008-2012, SSO (Environmental Statistics, 2013) recorded much higher values for the total catch compared to those presented in Table 14. Only annual catch of trout ranges between 700 and 1200 tons. The share of trout in the total catch of freshwater fish reaches above 70%. Total catch of carp is between 194 and 340 tons per year.

The general goal of the Programme for promotion of fishery and aquaculture in the Republic of Macedonia of 2011 is unimpeded development of fishery in the Republic of Macedonia and increase in the overall production of fish in Macedonia to projected and envisaged 4000 to 5000 tons per year, while respecting the principles of sustainable use of natural resources, protection and development of the existing ichthyofauna, with particular care for native noble fish species, control of fish and fish products quality, and care for and protection of health of consumers. Increase of the

overall production envisaged in the Programme exceeds the current quantities of fish produced and caught in fish ponds by 2-3 times. The said Programme contains measures for fish stocks enlargement (mainly stocking with fish), scientific and research activities, enhanced monitoring in fishery, increase of the capacity of the competent institutions, projects for obstacles (dams) removal to enable fish movement, development of fishing tourism, increase of aquaculture production and quality improvement, as well as preparation of fishery management master plans. In future, while developing fishery management master plans, care should be taken that they are harmonized with the management plans of the three natural lakes and other protected areas.

The main threats originating from fishing are related to problems in planning, organization and control of this activity. Among general problems, we could mention unplanned commercial exploitation of fish from lakes, illegal fishing, exploitation and pollution of waters. As far as the natural lakes are concerned, specific problems in Ohrid Lake include reduced populations of trout and belvica, expansion of bleak, fishing nets soaked to the bottom; for Dojran Lake – predominant population of the invasive species Prussian carp and reduction of the density of the populations of noble fish species and lack of information on the effect of oestrogen presence; for Prespa Lake – increased number of non-native fish species, presence of organochlorine pesticides and heavy metals in fish tissues threat to endemic Prespa trout Salmo peristericus.

The three large natural lakes in Macedonia are lakes shared with other neighbouring countries. This is of particular importance in the process of preparation of strategies for protection and rationale use of fish stock from a given lake. Transboundary plan for fish and fishery protection and management has been developed only for Prespa Lake and it will be promoted soon.

One of the main postulates in the protection of biological diversity is the census and description of present species, extent of endemism, their natural range of distribution, status on population level and extent of the status of being threat. All these points which are also elements in the establishment of the red list of endangered species have not been fully explored and therefore we presently refer to the Red list of endangered species of IUCN. Data included there on the representatives of our ichthyofauna is often incorrect or contrary to real status or “data deficient” is simply stated.

4.2.6.2 Aquiculture

The term aquiculture assumes anthropogenic activities involving aquatic organisms breeding for food production. Depending on temperature demands by individual fish species bred in fish ponds, aquiculture production has been divided in:

- Breeding of thermophile fish species in warm water fish ponds (mostly: carp, silver carp, bighead carp, grass carp, catfish)
- Breeding of freshwater fish species in freshwater fish ponds (mostly: rainbow trout, stream trout, Ohrid trout, golden trout)
- Breeding of fish in cages. At present, the highest number of cage farms is found in “Tikvesh” accumulation, amounting 19 with total of 517 cages for carp breeding. Today, cage production notes growing trend reaching 1407 tons (in 2010), including: 1188 t trout, 178 t carp and 41 t catfish.

There are reproduction centres in the Republic of Macedonia intended for fish stocking material production of native fish species for stocking with fish the fishery waters in the country owned by authorized institutions in the area of fisheries.

Aquiculture production has impact of freshwater component of biological diversity through introduction of new non-native species in water bodies and nutrient loading of aquatic ecosystems.

Golem grad island in Prespa Lake

4.2.7 Tourism

According to current investments, it seems that one of Macedonia's strategic commitments from economic development point of view is the development of tourism. Several strategic documents have been developed in the recent period with regard to tourism development on national level:

- National Strategy for Tourism Development, 2009-2013; and
- National Strategy for Rural Tourism, 2012-2017.

Only for 2013 and 2014, the Government allocated around EUR 4.5 million for tourism development and support.

However, outlining and analysing the contribution of tourism to the economic activity of Macedonia require availability of appropriate data on the whole tourism sector of Macedonia which lack to a great extent (Petrevska, 2010). Unfortunately, such data cannot be found in the mentioned strategic documents on tourism.

The vision of tourism under the National Strategy for Tourism Development is as follows: "By 2013, the Republic of Macedonia will develop an image of recognizable European destination for tourism, based on cultural and natural heritage and recognizable by environmentally sensitive and sustainable products and services of high quality, which are at the level of the best world experiences". This Strategy does not systematize touristic branches and their potential in Macedonia, though it identifies several directions of tourism development relating to: creation of national recognizable touristic product (Markovi Kuli, Cocev Kamen, Kokino or destination of organic food), utilization of existing touristic centres (Ohrid Lake for conferences and festivals), utilization of national parks, as well as Prespa Park, development of wine tourism, development of rural tourism, promotion of crafts and cultural manifestation and development of spa and hunting tourism. From among natural values, possibilities for tourism development related to national parks, lakes and caves in Macedonia. This leads to the conclusion that conservation of biological diversity is of key importance for the achievement of the objectives of this Strategy.

During the past years, the number of foreign tourists and the number of overnight stays has increased significantly. In parallel with this, the number of tourist accommodation facilities grows, especially Eastern and Pelagonija Regions.

Furthermore, through the Government, Macedonia has offered development of five tourism zones: Tourism development zone Dojran 1 and 2, Ohrid 1 and Struga 1. At the same time, construction of ski centre has been planned on the mountain of Galichica. Additionally, investment is promoted in spa tourism and promotion of geothermal dressage Raklish (Radovish), Toplec and Nikolikj (Dojran), Banjice (Tetovo), Proevci (Kumanovo Spa, Kumanovo), Sabota Voda (Veles), Mariovo (Prilep) and Kezhovica (Shtip).

An important characteristic of Macedonian tourism is that it loses domestic tourists for three reasons: Macedonian tourists, in financial terms, can afford visits abroad, they already possess properties in tourist resorts and do not use the services of accommodation facilities through which the number of tourists is registered or they become uninterested in domestic tourist resorts.

The National Strategy for Rural Tourism integrates the forms of ecotourism, hunting and fishing tourism, rural (farm) tourism thus ensuring preservation of natural resources and biological diversity. The Strategy identifies and proposes 15 tourist destinations for rural tourism development in Macedonia, namely: Debar-Kichevo, Vevchani, Ohrid-Prespa ecoregion (Galichica), Mavrovo-Rostushe, Polog, Osogovo area, Kumanovo area, Azot, Maleshevo area, Tikvesh area, Ethno and Spa Region Belasica, Krushevo, Pelagonia, Mariovo, Rural Skopje

For the purposes of tourism development, the Government of the Republic of Macedonia has promoted establishment of tourism development zones (TDZ). Tourism development zone has been defined in the Law on Tourism Development Zones (Official Gazette of the Republic of Macedonia no.

141/12) as a specific fenced and marked area which is functional whole established for tourism development by introduction of standards in the segment of services, as well as efficient use of resources by application of the highest ecological standards where activities are performed under conditions specified in the law. The Law will initially cover eight locations sized between 13 and 50 hectares in the areas of Struga, Prespa, Dojran and Ohrid. From among announced locations, three are situated within the boundaries of NP Galichica (TDZ "Ljubanishta", TDZ "Stenje", and TDZ "Otesheve"). In the past period, the Government of the Republic of Macedonia has granted consent for ultimate Conversion of agricultural into construction land for the purposes of development of Urban Plan for areas outside populated places for development of Tourism development zone in the cadastre (real estate register) municipality of Kalishta, Struga Municipality (Official Gazette of the Republic of Macedonia no. 135/2013) and CM Nov Dojran, Dojran Municipality (Official Gazette of the Republic of Macedonia no. 127/2013).

Apart from the activities of the Government of the Republic of Macedonia and the competent Ministry of Economy and Agency for Tourism Development and Support carried out on national level, plans for tourism development at regional or local levels have been prepared as of lately. In these plans, promotion of various forms of alternative tourism, ecotourism, hunting tourism, rural tourism, establishment of planning, recreation and biking paths, etc., prevails.

All these documents (national, regional, local) reveal poor familiarity with the potentials offered by biological diversity of the Republic of Macedonia. Also, the planning of tourism development does not pay sufficient attention to effects on nature and especially biological diversity, and tourism zones for mass tourism are often planned in protected areas or other significant localities. Ecotourism is a potentially important economic branch in Macedonia which could be founded on the high diversity of flora, fauna and ecosystems in certain regions.

4.2.8 Industry and mining

The industry holds one of the most prominent positions in the development of overall Macedonian economy. It covers the following three areas: mining and stone extraction, manufacturing industry and electricity supply. In the overall industrial production, the greatest share belongs to electricity supply (14.64%), food production (11.67%), clothes production (10.19%), metals production (9.34%), beverage production (6.18%), production of other non-metal minerals (5.90%) and tobacco production (4.48%). Industrial sectors contribute significantly to the structure of the gross domestic product (GDP). According to data from 2011, industrial sectors contributed 18.0% to the overall GDP structure.

The main mining facilities for metals in Macedonia are Buchim (copper and gold), Sasa (lead and zinc), Zletovo (lead and zinc), Toranica (lead and zinc), Rzhanovo (nickel). Mines that are out of operation but still pose threat to environment include Lojane (antimony and chromium) and Radusha (chromium). Lignite for the purposes of energy industry is excavated in Suvodol, Oslomej and Brod-Gneotino. The biggest industrial facilities actually deal with processing of mineral resources for cement, alloys with iron (ferrous silica, ferrous nickel, lead, zinc, copper, oil (Stuhlberger ed. 2010).

So far, around 70 million tons of waste from leads and zinc mines (containing mainly Pb, Cd, Zn and organic flotation reagents) has been disposed of around mines Sasa, Toranica and Zletovo-Probishtip. Additionally, more than 150 million tons of flotation slag and 150 million tons of mining slag (with certain content of Cu) have been disposed of in the surrounding of the copper mine Buchim. Production of energy from fossil fuels generates around 330 million tons of waste, around 50 million tons of which is ash from coal combustion (Stuhlberger ed. 2010). On annual basis, 19.5 million tons of industrial waste are generated, 4.6 million tons of which are hazardous waste. Out of this, the biggest portion comes from mining (17.25 million tons, 4.55 million tons of which are hazardous waste), and smaller portion from other industries. Waste generation from mining is expected to increase by 10% by 2015 (Stafilov et al. 2009). We should underline the existence of landfills of metallurgical facilities which used to work in the past (smeltery for Pb, Zn and Cd in Veles, smeltery for ferrous chromium Jugohrom, smeltery for Fe in Skopje), or still work (Feni, Makstil, Silmak). These facilities generate around 2 million tons of waste dross per year. Enormous environmental pollution (air, soils, ground waters, food) has been already associated with these landfills.

Mining and metallurgy have the greatest contribution to soil contamination among all industrial sectors (31.3%), followed by energy, organic chemical industry, refinery and leather manufacturing industry (SSO, 2013). These industrial facilities and landfilled waste also cause pollution of air with dust containing heavy metals (Barandovski et al., 2008) or toxic pesticides (Stafilov et al., 2011).

Statistical data (SSO, 2013) concerning quantity of water for industry and mining purposes also gives rise to concern. These are mostly supplied from surface waters (watercourses, accumulations, lakes). Surface waters supply more than 90% of the overall waters taken for industry and mining, and the rest comes from springs, ground waters and other sources. During the last years, industry and mining discharge 50 to 300 times more untreated waste waters compared to treated. In 2012, out of the total discharged untreated water from industry and mining, 2.4% have been discharged in the sewerage network, and as much as 88.1% into watercourses, and the rest in accumulations and soils. In the Republic of Macedonia, only around 3-4% of the overall quantity of waste waters are treated (SSO, 2013).

Different documents (CARDS, 2004; Peck & Zinke 2006; Stafilov et al. 2009) highlight the main threats to environment, most of which are related to mining activities:

- High environmental risk: OHIS (Skopje), mine Sasa (Makedonska Kamenica), Smelting Facility MHK Zletovo (Veles) and mine Buchim (Radovish)
- Medium environmental risk: mine Zletovo (Probishtip), former mine Lojane (Kumanovo), Jugohrom (Jegunovce), mine Toranica (Kriva Palanka), Makstil (Skopje)
- Low environmental risk: REK Bitola (Bitola), fertilizer production plant MHK Zletovo (Veles), refinery OKTA (Skopje), REK Oslomej (Kichevo), metal processing factory Tane Caleski (Kichevo), FENI (Kavadarci) and leather industry Godel (Skopje).

Besides environment and nature pollution, mining has other effects on biological diversity as well. In this context, surface quarries (sand, gravel, marble, etc.) causing direct destruction of parts of biological diversity, and very often in sensitive areas, are of particular importance.

4.2.9 Energy

Energy sector in the Republic of Macedonia poses severe threat to environment, as nearly 90% of primary energy is generated from fossil fuels, mainly lignite and crude oil. Electric power system of Macedonia is composed of (Shopova-Alushoska, 2013):

- Thermal lignite and crude oil fired power plants, with total installed capacity of 1.010 MW;
- Hydro power pants, with total installed capacity of 580 MW;
- Co-generation thermal power plants – heating plants operating on natural gas with total installed capacity of 250 MW for electricity production and 174 MW for heat production; and
- Electricity transmission and distribution system.

Thermal power plants are dominant in the electric power system of Macedonia. The biggest portion of the overall electricity production in Macedonia is generated by TPP "Bitola" (80%) and REK Oslomej from the coal from the mines Suvodol and Oslomej (Shopova-Alushoska, 2013).

The Strategy for Energy Development in the Republic of Macedonia (for the period 2010-2020, with a vision by 2030) defines the most appropriate long-term development of energy sector in the country in order to secure safe and proper quality supply of consumers with energy, with maximum utilization of renewable energy sources being priority activity. According to the Strategy for Utilization of Renewable Energy Source s in Macedonia by 2020, Macedonia belongs to the group of countries with relatively low level of renewable energy sources utilization (with a share of 13.8% in the consumption of final energy in 2005), among which hydro power has relative share of 38% (the ratio of production between large HPPs and small HPPs was 94% to 6%, respectively). Increased utilization of renewable energy sources up to 21% has been planned for the period by 2020.

Possible impacts from energy sector on biological diversity have been identified in the Strategic Environmental Assessment Report on the Strategy for Energy Development.

Coal. Envisaged locations for coal exploitation are situated in areas with already degraded environment (owing to the operation of REK Bitola and REK Oslomej, as well as open quarries for coal exploitation), except Mariovo, and their continued exploitation will cause additional pressures on biological diversity (Emerald sites – Mariovo), air (Bitola, Kichevo), water (rivers Crna Reka, Treska), etc. Negative impacts are also expected from mines for pit based exploitation of coal. Environmental impacts that need to be particularly stressed are those expected upon completion of full exploitation of ore, unless appropriate re-cultivation measures are undertaken. REK Bitola and REK Oslomej combust more than 10 million tons of coal per year. Use of coal as energy resource induces generation of high emissions of sulphur dioxide (SO2) which is the main contributor to the effect of acid rains. Acid rains have negative impact on biological diversity, aquatic organisms, soil and human health. Specific problem causing significant negative impact on biological diversity and health of the population in the surrounding area of coal based thermal power facilities is generation of huge quantities of ashes (above 1 million tons per year). Fact causing particular concern is that fossil fuels and coal especially, contain radioactive matters. Coal also contains traces of mercury, arsenic and other hazardous heavy metals, which pose severe threat to the quality of air, water and ecosystems.

Oil and oil derivatives. Oil combustion generates emissions of nitrogen oxides, and depending on oil composition also sulphur oxides and particulate matters, methane, heavy metals and volatile organic compounds, which affect the quality of air, water, soil and generate solid waste, too. During the cooling of plants using oil and oil products for energy production, huge quantities of water are used which of course affects local water resources, as well as aquatic living world. Incidents and accidents on oil and oil derivatives transport means result in disastrous consequences on ecosystems. The Strategy for Energy Development envisages share of oil and oil derivatives in energy production to decline by application of energy efficiency measures that will result in reduced impacts on biological diversity and environment in general.

Natural gas. Gas fired plants can cause significant impacts on water resources, depending on the type of technology used for gas combustion. C-generation plants have cooling systems that require huge quantities of water. During connection of all populated places to gas pipeline in the construction phase, there will be negative impacts on environment in terms of air, soil, waters pollution, as well as on biological diversity, natural and cultural heritage.

Figure 6. High voltage transmission grid in Macedonia (Electricity map of the Republic of Macedonia, Source: AD MEPSO, http://www.mepso.com.mk/Details.aspx?categoryID=114

Hydropower sector. Within ELEM, there are seven hydropower plants, two of which are running (Raven and Vrutok) and five accumulation based (Vrutok, Shpilje, Globochica, Tikvesh and Kozjak). The overall installed capacity of hydro power facilities is 528.4 MW, or 40% of the overall ELEM's capacity (Shopova-Alushoska, 2013). The Strategy for Energy Development, by 2020, besides revitalization and utilization of existing hydro power plants, envisages construction of large hydropower plants, such as Sveta Petka (started operation in 2014), Chebren, Galishte, Lukovo Pole, Boshkov Most, Gradec, etc. (with total installed capacity of 690MW), as well as numerous small hydropower plants (121 small hydropower plants have been already tendered, their total installed capacity being 93 MW, out of the total number of 400 planned for construction under the 1980 Study for hydro power potential of small hydro power pants (see Chapter 4.2.3.). Operation of existing and planned hydro power plants will not only modify the water flow, but it will also alter other characteristics of watercourses, that may have negative impact on their life and riparian habitats. Flooding of river valleys poses severe threat to biological diversity.

Biomass. Utilization of biomass and waste biomass as an energy resource cause burdening of the environment in terms of threats to biological diversity, quality of air, soil, etc. If forests are used for energy purposes, then environmental impacts will be negative, considering the importance of forests in biosphere for carbon dioxide and oxygen cycling, as well as the fact that protection of nature in our country cannot be even imagined without forest habitats. Furthermore, unless sustainable manner of biomass production is practiced for biodiesel fuel production, this can cause disruption of biological diversity and quality of environmental media in general. Particular attention should be devoted to the selection of locations for growing cereals, namely, care should be taken that these are not planted in ecologically sensitive areas.

Solar power. The Strategy envisages construction of photovoltaic plants, and their impact on biological diversity is insignificant.

Wind power. Construction of wind farms has been planned with a total capacity of 90-180 MW (the first one in Bogdanci is already operational), and some of them can pose risk to wild life, primarily birds and bats.

Geothermal power – it contributes around 0.4 % to the utilization of primary energy and has insignificant impact on biological diversity.

Transmission and distribution grid. The high voltage grid in Macedonia (Figure 6) is operated by AD MEPSO, and low voltage distribution grid by EVN (150 km of 110 kV, 1000 km of 35 kV, 720 km of 20 kV, 8900 km of 10 kV and 11600 km of 0.4 kV). Negative environmental impacts from the development of the transmission grid are associated with pollution of air, soil, waters, biological diversity, natural and cultural heritage. Also, transmission grid is source of non-ionizing radiation. Particularly negative environmental impacts are expected in case of fire, failure or accidents.

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4.2.10 Pollution of environment

The Republic of Macedonia has adopted high number of laws and bylaws to regulate the issue of environment, its pollution and monitoring (water, air, noise and waste management). With regard to all environmental media and areas (waters, air, waste, monitoring), national strategies have been adopted and they provide the main directions towards settlement of the existing problems and planning of the main activities in future. The most important documents include the First and the Second National Environmental Action Plan (NEAP 1 and NEAP 2).

Based on data presented in the Strategy for Waters of the Republic of Macedonia adopted in 2012, and based on data from the regular monitoring of waters and conducted surveys, published expert and scientific papers, we may conclude that the quality of waters in Macedonia is rather low due to various sources of their pollution. This refers particularly to surface waters, but there are also indications for contamination of ground waters. It has been indicated that water resources in Macedonia are relatively clean in upper courses, but the status of their quality deteriorates along their middle and lower courses. This situation results from discharges of untreated waste waters, mostly from populated places, but also from industry and agriculture.

All conducted investigations of the quality of surface waters in Macedonia have shown their continuous physical, chemical and biological pollution. This concerns particularly pollution originating from household waste waters, especially from larger urban settlements, mostly due to the absence of waste water treatment plants. Waste waters from industrial facilities are either not treated at all or their treatment is not done to the sufficient level. Most often treatment of waste waters is constrained to mechanical water treatment without application of appropriate chemical and/or biological treatment. Cases of non-operation of waste water treatment systems in industrial facilities are frequent, due to financial or technical problems. Agriculture contributes to waters pollution as well. Namely, there are indications of soil contamination due to over-use of artificial fertilizers and other chemical preparations, as well as pollution of water accumulations for agricultural areas irrigation with household and industrial waste waters. We should also mention water pollution from livestock breeding farms.

Monitoring of river surface waters in Macedonia is performed by National Hydrometeorological Service (NHS), Hydrobiological Institute from Ohrid performing monitoring of the three natural lakes, and Public Health Institute (PHI) is focused more on the control of parameters of sanitary relevance. NHS manages the system for rivers in Macedonia monitoring (RIMSYS) with 12 measuring stations. Unfortunately, this automatic system monitors only water level in rivers and water temperature, though not at all measuring points, although it has been designed and applied to monitor very important parameters of relevance for the assessment of the quality of surface waters. Regular monitoring of the quality of surface waters in Macedonia implemented by NHS indicates that most of the parameters have increased values compared to those specified in the Decree on classification of waters in the Republic of Macedonia. Certain studies indicate a general trend of increase in the concentrations of nutrients near bigger populated places. Higher concentrations of heavy metals have been measured in sediment samples resulting from industrial pollution. Concentrations of heavy metals in water samples do not exceed the limit values. Analysis of organic pollutants in water and sediments indicate severe industrial pollution, and especially high concentrations of polycyclic aromatic hydrocarbons, pentachlorobenzene, hexachlorobezene, phenols and pesticides have been recorded. Some of the existing organic pollutants indicate pollution from faecal waste water. In fish tissues, high contents of heavy metals and organic substances have been detected. The quality of water in natural lakes indicates that waters of Dojran Lake and partially of Prespa Lake by certain physical-chemical and chemical parameters do not meet the required norms. We should especially note high concentrations of different pesticides in water, sediments and fish from these two lakes.

Presently, the Republic of Macedonia has problem with rational use and protection of ground waters. Certain studies indicate impacts of municipal and industrial landfills on ground waters contamination.

Presence of pollutants in the air is due mainly to their emission from industrial facilities, combustion of fossil fuels, heating systems and traffic. During the last 15 years since air pollution has been monitored, appropriate information has been provided in Macedonia, especially upon introduction of automatic system for continuous monitoring of the state of air pollution in Skopje and other cities in the Republic of Macedonia. Generally, we may say that for the last decade, production of electricity and heat, traffic and industrial processes have been the greatest contributors to air pollution. The results obtained show that concentrations of SO¬2¬, NO2 and CO are most frequently below the maximum permissible concentrations for ambient air. Reduced impact of industry most probably contributes to this, because considerable number of industrial facilities have

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been out of operation or operated with reduced capacity in the past years. It should be mentioned that concentrations of SO¬2 at certain measuring points (Skopje, Veles) during winter period partially exceed the maximum permissible concentrations, primarily due to emissions from heating facilities and combustion of fossil fuels in households. It should be also mentioned that average annual concentration of NO2 often exceeds the limit value in Skopje. Measurements show increased concentrations of ozone in summer period due to higher solar radiation. Regular measurements of the quality of the air during 2012 recorded exceeding of limit values for solid particles sized up to 10 μm (PM10), especially during winter. PM10 causes negative effects on the growth and reproduction of plants, reduces agricultural yield, affects ecosystems through changes in water running, cycles of minerals/nutrients and habitats and causes disintegration of organic materials. Ozone causes irritation of eyes and nose, problems with breathing, asthma and reduced resistance to colds and other infections. It can also accelerate aging of lungs tissue.

Apart from this regular air quality monitoring, high number of projects and scientific studies has been implemented in the Republic of Macedonia, concerning air pollution monitoring. It has been indicated that emission of unintentional POPs (especially dioxins and furans) is very high, primarily due to uncontrolled burning of landfills with municipal waste, but also as a result of combustion of fossil fuels and operation of industry.

Investigations of the presence of heavy metals in air indicate that concentrations of heavy metals in certain regions are very high, mainly as a result of emission of solid particles from industrial facilities. Pollution of air with heavy metals is especially notable in Veles as a result from the emission of solid particles from the existing landfill of waste slag from the former operation of lead and zinc smelting company, and also from extremely contaminated soils in the city and its surrounding with lead and zinc, as well as with arsenic, cadmium, copper, mercury, indium, manganese, thallium and antimony. Operation of ferrous nickel smelting plant near Kavadarci contributes to dust emission with high content of nickel.

Soil is very important natural and economic resource. Yet, protection of soils in Macedonia is often neglected and this leads to its pollution. Polluted soils are the most direct source of pollution of surface and ground waters, as well as air pollution. The most frequent sources of soils pollution include municipal landfills, industrial landfills, waste waters and waste gases, artificial fertilizers, etc. Apart from continuous pollution of soils, there is a lack of organized regular monitoring of the extent of soils pollution in Macedonia. It should be also pointed out that there is no legislation in Macedonia to specify in more detail the maximum permissible concentrations of harmful substances in soils. Due to the lack of systematic monitoring of the quality of soils in Macedonia, the only information of this kind can be found in studies implemented in the frames of certain scientific and research projects. Studies completed for the purpose of preparation of geochemical atlases of soils in certain regions in Macedonia showed that soils in the city of Veles and its surrounding area are contaminated intensively with heavy metals. Similar situation of soil contamination with heavy metals has been recorded in the surrounding of the landfills with slag from lead and zinc ore flotation in Probishtip, Sasa and Toranica. Also, in the surrounding area of the mine and flotation of copper ore “Buchim” near Radovish, increased content of copper and arsenic in soils was detected. In the soils around OHIS, high content of certain heavy metals was detected (lead and mercury), though much bigger concern is caused by the status of these soils contamination with very toxic organic pollutants (pesticides, solvents, raw materials used for plastics production, etc.), which were formerly used in technological process or produced in the factory of OHIS in Skopje.

All these conditions require undertaking of urgent measures for remediation of these soils because of the pollution of other environmental media as well and continuous hazard for people and living organisms.

The Republic of Macedonia has no systematized and permanent monitoring of the impact of pollution on the components of biological diversity. There are numerous results from scientific research concerning mainly water ecosystems and their flora and fauna. Such results showed that in certain regions, the waters of Vardar River and its tributaries, as well as waters of Dojran Lake, are subject of strong negative impact. Based on these results, assessment was made of the ecological status of waters in this basin. Impacts originating from bigger settlements were particularly manifested (absence of waste water treatment plants). It was found out that the main course of Vardar River was moderately polluted, while the most polluted sections included the lower course of the rivers Bregalnica and Crna Reka in the southern part of Pelagonija. The results from the surveys of Dojran Lake also do not meet the requirements of the Decree on the classification of waters in the Republic of Macedonia. With regard to soil and atmospheric pollution, there is sparse data on the level of damage with certain plant species around the city of Veles or park plants in Skopje.

4.2.11 Use of wild species

Use of natural resources, such as plants, fungi, lichens, snails and other animal parts is regulated by the Law on Nature Protection. With regard to endangered wild species, lists of species are specified containing species the collection of which is subject to permit issued by MoEPP. There are no records of all collected quantities of wild species in Macedonia. The best source of information is contained in issued permits for export, on the basis of which estimates of exported quantities in 2011, 2012 and 2013 have been made (Figures 6-9), though feedback information is needed from exporters to confirm the quantities implemented relative to permits obtained. In order to make full assessment, quantities of collected resources used in Macedonia, mainly for domestic use, should be made as well.

Besides MoEPP, permits for collection of other forest products are issued by PE "Macedonian Forests". The operation of the permitting system for collection and purchase established by PE "Macedonian Forests" promises that it will be possible to get a better insight in the quantities of collected medicinal and aromatic plants (MAP) and fungi in future. Also, national parks issue permits for collection of wild species of plants and fungi on their territories.

The group of medicinal and aromatic plants (MAP) in Macedonia counts around 700 species. These are species used in our traditional medicine and by neighbouring peoples, as well as species on which scientific data of their medicinal effect exists. Among all these species, around 220 plant species are more frequently used. The following resources are most frequently used from among wild growing species: berry of common juniper, (oak and pine) moss, leaf of bearberry, above ground part of yellow John's wort, Shar Planina tea, red St. John's wort, oregano (wild marjoram), balm, common horsetail, root and flower of primula, root of valerian, fruit of sweet anise, rose-hip, blueberry, raspberry, blackberry, flower of elder, black mallow, root of white mallow, seeds and roots of nettle.

Collection of fungi is growing in Macedonia, and the following fungi species are collected for commercial purposes

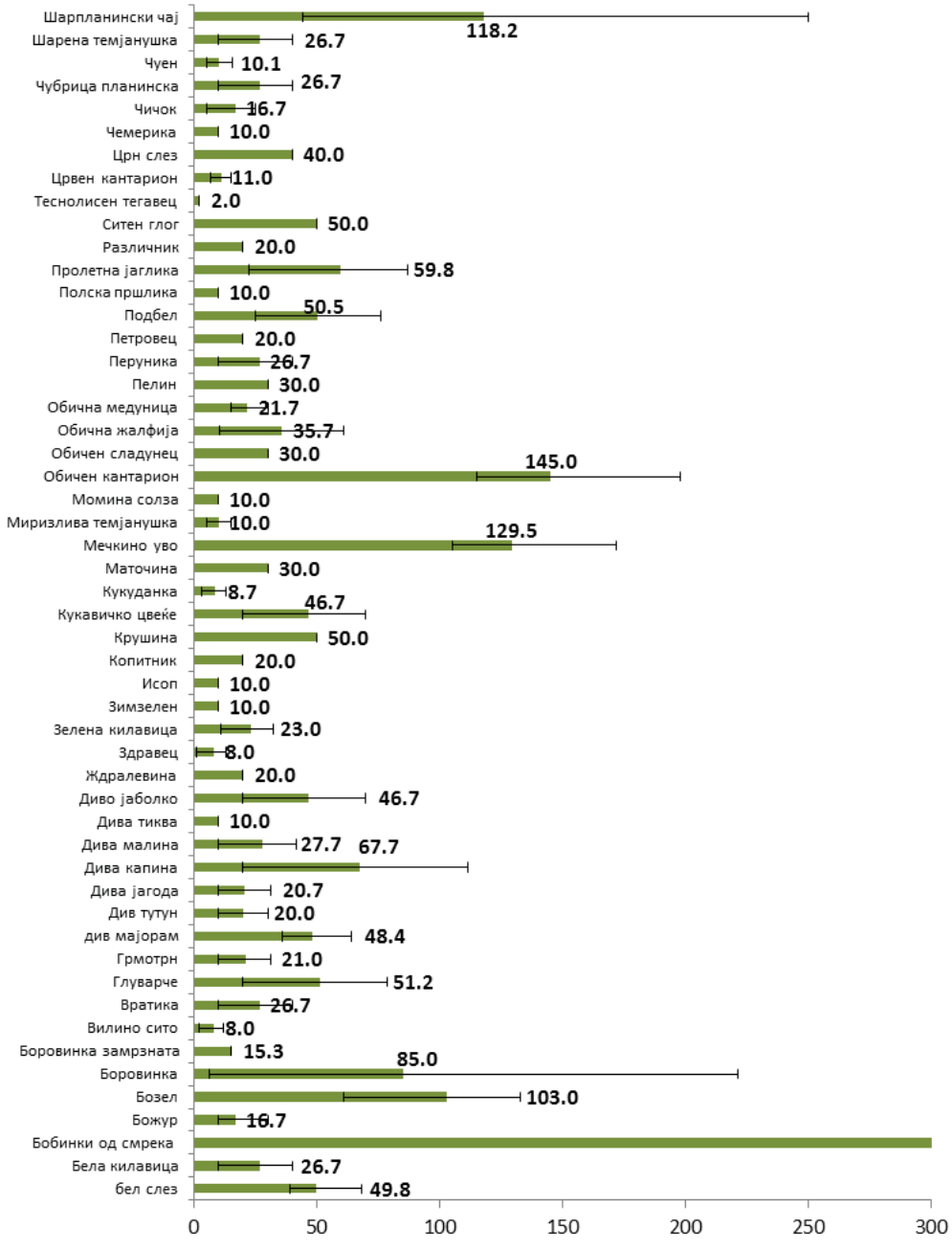


Figure 7. Quantities of collected plant resources (tons) by issued export permits for 2011, 2012 and 2013.

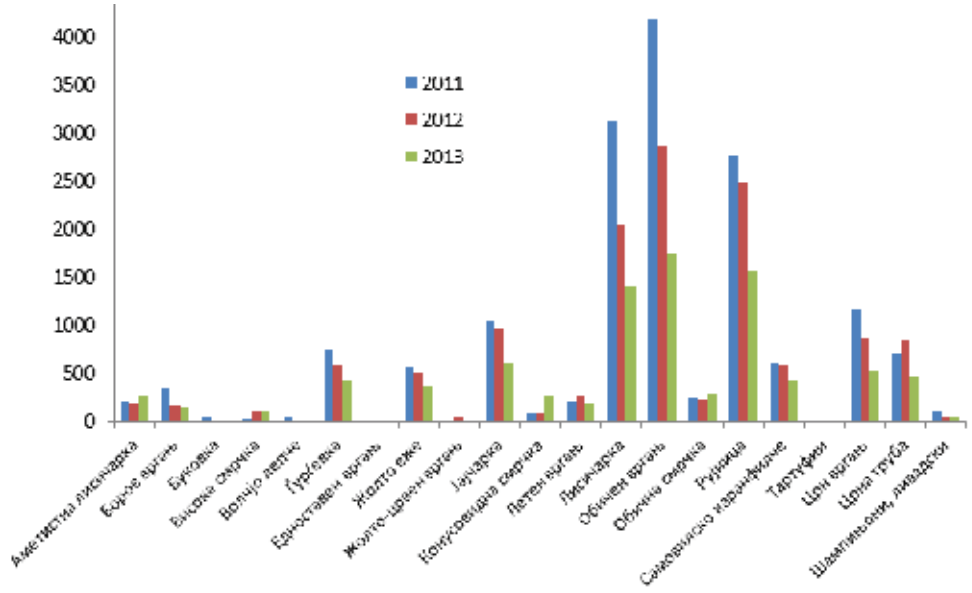


Figure 9. Quantity of dry fungi (tons) by issued export permits for 2011, 2012 and 2013.

and export: common bolete (Boletus edulis), bronze bolete (Boletus aereus), pine bolete (Boletus pinophilus), summer bolete (Boletus aestivalis),royal bolete (Boletus regius), Caesar's mushroom (Amanita caesarea), chanterelle (Cantharellus cibarius), hedgehog mushroom (Hydnum repandum), red pine mushroom (Lactarius deliciosus), black trumpet (Cratarellus cornucopioides), true morel (Morchella conica); black morel (Morchella elata), St. George's mushroom (Calocybe gambosa), fairy ring mushroom (Marasmius oreades).

Four species of lichens are collected in Macedonia, most of all, oakmoss (Evernia prunastri), tree moss (Pseudevernia furfuracea), and much old man's beard (Usnea barbata) and Iceland moss (Cetraria islandica).

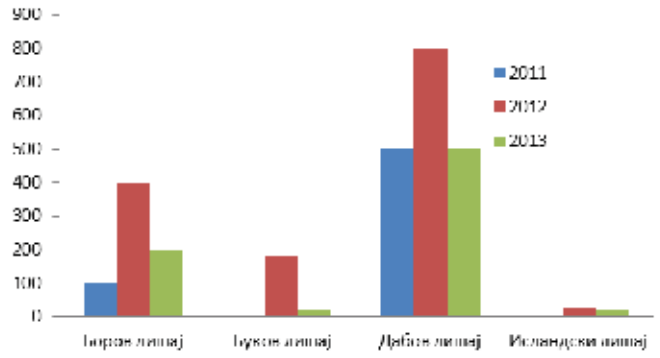


Figure 10. Quantity of lichens (tons) by issued export permits for 2011, 2012 and 2013 (Legend: old man's beard, tree moss, oakmoss, Iceland moss).

The status of wild species of MAP and fungi imposes the need for studies development to assess the quantities of MAP and fungi, especially on species of great commercial interest (biomass and production per regions, quantities that may be collected on annual basis). By this, the Administration of Environment would have scientifically based data available, on the basis of which it will carry out the permitting procedure in a controlled manner and secure sustainable use of these bio-resources. The primary responsibility for such studies of resource assessment would belong to PE "Macedonian Forests" which at the same time manages these resources, specifies the quotas and issues permits in line with the latter.

In the period 2011-2013, export permits were issued for total of 1760 tons of snails (Helix lucorum).

The analysis made of collection, use and export of natural resources of plants, fungi, lichens and animal products leads to the conclusion that it is necessary:

- to determine the competences concerning issuance of permits for wild species collection between different institutions (MoEPP, MAFWE, PE "Macedonian Forests" and protected areas);
- to revise the list of species allowed be collected (List of endangered species of plants, fungi and animals) and enrol only species of commercial interest therein (competence of MoEPP);
- to revise the list of other forest products (competence of MAFWE);
- to carry out assessment of natural resources of commercial interest and define quotas for collection of wild species and their parts accordingly;
- in the customs tariff regulation (Decision on the distribution of goods on export and import forms), specifying precisely tariff labels for exported species or their parts;
- to specify precisely the fees paid at export of plants and fungi by applying the "user pays" principle provided for in the Law on Environment and increase in the level of the fee;
- to provide feedback from the Customs Administration and exporting companies with regard to executed quantities of export;
- to establish/improve the system of wild species collection (licensing of collectors, their training, etc.);
- to establish monitoring of the whole system of collection, purchase, use and export of wild species of plants, fungi, lichens and animals.

4.2.12 Invasive species

Non-native (introduced, alien) species are those that are not natural for a given region or ecosystems, but have been introduced there purposefully or by chance (mainly by man). Some species were brought by man many centuries ago and they have made themselves at home in nature and are usually not regarded as non-native (carp, certain fruit tree species, etc.). Invasive species are those non-native species that have ability to spread and cause disruption of natural ecosystems, often to the detriment of other wild species or cause damage to human goods or human health.

Introduction of non-native species in nature in Macedonia is regulated by the Law on Nature Protection. Purposeful introduction of certain species is subject to permit by MoEPP.

Pumpkinseed (*Lepomis gibbosus*) was introduced from North America to fight malaria

Group	Number	Non-native species
Plants (only invasive species are presented)	110 (46 invasive)	Abutilon theophrasti, Acer negundo, Ailanthus altissima, Amaranthus spinosus, A. hybridus, Ambrosia artemisifolia, Ammannia baccifera, Amorpha fruticosa, Azolla filiculoides, Bryonia dioica, Broussonetia papyrifera, Chamomilla suaveolens, Chenopodium ambrosioides, Ch. multifidum, Commelina communis, Conyza albida, C. bonariensis, C. canadensis, Cuscuta campestris, Datura stramonium, Elaeagnus angustifolia, Eleusine indica, Elodea canadensis, Erigeron annuus, Euphorbia maculata, E. prostrata, Galinsoga ciliata, G. parviflora, Helianthus tuberosus, Heteranthera limosa, Impatiens balfourii, Juncus tenuis, Lindernia dubia, Lobularia maritime, Oenothera biennis, Paspalum paspalodes, Phalaris canarensis, Robinia pseudoaccacia, Rudbeckia laciniata, Sisyrinchium bermudiana, Solanum cornutum, S. elaeagnifolium, Sorghum halepense, Sporobolus indicus, Tagetes minuta, Xanthium spinosum
Cnidarians	1	Craspedocusta sowerbyi
Shells	1	Physa acuta
Crustaceans	2	Orchestia cavimana, Gammarus roeselii
Spiders	8	Sosticus loricatus, Pholcus opilionoides, Ph. phalangioides, Spermophora senoculata, Tetragnatha shoshone, Achaearanea tepidariorum, Steatoda grossa, S. triangulosa
Mites	5	Eriophyes pyri, Reckella celtis, Eotetranychus weldoni, Panonychus citri, Hyalomma scupense
Centipedes	1	Oxidus gracilis
Orthopterans	3	Blatta orientalis, Blatella germanica, Locusta migratoria
Hemipterans, mainly aphids	11	Acyrthosiphon caraganae, Aphis gossypii, Aphis spiraephaga, Brachycaudus rumexicolens, Chaetosiphon fragaefolii, Chromaphis juglandicola, Macrosiphum euphorbiae, Myzus varians, M. ascalonicus, M. persicae, Stictocephala bisonia
Butterflies	11	Hyphantria cunea, Phthorimaea operculella, Sitotroga cerealella, Parectopa robiniella, Phyllonorycter platani, Cadra figulilella, Ephestia elutella, Plodia interpunctella, Antheraea yamamai, Grapholita molesta, Coleophora laricella
Chrysomelidae	7	Epitrix hirtipennis, Acanthoscelides obtectus, A. pallidipennis, Bruchus pisorum, B. rufimanus, Callosobruchus chinensis, Leptinotarsa decemlineata
Diptera	1	Obolodiplosis robiniae
Fish	19	Acipenser gueldenstaedtii, Acipenser ruthenus, Lepomis gibbosus, Parabramis pekinensis, Carassius carassius, Carassius gibelio, Pseudorasbora parva, Hypophthalmichthys molitrix, Hypophthalmichthys nobilis, Ctenopharyngodon idella, Ameiurus nebulosus, Ictalurus punctatus, Oxynoemacheilus angorae, Gymnocephalus cernua, Sander lucioperca, Gambusia holbrooki, Oncorhynchus mykiss, Salmo marmoratus, Salvelinus fontinalis
Birds	1	Phasianus colchicus
Mammals	8	Myocastor coypus, Ondatra zibethica, Ovis aries, Nyctereutes procyonoides, Oryctolagus cuniculus, Mus musculus, Rattus rattus, Rattus norvegicus

Table 15. Non-native species registered in Macedonia.

4.2.12.1 Plant invasive species

Higher plants have been most intensively explored taxonomic group in Macedonia with regard to biology of invasive species. After Northern America, Europe is the second continent where most intensive research are carried out, covering more than 80 invasive plant species. Insight in different impacts caused by non-native plants in Europe can be obtained in the overview of the species enrolled among 100 worst non-native species; these taxa were selected in order to provide representativeness of the sample of different impacts known to occur in Europe. From among enrolled 18 plant taxa, 17 are known to affect native species and 8 cause disorder in plant communities.

Alien plant species make ecological and economic impacts, both direct and indirect, at several levels. With reference to economic impacts, some of them, such as weed plant Paspalum paspaloides, are known to have negative impact on commercial production and yields of agricultural and forest products. Acacia (Robinia pseudoacacia) and tree of heaven (Ailanthus altissima) are typical examples of alien species in Europe causing severe damages on infrastructure and public services when used for forestation.

Unique genetic nature of native and even endemic species of special conservation value can be lost through invasive genetic population of broadly distributed alien species. Alien plant species reduce the availability of pollinators to native species.

The Republic of Macedonia has not developed the final list of invasive vascular plants yet. Currently, work is done towards preparation of the list of invasive aquatic and terrestrial plants from Macedonia in the frames of the list of invasive species in Southeastern Europe.

The number of registered archeophytes (introduced long time ago) and neophytes (newly introduced species) in Macedonia's flora has not been established precisely yet, though the estimate is at more than 110 species and this number is constantly increasing. Out of these, 46 are considered invasive plant species (Table 15). Most of the invasive plant species occur on ruderal grounds and in certain aquatic ecosystems.

An example is the Waterweed, Elodea canadensis, introduced for the first time in Ohrid Lake through Studenchishte canal in 1957. It is invasive weed plant reproducing and spreading rapidly in competition with native submersed macrophyte species and occupying their habitats. Fortunately, the waterweed in Ohrid Lake has been gradually vanishing as of recently.

Certain invasive species that have south-north direction of spread can be expected to become more aggressive towards northern parts of the territory of the Republic of Macedonia. Such is the case of the species Solanum elaeagnifolium and Conyza bonariensis.

4.2.12.2 Animal invasive species

Non-native and invasive animal species in the Republic of Macedonia have not been sufficiently explored and documented. Most of the introduced and invasive faunal species belong to fish, mammals and insects.

So far, very little attention has been devoted to the presence of non-native invasive species of invertebrates in Macedonia and their invasive nature. To a certain extent, an exception of this are species causing damages to agricultural crops, such as Colorado potato beetle (Leptinotarsa decemlineata). Several projects have been implemented during the last decade to register non-native species in Macedonia. So far, around 50 non-native invertebrate species have been registered in Macedonia, but their true number is certainly far higher.

Prespa Lake is one of the most striking examples in introduction of new species. Out of the total number of 23 fish species present in the Lake, 12 non-native species have been registered in the second half of XX century (of those, seven are still present in the Lake). Particular expansion was recorded for the population of pumpkinseed (Lepomis gibbosus), bitterling (Rhodeus amarus) and topmouth gudgeon (Pseudorasbora parva).

In certain periods of the year, non-native fish dominate to the detriment of native species. For example, in the locality Asamati (Figure 11), species diversity is approximately normal in June, while non-native fish species dominate in September.

Despite the specific Law on Ohrid, Prespa and Dojran Lakes protection existing since 1977, as well as the current regulations adopted under the Law on Fishery formerly and now on aquaculture as well, imposing the most strict prohibition for introduction of new species of aquatic organisms, such events used to occur in the past and in certain water bodies they still occur.

Aquacultural production affects biological diversity of inland aquatic ecosystems through introduction of new non-native species in water bodies. Namely, by procurement of offspring (fish stocking material) for the fishponds from abroad, together with the ordered offspring, owing to inadequate control by or insufficient information of the competent institutions, other fish species are delivered as well that were present among offspring material of the producer.

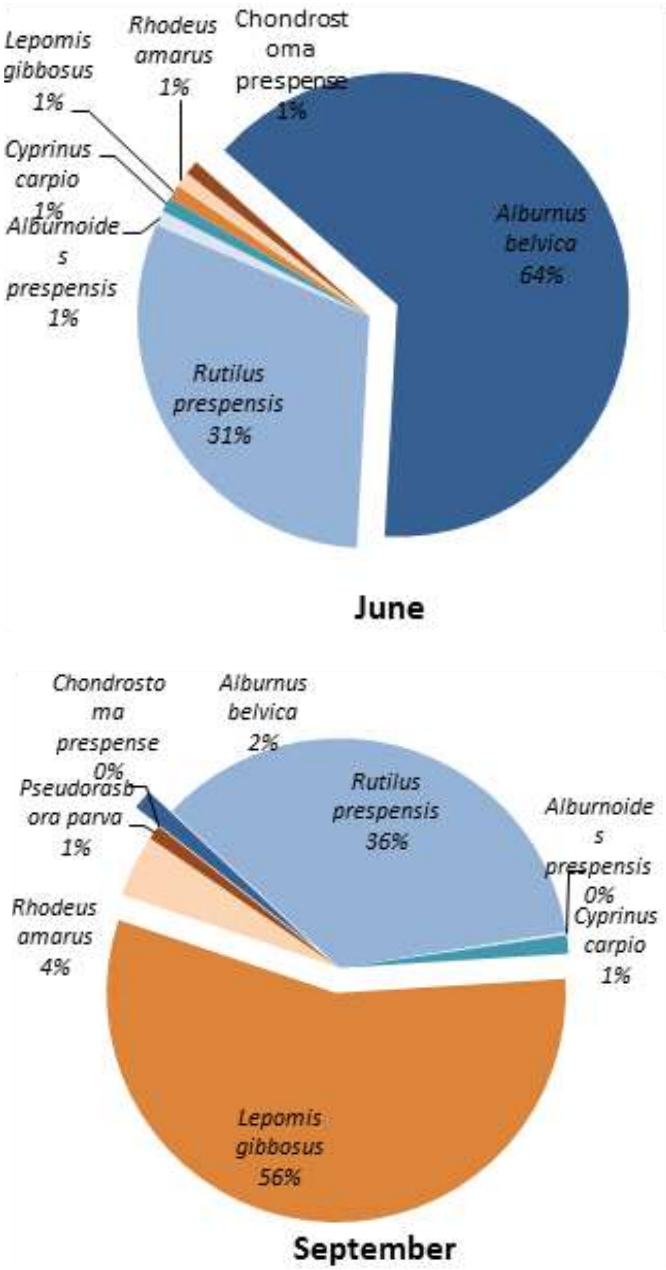


Figure 11. Representation of species in the locality Asamati during June and September.

Thus, in the watercourses running close to trout fishponds with rainbow trout, individuals of this species occur almost regularly and they affect negatively not only other native fish species, but also the entire faunal component. It is well known that specimens of this fish occur in Ohrid Lake even today, being much more eurythermal compared to stenotherm Ohrid trout and competitive relations in feeding between (in this case) Ohrid fish are disrupted. Presence of rainbow trout in Ohrid Lake originates from the surrounding fish ponds located on the Albanian shore of the Lake.

4.2.13 Climate change and desertification

Loss of biological diversity, climate change and desertification and land degradation were identified as the greatest challenges for sustainable development achievement at the World Summit for Sustainable Development held in Rio de Janeiro in 1992.

Climate change affects all levels of biological diversity. It poses severe threat to biological diversity because species and ecosystems have adapted to life under certain climate and often cannot adapt to higher temperatures, more frequent draughts and extreme weather events. The current rate of species extinction throughout the world is already hundred times higher than the one in pre-industrial era. This accelerated loss of biological diversity is not due only to climate change, but also by other anthropogenic factors (population growth, modification and changes in land use, overexploitation of certain species, logging, and pollution of the environment). Increased temperature affects the time of reproduction and migration of plants and animals, distribution of species, length of crops growth, as well as incidences of diseases and pests.

Republic of Macedonia ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1997, and Kyoto Protocol to the Convention in 2004. The main provisions related to the implementation of the obligations under the Convention and the Protocol have been integrated in the Law on Environment, and also the provisions regulating specific environmental media and areas apply for the purposes of ozone layer protection and protection against negative impact of man on climate system. Competent institution for the implementation of this Convention is the Ministry of Environment and Physical Planning, but multidisciplinary nature of the topic requires involvement of high number of stakeholders.

