REPUBLIC OF NORTH MACEDONIA

SIXTH NATIONAL REPORT
TO THE UNITED NATIONS CONVENTION
ON BIOLOGICAL DIVERSITY

Skopje, 2020

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The report was prepared in close cooperation with MOEPP, MES-Macedonian Ecological Association, DEKONS-EMA and more than 30 National engaged experts in different fields

Menka Spirovska, overall coordination

Coordinators of different chapters: Vlatko Trpeski, Sashko Jordanov, Betim Lamallari, Prof. Slavco Hristovski, Robertina Brajanoska and Trajche Mitev

Wider working group: Representatives from relevant ministries, institutions and NGOs

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Abbreviations

CBD	Convention of Biological Diversity

CDDA	Common Database on Designated Areas
CEPF	Critical Ecosystem Partnership Fund
CITES	Convention on International Trade in Endangered Species of Wild Plants and Animals
DPR	Department for Public Relations in MoEPP
EBRD	European Bank for Reconstruction and Development
EEA	European Environmental Agency
EIA	Environmental Impact Assessment
EU	European Union
EUNIS	European nature information system
EUROBATS	Agreement on the Conservation of Populations of European Bats
FASF	Faculty of Agricultural Sciences and Food
FAO	Food and Agriculture Organization
GBIF	Global Biodiversity Information Facility
GEF	Global Environment Facility
GIZ	The Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (German Development Agency)
HA	Hunting Associasion
IPARD	EU instrument for pre-accession assistance for rural development
IUCN	International Union for Nature Conservation
MAES	Mapping and Assessment of Ecosystems and their Services
MAFWE	Ministry of Agriculture, Forestry and Water Economy
MAK-NEN	Macedonian National Ecological Network
MASA	Macedonian Academy of Sciences and Arts
MES	Macedonian Ecological Society
METT	Management Effectiveness Tracking Tool
MoEPP	Ministry of Environment and Physicl Planning
NAP	National Action Plan
NBSAP	National Biodiversity Strategy and Action Plan
NCP	Nature Conservation Programme in the North Macedonia
NM	Natural Monument (cat III IUCN)
NP	National Park
NT	National Target
PA	Protected area
PE	Public Enterprise
PGRFA	Plant genetic resources for food and agriculture
PI	Public Institution
PONT	Prespa-Ohrid Nature Trust Fund
RECA	Real Estate Cadastre Agency
RNM	Republic of North Macedonia
RM	Republic of Macedonia
SDC	Swiss Development and Cooperation Agency
SDG	Sustainable Development Goals
SEA	Strategic Environmental Assessment
SEI	State Environment Inspectorate
SG	Strategic Goal
SMP	Small and Medium Enterprises
SHPP	Small hydro power plants
SSO	State Statistical Office
UNCCD	UN Convention to Combat Desertification
UNDP	United Nations Development Programme

UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UWWTD	Urban Waste Water Treatment Directive
UWWTPs	Urban Waste Water Treatment Plants
WTF	Water Framework Directive

1. Section I: Information on the target being pursued at national level

Throughout 2013-2014, during the revision of the first National Biodiversity Strategy and Action Plan (developed in 2004), a consultations process with relevant stakeholders started on a national level, aimed to define the national targets. As such, the targets of the first NBSAP were considered, followed by the biological diversity status and trends, identification of the threats to the biological

diversity in the country, as well as guidelines of the Convention on Biological Diversity for the implementation of the global Aichi Targets. Although relevant to the Aichi Targets, the twelve basic national targets set in the first NBSAP were not sufficient, as was evident after the undertaken analysis (out of a total of 20 Aichi Targets, the first NBSAP had fully covered 6, 4 were partially covered or associated with a particular objective, 8 were not mentioned at all, and 2 goals are not relevant for the country. Also, an analysis of the identified high and very high priority threats and their connection to the Aichi Targets was undertaken, which showed that the threats in North Macedonia[1] are relevant globally as well.

As a result of this process, 19 national targets (NT) for biological diversity were identified, grouped in the following 4 strategic goals (SG):

SG A. To overcome the main/underlying causes of biodiversity loss through its mainstreaming in the society

NT-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.

NT-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.).

NT-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.

NT-4 To increase the level of investments and financing sources for biodiversity conservation from the central and local budget and other sources

SG B. Reduce direct and indirect pressures on ecosystems and other components of biological diversity

NT-5 To establish management practices in forestry, agriculture, hunting and fishery that contribute to conservation of biodiversity and maintenance of ecosystem services

NT-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

NT-7 Develop and implement plans for sustainable production and sustainable consumption for the purpose of natural resources use within safe ecological limits

NT-8 To create and establish appropriate policies for the evidence, control and protection from invasive alien species

[1] Concerning the Final Settlement of the Disputes described in United Nations Security Council Resolutions 817 (1993) and 845 (1993), Declaring the Interim Agreement of 1995 and Establishing a Strategic Partnership between the Parties and the Ratification of the Agreement NATO Accession Protocol First Party to the Final Settlement, and with the entry into force of Amendments XXXIII, XXXIV, XXXV and XXXVI of the Constitution of the Republic of Macedonia, the official name of the State was changed to “Republic of Northe Macedonia” with these amendments becoming an integral part of the Constitution of the state.

NT-9 To integrate measures for adaptation and mitigation of climate change and combating desertification

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

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

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

NT-13 To improve in situ and ex situ protection of genetic resources of native species cultivated plants and domestic animals

NT-14 To establish monitoring of biodiversity and natural processes

NT-15 To promote the protection of species and ecosystems on transboundary level through implementation of joint actions/measures

NT-16 To improve the status of important ecosystems in terms of providing essential ecosystem services

NT-17 To integrate requirements of Nagoya Protocol for access to genetic resources into national legislation to 2018

SG D. Enhance knowledge and availability of all relevant information on biological diversity

NT-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

NT-19 Preserve and promote traditional knowledge, innovations and practices for conservation and sustainable use of natural resources.

The National Targets, as well as the planned actions for achieving those targets, have been explained in detail in the National Biodiversity Strategy with Action Plan for the period 2018-2023.

The National targets and proposed actions to reach those targets are presented in details in the National Biodiversity Strategy and Action Plan for the period 2018-2023.

I. Information on the targets being pursued at the national level

■ My country has adopted national biodiversity targets or equivalent commitments in line with the Strategic Plan for Biodiversity 2011-2020 and the Aichi Targets

or

☐ My country has not adopted national biodiversity targets and is reporting progress using the Aichi Biodiversity Targets for reference.

1.1. National target 1

National Target 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

Rationale for the national target

In the Republic of North 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). On the other hand, understanding different values of biological diversity (especially its ecological, economic and social importance) is necessary in the building of motivation for action and creation of "political will" for undertaking protection and sustainable use actions.

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.

Aiming to achieve this national target in general two groups of measures with 12 actions have been

identified:

A.1. Raising public awareness about biodiversity values and ecosystem services

A.2. Implement education activities on biodiversity and relevant topics

Level of application:

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

■ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

Other related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

or

☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity

Other relevant information

Relevant websites, web links, and files

http://www.moepp.gov.mk/wp-content/uploads/2014/12/NATIONAL-BIODIVERSITY_MKD.pdf

1.2. National target 2

National target 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.)

Rationale for the national target

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 favor 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.

Aiming to achieve this national target four measures with 17 actions have been identified:

A.3. Ecosystem services and their economic valuation

A.4. Incorporation of biodiversity conservation into the Spatial Plan of North Macedonia, sectoral strategies/programmes and strategies for local development

A.5. Integration of legal procedures for nature and environment (EIA/SEA procedures and Appropriate Assessment)

A.6. Sustainable use of natural resources

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☒ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

Other related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

or

☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain

Other relevant information

The process of selection of national targets is presented in the National Target 1.

Relevant websites, web links, and files

1.3. National target 3

National target 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

Rationale for the national target

In the past several years, the Republic of North 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. 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.

The National Programme for Agriculture and Rural Development for the period 2014-2020 which guides the

policy of the Government of the Republic of North 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), favorable rural crediting, state aid to agriculture and rural development, including measures for technical assistance. 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 unfavorable for biological diversity.

Major financial resources are being allocated as agriculture production subsidies. The national agriculture and rural development strategy for the period 2014-2020, according which the policy of the Government of the R.N. Macedonia is conducted to support agriculture and rural development, encompasses the following financial aid schemes: direct payments, management of agriculture product markets, capital grants for rural development (financed from the national budget and European funds IPARD funds), beneficial rural crediting, state aid in agriculture and rural development, including measures for technical support. On the agenda, among other things, is also the consolidation of agricultural land where the mail goal is increasing production of one type of crops over larger areas. This approach will have to be followed by an increase in production of monocultures over larger areas – those products will be acceptable and competitive in the market, but the manner of their production is unsuited for biological diversity.

With reference to construction of power facilities, the Government of the Republic of North 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.).

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 the country. 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.

The following measure with 11 actions has been prescribed in order to achieve this national target:

A.7. Mainstreaming the policy of subsidies of economic sector to support biodiversity

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

Other related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

or

☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain

Other relevant information

Relevant websites, web links, and files

1.4. National target 4

National target 4

To increase the level of investments and financing sources for biodiversity conservation from the central and local budget and other sources

Rationale for the national target

One of the main obstacles to the implementation of NBSAP not only in North 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 (budget of the R. of N.M.), 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 North Macedonia and other sources (donations, grants, European Union funds, 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.

In 2019, the implementation of priority investment projects continued, in particular in the area of waste

water collection and treatment, thus making progress in the implementation of the national legislation. In the area of wastewater treatment, several projects for construction of treatment plants were implemented, as well as for preparation of feasibility studies and technical and tender documentation for implementation of investment projects in the waste management. One of the instruments for financing projects in the area of environment implemented by the MoEPP is the annual Environmental Investment Program adopted under the Law on Environment, with funds raised from environmental protection fee when registering motor vehicles and boats.

The Government of the Republic of North Macedonia adopted the Environmental Investment Program for 2019[2] with funds in the amount of 98,000,000.00 denars (1,593,935 EUR) for financing and co-financing of projects in the area of environment for 2019. Pursuant to the Program, the MoEPP published a Competition[3] for financing and implementation of programs, projects and other activities in the area of environment for 2019 which allocated funds in the amount of 67 million denars (items from the Program 1, 2, 3 and 4) to 88 small-scale projects in the following areas:

- Preparation of technical documentation and construction of sewerage and waste water drainage and treatment systems in the amount of 53,000,000.00 denars;
- Implementation of projects and activities in the area of protection of nature and biodiversity in the amount of 2,000,000.00 denars;
- Implementation of projects and activities in the area of awareness raising, education and training in the area of environment, in the amount of 8,000,000.00 denars;
- Stimulation of educational, research and development studies, programs and project for protection and improvement of the environment and nature, in the amount of 4,000,000.00 denars;

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, North Macedonia will need to allocate around 3% of its GDP once it becomes an EU Member state). 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 North Macedonia is provided from international sources (e.g. GEF, European Union, UNEP, the Swiss agency for development and cooperation (SDC), PONT, GIZ, etc.), though it is necessary to strengthen the capacity for absorption of these funds, especially the funds of the EU programme for pre-accession assistance.

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.

There are tax and custom 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

[2]Official Gazette No.17/2018
[3]Official Gazette No.19/2019

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 biodiversity conservation, reliefs would concern persons who are not tax payers, but bylaws should be revised to be more specific in technologies defining.