The First and the Second National Communications on Climate Change (MoEPP 2003, 2008) identified refuge shelters and refuge areas susceptive to the effects of climate change and vulnerable to different extents and requiring specific approach to adaptation. These refuge shelters are very important for biological diversity in Macedonia because of the great richness in species, especially endemic and relict species that have found shelters in such areas in response to climate change occurring in preceding epochs.

In the Third National Communication on Climate Change (MoEPP 2014), the assessment of biological diversity was based on identification of vulnerable habitats and species, expert judgment of their vulnerability, analysis of possible invasive species, assessment of the adequacy of the national system of protected areas with regard to climate change, assessment of the functionality of bio-corridors in Macedonia, as well as modelling of selected habitats and species. Through the assessment of vulnerability, total of 18 vulnerable habitats, 58 plant and 224 animal species was identified. Expert judgments were made for all habitats and species, based on which changes can be expected in distribution (vertical and horizontal displacement, changes in phenology, especially for certain bird species), and even extinction of certain habitats (lowland marshes) and species (plant and animal species associated with mountainous, marshy and riparian habitats). The Action Plan includes 18 actions for biological diversity, and Action Plan has been adjusted to the requirements of the National Strategy for Biological Diversity with Action Plan.

Land degradation assumes reduction or loss of land as natural resource. It is often caused by inappropriate use of land with combined processes, including those resulting from human activities, such as: erosion, deterioration of physical, chemical and biological properties of land, long-term loss of natural vegetation. Degradation of land in arid, semi-arid and dry sub-humid areas, resulting from different factors of impacts including climate change and man's influence, leads to desertification. Desertification and land degradation have been identified as the main problems affecting economic and social aspects and all together affect the environment.

The main processes contributing to land degradation include: erosion, depletion in organic matters, contamination, salinization, compaction, loss of biological diversity in soil, soil sealing and land-slides and floods. According to investigations conducted so far, erosion affects around 96% of the territory of Macedonia with domination of water erosion (draft NAP 2014). Erosion map in the Republic of Macedonia (Figure 12) was developed by former Water Management Institute of Macedonia in scale 1:50000 and published in 1993. Erosive areas and erosion susceptive areas have not been designated officially.

With regard to depletion in organic matters, soils under intensive agricultural production on inclined terrains of hard texture and shallow soil profile are the most vulnerable soils; according to conducted analysis (draft NAP 2014) they spread mainly in central and eastern parts of Macedonia. Salty soils occur in Macedonia and around 90% of the total area of soils affected by processes of salinization is situated in the basins of Ovche Pole, Strumica, Skopje and Pelagonija. Soil sealing (loss of soil caused by various processes of land covering with urbanized areas for housing, roads and other types of urbanization) in Macedonia has not been determined, except analyses completed for the City of Skopje (Trpchevska-Angjelkovikj, 2014), according to which permanent growth of population leads to vast sealing of agricultural land. Vulnerable and affected areas with different types of degradation and desertification in Macedonia have not been identified and marked yet.

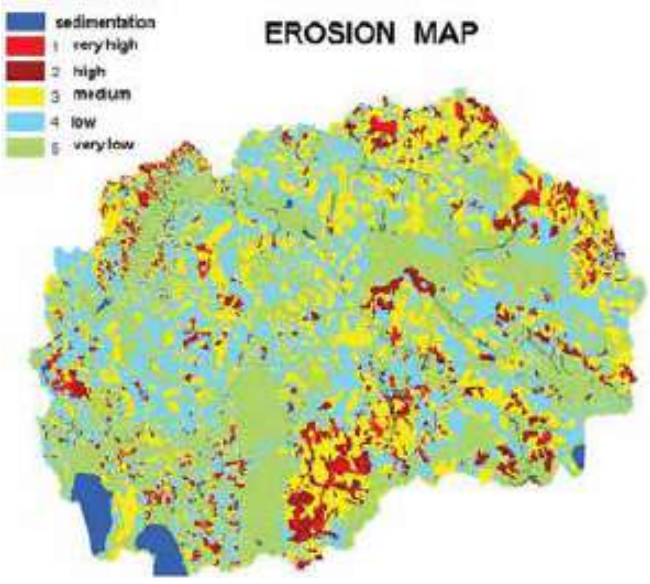


Figure 12. Erosion map of the Republic of Macedonia (developed by Water Management Institute of Macedonia, 1993).

In 2002, Republic of Macedonia ratified the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa. The obligations under the convention have been transposed in the Law on Environment, according to which the Republic of Macedonia shall, for the purposes of coping with desertification and mitigation of draught effects, adopt national Plan for coping with desertification and mitigation of draught effects (NAP) in line with the principle of international cooperation, principle of integration, as well as in line with the goals of the national social and economic development. Competent institution for the implementation of this Convention is the Ministry of Environment and Physical Planning, and National Committee to Combat Desertification was established in 2005, due to its multi-disciplinary nature. In 2013, in the frames of the Administration of Environment, specific Division for soils was established, with a task to undertake activities for soil management, organize preparation of plans for soil protection against contamination, keep records of polluting substances and undertake measures for reduction of soil contamination, etc.

MoEPP in cooperation with MAFWE and National Hydrometeorological Service works on the preparation of the First National Plan to combat desertification and mitigation of draught effects, which will be adjusted with the ten-year Strategy of the Convention for the period 2008-2018.

5 Ecosystem services

The concept of ecosystem services derives from the integration of environment and economy for clearer and more effective highlighting of the meaning of the environment for people's life and economies in countries. The key idea behind the concept is that systematic determination of benefits and beneficiaries of ecological processes will promote the integration of social economic and environmental aspects in strategic policies adoption. This approach is not a substitute for the concept of sustainable development, which is widely accepted and used in policies adoption, but is intended to upgrade it through stronger integration of environment and economy.

Assessment of ecosystems is intended to identify the causes for the changes in ecosystems and consequences of such changes on human well-being. It has been considered that, in this way people, including decision-makers will treat biological diversity with seriousness. Millennium Ecosystems Assessment (Hassan et al. (2005) relies on the conceptual frame of the way in which ecosystem services affect human well-being and how is that influence conditioned by socio-economic factors. Four main groups of ecosystem services have been recognized in this assessment, namely: provisioning, regulating, supporting and cultural (Figure 13). Their relevance for human well-being is due to their impact on the following aspects: (1) safety, (2) basic materials for living, (3) health and (4) good social relations which altogether provide to the individual freedom to choose and act, i.e. a possibility to be able to achieve what the individual deems worth doing and existing. As shown on Figure 13, influence of ecosystem services on human health is intermediated by socio-economic factors. The intensity with which ecosystem services affect the constituents of human well-being is reflected in the thickness of arrows in the diagram (thicker arrows denote stronger influence), while the role of socio-economic factors in that influence is marked with arrow colour (darker colour denotes greater role).

Figure 13. Conceptual framework of Millennium Ecosystem Assessment (adapted from the 2005 Millennium Ecosystem Assessment).

Global Initiative under the name The Economics of Ecosystems and Biodiversity (TEEB) has particular contribution to knowledge enrichment and increase of public awareness of the importance of ecosystem services in the years following the publication of the Millennium Ecosystem Assessment. This Initiative has developed its approach to identification and demonstration of economic value of ecosystems and biological diversity intended to decision-makers in both public and private sectors. It is believed that identification of economic or monetary value of ecosystem services will improve the valuation of biological diversity and ecosystem services in decision making.

Furthermore, demonstration of the value of ecosystem services in monetary units is an important tool for public awareness raising by spreading message to decision makers about the (relative) importance of ecosystems and biological diversity (de Groot et al. 2012). On the other hand, it should be born in mind that the estimates of economic value of market invaluable ecosystem goods and services reveal social costs and benefits which would otherwise remain hidden (Farber et al., 2006; Wilson & Carpenter, 1999).

Social and political challenges concerning integration of ecosystem services approach integration through institutionalization of effective and sustained system for management, monitoring and support of initiatives that will more accurately reflect the relevance of ecosystem services for human well-being (Daily and Matson 2008), are equally great. With this in mind, the Conference of the Parties to the Convention on Biological Diversity, by adopting the revised Strategic Plan for Biological Diversity for the period 2011-2020, attributed great importance to the integration of ecosystem services approach in sectoral and cross-sectoral plans at all governmental levels, but also wider in society. The concept of ecosystem services has key position in the Vision of this document: "By 2050, biological diversity is valued, conserved and wisely used, while maintaining ecosystem services, supporting healthy planet and providing benefits for all people." Furthermore, Signatories of the Convention are obliged to update their national biological diversity strategies with action plan (NBSAP) in line with the Strategic Plan for Biological Diversity for the period 2011-2020 and Aichi Targets that derived from it. The Institute for European Environmental Policies and World Centre for Monitoring of the Conservation (UNEP-WCMC) have recently issued a Manual titled "Integration of biological diversity values and ecosystem services into NSBAPs: Guide supporting NBSAP practitioners". Under the Guide, integration of biological diversity and ecosystem services should be the central topic of the process of NBSAP updating. In this regard, successful integration of ecosystem services into the development of other sectoral strategies requires availability of relevant evidence base or records of the most important ecosystem services in the country, as well as of the impacts of different sectors on ecosystems that provide such services, namely information is required on the dependence of different economic sectors and socio-economic groups on such services.

5.1 Application of ecosystem service approach in the Republic of Macedonia

As indicated above, practical application of ecosystem services approach relies on three pillars or aspects – identification, quantification of the scope and status and value of ecosystem services (Naruševičius and Matiukas 2011). There are different approaches and methods for gathering of information on these aspects and the most frequently used ones include: (1) participation of affected and interested parties, (2) assessment of ecosystems, (3) ecosystem services mapping, (4) ecosystem services indicators, (5) monetary appraisal, and (6) accounting of natural capital and environmental economy (UNEP-WCMC and IEEP 2013). The first two approaches generate mainly qualitative data, while the rest are based on a high number of quantitative inputs and application of computer and mathematical methods.

Experiences in the Republic of Macedonia with the application of these methods are modest at the moment, as is information on the above basic aspects of ecosystem services approach. Initial application of the concept of ecosystem services and related methods for economic appraisal can be found in the Study "Valorization of the natural values of Shar Planina and appraisal of their market value" (Melovski et al. 2008). The Study "Economic appraisal of protected areas: options for Macedonia" of 2009, developed under the Project "Strengthening of ecological, institutional and financial sustainability of the system of protected areas in Macedonia" (UNDP) is focused on economic value of protected areas in Macedonia. Taking the Strict Natural Reserve "Tikvesh" and Natural Monument "Matka" as examples, the Study demonstrates how information of the economic values of nature can be used in the management of the protected areas. In the frames of the Project, amendments of the Law on Nature Protection were prepared and their adoption in 2010 introduced for the first time the concept of ecosystem services in Macedonian legislation. In 2013, the Study "New Achievements in the Republic of Macedonia's conservation: economic arguments for long-term protection of the Natural Park Ezerani" (UNDP) was prepared, where the concept of ecosystem services was the central topic. The Study first identifies the ecosystem services of the Natural Park Ezerani, and then determines the economic value of the key ecosystem services, which establishes the basis for the assessment of the costs and the benefits related to the area environmental restoration. The concept of ecosystem services is also mentioned in several other documents and studies, such as: "Study for valorization with proposed establishment of Protected Landscape Osogovo Mountains" (Macedonian Ecological Society, 2012), "Analysis of the Strategies in the Republic of Macedonia in terms of climate change adaptation" (Eco-Sense 2012) and "Local Biological Diversity Action Plan of the Municipality of Debar" (Debar Municipality, 2013).

On the other side, there are currently more sources of quantitative data (combined with expert appraisal), the analysis of which can provide initial information on some of the main aspects of ecosystem services, especially on the types of ecosystem services on the territory of the Republic of Macedonia, as well as their spatial and temporal distribution and status. Thus, for example, on the basis of land cover data obtained through the implementation of the Project CORINE (EEA 1994; Coordination of Information on the Environment), maps can be developed on spatial and temporal distribution of the most prominent ecosystems in the Republic of Macedonia, which is basis for further analysis of services provided by them. To demonstrate the potential for improvement of the information on ecosystem services in the Republic of Macedonia, in the frames of the activities for NBSAP development, the map of distribution of eight basic ecosystem groups in the Republic of Macedonia was developed first, these being: (1) urban ecosystems (artificial habitats), (2) agricultural ecosystems, (3) grasslands, (4) forest and wooded land, (5) shrubs, (6) naturally unvegetated or sparsely vegetated areas, (7) marshy ecosystems, (8) rivers and lakes (Figure 14).

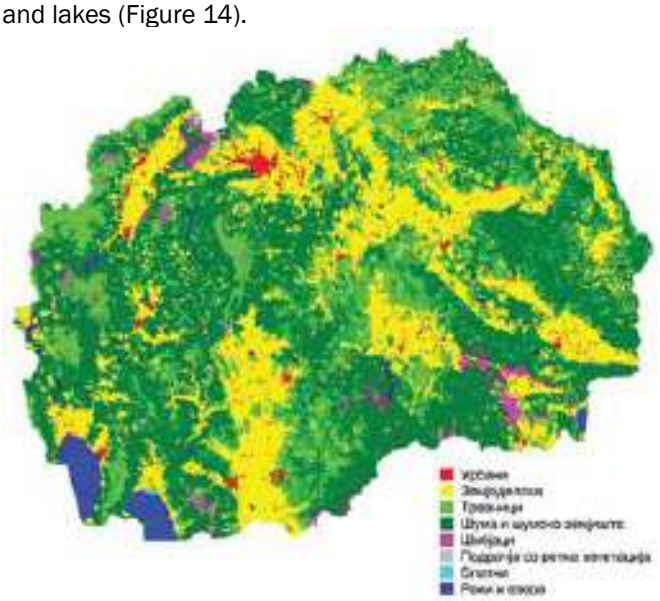


Figure 14. Types of ecosystems in the Republic of Macedonia.

The process of the map development followed the methodology and the classification of the European working group on mapping and assessment of ecosystems and their services (Maes et al. 2013), based on quantitative land cover data obtained by analysis of the satellite images in the frames of CORINE Project. Land cover data under CORINE is obtained by combination of data on vegetation cover and land use, i.e. analysis of data on natural conditions and human activity. The results of the analysis are presented as spatial data on 44 land cover classes in total, out of which 31 classes occur in the Republic of Macedonia. For the territory of the Republic of Macedonia, there are two sets of CORINE land cover data obtained by analysis of satellite images in 1996 and 2006, respectively.

CORINE land cover data can be also used for spatial and temporal assessment of the potential for provision of one or more ecosystem services on the territory of the Republic of Macedonia. Applying the ecosystem services mapping methodology developed by Burkhard et al. (2009, 2013) and 2006 CORINE data, map of spatial distribution of the overall capacity of ecosystems in the country to provide one or more of the total of 29 ecosystem services (Figure 15), was developed for the purposes of this document, namely map of distribution of the ecosystem service "fire wood" (Figure 16). Similarly, the analysis of this data can leads to the conclusion that the three National Parks (Pelister, Mavrovo and Galichica) cover around 6.9% (51.434 ha) of the overall national territory (831.080 ha), which is characterized with very high capacity for provision of the ecosystem service

"Regulation of global climate" (Table 16 and Figure 17).

Application of the methodology of Burkhard et al. (2009, 2013) relies on specific matrix for hypothetical assessment of the capacity of different types of land cover to provide specific ecosystem services. The matrix was developed by use of expert knowledge, spatial information and empirical data of biogeographical regions, i.e. ecosystems that may manifest certain differences compared to those in our country. More details on the methodology of assessment and mapping of the capacity of different types of land cover to provide specific ecosystem services according to Burkhard et al. (2009, 2013) are presented in Annex 1.

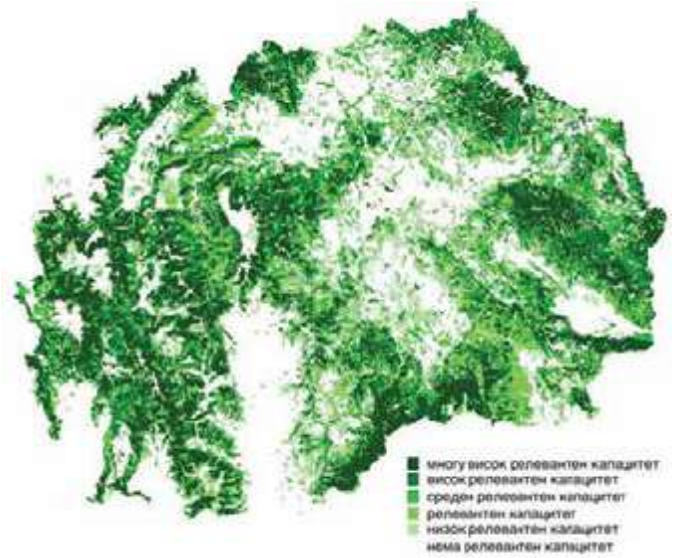


Figure 16. Potential for the provision of the ecosystem service "fire wood" on the territory of the Republic of Macedonia.

Protected areas	Area coverage of PA (ha)	% of national territory	Area of high or very high capacity (ha)	% of national territory with high or very high capacity (%)
NP Mavrovo	72.204	2.81	34,108	4.1
NP Galicica	24.151	0.94	8,605	1.04
NP Pelister	17.150	0.67	8,721	1.05

Table 16. Share of national parks in the total area of the Republic of Macedonia with high or very high capacity for the provision of the ecosystem service "Regulation of global climate".

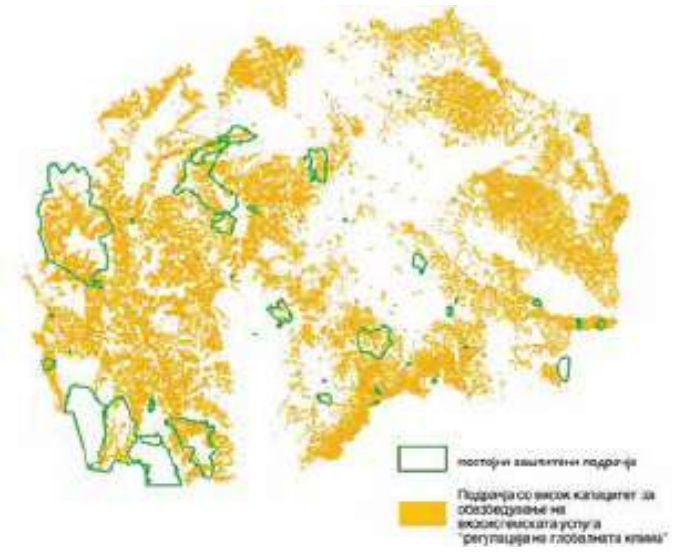


Figure 17. Spatial distribution of areas in the Republic of Macedonia with high capacity for provision of the ecosystem service "Regulation of global climate" and their distribution within the existing protected areas.

Figure 15. Overall potential for the provision of ecosystem services in the Republic of Macedonia.

It should be noted that such obtained models (maps) provide only initial overview of the spatial distribution of ecosystem services. Nevertheless, the examples above underline the fact that spatial distribution of ecosystem services at the level of landscape or region is uneven due to variations in biophysical environment. Furthermore, these parameters demonstrate the manner in which ecosystem service mapping can be used for identification of the areas with overlapping of significant capacity to provide one or more ecosystem services and presence of biological diversity components of particular interest for conservation.

The given examples support the claim of certain authors that the mapping of ecosystem services, especially in combination with ecosystem services indicators is one of the key elements for better understanding and acceptance of the approach in the adoption of strategies, policies and decisions in both public and private sectors (Daily and Matson 2008).

While valuing the ecosystem services in the Republic of Macedonia, it should be considered that the value is not determined only by the current level of provision, but also by human demand, i.e. desired level of provision. In other words, the assessment of ecosystem services should include identification of the link between provision and consumption (Paetzold et al. 2010). Accordingly, the analysis should consider who the service beneficiaries are, where they are located, how they perceive the value of individual ecosystem services that derive from a given ecosystem, and how does spatial distribution of the specific ecosystem service affect these parameters.

Integration of the values of biological diversity in the adoption of strategies, policies and decision in public and private sector is the central topic of the concept of ecosystem services. Expert and scientific community in Macedonia faces challenges in the development and practical application of the ecosystem services approach. As indicated above, apart from conceptual and methodological gaps, the main obstacle is the lack of information related to the three pillars or aspects – identification, quantification of the scope and status and value of ecosystem services. In the future, continuous support should be secured to scientific and applicative surveys in this field, and priority activities should certainly include development of comprehensive national study for valuation of ecosystem services in Macedonia.

6 Institutional, legal and financial framework for biodiversity conservation

6.1 Institutional framework

The existing institutional setup for biological diversity conservation and sustainable use in the Republic of Macedonia is mainly centralized in governmental institutions. Although the process of decentralization has been initiated long time ago (as early as in 2005), only few competences concerning biological diversity conservation have been delegated to local level.

The Assembly of the Republic of Macedonia (through its Commission for transport, communications and environment) and the Government of the Republic of Macedonia (through the ministries and the Commission for economic system and current economic policy) play the main role through adoption of legislation and strategic documents, proclamation of protected areas, etc.

The competent state authority in the areas of environment and nature protection is the Ministry of Environment and Physical Planning (MoEPP).

The Administration of Environment was established in 2007, as a body responsible for the performance of expert activities in the area of environment and nature protection, and its main goal is to establish efficient and integrated system of environment and nature protection, thus improving the quality of the environment in the Republic of Macedonia. Five departments were established within the Administration, as follows: Department of Environment, Department of Waste Management, Department of Waters, Department of Industrial Pollution and Risk Management and Department of Nature (Figure 18).

The Department of Nature has 13 employees distributed in four divisions (for biological diversity; natural heritage protection; space planning in protected areas and geodiversity; and genetically modified organisms) carries out activities for nature protection through protection of biological and landscape diversity and protection of natural heritage

The Department of Waters is responsible for the performance of expert activities related to waters protection in accordance with the regulations on waters. The Department of Environment is responsible for the performance of environmental impact assessment procedure, protection of soil, protection against noise and maintaining of databases for quality of the environment.

There are other departments within MoEPP which also have significant role in the conservation of biological diversity, such as: Department of Spatial Planning, Macedonian Environmental Information Centre, as well as Spatial Information System Office and State Environmental Inspectorate, etc.

The National Committee for Biological Diversity (composed of twenty scientists and experts) with the Secretariat (composed of 7 members) was established in 1999 aiming to monitor the implementation of the Convention on Biological Diversity at national level (to review expert issues related to conservation on biodiversity on a national level and give appropriate recommendations). The Committee was especially active during the elaboration of the Country Study on Biological Diversity (First National Report, 2003) and the

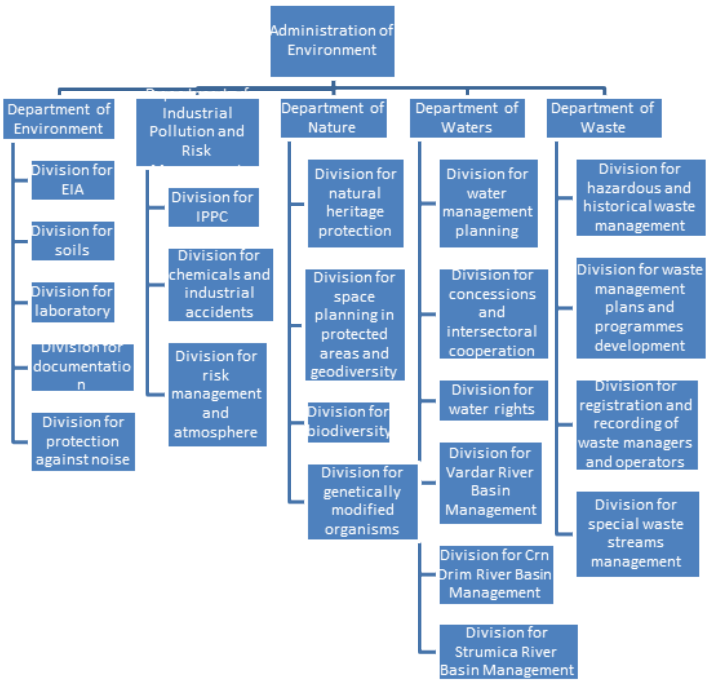


Figure 18. Organizational Chart of the Administration of Environment.

first National Strategy for Biological Diversity and Action Plan (2004), but later its activity has lessened.

The entities mandated to manage protected areas are responsible for the management of biological diversity in the respective protected areas. Public Institutions for National Parks (Mavrovo, Galichica and Pelister) management are the most important. Public Enterprise was also established for management and protection of Multipurpose Area "Jasen". Other institutions/organizations may be appointed as protected areas management entities – in most cases, these are units of local self-government or, in other cases, certain institutions (e.g. Institute for Ancient Slavic Culture – Prilep) or NGOs (Peoni, Izvor-Kratovo, Ursus Speleos).

The Ministry of Agriculture, Forestry and Water Economy has important role in the conservation and sustainable use of biological diversity, especially through the following:

- 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 for Organic Production, State Inspectorate of Agriculture),
- Protection of agro-biological diversity (Department of Livestock Breeding, Administration of Seeds and Seeding Material),
- Rural development (Department of Rural Development),
- Protection of animals and plants against diseases and pests (Veterinary Medicine Administration, Phytosanitary Administration, State Veterinary Inspectorate, Administration for Plants Protection),

- Agricultural land consolidation and management (Department of Agricultural Land Registration and Management, Department of Agricultural Land Consolidation, Exchange and Identification of Land Plots), etc.

The main challenges in the implementation of the Convention on Biological Diversity on national level identified in the process of elaboration of the Fifth National Report to CBD, include the following:

1. Lack of capacity in Nature Department of the MoEPP.
2. Lack of specific technical institution on national level for nature protection.
3. Insufficient capacity on local level (especially with municipalities nominated as protected areas management entities) for implementation of nature protection activities.
4. Insufficient or inadequate human capacity in entities mandated with protected areas management for application of conservation measures and activities.

To overcome the above challenges, it is necessary to restructure and strengthen the capacity of MoEPP's Nature Department and provide sufficient financial resources required to implement annual programmes for nature protection. There is an evident need to renew the National Committee for Biological Diversity and establish an Institute or Agency for nature as an independent technical body. Strengthening of the capacity on local level, especially in municipalities appointed as protected areas management entities and other entities is necessary to achieve efficient management of protected areas.

6.2 Stakeholders

Integration of issues related to conservation and sustainable use of biological diversity in relevant sectoral policies and plans is one of the main requirements of the Convention on Biological Diversity (Article 6-b) for the Parties. Involvement of stakeholders establishes links between planning process and implementation; enables access to high number of required information and knowledge; increases public awareness; builds consensus and maximum harmonization of the policy for issues concerning biological diversity conservation. The Convention identifies five main groups of stakeholders: state institutions (different ministries, agencies, etc.), scientific communities, non-governmental organizations, private sector and local communities.

Apart from the two main ministries described above, identification of stakeholders was made on the basis of their relevance in the overall process of elaboration and implementation of NSBAP and they are grouped into 5 groups in line with their interests and rights in the process of planning of biological diversity conservation (Table 17).

Identified main challenges in the implementation of the Convention on Biological Diversity on national level during the development of the Fifth National Report to CBD include the following ones as well: insufficient inter-institutional cooperation with regard to natural resources use, but also overlapping responsibilities between relevant ministries, especially in the domain of inspection supervision. These challenges are elaborated adequately in the Action Plan for Biological Diversity.

Table 17. Overview of the most important stakeholders for biological diversity conservation.

Stakeholders	
1. Those that have direct customary or statutory rights to biodiversity conservation	- Ministry of Environment and Physical Planning; - Ministry of Agriculture, Forestry and Water economy; - local self-governments, Association of Local Self-government Units; - protected area management authorities;
2. Those that may have an impact to biodiversity	- public enterprises for forests, water, pastures and roads; - agencies for spatial planning and energy; - ministries, agencies and private sector involved in use of natural resources; - land use; - ministries, agencies and private sector involved in tourism development; - hunting and fishing associations.
3. Those that possess knowledge, experience and expertise and that can assist in revision and implementation of NBSAP	- MASA; - Universities and scientific institutions; - Natural history museums (Natural History Museum of Macedonia – Skopje and National Museum "Nikola Nezlobinski" – Struga); - Public scientific institution Hydrobiological Institute; - National Hydrometeorological Service; - Zoological gardens (Skopje and Bitola); - Non-governmental organizations.
4. Those that may be affected by measures defined in the strategic document (NBSAP)	- Ministries and agencies responsible for development of energy, transport, tourism, etc.; - Energy sector management companies.
5. Those that may be affected by the change in the status and trend of biodiversity	- Sector tourism; - Business sector; - Concessioners; - Ministry of Health, Institute for Public Health; - Crisis management centre, Administration for protection and rescue.

6.3 Legal framework for biodiversity protection

Protection of natural rarities occurred for the first time in the 1963 Constitution of the Socialist Republic of Macedonia (Article 32). (though the term "biological diversity" is not mentioned), the 1991 Constitution of the Republic of Macedonia (Official Gazette of the Republic of Macedonia no. 52/91) contains legal grounds for nature protection, thus providing for the right to a healthy environment (Article 43, paragraph 1); every citizen has a duty to improve and protect environment and nature (Article 43, paragraph 2); natural wealth of the country, flora and fauna, are determined as goods of general interest enjoying special protection (Article 56, paragraph 1); and certain goods of general interest for the country may be awarded for use in a manner and under conditions specified in the law (Article 56, paragraph 3).

The 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, 13/13, 163/13, 41/14) is a framework law that regulates the protection and promotion of the environment for the purpose of ensuring the right of citizens to a healthy environment including biological diversity. Moreover, international multilateral agreements ratified by the Republic of Macedonia (Convention on biological diversity, Bonn Convention, Ramsar Convention, Bern Convention, UNESCO, etc.) represent part of the legal system on nature conservation in the country.

Almost 10 years ago, an attempt was made to consolidate and update the previous laws affecting species and habitats protection: Law on Natural Rarities Protection (Official Gazette of the Social Republic of Macedonia no. 41/1973), Law on Protection of National Parks (Official Gazette of the Social Republic of Macedonia no. 33/80) and Law on Protection of Ohrid, Prespa and Dojran lakes (1977) in accordance with the new global trends in nature conservation (adopted CBD 2010 Targets), global categorization of protected areas prescribed by International Union for Conservation of Nature (IUCN), sustainable development principles and obligations from relevant ratified international agreements. Certainly, noticeable role in the creation of the law had the process of accession of the Republic of Macedonia to the European Union starting with the transposition of national legislation to the EU Acquis, including transposition of the two most important directives for nature protection – Birds and Habitats Directives in national legislation.

Most important international agreements related to biological diversity conservation ratified by the Republic of Macedonia

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 (Bern, 1979)

UNESCO Convention for the Protection of the World Cultural and Natural Heritage (World Heritage Convention, Paris, 1972)

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Washington, 1972)

European Convention for the Protection of Vertebrate Animals Used for Experimental and other Scientific Purposes (Strasbourg, 1996)

European Landscape Convention (Florence, 2000)

Agreement on the Conservation of Bats in Europe (London, 1991)

Agreement on the Conservation of African-Eurasian Migratory Waterbirds (Hague, 1995)

Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters (Aarhus, 1998)

UN Framework Convention on Climate Change (Rio de Janeiro, 1992)

UN Convention to Combat Desertification in Those Countries Experiencing Drought and/or Desertification, Particularly in Africa – UNCCD (Paris, 1994)

In 2004, the Law on Nature Protection (Official Gazette of the Republic of Macedonia no. 67/04) was adopted as a general law that regulates the protection of nature by protecting the biological and landscape diversity, and the protection of the natural heritage, in protected areas and outside of protected areas, as stated in Article 1. Since its adoption, the Law has been amended on several occasions (Official Gazette of the Republic of Macedonia nos. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/2013, 163/13, 41/14). Full implementation of the Law will be accomplished upon the adoption of the relevant bylaws – around 50 bylaws are prescribed, 17 of which have been adopted. However, development and adoption of some secondary legislation requires significant efforts and previous scientific/expert work needs to be undertaken.

The following main elements are covered in the Law on Nature protection:

1) general provisions, general restrictions or prohibitions for the purpose of nature protection;
2) protection of nature, general measures, nature impact assessment, protection of species, protection of habitats and ecosystems, protected areas, protection of landscape, minerals and fossils;
3) organisation of the protection of nature;
4) record-keeping in the area of nature protection;
5) monitoring;
6) national strategy for nature protection;
7) financing;
8) penalty provisions; and
9) transitional and final provisions.

In addition to the provisions of the Law on Nature Protection, the use of natural resources for economic purposes and land use shall also be regulated by the provisions of sectoral laws (Tab. 18).

Preservation of agro-biological diversity is subject of regulation of the Law on Agriculture and Rural Development (Official Gazette of the Republic of Macedonia no. 49/2010; 53/2011, 126/2012, 15/2013 and 69/2013) which in Article 78 thereof provides for support for conservation of genetic diversity of native agricultural plants and native livestock breeds in accordance with the published List (Official Gazette of the Republic of Macedonia no. 71/11), stipulates the manner of monitoring and analysis of conditions and measures for conservation of native species of agricultural plants and native livestock breeds on the basis of the extent of their being threatened and their eradication is prohibited. The work of the gene bank is covered in the Law on Seed and Seeding Material (Official Gazette of the Republic of Macedonia no. 55/11). The Law on Livestock Breeding

Table 18. Relevant laws for biodiversity protection in Macedonia.

Topic	Law
Agrobiodiversity	**Law on Agriculture and Rural Development** (Official Gazette of the Republic of Macedonia no. 49/2010; 53/2011, 126/2012, 15/2013 and 69/2013)
	Law on Seed and Seeding Material (Official Gazette of the Republic of Macedonia no. 55/11)
	Law on Agricultural Products Quality (Official Gazette of the Republic of Macedonia no. 140/2010, 53/2011 and 55/2012)
	Law on Animal Husbandry (Official Gazette of the Republic of Macedonia no. 7/2008, 116/2010 and 23/2013)
Use of natural resources	**Law on Hunting** (Official Gazette of the Republic of Macedonia no. 26/09, 32/09, 136/11, 01/12, 69/13, 164/13 and 187/13)
	Law on Forests (Official Gazette of the Republic of Macedonia no. 64/09, 24/11, 53/11, 25/13, 79/13, 147/13 and 43/13)
	Law on Fishery and Aquaculture (Official Gazette of the Republic of Macedonia no. (7/08, 67/10, 47/11, 53/11 and 95/12)
	Law on Organic Agricultural Production (Official Gazette of the Republic of Macedonia no. 146/2009)
	Law on Waters (Official Gazette of the Republic of Macedonia no. 87/08, 06/09, 161/09, 83/10 and 51/11)
	Law on Water Management Companies (Official Gazette of the Republic of Macedonia no. 85/03, 95/05, 103/08, 1/12 and 95/12)
	Law on Water Communities (Official Gazette of the Republic of Macedonia no. 51/03, 95/05, 113/07 and 36/11)
	Law on Pastures Management (Official Gazette of the Republic of Macedonia no. 3/98, 101/2000, 89/2008, 105/2009, 42/10 and 164/2013)
Land use	**Law on Spatial and Urban Planning** (Official Gazette of the Republic of Macedonia no. 51/2005, 137/07,91/09, 124/10,18/11,53/11,144/12 and 55/13)
	Law on Construction (Official Gazette of the Republic of Macedonia no. 130/09, 124/10, 18/11, 36/11, 13/12, 144/12, 25/13)
	Law on Construction Land (Official Gazette of the Republic of Macedonia no. 17/11, 53/11, 144/12, 25/13)
	Law on Agricultural Land (Official Gazette of the Republic of Macedonia no. 135/07, 18/11, 42/11, 148/11,95/2012, 79/2013, 87/2013, 106/2013, 164/2013 and 39/2014)
	Law on Concessions and Other Public Private Partnership (Official Gazette of the Republic of Macedonia no. 7/2008, 139/2008, 64/2009 and 52/2010)
	Law on Mineral Resources (Official Gazette of the Republic of Macedonia no. 136/2012, 25/2013, 93/2013, 132/2013 and 44/2014)
	Law on Auto Bearings (Official Gazette of the Republic of Macedonia no. 13/2013)
	Law on Tourism Development Zones (Official Gazette of the Republic of Macedonia no.141/12)
GMO	**Law on Genetically Modified Organisms** (Official Gazette of the Republic of Macedonia no.35/2008)
Food safety and animal protection	**Law on Veterinary Medicine** (Official Gazette of the Republic of Macedonia no. 113/2007, 23/2011 and 156/2011)
	Law on Animal Protection and Welfare (Official Gazette of the Republic of Macedonia no. 113/2007 and 136/2011)
	Law on Food Safety (Official Gazette of the Republic of Macedonia no. 157/10)

(Official Gazette of the Republic of Macedonia no. 7/2008, 116/2010 and 23/2013) defines 11 native breeds and/or lines of domestic animals.

The Law on Nature Protection stipulates the obligation to assess the impacts of measures and activities envisaged under various development strategic, programme and planning documents that might have impact on nature, as well as activities planned in nature, which during their implementation, independently or combined with other activities, may disturb natural balance (Articles 15 and 18). The purpose of these activities is to avoid or minimize nature degradation, and they are implemented in accordance with the provisions of the Law on Environment. These provisions (SEA and EIA) are especially important in terms of preventing fragmentation of habitats during the implementation of projects for construction of roads, dams, airports, etc. Depending on anticipated or caused degradation of nature, as well as the ability for compensation, compensation measures are envisaged (Article 19), i.e. activities compensating or mitigating nature degradation. In practice, progress has been noted in the application of SEA legal procedure during the last years, though ultimate effects do not have satisfactory results. It is especially important to mention that the quality of developed studies, concerned public participation and measures to reduce negative impacts related to biological diversity, is improving. Legal framework for SEA application has been established, however we may conclude that these procedures do not achieve the desired effect from nature and biological diversity protection point of view.

6.4 Funding

According to the Law on Nature Protection, the funds for nature protection are foreseen to be provided from the Budget of the Republic of Macedonia, budgets of the units of local self-government on the territory of which the protected area is situated, compensations for entrance, visit, parking, collection of wild species of plants, fungi and animals, sustainable use of natural resources and other sources (donations, grants, credits, EU funds and other sources).

In 2013, regulations were adopted to establish a price list for the utilization of protected area services, but the system for payment still lacks implementation. Unfortunately, the system for payment is not operational yet, due to lack of capacity to carry out the fee collection. It has to be pointed out that the system of payment for use of services in protected areas is one of the crucial elements in self-sustainable system of protected areas management.

Through the annual Environmental Investment Programme (specified in the Law on Environment) MoEPP awards funds to implement programmes, projects and other activities in the area of environment including support for scientific research work and public awareness raising and education. Beneficiaries of these funds are as follows: municipalities or associations of municipalities, legal and natural persons, non-for-profit and non-governmental organizations (including universities and other scientific institutions), non-governmental organizations established for the purposes of environment and nature protection.

Starting in 2007, through the Programme for Environmental Investments every year (except in 2009 and 2012 when the Programme was not adopted), a total of 36 million denars are awarded from the budget line for biodiversity and nature protection, and the total amount of allocated funds per year are given in Table 19.

Table 19. Planned and allocated financial resources for biological diversity and

Year	Allocated funds (MKD)	Allocated funds(EUR)
2007	4,000,000.00	65,040.00
2008	4,000,000.00	65,040.00
2009	Unpublished competition	-
2010	9,000,000.00	146,342.00
2011	8,000,000.00	130,081.00
2012	Unpublished competition	-
2013	6,000,000.00	97,561.00
2014	5,000,000.00	81,301.00
Total:	**36,000,000.00**	**585,365.00**

However, activities for nature protection in the Republic of Macedonia are to the greatest extent financed by foreign funds, such as: Global Environmental Facility, EU funds, and donations/grants from other countries, among which Switzerland, Germany, Netherlands, Norway, Finland, Austria, Italy and other countries have provided the most significant support. Significant funds for protection of biodiversity are obtained from private foundations as well. Beneficiaries of these funds and projects are different state institutions, research institutes and international and national NGOs.

In the period 2007-2013, EU funds, through the Instrument for Pre-Accession Assistance (IPA) a number of projects for nature and biological diversity conservation have been awarded support and implemented under the programme for cross-border cooperation between Macedonia and the neighbouring countries: Albania, Bulgaria and Greece. Thus, within the cross-border cooperation programme between Macedonia and Bulgaria (2007-2013), eight projects were supported with relevance to nature and/or biological diversity conservation, with a total budget of around EUR 2 million. The respective programme with Greece supported six projects with relevance for nature with a total budget of around EUR 4 million, and with Albania – six projects. So far, no project activities have been financed under the cross-border programme with Kosovo.

Based on presented data, it may be concluded that the Budget of the Republic of Macedonia, through the Programme for Environmental Investments, during the last eight years, has supported projects with total of 36 million denars (around EUR 585 thousand), while foreign grants exceed this support by several times.

7 Legal protection of biological diversity

The Law on nature protection prescribes measures for protection of species, habitats, proclamation of protected areas and natural rarities, establishment of ecological network, protection of landscape as well as protection of minerals and fossils.

7.1 Species protection

In addition to the general measures for protection of species and prohibited activities (Law on Nature Protection, Article 21) special measures to protect the species are prescribed include: adoption of red list of species according to their threat status, proclamation of strictly protected and protected species, measures for the protection of internationally protected species, control of the collection and trade in threatened and protected wild species of plants, fungi and animals, keeping and breeding of animals in captivity, introduction and reintroduction of species in nature.

7.1.1 Red List and Red Data Book

Preparation of the Red List provides scientific information and analysis of the state, trend and level of threat to species, in order to turn the attention of the public, and especially decision makers (at national and global levels) towards endangered species in order to design appropriate strategies/programmes and undertake actions for biological diversity conservation. It has been elaborated in accordance with the criteria for evaluation developed by IUCN, whereas species are categorized into 7 categories relative to the extent of their being under threat: extinct species (EX), species extinct in wild (EW), critically endangered (CR), endangered (EN), vulnerable (VU), near threatened (NT), least concern (LC) species, and additionally the category of data deficient species (DD). These criteria have been accepted in the Law on Nature Protection (Article 34). Despite the legal obligation, national red lists of threatened species of plants and animals have not been adopted by the Government of the Republic of Macedonia.

Attempts have been made during the last several years by the scientific public to propose red lists. The Red List of Fungi was proposed in 2012 by scientific experts (Karadelev & Rusevska 2012). This list contains 213 species of the phyla Ascomycota and Basidiomycota. Species are categorized by IUCN criteria, and category of critically endangered (CR) has 21 species, endangered (EN) – 30 species, vulnerable (VU) – 71 species, near threatened (NT) – 40 species, least concern (LC) – 9 species and data deficient (DD) has 42 species.

Krpač & Darcemont (2012) proposed a Red List of Butterflies in Macedonia. This List includes 69 species, among which 1 was evaluated as endangered (EN), 15 as vulnerable (VU), 24 as near threatened (NT), and the rest of 27 were not awarded status by IUCN, but were regarded as important for conservation due to their endemism or small area of distribution.

Lemonnier-Darcemont et al. (2014) prepared a Red List of Orthopterans in Macedonia based on IUCN criteria. Leading criterion in the assessment of the status was the assessment of the size of the population and the trend, as well as the area of distribution. The List includes 17 taxa (around 10% of the overall Macedonian fauna): one critically endangered – CR (Bradyporus macrogaster macrogaster), four endangered – EN (Saga pedo, Bradyporus oniscus, Paracinema tricolor and Stethophyma grossum), eight vulnerable – VU, and four near threatened – NT. Additionally, 10 taxa were categorized as "data deficient" – DD. All remaining species of orthopteran fauna in Macedonia are assessed as least concern - LC.

The blue-throated keeled lizard (*Algyroides nigropunctatus*)

7.1.2 Strictly protected and protected wild species

Threatened wild species i.e. those that are categorized as critically endangered, endangered or vulnerable may be proclaimed as strictly protected or protected wild species according to the Article 35 of the Law on Nature Protection and thus acquiring the status of natural heritage.

The lists of strictly protected wild species (including total of 194 species, of which 9 fungi, 51 flora and 134 fauna species) and protected wild species (total of 820 species, of which 75 species of fungi, 151 flora and 594 fauna species) were adopted in 2011 (Official Gazette of the Republic of Macedonia no. 139/2011) without prior categorization of species based on their threat status.

Unfortunately, the lists mentioned do not state criteria under which strictly protected and protected species have been determined. They contain many unprecise formulations, high number of typing, nomenclature and taxonomic errors, synonyms, etc. Lists also include many species that do not have specific importance in terms of threat, endemism or distribution, population status, etc. These deficiencies impose the need to elaborate national red lists of species founded on research and relevant expert assessments.

Prohibited activities for strictly protected species are prescribed (destruction, logging, shooting, disturbing etc.), while measures and activities for protection and method of use of species declared as protected are not prescribed yet.

7.1.3 Protection of species of economic importance

7.1.3.1 Collection and trade of threatened and protected wild species of plants, fungi and animals

Collection and trade of threatened and protected wild species of plants, fungi and animals and their parts shall be conducted only upon prior acquisition of license for collection (article 23) or licence/certificate for trade (Article 29), issued by the Minister of Environment and Physical Planning

The 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) including:

- all species listed in the annexes of the CITES (List 1);
- species listed in the annexes of the EU Regulation for protection of wild flora and fauna through regulation of trade (338/97/EC) (List 2);
- List 3 comprises the national list of plant, fungi and animal species whose trade is regulated with licensing procedure (D4 or CITES).

According to the Law, the total quantity of endangered and protected wild species of plants, fungi, animals and their parts that are collected for commercial purposes shall be established on the basis of preceding assessment of the species status and opinion obtained from scientific and professional organizations about the population density of endangered species in natural habitats every year and it is not implemented in practise.

Submission of applications for import, export and transit permits by business community, as well as issuance of the permits by the competent institution (MoEPP) are carried out electronically through a single-window system for import, export and transit of goods (EXIM), established in 2009 to connect MoEPP, Customs Administration, companies and other competent institutions and agencies. More information on export of wild species of plants and fungi is presented in Chapter 4.2.10.

Possibility for restriction or prohibition of use of certain species in case when the favourable conservation status of the species or habitat types is endangered due to unreasonable use of the natural resource is given in the Law on nature protection (Article 14). Collection and trade of the plant species Gentiana lutea and Gentiana punctate is prohibited with Ministerial decision since 2006.

7.1.3.2 Game

The Law on Hunting prescribes the protection of 133 species determined as game (110 birds and 23 mammal species) of which only 14 species are game without protection. Three ways of protection are prescribed for the protected game: closed season, temporary and permanent protection (Articles 11, 12 and 13). A coherent link between this law and the Law on nature protection need to be provided in order to avoid duplications that might jeopardise implementation of both laws.

Based on the conducted analysis of species determined as game and species designated as strictly protected and protected (under the Lists determining strictly protected and protected species of wild plants, fungi and animals), it has been concluded that six species of mammals have been designated as strictly protected species and two species as protected – of which 5 strictly protected species and 2 protected species are considered game under permanent protection in accordance with the Law on Hunting.

Out of 77 bird species designated as strictly protected, 71 species are under permanent protection and one species under protection through hunting closed season in accordance with the Law on Hunting, and five species are not considered game or protected species.

Group	Law on Nature Protection		Law on Hunting		
			Closed season	Temporary protection	Not recognized as game
Mammals	Strictly protected	6	5		
	Protected	10	2		
Birds	Strictly protected	77	71	1	5
	Protected	29	1	25	3

7.2 Protection of habitats and ecosystems

According to the Law on Nature Protection, protection of ecosystems and habitats shall be carried out by way of implementing general measures and activities for nature protection, by using the natural resources in a sustainable manner, and by spatial planning and spatial development (Article 47) ensuring their favourable conservation status (Article 48). Preparation of several bylaws with national list of habitat types including habitats map, their importance, assessment of threat status (Article 49) as well as measures for preserving the types of habitats in a favourable conservation status (Article 50) requires urgent attention and efforts. Provisions of other sectoral laws are also relevant for conservation of different ecosystems and habitats.

The use of forest ecosystems within the protected areas is prohibited in accordance to the Law on Nature Protection (Article 54). The conservation of the biological diversity of the forest ecosystems shall be carried out by way of protecting the forests within the frames of the protected areas, through the Programme for management of forest habitats within protected areas that is a part of the protected area management plan. The conservation and protection of forest ecosystems shall be provided according to the principles of sustainable development, conservation and maintenance of the natural composition of the species and their natural renewal, as well as maintenance of ecosystem services.

This provisions are overlapping and interfere with the Law on Forests, which regulates issues related to planning, management, use, protection of forests and its provisions are applied to all forests and forest land regardless of the ownership and use (Article 1). Specific obligation is given to the management authorities of protected areas – the measures prescribed in the general and specific plans for management and protection of forests shall be incorporated in the protected area management plan, and the content, preparation and adoption of the special plan for protection of forests within protected areas shall be prescribed by the Minister responsible for forestry (Article 29).

General provisions for waters protection and conservation of biological and landscape diversity in wetlands are contained in the Law on Nature Protection (Articles 55-59), including prohibition of watercourses partition in a way that contributes to degradation of the habitat, reduction of water quantity below biological minimum, drying out, covering of springs, marshes and other wetlands, undertaking measures and activities to prevent pollution of aquatic habitats and waters that enter aquatic habitats, prohibition of construction of facilities or management of natural resources along natural springs, along the banks of natural watercourses, shore areas of natural or artificial lakes, as well as flooding plains of watercourses. These regulations are insufficiently enforced in practice.

The Law on Waters stipulates several specific measures for conservation of wetlands, the goal of which, inter alia, is to provide: protection, conservation and permanent improvement of available water resources, improvement of the status of riverine land, aquatic ecosystems and water dependent ecosystems, protection and improvement of aquatic environment through rational and sustainable use of waters, as well as progressive reduction of harmful discharges and gradual elimination of emissions of dangerous matters and substances into waters. According to Article 96 of the Law on Waters, the Government of the Republic of Macedonia determines areas designated as protected natural heritage where maintenance and improvement of the status of waters is an important factor. Protection measures should be specified for zones intended for protection of plant and animal species living in or depending on water and are economically important. Such areas have not been designated yet.

Protection of biological and landscape diversity of pasture habitats and grasslands is secured through their traditional use, as prescribed by the Law on Nature Protection, Article 60. The manner of use and the protection of important or endangered types of pasture habitats shall be prescribed by both Ministers responsible for nature protection and in consent with the Minister responsible for the affairs of agriculture and forestry. Additionally, protection measures for grasslands should be prescribed by the Law on pasture management. However, the existing law (adopted in 1998) does not regulate contemporary trends / needs of the area and does not comply with other relevant laws, so its full revision is required.

In order to protect the biological and landscape diversity of the high-mountain habitats and ecosystems, any anthropogenic activity shall be forbidden, except the one related to the traditional stockbreeding, as well as ecotourism in compliance with the principles of sustainable development.

7.3 Protected areas

Designation of protected areas in the Republic of Macedonia started in 1948 when the first National Park "Pelister" was proclaimed. Most of the protected areas were proclaimed during 1960s, 1970s and 1980s and included different bigger and smaller size areas covering different types of habitats, but also different rare, endemic and relict species. During the process of proclamation status of threat to habitats and species was not considered seriously. Some of the protected areas were proclaimed for the purpose of geodiversity or fossils preservation. Moreover, the areas were proclaimed at different levels (national or local), the boundaries were not clearly defined, management entities not nominated (except for the three national parks), and objectives of management are unclear.

At present, the network of protected areas in Macedonia is not a coherent system – it covers areas proclaimed in different periods, according to different categorizations and with different goals. The Law on Nature Protection provides solid legal basis for establishment of representative and efficient system of protected areas, for the purpose of protection of the biological diversity within the frames of the natural habitats, the processes occurring in the nature, as well as the abiotic features and the landscape diversity (Article 65).The Law also encourages international cross-border connection with protected areas on the territories of neighbouring countries (Article 67).

7.3.1 National protected areas network

New categorization of protected areas in the Republic of Macedonia has been prescribed in the Law on Nature Pro-

tection, more or less harmonized with IUCN, compared to the previous categorization prescribed in the Law on Natural Rarities of 1973. The names of categories have been retained as those under IUCN categorization, maybe slightly modified or entirely changed. According to Ornat & Reinés (2007), categories of protected areas in Macedonia are classified as level 2 of harmonization with IUCN categorization, or categories are practically identical to those of IUCN, though IUCN is not referred to specifically in the national law.

The following categories of protected areas and their respective goals of management are specified in Articles 66-90 of the Law on Nature Protection:

1) Category I - (Ia) Strict Nature Reserve, and (Ib) Wilderness Area;
2) Category II - National Park;
3) Category III - Natural Monument;
4) Category IV - Park of Nature;
5) Category V - Protected Landscape; and
6) Category VI - Multipurpose Area.

Aiming to harmonize the system of protected areas with existing legislation, the Law on Nature Protection prescribes an obligation for revalorization and preparation of new acts for proclamation under the new categorization of protected areas in the period of 6 years (starting from 2005). In practice the whole process is realized very slowly. Declaring one area needs preparation of a study for valorization/revalorization with content prescribed in the bylaw adopted in 2012. In the process of (re-)proclamation public involvement is mandatory (Articles 92-97). After the adoption of the Law, re-proclamation procedure was implemented for 10 protected areas, for another area the procedure is commenced and 2 new protected areas were proclaimed.

At present, the network of protected areas in Macedonia comprises 86 areas proclaimed under the old categorization, under the new categorization and re-proclaimed areas. For the purpose of this analyses, areas proclaimed according to the old categorization were elaborated under appropriate IUCN category. Thus, protected areas network covers about 9% of the territory of the Republic of Macedonia. Number of protected areas distributed in different categories and the overall area they cover are presented in Table 20.

The act proclaiming protected area defines the boundaries of the protected area, different zones and allowed activities within the area – zone of strict protection, zone of active management, zone of sustainable use and buffer belt, as well as entity nominated to manage that area.

Efficient management of protected areas is a great challenge. The main obstacles to the more efficient achievement of the goals of the areas include insufficient capacity of entities mandated with the management of these areas. There is also a need to change the structure of the staff of protected areas managing entities by engaging properly educated staff able to respond to the goals of these protected areas management related to biological diversity conservation. So far, the only operational bodies are the public institutions of the three national Parks, and to some extent the Public Enterprise managing Multipurpose Area "Jasen". At the moment, the Municipality of Resen (nominated to manage the Natural Monument "Prespa Lake" and Park of Nature "Ezerani" employs maximum efforts to strengthen its management capacity with the support of international projects (UNDP/SDC project on Prespa Lake). Other municipalities obliged as managing entities of protected areas (e.g. Vevchani Municipality for the management of Natural Monument "Vevchani Springs", Municipality of Novo Selo for the management of Natural Monument "Smolare Waterfall", Dojran Municipality for the management of Natural Monument "Dojran Lake") have not established appropriate management body and face real problems with regard to the enforcement of the legislation on nature protection. Good example of transferred management right by municipality to a non-governmental organization with adequate capacity includes the case of the non-governmental organization "Izvor" from Kratovo which manages the Natural Monument "Kuklica" (dolls) and speleological society Ursus Speleos obliged by the Municipality of Makedonski Brod to manage the Natural Monument "Slatinski Izvori (Slatino Springs)".

Protected areas management plans are prepared by the entity nominated for management within 2 years from the area proclamation, in accordance with the content specified in the Rulebook (Official Gazette of the Republic of Macedonia no. 26/12); they are prepared for a period of ten years (Article 99), and the adoption procedure includes compulsory public consultation through organization of public debates. Three protected area management plans for NP Pelister (SDC Project for NP Pelister protection), NP Galichica (KfW project "Transboundary Biosphere Reserve Prespa Park – Support to national Park Galichica) and PN Ezerani (GEF/UNDP/MoEPP Project for Prespa Basin Protection) have been prepared with the support of foreign donors and adopted by management entities upon prior consent issued by MoEPP. Additionally, draft management plans have been prepared for 7 areas, but have not been adopted yet due to uncompleted procedure adoption of new act to proclaim

Category of protection according to IUCN	Number of sites	Coverage (ha)	% of the country territory
Ia. Strict Nature Reserve	2	7787	0.3
Ib. Wilderness Area	-	-	-
II. National Park	3	114870	4.48
III. Natural Monument	67	78967.5	3.0
IV. Park of Nature	12	3045	0.12
V. Protected landscape	1	108	0.004
VI. Multipurpose Area	1	25305	0.98
Total	86	230083	8.9

Table 20. Number and area of protected areas in different category of protection (Source: MoEPP, CDDA 2014).

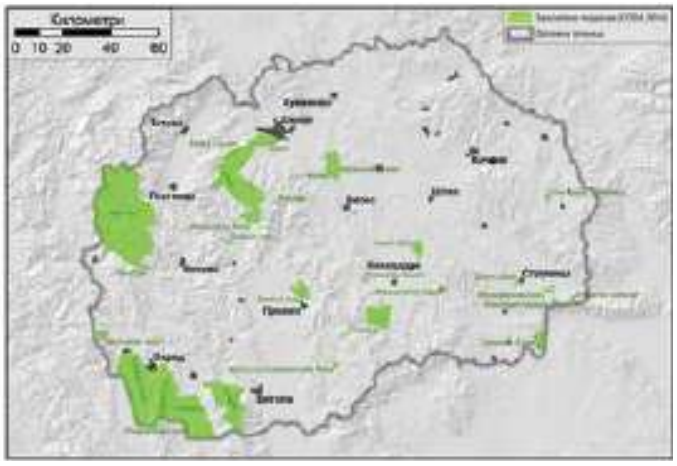


Figure 19. Map of protected areas in the Republic of Macedonia.

or re-proclaim the protected area. Protected areas that have management plans in place lack external evaluation of their implementation with regard to the achievement of the goals for which the protection has been established.

Spatial plans are adopted for the purpose of regulating and using the space in the protected areas (Article 103 of the Law on Nature Protection) – compulsory for the category of National Park, and as required for other categories of protected areas. The first Spatial Plans for NP Galichica, NP Pelister and NP Mavrovo were adopted in 1988 and they remain valid until the adoption of new plans. In the course of 2011, draft Spatial Plan was prepared for NP Galichica (for the period 2009-2020), and in the course of 2013-2014, the draft Spatial Plan for NP Mavrovo (for the period 2012-2030), but these have not been adopted yet.

Immediate protection of protected areas is implemented by ranger service established or appointed by the management entities (Article 108), and the manner of protection application is specified in Articles 109-112 and several by-laws. Ranger service has been established only in the three National Parks, Multipurpose Area "Jasen" and PN Ezerani and NM Prespa Lake.

Funding of protected areas is also great challenge because no resources for their funding, whatsoever, are allocated from the Budget of the Republic of Macedonia. The Law on Nature Protection stipulates different manners in which National Parks (Article 141-a) and other protected areas (Article 161) may generate financial resources and keep their own revenues (e.g. through fees for entrance in the protected areas or in specific facilities, for performance of activity in the protected area, compensation for use of resources, navigation, logo of the National Park on products and services for commercial use, ecosystem services and other sources). National Parks are self-financing institutions, which need to undertake entrepreneurship approach to cover their own expenditures. Most of the Parks take advantage of the proposed possibilities and support by donors, for the purposes of construction of infrastructure, preparation of management plans and support to technical staff. There is general expectation that investments made in tourist infrastructure development will contribute to the generation of significant revenues for management upon project completion. However, there is also a danger that the need for revenues generation in future might cause diverting the management towards commercial activities which is far from generating revenues required for protection focused management. Certain areas have potential to generate revenues beyond doubt, through tourism and use of resources or attract donors, while other areas of the same and even greater value cannot hope for financial sustainability (Apelton 2008).

Current network of protected areas is not efficient and copes with many challenges: the areas are proclaimed under different categorizations; the process of re-proclamation is going on very slowly; there is notable difference in the position of protected areas between eastern and western parts of Macedonia (Figure 19); major part of the areas do not have management entities or nominated entities have insufficient capacity or fail to implement any measure/activity (nominated only on paper); management plans have been prepared only for the national parks and few other areas; besides the legal grounds for funds allocation from the central budget, protected areas are still self-financing.

7.3.1.1 Natural rarities

Additional form of protection – proclamation of natural rarities was introduced with the amendments of the Law on Nature Protection in 2010 (Article 90-a). The following may be proclaimed as natural rarities: certain rare, threatened and endemic plant and animal species, their parts and communities, relief forms, geological profiles, paleontological and speleological objects (if their area is smaller than 100 ha) owing to their scientific, aesthetic, health and other significance, cultural, training, educational, tourist and recreational function.

Apart from the fact that natural rarities are proclaimed by the Minister of environment, the procedure for their proclamation is much shorter, no major financial resources are required and measures for these localities protection can be implemented rapidly, the 91 proposed areas (in the frames of GEF/UNDP/MoEPP project Strengthening of ecological, institutional and financial sustainability of the system of protected areas in the Republic of Macedonia) have not been proclaimed as natural rarities yet. The proposed items include mainly individual or group of tree trunks (Plane tree, Marsh oak, Pubescent oak, Italian oak), speleological objects, small localities of geomorphological (Volcanic Bombs, Pilav Tepe, etc.), hydrological (Studenchica, Izvor Popolzhani) or paleontological significance (Stamer, Belushka, Dechki Kamen, etc.) or small forest stands (Golem Kozjak – white pine reserve, Gornjani – Turkey oak reserve, etc.).

7.3.1.2 Representative national network of protected areas

In 2010, detailed analysis was made of all protected and proposed for protection areas included in the Study of the Natural Heritage under the Spatial Plan of the Republic of Macedonia (adopted in 2004) and other documents, as part of the UNDP/GEF project Strengthening of ecological, institutional and financial sustainability of the system of protected areas in the Republic of Macedonia and representative national network of protected areas and areas proposed for protection was proposed as a result (Table 21, Figure 20), that will contribute to more efficient conservation of species, habitats and ecosystems of national and global importance.

Representative national network of protected areas includes 99 areas, 34 of which have been already protected, 42 proposed under the Spatial Plan of the Republic of Macedonia and 23 newly identified areas. It covers an area of around 20% of the national territory and is in accordance with the goals of the Convention on Biological Diversity by 2020. Even more important, the network includes areas of different natural values (marshes, mountain areas, alpine, forest areas, lowland and even semi-natural ecosystems) compared to the old system of protected areas (legally not existing yet) which was oriented more to forest, alpine and lake ecosystems.

Information on the status of natural heritage in the Republic of Macedonia and the need to establish system of protected areas with representative national network of protected areas was submitted to the Government of the Republic of Macedonia in the course of 2013 and considered as information material, but it is not used as basis in the process of protected areas proclamation.

	Category	Number of areas by category	Total area	% of the national territory
Protected areas	SNR	2	470.76	
	NP	3	115713.21	
	NM	20	85517.03	
	PN	7	3164.11	
	MPA	2	31529.39	
Total		34	236394.5	9.19
Areas proposed for protection (under the Spatial Plan of RM)	NP	2	85116.98	
	NM	21	17951.12	
	PN	17	18696.42	
	PL	2	30006.27	
Total		42	151770.79	5.90
Newly proposed areas for protection	NP	1	16767.09	
	NM	10	15361.82	
	PN	8	10689.72	
	PL	4	89649.76	
Total		23	132468.39	5.15
Total		99	511265.36	20.25

Table 21. Representative protected areas network.

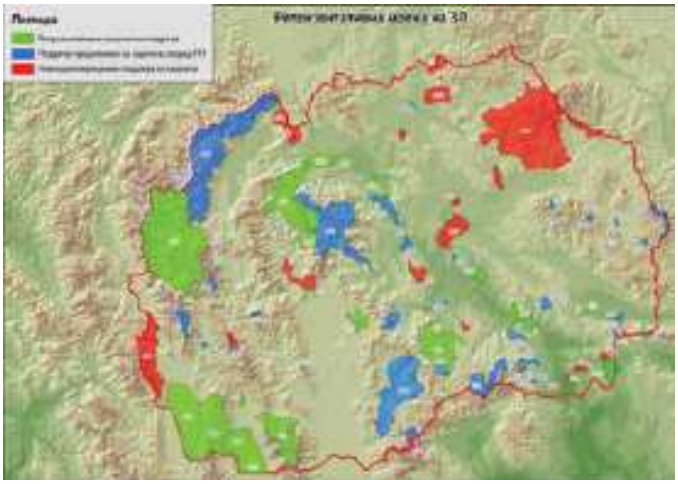


Figure 20. Map of protected area representative network.

7.3.2 International protected and designated areas

Protected area or natural rarity may be nominated for acquisition of internationally recognized status of natural heritage under Article 91 of the Law on Nature Protection in accordance with international agreements ratified by the Republic of Macedonia. Several areas in the Republic of Macedonia have international status of protection, and higher number of areas important for birds, plants and butterflies have been identified and designated in accordance with international criteria.

7.3.2.1 Ramsar sites

Convention on Wetlands of International Importance (Ramsar, 1971) establishes network for international cooperation for protection and sustainable use of wetlands. The network of Ramsar sites is aimed at protecting aquatic ecosystems characterized with great richness of biological diversity, but sometimes they are significantly threatened at global level and therefore they have vital role in the protection of migratory paths of waterfowls. The world Ramsar list of wetlands of international importance includes two areas from the Republic of Macedonia – Prespa Lake in 1995 and Dojran Lake in 2007. National programme for wetlands conservation (which is an obligation of the Parties to the Ramsar Convention) has not been developed, measures for their protection and sustainable use have not been included in the national spatial plans, but only in certain protected areas management plans (e.g. for the Park of Nature "Ezerani").

7.3.2.2 UNESCO sites

United Nations Convention on the Conservation of Natural and Cultural Heritage (UNESCO) as common heritage of mankind is international agreement which for the first time links the concept of nature conservation and protection of cultural heritage in recognition of the interaction of people with nature and the essential need for their protection as balance between them.

In 1979, the Lake of Ohrid was enrolled in the List of the world heritage in accordance with the criterion on nature, and later (in 1980) extended by inclusion of the cultural and historical area, in accordance with the criteria on culture, and thus the area covers 83.350 ha. Draft Law on the management of the world cultural and natural heritage of Ohrid region has been prepared, but it has not been adopted yet.

In 2004, two more areas of exceptional natural values – the cave Slatino Springs (unique natural phenomenon and biggest of all caves explored so far in the Republic of Macedonia) and rock landscape Markovi Kuli (consisting of numerous diverse forms forming exceptional relief with representative sculptures) have been enrolled in the Tentative List of UNESCO.

In 2014, the first biosphere reserve Ohrid-Prespa was designated in accordance with the criteria of the UNESCO's "Man and Biosphere" Programme. Preparation of the required documentation for biosphere reserve nomination was carried out in the period 2012-2013 through involvement of all relevant structures from the two countries – Republic of Macedonia and Republic of Albania – supported through the Project Transboundary Biosphere Reserve Ohrid-Prespa – Support to Prespa National Park in Albania. Elaboration of proposal for establishment of biosphere reserve Osogovo is in progress.

7.3.2.3 Important plant areas

Important Plant Areas (IPAs) are the most important sites in the world for diversity of wild growing plants (Radford & Odé 2009). IPAs are defined as areas with natural or semi-natural habitats abundant in specific plant diversity, i.e. rare, threatened and/or endemic plant species and/or plant communities of great botanical value. This mechanism has been accepted at global and European level as contributing to the conservation of plants that are important for their rarity or uniqueness, due to over-exploitation or for their rarity and/

or uniqueness due to over-exploitation or being threatened for other causes. Identification and designation of IPAs in Europe has been initiated by PlantLife International and take place in accordance with defined criteria that are applicable on global level based on the presence of: A – endangered species, B – plant diversity, C – endangered habitats.

Identification of IPAs in the Republic of Macedonia was carried out in the period 2003-2009, resulting in identification of 42 IPAs covering around 459.425 ha, or almost 18 % of the national territory (Melovski at al. 2010). Some of these Important Plant Areas cover large areas (mountain massifs), and some have relatively small areas (areas with wetlands and areas with steppe like vegetation). Five areas are characterized with globally threatened species, though there is a need to undertake further analysis in Macedonia for many endemic and subendemic species. Forests and grasslands are the most frequent IPAs in Macedonia, covering 85% and 67% respectively of the identified IPAs, where such habitats are often predominant vegetation types, especially the 18 mountainous IPAs. From among grasslands, dry pastures are the most frequent (on 20 IPAs), followed by alpine and subalpine pastures (12 IPAs). Rare habitats or habitats with sparse vegetation are also frequent on IPAs in Macedonia and occupy 60% of the overall IPAs.

Protection of these areas on national level is insufficient – only 13 IPAs (in full or in part) are protected on national level. Twelve IPAs are transboundary, i.e. Important Plant Areas positioned on the border with neighbouring countries.

7.3.2.4 Important bird areas

The programme for Important Bird Areas (IBAs) is initiative carried out by BirdLife International on global level in order to provide conservation of areas that are important for the conservation of globally endangered bird species and species of European interest for conservation, areas for migratory birds which gather in high number, areas for birds specific to a small region and areas where groups of species specific to a given biome can live (Heath & Evans 2000).

The First List of IBAs for the territory of Europe was published in 1989, where ten areas covering total area of 2709 km2 (around 10% of the Republic of Macedonia's territory) were identified in Macedonia (as part of SFRY). The latest review of the Important Bird Areas in Macedonia was made in the course of 2010 resulting in identification of 24 IBAs covering an area of 6709 km2 or 26.9% of the national territory (Velevski et al. 2010).

For the purpose of the selection of areas of European importance, 26 species constantly present during nesting seasons were used, for which it was deemed that the approach of locality based protection is appropriate for Macedonia. 22 localities meet the criteria for globally important areas – three localities (Ohrid, Prespa and Dojran Lakes) meet the criterion A4 – co-generation (above 1% of the global population of waterfowls or more than 20.000 waterfowl individuals), eight areas support important populations of species specific to Mediterranean biome, and three other areas host important populations of species specific to European alpine biome. The network of IBAs includes 80-100% of the national populations of globally threatened species, while the coverage of other species ranges between 7% and 100%, reaching above 40% for most of the species.

Protection of these areas on national level is insufficient – only few areas are fully protected (Prespa Lake, Tikvesh Lake, Demir Kapija and Radika River Basin), and most of them lack any measure for protection. The network of IBAs overlaps with the network of protected areas in only around 10%, which is insufficient to preserve priority species of birds. Additional challenge is the need for precise determination of IBAs for forest bird species.

7.3.2.5 Prime butterfly areas

Prime Butterfly Areas in Europe are in the initial stage of selection, aimed at target species of priority for conservation in this huge diverse region. Three main criteria are used in determining the Prime Butterfly Areas, namely (Warren & van Swaay 2003): global distribution of the species is limited to the area of Europe; species is listed in Appendix II of the Bern Convention and/or Habitats Directive and the species is endangered according to data available in the Red Book of Europe's butterflies.

There are five target butterfly groups in Macedonia according to which Prime Butterfly Areas are identified: Euphydryas aurinia, Euphydryas maturna, Lycaena ottomana, Maculinea arion and Parnassius apollo. Taking into account the distribution of these species, eight prime butterfly areas have been identified on the territory of Macedonia. Three of the eight areas already have certain protection on national level (part of Baba Mountain, Galichica and the Gorge of the river Radika are within the boundaries of the existing national parks). In the course of 2007, project activity was carried out in order to identify new prime butterfly areas in border areas with Serbia and Bulgaria (Micevski & Micevski 2008).

7.4 Ecological networks

Ecological network is a system of mutually connected or spatially close ecologically important areas, connected by natural or artificial corridors, which by balanced biogeographical distribution contribute significantly to the protection of natural balance and biological diversity. Establishment of national ecological network comprising besides ecologically important areas also a system of ecological corridors, protected areas and areas proposed for protection, as well as ecologically important areas for European Union – Natura 2000, is stipulated in the Law on Nature Protection (Article 53). This will provide functional protection of biological diversity outside protected areas as well.

Establishment of the national ecological network is envisaged in several national strategic documents, such as: Spatial Plan of the Republic of Macedonia (2004) (basic elements are defined in the Study on the protection of natural heritage of 1999, Second NEAP (2006) and First NBSAP (2004).

7.4.1.1 National ecological network (MAK-NEN)

National ecological network (MAK-NEN) was elaborated in the period 2008-2011 (Brajanoska at al. 2011). Brown bear (Ursus arctos) was taken as target species in the identification of the core areas, ecological corridors connecting core

areas, buffer zones and restoration areas. The produced MAK-NEN map includes 13 core areas (crucial for maintenance of stable population of the bear), 26 corridors (12 linear, 11 landscape and 3 stepping stone corridors), and buffer zones were established around most of the core areas of different width depending on natural relief characteristics and anthropogenic impact, as well as several restoration areas (Figure 21). Furthermore, 23 potential "bottlenecks" were identified mainly related to the development of transport and energy infrastructure which could in future grow into unpassable barrier for carnivore movement. Guidelines for protection and management of identified corridors are included in the Bear Corridor Management Plan (Brajanoska at al. 2011). MAK-NEN provides clear and easy to understand platform for its application by the relevant sectors in decision making in order to reduce the impact on biological diversity, and its inclusion in space planning documents and strategic documents of different sectors (forestry, transport, agriculture, energy, etc.).

Figure 21. Macedonian national ecological network.

7.4.1.2 Emerald Network / Natura 2000

Emerald network is a network of areas of special conservation interest designated to preserve the network of natural habitats and it is developed on the territory of the Parties to Bern Conventions. The main motive behind the development of this network is to contribute to the ecological network Natura 2000 in countries that are not member states of the European Union, using as much as possible similar methodological approach. Activities towards development of the national Emerald network in the Republic of Macedonia started back in 2002, and full identification was finalized in 2008. Total of 35 areas is included in the national Emerald network covering total area of 752.223 ha, which is around 29% of the territory of the Republic of Macedonia (MoEPP 2008). 20 of these areas are located in alpine biogeographical region (Western Macedonia), and the rest of 15 in continental region (Eastern Macedonia). 12 Emerald areas are fully, two partially protected on national level within the boundaries of existing protected areas, while the rest is outside the network of protected areas.

In the process of integration into European Union (upon awarded candidate country status in 2005), the Republic of Macedonia is obliged and committed to respond to the requirements of the EU, including implementation of the two most important directives on nature – Habitats Directive and Bird Directive which are the grounds for the establishment of the Natura 2000 network. Sectoral Strategy for approximation in the segment of nature and forestry (prepared in the frames of the CARDS 2006 Project "Strengthening of environmental management in the Republic of Macedonia") included detailed gap analysis on the basis of which actions necessary for full legal transposition and practical implementation of the two Directives were defined. So far, activities have focused on directives transposition into national legislation through implementation of several projects by MoEPP, as well as non-governmental organizations, and identification of Natura 2000 sites has not started yet. Identified important areas for birds, plants and butterflies and Emerald areas can certainly serve as good basis for their implementation.

7.4.1.3 Balkan Green Belt

The idea for establishment of the green belt along the border of the former "iron curtain" between East and West during the cold war was initiated in 2002 by BUND and BfN on the basis of different existing regional initiatives and first conferences on the European Green Belt were organized together with IUCN during 2003 and 2004 in order to establish the grounds for the ecological network to serve as global symbol of cross-border cooperation for the purpose of nature protection and sustainable development. Its vision is to conserve and restore the shared natural heritage along the former iron curtain as ecological network connecting high natural values and cultural landscapes, while taking into account economic, social and cultural needs of local communities. The Green Belt crosses 24 European countries (length of 12500 km), starting from Barents Sea up to Black Sea and it is divided into three parts: Fennoscandian, Central European and Balkan Green Belt.

Republic of Macedonia is part of the Balkan Green Belt, together with Romania, Serbia, Montenegro, Bulgaria, Greece, Albania and Turkey, which though not directly affected by the cold war were also kept under strict control, so that border areas were isolated landscapes with natural preserved habitats free of human activities. The Green Belt in Macedonia stretches along the three national borders to Bulgaria, Greece and Albania, with different width, and covers an area of 5125 km2 (around 20% of the country's territory). It incorporates 11 protected areas (the three national parks, the three natural lakes and other lower category protected areas) and a number of areas proposed for protection. In the frames of this initiative, during the past years, several project activities have been implemented with regard to valorization and elaboration of proposals for protection of several areas included in the Balkan Green Belt – Osogovo Mountains and Jablanica. In 2013, the Joint Declaration of Intent for the European Green Belt was signed by MoEPP.

8 Research and monitoring
8.1 Biological diversity research

The volume of knowledge of biological diversity, especially some of its components, has enhanced during the period 2003-2013. Thus, for example, around 250 taxa new to science have been described (6 higher plants, more than 170 taxa of diatomeous algae and 56 invertebrate species) and hundreds of previously unregistered species have been registered for the first time (23 higher plants, 237 fungi species, and estimate of the number of invertebrates has increased from around 10000 to around 13400 species). Quantitative assessments of the populations of certain priority species (e.g. Balkan lynx, several bird species) have been made, and trends in the populations of certain bird species (griffon vulture, Egyptian vulture, lesser kestrel, imperial eagle) have been documented.

The first report aimed at comprehensive presentation of the status of biological diversity in the Republic of Macedonia is the report Analysis and Valorization of Biological Diversity, developed in 2009 (Petkovski, 2009a) in the frames of GEF/UNDP/MoEPP Project on protected areas, enclosing Catalogue of species in digital form as well (Petkovski, 2009b).

Significant progress has been achieved in the course of the last several years in the knowledge of algae diversity, especially diversity of silicate algae (diatoms). Monograph and several scientific papers on diatoms in Ohrid and Prespa Lakes (Levkov et al. 2007; Levkov & Williams 2011, 2012; Cvetkoska et al. 2012; Jovanovska et al. 2013) have been published, describing 75 species new to science. Later on, detailed taxonomic research was conducted with regard to individual genera, such as Amphora (Levkov 2009), Luticola (Levkov et al. 2013), Eunotia (Pavlov & Levkov 2013), Hippodonta (Pavlov et al. 2013), Diploneis (Jovanovska et al. 2013) including taxa from geologically old lakes (Ohrid, Prespa and Dojran), sub-alpine and river habitats, as well as extreme habitats (thermal springs, aerophyts and epizoics). In the frames of these and other studies, around 60 species new to science have been described and high number of species has been registered for Macedonia.

During the past period, continuous research work has been carried out with regard to fungal diversity in Macedonia, especially for macromycetes, resulting in 2000 taxa identified and enrolling the country among one of the best explored regions in Europe. Furthermore, several papers elaborating numerous new and rare species of fungi in Macedonia have been published (Karadelev et al. 2007, 2008, 2009; Karadelev & Murati 2008, Doğan & Karadelev 2009). Detailed taxonomic research was conducted for the genera Phellinus (Karadelev & Spasikova 2006), Tulostoma (Karadelev & Rusevska 2009), Phallus и Scleroderma (Karadelev et al. 2009), while specific publications elaborated underground (Chavdarova et al. 2011), medicinal (Bauer-Petrovska et al. 2006, 2008)and poisonous fungi in Macedonia (Karadelev & Spasikova 2006, 2009). New species of the phylum Ascomycota (Karadelev et al. 2009, 2014) were also published. Furthermore, systematic research was conducted of the micro diversity of certain regions in the country, including the mountains of Ograzhden, Jablanica, Jakupica, Korab and Dobra Voda (Karadelev et al. 2009 a, b, c, d). As of recently, intensive work has been done to conserve fungi and establish the basic Red List of fungi in Macedonia (Karadelev & Rusevska 2012), in which 213 fungal species were categorized according to IUCN criteria.

Intensive floral research has proceeded during the past period on the whole territory of the Republic of Macedonia. For the first time, synthesis overview of the bryoflora of Macedonia was published (Cekova, 2005), covering 397 taxa and this paper contains all literature data listed by a number of authors for the bryoflora of Macedonia until that date. Later on, Martinčić (2009) listed 75 new taxa, while Papp & Erzberger (2012) registered 43 new taxa. Further research of taxonomy and horology of taxa in this group in the Republic of Macedonia is necessary to complete the knowledge of the real number of taxa.

Continuous investigations under the Project "Flora of the Republic of Macedonia" implemented by the Macedonian Academy of Sciences and Arts resulted in publication of the 6th and the last book of volume I of the edition "Flora of the Republic of Macedonia" (Micevski & Matevski, 2005), finalizing the work on the families of the group Choripetalae. In 2010, the First book of the II volume of the edition "Flora of the Republic of Macedonia" (Matevski, 2010) was published and initiated the elaboration of the families of the group Sympetalae. Certain number of flora data was also obtained through implementation of different projects (veg-

Number of volume	Fam.	genus	species	subsp.	var.	form	Number of taxa
Flora of RM I,1 (1985)	27	57	163	28	25	53	69
Flora of RM I,2 (1991)	13	54	249	87	67	66	469
Flora of RM I,3 (1993)	17	86	363	57	69	39	528
Flora of RM I,4 (1998)	16	71	323	32	82	35	472
Flora of RM I,5 (2001)	8	44	277	57	125	38	497
Flora of RM I,6 (2005)	20	84	244	72	54	26	356
Flora of RM II,1 (2010)	7	40	131	37	15	5	188
Total processed	108	436	1750	370	437	262	2779
Unprocessed taxa (Sympetalae)	19	160	870				
Unprocessed taxa (Monocotyldonae)	20	150	600				
Total (processed + unprocessed)	147	746	ca 3220				

Table 22. Overview of processed (and not processed) families, genera, species and lower taxa in the edition "Flora of the Republic of Macedonia" (I/1-6, II/1).

etation investigations, studies of (re)valorization of certain protected areas, etc.). Significant flora data is mentioned in the two monographic studies of Macedonian steppe (Matevskiet al.2008) and forest vegetation of mountainous massif of Galichica (Matevski et al. 2011). Teofilovski (2011) published significant floristic data on Suva Gora Mountain, but also on other parts of Macedonia. Here worth mentioning are the monographs on the natural values of Monospitovo Swamp (Melovski et al. 2008) and Shar Planina Mt. (Melovski et al. 2010).

With regard to reptile distribution in Macedonia, the work of Sterijovski et al (2014) is of particular importance, as it presents numerous data and maps of distribution for all 32 species of this class found in Macedonia. Quantitative investigations of herpetofauna on the Island of Golem Grad in Prespa Lake were conducted, with an accent on Hermann's tortoise, dice snake and nose-horned viper, and results have been published only partially so far (Sterijovski et al. 2011; Ajtić et al. 2013).

Apart from the Catalogue of Petkovski (2009), there is no synthesis list of bird fauna in Macedonia. Yet, it is known that ornithofauna of Macedonia counts 333 bird species (Velevski et al. 2013) and the numbers and trend of population is known only for limited number of them. During the last decade, review of the Important Bird Areas (Velevski et al. 2010) has been carried out (see Chapter 7.3.2.4).

List and Catalogue of mammals in Macedonia with comments on distribution and overview of endemism are provided by Krystufec & Petkovski (2003, 2006), according to which 83 mammalian species are listed for the Republic of Macedonia

In the course of the last 10 years, more than 300 scientific works dealing with biological diversity of invertebrates in Macedonia have been published. Minor part of these scientific publications is monographic works. It is worth to mention the attempt of Petkovski (2009) towards cataloguing the fauna of Macedonia, lists of snail species (Stankovic et al. 2006), orthopterans (Chobanov & Mihajlova 2010) and ants (Karaman 2009). Prominent publications dealing with invertebrates in Macedonia include editions on Orthoptera (Micevski et al. 2003) and daily butterflies (Micevski&Micevski 2005) in NP Pelister and daily butterflies in NP Galichica (Krpac et al., 2011). Eight Prime Butterfly Areas have been designated in Macedonia (Van Swaay & Warren 2003), and worth mentioning is the proposed Red List of daily butterflies of Macedonia (Krpač & Darcemont 2012) and Orthoptera (Lemonnier-Darcemontet al. 2014).

8.2 Biological diversity monitoring

Department of Nature within MoEPP is responsible for the performance of the status of biological diversity and geo-heritage and undertakes measures for protection and conservation. The Law on Nature Protection (Article 154) requires adoption of methodology for monitoring performance, but such bylaw has not been developed so far.

With reference to aquatic ecosystems and their biological diversity, NHS is the responsible institutions. Monitoring of large natural lakes is an obligation of the Hydrobiological Institute in Ohrid. Besides the said institutions, biological diversity monitoring should also involve the entities mandated with protected area management, while expert assistance should be provided by faculties, institutes and museums. Entities responsible for biological diversity monitoring often have smaller than necessary capacity, and it needs to be enhanced in technical and expert terms – besides the necessary knowledge of biology and ecology of target species and habitats/ecosystems, relevant knowledge of spatial and temporal statistical analyses is needed as well. Data from the monitoring is not gathered into a single integrated database.

In practice, specific monitoring activities of the components of biological diversity are carried out only in the frames of different projects implemented by different organizations. Since 2010, the Public Institution National Park of Galichica performs activities on regular basis under the Programme for long-term monitoring in the Park and it is composed of 5 thematic components, namely: (1) monitoring of inanimate nature; (2) monitoring of forest plant communities/habitats; (3) monitoring of grassland plant communities/habitats; (4) monitoring of plant species and (5) monitoring of animal species.

8.2.1 Monitoring of biological diversity of aquatic ecosystems

The existing hydrological monitoring network operated by NHS consists of 110 monitoring stations in total. However, less than half are operational. Most of the non-operational stations are actually poorly maintained or cope with unremovable defects. Active stations do not perform all measurements on regular basis. These stations measure only hydrological parameters – water level, temperature, flow and sedimentation.

Biomonitoring is integral part of the systematic water quality monitoring. In 2011, biomonitoring in Macedonia was carried out on 9 watercourses at 16 measuring points. The following biological elements are used to assess the quality: composition and abundance of aquatic flora and composition and abundance of benthos invertebrate fauna. Collection of biological material takes place five time in a year (February, April, June, August and October), covering the four seasons. Based on the analyses completed in 2011, it may be concluded that 95% of them indicate that waters in the controlled watercourses have quality of second class, and only 5% are of first class quality. Hydrobiological Institute from Ohrid participates in the monitoring of lakes, especially Ohrid, Prespa and Dojran Lakes. In addition to this, measurements are performed on rivers entering the lakes, littoral before them and one measuring point in the pelagial of each lake. Monitoring network consisting of eight monitoring points on rivers and 5 monitoring points in the lake itself has been established on Prespa Lake. According to data, surface waters of the lake are classified as acceptable, and upper courses of the rivers Brajchinska and Kranska are classified as excellent, while poor status is recorded in the lower courses of the rivers Golema Reka and Istochka Reka.

8.2.2 Monitoring of forests

In performing intensive and permanent monitoring of forest ecosystems with regard to the damage caused by atmospheric impacts and other natural disasters that alter the state of forests and forest land, the body of the state administration responsible for the affairs in the area of forestry adopts programme of measures and activities for collection of data on the extent of damage of forests and establishes register of the extent of damage of forests. The programme is adopted for a period of two years, and it is prepared and implemented by the faculty of Forestry at the Ss. Cyril and Methodius University in Skopje. The manner to collect data on the extent of damage of forests, the form, the content and the manner of keeping the register of the extent of damage of forests, as well as the manner of data use are prescribed by the Minister managing the body of the state administration responsible for the affairs in the area of forestry.

In practice, in the frames of different projects, research is carried out through which certain specific changes affecting the state of forests are observed. Thus, in the National Park "Pelister", restoration of the old Macedonian pine forest is observed through monitoring of the process of Macedonian pine recovery. The reporting diagnosis and prognosis (RDP) service of the Faculty of Forestry in Skopje, through network of bio-indicating points, monitors the changes in forest health status on national level. In order to protect forests and forest land on the whole territory of the Republic of Macedonia, measures and activities are implemented to protect biotic, abiotic and other factors that may cause harmful consequences in forests.

While performing the activities for forest protection, forests users are obliged to notify, in a timely manner, the body of the state administration responsible for the affairs in the area of forestry or the authorized person performing technical and advisory work in the private forest of each new and unusual occurrence that might cause damage in the forest and act as requested by reporting and diagnosis service. This system of notification functions well in practice – all regional offices and administrations of the National Parks and others, whenever they note calamity occurrences (mainly caused by insects or diseases) will notify RDP service at the Forest Protection Department of the Faculty of Forestry – Skopje in writing, upon which inspection is conducted on the spot and opinion and recommendations are issued with regard to appropriate measures undertaking. Twice a year, RDP service submits report on the forest health status to the MAFWE.

Targeted monitoring of forest habitats and species living therein (forest biodiversity) is not implemented fully, because monitoring is targeted primarily at forest diseases and insects causing calamity occurrences and major damages on forest, i.e. it refers to forests mainly as resource. It is necessary to extend the monitoring in future with regard to biological diversity.

With reference to forest fire monitoring, entities managing the forests are obliged to collect data on forest fires and within eight days from the day of fire outbreak at latest they are obliged to report on this to the body of the state administration responsible for the affairs in the area of forestry.

In order to improve the monitoring over forest fires, prevention, factors and causes, type and scale of fires, participants in fore extinguishing and costs of extinguishing, damages caused, it has been planned to establish and maintain Central Information System and register of forest fires within the body of the state administration responsible for the affairs in the area of forestry.

8.2.3 Monitoring of species and habitats

Monitoring of certain important species is performed in the frames of certain species. Thus, continuous monitoring of vultures in Macedonia has been carried out by the Macedonian Ecological Society since 2003 within the Vulture Conservation Project in Macedonia. Monitoring of the lynx is performed continuously from 2006 (by camera trap method) in the frames of the Balkan Lynx Recovery Programme by the Macedonian Ecological Society.

Due to intensified threats against biological diversity in the period 2003-2013, negative trends in the populations of certain species have been recorded. Major part of known trends in species populations the monitoring of which has commenced in the past period are negative. During this period, full extinction of bearded and black vultures from Macedonia was observed, with drastic decline in the number of griffon and Egyptian vultures (Figure 22), primarily as a result of easily accessible chemical preparations used for wolf and dog poisoning.

The Midwinter Waterfowl Census on the three natural lakes, also including given artificial lakes and fishponds, is performed irregularly, with interruptions owing to fund availability, though with increased intensity in the last several years. The Census in Ohrid Lake has been performed on several occasions (Micevski 1996; Micevski & Schneider-Jacoby 1997; Fremuth et al. 2000). Midwinter Waterfowl Census on Prespa Lake in Macedonia has been performed irregularly, too, but valuable data exists for 1987–1990, 1997–2002, 2004–2006 и 2009–2012 (Micevski & Schneider-Jacoby 1997; Velevski et al. 2010; Catsadorakis et al. 2013). In 2009, Transboundary monitoring plan was adopted for Prespa region (Perennou et al. 2009), which enabled synchronized counting of waterfowls in the three countries: Greece, Macedonia and Albania. According to the monitoring results for 2010-2012, the total number of wintering waterfowls exceed by far the Ramsar threshold of 20000 individuals and therefore the lakes have been classified as wetlands of international importance (Catsadorakis et al. 2013).

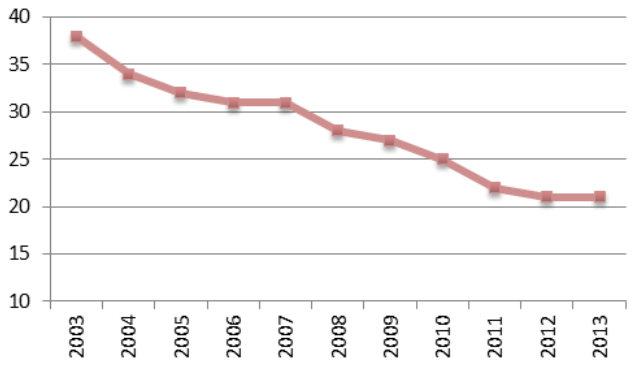


Figure 22. Trend in population of Egyptian vulture Neophron percnopterus (Velevski 2013, with supplement).

In the National Park of Galichica, in the frames of the thematic monitoring of inanimate nature through automatic monitoring station on the peak Tomoros (1673 m a.s.l.), the most important climate parameters (temperature of air and soil, relative air humidity, quantity of precipitations, height of snow cover, wind direction and velocity and intensity of solar radiation) are monitored. For biological diversity monitoring, 22 standard operational procedures (SOP or monitoring protocols) have been developed, five of which concern the following habitats: peon forest of Greek juniper, fir-mesic forests with Quercus frainetto, southwestern mesic fir-beech forests, Balkan cleared pastures and Balkan fir cleared pastures. The monitoring of plant species involves four protocols concerning endemic plant species (Crocus cvijicii, Centaurea tomorosii, Nepeta ernesti-mayeri and Sideritis raeseri) and one protocol for incidental detection of important vascular plant species. Animal species monitoring involves two protocols for invertebrates (Helix secernendaschlaeflii and Parnassius apollo), seven protocols for vertebrates (Triturus macedonicus, Algyroides nigropunctatus, Phalocrocorax carbo, Mergus merganser, Alectoris graeca, Pyrrhocorax graculus and Caprimulgus europaeus), protocol for monitoring of common bat species (Pipistrellus spp., Nyctalus leisleri and Eptesicus serotinus) and protocols for incidental detection of important mammal and bird species. Activities during the last four years have been focused on determination of the baseline or reference value for the parameters measured, in accordance with SOP, for the purpose of which three successive measurements are necessary during three years.

Hunters' associations and concessionaires of hunting grounds perform monitoring of the game number status. Based on such data, annual plan is prepared for implementation of the specific hunting management master plan (Law on Hunting, Official Gazette of the Republic of Macedonia no. 20/96 - Article 50). The Programme for fishery and aquaculture development in the Republic of Macedonia envisages establishment of full monitoring of fishery waters and system for information and networking, especially monitoring of the status of fish settlement, fish habitats and spawning grounds. Although game and fish monitoring is performed mostly for commercial purposes, these activities provide data on the status of certain species populations.

8.3 National information system on biological diversity

Serious step towards establishment of electronic records of natural heritage, biological diversity and nature protection was made in the period 2010-2011, when software application was developed, installed and tested on the central database: national information system of biological diversity" (NISBD) in the frames of the UNDP/GEF/MoEPP Project "Strengthening of ecological, institutional and financial sustainability of protected areas". During the implementation of this phase of the project, prior available information on biological diversity in the Republic of Macedonia synthesized as Catalogue of Species (Petkovski 2009) was transformed into database in Microsoft Access. At the same time, information under the component "Development of representative national network of protected areas" regarding protected areas and areas proposed for protection and identified as important for biological diversity, as well as existing data on biological diversity in several selected protected areas, was connected to the central SQL database and presented as NISBD. This system comprises data on around 10000 taxa, geographical and administrative data on around 250 areas and around 30000 entries of species distribution in these areas. The system provides access at several levels: administrator's level, entry of data and data review. System maintenance and upgrading for biological diversity envisaged signing of protocols for access to data with the relevant institutions and organizations in the country, as well as development of platform for cooperation with other institutions in the region possessing data on biological diversity of Macedonia for the purpose of their data inclusion in NISBD. At the moment, the system needs hardware and software upgrading, adoption of the necessary bylaws and training of adequate staff for its management.

Normative and practical establishment of NISBD will facilitate the management of administrative procedures and decision making by the bodies of state and local administrations towards efficient protection of natural heritage, gathering of data on biological diversity and focusing on scientific research of species and habitats, i.e. localities which are currently data deficient, but it will also enable promotion of natural values of the Republic of Macedonia, fostering of the development of various forms of alternative tourism and contribute to rural economy strengthening.

9 Education and public awareness

Capacity building and public awareness rising are the key factors in the achievement of the goals for biological diversity protection. Preservation of biological diversity is preconditioned by its understanding and appreciation, as well as its role in the maintenance of ecosystem and ecosystems services utilized and enjoyed by man.

Government bodies led by MoEPP and MES should demonstrate leadership in biological diversity protection through development of guidelines, strategies and regulations, but it is also important that those are accepted and implemented by all other sectors, primarily by business sector, industry, agricultural, forestry and energy sectors, as well as wider public. All these are important and should be incorporated in the process of education. In this way, we will be able to reach certain positive changes in the best and most efficient way. In any case, young population is the most important because it is the easiest to incorporate ecological knowledge, skills and attitudes in them which can later grow into ecological lifestyle with adequate level of environmental awareness. Such ethics can have positive influence and prove decisive in changes and processes in their surrounding and contribute to the improvement of the status of biological diversity. Of course, this does not mean that other groups should be neglected, but on contrary their education should be taken care of simultaneously.

Kermes oak (*Quercus coccifera*)

9.1 Formal education system

The level of environmental education of students in the educational system of the Republic of Macedonia has been explored for a longer period by Srbinovski et al. (2007), Srbinovski & Palmer (2007), Srbinovski (2003a, 2003b, 2003c, 2003d, 2003e, 2003f, 2003g, 2004a, 2004b, 2004c, 2004d, 2004e, 2005a, 2005b, 2005c, 2005d, 2005e; 2005f, 2006a, 2006b; 1998a, 1998b, 2002), etc. The results presented in these papers indicate that topics concerning ecology and environment protection, including biological diversity, have been represented more and more during the last decade.

Curriculum for nine-year primary education incorporates topics related to biological diversity, primarily curricula for IV, VI and VII grades (Bureau for Education Development 2014). Introduction in the basic characteristics and role of biological diversity is presented in the curricula of the first development period (I-III grades). In the subject "Introduction in environment", these contents are included in the topic "I am part of nature". Curricula studying the area of natural sciences are taught in the second development period (IV-VI grades) of nine year primary education, under the title Nature (IV grade), Natural Sciences (V grade) and Natural Sciences and Techniques (VI grade), in order to have student developed related, unique natural science understanding of the diversity of nature and world in wider context. Curriculum of the IV grade, in the subject Nature, includes general introduction in different types of habitats - essential living medial (soil, water and air) elaborated under the themes "Life in nature" and "Ecology". Under this theme, certain species of biological diversity are covered as well. In the textbook of Nature, these themes represent different types of natural habitats (pond, river, lake, meadow and forest) and man-made habitats (fishpond, park, field, etc.), indicating their mutual relations, usually presented through examples and photos.

Curriculum for sixth-grade students of eight year primary education includes contents devoted to plants, primarily their structure, function and classification, covering four kingdoms: Monera (bacteria), Protista (algae), fungi and plants (seedless plants and gymnosperms and angiosperms). Mainly wide known species are mentioned in this section (2-3 examples, etc.). Most of the plant diversity is presented through examples that are not specific to Macedonia or cultivated species, and very few data is presented of species diversity in Macedonia.

Curriculum for the seventh-grade students of eight-year primary education includes several themes related to animal study: structure of cells, tissues and organs of animals, relations with environment, etc. Under the theme "groups of animals and naming", classification of animal kingdom is elaborated, where biological diversity is presented by individual groups. Here also most of the contents are devoted to widely known species, primarily from other continents, and minor part deals to representatives specific to our area.

Study of biological diversity in high grammar and vocational school, according to curriculum and teaching plan (Bureau for Education Development, 2014) is represented in several topics, in the first and the fourth grades, such as: ecology, overview of fauna / organizational forms of life (system of five kingdoms). The topic overview of fauna / organizational forms of life (system of five kingdoms) includes examples of certain organisms related to representatives of class or higher taxonomic group, meaning of certain known representatives (nutritive, curative, industrial ecologically important, poisonous, pathogen species, etc.); animals in nature, economy and other aspects of man's living. Other topics include less such examples related to the concept of biological diversity.

Most of the examples presented in the curriculum and teaching plan and in the textbooks in current use represent organisms or communities that do not refer to the area of Macedonia, while examples referring to representatives from our area are not sufficiently represented or are partially elaborated and representative examples of the territory of Macedonia.

The age group for which the above contents are intended is prepared sufficiently to receive more specific information and therefore presentation of biological diversity in textbooks should have more serious approach. Particular attention should be devoted to presentation of species and habitats through photos that should be selected to cover sufficient examples that are authentic for Macedonia.

In the higher education level, primacy of ecological studies is with studies of ecology (I and II cycles) in the frames of the Institute of Biology at the Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, and these studies include subjects teaching several topics of biological diversity (study, protection, management). Certain ecological disciplines are also taught at other faculties in the frames of specific departments, such as agriculture (eco-agriculture,

agro-economy), forestry (eco-engineering and eco-management), and mechanical engineering (energy and ecology). Furthermore, curricula of the faculties of other private and state universities also include ecological disciplines, such as management of ecological resources, ecological and rural tourism, ecological economy, ecological management, etc.

In the course of 2013, with the support of SDC/Farmahem/MoEPP Programme for nature conservation, activities were initiated towards improvement of the education system and introduction of biological diversity conservation in the Faculty of Forestry in Skopje, through establishment of cooperation between the Faculty of Forestry in Skopje and University of Applied Sciences from Bern, for the purpose of exchange of experience and knowledge between the two institutions in the segment of forest management, conservation of biological diversity and sustainable development.