Aiming to achieve this national target the following measure is prescribed with 12 actions:

A.8. Provide funding for biodiversity conservation from different sources

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ■ 20

Other related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

or

☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain

Other relevant information

Relevant websites, web links, and files

1.5. National target 5

National target 5

To establish management practices in forestry, agriculture, hunting and fishery that contribute to conservation of biodiversity and maintenance of ecosystem services

Rationale for the national target

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 North 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.

This National target is very complex and includes many actions (23) that can be grouped in the following measures:

B.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

B.2. Fostering of the integration of biological diversity components into forestry practices and management of Nigh Nature Value Forests

B.3. Fostering the integration of biodiversity in agricultural practices

B.4. Support implementation of activities for sustainable fisheries and aquculture

B.5. Encouragement of eco-tourism and rural tourism

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16 ☐ 2 ■ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ☐ 4 ☐ 9 ☐ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 **Other related Aichi Biodiversity Targets** ☐ 1 ☐ 6 ☐ 11 ☐ 16 ☐ 2 ☐ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ☐ 4 ☐ 9 ■ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 or ☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain
Other relevant information
Relevant websites, web links, and files

1.6. National target 6

National target 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
Rationale for the national target 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 North Macedonia have 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 North 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 North 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 North 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).

A total of 13 actions have been identified for implementation of this national target, part of the following measures:

B.6. Strengthening of the Integrated Pollution Prevention and Control system

B.7. Improvement of monitoring of waters, ambient air and soil

B.8. Implementation of measures to mitigate the effects of existing landfills on biological diversity

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ■ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

Other related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16 ☐ 2 ☐ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ☐ 4 ☐ 9 ☐ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 or ☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain
Other relevant information
Relevant websites, web links, and files

1.7. National target 7

National target 7 Develop and implement plans for sustainable production and sustainable consumption for the purpose of natural resources use within safe ecological limits.
Rationale for the national target 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 North 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. In order to achieve this target the following measure is identified that is similar to the measure A.6. B.9. Determination of safe sustainable limits (quotas) for the use of biological diversity components and natural resources in general
Level of application ☐ Regional/multilateral – please indicate area concerned ■ National/federal

☐ Subnational – please indicate area concerned
Relevance of the national targets to the Aichi Biodiversity Targets **Main related Aichi Biodiversity Targets** ☐ 1 ☐ 6 ☐ 11 ☐ 16 ☐ 2 ☐ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ■ 4 ☐ 9 ☐ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 **Other related Aichi Biodiversity Targets** ☐ 1 ☐ 6 ☐ 11 ☐ 16 ☐ 2 ☐ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ☐ 4 ☐ 9 ☐ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 or ☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain
Other relevant information
Relevant websites, web links, and files

1.8. National target 8

National target 8 To create and establish appropriate policies for the evidence, control and protection from invasive alien species
Rationale for the national target Aiming to reach this national target 8 measures have been identified that are grouped in the following measure: B.10. Identification, monitoring and control of non-native species especially invasive species
Level of application ☐ Regional/multilateral – please indicate area concerned ■ National/federal

☐ Subnational – please indicate area concerned
Relevance of the national targets to the Aichi Biodiversity Targets **Main related Aichi Biodiversity Targets** ☐ 1 ☐ 6 ☐ 11 ☐ 16 ☐ 2 ☐ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ☐ 4 ■ 9 ☐ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 **Other related Aichi Biodiversity Targets** ☐ 1 ☐ 6 ☐ 11 ☐ 16 ☐ 2 ☐ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ☐ 4 ☐ 9 ☐ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 or ☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain
Other relevant information
Relevant websites, web links, and files

1.9. National target 9

National target 9 To integrate measures for adaptation and mitigation of climate change and combating desertification
Rationale for the national target 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.

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.

A National Action Programme (NAP) approximated with the 10-year Strategy of the Convention to Combat Desertification (UNCCD) was developed for the first time in the Republic of North 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. The NAP identifies the limits which correspond to: lack of capacities, poorly defined jurisdictions and weak collaboration and coordination, the lack of integral lawful framework, low consciousness about the problem, lack of a monitoring and data gathering system, lack of an appropriate system for land management, unrevised erosion map, the nonexistence of a vegetation map, lack of financial resources, etc.

Actions proposed for this National Target 9 are complementary to actions in the Third National Communication on Climate Change and National Action Programme to Combat Desertification. They are related to the coordination between the Strategy for Biological Diversity and the other two Rio conventions (UNFCCC and UNCCD), especially through efficient water and land management, conducting appropriate research and establishment of monitoring, improved management of protected areas, etc.

In order to reach this national target, 12 actions have been identified and grouped in two measures:

B.11. Undertake coordination of activities for biological diversity conservation with activities for combating climate change (in line with UNFCCC)

B.12. Undertake measures to prevent full degradation (desertification) of certain ecosystems (in line with UNCCD)

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ■ 15 ☐ 20

Other related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

or

☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain

Other relevant information

Relevant websites, web links, and files

1.10. National target 10

National target 10

Prevent loss, degradation and fragmentation of natural habitats of national and international importance

Rationale for the national target

In the Republic of North Macedonia, habitats that are important not only on a national, but European level as well have been identified. Loss, degradation and fragmentation are the main threats identified for natural habitats in the country. A national list of habitats should be created, including the type and degree of endangerment and importance. Efficient application of such list requires preparation of habitats' map. Furthermore, protection measure for endangered and important habitat types should be implemented. 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 North Macedonia.

A Draft National list of habitats from Annex I of the EU Habitats Directive for each of the two biogeographical regions (continental and alpine) has been prepared. Still, field research must continue for the identification

of habitats from Annex I of the Habitats Directive in order to update the list. A Catalogue of habitats with European importance should be created in accordance to the Habitats Directive.

Forests cover around 38% of the territory of the Republic of North Macedonia. Data for the period 2003 to date shows that forest ecosystems in North 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.

The Republic of North 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 North Macedonia at higher level.

In order to achieve this national target, 13 actions have been prescribed and grouped in the following measures:

C.1. Mapping, conservation and restoration of habitats

C.2. Provision of forest protection against forest fires

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
■ 5 ☐ 10 ☐ 15 ☐ 20

Other related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

or

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Other relevant information

Relevant websites, web links, and files

1.11. National target 11

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

Rationale for the national target

The existing network of protected areas includes 86 areas covering around 9% of the territory of North Macedonia. The Spatial Plan of the Republic of North Macedonia is the most comprehensive document (though the 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. Besides being included in the National Biodiversity Strategy with Action Plan, the National Targets for protected areas are included in the National Strategy for Biological Diversity (2018-2023). A National Action Plan for implementation of the Programme for work for protected areas to the Convention on Biodiversity has been prepared in 2012.

The Aichi Target 11 from the CBD is related to protected areas and it is part of the National Strategy for Biological Diversity. In accordance with this target, it is proposed that the surface of protected areas should be increased to 15%, to secure their functional connection as an ecological network and to establish effective management of the protected areas in collaboration with the local communities.

On the other hand, Report on “Representative national network of protected areas” was developed in 2011, which includes 99 areas and covers nearly 20% of R.N.Macedonia territory. The network includes 99 areas, 34 of which are representative protected areas, 42 representative areas have been selected from the list of proposed protection areas listed in the Spatial plan of the Republic of North Macedonia (of 193 in total) and furthermore, additional 23 areas important for protection in accordance with different international criteria and initiatives have been identified (identified Important Plant Areas, Important Bird Areas and Prime

Butterfly Areas, Emerald sites) and areas under international protection (UNESCO and Ramsar sites), taking into account data from national assessments of populations and natural ranges of selected priority species and habitats). The report is used by the MoEPP for internal purposes.

The efficient management, funding and involvement of the stakeholders in protected areas decision making and management processes are great challenges. According to IUCN guidelines, the category of the area should be based on the primary goals of the 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 being a mitigation (and adaptation) measure for the effects of climate change. In this context, in 2011 a draft National ecological network (MAK-NEN) was developed. The network should be adopted and harmonized with other sectors. Taking appropriate measures for protection/management of corridors is of particular importance to biological diversity.

It is necessary to improve the management of internationally protected areas in the country, most of them being transboundary. Dojran and Prespa Lakes are under international protection in accordance with the Ramsar Convention. For the Ohrid Lake, an application for Nomination for the World Ramsar List has been prepared. Currently, the application is being expanded and updated with data about biological diversity and determination of the area borders.

In the course of 2014, the Ohrid-Prespa region was designated as a transboundary biosphere reserve according to the "Man and Biosphere" UNESCO program. The initiative for designation of old beech forests in Europe as natural heritage under UNESCO includes the Republic of North Macedonia with its proposal site "Dlaboka Reka" at NP Mavrovo in 2019 to the preliminary UNESCO list of old beech forests in Europe. Designation of the mentioned areas as internationally protected would significantly improve the situation concerning the increase of the percentage of protected area and conservation of biological diversity.

Finally, the process of identification of Natura 2000 areas, which is undeniable part of the process of accession of the Republic of North Macedonia to the European Union, for which in the past few year activities have been undertaken, needs to be intensified.

This national target includes 15 actions that are grouped in the following measures:

C.3. Development of protected area system

C.4. Identification of Natura 2000 sites and other internationally designated areas

C.5. Establishment of effective management of protected areas

C.6. Monitoring and conservation of species and habitats on important sites outside of protected areas

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ■ 11 ☐ 16

☐ 2 ☐ 7 ☐ 12 ☐ 17

☐ 3 ☐ 8 ☐ 13 ☐ 18

☐ 4 ☐ 9 ☐ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 **Other related Aichi Biodiversity Targets** ☐ 1 ☐ 6 ☐ 11 ☐ 16 ☐ 2 ☐ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ☐ 4 ☐ 9 ☐ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 or ☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain
Other relevant information
Relevant websites, web links, and files

1.12. National target 12

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
Rationale for the national target 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: extinct species (EX), species extinct in the wild (EW), critically endangered (CR), endangered (EN), vulnerable (VU), near threatened (NT), least concern (LC), data deficient (DD). Endangered species are critically endangered (CR), endangered (EN) and vulnerable/sensitive (VU). These categories have been integrated in the Law on Nature Protection (Article 34), according to which, wild species may be designated as strictly protected or protected, thus acquiring the status of natural heritage. Measures and activities for species protection and manner and extent of use should be prescribed in a bylaw (Article 42). In 2010, a List of species with conservation status in RNM as a comparative overview of species was prepared, which includes the lists of international conventions, the EU Birds and Habitats Directive, as well as IUCN's Red List of Globally Endangered Species. Based on the list, in 2011 a bylaw was prepared - Lists identifying strictly protected and protected wild species of plants, fungi and animal (Official Gazette no.

139/11), which includes 194 strictly protected and 820 protected species. The enactment of this bylaw was an obligation from the National Programme for Adoption of the Acquis Communautaire (NPAA). Despite the negative reaction from the scientific community regarding the bylaw, that legal act represents a good mechanism for legal protection of the species. In the coming period, a revision of the Lists for determination of strictly protected and protected wild species should be done, on the basis of previous scientific research and situation analyses, as well as trends and degree of species endangerment.

To that end, the necessity for development and adoption of national red list of all taxonomic groups becomes a priority. The steps undertaken for the development of national red lists should be intensified.

A draft Red List of Fungi (Karadelev & Rusevska, 2012) was prepared in 2012. This List contains 213 species belonging to phyla Ascomycota and Basidiomycota. Activities for the preparation of a National Red List of Fungi in accordance with the criteria and procedures or IUCN is underway.