9.2 Informal education system

Non-governmental sector plays an important role in informal education, for which one can freely say that it leaves behind even more lasting knowledge among educated persons, for the simple reason that it is not compulsory while at the same time it is well designed to be interesting and adjusted to the age group. In the Republic of Macedonia, more than 150 ecological societies have been registered, though only few of them are active in the domain of environmental education. Besides ecological societies, other organizations or associations acting towards sustainable development fostering in the country, take part in informal education.

During the last decade, the number of campaigns and educational programmes concerning biological diversity conservation and promotion has increased. Programmes of international organizations implementing/supporting projects in the area of nature protection, bilateral projects supported by certain embassies and other activities are of particular importance, and they contribute, together with governmental bodies and non-governmental sector, to improved knowledge and importance of biological diversity.

Green package for student education was prepared by the Regional Environmental Centre in cooperation with the MoEPP and MES in order to contribute to improved quality of the environment in Macedonia, including also topics of biological diversity.

The Programme dubbed “We Have No Spare Planet” implemented by the non-governmental organization OHO since 1999 is aimed at increasing public awareness of the importance of environment protection, including biological diversity. The Programme has grown into interactive, complex educational programme covering all kinder gardens, primary and secondary schools and students’ homes in the Republic of Macedonia and offering education and comprehensive methodology for environmental management of those institutions.

Macedonian Ecological Society includes educational activities in most of its projects concerning nature and biological diversity protection, especially in the projects for vultures and other bird species protection, Balkan lynx, important plant species, ecological networks, camps for Dojran Lake monitoring, establishment of new protected areas, etc.

Other NGOs carry out environmental education activities with lesser accent on biological diversity. In many projects implemented on local level (development of alternative tourism, building of mountaineers’ biking paths, etc.), biological diversity is perceived only as resource, and education does not address its appropriate protection.

Common feature of most of the educational activities is that they are not carried out continuously, the effect of conducted educational activities is not measured and sometimes they give wrong instructions for biological diversity conservation.

One of the important instruments for public awareness rising is marking of international days regarding biological diversity. Apart from the Day for Biological Diversity, different activities marking other international important days or campaigns are carried out on national or local level, among which we could mention the following as the most important: World Migratory Bird Day, World Wetlands Day, the “Spring Alive” campaign, International Bat Night, etc.

During the last years, production of films (short, documentary, spots, etc.) has become popular in the Republic of Macedonia and they are related mainly to the promotion of natural heritage primarily for tourism development, broadcasted on national television channels. Also, several programmes on curative plants have been recorded. Two documentary films are also worth mentioning, being products of the German Production MDR, prepared in the course of 2010, namely “In the heart of the Balkans – Looking for the lynx” and “In the heart of the Balkans – Pelicans from Prespa Park”.

Ducks flying over Paljurci reservoir

10 Analysis of the First Biological Diversity Action Plan – lessons learned

The analysis of the implementation of the first Action Plan was made as the first step in the process of revision of the National Biodiversity Strategy with Action Plan (NBSAP) of the Republic of Macedonia (adopted in 2004) together with the assessment of biological diversity status (for the period 2003-2013).

Guidelines under the Convention on Biological Diversity (CBD) contained in Decision (CBD/COP/DEC VIII/8) and experiences from other countries were used in the evaluation of the NBSAP implementation. For that purpose, the status of implementation was reviewed for each action (fully/partially implemented or not implemented), as well as the main obstacles for its implementation.

The analysis of the Action Plan for biological diversity was carried out in the period from June to December 2013 through broad process of consultations with all stakeholders: MoEPP, especially Nature Department, other competent ministries and wider expert community on workshops with the stakeholders.

For the purpose of achieving the main goal and general objectives, the First Action Plan for biological diversity contained 217 actions grouped into 11 strategic approaches. Based on conducted analysis, it was concluded that only 64 actions (29%) have been implemented, 56 (26%) have been implemented partially, and 96 actions (44%) have not been implemented (Table 23). The greatest progress was noted in Strategic approach I. Legislation, where most of the activities were fully (31 actions or 71%) or partially (4 actions or 9%) implemented. Significant progress was noted in E. Investigation and monitoring, F. Public awareness and education and to some extent A. In situ conservation. The lowest progress was noted in the implementation of actions under strategic approaches B. Ex situ conservation, D. Institutional strengthening, J. Financial resources for implementation of NBSAP and K. Coordination and implementation of NBSAP.

The following implemented actions are worth mentioning:

• Development of protected areas management plans in accordance with internationally recognized methodology. The contents of the management plans for protected areas is regulated by a Rulebook (26/2012). The management

Strategic approach	Implemented actions	Partially implemented actions	Not implemented actions	Total
A. *In situ* conservation	13	15	26	54
B. *Ex situ* conservation	-	4	10	14
C. Sustainable use of biodiversity	2	9	6	17
D. Institutional strengthening	1	6	10	17
E. Investigation and monitoring	6	8	7	21
F. Public awareness and education	6	4	3	13
G. Impact assessment	1	-	3	4
H. Incentive measures	-	2	6	8
I. Legislation	31	5	9	45
J. Financial resources for implementation of NBSAP	1	4	3	8
K. Coordination and implementation of NBSAP	3	-	13	16
Total	**64 (29%)**	**57 (26%)**	**96 (44%)**	**217**

Table 23. Analysis of the implementation of the First Action Plan for Biological Diversity (2004).

plans for the three National Parks have been prepared, but the plan for NP Mavrovo has not been adopted yet. As far as MPs for other categories of protected areas are concerned, only MP for PN Ezerani has been developed and adopted. Management plans have been developed for SNR Tikvesh, NM Matka, MPA Jasen, NM Smolare Waterfalls and NO Koleshino Waterfalls, but not adopted because of the non-finalized process of re-proclamation. Development of the MP for NM Prespa Lake is under preparation.

• Establishment / expansion of the network of protected areas. The system of protected areas was completely reviewed and supplemented in the Representative Network of Protected Areas, followed by appropriate information prepared by MoEPP, but it has not been adopted by the Government of the Republic of Macedonia. The process of (re-) proclamation of individual protected areas is carried out at a very slow pace. Studies for revalorization were prepared for 11 areas (Galichica, Pelister, Mavrovo, Prespa Lake, Ezerani, Tikvesh, Matka, Alshar, Jasen, Osogovo, Vodno). Only 11 areas have been (re)proclaimed (NP Galichica, NM Prespa Lake, NM Smolare Waterfalls, NM Vevchani Springs, NM Markovi Kuli, NM Kuklica, SNR Ploche Litotelmi, NM Lokvi-Golemo Konjari, NM Dojran Lake, Nature Park Ezerani, NM Slatino Springs. One area (Alshar) has been excluded from the list of Pas. Out of the total of 13 areas, only three have been proclaimed for protected. Also, national Emerald network was elaborated, but activities for its updating have not commenced yet.

• Establishment of bio-corridors between protected areas. National ecological network MAK-NEN has been developed with identified corridors, but it has not been formally adopted by the Government of the Republic of Macedonia, upon which those would be incorporated in the Spatial Plan of the Republic of Macedonia.

• Identification of important plant and animal areas. In the past period, important plant areas have been identified, important bird areas have been revised, primary butterfly areas and the key areas for biological diversity have been identified, and virgin forests in Macedonia have been located in part, while information on refuge regions has been improved.

• Construction and maintenance of feeding sites for vultures and birds of prey and application of Anti-dot programme. Actions concerning vultures' conservation have been implemented through series of projects which have exceeded by far the actions specified in the first NSBAP. Feeding sites were established, anti-dot programme was implemented, and continuous monitoring, education, contacts and assistance to local population are undertaken.

• Measure for gene and seed bank was applied through implementation of series of actions concerning preparation of guidelines for species collection and maintenance, establishment of gene banks for plant resources for food and agriculture, establishment of gene banks for aromatic and medicinal herbs, cryopreservation of genetic and reproductive material of native breeds of domestic animals, repatriation of agricultural collections kept ex situ in other countries, as well as establishment of database of agro-biodiversity.

• During the last decade, national mycological collection (fungarium) was established at the Institute of Biology, FNSM, UCM – Skopje. Besides this collection, national collection of diatomea was established, too.

• Promotion of bilateral cooperation. In the past period, Republic of Macedonia has signed bilateral agreements with Turkey, Italy, Czech Republic, Hungary, Albania, Croatia, Serbia, Montenegro, for the purposes of environment and nature protection and promotion.

• Establishment of programme for applied projects in the area of biological diversity. MoEPP, in the frames of the public call for projects funding under the Programme for Environmental Investments, included specific component on biological diversity.

The following obstacles in the implementation of the First Action Plan for biological diversity have been identified:

• Lack of financial resources;

• Conservation of biological diversity is not priority (lack of political will, accent on economic development);

• Lack of capacity in MoEPP and other institutions;

• Insufficient coordination and cooperation between departments in MoEPP, as well as with other relevant ministries, agencies and organizations;

• Unadjusted legal solutions, non-compliance with the legislation (poaching, illegal fishing, illegal wood cutting, etc.);

• Slow procedures for designation of new protected areas and non-adopted developed documents.

11 Biological Diversity Strategy and Action Plan

The main goal of the First National Biodiversity Strategy with Action Plan adopted in 2004 was aimed at "conservation of biological diversity and provision of its sustainable use for people's well-being, while taking care of unique natural values and rich tradition of the Republic of Macedonia" and it is reminiscent of a long-term vision of the country.

Vision

In the process of revision of the first NBSAP, bearing in mind the global vision and the vision of the European Union, as well as national purposes, the long-term vision for the status of biological diversity by 2050 was set through participatory process involving the relevant stakeholders and it reads:

"Biological diversity, unique natural wealth and traditional relations of people with the nature in the Republic of Macedonia are conserved, valued and deliver ecosystem services that contribute to human well-being".

11.1 National goals and targets

For the purpose of defining the national targets, process of consultation with the relevant stakeholders was conducted through which the goals of the first NBSAP, status and trends of biological diversity and identified threats to biological diversity in the country were reviewed and the Guidelines of the Convention on Biological Diversity concerning the implementation of the globally set Aichi targets were considered. The twelve main targets set in the first NBSAP are largely relevant to the objectives of Aichi, but insufficient. Thus, according to the analysis, out of total twenty Aichi targets, six targets are covered in the first NSBRAP, four are partially covered or associated with a particular objective, eight are not mentioned, and two targets are not relevant for the country. Also, an analysis of the identified threats from very high and high priority and their connection with the objectives of Aichi was undertaken, which showed that the threats in Macedonia are relevant and globally. They are appropriately addressed in the Action Plan for Biodiversity.

Table 24. National strategic goals and targets for biological diversity.

Strategic goal/ target	Relation to Aichi Targets
Strategic goal A. To overcome the main/underlying causes of biodiversity loss through its mainstreaming in the society	
1. Raised public awareness on biological diversity and its values, the services provided by ecosystems and the steps to be taken for the protection and sustainable use of biological diversity	1
2. The values of biodiversity to be gradually incorporated into economic development policies on national and local level (poverty reduction, accounting systems, national and local development plans, etc.)	2
3. To introduce positive incentives for conservation and sustainable use of biological diversity assigned with the Convention and EU obligations, and to identify and revise incentives harmful to threatened biodiversity components	3
4. To increase the level of investments and financing sources for biodiversity conservation from the central and local budget and other sources	20
Strategic goal B. Reduce direct and indirect pressures on ecosystems and biodiversity	
5. To establish management practices in forestry, agriculture, hunting and fishery that contribute to conservation of biodiversity and maintenance of ecosystem services	7, 14
6. Pollution, including waste and excess nutrients, to be reduced to levels that are not harmful to biodiversity, ecosystems and the provision of ecosystem services	8
7. To develop and implement plans for sustainable production and consumption for use of natural resources within safe ecological limits	4
8. To create and establish appropriate policies for the evidence, control and protection from invasive alien species	9
9. To integrate measures for adaptation and mitigation of climate change and combating desertification	15
Strategic goal C. To improve the status of biodiversity components aiming to increase the benefits of biodiversity and ecosystem services	
10. To prevent the loss, degradation and fragmentation of natural habitats of national and European importance	5
11. To increase the surface of protected areas to 15% including their functional connectivity as ecological network, and establish effective management of protected areas in collaboration with local communities	11
12. To determine the level of threat to wild species in order to prevent the extinction of endangered species, and to improve and maintain conservation status, particularly of the species in decline	12
13. To improve in situ and ex situ protection of genetic resources of native species cultivated plants and domestic animals	13
14. To establish monitoring of biodiversity and natural processes	19, 12, 11, 9, 13
15. To promote the protection of species and ecosystems on transboundary level through implementation of joint actions/ measures	
16. To improve the status of important ecosystems in terms of providing essential ecosystem services	14
17. To integrate requirements of Nagoya Protocol for access to genetic resources into national legislation to 2018	16
Strategic goal D. To improve biodiversity knowledge and availability of all relevant information related to biodiversity	
18. To encourage building expertise of staff, financially support the research of components of biodiversity, to establish and update the database on national level to better use and sharing of information on biodiversity	19

Newly developed national biodiversity targets are elaborated separately in the text below with a brief explanation of the need for setting this specific target nationwide, major gaps and priority actions for its achievement.

11.2 Principles and priorities of the Strategy for biological diversity

The key values and ideas that will guide the National Biodiversity Strategy were developed (or revised) in parallel with the definition of the new national targets. The first NBSAP defined 12 strategic principles almost entirely relevant for the new NBSAP as well. Furthermore, the seven principles for nature protection defined in Article 7 of the Law on Nature Protection are integrated in the strategic principles by which all stakeholders should be led in the implementation of this NBSAP.

One of the most important strategic principles beyond any doubt (also a recommendation under CBD) which is key for the successful implementation of NBSAP is the mainstreaming of the conservation and sustainable use of biological diversity in all relevant sectors in the country (together with economic and social development). In practice, this means that efficient implementation of the Action Plan for biological diversity requires involvement of all stakeholders and each individual.

Definition of appropriate measures for biological diversity conservation, in line with the principles of high level of protection, sustainable development, precaution and prevention, should be founded upon sufficient information and knowledge of biological diversity and enhanced accessibility thereto. Provision of in situ protection of important species and habitats, through application of specific measures for their preservation and establishment of protected areas and ecological network is of particular importance.

Education and public awareness of the importance of biological diversity, benefits of ecosystem services for human well-being and the role they play in the national economy is indispensable precondition for greater involvement of the public in the process of biological diversity conservation and efficient implementation of Biodiversity Action Plan.

NBSAP Priorities

The most important and the most urgent issues incorporated in the NBSAP that should be implemented through anticipated actions are as follows:

- Integration of issues of biological diversity conservation in the relevant sectoral strategies and plans;
- Provision of sufficient information/knowledge of the status and the trends of biological diversity;
- Legislative and institutional strengthening with regard to biological diversity conservation and management;
- Implementation of appropriate measures for biological diversity conservation
- Sustainable use of biological diversity components;
- Establishment of monitoring, assessment and evaluation, prevention and mitigation of impacts on biological diversity;
- Education, raising public awareness, information and dissemination of information on biological diversity;
- Access to genetic resources and traditional knowledge related to them, as well as benefits sharing.

Principles of nature protection (Article 7):

1. Principle of high level of protection – When undertaking or performing activities all shall be obliged to provide for a high level of protection of the biological and landscape diversity and of the natural heritage, as well as the conservation of the common beneficial role of nature;

2. Principle of integration – The measures and activities of nature protection shall be integrated in all development strategic, planning and programme documents, plans for spatial development and use, as well as in the plans for natural wealth management and use;

3. Principle of sustainable development – For the purposes of satisfying the needs of nature protection, as well as the social and economic needs of the present generations, without jeopardizing the rights of the future generations to satisfy their needs, the non-renewable natural wealth shall be used in a rational manner, while the renewable resources shall be used in a sustainable manner;

4. Principle of precaution – If based on the modern scientific and technical-technological knowledge, it is concluded that certain activity or action could damage nature, the necessary measures and activities shall be undertaken prior to obtaining the scientific proof that damages could occur;

5. Principle of prevention ¬– It shall be the right and obligation of legal and physical persons to undertake measures and activities for nature protection before damages occur;

6. User-pays principle – when using the nature, the user of the nature is obliged to compensate the costs for maintenance of the natural balance and for enjoying the natural heritage, as well as for recovery of the nature degradation that occurs when using the nature and enjoying the natural heritage;

7. Principle of public participation – The public shall have the right to an unhindered access to information on the state of the nature, the right to be informed in timely manner about damages in nature and about activities undertaken for elimination of the damages, as well as the right to participate in the decision-making process concerning nature protection; and

8. Principle of cooperation - The competent state bodies and the bodies of the local self-government units, as well as other organizations and institutions shall, when performing the activities within the scope of their competence, be obliged to comply with the principles, objectives, measures and activities for nature protection, while closely cooperating among each other and internationally.

11.3 Introduction to Action Plan for Biological Diversity

The Action Plan contains specific actions linked with preservation and sustainable use of biological diversity that need to be implemented to achieve the set national biodiversity targets. It will serve as framework and guideline for all activities that should be undertaken by the Republic of Macedonia to preserve biological diversity by 2020 and thus contribute to the achievement of the global biological diversity targets (Aichi Targets).

The Action Plan for Biological Diversity envisages actions related to:

- Raising of public awareness and education of the importance of biological diversity and ecosystem services, as well as strengthening of capacity at different levels;
- Protection of certain important species and habitats;
- Implementation of biological diversity surveys and enhancement of knowledge;
- Establishment of databases and mechanism for information exchange (CHM);
- Expansion of the network of protected areas (national and international), its connection with ecological corridors and improvement of management efficiency;
- Strengthening of cooperation with the countries in the region and undertake joint activities for the conservation of biological diversity at cross-border level
- Development and amendment of appropriate legal and institutional solutions;
- Introduction of certain regulations or procedures;
- Use of different approaches and tools for efficient protection of biological diversity, such as EIA and SEA;
- Integration of biological diversity issues in different sectoral policies.

The plan for realization of actions is presented in the table below each national target in which the envisaged actions are additionally explained with the following information:

- code/number of action;
- data on its linkage with other actions;
- priority;
- responsible institution for implementation;
- period of implementation;
- indicative budget and possible financing sources;
- proposed indicator(s) to monitor the progress of its achievement.

The possible sources of funding for individual actions are included in the table, such as: budget funds provided through the MoEPP, MAFWE, Ministry of Education and Science (MES), local self-governments, funds provided through the business community, as well as funding by foreign donors (GEF funds, EU funds, etc.) and other sources.

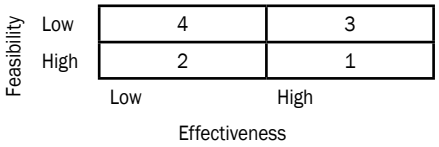
Criteria in determining priority activities

To determine the priority of the proposed actions, the Action Plan for Biological Diversity has taken into account the effectiveness and feasibility of each action.

Effectiveness concerns the extent to which the activity will contribute to the achievement of the set national target.

Feasibility will depend on the time and other resources necessary to implement the activity, as well as political support thereto. Activities that may be completed for a short period of time with employment of small resources and enjoy support by the relevant officials have high extent of feasibility.

The scheme below indicates the way of priority setting for each of the actions. According to this scheme, highest priority (1) should be awarded to activities that will have the greatest effect/impact with employment of small resources for a short time.



Additionally, these criteria were complemented by one more – urgency of the action. Urgent action will be considered the action which, if postponed for implementation, this will cause additional problems or a good opportunity will be missed (e.g. funding through donor programmes that are active at the moment or species/habitat facing immediate danger of extinct). According to the gradation in the above scheme, these activities will have priority “1”.

11.4 STRATEGIC GOAL A: “Address the underlying causes for biological diversity loss through its mainstreaming across the society”

The rich biological diversity of the Republic of Macedonia, besides intrinsic value (value in itself) that it possesses, supports ecosystems that are important to our economic, social and cultural living. In other words, biological diversity has multiple and important role in meeting the demands of man, i.e. it contributes to man’s well-being. On the other side, policies and programmes relating to other sectors of social living and intended to promote citizens’ well-being, often fail to recognize the values of biological diversity. Their implementation, especially policies and programmes that have resulted in land use change or physical infrastructure development, sometimes causes damages to biological diversity and health of ecosystems upon which our well-being depends. Such hidden and unwanted consequences will be to a great extent overcome if values and information of biological diversity, as well as ecosystems and services they deliver, are taken into account in the elaboration of national and local development strategies and spatial plans. Furthermore, the values of the biological diversity have to be recognized and accepted by all sectors of social living. Namely, existence of political will is necessary not only with authorities, but also wide support and change in the attitudes of organizations and individuals. Thus, reduction of hidden and underlined causes for the loss and pressure on ecosystems and biological diversity, including increased investment and financing of biodiversity conservation, necessitate that the four national targets presented below are accomplished.

11.5 National Target 1: "Raise public awareness of biological diversity values, services delivered by ecosystems and steps to be undertaken toward protection and sustainable use of biological diversity to a higher level"

Understanding of the various values of biological diversity (especially its ecological, economic and social importance) is necessary in building motivation for acting and creating political will for actions undertaking for protection and sustainable use. The Programme for communication, education and public awareness (CEPA) as part of cross-cutting issues of the Convention on Biological Diversity is important instrument for this target achievement.

In the Republic of Macedonia, there is no information of the level of knowledge/public awareness of the values of biological diversity and services delivered by ecosystems. Activities for public awareness raising and education of the population are usually implemented in the frames of major projects for biological diversity conservation, which are relatively short-term (for the duration of the project), sometimes accompanied with medial campaigns (short articles / programmes on certain significant areas of the natural heritage), but the result achieved is difficult to measure. National and local media, generally speaking, do not show great interest in elaborating this subject matter (complex problem-low interest by editors and inadequately trained journalists in all media).

The subject matter of biological diversity in educational system (primary and secondary education) is included in the curricula, though not adequately treated in classes. In the higher education level, this subject matter is taught only with appropriate educational profiles, but not with social and humanistic, as well as technical vocations. High number of educational activities (informal education) is carried out by non-governmental organizations.

A precondition for initiation of any activity that should contribute to increased level of information of the population of the values of biological diversity and the need to undertake actions for its conservation is a broad poll conducted among different age, gender, ethnic, educational and geographical structures of the population (representative sample), through which the baseline status will be established. The analysis of data from such survey will enable designing of well targeted campaigns for different target groups, introducing appropriate obligations for media, promotion of natural heritage, production of vocational popular books, brochures, tourist maps and manuals on the values of and threats to biological diversity and services offered by ecosystems. Activity coordinated with other sectors (especially tourism) can contribute to the increase of public awareness of the values of biological diversity. Furthermore, there is a need for system based change in education towards increased creative and practical training, planned informal education, appropriate supplementary and continuous training of central and local level administration, etc.

Actions to achieve National Target 1b

1.1. Establishment of the level of knowledge and awareness about the values of biological diversity of the Republic of Macedonia for different target groups
1.2. Implementation of activities for public awareness raising among specific target groups
1.2.1. Preparation and implementation of a Communication Plan
1.2.2. Organization and implementation of national campaign for public awareness raising about the values of biological diversity and ecosystem services
1.2.3. Promotion of the values and importance of protected areas
1.2.4. Preparation and publication of vocational and popular books/manuals/ brochures on different components, values, use of and threats to biological diversity
1.2.5. Development of tourist maps/offers/guides on protected and sensitive areas to the benefit of biological diversity conservation
1.2.6. Marking of international days related to biological diversity
1.3. Implementation of education activities
1.3.1. Preparation of a plan for education in the area of biological diversity (for formal and informal education)
1.3.2. Implementation of educational competition in the area of biological diversity
1.3.3. Organization of didactic topic based excursions – positive and negative examples of biological diversity status and management
1.3.4. Organization of other educational thematic excursions according to educational plan
1.4. Strengthening of the capacity of the civil sector and ULSG for participation in SEA and EIA procedures

No.	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
1.1	Establishment of the level of knowledge and awareness about the values of biological diversity of the Republic of Macedonia for different target groups	1	MoEPP in cooperation with the implementing intersectoral body (National Committee on Biodiversity – NCB), survey agency	2015	Budget of RM, foreign grants	Target groups identified; representative sample identified; survey conducted
1.2	Implementation of activities for public awareness raising among specific target groups					
1.2.1	Preparation and implementation of a Communication Plan	1	MoEPP (Department of Public Relations), public relations organizations, media, NGOs	2015-2020	Budget of RM, foreign grants	Communication Plan developed and implemented
1.2.2	Organization and implementation of national campaign for public awareness raising about the values of biological diversity and ecosystem services	1	MoEPP, public relations organizations, NGOs, PA management entities, Units of Local Self-Government (ULSG), media, business community, other stakeholders identified according to the survey		Budget of RM, foreign grants, business sector	Campaign implemented; media broadcasting the campaign; size of sample covered by activities
1.2.3	Promotion of the values and importance of protected areas	1	MoEPP, PA management entities, NGOs, etc.	Cont.	Budget of RM, PA management entities, foreign grants	Number of implemented activities promoting the values of protected areas
1.2.4	Preparation and publication of vocational and popular books/manuals/brochures on different components, values, use of and threats to biological diversity	2	Scientific institutions, experts, PA management entities, NGOs, etc.	Cont.	Budget of RM, PA management entities, foreign grants	Number of vocational and popular books/manuals/brochures published
1.2.5	Development of tourist maps/offers/guides on protected and sensitive areas to the benefit of biological diversity conservation	1	Experts, PA management entities, NGOs, Agency for Tourism Support and Promotion, etc.	Cont.	Budget of RM, foreign grants	Number of developed tourist maps/offers/guides on protected and sensitive areas
1.2.6	Marking of international days related to biological diversity	1	MoEPP, NGOs, international organizations, ULSG, media, business community, other stakeholders	Cont.	Budget of RM, foreign grants	Number of held events to mark international days
1.3	Implementation of education activities					
1.3.1	Preparation of a plan for education in the area of biological diversity (for formal and informal education)	2	MoEPP, Bureau for Development of Education – Ministry of Education and Science (MoES), Ministry of Culture (MoC), MAFWM, educational institutions on all levels, informal education groups, NGOs	2016	Budget of RM, foreign grants	Education plan developed
1.3.2	Implementation of educational competition in the area of biological diversity	1	MoES, educational institutions on all levels, NGOs		Budget of RM, foreign grants	Competitions implemented; sample covered by activities
1.3.3	Organization of didactic topic-based excursions (positive and negative examples of biological diversity status and management)	2	MoES, educational institutions on all levels, NGOs	Cont.	Budget of RM, foreign grants	Excursions realized
1.3.4	Organization of other educational thematic excursions according to educational plan	2	MoES, educational institutions on all levels, NGOs	2017-2020	Budget of RM, foreign grants	Number of realized activities and sample covered by the activities (schools, students, etc.)
1.4	Strengthening of the capacity of the civil sector and ULSG for participation in SEA and EIA procedures	1	MoEPP (Department of Spatial Planning, Department of Environment), ULSG, domestic and international experts / organizations		Budget of RM, foreign grants	SEA and EIA training implemented; sample covered by the training

Leshnica is one of the most picturesque sites on Shar Planina mountain

11.6 National Target 2: "Values of biological diversity are gradually integrated in the policies of economic development on national and local levels (poverty reduction, environmental accounting[1], national and local development plans, etc.)"

Balancing between priorities of different sectors in the society, especially between the need for economic development and conservation of biological diversity undeniably presents great challenge for those in charge of making and implementing the policies on central or local levels. Nevertheless, in most of the cases their decisions favour economic growth or other priorities, often to the detriment of biological diversity. Frequent discrepancy between development policies and biological diversity conservation signifies the need for activities that will assist those involved in adoption and implementation of policies in other sectors to recognize and respect the link existing between ecosystems and development, i.e. between biological diversity and man's well-being. To that end, it is necessary to provide information about the importance of the key ecosystem services, on the way in which individual economic sectors affect ecosystems providing such services and the way in which individual economic sectors and socio-economic groups in the society depend on biological diversity and ecosystem services. Attention should be paid to all basic groups of ecosystem services: provisioning, regulating and cultural. This will be achieved through implementation of appropriate research and studies, but also systematic collection, processing and dissemination of data through establishment of national environmental accounting.

Preparation of development strategies and processes of planning on national and local levels should apply modern methodologies, such as assessment of ecosystems, mapping of ecosystem services, indicators of ecosystem services and monetary valuation of ecosystem services. Experiences from many countries in the world indicate that determination of economic or monetary value of ecosystem services encourages integration of biological diversity values in decision making. Furthermore, integration of biological diversity in other sectors of the society will be promoted through improved enforcement of existing legal procedures, like for example those of assessment of the impact of certain strategies, plans and programmes on environment.

1 Environmental accounting sets the framework for environmental data arrangement in a manner to ensure linkage with economic data. Agenda 21, document adopted by 178 Governments at the United Nations Conference of Environment (Rio de Janeiro, 3-14 June 1992); several steps were recommended for environmental policies and development integration, including application of environmental accounting. To that end, in 1993, the United Nations published Handbook of National Accounting: Integrated Environmental and Economic Accounting. Since 2003, European Commission, International Monetary Fund, Organization for Economic Cooperation and Development and the World Bank joined the efforts for development of environmental accounting standards that would be internationally recognized .. The latest achievements in the system development were presented in 2014, in the publication System of environmental - economic accounting 2012: central framework.

Actions to achieve National Target 2

2.1. Development of a study about the economic values of ecosystem services

2.2. Assessment of ecosystem services within individual sectors

2.2.1. Introduction of procedures for assessment of ecosystem services within individual sectors and their implementation in the process of adopting strategies, plans and programmes

2.2.2. Introduction of environmental accounting procedures at national level intended for the business sector

2.3. Incorporation of biodiversity conservation goals into sectoral strategies, plans and programmes (energy, waters, agriculture, rural development, forestry, fight against poverty, etc.) by including alternative solutions

2.3.1. Development of sensitivity maps with regard to biological diversity for projects related to the economic sectors (mineral and mining resources, hydro power, wind power, etc.) for the purpose of preventive identification of areas important for biological diversity

2.3.2. Development of SEA for the construction of small hydropower plants

2.3.3. Support to the process of adoption of water management master plan and river basin management plans in the Republic of Macedonia

2.3.4. Preparation of a study for identification of alternative energy sources least harmful to biological diversity

2.3.5. Ensuring functionality of the national ecological network MAK-NEN through integration of the measures for ecological corridors management in the economic sectors

2.3.6. Support for the implementation of the measures regulating sand and gravel exploitation along rivers and lakes

2.3.7. Fostering implementation of rural development funds focusing on reduced abandonment of traditional practices (abandonment of mowing, degradation of rural landscape) in hilly and mountainous areas

2.4. Implementation of intersectoral analysis of the current Spatial Plan and prepara tions for the development of the new Spatial Plan

2.5. Integration of biodiversity conservation aspects in the preparation of local economic development (LED) strategies and other strategic planning documents at local and regional levels

2.6. Integration of the nature impact assessment procedure (in accordance with Article 6 of Habitats Directive) for development projects and plans in future Natura 2000 and/or Emerald sites

2.7. Enhancement of the effects of the implementation of the obligations under EIA on biological diversity conservation

2.7.1. Improvement of the quality of developed EIAs through education of experts

2.7.2. Strengthening of the implementation of measures ensuing from developed EIAs

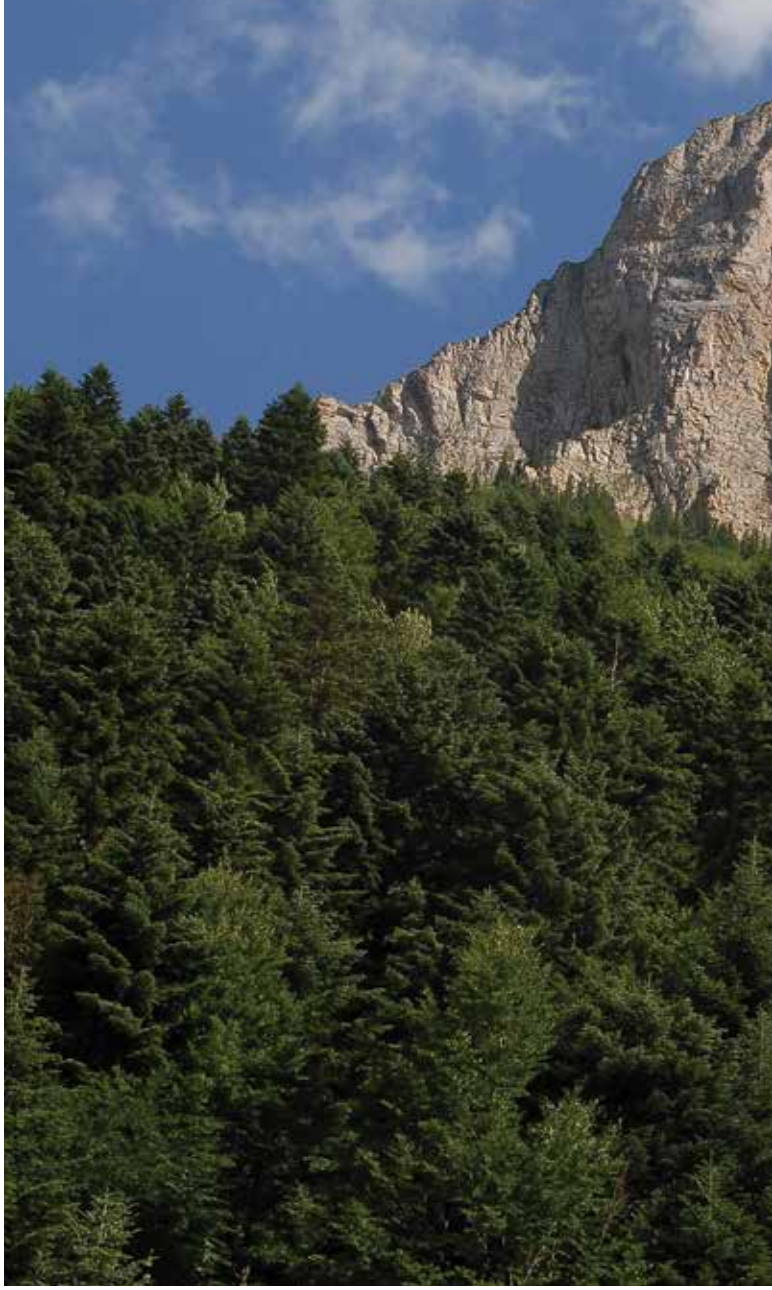
2.8. Sustainable use of natural resources towards poverty reduction

2.8.1. Identification of opportunities for developing alternative tourism and its application in specific areas

2.8.2. Identification of opportunities for the use biological resources – establishment of productivity and sustainable quotas to secure stable populations

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
2.1		Development of a study about the economic values of ecosystem services	2	MoEPP in cooperation with scientific institutions and experts	2018 - 2020	Budget of RM, foreign grants	Study about the economic values of ecosystem services developed
2.2		Assessment of ecosystem services within individual sectors					
2.2.1		Introduction of procedures for assessment of ecosystem services within individual sectors and their implementation in the process of adopting strategies, plans and programmes	1	MoEPP, in cooperation with NCB	2020-2023	Budget of RM, foreign grants	Number of strategies, plans and programmes requiring assessment of ecosystem services
2.2.2		Introduction of environmental accounting procedures at national level intended for the business sector	2	MoF, MoEPP, business sector, ULSG, experts	2020-2023	Foreign grants	Number of training sessions held with target groups (business sector, state institutions)
2.3		Incorporation of biodiversity conservation goals into sectoral strategies, plans and programmes (energy, waters, agriculture, rural development, forestry, fight against poverty, etc.) by including alternative solutions					Number of strategic and planning documents and number of sectors incorporating biodiversity conservation goals
2.3.1		Development of sensitivity maps with regard to biological diversity for projects related to the economic sectors (mineral and mining resources, hydro power, wind power, etc.) for the purpose of preventive identification of areas important for biological diversity	1	MoEPP, ME, Ministry of Transport and Communications (MTC), experts, Agency for Real Estate Cadastre, Agency for Spatial Planning (ASP)	2019-2023	Budget of RM, business sector, foreign grants	Sensitivity maps developed; use of sensitivity maps in various sectors
2.3.2		Development of SEA for the construction of small hydropower plants	1	MoEPP (Department of Spatial Planning, Department of Waters), ME, experts	2018-2020	Budget of RM, foreign grants	SEA developed
2.3.3		Support to the process of adoption of water management master plan and river basin management plans in the Republic of Macedonia	2	MAFWM, MoEPP (Department of Waters), river basin management bodies	Cont.	Budget of RM	Water management master plan adopted; number of river basin management plans developed
2.3.4		Preparation of a study for identification of alternative energy sources least harmful to biological diversity	1	Experts, scientific institutions, ME, MoEPP	2019-2021	Budget of RM, foreign grants	Study for identification of alternative energy sources developed
2.3.5	4.4.1	Ensuring functionality of the national ecological network MAK-NEN through integration of the measures for ecological corridors management in the economic sectors	1	MoEPP in cooperation with other relevant sectors, NGOs	2018-2023	Budget of RM, foreign grants	Number of developed measures for ecological corridors management in the economic sectors
2.3.6		Support for the implementation of the measures regulating sand and gravel exploitation along rivers and lakes	2	MoEPP, ME, ULSG	Cont.	Budget of RM, ULSG	Measures regulating sand and gravel exploitation implemented; number of penalties for illegal sand and gravel exploitation
2.3.7	3.1.3	Fostering implementation of rural development funds focusing on reduced abandonment of traditional practices (abandonment of mowing, degradation of rural landscape) in hilly and mountainous areas	2	MAFWM, Ministry of Labour and Social Policy (MLSP), NGOs, ULSG, Public Enterprise for Pasture Management	Cont.	Budget of RM, foreign grants, IPARD funds	Examples of agricultural traditional practices maintained and rural landscape preserved
2.4		Implementation of intersectoral analysis of the current Spatial Plan and preparations for the development of the new Spatial Plan	2	All relevant ministries, sectors and other stakeholders	2018-2020	Budget of RM, foreign grants	Intersectoral analysis implemented; reports on new SPs developed
2.5		Integration of biodiversity conservation aspects in the preparation of local economic development (LED) strategies and other strategic planning documents at local and regional levels	1	MoEPP in cooperation with NCB, National Council for Sustainable Development in RM, ZELS, ULSG, MLSG, Bureau for Regional Development	Cont.	Budget of RM, USLG budget, foreign grants	Number of developed LED strategies and other planning documents at local level including of biodiversity aspects
2.6		Integration of the nature impact assessment procedure (in accordance with Article 6 of Habitats Directive) for development projects and plans in future Natura 2000 and/or Emerald sites	2	MoEPP in cooperation with other relevant sectors	2018-2020	EU funds, foreign grants	Number of projects in future Natura 2000 and/or Emerald sites implementing nature impact assessment procedure
2.7		Enhancement of the effects of the implementation of the obligations under EIA on biological diversity conservation					
2.7.1		Improvement of the quality of developed EIAs through education of experts	1	Scientific institutions, MoEPP, international experts	Cont.	Budget of RM, foreign grants, EU funds	Number of training sessions held and experts involved
2.7.2		Strengthening of the implementation of measures ensuing from developed EIAs	1	State Environmental Inspectorate (SEI)	Cont.	Budget of RM – special funds not required	Number of projects with fully implemented measures
2.8		Sustainable use of natural resources towards poverty reduction					Study on natural resource potential towards poverty reduction developed
2.8.1		Identification of opportunities for developing alternative tourism and its application in specific areas	1	Agency for Promotion and Support of Tourism, PA management entities, MAFWM, MLSP, municipalities, individual businessmen	2018-2020	Budget of RM, foreign grants	Opportunities for developing alternative tourism identified; examples of implemented alternative tourism
2.8.2	7.2.	Identification of opportunities for the use biological resources – establishment of productivity and sustainable quotas to secure stable populations	1	MoEPP in cooperation with experts, scientific institutions, NGOs	2018-2022	Budget of RM, foreign grants	List of most exploited resources developed; quotas for sustainable use of resources established

11.7 National Target 3: "Introduction of positive incentives for conservation and sustainable use of biological diversity in accordance with the Convention and EU related obligations and identification and correction of incentives that are harmful to affected biological diversity components"



Different types of incentives or subsidies in production or consumption introduced in countries can often have unpredicted or unintended (side) negative effects on biological diversity. Also, policies and laws regulating the use of resources (e.g. land use or environmental resources management) can have harmful effects on biological diversity.

In the past several years, the Republic of Macedonia has been providing different incentives to improve economic conditions in the country, targeted especially at business sector (support to small-scale businesses, foreign investments, entrepreneurship), use of renewable energy sources (solar panels, small hydro power plants, wind parks, etc.) or different forms of support to agriculture, tourism, etc.

Huge financial resources are allocated to subsidize agricultural production, through payment of around 640 million EUR in the period from 2003 to 2013. The National Programme for Agriculture and Rural Development for the period 2013-2017 which guides the policy of the Government of the Republic of Macedonia for agriculture and rural development support during current and future period includes the following schemes of financial support: direct payments, arrangement of markets for agricultural products, capital grants for rural development (financed from the central budget and European IPARD funds), favourable rural crediting, state aid to agriculture and rural development, including measures for technical assistance. Allocation of 150 million EUR per year has been planned for the period 2015 to 2017.

The agenda includes, inter alia, consolidation of agricultural land where the main goal is expansion of the production of a single type of crop on larger areas. This approach will have to be accompanied with increased production of mono-crops on larger areas – such products will be competitive and acceptable on the market, but the manner of their production is unfavourable for biological diversity.

With reference to construction of power facilities, the Government of the Republic of Macedonia fosters the development through acquisition of the status of preferential producer of electricity from renewable energy sources (feed-in tariffs) for each type of electricity production from renewable energy source (e.g. construction of small hydro power pants, solar panels, etc.). Under the Strategy for Utilization of Renewable Energy Sources in the Republic of Macedonia by 2020, MoEPP plans to award concessions for around 400 hydro power plants on the territory of Macedonia (see Chapters 4.2.9 and 4.2.3).

The analysis of the impact of different subsidies on biological diversity has not been done yet. According to international conventions concerning biological diversity conservation, strategic and action plans generating encouragement or subsidizing of other economic parameters should be adjusted in the context of protected areas and areas of importance for biological diversity in Macedonia. Plans/subsidies found out to have harmful effects on biological diversity should be revoked (if possible) or a plan should be prepared for their phasing-out. If there is no possibility to cancel them because of their importance for achievement of other social goals in the country, they should be reformed in order to minimize their negative effects. This matter is very complex as it involves high number of stakeholders and often negotiations should take place on higher level. Therefore, it is necessary to make analysis of potential environmental, economic and social costs and benefits of coping with harmful incentives. On the other hand, subsidies contributing to biological diversity conservation and sustainable use and contributing at the same time to poverty eradication should be identified and promoted.

Leshnica limestone rocks

Actions to achieve National Target 3

3.1. Mainstreaming the policy of subsidies of economic sector (agriculture, rural development, energy) to support biodiversity

3.1.1. Analysis of existing subsidies and redefinition of subsidies conflicting with the national targets for biological diversity

3.1.2. Analysis and introduction of incentive measures, including payment for ecosystem services towards poverty reduction through sustainable use of biological diversity and ecosystem services

3.1.3. Promotion of and support to subsidies in agricultural sector that are favourable for biological diversity conservation

3.1.4. Encouraging measures and practices for maintenance and improvement of ecological values of rural landscape

3.1.5. Support to farmers maintaining native species of agricultural crops and domestic animals

3.1.6. Support to good agricultural practice and introduction of agro-ecological measures

3.1.7. Support to develop measures for agricultural activity in areas with limited possibilities for agricultural activity

3.2. Development of study on the benefits of subsidies for electricity production from renewable sources that are in conflict with biological diversity targets (and potential review of existing schemes)

3.3. Development of study on the benefits of subsidies for mass tourism and fostering subsidies for alternative forms of tourism and potential review of existing schemes

3.4. Preparation of analysis for the potential ecological, economic and social costs and benefits from tackling harmful subsidies

3.5. Support to nursery-based production of native woody species

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicators
3.1		Mainstreaming the policy of subsidies of economic sector (agriculture, rural development, energy) to support biodiversity					
3.1.1		Analysis of existing subsidies and redefinition of subsidies conflicting with the national targets for biological diversity	1	Experts, MoEPP, MAFWM, APDA, ME, MLSP	2018-2019	Budget of RM, foreign grants	Subsidies conflicting with the national biodiversity targets redefined
3.1.2	2.9	Analysis and introduction of incentive measures, including payment for ecosystem services towards poverty reduction through sustainable use of biological diversity and ecosystem services	2	Experts, MoEPP, MLSP, MAFWM, PA management entities, other stakeholders	2020 - 2023	Budget of RM	Analysis and introduction of incentive measures conducted; number of introduced payment measures for ecosystem services towards poverty reduction
3.1.3		Promotion of and support to subsidies in agricultural sector that are favourable for biological diversity conservation	1	MAFWM, Rural Development Network of RM, Federation of Farmers, private farmers, etc.	2018 - 2023	Budget of RM, foreign grants	Subsidies in agricultural sector favourable for biodiversity conservation promoted
3.1.4	2.10	Encouraging measures and practices for maintenance and improvement of ecological values of rural landscape	2	MoEPP, MAFWM, Rural Development Network of RM, Federation of Farmers, private farmers	2019 - 2021	Foreign grants, EU funds	Measures and practices introduced
3.1.5		Support to farmers maintaining native species of agricultural crops and domestic animals	2	MAFWM, Rural Development Network of RM, Federation of Farmers, private farmers	2018 - 2023	Budget of RM, EU funds	Number of farmers receiving support; number of farmers growing native crops
3.1.6		Support to good agricultural practice and introduction of agro-ecological measures	2	MAFWM, MoEPP, farmers, local population	2018 - 2023	EU funds, foreign grants, budget of RM	Examples of good agricultural practice; agro-ecological measures introduced
3.1.7		Support to develop measures for agricultural activity in areas with limited possibilities for agricultural activity	2	MAFWM in cooperation with MoEPP	2018 - 2023	EU funds, foreign grants	Examples of agricultural activity in areas with limited possibilities
3.2		Development of study on the benefits of subsidies for electricity production from renewable sources that are in conflict with biological diversity targets and potential review of existing schemes	2	MAFWM, ME, experts, NGOs, Energy Agency	2018 - 2020	Foreign grants, budget of RM	Study developed; existing schemes reviewed
3.3		Development of study on the benefits of subsidies for mass tourism and fostering subsidies for alternative forms of tourism (with potential review of existing schemes)	1	ME, Agency for Tourism Development and Support, MAFWM, experts, other stakeholders	2018 - 2021	Foreign grants, EU funds	Study developed; subsidies for alternative forms of tourism awarded
3.4		Preparation of analysis for the potential ecological, economic and social costs and benefits from tackling harmful subsidies	2	MoEPP, ME, MLSP in cooperation with scientific institutions / expert	2018-2019	Budget of RM, foreign grants	Analysis prepared
3.5		Support to nursery-based production of native woody species	1	MAFWM, MoEPP, PE Macedonian Forests, private nurseries	2018 - 2023	Budget of RM, foreign grants	Nurseries with native species

11.8 National Target 4: "Increase the level of investments in and funding of biological diversity conservation from central and local budgets and other sources"

One of the main obstacles to the implementation of NBSAP not only in Macedonia but also in many countries is the constrained financial ability. To overcome this challenge, it is necessary to mobilize all resources especially from domestic sources on national level (central budget), local level (budgets of local self-governments), business sector and in the frames of the non-governmental sector.

The Law on Nature Protection stipulates that the funds for nature protection are provided by the Budget of the Republic of Macedonia and other sources (donations, grants, credits funds of the European Union, etc.). However, the level of investments in the area of nature protection is low and does not secure full and constant financial support to the system of biological diversity conservation. Furthermore, it is necessary to design a self-sustainable financial system for protected areas management. Following the example of decentralization of municipalities, a similar system should be implemented with reference to protected areas (see Chapter 6.4).

Central budget allocates around 0.15% of environmental demands. The Public Investments Programme (PIP) 2008-2010 has estimated that 5.1% of the financial resources will be environmental investments (EUR 44.27 million) and this has been followed by constant reduction. In PIP 2009-2011, this percentage declined significantly to 2.1% of the total financial resources (EUR 30.39 million) and in PIP 2011-2013 it reached as slow as 1% (EUR 14.37 million). With regard to priorities for public environmental investments, the main projects fall in the areas of water and waste management, which is in line with the recommendations of the National Strategy for Environmental Investments. In order to have the citizens in Macedonia respect these and many other benefits, it is necessary that the state allocates significant portion of the budget for environment protection and improvement (according to the estimates of the National Strategy for Environment Approximation, Macedonia will need to allocate around 3% of its GDP once it is received in the EU). It has been further estimated that the highest portion of these funds will need to be used for protected areas management.

Major part of the funds for biological diversity conservation in Macedonia is provided from international sources (e.g. GEF, European Union), though it is necessary to strengthen the capacity for absorption of these funds, especially the funds of the EU programme for pre-accession assistance (see Chapter 6.4).

The existing schemes for funding and subsidizing agriculture in rural areas could improve significantly the status of biological diversity provided that such funds are targeted at biological diversity protection, traditional practices, etc. Financial support to agriculture is covered by National target 3.

There are tax and customs reliefs for application of technologies that are compliant with the principles of environment protection. Under the Law on Profits, "the tax payer shall be entitled to accelerated amortization of capital assets in cases of accomplished technological modernization or procurement of means for environment and nature protection, but not higher than the level exceeding 25 % of the amortization". Means intended for environment and nature protection shall be the resources intended for equipment, devices and instruments used for reduction and measurement of the pollution of air, water and soil, introduction of clean technologies, as well as construction of household and industrial waste water treatment plants, installation of filters for air protection against pollution, production of products from waste materials, collection and disposal of household and hazardous matters, etc. (according to Article 4, paragraph 1, item 18 of the Rulebook on the manner of calculation and payment of the tax on profit and prevention of dual exemption or dual taxation). With regard to biological diversity conservation, reliefs would concern persons who are not tax payers, but bylaws should be revised to be more specific in technologies defining.

Actions to achieve National Target 4

4.1. Provision of basic funds for protected areas from the Budget of the Republic of Macedonia

4.2. Fostering of tax and customs reliefs for application of technologies that are compliant with the principles of biological diversity conservation

4.3. Establishment of Nature Protection Agency

4.4. Introduction of a nature protection programme in MoEPP and establishment of special item in the budget for biological diversity conservation (with value equalling 20% of the funds for NBSAP implementation)

4.5. Introduction of mechanism for biological diversity incentives and fund reinvestment

4.6. Establishment of self-sustainable financial system of protected area management

4.7. Introduction of tax reliefs and subsidies for services and products in protected areas and encouragement of the self-sustainability mechanism

4.8. Establishment of mechanisms for financing biological diversity conservation from the budgets of the local self-governments

4.9. Organization of donor conferences for issues on biological diversity

4.10. Encouragement of social accountability with companies to support project activities referring to the conservation of biological diversity

4.11. Strengthening of the capacities to apply for biological diversity conservation projects in EU funds and other international donors and mechanisms within MoEPP, ULSG, PA management entities, NGOs and other relevant stakeholders

4.12. Consideration of the possibility to re-allocate a percentage of the personal tax for projects and programmes of general interest, also including protection of biological diversity

No.	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
4.1	Provision of basic funds for protected areas from the Budget of the Republic of Macedonia	1	Government of RM	Cont.	Budget of RM	PA basic funds provided
4.2	Fostering of tax and customs reliefs for application of technologies that are compliant with the principles of biological diversity conservation	2	Ministry of Finance (MoF), tax and customs services	Cont.	Budget of RM	Tax and customs reliefs introduced towards biological diversity protection
4.3	Establishment of Nature Protection Agency	1	Government of RM	2018 -	Budget of RM	Nature Protection Agency established
4.4	Introduction of a nature protection programme in MoEPP and establishment of special item in the budget for biological diversity conservation (with value equalling 20% of the funds for NBSAP implementation)	1	Government of RM, MoEPP	Cont.	Budget of RM	Programme adopted; funds for NBSAP implementation provided
4.5	Introduction of mechanism for biological diversity incentives and fund reinvestment	2	MoEPP, PAs, experts, other stakeholders	2018 - 2020	Budget of RM	Mechanism introduced
4.6	Establishment of self-sustainable financial system of protected area management	1	MoEPP, PAs, experts	Cont.	Budget of RM, PA budget	Self-sustainable financial system established; number of PAs having implemented such system
4.7	Introduction of tax reliefs and subsidies for services and products in protected areas and encouragement of the self-sustainability mechanism	2	MoEPP, PAs, tax services	2018-2023	Budget of RM, foreign grants	Tax reliefs and subsidies for services and PA products implemented
4.8	Establishment of mechanisms for financing biological diversity conservation from the budgets of the local self-governments	3	MLSG, ULSG, ZELS, MoEPP	Cont.	Budget of RM, ULSG budget	Financing mechanism established
4.9	Organization of donor conferences for issues on biological diversity	2	MoEPP, NGOs, business sector, other stakeholders	Cont.	Budget of RM, foreign grants	Donor conferences held
4.10	Encouragement of social accountability with companies to support project activities referring to the conservation of biological diversity	2	Relevant ministries in cooperation with companies	Cont.	Company budget	Number of companies supporting biodiversity conservation projects; projects supported by companies
4.11	Strengthening of the capacities to apply for biological diversity conservation projects in EU funds and other international donors and mechanisms within MoEPP, ULSG, PA management entities, NGOs and other relevant stakeholders	1	National and international experts, NGOs	Cont.	Foreign grants	Number of training sessions conducted; number of submitted / approved projects
4.12	Consideration of the possibility to re-allocate a percentage of the personal tax for projects and programmes of general interest, also including protection of biological diversity	2	Government of RM, MoF, experts	2019 - 2021	Budget of RM, foreign grants	Possibilities identified and percentage of the personal tax for BD protection re-allocated

Shar Planina central mountain range

11.9 STRATEGIC GOAL B: "Reduce direct and indirect pressures on ecosystems and other components of biological diversity"

Analysis of the main threat to biological diversity in the Republic of Macedonia indicates that excessive and unsustainable use of natural resources, unplanned urbanization and pollution directly affect the processes in high number of ecosystems. Combined with fragmentation of habitats, climate change and non-native invasive species, these impacts contribute directly to unfavourable status of individual components of biological diversity in the Republic of Macedonia.

Considerable number of direct pressures on ecosystems and other components of biological diversity will be reduced by application of modern principles and practices for sustainable forestry and agriculture, reduction of the pollution with waste matters or nutrients to a level that is not detrimental to biological diversity including ecosystems, as well as through prevention and control of the spread of non-native invasive species. Intensity of these direct pressures will reduce further if we overcome hidden and unwanted effects on biological diversity by policies in other sectors, but also through restriction of the consumption of natural resources within safe ecological limits.

11.10 National Target 5: "Establish practices for forestry, agriculture, hunting and fishery management that contribute to the conservation of biological diversity and maintenance of ecosystem services"

Inadequate manners and intensity of natural resources exploitation cause severe threats to the components of biological diversity and natural processes in ecosystems. Practices applied in the forestry and agriculture in the Republic of Macedonia often fail to take into account the overall spectrum of services delivered by ecosystems the resources of which are used. Several of the direct threats deriving from these sectors should have high priority in the activities for conservation of biological diversity and maintenance of ecosystem services. In forestry, those include clearcutting over large areas, excessive and illegal wood cutting on certain areas, lack of selective and inappropriate attitude towards forests of high biological diversity and other inadequate practices. In agriculture, the focus should be placed on the reduced application of biocides, hormones and chemicals, fertilization and other practices. Anyhow, the highest priority should be attributed to threats to biological diversity resulting from the abandonment of traditional agricultural practices (e.g. abandonment of pastoral systems and lack of mowing and grazing). Use of biological resources in other sectors, such as hunting and fishery, is also source of significant pressures. Among them, reduction of the pressure on terrestrial animals due to hunting by traps, poisoning and poaching, should have highest priority.

The abovementioned pressures on the components of biological diversity and natural processes in ecosystems will be reduced by introduction of principles and practices for rational and sustainable use of biological diversity, including also improved enforcement of laws and regulations for effective control of illegal exploitation. To this end, it is necessary to provide harmonization between policies and laws that regulate the use of individual natural resources and those aimed at conserving biological diversity.

Actions to achieve National Target 5

5.1 Harmonization of the legislation for nature protection with the laws on forests, hunting, fishery and rural development, pastures, agricultural land, livestock breeding and waters

5.2 Strengthening of the capacity of judiciary to cope with environmental crime

5.3 Strengthening of the capacity for detection of illegal use of poisons

5.4 Fostering of the integration of biological diversity components (especially threatened species and habitats) into forestry practices

5.4.1 Fostering of the integration of the needs for functionality of bio-corridors and ecological network into forestry practices and rural development

5.4.2 Support to the introduction of measures for protection and conservation of non-forest habitats of high natural values (montane pastures, meadows, etc.) in forestry practices

5.4.3 Reduced application of clearcutting over large areas and other practices in forestry that may pose threat to biological diversity

5.4.4 Transfer of knowledge and international practices in forests management and exploitation from biological diversity conservation point of view

5.4.5 Fostering of the forest inventorization process

5.4.6 Fostering of the forest certification process

5.5 Support to the management of biodiversity-rich forests (or HNV Forest), including near-virgin forests

5.5.1 Development of study for identification of biodiversity-rich forests, including near-virgin forests

5.5.2 Introduction of protection of near-virgin forests and old forests that may turn into near-virgin forests

5.5.3 Preparation of guidelines for introduction of good management practices in biodiversity-rich forests

5.5.4 Implementation of pilot project to test good management practices in biodiversity-rich forests and bio-corridors maintenance

5.6 Support to the renewal of the stocks for forestation of bare and erosive lands

5.7 Strengthening of the capacity of institutions and hunting site managers for game protection against poaching and control of unselective methods and products in hunting

5.8 Support towards strengthening the capacity of the State Inspectorate for Forestry and Hunting

5.9 Development of study for identification of biodiversity-rich agricultural areas (HNV Farmland areas) and their integration in agricultural policies

5.10 Encouragement of modernization of existing irrigation systems through compulsory introduction of drip irrigation system and other measures (billing by water spent)

5.11 Minimization of water intake on open waters for the purposes of agriculture and transfer towards use of other sources (wells and pumps)

5.12 Preparation of study on the consequences from excessive grazing on certain areas

5.13 Preparation of study on the impact of fishponds on biological diversity

5.14 Support in the implementation of actions under the Programme for Fisheries and Aquaculture concerning activities linked to the improvement of the status of native fish populations, conservation of their aquatic habitats and assistance in the establishment of methodologies for monitoring the efficiency of protection measures

5.15 Encouragement of rural tourism by promoting food from native species/breeds

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
5.1		Harmonization of the legislation for nature protection with the laws on forests, hunting, fishery and rural development, pastures, agricultural land, livestock breeding and waters	3	MoEPP in cooperation with MAFWM and other relevant sectors	Cont.	Add. budget not required	Scope of harmonized legislation
5.2		Strengthening of the capacity of judiciary to cope with environmental crime	2	SEI, courts in RM, international experts, Faculty of Security	2018 - 2023	Budget of RM, foreign grants	Training to cope with environmental crime held
5.3		Strengthening of the capacity for detection of illegal use of poisons	1	MoEPP, MAFWM, PAs, hunting clubs, NGOs, international experts and other stakeholders	2018 - 2023	Budget of RM, foreign grants	Training for detection of illegal use of poisons held
5.4		Fostering of the integration of biological diversity components (especially threatened species and habitats) into forestry practices					
5.4.1	2.3.5	Fostering of the integration of the needs for functionality of bio-corridors and ecological network into forestry practices and rural development	3	MoEPP, MAFWM, PE Macedonian Forests, scientific institutions, experts	Cont.	Budget of RM	Rulebooks adopted; methodology in line with laws on nature, forestry and rural development prepared
5.4.2		Support to the introduction of measures for protection and conservation of non-forest habitats of high natural values (montane pastures, meadows, etc.) in forestry practices	3	MoEPP, MAFWM, PE Macedonian Forests, scientific institutions	Cont.	Budget of RM, foreign grants	Measures for protection and conservation of non-forest habitats of high natural values adopted; number of areas with measures incorporated into forestry practices
5.4.3		Reduced application of clearcutting over large areas and other practices in forestry that may pose threat to biological diversity	2	MAFWM, PE Macedonian Forests, scientific institutions, private forest owners	Cont.	Budget of RM	Bylaws adopted; penalty provisions; practical methods and tools for better coordination and efficiency of competent services
5.4.4		Transfer of knowledge and international practices in forests management and exploitation from biological diversity conservation point of view	2	MAFWM, PE Macedonian Forests, scientific institutions, private forest owners, international experts	Cont.	Budget of RM, foreign grants	Number of training sessions for the domestic sectors held; status of forests and biological diversity
5.4.5		Fostering of the forest inventorization process	1	MAFWM, PE Macedonian Forests, scientific institutions, private forest owners	2018 - 2023	Budget of RM, foreign grants	Inventory prepared
5.4.6		Fostering of the forest certification process	2	MAFWM, PE Macedonian Forests, scientific institutions, private forest owners	2018 - 2021	Budget of RM, foreign grants	Area of certified forest
5.5		Support to the management of biodiversity-rich forests (or HNV forests), including near-virgin forests					
5.5.1		Development of study for identification of biodiversity-rich forests, including near-virgin forests	1	MAFWM, MoEPP, PE Macedonian Forests, PAs scientific institutions	2018 - 2020	Foreign grants	Study identifying HBD forests prepared
5.5.2		Introduction of protection of near-virgin forests and old forests that may turn into near-virgin forests	3	MAFWM, PE Macedonian Forests, PAs	2018 - 2020	Budget of RM	Suggestions for amendments to the legal provisions protecting near-virgin and old forests; number of near-virgin and old forests integrated into forest management documents

5.5.3		Preparation of guidelines for introduction of good management practices in biodiversity-rich forests	2	MAFWM, PE Macedonian Forests, private forest owners, scientific institutions, international experts	2018 - 2021	Foreign grants	Guidelines to intr oduce good practices prepared; training and seminars held
5.5.4		Implementation of pilot project to test good management practices in biodiversity-rich forests and bio-corridors maintenance	2	MAFWM, MoEPP, PAs	2018 - 2020	Foreign grants	Pilot projects implemented
5.6		Support to the renewal of the stocks for forestation of bare and erosive lands	2	MAFWM, PE Macedonian Forests, scientific institutions	2018-2019.	Budget of RM, foreign grants	Stocks for forestation of bare and erosive lands renewed
5.7		Strengthening of the capacity of institutions and hunting site managers for game protection against poaching and control of unselective methods and products in hunting	2	MAFWM, hunting grounds managers	2018 - 2021	Foreign grants	Number of training sessions held; number of reported and solved cases of poaching (it should be observed whether falling trends occur in parallel to the strengthening of capacities)
5.8		Support towards strengthening the capacity of the State Inspectorate for Forestry and Hunting	3	MAFWM, Inspectorate for Forestry and Hunting, hunting grounds managers	2018 - 2021	Foreign grants	Organizational unit established; number of incidents; number of solved cases; number of interventions and positive solutions
5.9		Development of study for identification of biodiversity-rich agricultural areas (HNV Farmland areas) and their integration in agricultural policies	2	MAFWM, MoEPP, PE Macedonian Forests, scientific institutions, international experts	2018 - 2021	Budget of RM, EU funds	Study for identification of biodiversity-rich agricultural areas prepared; area number and size
5.10	NT-9	Encouragement of modernization of existing irrigation systems through compulsory introduction of drip irrigation system and other measures (billing by water spent)	3	MAFWM, Federation of Farmers, private farmers	2018 - 2023	Budget of RM, foreign grants	Number and size of areas with established drip irrigation system; other implemented measures
5.11		Minimization of water intake on open waters for the purposes of agriculture and transfer towards use of other sources (wells and pumps)	2	MAFWM, Federation of Farmers, private farmers	2018 - 2023	Foreign grants	Trends in the number of watercourses reaching the tributary during the summer
5.12		Preparation of study on the consequences from excessive grazing on certain areas	2	PE for Pasture Management, MAFWM, scientific institutions, herders	2018 - 2020	Foreign grants	Study prepared
5.13		Preparation of study on the impact of fishponds on biological diversity	2	MoEPP, Hydrobiol. Institute, scientific institutions	2018 - 2020	Foreign grants	Study prepared
5.14		Support in the implementation of actions under the Programme for Fisheries and Aquaculture concerning activities linked to the improvement of the status of native fish populations, conservation of their aquatic habitats and assistance in the establishment of methodologies for monitoring the efficiency of protection measures	2	MAFWM, scientific institutions Hydrobiol. Institute, fishing clubs, concession holders, NGOs		Budget of RM, foreign grants, EU funds for cross-border cooper.	Number of Programme activities implemented
5.15		Encouragement of rural tourism by promoting food from native species/breeds	2	MAFWM, ME, Agency for Tourism Development and Support		Budget of RM, Dept. for Tourism, local farmers	Number of farms offering such type of tourism; number of overnights; income realized

11.11 National Target 6: "Reduce pollution, including waste and excessive inlet of nutrients, to levels that are not detrimental to biological diversity, ecosystems and ecosystem services delivery"

Pollution is increasingly significant cause to biological diversity loss and malfunctioning of ecosystems, including excessive inlet of nutrients (primarily nitrogen and phosphorous) that affect especially aquatic ecosystems and arid areas.

High number of major environmental polluters in Macedonia has not established systems for harmful matters emissions prevention despite the obligations imposed by IPPC procedure and issuance of integrated permits. The harmfulness of air emissions for human health does not contribute significantly to conditions improvement. When it comes to atmospheric pollution, wild species are mainly indirectly affected due to pollutants disposition on soil and vegetation used as fodder. The most detrimental impact of pollution is probably reflected on aquatic ecosystems and organisms inhabiting them. In this context, besides industry, municipal waste waters have great impact. We may freely state that most of such waste waters is discharged into watercourses and lakes without prior treatment. Waters and soils (together with ground waters) suffer significant pollution from unregulated landfills as well, both through surface runoff and underground runoff of the leakage from landfills. This problem is especially manifested in karstic areas (because of the permeability of calcareous ground – for example, Ohrid landfill). These conditions have significant impact on ecosystems potential to provide ecosystem services – services related to water supply, clean air, recreation services, and the like.

Significant contribution to environment pollution (all media) comes from agriculture, too. Use of pesticides and mineral fertilizers in Macedonia is rarely based on expert information of the necessity for their use. Excessive quantities and in inappropriate periods are most often applied and this results in pollution of soils, ground waters and surface aquatic ecosystems.

Given the fact that inlet of pollutants in all environmental media in the Republic of Macedonia is significant, there is a need for its reduction for the purpose of biological diversity conservation and maintenance of the function of ecosystems (apart from human health protection). In order to achieve these targets, introduction of systems for reduction of discharged harmful matters into environment (air, waters, soil) is necessary.

The problem of lack of sufficiently quantified data on the impact of pollution on biological diversity in the country is apparent. Therefore, it is necessary to undertake actions towards improvement of environment pollution monitoring in Macedonia, to cover all environmental media, strengthening of the control of harmful matter emissions in waste waters, waste gases and status of solid waste (industrial landfills in particular).

Actions to achieve National Target 6

6.1 Strengthening of the Integrated Pollution Prevention and Control system (IPPC)

6.1.1 Strengthening of institutional capacity for consistent implementation of IPPC

6.1.2 Encouragement of polluters to implement the obligations ensuing from the national legislation on environment and nature

6.2 Implementation of pilot studies of the impact of pollution on terrestrial ecosystems and biological diversity

6.3 Strengthening of the capacity for environmental pollution monitoring

6.4 Improvement of surface and ground water monitoring

6.5 Improvement of ambient air monitoring

6.6 Establishment of soil pollution monitoring

6.6.1 Adoption of legislation on soil protection

6.6.2 Implementation of soil pollution monitoring

6.7 Construction of sewage system and municipal and industrial waste water treatment facilities

6.8 Implementation of measures to mitigate the effects of existing landfills on biological diversity

6.8.1 Development of study about the impact of existing solid waste landfills on biological diversity in their surrounding and immediate basin

6.8.2 Clearing of illegal waste dumpsites within areas important for biological diversity

6.8.3 Dislocation of landfills from karst river basins and landfills in the vicinity of rivers

6.8.4 Prevention of the access of wild and domestic animals to landfills

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
6.1		Strengthening of the Integrated Pollution Prevention and Control system (IPPC)					
6.1.1		Strengthening of institutional capacity for consistent implementation of IPPC	1	MoEPP in cooperation with competent institutions, business sector, Chambers of Commerce	2018 - 2023	Budget of RM, Twinning project and other EU funds, business sector	Training implemented; number of experts employed in the Department
6.1.2		Encouragement of polluters to implement the obligations ensuing from the national legislation on environment and nature	1	MoEPP, SEI, business sector	2018 - 2023	Business sector	Reduced environmental pollution according to the monitoring
6.2		Implementation of pilot studies of the impact of pollution on terrestrial ecosystems and biological diversity	2	MoEPP in cooperation with scientific institutions	2019 - 2023	Budget of RM, foreign grants	Number of pilot studies implemented
6.3		Strengthening of the capacity for environmental pollution monitoring	2	MoEPP in cooperation with scientific institutions, institutions responsible for monitoring	2018 - 2023	Budget of RM	Number of experts employed; number of training sessions held
6.4		Improvement of surface and ground water monitoring	1	MoEPP, MAFWM, NHS, Hydrobiol. Institute, scientific institutions	2018 - 2023	Budget of RM	Number of new measurement sites; number of monitoring parameters
6.5		Improvement of ambient air monitoring	2	MoEPP in cooperation with scientific institutions	2018 - 2023	Budget of RM	Number of new measurement sites; number of monitoring parameters
6.6		Establishment of soil pollution monitoring					
6.6.1		Adoption of legislation on soil protection	1	MoEPP	2018-2019	Budget of RM	Law on soil protection adopted
6.6.2		Implementation of soil pollution monitoring	3	MAFWM, MoEPP in cooperation with scientific institutions	2020-2023	Budget of RM	Trend in the number of measurement sites where continuous sampling is conducted
6.7		Construction of sewage system and municipal and industrial waste water treatment systems	2	MAFWM, MoEPP, MTC, ULSG in cooperation with scientific institutions	Cont.	EU funds, foreign grants	Number of installed water treatment facilities
6.8		Implementation of measures to mitigate the effects of existing landfills on biological diversity					
6.8.1		Development of study about the impact of existing solid waste landfills on biological diversity in their surrounding and immediate basin	2	MoEPP, ULSG, scientific institutions and experts	2020 - 2023	Foreign grants	Study prepared
6.8.2		Clearing of illegal waste dumpsites within areas important for biological diversity	2	MoEPP, ULSG, public communal enterprises	2018 - 2023	Budget of RM, foreign grants	Number od cleared landfills
6.8.3		Dislocation of landfills from karst river basins and landfills in the vicinity of rivers	3	MoEPP, ULSG, public communal enterprises		Budget of RM, foreign grants	Number od cleared landfills from river basins
6.8.4		Prevention of the access of wild and domestic animals to landfills	2	MAFWM, ULSG, Federation of Farmers, private farmers and other stakeholders		Budget of RM	Number of structurally improved landfills; educational lectures provided to farmers

Matka

11.12 National Target 7: "Develop and implement plans for sustainable production and sustainable consumption for the purpose of natural resources use within safe ecological limits"

The World Summit of Sustainable Development in Johannesburg, held in 2002, stressed the urgency of economic development and environment degradation decoupling that could be achieved through encouragement of efficient and sustainable use of natural resources. The growing consumption makes significant indirect pressure on biological diversity and ecosystems by intensifying the use of natural resources (energy, water and food). This leads to increased or excessive exploitation of natural resources, degradation of habitats, increased pollution and climate change, i.e. increase in direct pressures on biological diversity. The constantly growing uptake of natural resources in the Republic of Macedonia increases the pressure on all components of biological diversity (forests, aquatic ecosystems, game, economically important species of fish and medicinal and aromatic plants, etc.). Very high number of species is affected by degradation of their habitats. Increased intakes of water resources for the purposes of agriculture and energy sector are the most striking examples. The available data does not enable appropriate assessment of the current level of individual natural resources use and whether this exceeds ecological limits (quotas) for sustainable use of biological diversity components. Decision makers in public and private sectors necessitate such information in the development of plans and undertaking of activities aimed at efficient and sustainable use of biological diversity.

Actions to achieve National Target 7

7.1 Promotion and application of methodology for determination of ecological footprint in state institutions and corporations (business sector) and proposing activities towards its reduction

7.2 Determination of safe sustainable limits (quotas) for the use of biological diversity components, and natural resources in general

7.2.1 Determination of quotas for collection of wild species of plants, fungi, animals and commercially significant parts thereof

7.2.2 Determination of areas where collection of species at risk should be avoided

7.2.3 Harmonization and further regulation of the system for issuing wildlife harvesting license

7.2.4 Development of scientific studies on the status of game population for the purpose of setting more appropriate hunt quotas

7.2.5 Strengthening of the capacity of hunting grounds managers to monitor game animal numbers through counting techniques based on ecological methodology for the purpose of setting more precise hunt quotas

7.2.6 Review of the methodology establishing biological minimum in watercourses in a manner to account for the ecological flow

7.2.7 Determination of the potential of natural pastures and quotas for their use

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
7.1		Promotion and application of methodology for determination of ecological footprint in state institutions and corporations (business sector) and proposing activities towards its reduction		MoEPP, ASP, NGOs, business sector, international experts and other stakeholders	2019 - 2022	Budget of RM, foreign grants	Methodology training held; activities reducing ecological footprint implemented
7.2		Determination of safe sustainable limits (quotas) for the use of biological diversity components, and natural resources in general					
7.2.1		Determination of quotas for collection of wild species of plants, fungi, animals and commercially significant parts thereof	1	MoEPP in cooperation with scientific institutions	2018-2023	Budget of RM, foreign grants	Quotas for commercially significant species set
7.2.2		Identification of areas where collection of species at risk should be avoided	1	MoEPP in cooperation with scientific institutions	2018-2020	Budget of RM, foreign grants	Analysis prepared and areas identified
7.2.3		Harmonization and further regulation of the system for issuing wildlife harvesting license	1	MoEPP, PA manag. entities, PE Macedonian Forests, companies purchasing wild species	2018 - 2021	Budget of RM, foreign grants	Licensing system harmonized; number of issued licenses
7.2.4		Development of scientific studies on the status of game population for the purpose of setting more appropriate hunt quotas	2	MAFWM, MoEPP in cooperation with scientific institutions	2019 - 2022	Budget of RM, foreign grants	Studies on the status of game population prepared; game covered by the studies
7.2.5		Strengthening of the capacity of hunting grounds managers to monitor game animal numbers through counting techniques based on ecological methodology for the purpose of setting more precise hunt quotas	2	MAFWM, hunting grounds managers, scientific institutions, NGOs	2018 - 2023	Budget of RM, foreign grants	Number of training sessions held
7.2.6		Review of the methodology establishing biological minimum in watercourses in a manner to account for the ecological flow	1	MoEPP, MAFWM in cooperation with scientific institutions	2018 - 2020	Budget of RM, EU funds, foreign grants	Methodology reviewed; new principles to establish biological minimum
7.2.7	4.1	Determination of the potential of natural pastures and quotas for their use	2	MoEPP, MAFWM in cooperation with scientific institutions	2018 - 2020	Budget of RM, foreign grants	Studies on the potential of Macedonian pastures prepared; quotas for their use set


Osogovo Mountain

11.13 National Target 8: "Develop and establish appropriate policy for recording, control and protection of non-native and invasive species"

Many examples of negative influence of invasive species of ecosystems and other biological diversity components have been registered in the Republic of Macedonia. Native ichtyofauna and other biological diversity components in aquatic ecosystems in the country, where pressure of invasive species is intensified in interaction with other direct impacts, such as excessive utilization of native fish species,, climate change and pollution, are of particular concern. Although scientific and professional community in our country expresses increased concern with regard to direct pressures of invasive species on biological diversity, there is modest knowledge in this area. It is necessary to carry out comprehensive study to identify invasive plant and animal species, as well as ways and modes of their introduction in natural ecosystems. The results from this research should enable setting of priorities towards prevention of spread or extermination of invasive species or control of the ways of their introduction.

Particular problem related to the quality of man's life is the recent spread of the ragweed (Ambrosia artemisifolia) as exceptionally allergen species. Investigation of its spread and urgent measures to stop the progress of localized populations, as well as continuous monitoring for further prevention of its spread are necessary.

In fishing, there is established practice to transfer species across different water bodies in the country, whereas a species may be native to a given water body but not native to the body of water it had been transferred to. The risk of such actions which, in principle, should be avoided, in most cases is not quantified. This poses the need for further research and state monitoring.

Actions to achieve National Target 8

8.1 Identification, monitoring and control of non-native species, invasive especially

8.1.1 Development of a study identifying non-native species, invasive species especially, and establishment of the size and spatial distribution of their populations, means of transfer and the risk they pose to the country's biological diversity

8.1.2 Preparation/adoption of a national list of invasive species

8.1.3 Monitoring and control of invasive plant species

8.1.4 Monitoring and control of invasive fauna species

8.1.5 Monitoring and control of invasive fish species and investigating the real danger of them spreading to water bodies wherein they do not occur naturally

8.2 Monitoring of the occurrence of invasive species resulting from climate change (including vectors of diseases)

8.3 Encouraging activities towards eradication of non-native species in riparian vegetation and their substitution with native species

8.4 Support to ESENIAS monitoring network for invasive species

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
8.1		Identification, monitoring and control of non-native species, invasive especially					
8.1.1		Development of a study identifying non-native species, invasive species especially, and establishment of the size and spatial distribution of their populations, means of transfer and the risk they pose to the country's biological diversity	1	MoEPP in cooperation with scientific institutions	2018 - 2021	Budget of RM, foreign grants	Study prepared
8.1.2		Preparation / adoption of a national list of invasive species	1	MoEPP in cooperation with scientific institutions	2021-2022	Budget of RM, foreign grants	List prepared and adopted
8.1.3		Monitoring and control of invasive plant species	2	MAFWM, MoEPP in cooperation with scientific institutions	2020 - 2023	Budget of RM, foreign grants	Monitoring established; data collected from regular monitoring
8.1.4		Monitoring and control of invasive fauna species	2	MAFWM, MoEPP, Hydrobiol. Institutte , scientific institutions	2022-2023	Budget of RM, foreign grants	Monitoring established; invasive plant species' trends
8.1.5		Monitoring and control of invasive fish species and investigating the real danger of them spreading to water bodies wherein they do not occur naturally	2	MoEPP, Hydrobiol. Institute, PAs, scientific institutions	Cont.	Budget of RM, foreign grants	Invasive species' trends
8.2		Monitoring of the occurrence of invasive species resulting from climate change (including vectors of diseases)	2	Scientific institutions, NGOs	Cont.	Budget of RM, foreign grants	List of recorded invasive species prepared
8.3		Encouraging activities towards eradication of non-native species in riparian vegetation and their substitution with native species	2	Scientific institutions, NGOs and other stakeholders	Cont.	Budget of RM, foreign grants	Trends in the population of non-native species; number/ size of the localities where substitution has been conducted
8.4		Support to ESENIAS monitoring network for invasive species	1	MAFWM, MoEPP, scientific institutions, NGOs, other stakeholders	Cont.	Budget of RM, EU funds	Membership of institutions and NGOs in the ESENIAS network; Macedonian participation to ESENIAS meetings

11.14 National Target 9: "Integrate measures for climate change effects adaptation and mitigation and combat against desertification"

Climate change (temperature raise, increasingly frequent draughts and extreme weather events) affect all levels of biological diversity. Apart from accelerated loss of biological diversity, they also affect productivity of current ecosystems. Yet, biological diversity can respond to climate change, to a certain extent, with its own adaptation capacity.

Some of the measures for adaptation to and mitigation of negative effects of climate change on biological diversity specified in the Third National Communication on Climate Change (adopted in 2014) envisage ways of biological resources use that do not threaten biological diversity. They refer to: enhancement of knowledge, sustainable use of land, improved management of protected areas, preparation of efficient strategies for waters management and strategies for renewable energy sources use (hydrological system, solar power, wind power). The Third National Communication on Climate Change also identified constraints concerning "lack of data on climate impacts on biological diversity, especially in mountainous ecosystems, almost complete absence of biological diversity monitoring, lack of functional system of protected areas that takes into account climate change and lack of efforts for ex situ conservation". Also, within the sectoral report on biodiversity prepared for the Third National Communication on Climate Change, indicators for monitoring the changes of biological diversity caused by climate change have been proposed.

National Action Programme approximated with the 10-year Strategy of the Convention to Combat Desertification (UNCCD) is developed for the first time in Macedonia, in 2014. The methodology of developing the National Action Programme guarantees definition of measures that will support biological diversity conservation, i.e. it will be approximated with the action plan for biological diversity.

Actions proposed for this national target (8) are complementary to actions in the Third National Communication on Climate Change and National Action Programme to Combat Desertification. They concern coordination between Strategy for Biological Diversity and Climate Change Convention in the Republic of Macedonia, efficient waters management, performance of research of the impacts of climate on biological diversity and improved management of protected areas.

Actions to achieve National Target 9

9.1 Continuous coordination of activities for biological diversity conservation with activities for combating climate change

9.2 Development of a study of biological diversity and economic benefits of energy generating systems based on use of alternative energy sources (hydrological systems, solar power, wind power)

9.3 Identification of possible routes (bio-corridors) for movement and migration of animal and plant species under threat from climate change

9.4 Setting of ecological flow for mountain aquatic ecosystems

9.5 Development of a hydrological study about the threat to ponds in lowlands, mountain ponds and glacial lakes

9.6 Assessment of the effects of periodic natural and induced hydrological fluctuation on biological diversity in glacial lakes and lowland ponds and swamps in the context of climate change

9.7 Development of a study of historical and current upper forest boundary and modelling of future climate-induced changes

9.8 Detailed change mapping and modelling in certain mountainous pastures as pilot study of climate change

9.9 Supplementing the network of protected areas in Macedonia in a way to ensure easier adaptation of biological diversity components to climate change

9.10 Development of pilot models for determination of the climate change impact to biodiversity

9.11 Application of measures for adaptation to climate change in protected areas during management plan development

9.12 Undertaking measures to prevent full degradation (desertification) of certain ecosystems that are under strong anthropogenic pressure in line with the measures ensuing from the National Action Programme to Combat Desertification

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
9.1		Continuous coordination of activities for biological diversity conservation with activities for combating climate change	1	MoEPP in cooperation with scientific institutions	Cont.	Budget of RM, foreign grants	Joint consultation of the parties for biological diversity and combating climate change conducted
9.2		Development of a study of biological diversity and economic benefits of energy generating systems based on use of alternative energy sources (hydrological systems, solar power, wind power)	1	MoEPP, ME, energy sector, other stakeholders	2019 - 2023	ELEM, foreign grants	Study prepared
9.3		Identification of possible routes (bio-corridors) for movement and migration of animal and plant species under threat from climate change	1	MoEPP in cooperation with scientific institutions and individual experts	2019 - 2023	Budget of RM, foreign grants	Movement and migration routes of species under threat from climate change identified
9.4	7.2.6	Setting of ecological flow for mountain aquatic ecosystems	1	MoEPP, MAFWM, scientific institutions	2018 - 2020	Business sector, ELEM, foreign grants	Ecological flow study prepared
9.5		Development of a hydrological study about the threat to ponds in lowlands, mountain ponds and glacial lakes	2	Scientific institutions, MoEPP, MFAWM, international experts	2018 - 2021	Budget of RM, foreign grants	Hydrological study prepared
9.6		Assessment of the effects of periodic natural and induced hydrological fluctuation on biological diversity in glacial lakes and lowland ponds and swamps in the context of climate change	2	Scientific institutions, MoEPP, energy sector and other stakeholders	2018 - 2021	Budget of RM, foreign grants	Studies prepared; scientific insight; results from BD monitoring in affected areas
9.7		Development of a study of historical and current upper forest boundary and modelling of future climate-induced changes	2	Scientific institutions, MoEPP, other stakeholders	2018 - 2020	Budget of RM, foreign grants	Study prepared; models prepared
9.8		Detailed change mapping and modelling in certain mountainous pastures as pilot study of climate change	2	Scientific institutions, MoEPP, other stakeholders	2020 - 2023	Budget of RM, foreign grants	Maps developed; data gathered through modelling
9.9	NTs 10 and 11	Supplementing the network of protected areas in Macedonia in a way to ensure easier adaptation of biological diversity components to climate change	1	Scientific institutions, MoEPP and other stakeholders	2018-2023	Budget of RM, foreign grants	Proposal to supplement (designate) specific PAs for the adaption to climate change; number of designated PAs in the national PA network
9.10		Development of pilot models for determination of the climate change impact to biodiversity	1	MoEPP, scientific institutions, PAs and other stakeholders	2018-2023	Budget of RM, foreign grants	Number of training sessions held; number of models developed
9.11	10.2	Application of measures for adaptation to climate change in protected areas during management plan development	2	MoEPP, PA management entities, scientific institutions	2018 - 2023	Budget of RM, foreign grants	Management plans incorporating adaptation measures for adaptation to climate change
9.12	4.10, 6.2.6, 2.3.6, 3.4 and 4.4.3	Undertaking measures to prevent full degradation (desertification) of certain ecosystems that are under strong anthropogenic pressure in line with the measures ensuing from the National Action Programme to Combat Desertification	2	MoEPP, PA management entities, NGOs, scientific institutions	2020 - 2023	Budget of RM, foreign grants	Trends in the status of given significant ecosystems; measures prescribed and undertaken

11.15 STRATEGIC GOAL C: "Improve the status of biological diversity components to increase the benefits from biological diversity and ecosystem services"

Direct protection is not enough to improve the status of biological diversity, as it can incorporate only small part of biological diversity, and on the other side, acceptance and application of the rules imposed for protection are easily accepted by people whose priority is to provide their own survival and well-being. Therefore exactly, this goal is focused on additional approach the improvement of the status of biological diversity which is closely related to potential benefits for people that would follow the preservation of all elements of biological diversity.

Biological diversity plays important role in the functioning of ecosystems and therefore they are sensitive to changes in the numbers of populations or individual species. Reduction of species diversity in the composition of an ecosystem, disorders accordingly its functionality and this in turn results in loss of the potential for providing goods and services without which mankind could not be imagined.

One of the solutions to prevent loss, degradation and fragmentation of natural habitats in Macedonia is to enlarge the size of protected areas, as well as their functional connection. Additionally, there is a lack of assessment of the extent of wild species threat in Macedonia, the establishment of which would contribute significantly in setting priorities in protection, and thus make the prevention of species extinction more efficient. However, one of the mechanisms that would be useful in this regard is continuous monitoring of biological diversity and natural processes.

According to the analysis of biological diversity in the Republic of Macedonia presented in the Fifth National Report to the Convention on Biological Diversity, some of the ecosystems, like forests, natural meadows and water bodies are crucial for the conservation, because they support rich biodiversity and have importance for ecosystem services they deliver. It is beyond doubt that no particular significance was attributed to ecosystem approach to nature protection in Macedonia. In thus an important national document, it should be stressed that conservation of one ecosystem provides dual result – preserved biological diversity and increased benefits for people and other living organisms.

11.16 National Target 10: "Prevent loss, degradation and fragmentation of natural habitats of national and international importance"

In the Republic of Macedonia, habitats have been identified that are important not only on national, but European levels as well. Loss, degradation and fragmentation are the main threats identified for natural habitats in Macedonia. The first problem is the lack of list of habitats, including type and level of threat against them and importance established on the basis of the regulations of the Republic of Macedonia, international agreements ratified and regulations of the European Union. Efficient application of such list requires preparation of map of habitats. Development of list of threatened and important habitat types, as well as specification of measures for their conservation (stipulated in the Law on Nature Protection) would contribute to the initiation of the process of identification and mapping of priority habitats that will establish good basis for identification of Natura 2000 sites. It would be very useful if one natural habitat (e.g. meadows) is taken as pilot (test habitat) as action plan for its conservation is prepared. Such approach will contribute to multiplication of methodological approach to other priority habitat types in Macedonia.

Forests cover around 38% of the territory of the Republic of Macedonia. Data for the period 2003to date shows that forest ecosystems in Macedonia have been subject of modifications due to threats caused mostly by man – illegal wood cutting, forests, uncoordinated management, etc. With reference to fires, education of the local population of the hazard they may induce with stubble fields burning can play a role in the reduction of burnt forest area. Enforcement of stipulated penalty measures for these crimes is unknown and therefore strengthening of inspection supervision and intensification of preventive measures are necessary.

Given the fact that swamp habitats are highly affected natural habitats, it is necessary to turn to their direct protection. Based on the available knowledge, the most affected lowland swamps/wetlands are: Belchishte Swamp, Studenchishte Swamp, Katlanovo Swamp, Monospitovo Swamp, Negorci, etc., while the the most affected mountainous swamps are: Podgorechki and Labunishki Lakes (Jablanica), Bogovinje Lake and Lukovo Pole (Shar Planina), Lokuf (Deshat), Slana Bara (Osogovo Mountains), etc. Major parts of these habitats are degraded as a result of intensification of agriculture, water supply, irrigation, fish stocking and other economic sectors. Preparation of action plans for their conservation would be good first step towards underlining the importance of these habitats and biological diversity they support. Fulfilment of the set measures will result in their conservation and safeguarding the ecosystem services delivered by swamp ecosystems (especially treatment of waste waters). Presently, some of the swamps face direct risk of Conversion, and the latest example concern the plans of the Municipality of Ohrid for construction activities in the area of Studenchishte Swamp.

The Republic of Macedonia has elaborated the National ecological network uniting all important habitats, identified

in accordance with national and European criteria. Entry into force and introduction of this basic document in planning documents would raise the conservation of habitats of national and European importance in the Republic of Macedonia at higher level.

Actions to achieve National Target 10

10.1 Identification and mapping of habitats

10.1.1 Development of list of habitats and establishment of the extent of their threat and importance in accordance with the regulations of the Republic of Macedonia, international agreements ratified and regulations of the European Union (Article 49, LNP)

10.1.2 Mapping of important and threatened habitats in Macedonia and adoption of bylaws (under Article 49, LNP)

10.2 Specification of measures for preservation of habitats types in favourable status of conservation (Article 50, LNP)

10.3 Preparation of action plan for preservation of extensive meadows (identification, mapping of areas under meadows, valorisation, conservation measures, etc.)

10.4 Protection and restoration of swamp habitats/wetlands and riparian habitats

10.4.1 Identification of the most affected lowland swamps/wetlands and preparation of action plans for their conservation

10.4.2 Identification of the most affected mountainous swamps/wetlands and preparation of action plans for their conservation

10.4.3 Development of plan and implementation of activities for prevention of degradation of swamps and wetlands, especially from intensification of agriculture, water supply, irrigation, fish stocking and other activities of economic sectors

10.4.4 Implementation of pilot measures for restoration of wetlands

10.4.5 Implementation of pilot measures for protection and restoration of riparian habitats

10.5 Adoption of MAK-NEN and its implementation in planning documents

10.6 Preparation of national action plan for speleological structures management for the purpose of biological diversity conservation

10.7 Provision of forest protection against forest fires

10.7.1 Consistent application of measures for prevention and sanctions for intentional stubble fields and forest burning

10.7.2 Education of local population of harmful effects of intentional stubble fields and forest burning

Gjafa karst field on Galichica

No.	Relation to	Action		Competent institutions	Implementing	Funding	Action implementation indicator
10.1		Identification and mapping of habitats					
10.1.1		Development of list of habitats and establishment of the extent of their threat and importance in accordance with the regulations of the Republic of Macedonia, international agreements ratified and regulations of the European Union (Article 49, LNP)	1	MoEPP, scientific and expert institutions	2018 - 2020	Budget of RM, foreign grants	List of Macedonian habitats prepared; level of threat to habitats established
10.1.2		Mapping of important and threatened habitats in Macedonia and adoption of bylaws (under Article 49, LNP)	1	MoEPP, scientific and expert institutions, Cadastre of RM	2018 - 2023	Budget of RM, foreign grants	Important and threatened habitats identified; habitats mapped in GIS; bylaws adopted
10.2		Specification of measures for preservation of habitats types in favourable status of conservation (Article 50, LNP)	2	MoEPP, scientific and expert institutions	2020 - 2023	EU funds, budget of RM	Habitats conservation measures adopted
10.3		Preparation of action plan for preservation of extensive meadows (identification, mapping of areas under meadows, valorisation, conservation measures, etc.)	2	Scientific institutions, MAFWM, PE of Pasture Manag., NGOs	2020 - 2023	EU funds	Action plan prepared; registry of meadows of conservation value; map of important areas for extensive meadow conservation developed
10.4		Protection and restoration of swamp habitats/wetlands and riparian habitats					
10.4.1		Identification of the most affected lowland swamps/wetlands and preparation of action plans for their conservation	1	MoEPP, scientific and expert institutions	2018 - 2023	Budget of RM, foreign grants	Trends in existing threats to such habitats; list of priority lowland swamps according to the level of threat prepared; action plans for most affected lowland swamps/wetlands prepared
10.4.2		Identification of the most affected mountainous swamps/wetlands and preparation of action plans for their conservation	1	MoEPP, scientific and expert institutions	2018 - 2023	Foreign grants, budget of RM,	List of priority mountainous swamps according to the level of threat; action plans for most affected mountainous swamps/wetlands prepared
10.4.3	NT-5	Development of plan and implementation of activities for prevention of degradation of swamps and wetlands, especially from intensification of agriculture, water supply, irrigation, fish stocking and other activities of economic sectors	2	MoEPP, scientific institutions, NGOs, PAs, farmers, other stakeholders	2020 - 2023	Budget of RM, foreign grants, EU funds	Plan for swamp and wetland conservation prepared; trends in the status of swamps and wetlands; trends in population of species in swamps and wetlands; sustainable agricultural practices applied; drip irrigation system implemented
10.4.4		Implementation of pilot measures for restoration of wetlands	3	MoEPP, scientific and expert institutions, NGOs	2019-2023	Foreign grants	Restoration activities realized
10.4.5		Implementation of pilot measures for protection and restoration of riparian habitats	3	MoEPP, scientific and expert institutions, NGOs	2018-2023	Foreign grants	Activities to protect and restore riparian habitats implemented
10.5	NT-11	Adoption of MAK-NEN and its implementation in planning documents	1	MoEPP, Agency for Spatial Planning, MAFWM, PE Macedonian Forests	2018	Budget of RM	MAK-NEN adopted; planning documents implementing MAK-NEN
10.6		Preparation of national action plan for speleological structures management for the purpose of biological diversity conservation	3	MoEPP in cooperation with scientific institutions and speleological societies		Budget of RM, foreign grants	Action plan for speleological structures prepared
10.7		Protection of forests from forest fire					
10.7.1	NT-9	Consistent application of measures for prevention and sanctions for intentional stubble fields and forest burning	1	MAFWM, scientific institutions, PE Macedonian Forests, PAs, Protection and Rescue Directorate, CMC	Cont.	Budget of RM	Number of sanctions; number of reports
10.7.2		Education of local population of harmful effects of intentional stubble fields and forest burning	1	MAFWM, scientific institutions, PE Macedonian Forests, PAs, Protection and Rescue Directorate, CMC, NGOs	Cont.	Budget of RM, foreign grants	Training and lectures held; trends in the number of forest fires caused by intentional burning of stubble fields

Crno Ezero, Shar Planina

11.17 National Target 11: "Increase the size of protected areas up to 15% and secure their functional connection as ecological network and establish effective management of protected areas in cooperation with local communities"

Existing network of protected areas includes 86 areas covering around 9% of the territory of Macedonia. The Spatial Plan of the Republic of Macedonia is the most comprehensive document (though study of natural heritage is out of date), which contains information of existing and proposed protected areas and envisages enlargement of the size of protected areas to around 12% by 2020. On the other side, "Representative national network of protected areas" was developed in 2011. The elaboration of this network was based on the analysis of values of existing protected areas, areas proposed for protection, areas identified as internationally important (Important Plant Areas, Important Bird Areas and Prime Butterfly Areas), Emerald sites and areas under international protection (UNESCO and Ramsar sites), taking into account national assessments (or assumptions) of populations and natural ranges of selected priority species and habitats. Representative network includes 99 areas and covers nearly 20% of the territory of the Republic of Macedonia. This network is a good basis to encourage the process of designation of new protected areas in the country. Accomplishment of this target will support implementation of the global Aichi target related to protection of 17% of terrestrial ecosystems.

Efficient management, funding and involvement of the stakeholders in protected areas decision making and management processes are great challenges (see Chapter 7.3). According to IUCN guidelines, the category of the area should be based on the primary goals of the area management and the main goal of the management should be applied over at least 75% of the protected area. It is recommended that up to 25% of the protected area may be used for other purposes, provided that those goals are compatible with the main goals of the protected area management.

Connection of protected areas by corridors, i.e. the establishment of the ecological network is considered as one of the most effective measures for species and habitats conservation, as well as a mitigation (and adaptation) measure for the effects of climate change. In this context, implementation of the developed national ecological network MAK-NEN (see Chapter 7.4.1.1) or undertaking appropriate measures for protection/management of corridors is of particular importance.

It is necessary to improve the management of internationally protected areas in the country (most of them are transboundary). Dojran and Prespa Lakes are under international protection in accordance with the Ramsar Convention, but Ohrid Lake which meets the criteria for designation as wetland of international importance has not been nominated yet. In the course of 2014, Ohrid-Prespa region has been designated as transboundary biosphere reserve, and the initiative for designation of Osogovo Mountains as the second area under the same category is underway. The initiative for designation of old beech forests in Europe as natural heritage under UNESCO includes the Republic of Macedonia with its proposal. Designation of the mentioned areas for internationally protected would significantly improve the situation concerning the increase of the percentage of protected area and conservation of biological diversity. Additionally, with regard to identified important bird, plant and butterfly areas, it is recommendable to monitor their status and provide conservation of their core areas in order to preserve their values. Alliance for Zero Extinction, the global initiative with the aim to prevent the loss of species through identification and conservation of specific areas (known as AZE areas), includes current and potential protected areas, where endangered or critically endangered species are mainly limited to a single area. Finally, the process of identification of Natura 2000 areas, which is undeniable part of the process of accession of the Republic of Macedonia to the European Union, is still untouched topic (with minor exceptions involving educational trainings with Natura 2000 themes).