Krpač & Darcemont (2012) proposed a Red List of Butterflies in Republic of North Macedonia. This List includes 69 species.

Lemonnier-Darcemont et al. (2014) prepared a Red List of Orthopterans in North 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.

During the 2018-2019 period, in collaboration with UNEP the IUCN ENCARO office in Belgrade, as well as local experts, an assessment of all amphibian and reptile species on a national level was undertaken (46 species), in accordance with the IUCN criteria, and the first National Red List of Herpetofauna was prepared. Furthermore, an assessment of 14 species of vascular plants of international and national importance has been made, and a Priority List of flora taxa on a national level was prepared, to serve as the basis for further selection and determination of a final list of priority taxa for the Red List of Flora of the country http://redlist.moepp.gov.mk/pocetna/.

Activities for the preparation of a National Red List for Carnivores (lynx, wolf, bear, jackal and otter) are underway.

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.

Aiming to reach this national target, the following measures with 11 actions have been identified:

C.7. Assessment of threat status and conservation of threatened species

C.8. Implementation of activities for re-introduction of extinct native species

C.9. Implementation of ex situ conservation of native wild species

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ■ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

Other related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

or

☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain

Other relevant information

Relevant websites, web links, and files

1.13. National target 13

National target 13

To improve in situ and ex situ protection of genetic resources of native species cultivated plants and domestic animals

Rationale for the national target

Distribution, number and diversity of native agricultural crops in the Republic of North 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 North 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. The implementation of measures prescribed in the Programme for protection of biological diversity in livestock breeding from 2018-2024 ("Official Gazette of the RM" no. 168/2018) will contribute to the realization of this national target.

In order to achieve this national target 13 actions are prescribed and grouped in the following two measures:

C.10. Promotion of ex situ conservation of native species and varieties of agricultural crops

C.11. Promotion of ex situ conservation of native species of domestic animals

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ■ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

Other related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16

☐ 2 ☐ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ☐ 4 ☐ 9 ☐ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 or ☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain
Other relevant information
Relevant websites, web links, and files http://www.slvesnik.com.mk/Issues/7ceb924eab1845a3b65d0b6befc366ff.pdf

1.14. National target 14

National target 14 To establish monitoring of biodiversity and natural processes **Rationale for the national target** 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 the Republic of North Macedonia does not exist, except for certain selected species – the Balkan Lynx and the vultures (performed according to precisely defined protocols). Protocols for monitoring of selected species in the NP Galicica have been prepared and monitoring is taking place. Monitoring of carnivores in NP Pelister have been performed, as well as the Transboundary Monitoring System for Park Prespa is established. However, in these past 2 years, the activities related to monitoring of species and habitats from the EU Directves for habitats and birds related have been intensified, and draft-protocols for monitoring of 20 habitats, 20 plant and animal species and 20 birds with a conservation assessment have been prepared. The monitoring protocols for different parts are tested in NP Pelister and the Monument of nature Prespa Lake. Furthermore, a Manual for transboundary monitoring of selected species and habitats in the Ohrid, Prespa and Skadar Lakes have been prepared, with the assistance of GIZ. 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 wetlands. 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.

This national target includes 11 actions that are grouped in the following measures:

C.12. Establish biodiversity monitoring system with central database

C.13. Develop national biodiversity indicators

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ■ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

Other related Aichi Biodiversity Targets

☐ 1 ☐ 6 ■ 11 ☐ 16
☐ 2 ☐ 7 ■ 12 ☐ 17
☐ 3 ☐ 8 ■ 13 ☐ 18
☐ 4 ■ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

or

☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain

Other relevant information

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Relevant websites, web links, and files

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1.15. National target 15

National target 15

To promote the protection of species and ecosystems on transboundary level through implementation of joint actions/measures

Rationale for the national target

Considering the high variety of biological diversity on Balkan Peninsula and the central position occupied by the Republic of North Macedonia, as well as the high endemism in Ohrid and Prespa Lakes, the fact that North Macedonia is considered a biological diversity "hotspot" in Europe is not surprising. Furthermore, most of the boundary of the Republic of North Macedonia runs through mountainous areas in which high number of endemic and relict species of plants and animal spreads.

Moderate economic growth in the past period and closure of borders towards neighboring countries (Bulgaria, Greece and Albania) after the Second World War 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. However, many species require shared initiatives, activities and protection measures. The European Green Belt initiative (areas along the corridor of the former "Iron Curtain") contains measures and activities for the protection of the biological diversity in a transboundary context and the development of local communities, but more intensive transboundary activities are required.

In addition to this, the shared natural lakes and river basins with neighboring countries also require shared responsibility for their efficient protection and management.

Activities supported by the state and the EU related to transboundary protection of Ohrid-Prespa region are carried out as of recently. To that end, urgent activities for revitalization of the Transboundary Prespa Park are needed, after the Declaration was signed and ratified by the three countries and the EU.

With the exception of vultures, 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 North Macedonia (Annexes to Bonn and Bern Conventions, etc.).

In order to achieve this national target, the following measure has been identified:

C.14. Strengthen cross-border cooperation at different levels for effective protection and sustainable use of biodiversity

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16 ☐ 2 ☐ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ☐ 4 ☐ 9 ☐ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 **Other related Aichi Biodiversity Targets** ☐ 1 ☐ 6 ☐ 11 ☐ 16 ☐ 2 ☐ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ☐ 4 ☐ 9 ☐ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 or ■ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity As explained above, the Republic of North Macedonia occupies a central position on the Balkan Peninsula, characterized with a high degree of biological diversity. A large number of the important ecosystems (mountain, lake, etc.) are scattered along the border belt and joint, coordinated activities with neighboring countries are required for their protection.
Other relevant information
Relevant websites, web links, and files

1.16. National target 16

National target 16 To improve the status of important ecosystems in terms of providing essential ecosystem services **Rationale for the national target** Since the end of 1990s, the expert community in the Republic of North 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. In these past two years, an intensive work was carried out for mapping of the ecosystems on a national level, as well as determination of the ecosystems' status via different indicators and parameters (according to available data).

Measures for conservation or revitalization have to be undertaken with regard to critical ecosystems which deliver important services. Certainly, conservation is preferred to 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 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.

On a national level, a selection of ecosystems and their mapping throughout the territory of the country has been carried out. Work is being done on determining the ecosystem status, and it is also planned to develop a pilot mechanism for payment of ecosystem services. A brochure for ecosystem services has been prepared and a long-term plan for strengthening of capacities of all stakeholders for ecosystem services. As part of the plan implementation, training modules are being carried out for stakeholders about questions related to ecosystem services. Furthermore, work will be carried out for the introduction of a payment mechanism for ecosystem services, first in one pilot area with the possibility of replicating it in other protected areas in the country.

Aiming to achieve this national target 7 actions have been identified that are grouped in the following measures:

C.15. Identification of ecosystem services on national level and economic valuation

C.16. Restoration of key ecosystems in the country

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16 ☐ 2 ☐ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ☐ 4 ☐ 9 ■ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 **Other related Aichi Biodiversity Targets** ☐ 1 ☐ 6 ☐ 11 ☐ 16 ☐ 2 ☐ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ☐ 4 ☐ 9 ☐ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 or ☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain
Other relevant information
Relevant websites, web links, and files

1.17. National target 17

National target 17 To integrate requirements of Nagoya Protocol for access to genetic resources into national legislation to 2018 **Rationale for the national target** 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 and access to traditional knowledge, the Nagoya Protocol was adopted in 2010 for Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization. The purpose was to provide greater legal certainty and transparency for both genetic resource providers and users. The Protocol also contains provisions on access to traditional knowledge maintained by local community, thus providing that they participate in the benefit stemming from their use. The Republic of North 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.

This national target includes only three actions and the following measure:

C.17. Ratification and initial implementation of Nagoya Protocol

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ■ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

Other related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

or

☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain

Other relevant information

Relevant websites, web links, and files

1.18. National target 18

National target 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

Rationale for the national target

In the past 10-15-years, progress has been noted in research and knowledge of the components of biological diversity in the Republic of North Macedonia. 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 North 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 North 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 was developed in the course of 2010-2011, followed by the web-platform Mechanism for sharing biological diversity information (*Clearing House Mechanism* – CHM), however, they are not functional.

A regular data update to the international biological diversity databases should be done, for example the World Database of Protected Areas. Furthermore, data should be entered into the Global Biodiversity Information Facility (GBIF - http://www.gbif.org) through Macedonian Ecological Society (MES) as national data publisher.

Aiming to achieve this national target, the following measures with 9 actions have been identified:

D.1. Encourage creation of professional staff for biodiversity conservation

D.2. Establish national biodiversity information system and other relevant databases

D.3. Support funding for scientific research projects of biodiversity components

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ■ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

Other related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ☐ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

or

☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain

Other relevant information

Relevant websites, web links, and files

1.19. National target 19

National target 19

Preserve and promote traditional knowledge, innovations and practices for conservation and sustainable use of natural resources

Rationale for the national target

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 had 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.

In order to reach this national target, 5 actions have been identified and the following measure:

D.4. Documenting and promoting traditional use of biodiversity

Level of application

☐ Regional/multilateral – please indicate area concerned

■ National/federal

☐ Subnational – please indicate area concerned

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16
☐ 2 ☐ 7 ☐ 12 ☐ 17
☐ 3 ☐ 8 ☐ 13 ■ 18
☐ 4 ☐ 9 ☐ 14 ☐ 19
☐ 5 ☐ 10 ☐ 15 ☐ 20

Other related Aichi Biodiversity Targets

☐ 1 ☐ 6 ☐ 11 ☐ 16 ☐ 2 ☐ 7 ☐ 12 ☐ 17 ☐ 3 ☐ 8 ☐ 13 ☐ 18 ☐ 4 ☐ 9 ☐ 14 ☐ 19 ☐ 5 ☐ 10 ☐ 15 ☐ 20 or ☐ National target has no corresponding Aichi Biodiversity Target or relates to other parts of the Strategic Plan for Biodiversity – please explain
Other relevant information
Relevant websites, web links, and files

2. Section II. Implementation measures taken, assessment of their effectiveness, associated obstacles and scientific and technical needs to achieve national targets

The National Biodiversity Strategy of the Republic of North Macedonia (2018-2023), has defined 4 strategic and 19 national targets, harmonized with the Aichi Biodiversity Targets which are described in detail in Chapter 1.

Each national target envisages measures and actions for its achievement, as well as indicators for their measurement. Nine measures have been presented in this chapter refering to the activities that were implemented in the country in the last five years period.

2.1. Measure 1

Measure 1: Raising public awareness of biological diversity
Activities for raising public awareness of the biological diversity values and the need of its protection in the Republic of North Macedonia are being carried out on different levels (national and local) for different target groups. Alongside the Ministry of Environment and Physical Planning (MOEPP), other state institutions, NGOs, protected areas management bodies NGOs, subjects managing protected areas and local self-governments are largely involved in the implementation of activities as well. ***Determination of the level of knowledge and awareness about the values of biological diversity*** for different target groups should be done before organizing any campaign. On a country level, such research is yet to be done. However, research activities of public awareness about biological diversity have been realized by the MOEPP, as well as different project in different parts of the country, such as: 1. The Department of Public Relations (DPR) represents a link between the Ministry of Environment and Physical Planning and the public. The basic functions of DPR are: providing transparency and public availably of information about different aspects of environment and nature protection, Increasing public awareness and understanding of important environmental problems and possible solutions, in order to improve environmental conditions, as well as sharing useful information from

citizens and organizations which have a specialist knowledge about environmental resources or problems, regularly sharing information on protection of biodiversity on the MOEPP website and other social media.

2. As part of the Nature conservation program (NCP) in North Macedonia (phases 1 and 2), research about the level of public awareness of nature conservation was undertaken in 2013, 2016 and 2018. The three surveys used the same contents of questionnaires and the researches were done using a representational sample on the territory of municipalities from the East Planning Region. From the comparative analysis of the researches, we may note that the understanding of terms related to nature conservation is increasing, which is a result of the activities undertaken as part of the NCP to bring the meaning of natural values closer to the public, using various tools and campaigns. The citizens in the East Planning Region have a highly expressed awareness (around 70% of the examinees) towards the nature conservation idea. Also, a protected area for them is an area where the nature is conserved and protected by law. More than 2/3 of the examinees think that nature is not protected well enough in the region, and consider low levels of awareness as the reason for it. Field actions, media campaign and the curricular-educational process have been identified as the three most suitable tools for raising awareness (the Report is an internal document of the NCP and has not been published).

3. As part of the activities for selection of proposed Natura 2000 sites in the East Planning Region, a campaign for the Natura 2000 process between stakeholders and citizens in the Bregalnica Basin was undertaken in 2018. Before the start and after the finish of the campaign, a panel research was done in two cycles with a representational sample of 1293 examinees. Of the total, 97% of the examines claim that the nature in the region is unique and should be conserved, 78% have said that nature protection may offer economic development, but only 10% of the people had heard about Natura 2000. The communication tools developed as part of the NCP (banners and Instagram tours) in Phase II, have increased the promotion of biological diversity in the Bregalnica region.

4. As part of the project "Biodiversity Conservation through Sustainable Management of Resources in Shar mountain", a research was undertaken in 2016 in the six municipalities which situated around Shar Mountain in order to determine the awareness of the population for designation of part of Shar Mountain in the protection category – National Park. The interesting fact was that 83% of the local population claimed they would like Shar Mountain to be protected.

5. The Faculty of Forestry undertook activities for determination of the perception of the citizens on urban greenery for the territory of Skopje, definition of the benefits from urban greenery, an analysis of safety when visiting urban greenery and an analysis of the manner of urban greenery management in Skopje.

Preparation and implementation of a Communication Plan

A detailed Communication Plan in the area of biological diversity on a national level is yet to be prepared. However, as part of several project activities, the following has been prepared: a Program for public information and consultation on the establishment of Natura 2000, as part of the EU project "Strengthening the capacities for implementation of Natura 2000" (2016); Stakeholder involvement plan for protected areas/Natura 2000 as part of the EU Twinning project "Strengthening the capacities for effective implementation of the acquis in the field of nature protection" (2019); A Campaign plan for designation of part of the Osogovo Mountains and Chengino Kale as protected areas, as well as a campaign plan for proposed Natura 2000 sites in the Bregalnica basin, as part of the Nature conservation program in North Macedonia (2019-2020). All

these plans and programs are aimed to promote actions for designation of certain areas in protection categories, in accordance with the Law on Nature Protection or the establishment of the Natura 2000 network. Furthermore, a Campaign plan for the climate change impacts on everyday life was prepared (2019).

Implementation of a national campaign for raising public awareness about the values of biological diversity and ecosystem services

A well-designed campaign may have a great impact on the awareness of people about biodiversity values, the requirements and means of its protection and the ecosystem services. Over the past period, separate campaigns supported by different projects in the area of nature protection have been realized.

As part of the EU project "Strengthening the capacities for implementation of Natura 2000" (2016), a promotional campaign was prepared on the importance of Natura 2000 in our country, as well as 5 thematic brochures, a poster, flyers and 4 short videos. The promotion of the national website for Natura 2000 (www.natura2000.gov.mk), the Natura 2000 Facebook page (https://www.facebook.com/Natura2000MK) and an Instagram profile are part of this project too, all of which regularly share information on topics related to Natura 2000 in our country.

As the most characteristic, both by scope and importance, we should mention the Nature conservation program in the Republic of North Macedonia (NCP), which throughout its implementation has developed several tools for raising public awareness, and some of them have grown into relevant sources of acquiring information on biological diversity in the Bregalnica region, but also throughout the country as well. A message and logotype for distinguishability of NCP "With care to abundance" was created and is being used in all tools produced by the NCP, and on social media as well. The "With care to abundance" Facebook group has 36,000 active members, and it is the most followed nature and environment Facebook page. The group has 400,000 monthly impressions and the average monthly engagement is 10,000 users with 70,000 total likes, shares and comments. The NCP website has an average monthly traffic of 40,000 visits, publishing over 160 posts and the number is continually rising. Alongside its informative nature, the website has also an educational nature through blog posts and database of over 50 relevant documents from different areas related to nature and biological diversity protection. The Program has also set up an Instagram account to better reach the younger population. To this end, three InstaTours were organized in the Bregalnica region, where Instagram influencers and nature lovers took part in order to bring the natural and cultural values of the Bregalnica region closer to the younger population. One interesting fact is that the published Instagram stories were seen more than 460,000 times. Over the past period, the program has produced 22 short videos which have been published on the YouTube channel in order to introduce the public and bring it closer to natural values and biological diversity of the Bregalnica region. Lastly, an electronic paper is being published quarterly and distributed to more than 640 users.

The most impressive work/tool of the NCP for raising public awareness of nature protection and sustainable use of natural resources is the production of the documentary "Honeyland", which has won over 35 awards in prestigious film festivals, most notable being the three awards from the international festival "Sundance", as well as two Oscar nominations. It should be mentioned that the "Honeyland" documentary won the "Impact for change" award at the "Sundance" festival, meaning the message for sustainable use of natural resources is globally recognized, thus confirming its impact on the public as a powerful tool for raising public awareness. Around 400 articles have been

published about the “Honeyland” documentary, 100 of which by foreign media.

No less important are the campaigns for raising public awareness of natural values and their threats, aimed at raising the awareness of children in primary education and the citizens of Bitola for climate change, enabling them to better understand the causes and consequences, while also taking a positive and active approach towards prevention and mitigation of climate change impacts (“Climate change and the cry of the bees – our reality”) or increasing public awareness about the environment of the local population and students from primary schools about the role and importance of fauna snails from the Ohrid Lake.

An important tool for raising the public awareness is the establishment of web and Facebook pages/portals in order to reach a larger audience, such as:

- The website www.natura2000.gov.mk, where information about current Natura 2000 events are continually distributed, so that citizens are timely informed (2016);
- The Natura 2000 Facebook page, which in the 2016-2019 period has published 268 biological diversity news. The average access to information from 2018-2019 was 6458;
- The website for promotion of red lists (2020) etc.

Promotion of the importance and value of protected areas

The activity encompasses a promotion of the national parks in RN Macedonia, but also areas in designation phase for different protection categories, such as: Promotion of NP Pelister and Natural Monument (NM) Prespa Lake through the Twinning project “Strengthening the capacities for effective implementation of the acquis in the field of nature protection”; Promotion of NP Galichica through the EU/UNDP project for improvement of management of protected areas (Grant scheme EU/UNDP) and the Prespa-Ohrid Nature Trust (PONT); Promotion of NP Mavrovo through a EU/UNDP project for improvement of management of protected areas; Promotion of NP Pelister, NP Mavrovo, NP Galichica, NM Vevchani Springs, NM Markovi Kuli, and NM Kuklica through the (Grant scheme EU/UNDP), preparation of “Vision for Shar Mountain”, a document with messages from the local population from the 6 municipalities in the Shar Mountain region, contacted in the process of creation of the vision.

Preparation and publishing of vocational and popular books/manuals/brochures on different components, values, use of and threats to biological diversity

The activity encompasses preparation of vocational books, anthologies, brochures/leaflets and other electronic or printed educational-informative materials, which promote the values of biological diversity and nature; Manuals for sustainable management (economy) of forests, natural values and the use of natural resources from Jakupica Mountain; “The faces of wild plants in my area”; “The woodpecker’s trail”; “Natura 2000 and us”, “Hunting and fishing in Natura 2000 sites”; “Forests in Natura 2000”; “Natura 2000 and our health”, “Agriculture and Natura 2000”, “Tourism and Natura 2000”, “Biodiversity Conservation through Sustainable Management of Resources in Shar mountain”; An analysis of stakeholders in future transboundary protected area Shar Mountain/Shari/Korab-Koritnik; “An analysis of the formation process of the “Friends of Shara” platform”; Potential Natura 2000 site – NP Pelister; Potential Natura 2000 site – Prespa Lake; “Natura 2000… for Nature, for People”; “Ecosystems and ecosystem services”; “Osogovo - beautiful and different”; “National red lists in the Republic of North Macedonia”; “Unseen stories, unseen beauties”; “Discover Prespa”; “Stop poisoning wild animals”; “Preventing trade of protected bird species”; “Secret life - discovering the mammals of Prespa – exploration and research”; “Riparian

belt of Lower Bregalnica"; "Monitoring Manual for Lake-bound Species and Habitats of Lakes Prespa, Ohrid and Skadar"; Book "Allchar world natural heritage" in order to present the readers the truth about the unique site "Allchar", the lorandite mineral, and the biological diversity (flora, fauna and fungi) of this region.

As part of the NCP, phase II in coordination with MoEPP and collaboration with Pharmahem and national experts, in 2016 the Study on Geodiversity and Geological Heritage of the Republic of North Macedonia and other Components of Nature (Biological and Landscape Diversity) was prepared, as well as the most important document in the area of nature protection – the National Biodiversity Strategy with Action Plan (2017-2027) adopted by the Government in 2018.

Scientific journals issued in the Republic of North Macedonia are presented in the Measure 9.

The Macedonian Academy of Sciences and Arts (MASA) issues the "Flora of the Republic of N.Macedonia" which includes systematic research of vascular plants on the territory of RN Macedonia.

Several regular scientific journals are published in RN Macedonia:

- The Institute for Biology at the Faculty of Natural Sciences and Mathematics in Skopje (University "Ss. Cyril and Methodius) publishes a scientific journal, which in these past few years has been irregularly published and with little scientific papers. In the course of 2013, 5 papers were published, in the period 2014-2015 the number of papers was 7, whereas in 2016-2017 the total was 21 papers;
- MASA publishes the journal PRILOZI – Contributions, a Section of natural, mathematical and biotechnical sciences which is published twice a year. The Journal publishes original scientific works, short communiques, reviews, scientific papers and educational papers of all areas of the natural sciences – physics, chemistry, biology, geography, geology, mathematical sciences – mathematics, informational science; biotechnical sciences – agriculture and food, forestry:
- A journal by the Museum of Natural History Macedonia;
- The Macedonian Journal of Ecology and Environment (MJEE) is regularly published twice a year, containing scientific papers for that area.

Development of tourist maps/offers/guides on protected and sensitive areas to the benefit of biological diversity conservation

The websites of national parks NP Mavrovo and NP Galichica, as well as NM Vevhcani Springs, eco-tourism tourist offers and hiking trails with maps are being offered.

The Agency for Promotion and Support of Tourism in RN Macedonia has prepared a hiking map "Hiking trails of the Republic of N.Macedonia". For Shar Mountain, in 2017-2018, a "Shar Mountain – hiking maps" map was prepared by "Friends of Shara" which includes 55 trails, and the trails are also available for mobile applications.