Crno Ezero, Shar Planina

Actions to achieve National Target 11

11.1 Development of the protected area system

11.1.1 Revision of and amendment to the legislation on national categorization of protected areas with IUCN

11.1.2 Finalization of the process of protected areas re-designation

11.1.3 Harmonization of the system of protected and proposed areas (draft representative protected areas network) with other relevant sectors

11.1.4 Designation of new protected areas based on the Spatial Plan of the Republic of Macedonia, other strategic documents and relevant studies

11.1.5 Designation of natural rarities according to the national legislation

11.2 Identification of Special Conservation Areas and Special Protection Areas in the frames of the process of Natura 2000 establishment

11.3 Nomination and designation of new internationally protected areas

11.3.1 Nomination of Ohrid Lake for wetland of international importance in accordance with the criteria of the Ramsar Convention

11.3.2 Intensified cooperation with UNESCO with regard to areas from the Tentative List and support to the process of including the old beech forests from Macedonia in the proposal for world heritage

11.3.3 Analysing the possibilities for nomination of biosphere reserve under the UNESCO "Man and the Biosphere Programme"

11.3.4 Identification and study of zero extinction sites (AZE areas)

11.4 Establishment of effective management of protected areas

11.4.1 Preparation and adoption of management plans for all protected areas in accordance with the legislation

11.4.2 Adoption of management plans for national parks and/or other protected areas in accordance with the legislation

11.4.3 Appointment of protected area management entities in accordance with the legislation

11.4.4 Strengthening of the capacity and efficiency of protected area management

11.5 Monitoring of the status of priority species and habitats conservation outside the system of protected areas identified in the frames of Important Plant Areas, Important Bird Areas and Prime Butterfly Areas

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
11.1		Development of the protected area system					
11.1.1		Revision of and amendment to the legislation on national categorization of protected areas with IUCN	1	MoEPP in cooperation with scientific institutions	2018 - 2019	Budget of RM, foreign grants	Legislation reviewed and harmonized
11.1.2		Finalization of the process of protected areas re-designation	1	MoEPP in cooperation with scientific institutions, PA management entities	2018 - 2023	Budget of RM, foreign grants	Number of re-designated PAs
11.1.3		Harmonization of the system of protected and proposed areas (draft representative protected areas network) with other relevant sectors	1	MoEPP in cooperation with other stakeholders	2018-2020	Budget of RM, foreign grants	Harmonized representative network adopted
11.1.4		Designation of new protected areas based on the Spatial Plan of the Republic of Macedonia, other strategic documents and relevant studies	1	MoEPP in cooperation with scientific institutions, NGOs	2018 - 2023	Budget of RM, foreign grants	Number of newly designated PAs according to the developed RPAN
11.1.5		Designation of natural rarities according to the national legislation	1	MoEPP in cooperation with scientific institutions, NGOs	2018 -2023	Budget of RM, foreign grants	Number of designated natural rarities
11.2		Identification of Special Conservation Areas (SCAs) and Special Protection Areas (SPAs) in the frames of the process of Natura 2000 establishment	2	MoEPP in cooperation with scientific and expert institutions, NGOs	2018 - 2022	Budget of RM, EU funds	SCAs and SPAs identified (Natura 2000)
11.3		Nomination and designation of new internationally protected areas					Number of nominated and designated internationally protected areas
11.3.1		Nomination of Ohrid Lake for wetland of international importance in accordance with the criteria of the Ramsar Convention	2	MoEPP, scientific institutions, National Ramsar Committee, NGOs	2018	Budget of RM, foreign grants	Nomination of Ohrid Lake as Ramsar site submitted
11.3.2		Intensified cooperation with UNESCO with regard to areas from the Tentative List and support to the process of including the old beech forests from Macedonia in the proposal for world heritage	1	MoEPP, MAFWM, PAs, National UNESCO Committee, scientific institutions, NGOs	2018 - 2020	Budget of RM, foreign grants	Stakeholder meetings / dialogues on the topic held; designated UNESCO areas and sites with beech forest for world heritage
11.3.3		Analysing the possibilities for nomination of biosphere reserve under the UNESCO “Man and the Biosphere Programme”	2	MoEPP, MAB-UNESCO Committee, scientific institutions, NGOs	2018 - 2020	Budget of RM, foreign grants, EU funds	Areas identified for nomination; nomination of biosphere reserve developed and submitted
11.3.4		Identification and study of zero extinction sites (AZE areas)	2	Scientific institutions, NGOs	2020-2023	Foreign grants	Zero extinction sites identified
11.4		Establishment of effective management of protected areas					
11.4.1		Preparation and adoption of management plans for all protected areas in accordance with the legislation	1	PA management entities, scientific institutions, NGOs, MoEPP	Cont.	Budget of RM, foreign grants	Number of developed PA management plans
11.4.2		Adoption of management plans for national parks and/or other protected areas in accordance with the legislation	2	ASP, PA management entities, scientific institutions, MoEPP	2018-2023	Budget of RM, foreign grants	Number of developed and adopted PA spatial plans
11.4.3		Appointment of protected area management entities in accordance with the legislation	1	MoEPP in cooperation with potential PA management entities	Cont.	Budget of RM	Bylaw on the minimal criteria for nominated entities adopted; number of training sessions for Pas with appointed management entities
11.4.4		Strengthening of the capacity and efficiency of protected area management	1	MoEPP, scientific institutions, PA management entities, international experts	Cont.	Budget of RM, foreign grants	Training sessions and visits to well managed Pas abroad conducted; monitoring METT results
11.5	NT-10	Monitoring of the status of priority species and habitats conservation outside the system of protected areas identified in the frames of Important Plant Areas, Important Bird Areas and Prime Butterfly Areas	2	MoEPP in cooperation with scientific institutions, NGOs	Cont.	Foreign grants, EU funds	Trends of the species included in the monitoring; status of habitats (monitoring); activities (projects) related to such habitats and species implemented

11.18 National Target 12: "Establish of the level of threat to wild species, prevent reduction in populations and extinction of affected species, improve and maintain the status of protection, especially for species with populations in decline"

Establishment of threat to individual species, their spread, as well as causes for and level of threat, with primary activity in species conservation. The basis of such activities should be the development of Red Lists of certain groups of organisms, thus providing scientific information and analysis of the status, trend and level of threat to species. They are developed in accordance with the criteria for evaluation developed by IUCN, which define seven categories of species by the level of threat. These categories have been integrated in the Law on Nature Protection of the Republic of Macedonia (Article 34), according to which, under Article 35, species categorized as critically endangered, endangered or vulnerable may be designated as strictly protected or protected wild species, thus acquiring the status of natural heritage. Measures and activities for species protection and manner and extent of use will be prescribed in bylaw (under Article 42), which has not been prepared yet.

However, despite of the legal obligation, preparation of national red lists has not commenced yet. At the moment, Red list of fungi and Red list of part of daily butterflies have been proposed. In 2011, the Lists identifying strictly protected and protected wild species of plants, fungi and animals were adopted (Official Gazette of the Republic of Macedonia no. 139/2011), including 194 strictly protected and 820 protected species. These Lists were not recognized by the scientific community due to numerous inaccuracies and gaps occurring therein and they were developed without prior categorization of species based on their status of threat. All this imposes the necessity for development of national red list of species founded on research and relevant expert assessments.

Conservation of threatened species relies on scientific research, national and international legislation and specific interest of competent institutions. The implementation of threatened species protection requires undertaking of different types of actions, depending on species, causes of threats and local social circumstances. Measures and activities should include protection of localities, prevention of excessive collection, reduction of impact of invasive non-native species, preparation and implementation of programmes for re-introduction, ex situ conservation, etc. All activities and measures should derive from careful consideration of environmental, economic and social costs and benefits to justify the national target.

Actions to achieve National Target 12

12.1 Elaboration of red lists and red books

12.2 Revision of the Lists of strictly protected and protected wild species

12.3 Amendments to the legislation to add obligation for preparation of action plans about key species and habitats, invasive species, etc.

12.4 Preparation and implementation of action plans for conservation of threatened species identified in red lists

12.5 Assessment of the status and elaboration of measures for conservation of the Habitats Directive Annex V species

12.6 Implementation of activities for re-introduction of extinct native species

12.6.1 Development of study on the needs and possibilities for re-introduction of individual extinct native species

12.6.2 Implementation of re-introduction of individual extinct native species

12.7 Implementation of ex situ conservation of native wild species

12.7.1 Enlargement and maintenance of the Botanical Garden at UCM/FNSM Skopje with facilities for ex situ conservation of rare species of Macedonian flora

12.7.2 Preparation of plan for identification of species in need for conservation of genetic materials

12.7.3 Construction of authorized depositaries for species seized in illegal trade

12.7.4 Construction of shelter for injured/sick wild animal species

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
12.1		Elaboration of red lists and red books	1	MoEPP in cooperation with scientific institutions	2018-2023	Foreign grants, budget of RM	Number of developed / published red lists and books
12.2		Revision of the Lists of strictly protected and protected wild species	1	MoEPP in cooperation with scientific institutions	2018 ☐2019	Budget of RM	Lists reviewed
12.3		Amendments to the legislation to add obligation for preparation of action plans about key species and habitats, invasive species, etc.	1	MoEPP in cooperation with scientific institutions	2018 ☐2019	Budget of RM	Legal amendments adopted
12.4		Preparation and implementation of action plans for conservation of threatened species identified in red lists	2	MoEPP, scientific institutions, NGOs	2018☐2023	Budget of RM, foreign grants	Number of prepared action plans; activities ensuing from action plans implemented
12.5		Assessment of the status and elaboration of measures for conservation of the Habitats Directive Annex V species	2	MoEPP, scientific institutions, NGOs	2018 ☐2023	EU funds, budget of RM	Studies assessing the status of Annex V species prepared; measures to conserve Annex V species defined
12.6		Implementation of activities for re-introduction of extinct native species					
12.6.1		Development of study on the needs and possibilities for re-introduction of individual extinct native species	2	MoEPP in cooperation with scientific institutions, NGOs	2019 ☐2021	Foreign grants	Study prepared; species covered by the re-introduction study
12.6.2	12.6.1.	Implementation of re-introduction of individual extinct native species	3	MoEPP, scientific institutions, NGOs	2020 ☐2023	Foreign grants	Number of re-introduced native species; population trends of re-introduced species
12.7		Implementation of *ex situ* conservation of native wild species					Successful examples of *ex situ* conservation of native wild species
12.7.1		Enlargement and maintenance of the Botanical Garden at UCM/FNSM Skopje with facilities for *ex situ* conservation of rare species of Macedonian flora	2	MoEPP, scientific institutions, Botanical Garden at FNSM in Skopje	Cont.	Budget of RM, foreign grants	Facilities for *ex situ* conservation of rare species built
12.7.2		Preparation of plan for identification of species in need for conservation of genetic materials	2	Scientific institutions	2019 -2021	Budget of RM, foreign grants	Plan prepared
12.7.3		Construction of authorized depositaries for species seized in illegal trade	1	Zoological gardens (Skopje and Bitola)	2018 -2021	Budget of RM, foreign grants	Depository for seized wild species built
12.7.4		Construction of shelter for injured/sick wild animal species	2	Zoological gardens (Skopje and Bitola), NGOs	2018 -2021	Foreign grants	Number of built shelters

11.19 National Target 13: "Improve in situ and ex situ conservation of genetic resources of native cultivated plants and domestic animals"

Distribution, number and diversity of native agricultural crops in the Republic of Macedonia have been so far only partially studied (in certain villages or regions). Collected samples and data are not centralized in one place, and therefore certain activities are unnecessarily repeated. Due to discontinuous financial support, there is a risk to lose the existing collections. Therefore, one central gene bank is necessary with a task to coordinate the activities of collection, keeping the seed and seeding material, maintenance of data and analysis of material. In this way, possible loss of native seed and seeding material which is now kept in a diffused manner at several points would be avoided.

Today, existing native varieties are maintained by elderly farmers, while younger people are oriented at production with new varieties or ultimately leave rural areas. In order to secure the maintenance of native genetic resources, and at the same time motivate young people, it is necessary to organize on-farm conservation with binding contracts supported with subsidies. Numerous activities should be organized in rural environments in order to raise the awareness of farmers with regard to the importance of that material. This will contribute to the spread of these varieties and reduce the risk of their loss.

There is limited accurate data on genetic resources in livestock breeding in the Republic of Macedonia, but expert community has still recognized several domestic animal breeds and types. The system of categorization, monitoring and recording (inventory) of local breeds and monitoring of trends and risks in the domain of local breeds is under development.

Actions to achieve National Target 13

13.1 Promotion of ex situ conservation of native species and varieties of agricultural crops

13.1.1 Foundation of central gene bank of the Republic of Macedonia for ex situ storage of native seed and seeding material and secured funds for its maintenance

13.1.2 Creation of inventory of native species and varieties of agricultural crops represented on the territory of the Republic of Macedonia

13.1.3 Collection of seed and seeding material of native species and varieties

13.1.4 Characterization and evaluation of collected material of native agricultural crops

13.1.5 Establishment of central database of the material in the gene banks accessible for the general public

13.2 Establishment of system of on-farm and on-garden (in situ) conservation of agricultural crops and conclusion of contracts with interested farmers

13.3 Formation of catalogues and seeds exhibition collections of native agricultural crops in local offices of the MAFWE for easier distribution and spread of certain native varieties

13.4 Promotion of ex situ conservation of native species of domestic animals

13.4.1 Update to the database of protected domestic breeds

13.4.2 Collection and maintenance of genetic material from native species of domestic animals in the gene bank

13.4.3 Establishment of expert network and other stakeholders for the conservation of biological diversity in stockbreeding

13.4.4 Elaboration on the importance of biological diversity in stockbreeding and traditional practices in area conservation

13.4.5 Elaboration on the economic sustainability and valorisation of protected breeds

13.4.6 Monitoring of the system for in situ and ex situ conservation of breeds

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
13.1		Promotion of *ex situ* conservation of native species and varieties of agricultural crops					
13.1.1		Foundation of central gene bank of the Republic of Macedonia for *ex situ* storage of native seed and seeding material and secured funds for its maintenance	2	MAFWM, FASF, Institute of Agriculture	2019-2023	Budget of RM	Central gene bank of RM established; annual funds for its maintenance ensured
13.1.2		Creation of inventory of native species and varieties of agricultural crops represented on the territory of the Republic of Macedonia	1	MAFWM in cooperation with scientific institutions	2018 -2021	Budget of RM, foreign grants	Inventory of native species and varieties of agricultural crops in RM developed
13.1.3		Collection of seed and seeding material of native species and varieties	1	MAFWM in cooperation with scientific institutions	Cont.	Budget of RM, foreign grants	Collection of seed and seeding material developed
13.1.4		Characterization and evaluation of collected material of native agricultural crops	2	MAFWM in cooperation with scientific institutions	Cont.	Budget of RM, foreign grants	Indices of collected native agricultural crops developed
13.1.5		Establishment of central database of the material in the gene banks accessible for the general public	3	MAFWM in cooperation with scientific institutions	2019-2021	Budget of RM, foreign grants	Database developed; trends in native species and agricultural crops
13.2		Establishment of system of *on-farm* and *on-garden* (*in situ*) conservation of agricultural crops and conclusion of contracts with interested farmers	2	MAFWM in cooperation with scientific institutions, farmers	2018 -2022	Budget of RM, foreign grants	Number of farmers having concluded agreements; area intended for *on-farm* and *on-garden (in situ)* conservation; cultures included in the system
13.3		Formation of catalogues and seeds exhibition collections of native agricultural crops in local offices of the MAFWE for easier distribution and spread of certain native varieties	1	MAFWM in cooperation with scientific institutions, farmers, NGOs	2018 -2023	Budget of RM, foreign grants	Catalogues developed; number of local MAFWE offices included in the process; seed exhibitions opened
13.4		Promotion of *ex situ* conservation of native species of domestic animals					
13.4.1		Update to the database of protected domestic breeds	1	MAFWM in cooperation with scientific institutions, farmers, NGOs	2018 -2023	Budget of RM, foreign grants	Database established
13.4.2		Collection and maintenance of genetic material from native species of domestic animals in the gene bank	1	MAFWM in cooperation with scientific institutions, farmers, NGOs	2018 -2023	Budget of RM, foreign grants	Native species included and number of collected samples; number of implemented activities to promote *ex situ* conservation
13.4.3		Establishment of expert network and other stakeholders for the conservation of biological diversity in stockbreeding	1	MAFWM in cooperation with scientific institutions, farmers, NGOs and other stakeholders	2018 -2020	Budget of RM, foreign grants	Expert network established
13.4.4		Elaboration on the importance of biological diversity in stockbreeding and traditional practices in area conservation	2	Scientific institutions, NGOs, farmers	2020 -2022	Budget of RM, foreign grants	Study prepared; species included in traditional practices
13.4.5		Elaboration on the economic sustainability and valorization of protected breeds	3	MAFWM in cooperation with scientific institutions, farmers, NGOs	2018 -2022	Budget of RM, foreign grants	Assessment of economic sustainability and valorization of protected breeds prepared
13.4.6		Monitoring of the system for *in situ* and *ex situ* conservation of breeds	2	MAFWM in cooperation with scientific institutions, farmers, NGOs	2018 -2022	Budget of RM, foreign grants	Monitoring system established

11.20 National Target 14: "Establish monitoring of biological diversity and natural processes"

The increase in the number of threatened and extinct species on global and regional level imposes the need for continuous monitoring of the components of biological diversity. In this way, data required for the purpose of necessary measures for biological diversity conservation will be provided. Monitoring of the efficiency of the measures for biological diversity conservation requires organized monitoring of targeted components of biological diversity that are subject of management. Monitoring system for biological diversity in Macedonia does not exist, except certain incidental cases. Probably the only exceptions are "Transboundary monitoring system of Prespa Park", protocols for monitoring of selected species in the National Park "Galichica", protocols for monitoring of Balkan lynx and vultures in Macedonia, carried out according to precisely defined schedules.

The establishment of national monitoring system should be supported by series of administrative norms (bylaws) in which methodology and entities responsible for the monitoring implementation will be defined in detail. Before the commencement of the monitoring, it is crucial to determine properly the species and the habitats to be monitored, taking care of the monitoring needs in Natura 2000 sites as well. At the same time, it will be necessary to determine and introduce indicators of biological diversity to mirror the current status and trend of species and habitats. Species targeted for monitoring should derive from the red lists which need to be developed yet. Particular attention should be paid to wetlands that are threatened due to series of human activities. Establishment of wetlands ecological status will enable to acquire a strong argument for priority measures setting towards improvement of the state of water bodies.

Other types of monitoring which are partially established in the country are of particular importance for the monitoring of the biological diversity. Such are, for example, monitoring of aquatic ecosystems (rivers and lakes) and monitoring of atmospheric air.

Actions to achieve National Target 14

14.1 Adoption of bylaws for monitoring establishment

14.1.1 Development of plan with methodology for biological diversity monitoring

14.1.2 Identification of species and habitats to be subject of monitoring, including species and habitats of Natura 2000

14.1.3 Adoption of bylaws for accreditation of entities for monitoring performance (in relation to Article 148, paragraph 3 of the Law on Nature Protection)

14.2 Assessment and improvement of capacity (individual, institutional, technical, etc.) for monitoring performance

14.3 Establishment of monitoring system for biological diversity in Macedonia

14.4 Development of national indicators of biological diversity

14.4.1 Establishment of index of the populations of bird species associated with agricultural lands

14.4.2 Establishment of national index of threats to species (Red list index, IUCN)

14.4.3 Development of other necessary indicators

14.4.4 Development of monitoring protocols of biodiversity changes caused by climate change, in accordance to the proposed indicators in the Third National Communication on Climate Change

14.5 Support to restructuring of existing monitoring of aquatic ecosystems in accordance with the Framework Water Directive

14.6 Establishment of central database from all types of monitoring carried out in Macedonia

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
14.1		Adoption of bylaws for monitoring establishment					
14.1.1	NTs 5, 12	Development of plan with methodology for biological diversity monitoring	1	MoEPP, scientific institutions, NGOs, experts	2019 - 2021	Budget of RM, foreign grants	Bylaw adopted with developed plan for biological diversity monitoring
14.1.2	NTs 9, 11, 12, 13	Identification of species and habitats to be subject of monitoring, including species and habitats of Natura 2000	1	Scientific institutions, MoEPP, experts	2019 - 2020	EU funds, budget of RM	Selected species and habitats for monitoring
14.1.3	NT-5	Adoption of bylaws for accreditation of entities for monitoring performance (in relation to Article 148, paragraph 3 of the Law on Nature Protection)	2	MoEPP	2019 - 2021	Budget of RM	Bylaws adopted
14.2		Assessment and improvement of capacity (individual, institutional, technical, etc.) for monitoring performance	2	MoEPP, scientific institutions, experts	2019 - 2023	Budget of RM, foreign grants	Institutions and individuals for monitoring selected; assessment of their capacity to implement monitoring; transfer of knowledge (training, workshops, international institutions, etc.)
14.3	12	Establishment of monitoring system for biological diversity in Macedonia	2	MoEPP, PAs, scientific institutions, NGOs, ULSG	2020 - 2023	Budget of RM, foreign grants	Monitoring system established
14.4		Development of national indicators of biological diversity					
14.4.1		Establishment of index of the populations of bird species associated with agricultural lands	2	MoEPP, scientific institutions, experts, MAFWM	2019 - 2021	Foreign grants, EU funds	Index established
		Establishment of national index of threats to species (Red list index, IUCN)	1	MoEPP, scientific institutions, experts	2018 - 2021	Foreign grants	Methodology and fact sheet developed to establish index
		Development of other necessary indicators	3	MoEPP, scientific institutions, experts	2019 - 2021	Budget of RM, foreign grants	Number of defined and developed indicators
	NT-9	Development of monitoring protocols of biodiversity changes caused by climate change, in accordance to the proposed indicators in the Third National Communication on Climate Change	2	MoEPP, scientific institutions, experts	2019-2022	Foreign grants	Number of protocols prepared according to proposed indicators
14.5		Support to restructuring of existing monitoring of aquatic ecosystems in accordance with the Framework Water Directive	2	MoEPP, scientific institutions, experts, NHS	2018 - 2021	Budget of RM, foreign grants, EU funds	Protocols to amend existing monitoring in line with Framework Water Directive
14.6		Establishment of central database from all types of monitoring carried out in Macedonia	3	MoEPP, scientific institutions, experts, NHS	2020 - 2022	Budget of RM, foreign grants	Database from all monitoring types in Macedonia established

Emys orbicularis

11.21 National Target 15: "Promote conservation of species and ecosystems in transboundary context through undertaking of joint measures/ actions"

Considering the high extent of biological diversity on Balkan Peninsula and the central position occupied by the Republic of Macedonia, as well as the high extent of endemism in Ohrid and Prespa Lakes, the fact that Macedonia is considered a biological diversity "hotspot" in Europe is not surprising. Furthermore, most of the boundary of the Republic of Macedonia runs through mountainous areas in which high number of endemic and relict species of plants and animals spreads.

Moderate economic growth in the past period and closure of borders towards neighbouring countries after the Second World War (the so called "iron curtain") have contributed largely to the preservation of such diversity. Nevertheless, national conservation measures are insufficient with regard to many species whose population cores occur in border areas. In addition to this, shared natural lakes and river basins with neighbouring countries also require shared responsibility for their efficient protection and management.

Although activities supported by the state related to transboundary protection of Ohrid-Prespa region are carried out as of recently, specific measures of management of the newly designated areas (Trilateral Prespa Park and Ohrid-Prespa Biosphere Reserve) are almost completely absent. We should mention ample activities of the international community in Prespa region in the past period. Similar situation occurs with the initiative for Green Belt protection (areas within the border belt of the former "iron curtain") as for example Shar Planina, Jablanica, Osogovo Mts. Belasica, Mariovo etc. There are still no continuous and comprehensive activities towards conservation of certain internationally important species included in the annexes of international agreements ratified by the Republic of Macedonia (Annexes to Bonn and Bern Conventions, Habitats Directive , Bird Directive, etc.).

Actions to achieve National Target 15

15.1 Preparation of national action plans for species deriving from the obligations under international agreements (e.g. birds and bats under the Bonn Convention)

15.2 Preparation of national action plans for species conservation deriving from existing regional or European initiatives or plans (vultures, lynx, initiative for conservation of carnivores in Europe, etc.)

15.3 Implementation of the obligations related to the management of transboundary Prespa Park, including action plans for mountain tea, Prespa barbel, Prespa trout, Greek juniper forests, reed belts, brown bear and caves and bats

15.4 Preparation of management plan for Ohrid-Prespa transboundary biosphere reserve

15.5 Application of measures for biological diversity conservation within the European Green Belt

15.6 Signing of bilateral agreements for transboundary waters management

15.7 Designation of transboundary protected areas for which national or international initiatives exist

15.8 Strengthening cooperation and data exchange with other West Balkan countries for effective protection and sustainable use of biodiversity

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
15.1		Preparation of national action plans for species deriving from the obligations under international agreements (e.g. birds and bats under the Bonn Convention)	2	MoEPP in cooperation with scientific institutions, NGOs	2018 - 2023	Budget of RM, foreign grants	Number of prepared national action plans for species deriving from the obligations under international agreements
15.2		Preparation of national action plans for species conservation deriving from existing regional or European initiatives or plans (vultures, lynx, initiative for conservation of carnivores in Europe, etc.)	1	MoEPP in cooperation with scientific institutions, NGOs	2018 - 2023	Foreign grants	Number of prepared national action plans for species conservation deriving from existing regional or European initiatives
15.3		Implementation of the obligations related to the management of transboundary Prespa Park, including action plans for mountain tea, Prespa barbel, Prespa trout, Greek juniper forests, reed belts, brown bear and caves and bats	1	MoEPP, Prespa Park Coordination Body, PA management entities, scientific institutions, NGOs	2018 - 2023	Budget of RM, foreign grants	Number of realized activities in Prespa Park; realized activities to implement action plans
15.4		Preparation of management plan for Ohrid-Prespa transboundary biosphere reserve	2	MoEPP, PA steering bodies, scientific institutions, NGOs, cross-border competent institutions	2018 - 2020	Foreign grants	Management plan prepared
15.5		Application of measures for biological diversity conservation within the European Green Belt	2	MoEPP, scientific institutions, NGOs, international organizations	2018 - 2023	Foreign grants	Implemented activities (projects) related to the European Green Belt
15.6		Signing of bilateral agreements for transboundary waters management	2	MoEPP together with relevant institutions at cross-border level	2018 - 2021	Budget of RM, foreign grants	Contacts and dialogues realized; agreements signed
15.7		Designation of transboundary protected areas for which national or international initiatives exist	1	MoEPP, PA steering bodies, scientific institutions, competent institutions from neighbouring countries	2018 -2023	Budget of RM, foreign grants	Number and size of transboundary PAs
15.8		Strengthening cooperation and data exchange with other West Balkan countries for effective protection and sustainable use of biodiversity	1	MoEPP, PA steering bodies, scientific institutions, competent institutions from neighbouring countries	2018 -2023	Budget of RM, foreign grants	Held meetings of NFP and other relevant representatives; projects submitted and implemented at regional level

11.22 National Target 16: "Improve the status of important ecosystems in terms of essential ecosystem services provision"

Since the end of 1990s, expert community in the Republic of Macedonia has been manifesting growing interest in the application of the principles of ecosystem approach to natural resources management in the country. The first attempts were made in the frames of the projects for integrated management of Ohrid and Prespa Lakes, and lately with Bregalnica River basin project. The application of the concept of ecosystem services in ecosystem management is still modest. The recent project concerning the management of Nature Park "Ezerani" offers a good example of the way in which the concept of ecosystem services can apply in the management of degraded ecosystems in protected areas. However, conservation of biological diversity in the country cannot be accomplished solely through measures and activities within protected areas. Significant parts of ecosystems that are of particular importance for human well-being(as they provide services related to food, medicines, drinking water, raw materials, crops pollination, erosion control, matter cycling, etc.) are also under significant anthropogenic impact and are not incorporated in the system of protected areas. Good illustrations of this are forest and agricultural ecosystems which are managed actively. Application of ecosystem approach in part of these ecosystems, it is possible to restore the basic ecological processes and functions, especially those providing services that are vital for man's well-being.

It is necessary to identify the pressures on ecosystems providing services essential to human well-being. Measures for conservation or revitalization have to be undertaken with regard to critical ecosystems which deliver important services. Certainly, conservation of preferred before revitalization, which is usually more expensive and more time consuming.

Activities aimed at reducing the pressures on ecosystems, such as those in agriculture and forestry sectors (elaborated in more detail under National Target 4) will facilitate spontaneous restoration of part of degraded ecosystems. In certain cases however, well designed and coordinated activities and measures will be required to restore their functions, i.e. services that they deliver. Efforts towards restoration should be focused primarily on ecosystems the services of which have key or critical impact on people's well-being.

Involvement of the key entities in the activities for identification of the key ecosystem services and implementation of activities for revitalization of ecosystems delivering them, will also contribute to more equitable access to ecosystem services. Revitalization of these ecosystems will inevitably contribute to the conservation of biological diversity in the country as well.

Actions to achieve National Target 16

16.1 Implementation of activities aimed at ecosystems identification and mapping and assessment of their status

16.1.1 Identification of the basic types of ecosystems in the Republic of Macedonia

16.1.2 Mapping of the basic types of ecosystems

16.1.3 Implementation of status assessment of the basic types of ecosystems in Macedonia and their potential to deliver ecosystem services

16.1.4 Implementation of economic evaluation of ecosystems with the least favourable status

16.2 Identification of important ecosystem services on national level and their mapping, i.e. mapping the demand for certain ecosystem services

16.3 Preparation of plans and programmes for revitalization of the key ecosystems in the country

16.4 Identification of priorities for restoration of degraded ecosystems functions or their capacity to deliver services to people

No.	Relation to	Action		Competent institution	Implementing period	Funding	Action implementation indicator
16.1		Implementation of activities aimed at ecosystems identification and mapping and assessment of their status					
16.1.1		Identification of the basic types of ecosystems in the Republic of Macedonia	1	Scientific institutions, experts, NGOs, MoEPP	2019 - 2021	Budget of RM, foreign grants	Basic ecosystem types in RM identified
16.1.2		Mapping of the basic types of ecosystems	2	MoEPP, MAFWM, PE Macedonian Forests, PE of Pasture Manag., experts, Cadastre of RM	2020 - 2022	Foreign grants	Basic ecosystem types mapped
16.1.3		Implementation of status assessment of the basic types of ecosystems in Macedonia and their potential to deliver ecosystem services	2	Scientific institutions, experts, NGOs	2020 - 2022	Foreign grants	Status of basic ecosystem types assessed; ecosystem potential to provide ecosystem services established; number of evaluated ecosystems
16.1.4		Implementation of economic evaluation of ecosystems with the least favourable status	3	Scientific institutions, experts, NGOs	2020 - 2023	Foreign grants	Economic evaluation of ecosystems with the least favourable status
16.2		Identification of important ecosystem services on national level and their mapping, i.e. mapping the demand for certain ecosystem services	2	Scientific institutions, experts, NGOs	2018 - 2021	Foreign grants	Team working on ecosystem services established; demand for certain ecosystem services mapped
16.3		Preparation of plans and programmes for revitalization of the key ecosystems in the country	3	MoEPP in cooperation with scientific institutions	2020-2023.	Budget of RM, foreign grants	Number of prepared plans and programmes
16.4		Identification of priorities for restoration of degraded ecosystems functions or their capacity to deliver services to people	2	Scientific institutions, experts, NGOs	2019	Budget of RM, foreign grants	Priority ecosystems identified

National Target 17:
"Integrate the requirements of the Nagoya Protocol on access to genetic resources in the national legislation by 2018"

One of the three goals of the Convention on Biological Diversity is equitable sharing of the benefits of genetic resources. Following six years of negotiations in relation to international regime of access to genetic resources (for efficient implementation of CBD's Article 15) and access to traditional knowledge (for efficient implementation of CBD's Article 8), in 2010, on the 10th Conference of the Parties to CBD, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization was adopted. The purpose was to provide greater legal certainty and transparency for both genetic resources providers and users. The Protocol also contains provisions on access to traditional knowledge maintained by local community, thus providing that they participate in benefit sharing from their use.

The Republic of Macedonia has not signed this Protocol yet. Some preparatory activities in regard translation into Macedonian of the Protocol and Bonn Guidelines towards its implementation and presentation of the main requirements and obligations to derive from the signing of this Protocol in front of the relevant stakeholders were undertaken during 2013. It is necessary to carry out detailed analysis of benefits and obligations under this Protocol, analysis of the amendments of the national legislation required for its implementation, and it is also necessary to undertake activities for public awareness raising.

Actions to achieve National Target 17

17.1 Implementation of legislation analysis and necessary amendments towards compliance with the Protocol

17.2 Analysis of benefits and obligations under the ratified Protocol

17.3 Public awareness raising and education on Protocol implementation

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
17.1		Implementation of legislation analysis and necessary amendments towards compliance with the Protocol	1	MoEPP, experts	2018-2019	Budget of RM, foreign grants	Legislation analysis towards compliance with the Protocol; proposal amendments developed for harmonization with the legislation
17.2		Analysis of benefits and obligations under the ratified Protocol	1	MoEPP, proper experts	2019 - 2020	Budget of RM, foreign grants	Analysis conducted
17.3		Public awareness raising and education on Protocol implementation	2	MoEPP, NGOs	2019 - 2020	Budget of RM, foreign grants	Lectures and public presentations held; stakeholders involved with public presentations; information material prepared

STRATEGIC GOAL D: "Enhance knowledge and availability of all relevant information on biological diversity"

Conservation of biological diversity is indispensably related to certain system of knowledge and up-to date information regarding structure, functioning and values of all of its components, as well as information on the status of biological diversity components and consequences from their loss. Hence, enhancement of such knowledge and its accessibility is of crucial importance for efficient conservation of biological diversity at any level.

Research of the exceptionally rich biological diversity of the Republic of Macedonia has been carried out for nearly two centuries. However, relatively low number of researchers, insufficiently good organization of research, poor financial support, as well as the latest trends in science have all resulted in gaps in the knowledge in this field. Improvement of this situation requires financial and staff support to institutions involved in biological diversity research.

Sharing and dissemination of existing information is also at low level. Modern technology, primarily possibilities provided by information technology, enables much easier access to and dissemination of all information. Therefore, there is a need for central national database of biological diversity, which would be continuously updated and accessible to all interested parties.

Conservation of the components of biological diversity can be also impeded by lack or inaccessibility of useful information or scientifically supported facts. Despite of several attempts to establish biological diversity database, there is no such base in our country or it is non-operational. Only scientific professionals have individual data sets. So far, relevant information of biological diversity in Macedonia includes data on species and plant communities. This situation has to be addressed and new databases should include information on threats, root causes of biological diversity loss, spatial information, impacts of sectors, etc.

The Republic of Macedonia has rather solid basis of traditional knowledge and practice, a tradition which under the pressure of modern lifestyle is more and more neglected and gradually disappears with elderly population. Traditional attitude also exists towards certain natural resources (curative plants, lichens, fruits, fungi), but there is shortage of information of traditional values, as well as of the status and the trends of natural resources.

Leopard snake (*Zamenis situla*)

11.25 National Target 18:
"Encourage and financially support research of biological diversity components, establish and supplement database on national level for the purpose of sharing and improved use of information of biological diversity"

In the past period, 2003-2013, progress has been noted in research and knowledge of the components of biological diversity in the Republic of Macedonia (Chapter 8.1). It has been generally accepted that it is impossible to provide full information of biological diversity, for reasons including, inter alia, the complexity of the area. Nevertheless, besides objective, there are many subjective reasons for the lack of information on biological diversity in Macedonia. One of the reasons is the lack of experts/specialists in the area of biological diversity conservation (taxonomy, ecology and related disciplines, and there is especially low interest in social branches of science, including economy, for this kind of research) that would join the work of the state administration (education, science, environment protection, including inspectorates), local self-governments and scientific and educational institutions. Apart from this, research is not carried out in full and are targeted at narrow scientific topics within the scope of researchers' interest. Taxonomic and bio-geographical surveys dominate compared to surveys in the area of population ecology, genetic diversity, conservation biology, etc. Inventories of flora, fungi and fauna are in most cases non-comprehensive and consequently major part of biological diversity of the Republic of Macedonia remains unknown, with certain plant and animal groups lacking data completely. The number of quantitative population studies is low, which undoubtedly aggravates identification of priorities for conservation and successful implementation of risk analysis under individual development projects. Furthermore, quantitative surveys enable monitoring of the trends of the populations, which are of particular importance in the efforts aimed at assessing whether our response to biological diversity loss produces results.

On the other hand, major portion of existing information is hardly accessible and almost impossible to share and use, and therefore conservation of individual components of biological diversity is frequently hampered. In order to provide gathering of the existing knowledge of biological diversity in a central database, National Biodiversity Information System (NBIS, see Chapter 8.3) was developed in the course of 2010-2011, but it is currently non-functional and mechanism for biological diversity exchange (Clearing House Mechanism – CHM) has not been established.

There is also a need to establish links with international databases of biological diversity, for example, regular updating of data on protected areas in the World Database of Protected Areas, WDAP, which obviously has gap on Macedonia) and entry of data in the Global Biodiversity Information Facility (GBIF – http://www.gbif.org).

Actions to achieve National Target 18

18.1. Encouragement of creation of professional staff related to study of biological diversity conservation and provision of appropriate involvement at all levels of state administration and scientific and educational institutions

18.2. Establishment and maintenance of clearing house mechanism (CHM) for biological diversity

18.3. Update and maintenance of the national information system with biological diversity database and its upgrading to include monitoring data

18.4. Development of national registers of natural heritage and cadastre of protected areas, in accordance with the law

18.5. Giving priority to research

18.5.1. Provision of support for the development of catalogues of individual taxonomic groups and their updating and publishing

18.5.2. Initiation of activities for continuation of the project "Vegetation map of the Republic of Macedonia"

18.6. Funding and implementing projects for scientific research in the area of biological diversity

18.6.1. Development of programme of priorities in research funding in the area of biological diversity

18.6.2. Introduction of programmes for scholarship awarding and support to new and young scientists and experts

18.6.3. Encouragement of research in ecosystem services and biological diversity value

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
18.1		Encouragement of creation of professional staff related to study of biological diversity conservation and provision of appropriate involvement at all levels of state administration and scientific and educational institutions	1	Government of RM, MoES, universities, scientific institutions, NGOs	Cont.	Budget of RM	Number of graduates in areas related to biological diversity conservation; Staff employed in the administration on proper positions
18.2		Establishment and maintenance of clearing house mechanism (CHM) for biological diversity	1	MoEPP	Cont.	Budget of RM, foreign grants	Mechanism for BD information exchange established
18.3		Update and maintenance of the national information system with biological diversity database and its upgrading to include monitoring data	2	MoEPP in cooperation with institutions responsible for data collection	Cont.	Budget of RM, foreign grants	Biodiversity NIS activated and updated on a regular basis; Number of BD database users
18.4		Development of national registers of natural heritage and cadastre of protected areas, in accordance with the law	1	MoEPP, scientific institutions, Museum of Natural History	2018 - 2020	Budget of RM, foreign grants, EU funds	National registries prepared; PA cadastre developed
18.5		Giving priority to research					
18.5.1		Provision of support for the development of catalogues of individual taxonomic groups and their updating and publishing	1	MoES, MoEPP, scientific institutions	2018-2023	Budget of RM	Team to work on catalogues established; number of issued catalogues
18.5.2		Initiation of activities for continuation of the project “Vegetation map of the Republic of Macedonia”	2	Scientific institutions, experts, NGOs	2018-2022	Budget of RM, foreign grants	Team to develop map established; area covered with map
18.6		Funding and implementing projects for scientific research in the area of biological diversity					
18.6.1		Development of programme of priorities in research funding in the area of biological diversity	1	MoES	Cont.	Budget of RM	Scholarship programme established; Scholarship for new scientists related to BD awarded
18.6.2		Introduction of programmes for scholarship awarding and support to new and young scientists and experts	3	MoES and MoEPP in cooperation with proper scientific institutions, PA manag. entities	2018-2023	Budget of RM, foreign grants	Number of research implemented on this topic; number of publications issued; recommendations to introduce new directions in educational programmes on this topic

Black-winged stilt (*Himantopus himantopus*)

National Target 19: "Preserve and promote traditional knowledge, innovations and practices for conservation and sustainable use of natural resources"

Certain natural resources, both in the past and at present, have specific imprint and special meaning for the local population. Therefore, the population has traditionally cherished special attitude towards them. Their specific characteristics or purposes have contributed to their conservation and maintenance through application of traditional knowledge and practices.

In the context of the forestry, examples of the above are the forest sections and localities related to legends, hallowed forests and sacred spots, and certain waters and springs traditionally regarded as curative bear some importance, too. In the context of agriculture, traditional knowledge usually concerns application of special old methods of plants growing and livestock breeding. In plant production, this often assumes traditional methods of plants protection against diseases or fertilizing without chemicals use. Given the fact that this manner of growing is the basis of organic agriculture, recording and preserving these traditional practices are of particular importance. Even today, population uses numerous agricultural products for production of medicinal potions or products prepared by specific recipes. It is also very important to preserve this use and promote it in line with the trend for use of natural medicines emerging lately.

So far, state institutions have not have appropriate attitude towards these natural resources and their values have not been identified sufficiently among the priorities of the state policies. Nevertheless, traditional attitude of the population towards them, transferred from generation to generation, has contributed to their preservation to a certain extent, especially in rural areas. However, in periods of intensive economic activities and negative socio-demographic processes, many traditional values and natural resources are more and more lost.

As of recently, Government's policies partially support promotion and implementation of economic gains from traditional products through protection of their geographical origin (cheese, potato, beans, etc.) or protection of the method of these products preparation. In this regard, it is necessary to introduce stable system of subsidies for such products by the state.

Loss of resources or knowledge is often a result of insufficient level of information among population with regard to their values. Therefore, these should be promoted in front of the general public and provide support to the preservation and maintenance of traditional knowledge and practices thus securing their sustainability. To this end, it is necessary to carry out certain surveys of the state and the trends of traditional practices related to natural resources and establish database to support their promotion. In this way, they will be adequately valued and preserved.

Actions to achieve National Target 19

19.1. Fostering surveys and documenting good practices of traditional biological diversity use

19.1.1 Documenting traditional methods of agricultural crops growing and livestock breeding

19.1.2. Documenting traditional methods of food stuffs and other products production from agricultural crops and livestock

19.1.3. Documenting the tradition of keeping hallowed forests and forests associated with legends

19.1.4. Documenting the use of biological diversity in traditional treatment and ethnopharmacy

19.2. Promotion and subsidizing the traditional use of biological diversity

No.	Relation to	Action	Priority	Competent institution	Implementing period	Funding	Action implementation indicator
19.1		Fostering surveys and documenting good practices of traditional biological diversity use					Funds provided for this issue
19.1.1		Documenting traditional methods of agricultural crops growing and livestock breeding	2	MoEPP, MAFWM, scientific institutions, Federation of Farmers, NGOs, other stakeholders	2018-2020	Budget of RM, foreign grants	Traditional methods of agricultural crops growing and livestock breeding documented
19.1.2		Documenting traditional methods of food stuffs and other products production from agricultural crops and livestock	2	MAFWM, business sector, municipalities	2018-2023	Budget of RM, foreign grants	Traditional methods of production documented
19.1.3		Documenting the tradition of keeping hallowed forests and forests associated with legends	1	MOC, NGOs	2018-2023	Foreign grants	Documents and information materials prepared
19.1.4		Documenting the use of biological diversity in traditional treatment and ethnopharmacy	1	Scientific institutions, NGOs, ethno-pharmacists	2018-2023	Budget of RM, foreign grants	Documents and information materials prepared; number of implemented public presentations
19.2	NT-3	Promotion and subsidizing the traditional use of biological diversity	2	MAFWM, experts, NGOs	2018-2023	Foreign grants	Public presentations held; information materials about traditional BD utilization prepared; subsidies for traditional BD utilization introduced; stakeholders informed about the benefits from utilizing BD

Sand lizard (*Lacerta agilis*)

Annexes

Annex 1:Overview of habitats diversity in Macedonia (habitat classes of EUNIS level 3 are presented) and their threat status (expert judgement)

Threat intensity: 1 – low (and/or localized threat), 2 – moderate and 3 – high intensity (and/or widespread threat); HD – EU Directive on the conservation of natural habitats and of wild fauna and flora

First level	Second level	Third level	Basic threats	Threat intensity	Annex I HD
C: Inland surface waters	C1: Surface standing waters	C1.1: Permanent oligotrophic lakes, ponds and pools	Eutrophication, pollution	3	√
		C1.2: Permanent mesotrophic lakes, ponds and pools	Eutrophication, pollution, drying out	3	√
		C1.3: Permanent eutrophic lakes, ponds and pools	Drying out	3	√
		C1.4: Permanent dystrophic lakes, ponds and pools	Drying out	1	√
		C1.6: Temporary lakes, ponds and pools	Drying out	2	/
		C1.7: Permanent lake ice			/
	C2: Surface running waters	C2.1: Springs, spring brooks and geysers	Abstraction	1	√
		C2.2: Permanent non-tidal, fast, turbulent watercourses	Abstraction	2	√
		C2.3: Permanent non-tidal, smooth-flowing watercourses	Pollution	3	√
		C2.5: Temporary running waters			/
		C2.6: Films of water flowing over rocky watercourse margins	Abstraction (relation to C.2.2)	2	/
	C3: Littoral zone of inland surface waterbodies	C3.1: Species-rich helophyte beds	Removal	2	/
		C3.2: Water-fringing reedbeds and tall helophytes other than canes	Removal	2	/
		C3.4: Species-poor beds of low-growing water-fringing or amphibious vegetation	Removal	2	√
		C3.5: Periodically inundated shores with pioneer and ephemeral vegetation	Removal	2	√
		C3.6: Unvegetated or sparsely vegetated shores with soft or mobile sediments	Sand and gravel extraction	2	/
		C3.7: Unvegetated or sparsely vegetated shores with non-mobile substrates			/
		C3.8: Inland spray- and steam-dependent habitats	Abstraction (relation to C.2.2)	2	/

D: Mires, bogs and fens	D2: Valley mires, poor fens and transition mires	D2.1: Valley mires	Climate change	3	/
		D2.2: Poor fens and soft-water spring mires	Climate change	2	/
		D2.3: Transition mires and quaking bogs	Climate change	3	√
	D4: Base-rich fens and calcareous spring mires	D4.1: Rich fens, including eutrophic tall-herb fens and calcareous flushes and soaks	Drainage, climate change	3	√
		D4.2: Basic mountain flushes and streamsides, with a rich arctic-montane flora	Abstraction	2	/
	D5: Sedge and reedbeds, normally without free-standing water	D5.1: Reedbeds normally without free-standing water	Drainage	3	/
		D5.2: Beds of large sedges normally without free-standing water	Drainage	3	√
		D5.3: Swamps and marshes dominated by [Juncus effusus] or other large [Juncus] spp.	Drainage	3	/
	D6: Inland saline and brackish marshes and reedbeds	D6.1: Inland saltmarshes	Drainage	3	√
		D6.2: Inland saline or brackish species-poor helophyte beds normally without free-standing water	Drainage	3	√
E: Grasslands and lands dominated by forbs, mosses or lichens	E1: Dry grasslands	E1.2: Perennial calcareous grassland and basic steppes	Grazing, quarrying		√
		E1.3: Mediterranean xeric grassland	Conversion	2	√
		E1.4: Mediterranean tall-grass and [Artemisia] steppes	Conversion	3	/
		E1.5: Mediterranean-montane grassland	Grazing		√
		E1.6: Subnitrophilous annual grassland			/
		E1.8: Closed Mediterranean dry acid and neutral grassland	Grazing	2	/
		E1.A: Open Mediterranean dry acid and neutral grassland	Grazing	2	/
		E1.D: Unmanaged xeric grassland	Grazing	2	/
	E2: Mesic grasslands	E2.1: Permanent mesotrophic pastures and aftermath-grazed meadows	Overgrowth	2	√
		E2.2: Low and medium altitude hay meadows	Abandonment	2	√
		E2.3: Mountain hay meadows	Abandonment	3	√
		E2.6: Agriculturally-improved, re-seeded and heavily fertilised grassland, including sports fields and grass lawns			/
		E2.7: Unmanaged mesic grassland	Overgrowth	2	/
		E2.8: Trampled mesophilous grasslands with annuals			/
	E3: Seasonally wet and wet grasslands	E3.1: Mediterranean tall humid grassland	Overgrowth	2	√
		E3.2: Mediterranean short humid grassland	Overgrowth	2	/
		E3.3: Sub-mediterranean humid meadows	Abandonment	3	/
	E4: Alpine and subalpine grasslands	E4.2: Moss and lichen dominated mountain summits, ridges and exposed slopes	Piste	1	/
		E4.3: Acid alpine and subalpine grassland	Climate change, succession	3	√
		E4.4: Calcareous alpine and subalpine grassland	Climate change, succession	3	√
		E4.5: Alpine and subalpine enriched grassland	Climate change, succession	3	/
	E5: Woodland fringes and clearings and tall forb stands	E5.1: Anthropogenic herb stands			/
		E5.2: Thermophile woodland fringes	Succession	2	/
		E5.3: [Pteridium aquilinum] fields	Succession	1	/
		E5.4: Moist or wet tall-herb and fern fringes and meadows	Succession	1	√
		E5.5: Subalpine moist or wet tall-herb and fern stands	Succession	1	√
	E6: Inland salt steppes	E6.2: Continental inland salt steppes	Reploughing	3	√

F: Heathland, scrub and tundra	F2: Arctic, alpine and subalpine scrub	F2.1: Subarctic and alpine dwarf willow scrub	Climate change	2	/
		F2.2: Evergreen alpine and subalpine heath and scrub			√
		F2.3: Subalpine deciduous scrub	Very rare	3	√
		F2.4: Conifer scrub close to the tree limit	Climate change	2	√
	F3: Temperate and Mediterranean montane scrub	F3.1: Temperate thickets and scrub			√
		F3.2: Sub-Mediterranean deciduous thickets and brushes			√
	F5: Maquis, arborescent matorral and thermo-Mediterranean brushes	F5.1: Arborescent matorral			√
		F5.3: Pseudomaquis			/
		F5.5: Thermo-Mediterranean scrub			/
	F6: Garrigue	F6.6: Supra-Mediterranean garrigues	Conversion	2	/
	F7: Spiny Mediterranean heaths – phrygana, hedgehog-heaths and related coastal cliff vegetation	F7.3: East Mediterranean phrygana	Very rare	3	/
		F7.4: Hedgehog-heaths	Forest planting, conversion	2	/
	F9: Riverine and fen scrubs	F9.1: Riverine scrub	Destruction	1	√
		F9.2: [Salix] carr and fen scrub	Drainage	3	/
		F9.3: Southern riparian galleries and thickets	Conversion, very rare	3	√
	FA: Hedgerows	FA.1: Hedgerows of non-native species	Consolidation	1	/
		FA.2: Highly-managed hedgerows of native species	Consolidation	2	/
		FA.3: Species-rich hedgerows of native species	Consolidation	3	/
		FA.4: Species-poor hedgerows of native species	Consolidation	3	/
	FB: Shrub plantations	FB.3: Shrub plantations for ornamental purposes or for fruit, other than vineyards			/
		FB.4: Vineyards			/

G: Woodland, forest and other wooded land	G1: Broadleaved deciduous woodland	G1.1: Riparian and gallery woodland, with dominant [Alnus], [Betula], [Populus] or [Salix]	Melioration, conversion	3	√
		G1.2: Mixed riparian floodplain and gallery woodland	Melioration, conversion	3	√
		G1.3: Mediterranean riparian woodland	Destruction	2	√
		G1.4: Broadleaved swamp woodland not on acid peat	Drainage, destruction	3	/
		G1.5: Broadleaved swamp woodland on acid peat	Very rare	3	/
		G1.6: [Fagus] woodland	Logging		√
		G1.7: Thermophilous deciduous woodland	Clearcutting, fire	3	√
		G1.9: Non-riverine woodland with [Betula], [Populus tremula] or [Sorbus aucuparia]	Logging	1	/
		G1.A: Meso- and eutrophic [Quercus], [Carpinus], [Fraxinus], [Acer], [Tilia], [Ulmus] and related woodland	Logging, very rare	1	√
		G1.C: Highly artificial broadleaved deciduous forestry plantations			/
		G1.D: Fruit and nut tree orchards			/
	G2: Broadleaved evergreen woodland	G2.9: Evergreen orchards and groves			/
	G3: Coniferous woodland	G3.1: [Abies] and [Picea] woodland	Logging		√
		G3.4: [Pinus sylvestris] woodland south of the taiga	Logging	2	√
		G3.5: [Pinus nigra] woodland	Fire, logging	3	√
		G3.6: Subalpine mediterranean [Pinus] woodland	Logging	1	√
		G3.9: Coniferous woodland dominated by [Cupressaceae] or [Taxaceae]	Succession, fire	2	√
		G3.F: Highly artificial coniferous plantations			/
	G4: Mixed deciduous and coniferous woodland	G4.6: Mixed [Abies] - [Picea] - [Fagus] woodland	Logging	1	/
		G4.8: Mixed non-riverine deciduous and coniferous woodland	Logging	1	/
		G4.9: Mixed deciduous woodland with [Cupressaceae] or [Taxaceae]	Succession, fire	2	/
		G4.B: Mixed mediterranean [Pinus] - thermophilous [Quercus] woodland	Fire, very rare	3	/
		G4.C: Mixed [Pinus sylvestris] - thermophilous [Quercus] woodland	Logging	1	/
		G4.F: Mixed forestry plantations			/
	G5: Lines of trees, small anthropogenic woodlands, recently felled woodland, early-stage woodland and coppice	G5.1: Lines of trees			/
		G5.2: Small broadleaved deciduous anthropogenic woodlands			/
		G5.3: Small broadleaved evergreen anthropogenic woodlands			/
		G5.4: Small coniferous anthropogenic woodlands			/
		G5.5: Small mixed broadleaved and coniferous anthropogenic woodlands			/
		G5.6: Early-stage natural and semi-natural woodlands and regrowth			/
		G5.7: Coppice and early-stage plantations			/
		G5.8: Recently felled areas			/

H: Inland unvegetated or sparsely vegetated habitats	H1: Terrestrial underground caves, cave systems, passages and waterbodies	H1.1: Cave entrances	Destruction	2	√
		H1.2: Cave interiors	Destruction	2	√
		H1.3: Dark underground passages	Destruction	2	/
		H1.5: Underground standing waterbodies	Destruction	2	/
		H1.6: Underground running waterbodies			/
		H1.7: Disused underground mines and tunnels			/
	H2: Screes	H2.3: Temperate-montane acid siliceous screes			√
		H2.5: Acid siliceous screes of warm exposures			√
		H2.6: Calcareous and ultra-basic screes of warm exposures			√
	H3: Inland cliffs, rock pavements and outcrops	H3.1: Acid siliceous inland cliffs	Quarrying	1	√
		H3.2: Basic and ultra-basic inland cliffs	Quarrying	2	√
		H3.4: Wet inland cliffs	Drying out	1	/
		H3.5: Almost bare rock pavements, including limestone pavements	Quarrying	2	√
		H3.6: Weathered rock and outcrop habitats			√
	H4: Snow or ice-dominated habitats	H4.1: Snow packs			/
	H5: Miscellaneous inland habitats with very sparse or no vegetation	H5.4: Dry organic substrates with very sparse or no vegetation			/
		H5.5: Burnt areas with very sparse or no vegetation			/
		H5.6: Trampled areas			/
I: Regularly or recently cultivated agricultural, horticultural and domestic	I1: Arable land and market gardens	I1.1: Intensive unmixed crops			/
		I1.2: Mixed crops of market gardens and horticulture	Abandonment	2	/
		I1.3: Arable land with unmixed crops grown by low-intensity agricultural methods	Chemization	2	/
		I1.4: Inundated or inundatable croplands, including rice fields	Abandonment	2	/
		I1.5: Bare tilled, fallow or recently abandoned arable land			/
	I2: Cultivated areas of gardens and parks	I2.1: Large-scale ornamental garden areas			/
		I2.2: Small-scale ornamental and domestic garden areas			/
		I2.3: Recently abandoned garden areas			/

J: Constructed, industrial and other artificial habitats	J1: Buildings of cities, towns and villages	J1.1: Residential buildings of city and town centres			/
		J1.2: Residential buildings of villages and urban peripheries			/
		J1.3: Urban and suburban public buildings			/
		J1.4: Urban and suburban industrial and commercial sites still in active use			/
		J1.5: Disused constructions of cities, towns and villages			/
		J1.6: Urban and suburban construction and demolition sites			/
		J1.7: High density temporary residential units			/
	J2: Low density buildings	J2.1: Scattered residential buildings			/
		J2.2: Rural public buildings			/
		J2.3: Rural industrial and commercial sites still in active use			/
		J2.4: Agricultural constructions			/
		J2.5: Constructed boundaries	Abandonment	3	/
		J2.6: Disused rural constructions			/
		J2.7: Rural construction and demolition sites			/
	J3: Extractive industrial sites	J3.1: Active underground mines			/
		J3.2: Active opencast mineral extraction sites, including quarries			/
		J3.3: Recently abandoned above-ground spaces of extractive industrial sites			/
	J4: Transport networks and other constructed hard-surfaced areas	J4.1: Disused road, rail and other constructed hard-surfaced areas			/
		J4.2: Road networks			/
		J4.3: Rail networks			/
		J4.4: Airport runways and aprons			/
		J4.5: Hard-surfaced areas of ports			/
		J4.6: Pavements and recreation areas			/
		J4.7: Constructed parts of cemeteries			/
	J5: Highly artificial man-made waters and associated structures	J5.3: Highly artificial non-saline standing waters			/
		J5.4: Highly artificial non-saline running waters			/
		J5.5: Highly artificial non-saline fountains and cascades			/
	J6: Waste deposits	J6.1: Waste resulting from building construction or demolition			/
		J6.2: Household waste and landfill sites			/

X: Habitat complexes	X04: Raised bog complexes			/
	X05: Snow patches			/
	X06: Crops shaded by trees			/
	X07: Intensively-farmed crops interspersed with strips of natural and/or semi-natural vegetation			/
	X11: Large parks			/
	X13: Land sparsely wooded with broadleaved deciduous trees			/
	X14: Land sparsely wooded with broadleaved evergreen trees)			/
	X15: Land sparsely wooded with coniferous trees			/
	X16: Land sparsely wooded with mixed broadleaved and coniferous trees			/
	X20: Treeline ecotones			/
	X22: Small city centre non-domestic gardens			/
	X23: Large non-domestic gardens			/
	X24: Domestic gardens of city and town centres			/
	X25: Domestic gardens of villages and urban peripheries			/

Annex 2:
List of threats in Macedonia with priority assessment matrix

Threat	Distribution	Range	Intensity	Currency	Reversibility	Sum	Priority
A AGRICULTURE							
A01 Cultivation (includes increase of agricultural area)	3	1	1	1	2	8	II
A02 Modification of cultivation practices							
A02.01 Agricultural intensification	1	0.5	1	1	2	5.5	III
A02.02 Crop change	0	0	0	0.5	1	1.5	IV
A02.03 Grassland removal for arable land	0.5	0.5	1	1	2	5	III
A03 Mowing / cutting of grassland							
A03.01 Intensive mowing or intensification	0	0	0	0	1	1	IV
A03.02 Non-intensive mowing	0	0	0	0	1	1	IV
A03.03 Abandonment / lack of mowing	2	2	3	1	2	10	I
A04 Grazing							
A04.01 Intensive grazing							
A04.01.01 Intensive cattle grazing	0.5	0	0	1	2	3.5	IV
A04.01.02 Intensive sheep grazing	0.5	0.5	0.5	0.5	2	4	III
A04.01.03 Intensive horse grazing	0	0	0	0	2	2	IV
A04.01.04 Intensive goat grazing	0.5	0.5	0.5	1	2	4.5	III
A04.01.05 Intensive mixed animal grazing	0	0	0	0.5	2	2.5	IV
A04.02 Non-intensive grazing							
A04.02.01 Non-intensive cattle grazing	0.5	0.5	1	1	2	5	III
A04.02.02 Non-intensive sheep grazing	1	0.5	2	1	2	6.5	III
A04.02.03 Non-intensive horse grazing	0.5	0	0	1	2	3.5	IV
A04.02.04 Non-intensive goat grazing	1	0.5	2	1	2	6.5	III
A04.02.05 Non-intensive mixed animal grazing	0.5	0	0	1	2	3.5	IV
A04.03 Abandonment of pastoral systems, lack of grazing	2	3	3	1	2	11	I
A05 Livestock farming and animal breeding (without grazing)							
A05.01 Animal breeding	0.5	0.5	0,5	1	1	3.5	IV
A05.02 Stock feeding	0,5	1	1	1	2	5.5	III
A05.03 Lack of animal breeding	0	0	0	0	1	1	IV
A06 Annual and perennial non-timber crops							
A06.01 Annual crops for food production							
A06.01.01 Intensive annual crops for food production/ intensification	1	2	2	1	1	7	II
A06.01.02 Non-intensive annual crops for food production	1	0.5	1	1	1	4.5	III
A06.02 Perennial non-timber crops							
A06.02.01 Intensive perennial non-timber crops/intensification	2	2	2	1	1	8	II
A06.02.02 Non-intensive perennial non-timber crops	0.5	0.5	0.5	1	1	3.5	IV
A06.03 Biofuel-production	0.5	0.5	1	1	2	5	III
A06.04 Abandonment of crop production	1	0.5	0	1	0	2.5	IV
A07 Use of biocides, hormones and chemicals	2	2	2	1	2	9	II
A08 Fertilisation	2	2	1	1	2	8	II
A09 Irrigation	1	1	0.5	1	1	4.5	III
A10 Restructuring agricultural land holding							
A10.01 Removal of hedges and copses or scrub	0.5	0.5	1	1	2	5	III
A10.02 Removal of stone walls and embankments	0.5	0.5	0.5	0.5	2	4	III
A11 Agriculture activities not referred to above							

B SYLVICULTURE, FORESTRY						72.5	
B01 Forest planting on open ground							
B01.01 Forest planting on open ground (native trees)	0.5	0.5	0.5	1	2	4.5	III
B01.02 Artificial planting on open ground (non-native trees)	1	1	3	1	2	8	II
B02 Forest and plantation management & use							
B02.01 Forest replanting (replanting on forest ground after clear-cutting)							
B02.01.01 Forest replanting (native trees)	0.5	0	0	0.5	2	3	IV
B02.01.02 Forest replanting (non-native trees)	1	0.5	2	1	2	6.5	III
B02.02 Forestry clearance (clear-cutting, removal of all trees)	2	2	2	1	2	9	II
B02.03 Removal of forest undergrowth	0.5	0	1	1	1	3.5	IV
B02.04 Removal of dead and dying trees	1	1	3	1	2	8	II
B02.05 Non-intensive timber production (leaving dead wood)	0.5	1	1	1	1	4.5	III
B02.06 Thinning of tree layer	2	2	1	1	2	8	II
B03 Forest exploitation without replanting or natural regrowth	1	1	3	1	2	8	II
B04 Use of biocides, hormones and chemicals (forestry)	1	1	1	1	0	4	III
B05 Use of fertilizers (forestry)	0	0	0	0.5	0	0.5	IV
B06 Grazing in forests/woodland	0.5	0.5	1	1	2	5	III
B07 Forestry activities not referred to above						?	
C MINING, EXTRACTION OF MATERIALS AND ENERGY PRODUCTION						77.5	
C01 Mining and quarrying							
C01.01 Sand and gravel extraction							
C01.01.01 Sand and gravel quarries	1	1	2	1	2	7	II
C01.01.02 Removal of beach materials	0.5	0.5	2	1	2	6	III
C01.02 Loam and clay pits	0.5	0.5	2	1	2	6	III
C01.03 Peat extraction							
C01.03.01 Hand cutting of peat	0	0	0.5	1	3	4.5	III
C01.03.02 Mechanical removal of peat	0	0	2	1	3	6	III
C01.04 Mines							
C01.04.01 Open cast mining	3	2	2	1	3	11	I
C01.04.02 Underground mining	1	1	0.5	1	2	5.5	III
C01.06 Geotechnical survey	1	1	2	1	2	7	II
C01.07 Mining and extraction activities not referred to above	0.5	2	2	1	3	8.5	II
C03 Renewable abiotic energy use							
C03.01 Geothermal power production	0.5	1	1	1	2	5.5	III
C03.02 Solar energy production	0.5	0	0.5	1	2	4	III
C03.03 Wind energy production	0.5	1	3	1	1	6.5	III
D TRANSPORTATION AND SERVICE CORRIDORS						84	
D01 Roads, paths and railroads							
D01.01 Paths, tracks, cycling tracks	3	1	1	1	2	8	II
D01.02 Roads, motorways	2	2	2	1	1	8	II
D01.03 Car parcs and parking areas	0.5	0	0.5	1	2	4	III
D01.04 Railway lines, TGV	0.5	0.5	1	1	1	4	III
D01.05 Bridge, viaduct	0.5	0	0	1	1	2.5	IV
D01.06 Tunnel	0.5	0	0	1	1	2.5	IV
D02 Utility and service lines							
D02.01 Electricity and phone lines							
D02.01.01 Suspended electricity and phone lines	2	1	2	1	2	8	II
D02.01.02 Underground/submerged electricity and phone lines	0.5	0	0	1	1	2.5	IV
D02.02 Pipe lines	0.5	0.5	0.5	1	1	3.5	IV
D02.03 Communication masts and antennas	3	0.5	2	1	1	7.5	II
D02.09 Other forms of energy transport							
D03 Shipping lanes, ports, marine constructions (WFD)							
D03.01 Port areas (WFD)							
D03.01.01 Slipways	0.5	0.5	0	0.5	1	2.5	IV
D03.01.02 Piers / tourist harbours or recreational piers	0.5	0.5	2	1	2	6	III
D03.01.03 Fishing harbours	0	0	2	1	2	5	III

D03.02 Shipping lanes (includes canals, WFD)	0	0	2	1	1	4	III
D04 Airports, flightpaths							
D04.01 Airport	0.5	1	2	1	2	6.5	III
D04.02 Aerodrome, heliport	0.5	0.5	1	1	2	5	III
D04.03 Flight paths	0.5	0.5	0.5	1	1	3.5	IV
D05 Improved access to site	2	2	2	1	2	9	II
D06 Other forms of transportation and communication						?	
E URBANISATION, RESIDENTIAL AND COMMERCIAL DEVELOPMENT							
E01 Urbanised areas, human habitation							
E01.01 Continuous urbanisation	2	1	3	1	3	10	I
E01.02 Discontinuous urbanisation	3	0.5	2	1	2	8.5	II
E01.03 Dispersed habitation	0.5	0	1	1	2	4.5	III
E01.04 Other patterns of habitation							
E02 Industrial or commercial areas							
E02.01 Factory	1	0.5	3	1	3	8.5	II
E02.02 Industrial stockage	1	0.5	2	1	3	7.5	II
E02.03 Other industrial / commercial area (including shopping centres)	1	1	2	1	3	8	II
E03 Discharges							
E03.01 Disposal of household / recreational facility waste	3	1	3	1	3	11	I
E03.02 Disposal of industrial waste	2	2	3	1	3	11	I
E03.03 Disposal of inert materials	3	1	1	1	2	8	II
E03.04 Other discharges							
E03.04.01 Costal sand suppletion/ beach nourishment (WFD)	0.5	0.5	2	1	2	6	III
E04 Structures, buildings in the landscape							
E04.01 Agricultural structures, buildings in the landscape	1	0.5	0.5	1	2	5	III
E04.02 Military constructions and buildings in the landscape	0.5	1	1	1	2	5.5	III
E05 Storage of materials	0.5	0.5	0.5	1	2	4.5	III
E06 Other urbanisation, industrial and similar activities							
E06.01 Demolishment of buildings & human structures	0.5	0	0.5	0.5	1	2.5	IV
E06.02 Reconstruction, renovation of buildings	0.5	0	0.5	1	3	5	III
F BIOLOGICAL RESOURCE USE OTHER THAN AGRICULTURE & FORESTRY							
F01 Marine and freshwater aquaculture							
F01. Intensive fish farming, intensification	0.5	0.5	2	1	2	6	III
F01. Suspension culture (e.g. mussels, seaweed, fish)	0	0.5	3	1	2	6.5	III
F01.03 Bottom culture (e.g. shellfish)	0	0	0	0	2	2	IV
F02 Fishing and harvesting aquatic resources							
F02.01 Professional passive fishing							
F02.01.01 Potting						?	
F02.01.02 Netting	1	0.5	2	1	1	5.5	III
F02.01.03 Demersal longlining	0	0	0	0	1	1	IV
F02.01.04 Pelagic longlining	0	0	0	0	1	1	IV
F02.02 Professional active fishing							
F02.02.01 Benthic or demersal trawling							
F02.02.02 Pelagic trawling (drift-net fishing)	0.5	1	3	1	1	6.5	III
F02.02.03 Demersal seining						?	
F02.02.04 Purse seining						?	
F02.02.05 Benthic dredging	0	0	0	0.5	1	1.5	IV
F02.03 Leisure fishing (other than bait-fishing)							
F02.03.01 Bait digging / collection	1	0	0.5	1	1	3.5	IV
F02.03.02 Pole fishing (e.g. sturgeons)	2	1	0.5	1	1	5.5	III
F02.03.03 Spear-fishing (e.g. overfishing of Scyllarides)	0.5	0	2	1	1	4.5	III
F03 Hunting and collection of wild animals (terrestrial)							
F03.01 Hunting							
F03.01.01 Damage caused by game (excess population density)	0.5	0.5	0.5	1	0.5	3	IV
F03.02 Taking and removal of animals (terrestrial)							
F03.02.01 Collection of animals	2	1	2	1	1	7	II

F03.02.02 Taking from nest (falcons)	0.5	0.5	3	1	1	6	III
F03.02.03 Trapping, poisoning, poaching	3	2	3	1	2	11	I
F03.02.04 Predator control	2	1	3	1	2	9	II
F03.02.05 Accidental capture	1	1	2	1	2	7	II
F03.02.09 Other forms of taking animals						?	
F04 Taking / removal of terrestrial plants, general							
F04.01 Pillaging of floristic stations	0	0	0	0	0	0	IV
F04.02 Collection (fungi, lichen, berries etc.)							
F04.02.01 Hand raking	2	1	2	1	1	7	II
F04.02.02 Hand collection	3	0.5	1	1	1	6.5	III
F06 Hunting, fishing or collecting activities not referred to above							
F06.01 Game/ bird breeding station	0.5	0.5	1	0.5	1	3.5	IV
G HUMAN INTRUSIONS AND DISTURBANCES						175	
G01 Outdoor sports and leisure activities, recreational activities							
G01.01 Nautical sports							
G01.01.01 Motorised nautical sports (e.g. jet-skiing)	0.5	0.5	2	1	1	5	III
G01.01.02 Non-motorised nautical sports (e.g. wind-surfing)	0.5	0.5	0.5	1	1	3.5	IV
G01.02 Walking, horse riding and non-motorised vehicles	2	1	0.5	1	1	5.5	III
G01.03 Motorised vehicles							
G01.03.01 Regular motorized driving (standard vehicles & 4x4 on roads)	2	1	1	1	1	6	III
G01.03.02 Off-road motorised driving	2	1	2	1	2	8	II
G01.04 Mountaineering, rock climbing, speleology							
G01.04.01 Mountaineering & rock climbing	1	0.5	0.5	1	1	4	III
G01.04.02 Speleology	0.5	1	1	1	1	4.5	III
G01.04.03 Recreational cave visits (terrestrial & marine)	1	1	2	1	2	7	II
G01.05 Gliding, delta plane, paragliding, ballooning	0.5	0.5	0.5	1	1	3.5	IV
G01.06 Skiing, off-piste	0.5	0	0	0.5	1	2	IV
G01.07 Scuba diving, snorkelling	0.5	0	0	0	1	1.5	IV
G01.08 Other outdoor sports and leisure activities	0.5	0.5	1	1	1	4	III
G02 Sport and leisure structures							
G02.01 Golf course	0.5	0.5	3	0.5	2	6.5	III
G02.02 Skiing complex	0.5	2	2	1	2	7.5	II
G02.03 Stadium	0.5	0.5	0.5	1	3	5.5	III
G02.04 Circuit, track	0.5	0	0.5	1	2	4	III
G02.05 Hippodrome	0.5	0	1	1	2	4.5	III
G02.06 Attraction park	0.5	0.5	0.5	1	3	5.5	III
G02.07 Sports pitch	0.5	0.5	0.5	1	2	4.5	III
G02.08 Camping and caravans	0.5	0.5	2	1	2	6	III
G02.09 Wildlife watching	0.5	0	2	0.5	1	4	III
G02.10 Other sport / leisure complexes							
G03 Interpretative centres	0	0	0	0,5	2	2,5	IV
G04 Military use and civil unrest							
G04.01 Military manoeuvres	0,5	1	2	1	1	5,5	III
G04.02 Abandonment of military use	0,5	1	2	1	2	6,5	III
G05 Other human intrusions and disturbances							
G05.01 Trampling, overuse	1	0,5	2	1	1	5,5	III
G05.04 Vandalism	1	1	3	1	2	8	II
G05.05 Intensive maintenance of public parcs /cleaning of beaches	1	1	2	1	2	7	II
G05.06 Tree surgery, felling for public safety, removal of roadside trees	0,5	0,5	2	1	2	6	III
G05.07 Missing or wrongly directed conservation measures	3	3	3	1	2	12	I
G05.08 Closures of caves or galleries	0,5	0,5	2	1	1	5	III
G05.09 Fences, fencing	0,5	0,5	1	1	1	4	III
G05.10 Overflying with aircrafts (agricultural)	0,5	0,5	0,5	1	1	3,5	IV
G05.11 death or injury by collision	1	1	3	1	1	7	II
H POLLUTION							
H01 Pollution to surface waters (limnic, terrestrial, marine & brackish) (WFD)							

H01.01 Pollution to surface waters by industrial plants (WFD)	1	1	3	1	2	8	II
H01.02 Pollution to surface waters by storm overflows (WFD)	0,5	0,5	2	1	1	5	III
H01.03 Other point source pollution to surface water (WFD)	1	1	1	1	2	6	III
H01.04 Diffuse pollution to surface waters via storm overflows or urban run-off (WFD)	2	1	1	1	2	7	II
H01.05 Diffuse pollution to surface waters due to agricultural and forestry activities (WFD)	1	1	2	1	2	7	II
H01.06 diffuse pollution to surface waters due to transport and infrastructure without connection to canalization/sweepers (WFD)	2	0,5	2	1	2	7,5	II
H01.07 Diffuse pollution to surface waters due to abandoned industrial sites (WFD)	1	1	1	1	2	6	III
H01.08 Diffuse pollution to surface waters due to household sewage and waste waters (WFD)	3	1	2	1	2	9	II
H01.09 Diffuse pollution to surface waters due to other sources not listed (WFD)	2	0.5	2	1	2	7.5	II
H02 Pollution to groundwater (point sources and diffuse sources) (WFD)							
H02.01 Groundwater pollution by leakages from contaminated sites (WFD)	1	1	3	1	2	8	II
H02.02 Groundwater pollution by leakages from waste disposal sites (WFD)	2	2	3	1	2	10	I
H02.03 Groundwater pollution associated with oil industry infrastructure (WFD)	0.5	2	3	1	3	9.5	II
H02.04 Groundwater pollution by mine water discharges (WFD)	1	1	3	1	2	8	II
H02.05 Groundwater pollution by discharge to ground such as disposal of contaminated water to soakaways (WFD)	0.5	0.5	1	1	2	5	III
H02.06 Diffuse groundwater pollution due to agricultural and forestry activities (WFD)	2	3	2	1	2	10	I
H02.07 Diffuse groundwater pollution due to non-sewered population (WFD)	1	0.5	1	1	2	5.5	III
H02.08 Diffuse groundwater pollution due to urban land use (WFD)	1	1	1	1	2	6	III
H04 Air pollution, air-borne pollutants							
H04.01 Acid rain	2	2	0.5	1	3	8.5	II
H04.02 Nitrogen-input	1	1	0.5	1	2	5.5	III
H04.03 Other air pollution	2	2	2	1	2	9	II
H05 Soil pollution and solid waste (excluding discharges)							
H05.01 Garbage and solid waste	3	1	1	1	3	9	II
H06 excess energy (incl. geophysical surveys)							
H06.01 Noise nuisance, noise pollution							
H06.01.01 Point source or irregular noise pollution	1	1	2	1	1	6	III
H06.01.02 Diffuse or permanent noise pollution	2	1	2	1	1	7	II
H06.02 Light pollution	1	1	1	1	1	5	III
H06.03 Thermal heating of water bodies	0.5	1	3	1	1	6.5	III
H06.04 Electromagnetic changes						?	
H06.05 Seismic exploration, explosions	0	0	0	0	1	1	IV
H07 Other forms of pollution						?	
I INVASIVE, OTHER PROBLEMATIC SPECIES AND GENES						23.5	
I01 Invasive non-native species (plant & animal species)	3	0.5	1	1	3	8.5	II
I02 Problematic native species	1	1	1	1	2	6	III
I03 Introduced genetic material, GMO							
I03.01 Genetic pollution (animals)	0	0	0	0	3	3	IV
I03.02 Genetic pollution (plants)	1	0.5	0.5	1	3	6	III
J NATURAL SYSTEM MODIFICATIONS							
J01 Fire and fire suppression							
J01.01 Burning down (actively burning down existing vegetation)	2	2	3	1	2	10	I
J01.02 Suppression of natural fires	1	1	1	1	1	5	III
J01.03 Lack of fires	0.5	0.5	1	1	1	4	III
J02 Human-induced changes in hydraulic conditions							
J02.01 Landfill, land reclamation and drying out, general							
J02.01.01 Polderisation (WFD)	0	0	0	0	2	2	IV
J02.01.03 Reclamation of land from sea, estuary or marsh (WFD)	1	0.5	2	1	3	7.5	II
J02.01.04 Recultivation of mining areas	0	0.5	1	0	2	3.5	IV
J02.02 Removal of sediments (mud...)							
J02.02.01 Dredging / removal of limnic sediments (WFD)	1	1	1	1	2	6	III
J02.03 Canalisation & water deviation							
J02.03.01 Large scale water deviation	0.5	2	3	0.5	3	9	II
J02.03.02 Canalisation	1	1	2	1	3	8	II
J02.04 Flooding modifications							

J02.04.01 Flooding	1	1	1	1	2	6	III
J02.04.02 Lack of flooding	2	1	2	1	2	8	II
J02.05 Modification of hydrographic functioning, general							
J02.05.02 Modifying structures of inland water courses (WFD)	1	1	2	1	3	8	II
J02.05.03 Modification of standing water bodies	0.5	0.5	2	1	3	7	II
J02.05.04 Reservoirs	2	2	3	1	3	11	I
J02.05.05 small hydropower projects, weirs	2	1	2	1	2	8	II
J02.05.06 Wave exposure changes	0	0	0	0	0	0	IV
J02.06 Water abstractions from surface waters (WFD)							
J02.06.01 Surface water abstractions for agriculture (WFD, e.g. irrigation)	2	2	3	1	2	10	I
J02.06.02 Surface water abstractions for public water supply (WFD)	2	1	1	1	3	8	II
J02.06.03 Surface water abstractions by manufacturing industry (WFD)	0.5	0.5	1	1	1	4	III
J02.06.04 Surface water abstractions for the production of electricity (cooling) (WFD)	0.5	1	1	1	3	6.5	III
J02.06.05 Surface water abstractions by fish farms (WFD)	1	0.5	1	1	2	5.5	III
J02.06.06 Surface water abstractions by hydro-energy (WFD)	2	2	3	1	3	11	I
J02.06.07 Surface water abstractions by quarries/ open cast (coal) sites (WFD)	1	1	1	1	2	6	III
J02.06.08 Surface water abstractions for navigation (WFD)	0	0	0	0	0	0	IV
J02.06.09 Surface water abstractions for water transfer (WFD)	0.5	0.5	2	1	3	7	II
J02.06.10 Other major surface water abstractions (WFD)	0	0	0	0	0	0	IV
J02.07 Water abstractions from groundwater (WFD)							
J02.07.01 Groundwater abstractions for agriculture (WFD)	0.5	0.5	0.5	1	2	4.5	III
J02.07.02 Groundwater abstractions for public water supply (WFD)	1	0.5	0.5	1	2	5	III
J02.07.03 Groundwater abstractions by industry (WFD)						?	
J02.07.04 Groundwater abstractions by quarries/open cast (coal)sites (WFD)							
J02.07.05 Other major groundwater abstractions from groundwater for agriculture (WFD)						?	
J02.08 Raising the groundwater table /artificial recharge of groundwater (WFD)						?	
J02.08.01 Discharges to groundwater for artificial recharge purposes (WFD)	0	0	0	0	0	0	IV
J02.08.02 Returns of groundwater to GWB from which it was abstracted (WFD: e.g. for sand & gravel washing)	0	0	0	0	0	0	IV
J02.08.03 Mine water rebound (WFD)				0.5	0	0.5	
J02.08.04 Other major groundwater recharge (WFD)						?	
J02.09. Saltwater intrusion of groundwater (WFD)							
J02.09.01 Saltwater intrusion (WFD)	0	0	0	0	0	0	IV
J02.09.02 Other intrusion (WFD)						?	
J02.10 Management of aquatic and bank vegetation for drainage purposes	2	1	2	1	2	8	II
J02.11 Siltation rate changes, dumping, depositing of dredged deposits							
J02.11.01 Dumping, depositing of dredged deposits						?	
J02.11.02 Other siltation rate changes						?	
J02.12 Dykes, embankments, artificial beaches, general (WFD)							
J02.12.02 Dykes and flooding defence in inland water systems (WFD)	0.5	0.5	0.5	1	2	4.5	III
J02.13 Abandonment of management of water bodies	1	1	0.5	1	1	4.5	III
J02.15 Other human induced changes in hydraulic conditions						?	
J03 Other ecosystem modifications							
J03.01 Reduction or loss of specific habitat features							
J03.01.01 Reduction of prey availability (including carcasses)	3	2	2	1	2	10	I
J03.02 Anthropogenic reduction of habitat connectivity (fragmentation)							
J03.02.01 Reduction in migration/ migration barriers	2	2	2	1	2	9	II
J03.02.02 Reduction in dispersal	2	1	2	1	2	8	II
J03.02.03 Reduction in genetic exchange	2	1	1	1	2	7	II
J03.03 Reduction, lack or prevention of erosion	1	1	1	1	2	6	III
J03.04 Applied (industrial) destructive research	0	0	0	0.5	2	2.5	IV
K NATURAL BIOTIC AND ABIOTIC PROCESSES (WITHOUT CATASTROPHES)						122	
K01 Abiotic (slow) natural processes							
K01.01 Erosion	2	1	2	1	3	9	II
K01.02 Silting up	0.5	0.5	0.5	1	2	4.5	III
K01.03 Drying out	0.5	0.5	1	1	2	5	III

K01.04 Submersion	0.5	0.5	1	1	3	6	III
K01.05 Soil salinization	0.5	0.5	1	1	3	6	III
K02 Biocenotic evolution, succession							
K02.01 Species composition change (succession)	2	2	2	1	2	9	II
K02.02 Accumulation of organic material	0.5	0.5	1	1	3	6	III
K02.03 Eutrophication (natural)	1	0.5	1	1	3	6.5	III
K02.04 Acidification (natural)	0	0	0	1	3	4	III
K03 Interspecific faunal relations							
K03.01 Competition	0.5	0.5	1	1	2	5	III
K03.02 Parasitism	0.5	1	1	1	2	5.5	III
K03.03 Introduction of disease (microbial pathogens)	0.5	1	2	0.5	3	7	II
K03.04 Predation	0	0	0	1	2	3	IV
K03.05 Antagonism arising from introduction of species	0.5	0.5	0.5	0.5	3	5	III
K03.06 Antagonism with domestic animals	1	1	2	1	2	7	II
K03.07 Other forms of interspecific faunal competition						?	
K04 Interspecific floral relations							
K04.01 Competition	0.5	0.5	1	1	2	5	III
K04.02 Parasitism	0.5	1	2	1	2	6.5	III
K04.03 Introduction of disease (microbial pathogens)				0	3	?	
K04.04 Lack of pollinating agents	0.5	1	2	0.5	2	6	III
K04.05 Damage by herbivores (including game species)	1	0.5	1	1	1	4.5	III
K05 Reduced fecundity/ genetic depression							
K05.01 Reduced fecundity/ genetic depression in animals (inbreeding)	0.5	1	3	1	3	8.5	II
K05.02 Reduced fecundity/ genetic depression in plants (incl. endogamy)	0	0	0		3	3	IV
K06 Other forms or mixed forms of interspecific floral competition						?	
L GEOLOGICAL EVENTS, NATURAL CATASTROPHES						26.5	
L01 Volcanic activity	0	0	0	0	0	0	IV
L03 Earthquake	0	0	0	0	0	0	IV
L04 Avalanche	0.5	1	3	1	2	7.5	II
L05 Collapse of terrain, landslide	0.5	0.5	1	1	2	5	III
L06 Underground collapses	0	0	0	0	0	0	IV
L07 Storm, cyclone	0.5	0.5	0.5	0	1	2.5	IV
L08 Inundation (natural processes)	1	0.5	1	0.5	1	4	III
L09 Fire (natural)	0.5	1	3	1	2	7.5	II
L10 Other natural catastrophes						?	
M CLIMATE CHANGE							
M01 Changes in abiotic conditions						50.5	
M01.01 Temperature changes	2	2	2	1	3	10	I
M01.02 Droughts and less precipitations	2	2	2	1	3	10	I
M01.03 Flooding and rising precipitations	1	1	1	0	3	6	III
M01.04 pH-changes	0	0	0	0	3	3	IV
M01.05 Water flow changes (limnic, tidal and oceanic)	0	0	0	0	2	2	IV
M01.06 Wave exposure changes	0	0	0		0	0	IV
M02 Changes in biotic conditions							
M02.01 Habitat shifting and alteration	0.5	1	1	0	3	5.5	III
M02.02 Desynchronisation of processes	0.5	1	1	0	3	5.5	III
M02.03 Decline or extinction of species	0	0	0	0.5	3	3.5	IV
M02.04 Migration of species (natural newcomers)	0.5	0.5	0.5	0.5	3	5	III
X No threats or pressures							
XO Threats and pressures from outside the Member State	1	1	2	1	1	6	III
XE Threats and pressures from outside the EU territory	1	1	1	1	1	5	III

Annex 3: Indicative budget on the implementation of the 2013-2018 Biological Diversity Action Plan

	ACTION	Priority	Implementing institution	Implementation period	Indicative budget	Potential funding
SG - A	**ADDRESS THE UNDERLYING CAUSES FOR BIOLOGICAL DIVERSITY LOSS THROUGH ITS MAINSTREAMING ACROSS THE SOCIETY**					
NT - 1	**Raise public awareness of biological diversity values, services delivered by ecosystems and steps to be undertaken toward protection and sustainable use of biological diversity to a higher level**					
1.1	Establishment of the level of knowledge and awareness about the values of biological diversity of the Republic of Macedonia for different target groups	1	MoEPP in cooperation with the implementing intersectoral body (National Committee on Biodiversity – NCB), survey agency	2018-2019	20000	Budget of RM, foreign grants
1.2	Implementation of activities for public awareness raising among specific target groups					
1.2.1	Preparation and implementation of a Communication Plan	1	MoEPP (Department of Public Relations), public relations organizations, media, NGOs	2019-2023	10000	Budget of RM, foreign grants
1.2.2	Organization and implementation of national campaign for public awareness raising about the values of biological diversity and ecosystem services	1	MoEPP, public relations organizations, NGOs, PA management entities, Units of Local Self-Government (ULSG), media, business community, other stakeholders identified according to the survey	2019 - 2023	150000	Budget of RM, foreign grants, business sector
1.2.3	Promotion of the values and importance of protected areas	1	MoEPP, PA management entities, NGOs, etc.	Cont.	10000	Budget of RM, PA manag. entities, foreign grants
1.2.4	Preparation and publication of vocational and popular books/manuals/brochures on different components, values, use of and threats to biological diversity	2	Scientific institutions, experts, PA management entities, NGOs, etc.	Cont.	200000	Budget of RM, PA manag. entities, foreign grants
1.2.5	Development of tourist maps/offers/guides on protected and sensitive areas to the benefit of biological diversity conservation	1	Experts, PA management entities, NGOs, Agency for Tourism Support and Promotion, etc.	Cont.	100000	Budget of RM, foreign grants
1.2.6	Marking of international days related to biological diversity	1	MoEPP, NGOs, international organizations, ULSG, media, business community, other stakeholders	Cont.	50000	Budget of RM, foreign grants
1.3.	Implementation of education activities					
1.3.1.	Preparation of a plan for education in the area of biological diversity (for formal and informal education)	2	MoEPP, Bureau for Development of Education – Ministry of Education and Science (MoES), Ministry of Culture (MoC), MAFWM, educational institutions on all levels, informal education groups, NGOs	2018-2019	10000	Budget of RM, foreign grants
1.3.2.	Implementation of educational competition in the area of biological diversity	1	MoES, educational institutions on all levels, NGOs	2018 - 2023	10000	Budget of RM, foreign grants
1.3.3	Organization of didactic topic-based excursions (positive and negative examples of biological diversity status and management)	2	MoES, educational institutions on all levels, NGOs	Cont.	30000	Budget of RM, foreign grants
1.3.4	Organization of other educational thematic excursions according to educational plan	2	MoES, educational institutions on all levels, NGOs	2018-2023	15000	Budget of RM, foreign grants
1.4.	Strengthening of the capacity of the civil sector and ULSG for participation in SEA and EIA procedures	1	MoEPP (Department of Spatial Planning, Department of Environment), ULSG, domestic and international experts / organizations	2018-2023	20000	Budget of RM, foreign grants

NT - 2	Values of biological diversity are gradually integrated in the policies of economic development on national and local levels (poverty reduction, environmental accounting, national and local development plans, etc.)					
2.1.	Development of a study about the economic values of ecosystem services	2	MoEPP in cooperation with scientific institutions and experts	2018 - 2020	120000	Budget of RM, foreign grants
2.2.	Assessment of ecosystem services within individual sectors					
2.2.1	Introduction of procedures for assessment of ecosystem services within individual sectors and their implementation in the process of adopting strategies, plans and programmes	1	MoEPP, in cooperation with NCB	2020 - 2023	20000	Budget of RM, foreign grants
2.2.2	Introduction of environmental accounting procedures at national level intended for the business sector	2	MoF, MoEPP, business sector, ULSG, experts	2020-2023	10000	Foreign grants
2.3.	Incorporation of biodiversity conservation goals into sectoral strategies, plans and programmes (energy, waters, agriculture, rural development, forestry, fight against poverty, etc.) by including alternative solutions					
2.3.1.	Development of sensitivity maps with regard to biological diversity for projects related to the economic sectors (mineral and mining resources, hydro power, wind power, etc.) for the purpose of preventive identification of areas important for biological diversity	1	MoEPP, ME, MTC, experts, ASP	2019 - 2023	300000	Budget of RM, business sector, foreign grants
2.3.2.	Development of SEA for the construction of small hydropower plants	1	MoEPP (Department of Spatial Planning, Department of Waters), ME, experts	2018-2020	100000	Budget of RM, foreign grants
2.3.3.	Support to the process of adoption of water management master plan and river basin management plans in the Republic of Macedonia	2	MAFWM, MoEPP (Department of Waters), river basin management bodies	Cont.	15000	Budget of RM
2.3.4	Preparation of a study for identification of alternative energy sources least harmful to biological diversity	1	Experts, scientific institutions, ME, MoEPP	2019 - 2021	100000	Budget of RM, foreign grants
2.3.5	Ensuring functionality of the national ecological network MAK-NEN through integration of the measures for ecological corridors management in the economic sectors	1	MoEPP in cooperation with other relevant sectors, NGOs	2018 - 2023	100000	Budget of RM, foreign grants
2.3.6.	Support for the implementation of the measures regulating sand and gravel exploitation along rivers and lakes	2	MoEPP, ME, ULSG	Cont.	5000	Budget of RM, ULSG
2.3.7	Fostering implementation of rural development funds focusing on reduced abandonment of traditional practices (abandonment of mowing, degradation of rural landscape) in hilly and mountainous areas	2	MAFWM, MLSP, NGOs, ULSG, Public Enterprise for Pasture Management	Cont.	20000	Budget of RM, foreign grants, IPARD funds
2.4.	Implementation of intersectoral analysis of the current Spatial Plan and preparations for the development of the new Spatial Plan	2	All relevant ministries, sectors and other stakeholders	2018 - 2020	5000	Budget of RM, foreign grants
2.5.	Integration of biodiversity conservation aspects in the preparation of local economic development (LED) strategies and other strategic planning documents at local and regional levels	1	MoEPP in cooperation with NCB, National Council for Sustainable Development in RM, ZELS, ULSG, MLSG, Bureau for Regional Development	Cont.	10000	Budget of RM, USLG budget, foreign grants
2.6.	Integration of the nature impact assessment procedure (in accordance with Article 6 of Habitats Directive) for development projects and plans in future Natura 2000 and/or Emerald sites	2	MoEPP in cooperation with other relevant sectors	2018 - 2020	15000	EU funds, foreign grants
2.7.	Enhancement of the effects of the implementation of the obligations under EIA on biological diversity conservation					
2.7.1	Improvement of the quality of developed EIAs through education of experts	1	Scientific institutions, MoEPP, international experts	Cont.	15000	Budget of RM, foreign grants, EU funds
2.7.2	Strengthening of the implementation of measures ensuing from developed EIAs	1	State Environmental Inspectorate (SEI)	Cont.	5000	Budget of RM – special funds not required
2.8.	Sustainable use of natural resources towards poverty reduction					
2.8.1.	Identification of opportunities for developing alternative tourism and its application in specific areas	1	Agency for Promotion and Support of Tourism, PA management entities, MAFWM, MLSP, municipalities, individual businessmen	2018 - 2020	15000	Budget of RM, foreign grants
2.8.2.	Identification of opportunities for the use biological resources – establishment of productivity and sustainable quotas to secure stable populations	1	MoEPP in cooperation with experts, scientific institutions, NGOs	2018 - 2022	150000	Budget of RM, foreign grants

NT - 3	**Introduction of positive incentives for conservation and sustainable use of biological diversity in accordance with the Convention and EU related obligations and identification and correction of incentives that are harmful to affected biological diversity components**					
3.1.	Mainstreaming the policy of subsidies of economic sector (agriculture, rural development, energy) to support biodiversity					
3.1.1.	Analysis of existing subsidies and redefinition of subsidies conflicting with the national targets for biological diversity	1	Experts, MoEPP, MAFWM, APDA, ME, MLSP	2018-2019	5000	Budget of RM, foreign grants
3.1.2.	Analysis and introduction of incentive measures, including payment for ecosystem services towards poverty reduction through sustainable use of biological diversity and ecosystem services	2	Experts, MoEPP, MLSP, MAFWM, PA management entities, other stakeholders	2020 - 2023	8000	Budget of RM
3.1.3.	Promotion of and support to subsidies in agricultural sector that are favourable for biological diversity conservation	1	MAFWM, Rural Development Network of RM, Federation of Farmers, private farmers, etc.	2018 - 2023	40000	Budget of RM, foreign grants
3.1.4.	Encouraging measures and practices for maintenance and improvement of ecological values of rural landscape	2	MoEPP, MAFWM, Rural Development Network of RM, Federation of Farmers, private farmers	2019 - 2021	10000	Foreign grants, EU funds
3.1.5.	Support to farmers maintaining native species of agricultural crops and domestic animals	2	MAFWM, Rural Development Network of RM, Federation of Farmers, private farmers	2018 - 2023	50000	Budget of RM, EU funds
3.1.6.	Support to good agricultural practice and introduction of agro-ecological measures	2	MAFWM, MoEPP, farmers, local population	2018 - 2023	50000	EU funds, foreign grants, budget of RM
3.1.7.	Support to develop measures for agricultural activity in areas with limited possibilities for agricultural activity	2	MAFWM in cooperation with MoEPP	2018 - 2023	50000	EU funds, foreign grants
3.2.	Development of study on the benefits of subsidies for electricity production from renewable sources that are in conflict with biological diversity targets and potential review of existing schemes	2	MAFWM, ME, experts, NGOs, Energy Agency	2018 - 2020	25000	Foreign grants, budget of RM
3.3.	Development of study on the benefits of subsidies for mass tourism and fostering subsidies for alternative forms of tourism (with potential review of existing schemes)	1	ME, Agency for Tourism Development and Support, MAFWM, experts, other stakeholders	2018 - 2021	50000	Foreign grants, EU funds
3.4.	Preparation of analysis for the potential ecological, economic and social costs and benefits from tackling harmful subsidies	2	MoEPP, ME, MLSP in cooperation with scientific institutions / expert	2018-2019	10000	Budget of RM, foreign grants
3.5.	Support to nursery-based production of native woody species	1	MAFWM, MoEPP, PE Macedonian Forests, private nurseries	2018 - 2023	25000	Budget of RM, foreign grants
NT - 4	**Increase the level of investments in and funding of biological diversity conservation from central and local budgets and other sources**					
4.1	Provision of basic funds for protected areas from the Budget of the Republic of Macedonia	1	Government of RM	Cont.	100000	Budget of RM
4.2	Fostering of tax and customs reliefs for application of technologies that are compliant with the principles of biological diversity conservation	2	Ministry of Finance (MoF), tax and customs services	Cont.	10000	Budget of RM
4.3.	Establishment of Nature Protection Agency	1	Government of RM	2018 - 2020	100000	Budget of RM
4.4.	Introduction of a nature protection programme in MoEPP and establishment of special item in the budget for biological diversity conservation (with value equalling 20% of the funds for NBSAP implementation)	1	Government of RM, MoEPP	Cont.	120000	Budget of RM
4.5.	Introduction of mechanism for biological diversity incentives and fund reinvestment	2	MoEPP, PAs, experts, other stakeholders	2018 - 2020	10000	Budget of RM
4.6.	Establishment of self-sustainable financial system of protected area management	1	MoEPP, PAs, experts	cont.	120000	Budget of RM, PA budget
4.7.	Introduction of tax reliefs and subsidies for services and products in protected areas and encouragement of the self-sustainability mechanism	2	MoEPP, PAs, tax services	2018-2023	10000	Budget of RM, foreign grants
4.8.	Establishment of mechanisms for financing biological diversity conservation from the budgets of the local self-governments	3	MLSG, ULSG, ZELS, MoEPP	cont.	10000	Budget of RM, ULSG budget
4.9.	Organization of donor conferences for issues on biological diversity	2	MoEPP, NGOs, business sector, other stakeholders	cont.	30000	Budget of RM, foreign grants
4.10.	Encouragement of social accountability with companies to support project activities referring to the conservation of biological diversity	2	Relevant ministries in cooperation with companies	cont.	10000	Company budget
4.11.	Strengthening of the capacities to apply for biological diversity conservation projects in EU funds and other international donors and mechanisms within MoEPP, ULSG, PA management entities, CAs and other relevant stakeholders	1	National and international experts, NGOs	cont.	50000	Foreign grants

4.12.	Consideration of the possibility to re-allocate a percentage of the personal tax for projects and programmes of general interest, also including protection of biological diversity	2	Government of RM, MoF, experts	2019 - 2021	5000	Budget of RM, foreign grants
SG - B	**REDUCE DIRECT AND INDIRECT PRESSURES ON ECOSYSTEMS AND OTHER COMPONENTS OF BIOLOGICAL DIVERSITY**					
NT - 5	**Establish practices for forestry, agriculture, hunting and fishery management that contribute to the conservation of biological diversity and maintenance of ecosystem services**					
5.1	Harmonization of the legislation for nature protection with the laws on forests, hunting, fishery and rural development, pastures, agricultural land, livestock breeding and waters	3	MoEPP in cooperation with MAFWM and other relevant sectors	cont.	0	Add. budget not required
5.2	Strengthening of the capacity of judiciary to cope with environmental crime	2	SEI, courts in RM, international experts, Faculty of Security	2018 - 2023	50000	Budget of RM, foreign grants
5.3	Strengthening of the capacity for detection of illegal use of poisons	1	MoEPP, MAFWM, PAs, hunting clubs, NGOs, international experts and other stakeholders	2018 - 2023	50000	Budget of RM, foreign grants
5.4.	Fostering of the integration of biological diversity components (especially threatened species and habitats) into forestry practices					
5.4.1.	Fostering of the integration of the needs for functionality of bio-corridors and ecological network into forestry practices and rural development	3	MoEPP, MAFWM, PE Macedonian Forests, scientific institutions, experts	cont.	15000	Budget of RM
5.4.2.	Support to the introduction of measures for protection and conservation of non-forest habitats of high natural values (montane pastures, meadows, etc.) in forestry practices	3	MoEPP, MAFWM, PE Macedonian Forests, scientific institutions	cont.	20000	Budget of RM, foreign grants
5.4.3.	Reduced application of clearcutting over large areas and other practices in forestry that may pose threat to biological diversity	2	MAFWM, PE Macedonian Forests, scientific institutions, private forest owners	cont.	10000	Budget of RM
5.4.4.	Transfer of knowledge and international practices in forests management and exploitation from biological diversity conservation point of view	2	MAFWM, PE Macedonian Forests, scientific institutions, private forest owners, international experts	cont.	30000	Budget of RM, foreign grants
5.4.5.	Fostering of the forest inventorization process	1	MAFWM, PE Macedonian Forests, scientific institutions, private forest owners	2018 - 2023	20000	Budget of RM, foreign grants
5.4.6.	Fostering of the forest certification process	2	MAFWM, PE Macedonian Forests, PAs, private forest owners, scientific institutions	2018 - 2021	100000	Budget of RM, foreign grants
5.5.	Support to the management of biodiversity-rich forests (or HNV forests), including near-virgin forests					
5.5.1.	Development of study for identification of biodiversity-rich forests, including near-virgin forests	1	MAFWM, MoEPP, PE Macedonian Forests, PAs scientific institutions	2018 - 2020	50000	Foreign grants
5.5.2.	Introduction of protection of near-virgin forests and old forests that may turn into near-virgin forests	3	MAFWM, PE Macedonian Forests, PAs	2018 - 2020	10000	Budget of RM
5.5.3	Preparation of guidelines for introduction of good management practices in biodiversity-rich forests	2	MAFWM, PE Macedonian Forests, private forest owners, scientific institutions, international experts	2018 - 2021	30000	Foreign grants
5.5.4	Implementation of pilot project to test good management practices in biodiversity-rich forests and bio-corridors maintenance	2	MAFWM, MoEPP, PAs	2018 - 2020	100000	Foreign grants
5.6	Support to the renewal of the stocks for forestation of bare and erosive lands	2	MAFWM, PE Macedonian Forests, scientific institutions	2018-2019.	10000	Budget of RM, foreign grants
5.7	Strengthening of the capacity of institutions and hunting site managers for game protection against poaching and control of unselective methods and products in hunting	2	MAFWM, hunting grounds managers	2018 - 2021	80000	Foreign grants
5.8	Support towards strengthening the capacity of the State Inspectorate for Forestry and Hunting	3	MAFWM, Inspectorate for Forestry and Hunting, hunting grounds managers	2018 - 2021	30000	Foreign grants
5.9	Development of study for identification of biodiversity-rich agricultural areas (HNV Farmland areas) and their integration in agricultural policies	2	MAFWM, MoEPP, PE Macedonian Forests, scientific institutions, international experts	2018 - 2021	30000	Budget of RM, EU funds
5.10	Encouragement of modernization of existing irrigation systems through compulsory introduction of drip irrigation system and other measures (billing by water spent)	3	MAFWM, Federation of Farmers, private farmers	2018 - 2023	20000	Budget of RM, foreign grants
5.11	Minimization of water intake on open waters for the purposes of agriculture and transfer towards use of other sources (wells and pumps)	2	MAFWM, Federation of Farmers, private farmers	2018 - 2023	12000	Foreign grants
5.12	Preparation of study on the consequences from excessive grazing on certain areas	2	PE for Pasture Management, MAFWM, scientific institutions, herders	2018 - 2020	25000	Foreign grants