Marking of international days related to biological diversity

Various international days are celebrated on a national and local level each year, organized by the Ministry of Environment and Physical Planning in collaboration with donors, the Macedonian Ecological Society, other nongovernmental organizations and the management of the national parks (Mavrovo, Galichica and Pelister). The list contains the following important days: World Wetlands Day; European Natura 2000 Day; International Day for Biological Diversity; Day of forests; Day of

Parks Dinarides; World Migratory Bird Day (Dojran, southern and eastern parts of North Macedonia, Babuna, "Skopje loves birds", Bird watching in the park); Day of storks; Bat Appreciation Day; European days of bird watching (Dojran, Prespa, reasrch of the Katlanovo Swamp and in the Zoological Garden in Skopje); International Vulture Awareness Day; Earth Day; World Environment Day; Ohrid Lake Day; World Animal Day; Spring Day etc.

The MOEPP in collaboration with the NCP, phase II, UNEP and GIZ, has organized the event for celebration of 22nd of May – International Day for Biological Diversity. At the event, the National Strategy for Nature Protection with Action Plan (2017-2027) and the National Biodiversity Strategy for the period (2018-2023) were promoted.

The NCP phase II, in collaboration with MoEPP and MES organized the event for celebration of 21st of May – the European Natura 2000 Day in 2019. The event took place in the Educational center in v. Negrevo with the participation of students from primary and secondary schools from Berovo, Pehcevo and Delchevo, as well as their teachers and key stakeholder representatives.

The NCP phase II in collaboration with Euronatur has supported the Municipality of Chesinovo-Obleshevo in the organization of the yearly Conference to the European stork villages network (12-15.06.2019).

To which National target and Aichi Biodiversity Target(s) this measure contributes

This measure is implemented on a national and local level and is directly related to the achievement of NT-1, but it also more broadly follows the implementation of the complete Biodiversity Action Plan.

The measure is directly aimed at the realization of Aichi Target 1.

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes:

☒ Measure taken has been effective

☐ Measure taken has been partially effective

☐ Measure taken has been ineffective

☐ Unknown

The results of the several undertaken questionnaires point towards an increased awareness of the citizens for protection of some important areas. However, this measure requires continuous campaign activities appropriately designed for different target groups.

Relevant websites, web links and files

www.moepp.gov.mk

http://www.natura2000.gov.mk

http://www.mon.gov.mk/

https://www.bro.gov.mk/

http://redlist.moepp.gov.mk/

https://www.facebook.com/Natura2000MK

https://www.facebook.com/MOEPPMKD

www.npmavrovo.mk

www.galicica.org.mk

http://park-pelister.com/en/

www.vevcani.mk

http://kuklica.mk/

www.tourism.gov.mk,

www.tourismmacedonia.gov.mk

http://www.farmahem.com.mk/news/view/

http://www.bregalnica-ncp.mk/

https://mes.org.mk/blog/progarama-za-zachuvuvane-na-prirodata-vo-makedonija-faza-ii

https://mes.org.mk/en/zachuvuvane-na-bioloshkata-raznovidnost-preku-odrzhlivo-upravuvane-so-resursite-na-shar-planina/

https://www.honeyland.earth

http://manu.edu.mk/contributions/NMBSci/index.html

www.mjee.org.mk

www.acta.musmacscinat.mk-index.php/acta/index

http://www.doma.mk

www.nature.mk

https://gastropodaoflakeohrid.my-free.website

www.ugd.edu.mk/21870/1/Allchar%20-%20Monografija.pdf

www.northmacedonia-timeless.com,

http://mes.org.mk/blog/pticharene-vo-park-za-svetskiot-den-na-ptitsi-preselnitsi

http://mes.org.mk/blog/ipa-proekt-podobruvane-na-prekugranichnata-zashtita-i-razvoj-na-planinskiot-masiv-jablanitsa-shebenik-preku-aktivna-vkluchenost-na-lokalnoto-naselenie/,

http://mes.org.mk/blog/zachuvuvane-na-bioloshkata-raznovidnost-preku-odrzhlivo-upravuvane-so-resursite-na-shar-planina/,

http://mes.org.mk/wp-content/uploads/2018/11/teachers-materials_mkd_final.pdf,

https://www.youtube.com/channel/UCu57vNPcj8ZED1JK4_7dL9A/videos?sort=dd&view=0&flow=grid,

http://www.springalive.net/mk-mk/spring_news/edukativen-paket,

http://seerural.org/prespa-brochure/,

https://play.google.com/store/apps/details?id=com.eonnm.expsharm&hl=en_US

https://www.facebook.com/SoGrizaDoBeriket/

https://www.instagram.com/sogrizadoberiket/

https://gorgisugarev.wordpress.com/?fbclid=IwAR1re7Ug3gxN83mlwyd9XFjnmZuNq-

cKFKUCdg3Xph0O8SC9vmvjigRwDEE

Other relevant information

In regards to Natura 2000, it should be mentioned that the campaign should be intensified in the following period, both on a national level and throughout the whole East Planning Region level, especially in the areas - Lower Bregalnica, Ovche Pole and Chengino Kale in the Maleshevo Mountains, identified as potential future Natura 2000 sites. The campaign should continue with all relevant stakeholders (municipalities, regional units of relevant ministries, public enterprises, subjects which use the space, the business sector, nongovernmental organizations etc.), having in mind that for the local population, the term Natura 2000 is still not clear enough and is often confused with the term protected area.

Obstacles and scientific and technical needs related to the measure taken:

The campaign activities are usually undertaken as part of different projects, and some of them last for a short time. Continuous work with different target groups is required. Furthermore, the effects of the undertaken activities should be continuously monitored and explored.

Relevant websites, web links and files

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2.2. Measure 2

Measure 2: Implementation of educational activities for biological diversity

In the Republic of North Macedonia, different educational activities from the area of biological diversity are undertaken for formal and non-formal education despite the fact that the National plan for education about biological diversity values on different levels is yet to be prepared. Still, there are different forms of programs and educational packages, which are realized on a national, regional and local level or as part of the protected areas.

The following educational programs/packages have been prepared for non-formal education:

- Educational programs as part of the management plans of NP Pelister, NP Galichica and NP Mavrovo. These educational programs envisage the organization of excursions, seminars or lectures about the values of biological diversity of certain sites, presentations of procedures for designation of protected areas etc., which are being presented through various tools (visits, direct conversations, group presentations, etc.) to the different categories of visitors/listeners.
- Educational package for the Balkan Lynx for all grades of primary education;
- Educational package for plants in the Prespa Region;
- Educational package “How to watch birds” (for students and teachers).

Organization of educational competitions in the area of biological diversity

Each year, biology competitions are organized on a national level by the Faculty of Natural Sciences and Mathematics/Macedonian Biological Society, which are accredited to organize this type of competition. The following tables presents the number of organized competitions, together with mentor awards.

Competitions in natural sciences – primary schools

Year	2015	2016	2017	2018	2019

Competition level					
local	1106	2464	3857	3845	3085
regional	910	1607	2578	2293	1438
national	153	544	572	226	353

Competitions in biology – primary schools

Year	2015	2016	2017	2018	2019
Competition level					
local	2351	3337	3748	3392	2655
regional	1733	1581	2691	2101	1438
national	354	479	396	282	286

Competitions in biology – secondary schools

Year	2015	2016	2017	2018	2019
Competition level					
local	764	966	739	841	925
regional	552	724	569	461	569
national	251	256	263	170	233

Organization of educational excursions

Educational field trips for students in primary education regularly take place (twice a year), in accordance with the Program prepared by the Ministry of Education and Science.

Furthermore, different kinds of educational excursions for students in primary education from the whole country are organized at the national parks. As such, in 2019 NP Pelister organized 14 excursions with 355 students from primary and secondary schools, whereas NP Mavrovo in several turns of the same year, organized visits for 920 visitors.

We would also like to point out the opening of the Educational center for nature in village Negrevo, Pehcevo, in 2018 aimed at presentation, promotion of the biological diversity in the Maleshevo region (the Eastern part of the R.N. Macedonia) and support of educational activities for the younger generations. The Informational center was opened as part of the Nature conservation programme in North Macedonia – phase two. About 30 educational sessions for children of different ages have been organized during 2018-2019.

Biology students through their organization “Biology Students Research Society” each year (since 1996) have

been realizing research actions (camps) in different areas important for biological diversity.

Organization of different educational activities

In the past period, different educational activities in the area of biological diversity were organized:

- Education on the Balkan lynx – regularly implemented by MES. In the 2015-2019 period, over 2300 students and 129 teachers from several schools in RN Macedonia took part as presented in the table below.

	2015	2016	2017	2018	2019
Number of schools	4 (in Mavrovo)	7 (in Western N.Macedonia)	4 (Jablanica region)	7	8
Number of students	280	400	600	1051	200
Trained teachers			47	22	60

- The educational package "How to watch birds" was prepared in 2017-2018 (as part of the international Erasmus+ project Better life through nature) and is even supported by videos on the MES YouTube channel, and direct training for use of the educational package was provided to 100 educators and teachers from several schools in the country.

- In the Prespa region, starting from 2016, different educational activities in primary and secondary schools in Resen are being undertaken, using different educational packages: SpringAlive, educational plants package, educational package for the Balkan lynx, organization of educational tours to important sites in the Prespa region, as well as training for monitoring of species.

- The Program for Environmental Investments of the MoEPP supports activities for promotion and education of natural values in RN Macedonia.

- Educational activities in the Municipality of Ceshinovo-Obleshevo for demonstration of monitoring methodology of storks have been undertaken in 2015 and 2016.

- The National Institution Museum of Natural History of the Republic of North Macedonia – Skopje has a permanent exhibit (regular activity), and often organizes different thematic exhibitions: The wondrous world of spiders (2015), Living fossils and endemics from the Ohrid lake (organized in Bulgaria in 2018), the Secret nature of fungi (2019), Eight MEGA ANNA (2019), Artistic exhibition of butterfly species from N. Macedonia (2019); Exhibition of minerals and fossils from North Macedonia – MASA in 2019.

At the Information center of National Park Galichica, an educational event was held with students from the primary schools in Ohrid, aimed at introduction to park flora and fauna and the promotion of Natura 2000. During 2019, more than 10 educational activities/events for different target have been organized.

Additionally, in the Information center of NP Pelister, an educational event was held with students from the primary schools in Bitola, where the significant species from the park were presented, as well as what the Natura 2000 network represents.

As part of the celebration of the Habitats Directive Day – 21st of May, in the Information center in v. Negrevo (21.05.2019) an educational workshop was organized for Natura 2000 with the students from the primary schools in Berovo and Pehcevo.

- Educational activities for plant protection are being also carried out by the Botanical Garden in Skopje. More information is provided in Chapter 5.
- Educational activities about the significance and importance of the preservation of the riparian belt of the Bregalnica River with children and teachers from primary and secondary schools in Shtip were organized in

2018-2019, reaching around 350 children (supported by the Nature conservation programme in North Macedonia). In order to bring people closer and familiarize with these ecosystems, an Atlas of Species – Riparian Belt of Lower Bregalnica was prepared.

- In the 2015-2019 period, numerous educational and interactive activities on the topic of biodiversity have been organized for children of preschool age, about domestic and wild species (mammals, birds, reptiles and amphibians, insects – ladybird beetles, dragonflies), habitats, migratory birds and bird migration. Over 500 children aged 3-5 took part.

To which National target and Aichi Biodiversity Target(s) this measure contributes

This measure is directly aimed towards the achievement of NT-1, but indirectly, the educational activities contribute toward successful implementation of the complete Biodiversity Action Plan.

The measure is directed towards the achievement of Aichi Target 1.

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes:

☒ Measure taken has been effective

☐ Measure taken has been partially effective

☐ Measure taken has been ineffective

☐ Unknown

The assessment has been given on the basis of the number of realized educational activities listed above.

Relevant websites, web links and files

www.npmavrovo.mk

www.galicica.org.mk

www.nppelister.mk

https://biologija.yolasite.com/

http://mes.org.mk/wp-content/uploads/2018/11/teachers-materials_mkd_final.pdf

facebook/com/EdukativenCentarNegrevo/

https://idsbiolozi.com/

http://www.springalive.net/mk-mk/spring_news/edukativen-paket

https://www.pont.org/overview-of-2019-achievements-by-the-macedonian-ecological-society-mes/?fbclid=IwAR21cefJIz6Yxx1Gj2XomdvAIaO3BqlQq3N1Xe1Xb1HcyE5h5ahSCY08sVQ

www.redlist.moepp.gov.mk

http://www.bregalnica-ncp.mk/

http://www.doma.mk

http://www.natura2000.gov.mk

www.nature.mk

Other relevant information
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Obstacles and scientific and technical needs related to the measure taken:
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2.3. Measure 3

Measure 3. Institutional, legal and financial framework for biodiversity conservation
<u>Institutional framework</u> The institutional setup for nature protection is mainly centralized, i.e. the Assembly of the Republic of North Macedonia (through the Commission for transport, communications and environment) and the Government of the Republic of North Macedonia (through the ministries and the Commission for economic systems and current economic policy) play the main role in the process of adoption of legislation and strategic documents, proclamation of protected areas, etc. The Ministry of Environment and Physical Planning (MoEPP) was established in 1998. MoEPP performs work related to leading and creating nature protection policies, protection and management of biological and landscape diversity and protection of natural heritage, as well as control and oversight of the implementation of the provisions of the Law on Nature Protection. The Administration of Environment as part of the MoEPP is the competent authority for expert work in the field of nature protection, in accordance with the provisions of the Law on Nature Protection and performs the following: keeping a cadaster of protected areas, register of natural heritage and records of trade and other activities of protected species, monitoring the state of nature and other works in accordance with the law provisions. The following sectors have been established as part of the Administration of Environment: Department of Nature alongside the Department of Waters, Department of Environment, Department of Waste and the Department for Industrial Pollution and Risk Management. **The main responsibility for protection of biological diversity falls on the Department of Nature**, which functions with three (3) divisions: Division for Biodiversity, Division for protection of the Natural Heritage and Natura 2000 and Division for Spatial Planning in Protected Areas and Geodiversity. The Department of Nature employs 17 people, of which five (5) with master's degree, in biology (1), environment (1), physical planning (1), forestry (1) and tourism (1). The Department of Nature performs administrational and expert work in the field of nature protection. There is a need for strengthening of capacities by increasing the employee number, predominantly with the following expertise such as biologist, agricultural engineer, geographer, geologist, GIS expert, lawyer etc. **The State Environmental Inspectorate** (SEI) performs inspection supervision over the application of technical-technological measures for: protection of air, waters, soil, geodiversity protection, biodiversity, protected areas, protection from noise in the environment, protection from environmental incidents etc. The SEI functions as a separate legal entity, and is not part of the MoEPP. The SEI functions as a separate legal entity, and is not part of the MoEPP. The Nature Protection Inspectors are responsible for inspection and control over the implementation of the national legislation of nature protection. The capacities of SEI need to be strengthened by increasing the number of nature protection inspectors, having in mind that there are only two (2) authorized state inspectors for nature protection on a national level. More information about the level of

law enforcement regarding biodiversity conservation through the number of proceedings for biodiversity inspection and crime are presented in indicator 5.8 in the Annex I.

The Ministry of Agriculture, Forestry and Water Economy – has the authority to regulate the use of agricultural land, management and sustainable use of forests; hunting and fishing; protection of livestock and plants from sickness and pests; inspection supervision over the implementation of legislation in the field of forestry, hunting, agriculture, etc.

Ministry of Culture, Cultural Heritage Protection Directorate – established in 2004 in accordance with the Law on Protection of Cultural Heritage, the Directorate has significant competences in the area of studying, protection and promotion of cultural heritage in the country. Bearing in mind that there is an interaction between natural and cultural heritage and they represent an integral whole, the role of the Cultural Heritage Protection Directorate is very important in safeguarding and protecting nature, especially in the areas that are part of UNESCO World Heritage.

Public institutions National (PINP) Park Pelister, PINP Mavrovo and PINP Galichica – founded by the Government for management and protection of national parks.

The Municipalities managing protected areas (Resen, Vevchani, Kratovo, Novo Selo, Prilep, etc.).

Public Enterprise (PE) for management and protection of Multipurpose Area "Jasen" – established by the **Government.**

PE National Forests – manage the state forest ecosystems outside of the protected areas in accordance with the Law on Forests, with over 30 regional offices.

PE for Management of Pastures – supported by 17 regional offices, on the basis of the Law on Pastures, supports the traditional way of management of pastures.

Joint Stock Company (JSC) Water Economy – The JSC Water Economy of the Republic of North Macedonia was founded by the Government in 2015 in accordance with the Law on Water Economy. JSC Water Economy has established twelve (12) subsidiaries/branches which cover specific regions of the country. JSC Water Economy uses, maintains and manages the systems for cutting and drainage as a whole, due to: water supply for irrigation; water supply to a communal water supply company for human consumption (drinking water and other needs); water supply for industrial and technological (commercial) needs, including the production of electricity); regulation of river beds; drainage of land and withdrawal of discharged water. Using the funds from the programs of the subject in charge of environmental management and physical planning, JSC Water Economy constructs and maintains objects for protection and floods defense; constructs and maintains objects for prevention and protection from erosion, constructs and maintains objects for management of rivers and vices and performs other work in accordance with the law

Spatial Planning Agency - implements the policy of spatial planning and arrangement of the Republic of North Macedonia, through preparation and monitoring of the implementation of the National Spatial Plan; maintains and updates the only spatial-information data system; prepares urban plans and urban-plan documentation; prepares architectural-urban projects and infrastructure projects, expert analysis and information about the planning status for the needs of state authorities, etc.

Zoological Garden Skopje, Zoological Garden Bitola and Zoological Garden Shtip - implement *ex-situ* protection of biological diversity.

Scientific and educational institutions for biological diversity:

- Macedonian Academy of Sciences and Arts, Skopje (http://www.manu.edu.mk/)
- University "Ss. Cyril and Methodius", Faculty of Natural Sciences and Mathematics, Institute of Biology,

Skopje (http://ib.pmf.ukim.edu.mk)

- University "Ss. Cyril and Methodius", Faculty of Forestry, landscape architecture and environmental engineering "Hans Em", Skopje (http://www.sf.ukim.edu.mk/)
- University "Ss. Cyril and Methodius", Faculty of Agricultural Sciences and Food, Skopje (www.fznh.ukim.edu.mk)
- State University in Tetovo, Faculty of Natural Sciences and Mathematics; (https://unite.edu.mk/mk/)
- University "Goce Delchev" in Shtip (https://www.ugd.edu.mk/index.php/en/)
- University "Ss. Cyril and Methodius", Faculty of veterinary medicine, Skopje and the Institute of Animal Husbandry, Skopje; (http://fvm.ukim.edu.mk/)
- National institution "Natural History Museum of N.Macedonia", Skopje (http://www.musmacscinat.mk)
- Public scientific institution (PSI) Hydrobiological Institute, Ohrid (http://www.hio.edu.mk/);

Non-governmental organizations/civil societies in the field of nature protection and conservation

- Macedonian Ecological Society (MES) (www.mes.org.mk),
- Macedonian Mycological Society (http://macfungi.webs.com/),
- Biology Students Research Society (www.idsbiolozi.com);
- Macedonian Ecologists Movement (MEM);
- Society for the study and protection of biodiversity and sustainable development of natural ecosystems (BIOEKO)
- Society for study and protection of birds in N.Macedonia,
- Society for nature protection of N.Macedonia,
- Balkan foundation for sustainable development,
- SDT sustainable development training,
- Exploring society "Ursus Speleos",
- Centre for Promotion of Sustainable Agricultural Practices and Rural development (CeProSARD)
- Speleological society PEONI
- Environmental Society Planetum, Strumica
- Forestry Students' Association DREN (www.sf.ukim.edu.mk/dren) etc.

The MoEPP in collaboration with the abovementioned state organs/institutions and nongovernmental organizations/civil societies, performs activities for protection, conservation and sustainable use of biological diversity. A further harmonization is required, especially the nature protection legislation with the legislation on hunting and fishing in order to achieve an integral protection of biological diversity on a national level.

Legal Framework

During 2015-2020, a significant progress has been made concerning the legal framework for biodiversity protection. Regarding the harmonization of national legislation with the EU acquis on nature protection, the European Commission notes a significant progress in the past two reports on the country's progress towards the EU.

A new Law on Nature has been prepared (but not adopted yet), where the requirements from the EU Birds and Habitats Directive have been transposed fully, and 5 draft bylaws have been prepared as well, of which 3 are

directly related to the establishment of the Natura 2000 network. Furthermore, a bylaw was adopted – Lists for determination of strictly protected and protected wild species of plants, fungi and animals, which requires revision. A Draft Rulebook for marking and visualization of protected areas in the country has been prepared, which will enable continuous progress of national legislation on nature protection and the fulfillment of EU requirements from the Birds and Habitats Directive.

Alongside the National Biodiversity Strategy with Action Plan for the period (2018-2023), in accordance with the Law on Nature Protection, the Government of the RN Macedonia has adopted a National Strategy for Nature Protection with Action Plan (2017-2027) in 2018, which includes chapters on geodiversity and landscape protection.

Laws and decisions for proclamation of protected areas are part of the national legislation for naure protection. In accordance with the Law on Nature Protection, procedures for designation of part of the Osogovo Mountains as a protected area in the protected landscape category have been started, and the procedure for designation of Canyon-Matka and Mavrovo as protected areas is underway. The activities for proclamation of a part of Shar Mountain and Vodno as protected areas has been already started in the beginning of 2020.

As a contribution to the conservation of natural values on a national level, seven (7) natural rarities have been proclimed, of which six (6) are in the Eastern Planning Region, and the old Platan Chinar in Ohrid.

Progress has been achieved in the adoption of management plans for protected areas, and in 2019 the Management Plan of NM Vevchani Springs was adopted. In 2019, the Management Plan of NM Markovi Kuli was prepared, as well as the Management Plan of NM Prespa Lake, both of which are in the adoption phase. The preparation of new Management Plans of NP Pelister and NP Galichica is underway.

A Management Plan for the Natural and Cultural Heritage of the Ohrid Region has been adopted, as an obligation of the World Heritage Convention (UNESCO). Since 2018, MoEPP has been providing continuous funding to protected areas (NP Pelister, NP Galichica, NM Prespa Lake and PN Ezerani) through the Ohrid-Prespa nature fund, where a long-term funding of operational costs for nature protection up to 50% was secured, as well as an improvement in transboundary collaboration. This fund also provides financing and grants for NGOs.