5.13	Preparation of study on the impact of fishponds on biological diversity	2	MoEPP, Hydrobiological Institute, scientific institutions	2018 - 2020	25000	Foreign grants
5.14	Support in the implementation of actions under the Programme for Fisheries and Aquaculture concerning activities linked to the improvement of the status of native fish populations, conservation of their aquatic habitats and assistance in the establishment of methodologies for monitoring the efficiency of protection measures	2	MAFWM, scientific institutions Hydrobiological Institute, fishing clubs, concession holders, NGOs	2018 - 2023	10000	Budget of RM, foreign grants, EU funds for cross-border cooperation
5.15	Encouragement of rural tourism by promoting food from native species/breeds	2	MAFWM, ME, Agency for Tourism Development and Support	2018 - 2023	50000	Budget of RM, Department for Tourism, local farmers
NT - 6	**Reduce pollution, including waste and excessive inlet of nutrients, to levels that are not detrimental to biological diversity, ecosystems and ecosystem services delivery**					
6.1	Strengthening of the Integrated Pollution Prevention and Control system (IPPC)					
6.1.1	Strengthening of institutional capacity for consistent implementation of IPPC	1	MoEPP in cooperation with competent institutions, business sector, Chambers of Commerce	2018 - 2023	20000	Budget of RM, Twinning project and other EU funds, business sector
6.1.2	Encouragement of polluters to implement the obligations ensuing from the national legislation on environment and nature	1	MoEPP, SEI, business sector	2018 - 2023	10000	Business sector
6.2	Implementation of pilot studies of the impact of pollution on terrestrial ecosystems and biological diversity	2	MoEPP in cooperation with scientific institutions	2019 - 2023	30000	Budget of RM, foreign grants
6.3	Strengthening of the capacity for environmental pollution monitoring	2	MoEPP in cooperation with scientific institutions, institutions responsible for monitoring	2018 - 2023	20000	Budget of RM
6.4	Improvement of surface and ground water monitoring	1	MoEPP, MAFWM, NHS, Hydrobiological Institute, scientific institutions	2018 - 2023	100000	Budget of RM
6.5	Improvement of ambient air monitoring	2	MoEPP in cooperation with scientific institutions	2018 - 2023	70000	Budget of RM
6.6	Establishment of soil pollution monitoring					
6.6.1	Adoption of legislation on soil protection	1	MoEPP	2018-2019	10000	Budget of RM
6.6.2	Implementation of soil pollution monitoring	3	MAFWM, MoEPP in cooperation with scientific institutions	2020-2023	30000	Budget of RM
6.7	Construction of sewage system and municipal and industrial waste water treatment systems	2	MAFWM, MoEPP, MTC, ULSG in cooperation with scientific institutions	cont.	200000	EU funds, foreign grants
6.8	Implementation of measures to mitigate the effects of existing landfills on biological diversity					
6.8.1	Development of study about the impact of existing solid waste landfills on biological diversity in their surrounding and immediate basin	2	MoEPP, ULSG, scientific institutions and experts	2020 - 2023	25000	Foreign grants
6.8.2	Clearing of illegal waste dumpsites within areas important for biological diversity	2	MoEPP, ULSG, public communal enterprises	2018 - 2023	50000	Budget of RM, foreign grants
6.8.3	Dislocation of landfills from karst river basins and landfills in the vicinity of rivers	3	MoEPP, ULSG, public communal enterprises	2018 - 2021	100000	Budget of RM, foreign grants
6.8.4	Prevention of the access of wild and domestic animals to landfills	2	MAFWM, ULSG, Federation of Farmers, private farmers and other stakeholders	2018 - 2023	20000	Budget of RM
NT - 7	**Develop and implement plans for sustainable production and sustainable consumption for the purpose of natural resources use within safe ecological limits**					
7.1	Promotion and application of methodology for determination of ecological footprint in state institutions and corporations (business sector) and proposing activities towards its reduction	2	MoEPP, ASP, NGOs, business sector, international experts and other stakeholders	2019 - 2022	20000	Budget of RM, foreign grants
7.2	Determination of safe sustainable limits (quotas) for the use of biological diversity components, and natural resources in general					
7.2.1	Determination of quotas for collection of wild species of plants, fungi, animals and commercially significant parts thereof	1	MoEPP in cooperation with scientific institutions	2018-2023	50000	Budget of RM, foreign grants
7.2.2	Identification of areas where collection of species at risk should be avoided	1	MoEPP in cooperation with scientific institutions	2018-2020	20000	Budget of RM, foreign grants

7.2.3	Harmonization and further regulation of the system for issuing wildlife harvesting license	1	MoEPP, PA management entities, PE Macedonian Forests, companies purchasing wild species	2018 - 2021	20000	Budget of RM, foreign grants
7.2.4	Development of scientific studies on the status of game population for the purpose of setting more appropriate hunt quotas	2	MAFWM, MoEPP in cooperation with scientific institutions	2019 - 2022	50000	Budget of RM, foreign grants
7.2.5	Strengthening of the capacity of hunting grounds managers to monitor game animal numbers through counting techniques based on ecological methodology for the purpose of setting more precise hunt quotas	2	MAFWM, hunting grounds managers, scientific institutions, NGOs	2018 - 2023	20000	Budget of RM, foreign grants
7.2.6	Review of the methodology establishing biological minimum in watercourses in a manner to account for the ecological flow	1	MoEPP, MAFWM in cooperation with scientific institutions	2018 - 2020	50000	Budget of RM, EU funds, foreign grants
7.2.7	Determination of the potential of natural pastures and quotas for their use	2	MoEPP, MAFWM in cooperation with scientific institutions	2018 - 2020	50000	Budget of RM, foreign grants
NT - 8	**Develop and establish appropriate policy for recording, control and protection of non-native and invasive species**					
8.1	Identification, monitoring and control of non-native species, invasive especially					
8.1.1.	Development of a study identifying non-native species, invasive species especially, and establishment of the size and spatial distribution of their populations, means of transfer and the risk they pose to the country's biological diversity	1	MoEPP in cooperation with scientific institutions	2018 - 2021	50000	Budget of RM, foreign grants
8.1.2.	Preparation / adoption of a national list of invasive species	1	MoEPP in cooperation with scientific institutions	2021-2022	3000	Budget of RM, foreign grants
8.1.3.	Monitoring and control of invasive plant species	2	MAFWM, MoEPP in cooperation with scientific institutions	2020 - 2023	15000	Budget of RM, foreign grants
8.1.4.	Monitoring and control of invasive fauna species	2	MAFWM, MoEPP, Hydrobiol. Institute , scientific institutions	2022-2023	15000	Budget of RM, foreign grants
8.1.5.	Monitoring and control of invasive fish species and investigating the real danger of them spreading to water bodies wherein they do not occur naturally	2	MoEPP, Hydrobiol. Institute, PAs, scientific institutions	cont.	15000	Budget of RM, foreign grants
8.2.	Monitoring of the occurrence of invasive species resulting from climate change (including vectors of diseases)	2	Scientific institutions, NGOs	cont.	15000	Budget of RM, foreign grants
8.3.	Encouraging activities towards eradication of non-native species in riparian vegetation and their substitution with native species	2	Scientific institutions, NGOs and other stakeholders	cont.	10000	Budget of RM, foreign grants
8.4.	Support to ESENIAS monitoring network for invasive species	1	MAFWM, MoEPP, scientific institutions, NGOs, other stakeholders	cont.	10000	Budget of RM, EU funds
NT-9	**Integrate measures for climate change effects adaptation and mitigation and combat against desertification**					
9.1	Continuous coordination of activities for biological diversity conservation with activities for combating climate change	1	MoEPP in cooperation with scientific institutions	cont.	5000	Budget of RM, foreign grants
9.2	Development of a study of biological diversity and economic benefits of energy generating systems based on use of alternative energy sources (hydrological systems, solar power, wind power)	1	MoEPP, ME, energy sector, other stakeholders	2019 - 2023	25000	ELEM, foreign grants
9.3	Identification of possible routes (bio-corridors) for movement and migration of animal and plant species under threat from climate change	1	MoEPP in cooperation with scientific institutions and individual experts	2019 - 2023	100000	Budget of RM, foreign grants
9.4	Setting of ecological flow for mountain aquatic ecosystems	1	MoEPP, MAFWM, scientific institutions	2018 - 2020	25000	Business sector, ELEM, foreign grants
9.5	Development of a hydrological study about the threat to ponds in lowlands, mountain ponds and glacial lakes	2	Scientific institutions, MoEPP, MFAWM, international experts	2018 - 2021	25000	Budget of RM, foreign grants
9.6	Assessment of the effects of periodic natural and induced hydrological fluctuation on biological diversity in glacial lakes and lowland ponds and swamps in the context of climate change	2	Scientific institutions, MoEPP, energy sector and other stakeholders	2018 - 2021	50000	Budget of RM, foreign grants
9.7	Development of a study of historical and current upper forest boundary and modelling of future climate-induced changes	2	Scientific institutions, MoEPP, other stakeholders	2018 - 2020	50000	Budget of RM, foreign grants
9.8	Detailed change mapping and modelling in certain mountainous pastures as pilot study of climate change	2	Scientific institutions, MoEPP, other stakeholders	2020 - 2023	50000	Budget of RM, foreign grants
9.9	Supplementing the network of protected areas in Macedonia in a way to ensure easier adaptation of biological diversity components to climate change	1	Scientific institutions, MoEPP and other stakeholders	2018-2023	30000	Budget of RM, foreign grants
9.10	Development of pilot models for determination of the climate change impact to biodiversity	1	MoEPP, scientific institutions, PAs and other stakeholders	2018-2023	20000	Budget of RM, foreign grants

9.11	Application of measures for adaptation to climate change in protected areas during management plan development	2	MoEPP, PA management entities, scientific institutions	2018 - 2023	10000	Budget of RM, foreign grants
9.12	Undertaking measures to prevent full degradation (desertification) of certain ecosystems that are under strong anthropogenic pressure in line with the measures ensuing from the National Action Programme to Combat Desertification	2	MoEPP, PA management entities, NGOs, scientific institutions	2020 - 2023	10000	Budget of RM, foreign grants
SG - C	**IMPROVE THE STATUS OF BIOLOGICAL DIVERSITY COMPONENTS TO INCREASE THE BENEFITS FROM BIOLOGICAL DIVERSITY AND ECOSYSTEM SERVICES**					
NT - 10	**Prevent loss, degradation and fragmentation of natural habitats of national and international importance**					
10.1	Identification and mapping of habitats					
10.1.1	Development of list of habitats and establishment of the extent of their threat and importance in accordance with the regulations of the Republic of Macedonia, international agreements ratified and regulations of the European Union (Article 49, LNP)	1	MoEPP, scientific and expert institutions	2018 - 2020	500000	Budget of RM, foreign grants
10.1.2	Mapping of important and threatened habitats in Macedonia and adoption of bylaws (under Article 49, LNP)	1	MoEPP, scientific and expert institutions, Cadastre of RM	2018 - 2023	500000	Budget of RM, foreign grants
10.2.	Specification of measures for preservation of habitats types in favourable status of conservation (Article 50, LNP)	2	MoEPP, scientific and expert institutions	2020 - 2023	10000	EU funds, budget of RM
10.3.	Preparation of action plan for preservation of extensive meadows (identification, mapping of areas under meadows, valorisation, conservation measures, etc.)	2	Scientific institutions, MAFWM, PE of Pasture Management, NGOs	2020 - 2023	120000	EU funds
10.4.	Protection and restoration of swamp habitats/wetlands and riparian habitats					
10.4.1	Identification of the most affected lowland swamps/wetlands and preparation of action plans for their conservation, such as Belchishte Swamp, Studenchishte Swamp, Katlanovo Swamp, Monospitovo Swamp, Negorci, etc.	1	MoEPP, scientific and expert institutions	2018 - 2023	70000	Budget of RM, foreign grants
10.4.2	Identification of the most affected mountainous swamps/wetlands and preparation of action plans for their conservation, such as Podgorechki and Labunishki Lakes (Jablanica), Bogovinje Lake and Lukovo Pole (Shar Planina), Lokuf (Deshat), Slana Bara (Osogovo Mountains), etc.	1	MoEPP, scientific and expert institutions	2018 - 2023	70000	Budget of RM, foreign grants
10.4.3	Development of plan and implementation of activities for prevention of degradation of swamps and wetlands, especially from intensification of agriculture, water supply, irrigation, fish stocking and other activities of economic sectors	2	MoEPP, scientific institutions, NGOs, PAs, farmers, other stakeholders	2020 - 2023	20000	Budget of RM, foreign grants, EU funds
10.4.4	Implementation of pilot measures for restoration of wetlands	3	MoEPP, scientific and expert institutions, NGOs	2019-2023	100000	Foreign grants
10.4.5	Implementation of pilot measures for protection and restoration of riparian habitats	3	MoEPP, scientific and expert institutions, NGOs	2018-2023	100000	Foreign grants
10.5	Adoption of MAK-NEN and its implementation in planning documents	1	MoEPP, Agency for Spatial Planning, MAFWM, PE Macedonian Forests	2018	5000	Budget of RM
10.6	Preparation of national action plan for speleological structures management for the purpose of biological diversity conservation	3	MoEPP in cooperation with scientific institutions and speleological societies	2019 - 2023	30000	Budget of RM, foreign grants
10.7	Protection of forests from forest fire					
10.7.1	Consistent application of measures for prevention and sanctions for intentional stubble fields and forest burning	1	MAFWM, scientific institutions, PE Macedonian Forests, PAs, Protection and Rescue Directorate, CMC	cont.	5000	Budget of RM
10.7.2	Education of local population of harmful effects of intentional stubble fields and forest burning	1	MAFWM, scientific institutions, PE Macedonian Forests, PAs, Protection and Rescue Directorate, CMC, NGOs	cont.	50000	Budget of RM, foreign grants
NT - 11	**Increase the size of protected areas up to 15% and secure their functional connection as ecological network and establish effective management of protected areas in cooperation with local communities**					
11.1.	Development of the protected area system					
11.1.1	Revision of and amendment to the legislation on national categorization of protected areas with IUCN	1	MoEPP in cooperation with scientific institutions	2018 - 2019	5000	Budget of RM, foreign grants
11.1.2	Finalization of the process of protected areas re-designation		MoEPP in cooperation with scientific institutions, PA management entities	2018 - 2023		Budget of RM, foreign grants
11.1.3	Harmonization of the system of protected and proposed areas (draft representative protected areas network) with other relevant sectors	1	MoEPP in cooperation with other stakeholders	2018-2020	5000	Budget of RM, foreign grants

11.1.4	Designation of new protected areas based on the Spatial Plan of the Republic of Macedonia, other strategic documents and relevant studies	1	MoEPP in cooperation with scientific institutions, NGOs	2018-2023		Budget of RM, foreign grants
11.1.6	Designation of natural rarities according to the national legislation	1	MoEPP in cooperation with scientific institutions, NGOs	2018 -2023	5000	Budget of RM, foreign grants
11.2	Identification of Special Conservation Areas (SCAs) and Special Protection Areas (SPAs) in the frames of the process of Natura 2000 establishment	2	MoEPP in cooperation with scientific and expert institutions, NGOs	2018 - 2022		Budget of RM, EU funds
11.3	Nomination and designation of new internationally protected areas					
11.3.1	Nomination of Ohrid Lake for wetland of international importance in accordance with the criteria of the Ramsar Convention	2	MoEPP, scientific institutions, National Ramsar Committee, NGOs	2018	10000	Budget of RM, foreign grants
11.3.2	Intensified cooperation with UNESCO with regard to areas from the Tentative List and support to the process of including the old beech forests from Macedonia in the proposal for world heritage	1	MoEPP, MAFWM, PAs, National UNESCO Committee, scientific institutions, NGOs	2018 - 2020	15000	Budget of RM, foreign grants
11.3.3	Analysing the possibilities for nomination of biosphere reserve under the UNESCO "Man and the Biosphere Programme"	2	MoEPP, MAB-UNESCO Committee, scientific institutions, NGOs	2018 - 2020	10000	Budget of RM, foreign grants, EU funds
11.3.4	Identification and study of zero extinction sites (AZE areas)	3	Scientific institutions, NGOs	2020-2023	25000	Foreign grants
11.4	Establishment of effective management of protected areas					
11.4.1	Preparation and adoption of management plans for all protected areas in accordance with the legislation	1	PA management entities, scientific institutions, NGOs, MoEPP	Cont.	150000	Budget of RM, foreign grants
11.4.2	Adoption of management plans for national parks and/or other protected areas in accordance with the legislation	2	ASP, PA management entities, scientific institutions, MoEPP	2018-2023	70000	Budget of RM, foreign grants
11.4.3	Appointment of protected area management entities in accordance with the legislation	1	MoEPP in cooperation with potential PA management entities	cont.	7000	Budget of RM
11.4.4	Strengthening of the capacity and efficiency of protected area management	1	MoEPP, scientific institutions, PA management entities, international experts	cont.	30000	Budget of RM, foreign grants
11.5	Monitoring of the status of priority species and habitats conservation outside the system of protected areas identified in the frames of Important Plant Areas, Important Bird Areas and Prime Butterfly Areas	2	MoEPP in cooperation with scientific institutions, NGOs	cont.	100000	Foreign grants, EU funds
NT - 12	Establish the level of threat to wild species, prevent reduction in populations and extinction of affected species, improve and maintain the status of protection, especially for species with populations in decline					
12.1.	Elaboration of red lists and red books	1	MoEPP in cooperation with scientific institutions	2018-2023,	500000	Foreign grants, budget of RM
12.2	Revision of the Lists of strictly protected and protected wild species	1	MoEPP in cooperation with scientific institutions	2018 - 2019	5000	Budget of RM
12.3	Amendments to the legislation to add obligation for preparation of action plans about key species and habitats, invasive species, etc.	1	MoEPP in cooperation with scientific institutions	2018 - 2019	3000	Budget of RM
12.4	Preparation and implementation of action plans for conservation of threatened species identified in red lists	2	MoEPP, scientific institutions, NGOs	2018 - 2023	50000	Budget of RM, foreign grants
12.5	Assessment of the status and elaboration of measures for conservation of the Habitats Directive Annex V species	2	MoEPP, scientific institutions, NGOs	2018 - 2023	200000	EU funds, budget of RM
12.6	Implementation of activities for re-introduction of extinct native species					
12.6.1	Development of study on the needs and possibilities for re-introduction of individual extinct native species	2	MoEPP in cooperation with scientific institutions, NGOs	2019 - 2021	15000	Foreign grants
12.6.2	Implementation of re-introduction of individual extinct native species	3	MoEPP, scientific institutions, NGOs	2020 - 2023	50000	Foreign grants
12.7	Implementation of ex situ conservation of native wild species					
12.7.1	Enlargement and maintenance of the Botanical Garden at UCM/FNSM Skopje with facilities for ex situ conservation of rare species of Macedonian flora	2	MoEPP, scientific institutions, Botanical Garden at FNSM in Skopje	cont.	100000	Budget of RM, foreign grants
12.7.2	Preparation of plan for identification of species in need for conservation of genetic materials	2	Scientific institutions	2019 -2021	15000	Budget of RM, foreign grants
12.7.3	Construction of authorized depositaries for species seized in illegal trade	1	Zoological gardens (Skopje and Bitola)	2018 -2021	50000	Budget of RM, foreign grants
12.7.4	Construction of shelter for injured/sick wild animal species	2	Zoological gardens (Skopje and Bitola), NGOs	2018 -2021	150000	Foreign grants
NT - 13	Improve in situ and ex situ conservation of genetic resources of native cultivated plants and domestic animals					

13.1.	Promotion of ex situ conservation of native species and varieties of agricultural crops					
13.1.1	Foundation of central gene bank of the Republic of Macedonia for ex situ storage of native seed and seeding material and secured funds for its maintenance	2	MAFWM, FASF, Institute of Agriculture	2019-2023	50000	Budget of RM
13.1.2	Creation of inventory of native species and varieties of agricultural crops represented on the territory of the Republic of Macedonia	1	MAFWM in cooperation with scientific institutions	2018 -2021	20000	Budget of RM, foreign grants
13.1.3	Collection of seed and seeding material of native species and varieties	1	MAFWM in cooperation with scientific institutions	Cont.	30000	Budget of RM, foreign grants
13.1.4	Characterization and evaluation of collected material of native agricultural crops	2	MAFWM in cooperation with scientific institutions	Cont.	20000	Budget of RM, foreign grants
13.1.5	Establishment of central database of the material in the gene banks accessible for the general public	3	MAFWM in cooperation with scientific institutions	2019-2021	10000	Budget of RM, foreign grants
13.2	Establishment of system of on-farm and on-garden (in situ) conservation of agricultural crops and conclusion of contracts with interested farmers	2	MAFWM in cooperation with scientific institutions, farmers	2018 -2022	30000	Budget of RM, foreign grants
13.3	Formation of catalogues and seeds exhibition collections of native agricultural crops in local offices of the MAFWE for easier distribution and spread of certain native varieties	1	MAFWM in cooperation with scientific institutions, farmers, NGOs	2018 -2023	30000	Budget of RM, foreign grants
13.4	Promotion of ex situ conservation of native species of domestic animals					
13.4.1	Update to the database of protected domestic breeds	1	MAFWM in cooperation with scientific institutions, farmers, NGOs	2018 -2023	7000	Budget of RM, foreign grants
13.4.2	Collection and maintenance of genetic material from native species of domestic animals in the gene bank	1	MAFWM in cooperation with scientific institutions, farmers, NGOs	2018 -2023	20000	Budget of RM, foreign grants
13.4.3	Establishment of expert network and other stakeholders for the conservation of biological diversity in stockbreeding	1	MAFWM in cooperation with scientific institutions, farmers, NGOs and other stakeholders	2018 -2020	5000	Budget of RM, foreign grants
13.4.4	Elaboration on the importance of biological diversity in stockbreeding and traditional practices in area conservation	2	Scientific institutions, NGOs, farmers	2020 -2022	25000	Budget of RM, foreign grants
13.4.5	Elaboration on the economic sustainability and valorization of protected breeds	3	MAFWM in cooperation with scientific institutions, farmers, NGOs	2018 -2022	20000	Budget of RM, foreign grants
13.4.6	Monitoring of the system for in situ and ex situ conservation of breeds	2	MAFWM in cooperation with scientific institutions, farmers, NGOs	2018 -2022	5000	Budget of RM, foreign grants
NT - 14	Establish monitoring of biological diversity and natural processes					
14.1.	Adoption of bylaws for monitoring establishment					
14.1.1	Development of plan with methodology for biological diversity monitoring	1	MoEPP, scientific institutions, NGOs, experts	2019 - 2021	25000	Budget of RM, foreign grants
14.1.2	Identification of species and habitats to be subject of monitoring, including species and habitats of Natura 2000	1	Scientific institutions, MoEPP, experts	2019 - 2020	10000	EU funds, budget of RM
14.1.3	Adoption of bylaws for accreditation of entities for monitoring performance (in relation to Article 148, paragraph 3 of the Law on Nature Protection)	2	MoEPP	2019 - 2021	5000	Budget of RM
14.2.	Assessment and improvement of capacity (individual, institutional, technical, etc.) for monitoring performance	2	MoEPP, scientific institutions, experts	2019 - 2023	50000	Budget of RM, foreign grants
14.3	Establishment of monitoring system for biological diversity in Macedonia	2	MoEPP, PAs, scientific institutions, NGOs, ULSG	2020 - 2023	5000	Budget of RM, foreign grants
14.4	Development of national indicators of biological diversity					
14.4.1	Establishment of index of the populations of bird species associated with agricultural lands	2	MoEPP, scientific institutions, experts, MAFWM	2019 - 2021	25000	Foreign grants, EU funds
14.4.2	Establishment of national index of threats to species (Red list index, IUCN)	1	MoEPP, scientific institutions, experts	2018 - 2021	15000	Foreign grants
14.4.3	Development of other necessary indicators	3	MoEPP, scientific institutions, experts	2019 - 2021	10000	Budget of RM, foreign grants
14.4.4	Development of monitoring protocols of biodiversity changes caused by climate change, in accordance to the proposed indicators in the Third National Communication on Climate Change	2	Scientific institutions, MoEPP, experts	2019 -2022	25000	Foreign grants
14.5	Support to restructuring of existing monitoring of aquatic ecosystems in accordance with the Framework Water Directive	2	MoEPP, scientific institutions, experts, NHS	2018 - 2021	10000	Budget of RM, foreign grants, EU funds
14.6	Establishment of central database from all types of monitoring carried out in Macedonia	3	MoEPP, scientific institutions, experts, NHS	2020 - 2022	10000	Budget of RM, foreign grants

NT - 15	Promote conservation of species and ecosystems in transboundary context through undertaking of joint measures/actions					
15.1.	Preparation of national action plans for species deriving from the obligations under international agreements (e.g. birds and bats under the Bonn Convention)	2	MoEPP in cooperation with scientific institutions, NGOs	2018 - 2023	20000	Budget of RM, foreign grants
15.2	Preparation of national action plans for species conservation deriving from existing regional or European initiatives or plans (vultures, lynx, initiative for conservation of carnivores in Europe, etc.)	1	MoEPP in cooperation with scientific institutions, NGOs	2018 - 2023	20000	Foreign grants
15.3	Implementation of the obligations related to the management of transboundary Prespa Park, including action plans for mountain tea, Prespa barbel, Prespa trout, Greek juniper forests, reed belts, brown bear and caves and bats	1	MoEPP, Prespa Park Coordination Body, PA management entities, scientific institutions, NGOs	2018 - 2023	70000	Budget of RM, foreign grants
15.4	Preparation of management plan for Ohrid-Prespa transboundary biosphere reserve	2	MoEPP, PA steering bodies, scientific institutions, NGOs, cross-border competent institutions	2018 - 2020		Foreign grants
15.5	Application of measures for biological diversity conservation within the European Green Belt	2	MoEPP, scientific institutions, NGOs, international organizations	2018 - 2023	100000	Foreign grants
15.6	Signing of bilateral agreements for transboundary waters management	2	MoEPP together with relevant institutions at cross-border level	2018 - 2021	15000	Budget of RM, foreign grants
15.7	Designation of transboundary protected areas for which national or international initiatives exist	1	MoEPP, PA steering bodies, scientific institutions, competent institutions from neighbouring countries	2018 -2023	15000	Budget of RM, foreign grants
15.8	Strenghtening cooperation and data exchange with other West Balkan countries for effective protection and sustainable use of biodiversity	1	MoEPP, PA steering bodies, scientific institutions, competent institutions from neighbouring countries	2018 -2023	25000	Budget of RM, foreign grants
NT - 16	**Improve the status of important ecosystems in terms of essential ecosystem services provision**					
16.1.	Implementation of activities aimed at ecosystems identification and mapping and assessment of their status					
16.1.1	Identification of the basic types of ecosystems in the Republic of Macedonia	1	Scientific institutions, experts, NGOs, MoEPP	2019 - 2021	10000	Budget of RM, foreign grants
16.1.2	Mapping of the basic types of ecosystems	2	MoEPP, MAFWM, PE Macedonian Forests, PE of Pasture Management, experts, Cadastre of RM	2020 - 2022	70000	Foreign grants
16.1.3	Implementation of status assessment of the basic types of ecosystems in Macedonia and their potential to deliver ecosystem services	2	Scientific institutions, experts, NGOs	2020 - 2022	70000	Foreign grants
16.1.4	Implementation of economic evaluation of ecosystems with the least favourable status	3	Scientific institutions, experts, NGOs	2020 - 2023	50000	Foreign grants
16.2	Identification of important ecosystem services on national level and their mapping, i.e. mapping the demand for certain ecosystem services	2	Scientific institutions, experts, NGOs	2018 - 2021	100000	Foreign grants
16.3	Preparation of plans and programmes for revitalization of the key ecosystems in the country	3	MoEPP in cooperation with scientific institutions	2020-2023.	60000	Budget of RM, foreign grants
16.4	Identification of priorities for restoration of degraded ecosystems functions or their capacity to deliver services to people	2	Scientific institutions, experts, NGOs	2019 - 2022	20000	Budget of RM, foreign grants
NT - 17	**Integrate the requirements of the Nagoya Protocol on access to genetic resources in the national legislation by 2018**					
17.1.	Implementation of legislation analysis and necessary amendments towards compliance with the Protocol	1	MoEPP, experts	2018-2019	30000	Budget of RM, foreign grants
17.2	Analysis of benefits and obligations under the ratified Protocol	1	MoEPP, proper experts	2019 - 2020	20000	Budget of RM, foreign grants
17.3	Public awareness raising and education on Protocol implementation	2	MoEPP, NGOs	2019 - 2020	30000	Budget of RM, foreign grants

SG - D	ENHANCE KNOWLEDGE AND AVAILABILITY OF ALL RELEVANT INFORMATION ON BIOLOGICAL DIVERSITY					
NT - 18	**Encourage and financially support research of biological diversity components, establish and supplement database on national level for the purpose of sharing and improved use of information of biological diversity**					
18.1.	Encouragement of creation of professional staff related to study of biological diversity conservation and provision of appropriate involvement at all levels of state administration and scientific and educational institutions	1	Government of RM, MoES, universities, scientific institutions, NGOs	cont.	5000	Budget of RM
18.2	Establishment and maintenance of clearing house mechanism (CHM) for biological diversity	1	MoEPP	cont.	20000	Budget of RM, foreign grants
18.3	Update and maintenance of the national information system with biological diversity database and its upgrading to include monitoring data	2	MoEPP in cooperation with institutions responsible for data collection	cont.	10000	Budget of RM, foreign grants
18.4	Development of national registers of natural heritage and cadastre of protected areas, in accordance with the law	1	MoEPP, scientific institutions, Museum of Natural History	2018 - 2020	50000	Budget of RM, foreign grants, EU funds
18.5	Giving priority to research					
18.5.1	Provision of support for the development of catalogues of individual taxonomic groups and their updating and publishing	2	MoES, MoEPP, scientific institutions	2018-2023	30000	Budget of RM
18.5.2	Initiation of activities for continuation of the project "Vegetation map of the Republic of Macedonia"	1	Scientific intuitions, experts, NGOs	2018-2022	100000	Budget of RM, foreign grants
18.6	Funding and implementing of science research projects on biological diversity					
18.6.1	Preparation of programme for priorities in funding of biodiversity research	1	Scientific institutions, experts	2018-2020	10000	Budget of RM
18.6.2	Introduction of programmes for scholarship awarding and support to new and young scientists and experts	1	MoES	cont.	15000	Budget of RM
18.6.3	Encouragement of research in the areas of ecosystem services and biological diversity	3	MoES and MoEPP in cooperation with proper scientific institutions, PA management entities	2018 - 2023	70000	Budget of RM, foreign grants
NT - 19	Preserve and promote traditional knowledge, innovations and practices for conservation and sustainable use of natural resources					
19.1	Fostering surveys and documenting good practices of traditional biological diversity use					
19.1.1	Documenting traditional methods of agricultural crops growing and livestock breeding	2	MoEPP, MAFWM, scientific institutions, Federation of Farmers, NGOs, other stakeholders	2018-2020	20000	Budget of RM, foreign grants
19.1.2	Documenting traditional methods of food stuffs and other products production from agricultural crops and livestock	2	MAFWM, business sector, municipalities	2018-2023	20000	Budget of RM, foreign grants
19.1.3	Documenting the tradition of keeping hallowed forests and forests associated with legends	1	MOC, NGOs	2018-2023	30000	Foreign grants
19.1.4	Documenting the use of biological diversity in traditional treatment and ethnopharmacy	1	Scientific institutions, NGOs, ethnopharmacists	2018-2023	30000	Budget of RM, foreign grants
19.2	Promotion and subsidizing the traditional use of biological diversity	2	MAFWM, experts, NGOs	2018-2023	100000	Foreign grants

13 References

Ajtić, R., Tomović, L., Sterijovski, B., Crnobrnja-Isailović, J., Djordjević, S., Djurakić, M., Golubović, A., Simović, A., Arsovski, D., Andjelković, M., Krstić, M., Šukalo, G., Gvozdenović, S., Aïdam, A., Michel, C. L., Ballouard, J.M. & Bonnet, X. (2013): Unexpected life history traits in a very dense population of dice snakes. Zoologischer Anzeiger, http://dx.doi.org/10.1016/j.jcz.2012.10.001.

Balmford, A., Carey, P., Kapos, V., Manica, A., Rodrigues, A.S, Scharlemann, J.P. & Green, R.E. (2009). Capturing the Many Dimensions of Threat: Comment on Salafsky et al. Conservation Biology. 23 (2): 482-487.

Barandovski, L., Cekova, M., Frontasyeva, M. V., Pavlov, S. S., Stafilov, T., Steinnes, E., Uru¬mov, V. (2008). Atmospheric deposition of trace element pollutants in Mace¬do¬nia studied by the moss biomonitoring technique, Environ¬men¬tal Monitoring and Assessment, 138, 107-118.

Brajanoska, R., Cil, A., Civic, K., Jones-Walters, L., Heinrichs, A.K., Hristovski, S., Melovski, Lj., Schwaderer, G. (2013). Synthesis report ofthe project "Realisation of the Balkan Regional Ecological Network".ECNC-European Centre for Nature Conservation, EuroNaturFoundation, Macedonian Ecological Society, Skopje, pp. 77.

Brininstool, M. (2012). TheMineralindustryofMacedonia. U.S. Geological Survey Minerals Yearbook—2010, 29: 1-3.

Catsadorakis, G., Aleksi, P., Avramoski, O., Bino, T., Bojadzi, A., Brajanoski, Z., Fremuth, W., Kazoglou, Y., Koutseri, I., Logotheti, A., Malakou, M., Nikolaou, H., Nikolaou, L., Putilin, K., Shumka, S., Uzunova, D., Velevski, M. (2013). Waterbirds wintering at the Prespa lakes as revealed by simultaneous counts in the three adjoining littoral states. Macedonian Journal of Ecology and Environment 15(1): 23-31.

CITES Secretariat & Jyoti Mathur-Fillip (2011). Contributing to the development, review, updating and revision of national biodiversity strategies and action plans ontrňal, 94 pages

CMS Secretariat & Christian Prip (2013). Guidelines on the integration of migratory species into national biodiversity strategies and action plans

Cvetkoska, A., Reed, J. & Levkov, Z. (2012): Lake Ohrid diatoms as palaeoclimate indicators of climate change during the last glacial-interglacial cycle. In: Witkowski, A. (ed.), Diatom monographs Vol. 15: 1–216.

Džukić, G., Kalezić, M.L. (2004): The biodiversity of amphibiansand reptiles in the Balkan Peninsula. pp. 167-192. In: Griffiths, H.I., Kryštufek, B., Reed, J.M. (eds.), Balkan biodiversity. KluwerAcademic Publishers, Amsterdam.

Gueorguiev, V. B. (1977). La faune troglobie terrestrede la peninsuleBalkanique: Origine, formation etzoogeographie. Bulgarian Academy of Sciences, p. 182.

Georgiev, S. B. (2004). Sadašnje poznavanje endemizma ihtiofaune Republike Makedonije. Ribarstvo, 62, 2: 43-58

Heath, M.F. and M.I. Evans (Eds) (2000). Important bird areas in Europe: Priority sites for conservation. – 2 vols. Cambridge, UK, BirdLife International, BirdLife Conservation Series No. 8).

Hassan R., Scholes R., and Ash N. eds. 2005. Millennium ecosystem assessment. Washington: Island Press.

IUCN (2014) The IUCN Red List of Threatened Species. Version 2014.2. <www.iucnredlist.org>. Downloaded on 26 September 2014.

IUCN-CMP (2002). Unified Classification of Direct Threats. Version 1.0 .

Jakšić, P. (1998). Dnevnileptiri Balkanskog Poluostrva (Dnevni leptiri Balkanskog poluostrva). Bionet 8: 22-24.

Jovanovska, E., Nakov, T. & Levkov, Z. (2013): Observations of the genus Diploneis (Ehrenberg) Cleve from lake Ohrid, Macedonia. Diatom Research 28(3): 237-262.

Kryštufek, B. & Reed, J. M. (2004). Balkan biodiversity: pattern and process in the European hotspot.SpingerVerlag, 357 pp.

Lemonnier-Darcemont, M., Chobanov, D., Krpač, V. T. (2014). Red List of Orthoptera of the Republic of Macedonia. Rev. Écol. (Terre Vie) 69: 151-158.

Levkov, Z. & Williams, D.M. (2011). Fifteen new diatom (Bacillariophyta) species from Lake Ohrid, Macedonia. Phytotaxa 30: 1–41.

Levkov, Z. & Williams, D.M. (2012). Checklist of diatoms (Bacillariophyta) from Lake Ohrid and Lake Prespa (Macedonia), and their watersheds. Phytotaxa 45: 1–76.

Levkov, Z. (2009): Amphora sensu lato. In: Lange-Bertalot, H. (ed.), Diatoms of Europe, Diatoms of the European Inland waters and comparable habitats. A.R.G. Gantner Verlag K.G., Vol: 5: 1–916.

Levkov, Z., Caput-Mihalic, K. & Ector, L. (2010). A taxonomical study of Rhoicosphenia Grunow (Bacillariophyceae) with a key for identification of taxa. Fottea 10: 1–56.

Levkov, Z., Krstic, S., Metzeltin, D and Nakov, T. (2007). Diatoms of Lakes Prespa and Ohrid (Macedonia). Iconographia Diatomologica 16: 1–603. R.G. Gantner Verlag K.G.

Levkov, Z., Metzeltin, D. & Pavlov, A. (2013).Luticola and Luticolopsis. In: Lange-Bertalot, H. (ed.), Diatoms of Europe, Diatoms of the European Inland waters and comparable habitats. A.R.G. Gantner Verlag K.G., Vol: 7: 1–696.

Lopatin, I.K&Matvejev, S.D. (1995). Zoogeography, Principles of Biogeography andecology of the Balkan Peninsula (distribution of biomes, distribution laws, elements of flora and fauna. University textbook. S.D. Matvejev, 166 pp, Ljubljana.

Martinčič, A., (2009). Contributions to the Bryophyte Flora of Republic of Macedonia. Hacquetia 8, 2: 97–114.

Michev, T., Simeonov, D., Porfirov, L. (2012). Birds of the Balkan Peninsula – field guide.Ecotan, Bulgaria.

Micevski, B., Micevski, N. (2008). Contribution to the knowledge of butterfly fauna of Macedonia. 2. Osogovo Mountains. Biologica Macedonica 61: 85-92.

Micevski, B. & Schneider-Jacoby, M. (1997). Winter census of waterfowl in Macedonian Part of Prespa Lake in January 1997. In: Gjiknuri, L., Miho, A., Shumka, S. (eds.). Proceedings of the International Symposium "Towards Integrated Conservation and Sustainable Development of Trans-boundary Macro and Micro Prespa Lakes", 24-26 October 1997, 160-164. Korcha, Albania.

Micevski, B. (1996). Ohrid Lake winter ornithofauna (faunistical and structural characteristics). Ann.Biol.49:85-93.

Micevski, B. (1999). Winter census of the waterfowl on the Macedonian part of Ohrid Lake in January 1998 (with structural, dietary and evaluation analyses). I Congress of Ecologist of the Republic of Macedonia with International Participation, Ohrid, 20-24.09.1998, 313-323.

Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC.

Nilson G., Andrén C. (2001). The meadow and steppe vipers of Europe and Asia - the Vipera (Acridophaga) ursinii complex. Acta Zool. Acad. Sci. H. 47: 87-267.

National Waste Management Plant and Ficibilities Studies, European Agency for Reconstruction, Ministry of Environment and Physical Planning, Skopje, 2005.

Peck, P. & Zinke, A. 2006: Draft of the refined assessment of South Eastern European mining-related risks: Identification and verification of "environmental hot spots" in Albania, Bosnia & Herzegovina, Macedonia , Montenegro and Serbia . Report prepared as a part of the UNEP Vienna coordinated ADA project "Improving regional cooperation for risk management from pollution hotspots as well as transboundary management of shared natural resources". 63 pp. and annexes.

Papp & Erzberger (2012). Contribution to the Bryophyte Flora of the Former Yugoslav Republic of Macedonia. Polish Botanical Journal 57(1): 205–221, 2012.

Pavlov A. & Levkov, Z. (2013). Observations on the genus Pinnularia section Distantes (Bacillariophyta) from Macedonia; diversity and distribution. Contributions, Section of Natural, Mathematical and Biotechnical Sciences, MASA Vol. 34: 33–57

Pavlov, A. & Levkov, Z. (2013). Diversity and distribution of Eunotia Ehrenberg in Macedonia. Phytotaxa 86: 1–117.

Pavlov, A. Levkov, Z. Williams, D.M. & Edlund M.B. (2013). Observations on Hippodonta (Bacillariophyceae) in selected ancient lakes. Phytotaxa 90: 1–53.

Peck, P., Zinke, A. (2006). South Eastern European mining-related risks: Identification and verification of "environmental hot spots". Updating of the ENVSEC desk assessment 2004 of security risks posed by mining – Reducing Environment & Security Risks from Mining in South Eastern Europe for: Albania, Bosnia & Herzegovina, Macedonia, Montenegro and Serbia. Prepared as a part of the UNEP Vienna coordinated ADA project: "Improving regional cooperation for risk management from pollution hotspots as well as transboundary management of shared natural resources". UNEP Vienna – Interim Secretariat of the Carpathian Convention (UNEP-ISCC). Lund/Vienna, p. 59.

Perennou, C., Gletsos, M., Chauvelon, P., et al. (2009). Development of a Trans-boundary Monitoring System for the Prespa Park Area. SPP, Agios Germanos, Greece.

Radford, E.A. and B. Odé (Eds) (2009) Important Plant Areas in South East Europe – conserving priority sites for plants. – UK, Plantlife International.

Salafsky, N., Salzer, D., Stattersfield, A. J., Hilton-Taylor, C., Neugarten, R., Butchart, S. H. M., Collen, B., Cox, N., Master, L. L., O'Connor, S. and Wilkie, D. (2008). A Standard Lexicon for Biodiversity Conservation: Unified Classifications of Threats and Actions. ConservationBiology. 22: 897–911. (doi: 10.1111/j.1523-1739.2008.00937.x).

Savić, I. R. (2008).Diversification of the Balkan fauna: its origin, historical development and present status. In: S. E. Makarov & R. N. Dimitrijević (Eds.). Advances in Arachnology and Developmental Biology. Papers dedicated to Prof. Dr. BožidarĆurčić.Inst. Zool., Belgrade; BAS, Sofia; Fac. Life Sci., Vienna; SASA, Belgrade& UNESCO MAB Serbia. Vienna — Belgrade — Sofia, Monographs, 12, 57-78.

Secretariat of the Convention on Biological Diversity (2010). Global Biodiversity Outlook 3. Montreal, p. 94.

Stafilov, T., Peeva, L., Nikov, B., de Koning, A. (2009). Industrial Hazardous Waste in the Republic of Macedonia. Proceedings of Applied Environmental Geochemistry – Anthropogenic impact on the human environment in the SE Europe Ljubljana, 6-9 October 2009, pp. 108-112

Stafilov, T., Škrbić, B.,Klanova,J., Čupr, P., Holoubek, I., Kočov,M., Đurišić-Mladenović, N. (2011). Chemometric assessment of the semivolatile organic contaminants content in the atmosphere of the selected sites in the Republic of Macedonia, Journal of Chemometrics, 25(6), 262–274

Stafilov, T., Šajn, R., Pančevski, Z., Boev, B., Frontasyeva, M.V.,Strelkova,L.P. (2008a).Geochemical atlas of Veles and the environs, Faculty of Natural Sciences and Mathematics, Skopje.

Stafilov, T., Šajn, R., Boev, B., Cvetković, J., Mukaetov, D., Andreevski, M. (2008b). Geochemical atlas of Kavadarci and the environs, Faculty of Natural Sciences and Mathematics, Skopje.

Stafilov, T., Balabanova, B., Šajn, R., Bačeva, K., Boev, B. (2010). Geochemical atlas of Radoviš and the environs and the distribution of heavy metals in the air, Faculty of Natural Sciences and Mathematics, Skopje.

Stafilov, T., Šajn, R., Sulejmani, F., Bačeva, K. (2011). Geochemical atlas of Kičevo and the environs, Faculty of Natu¬ral Sciences and Mathematics, Skopje.

Stafilov, T., Balabanova, B., Šajn, R. (2014). Geochemical atlas of the region of the Bregalnica River Basin, Faculty of Natural Sciences and Mathematics, Skopje

Sterijovski, B., Ajtić, R., Tomović, L., Djordjević, S., Djurakić, M., Golubović, A., Crnobrnja-Isailović, J., Ballouard, J.M., Groumpf, F., Bonnet, X. (2011): Natrix tessellata on Golem Grad, FYR of Macedonia: a natural fortress shelters a prosperous snake population. Mertensiella 18: 298-301.

Sterijovski, B.,Tomović, Lj. and Ajtić, R. (in prep). Contribution to the knowledge of the Reptile fauna and diversity in the FYR of Macedonia.North-Western Journal of Zoology 10 (1): 83-92

Stevanović, V. Tan, K. &Petrov, A. (2007). Mapping the endemic flora of the Balkans - a progress report.Bocconea 21: 131-137.

Stuhlberger, E. ed. (2010). Mining and Environment in the Western Balkans. UNEP, EnvSec, 106 pp.

Tzedakis, P. C. (2004). The Balkans as Prime Glacial Refugial Territory of European Temperate Trees. p. 49-68. In: Griffiths, H. I.; Kryštufek, B.; Reed, J. M. (Eds.). Balkan BiodiversityPattern and Process in the European Hotspot.SpingerVerlag, pp. 357.

TEEB (2009), The Economics of Ecosystems and Biodiversity. Climate Issues Update

TEEB (2010), The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A Synthesis of the Approach, Conclusions and Recommendations of TEEB.

UNEP (2011). Pan-European 2020 Strategy for Biodiversity.

UNEP/CBD/COP/DEC/X/2 (2010). The Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets.

Van Swaay, C. and M. Warren (Eds) (2003) Prime Butterfly Areas in Europe. Priority sites for conservation. – National Reference Centre for Agriculture, Nature and Fisheries, Netherlands Ministry of Agriculture, Nature Management and Fisheries

Velevski, M., Hallmann, B., Grubač, B., Lisičanec, T., Stoynov, E., Lisičanec, E., Avukatov, V., Božič, L. and B. Štumberger (2010) Important bird areas in Macedonia: Sites of Global and European importance.Acrocephalus 31, 147: 181-282.

Vigna Taglianti, A., Audisio, P., Biondi, M., Bologna, M., Carpaneto, G., De Biase, A., Fattorini, S., Piattella, E., Sindaco, R., Venchi, A., Zapparoli, M. (1999). A proposal for a chorotype classification of the Near East fauna, in the framework of the Western Palearctic region. Biogeographia 20: 31-59.

Апелтон, М. (2008). Заштитени подрачја во Македонија: преглед. Извештај во рамки на ГЕФ/УНДП/МЖСПП проектот „Зајакнување на еколошката, институционалната и финансиската одржливост на системот на заштитени подрачја во Македонија“, Скопје.

Биро за развој на образованието (2014). Наставни планови и програми, http://bro.gov.mk/?q=mk/nastavni-programi, 08.2014.

Брајаноска, Р., Меловски, Љ., Христовски, С., Саров, А. и Авукатов, В. (2011). План за управување со коридорите на кафеавата мечка. Извештај од проектот „Развој на национална еколошка мрежа во Република Македонија (МАК-НЕН).“ Македоснко еколошко друштво, Скопје, стр. 114.

ГЕФ/УНДП/МЖСПП проект „Зајакнување на еколошката, институционалната и финансиската одржливост на системот на заштитени подрачја во Македонија“ (2008-2011), финансиран од ГЕФ.

Државен завод за статистика (2014). Статистички годишник на Република Македонија за 2013 година. Скопје.

Државен завод за статистика (2013). Статистика на животната средина на Република Македонија, 167 стр.

Костов, В. (координатор) (2011). Програма за унапредување на рибарството и аквакултурата во Република Македонија за период од 12 години, Институт за сточарство, Универзитет Св. Кирил и Методиј – Скопје.

Матевски, В. (2013). Разновидност и потекло на флората на Република Македонија. МАНУ-Пристапни предавања, прилози и библиографија на новите членови на Македонската академија на науките и уметностите, XVII, МЕА 2005.

Меловски, Љ., Матевски, В., Костадиновски, М., Караделев, М., Ангелова, Н. & Радфорд, Е. (2010). Значајни растителни подрачја во Македонија. Македонско еколошко друштво, Скопје, стр. 128.

Меловски, Љ., Иванов, Ѓ, Ангелова, Н., Велевски, М., Христовски, С. (уредници) (2008). Моноспитовско Блато - последното мочуриште во Македонија. Општина Босилово, 56 стр.

Меловски, Љ. и Христовски, С. (2008). Валоризација на природните вредности на Шар Планина и проценка на нивната пазарна вредност (завршен извештај). Министерство за животна средина и просторно планирање, Скопје, 186 стр.

Петревска, Б. (2010). Значењето на туризмот во економската активност на Македонија, Зборник на трудови на МИТ Универзитет – Скопје, 1(1): 249-258.

СДЦ/УНДП проект „Ревитализација на екосистемите на Преспанското Езеро“. Повеќе информации за проектот се достапни на: http://www.mk.undp.org/content/the_former_yugoslav_republic_of_macedonia/en/home/operations/projects/environment_and_energy/restoration-of-the-prespa-lake-ecosystem.html.

СДЦ/Фармахем/МЖСПП „Програма за зачувување на природата во Македонија“. Повеќе информации за програмата се достапни на: www.bregalnica-ncp.mk.

Фронт 21/42 (2012). Анализа на транспозицијата, спроведувањето и извршувањето на еколошкото законодавство на Европската Унија во Република Македонија со фокус на хоризонталното законодавство, Скопје, стр. 66.

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