Relevant sectoral strategies and plans incorporating the biodiversity topic are elaborated in the Chapter 3, National target 2 and the Annex with national indicators (indicators 2.1 and 2.2)

Financing nature protection

The financing of nature protection, and biological diversity alongside it, is regulated in accordance with the Law on Nature Protection, which envisages compensations through which the biological diversity protection in and out of the protected areas can be financed.

The financing of nature protection is realized on the basis of the Annual Environmental Investment Programme, which contains special financial items for biological diversity projects and activities, as well as through the Annual Nature Program. Since 2007, the Ministry of Environment and Physical Planning has been supporting NGO activities through the Annual Environmental Investment Programme of nearly 1 million euros, which are split in grants to municipalities (60-70%), and to NGOs, business activities and academies (30-40%). Around 40-50 grants for one-year duration projects are awarded per year. More information about national funding is presented in Chapter 3, National Target 4 and indicator 4.1 in the Annex.

Since 2018, the MoEPP has secured a continuous funding of protected areas (NP Pelister, NP Galichica, NM Prespa Lake and Nature Park Ezerani) via the Ohrid-Prespa Nature Trust Fund (PONT) where a long-term co-financing of operational expenses for nature protection of up to 50% has been secured, with improvements in transboundary cooperation as well. More information about funding of protected areas is presented in Chapter

3, National Target 4 and indicator 4.1 and case study 4.2 in Annex I.

The financing of nature protection in the Republic of North Macedonia mainly comes from foreign donors such as the EU through the IPA Funds, the Horizon Research and Innovation Programme, Erasmus+ projects, GEF, SDC, GIZ, PONT, World Bank, European Bank for Reconstruction and Development, German Embassy in Skopje, German Federal Ministry for Economic Cooperation and Development (BMZ), Ministry of Foreign Affairs of Norway, MAVA Foundation, WWF Adria, UNEP, UNDP, EEA Grant scheme, Critical Ecosystem Partnership Fund (CEPF), Euronatur, Birdlife International, Plantlife, etc.

Donor	**Amount**	**Currency**
EU through different instruments/programmes	8,000,000.00	EUR
GEF through different implementation agencies	3,210,000.00	USD
SDC through different national partners	7,800,000.00	CHF
CEPF through different NGOs	600,000.00	USD
PONT through protected areas and NGOs in Prespa region	500,000.00	EUR
GIZ, DBU, German Embassy	2,250,000.00	EUR
MAVA Foundation through different European and national partners	560,000.00	EUR
Norwegian Government	720,000.00	NOK
WWF	22,000.00	EUR

To which National target and Aichi Biodiversity Target(s) this measure contributes

The measure for institutional and legal framework for biodiversity is related to all national targets from the Strategy for biological diversity (2018-2023) because a good legal framework with strong institutions and a solidly based institutional frame for biodiversity is required to secure appropriate protection, conservation and sustainable use of the biological diversity components.

In regard to financing, this measure is directly related to NT-4, and indirectly contributes towards the achievement of NT-2, NT-3, and NT-18.

This measure is directly related to Strategic Goal E, Aichi Target 20, but contributes to the achievement of other targets as well.

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes:

☐ Measure taken has been effective

■ Measure taken has been partially effective

☐ Measure taken has been ineffective

☐ Unknown

Regarding this measure for institutional and legal framework, all national targets from the NBSAP (2018-2023) have been taken into account.

In the assessment of this measure regarding funding, the following indicators have been taken into account: Trends in investments from the central budget allocated for the implementation of the NBSAP (2018-2023), Case study for allocated funds for protected areas, environmental taxes – amount and purpose etc.

Taking into account the realized activities related to the institutional, legal and financial framework for biodiversity, the progress on a national level on this topic is evident from several aspects.

Other relevant information

In order to deal with expert issues in the field of nature protection, especially the requirements of the EU Acquis on nature protection, the international agreements for nature protection and to make further progress in the national legislation on nature protection, the Government of the Republic of North Macedonia should establish an Agency/Institute for nature protection, as a separate and independent expert institution with a separate budget. This institution should focus on nature protection by gathering, classification and publishing of data and information on nature protection. The main goal should be following nature protection policies, through the principle of sustainable development, as well as performing expert work in the field of nature protection.

The establishment of the Agency/Institute for nature protection has been proposed in the reports by EU/IPA project on nature protection, the National Biodiversity Strategy and Action Plan (2018-2023) and the National Strategy for Nature Protection (2017-2027).

The state budget financing of nature protection, and biodiversity alongside it, should be improved.

Obstacles and scientific and technical needs related to the measure taken:

An obstacle in the implementation of activities is the lack of institutional capacities (on a central and local level) on nature protection. The Department of Nature in the MoEPP is the only organizational unit in charge of protection, conservation and sustainable use of biological diversity. The funding of biological diversity protection on a national and local level is not enough and there is a lack of national expertise on biological diversity.

2.4. Measure 4

Measure 4. Incorporation of biodiversity the Spatial plan, the national sectoral strategies and local plans

The inclusion of all relevant stakeholders in the activities for the conservation of biological diversity and the incorporation of biodiversity in relevant sectoral strategies and plans is the main topic of the Global strategic plan for biological diversity. The Republic of North Macedonia has envisaged several national biodiversity targets addressing different sectoral policies on a national and local level which would contribute to the conservation of biodiversity and the sustainability of ecosystem services.

Spatial plan of the R.N. Macedonia

The Spatial plan of the R.N. Macedonia is an integral strategic document for spatial development of the country, providing guidelines for the purpose, use, protection, organization, planning and management of the space of the country (in accordance with the Law on Spatial and Urban Planning, article 8). The Spatial plan of R.N. Macedonia is elaborated through spatial plans of the planning regions and spatial plan for an area of special interest to the state. Additionally, spatial plans are elaborated with urban plans. The current Spatial plan is in force until 2020 and preparational activities for the development of a new Spatial Plan of R.N. Macedonia have started. The selection of methodology is underway, and training in methodology and a better system of planning, following international standards, has taken place. A new Sectoral Study for natural heritage should be prepared, for the requirements of the new Spatial Plan of the country (because the existing study is outdated, having been developed in 1999) which would contain all previously prepared analyses/documents related to natural heritage and would take into consideration the European and global targets for protection of biodiversity.

A Draft Spatial Plan for the East Planning Region was prepared in 2016 by the Spatial Planning Agency with the

support of the Swiss “Programme for nature conservation in North Macedonia”. The plan contains a Study of natural heritage with proposals for designation of protected areas in the East Planning Region.

Incorporation of biodiversity in sectoral plans

One of the more significant strategies which should help in the incorporation of biodiversity in economy sectors in the country is the Strategy for Sustainable Development (2009-2030) whose aim is directed towards a sustainable integration of tourism, forestry, agriculture and the industrial sector by a sustainable support from the energy sector, the infrastructure and the transport sector. However, it lacks the Targets for sustainable development as stated in the Third Environmental Performance Review of the Republic of North Macedonia (UNECE, 2019). A short gap analysis of their incorporation was prepared in 2016 using a multi-sectoral approach, but that analysis is unavailable. For the purpose of its implementation, in 2010, a National Council for Sustainable Development was formed, which includes 16 members from relevant state and scientific institutions, and it is presided by the Deputy President of the Government in charge of economic affairs. Efforts for revision of the Strategy are being made.

During 2015-2019, different sectoral strategies and programs have been prepared and adopted, related to agriculture and rural development, energy and renewable sources of energy, water management, development of tourism and rural tourism on its own, transport strategy, strategy for eradication of poverty, etc., presented in Chapter 3for achievement of National target 2 and listed in Indicator 2.1 in the Annex I.

An analysis of the National Strategy for Agriculture and Rural Development (for the period 2014-2020) has been made, being a primary strategic document in the field of agriculture and rural development, where one of the main priorities is “functionality of the food safety system and sustainable management of natural resource with a special emphasis on the use of the agroecological approach”. More information is given in the case study under National target 2 in Annex I.

The National Strategy for Waters was prepared for the period 2011-2041. A new water management plan for R. of N. Macedonia is yet to be prepared, but a Bregalnica River Basin Management Plan has been prepared (with the support from the State Secretariat for Economic Affairs, Switzerland) and has been adopted by Municipality of Shtip (2017-2022), and the Prespa Lake Watershed Management Plan was adopted by the Municipality of Resen (2016-2021). Furthermore, the following drafts were prepared recently: Draft Strumica River Basin Management Plan (part of the UNDP/SDC project “Restoration of the Strumica River Basin” and a Draft Vardar River Basin Management Plan (2019) which are yet to be adopted.

As a preventive identification of areas important for biological diversity, in 2015 an ecological sensitivity map for the Bregalnica River Basin was prepared (for sectoral projects related to economy – mineral and raw materials, hydro energy, wind energy, road infrastructure, etc.) as part of the “Nature conservation programme in North Macedonia”. This example was followed for the Strumica Basin and the map of ecological sensitivity for it is in the final preparational stage (through the UNDP/SDC project).

An assessment of the ecological integrity of 4 rivers in RN Macedonia which are affected by the construction of small hydro power plants (SHPP) was undertaken on the basis of aquatic macroinvertebrate. The selected SHPP are financed by international development banks such as the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD).

Furthermore, a basic sensitivity map for the impacts from energy infrastructure (medium and high voltage overhead power lines and wind parks – planned or constructed) on birds was prepared in 2017, as part of the project “Capacity Building for Flyway Conservation in the Mediterranean”.

On a municipality level, Local Environmental Action Plans are being prepared, which contain a separate chapter on protection of biological diversity, but this is not developed enough and has weak implementation.

Local action plans for biological diversity (although not a legal requirement) were prepared in 2011 for the Municipality of Gostivar, the Municipality of Mavrovo-Rostushe and the Municipality of Debar (REC/ECNC) but there is no available data about their implementation.

Implementation of EIA and SEA

These procedures are a very important tool for integration of the biodiversity protection measures which R. of N. Macedonia has established in the Law on Environment and makes effort towards their improvement. An Environmental impact assessment (EIA) is prepared for each infrastructural project, as well as a public debate at the area where the assessment takes place. The studies are published on the MoEPP webpage for public comments in the given deadline (www.moepp.gov.mk). To improve the quality of the EIA studies/elaborates, training for SEA and EIA has been undertaken several times as part of the EBRD project "Building technical capacities for biodiversity". Guides for preparation of EIA for infrastructural projects and assessment of the impact on biodiversity have been prepared, as well as guide for preparation of EIA/SEA, measures and impact on bats in collaboration with EUROBATS.

As a positive example for integration of biological diversity aspects into Sectoral polices is the undertaken SEA for the National Energy Strategy, identifying the implementation of a strategic target– Acquiring electrical energy from renewable sources of energy – water, and the construction of small hydro power plants, as a possible discrepancy in regards to the goals for protection of biological diversity. In order to decrease the possible impacts from the construction of small hydro power plants, especially in protected areas or areas which are in the procedure of being designated with a protection category, a re-examination of the Programme for construction of small hydro power plants and the undertaking of a SEA before publishing each tender procedure for awarding new concessions was proposed.

In order to incorporate the nature impact assessment procedure (in accordance with article 6 of the Habitats Directive) for development projects and plans of future Natura 2000, a Draft Rulebook for Appropriate Environmental Impact Assessment was prepared (as part of the EU twinning project "Strengthening the capacities for effective implementation of the acquis in the field of nature protection"). The bylaw will enter into force when the country becomes a member of the EU.

Certification and standards

The introduction of *organic agricultural production* in RN Macedonia has its beginning in 2003 when the Law for Organic Agricultural Production was adopted. Until 2011, the organic agricultural production area and the number of operators has seen a constant rise, and the 2012-2018 period has a fluctuating trend both in area and number of operators. The total area under organic agricultural production in 2018 was 3909 ha which is only 0.75% of the total arable land in the country. In 2017, 654 operators of organic agricultural production were registered. A National plan for organic agriculture of the R. of N. Macedonia was adopted for the period 2013-2020, whose main strategic goal is to increase competitiveness of organic production in the Republic of North Macedonia for successful sales in domestic and foreign markets. Furthermore, the Ministry of Agriculture, Forestry and Water Economy regularly allocates funds for financial support of organic production. In 2015, 47,770,000 denars were allocated, 30,000,000 denars in 2016 and 61,000,000 denars in 2017. Additionally, different kinds of training for organic production and a support of export of organic products are being organized. More information is given in Chapter III, NT 5 and indicator 5.5 presenting the trend in the area under organic production in the Annex I.

Despite the organic products, RN Macedonia has undertaken activities for protection of agricultural and foodstuffs by placing a *label of origin, geographical label and label of guaranteed traditional specialty* prescribed in the Law on Agricultural Products. As part of an EU/UNDP project in 2019, 4 products with

geographical label from Belasica were protected.

The forestry sector in RN Macedonia has initiated activities for introduction of *forest certification* in the country, and national forest certification standards have been prepared according to the requirements (criteria and indicators) of the Programme for the Endorsement of Forest Certification – PEFC and in accordance with Macedonian legislation. The body responsible for PEFC certification scheme is the Forest Stewardship Council (FSC) in RN Macedonia. Alongside the national standard for sustainable management of forests in North Macedonia, this body has adopted other documents related to group certifications, use of logo, all the way to the end products in the wood industry (Chain of Custody). The prepared national standard and certification criteria for forest in RNM should be accepted/adopted at the next general assembly of the PEFC. In practice, the certification process of forests in RNM has not been implemented in any forest management unit.

Economic and financial mechanisms

The expenses for protection of the environment (according to the State Statistical Office) consist of two components: investments in resources for protection of the environment and expenses for maintenance of the resources for protection of the environment, with over 60% being used for waste management.

The resources for protection of the environment are planned to be provided from the Budget of R.N.Macedonia and other sources (in accordance with article 161 of the Law on Nature Protection) which include: budgets of the units of local self-government on the territory of which the protected area is situated, compensation for entry, visit, parking, collection of wild plants, fungi and animals and their parts, sustainable use of natural resources, compensation for stay, sailing, ecosystem services, performance of activity or activity in a protected area, and other sources (donations, grants, credits, etc.). No funding is allocated for protected areas from the Budget of RNM. Staring from 2019, a Nature Protection Programme was adopted with a total value of 715,580,000 denars (EUR 11,630,000) out of which 1,115,000 denars (EUR 18,000) are allocated from the Budget of RNM. The MOEPP, starting from 2007, has been allocating funds through the Programme for Environmental Investments, and part of them are used for nature protection projects. More information about the allocated funds from the Budget of the RNM are presented in Chapter 3, NT-4 through the indicators 4.1 and 4.2, presented in Annex I. A large share of the funds for protection of biological diversity are secured from different foreign donators, predominantly the EU, the Global Environment Fund, and donations/grants from other countries, with significant support being provided by Switzerland, Germany, Holland, Austria, Italy and other countries.

In RN Macedonia, in accordance with the provisions of the Law on Environment, environmental taxes have been adopted. According to the environmental tax data from the State Statistical Office, the lions share in the environmental taxes was that of energy taxes (around 65%), transport taxes (around 35%), with pollution taxes being the smallest one (0.9%). The principle of the polluter paying is implemented in the legislation, but it is not being effectively implemented, as pointed out in the Third Environmental Performance Review of the R. of N. Macedonia.

The value added tax exemption for institutions such as botanical and zoological gardens, parks etc. (Law on Value Added Tax, article 23) fulfills one of the actions in NT-4 (the introduction of tax reliefs and subsidies for services and products in protected areas), which is one of the primary activities of the Public Institutions National Parks.

In accordance with the Statute of the Public Institution National Park, the institution is founded for the performance of activities of protection and management of the National Park. The basic activity of National Institution National Park is 92.53 – activity of botanical and zoological garden and other natural reserves.

In agriculture, rural development, energy, tourism, etc. different subsidies are being implemented, whose

biodiversity impact has not been analyzed. An analysis of the hydro-energy subsidies system and proposals for changes in the policies of the Western Balkan countries, with RN Macedonia taking part, was prepared in 2019 by the CEE Bankwatch network. The Ministry of Economy awards premiums and preferential tariffs for electricity production from photovoltaics, preferential tariffs for wind plants, small hydro power plants and other producers from renewable sources (more information in Chapter 3 and Annex I-indicators 3.1 and 3.2). Furthermore, by the Government of the RNM has implemented subsidies for the purchase of heating inverters or pellet stoves for households or purchase and installation of solar thermal collector systems in households by reimbursing part of the funds. In regard to tourism in the country, a "Rulebook on the Manner of Granting, Type and Amount of Subsidies" was prepared by the Agency for Promotion and Support of Tourism in 2013, but there is no available data regarding the awarded subsidies.

Additionally, the Government of the RN Macedonia (in accordance with the Law on Public Procurement, Official Gazette of the RM no. 83/18) introduced a practice of online publishing and application of tender documentation, which is related to the introduction of environmental accounting procedures.

For the implementation measure, please indicate to which national or Aichi Biodiversity Target(s) it contributes:

The measure contributes towards the achievement of the NT-2, NT-4 and NT-5.

This measure is directly related to the achievement of Aichi Target 2 and indirectly to the Targets 4 and 7.

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes:

☐ Measure taken has been effective

☐ Measure taken has been partially effective

■ Measure taken has been ineffective

☐ Unknown

The preparation of different strategic documents from relevant sectors (together with appropriate legislation) is a significant step in the incorporation of biodiversity protection measures. However, a detailed analysis should be undertaken, in order to assess the impact of the measures taken. Also, more importance should be given to the subsidies awarded by different sectors, which are not always favorable to biodiversity protection.

Relevant websites, web links and files

http://www.unece.org/index.php?id=52683

http://www.bregalnica-ncp.mk/wp-content/uploads/2016/12/Nacrt_plan_PPIPR.pdf

http://www.bregalnica-ncp.mk/documents/?lang=en

http://mzsv.gov.mk/CMS/Upload/docs/NSZRR2014-2020.pdf

http://agrometeo.mk/)(http://nabavki.gov.mk/

https://www.mk.undp.org/content/north-macedonia/en/home/projects/Restoration-of-Strumica-River-Basin.html

https://bankwatch.org/wp-content/uploads/2017/12/ecological-integrity-hydropower-Macedonia.pdf

https://bankwatch.org/wp-content/uploads/2019/09/who-pays-who-profits.pdf

Other relevant information The ecosystem services have been analyzed in Measure 6 of this chapter.
Obstacles and scientific and technical needs related to the measure taken: For an implementation of this significant measure which includes a large number of stakeholders and the business sector, it is expected that different obstacles and challenges would appear, and we would like to point out the following obstacles: - Lack of capacities on a central and local level, - The protection of biodiversity is still not suitably recognized and incorporated in national sectoral policies and local plans, - Infrastructural, energy and other types of projects should comply with the environmental and nature legislation, - There is a lack of data about the state of natural heritage, and also about habitats and biodiversity in the prepared EIA studies, - The incorporation of biodiversity in relevant sectors requires major financial resources which are usually lacking.

2.5. Measure 5

Measure 5 Sustainable use of resources (forestry, agriculture, pastures, waters and wild plants, fungi and animals)
The Republic of North Macedonia has a remarkable natural heritage and according to the number and species diversity is a biodiversity hot spot of Europe. Intense economic growth is often based on the unsustainable use of natural resources, especially water, minerals, and biodiversity that leads to change, degradation and destruction of natural habitats and species. The intensification of urbanization, road infrastructure, energy production, overuse of forests and medicinal and aromatic plants as well as mass tourism are serious threats to the survival and maintenance of biodiversity. The succession of grassland habitats as a result of depopulation of rural areas due to economic changes on one hand and the intensification of agricultural production on the other, poses a threat to many natural habitats. The application of modern principles and practices for the sustainable use of natural resources is very important in reducing the pressure on ecosystems. The various measures taken in the Republic of North Macedonia in forestry, agriculture, hunting, fishing, tourism, the use of medicinal and aromatic plants and fungi as well as the use of pastures are presented below. ***Agriculture and rural development*** According to SSO data, agricultural land (arable land and pastures) in 2018 covers about 1264139 hectares or about 41% of the total land area. Almost half of the agricultural land is arable and the other half is pasture land. The largest share in the arable land is made of orchards and gardens, of which the largest area (32.5%) is planted with cereals. Agriculture (along with forestry and fisheries) is the third largest economic sector by services and industry in the Republic of North Macedonia. Increased competitive pressure in the processes of intensive integration into international trade flows, and primarily with the accession of the Republic of North Macedonia to the World Trade Organization and the

signing of other bilateral and multilateral free trade agreements, is a serious challenge for Macedonian agriculture. Also, approximation to the standards defined in the EU Common Agricultural Policy (CAP) regulations places a strong emphasis on environmental issues and is a major challenge in the EU accession process.

The Ministry of Agriculture Forestry and Water Economy (MAFWE) under the National Strategy for Agriculture and Rural Development (2014-2020) includes six objectives and measures: "Optimizing the use of limited land, forest and water resources in a way that will not negatively impact the environment and build sustainable rural communities through integrated rural development". However, the specific purpose of this Strategy needs to be broadened and directed towards the CAP. The Rural Development Policy contains all the elements for stimulating development through modernization and structural adjustment of the agrofood sector as well as encouraging economic activities to preserve the natural, cultural and developmental values of the rural areas. One of the priority areas for support through the rural development policy is "Protecting and improving the environment and rural areas, aimed at promoting agricultural production practices for sustainable use of agricultural land, protection and improvement of the environment and rural areas in order to preserve plant and animal diversity and improvement of soil, water and air". The establishment of a Local Action Group (LAG) for rural development has been supported in the past.

Some of the activities implemented by MAFWE through various projects are important for incorporating aspects of biodiversity into agriculture and rural development:

- Development of orthophoto maps and digitization of agricultural land use for updating the Land Parcel Identification System (LPIS).
- Land consolidation in order to defragment agricultural land whose current average parcel size is less than 0, 3 ha.
- Establishment of agricultural cooperatives prescribed in the Law on Agricultural Cooperatives. In the period 2013-2017, 39 cooperatives with different number of members are registered in the Register of Agricultural Cooperatives whose total production capacities are about 1130 hectares of arable land, 1000 bee families, 450 heads of cattle, 200 goats and 250 sheep.
- A Macedonian Soil Information System with FAO support was developed, containing a total of 61 maps in a scale of 1: 50,000 with a special interpreter.
- A specialized website for agro-meteorological forecasting has been developed, which in a simple and understandable way presents the information needed by farmers to take appropriate agro-technical measures.
- MAFWE issued a guide on achieving the principles of good agricultural and hygienic practice of agricultural holdings, as well as a rulebook on a list of special minimum requirements for good agricultural practice and environmental protection. Grants to farmers for the introduction of good agricultural practice in the Strumica region were awarded in cooperation with UNDP. The UNDP/SDC also continuously supports actions for the introduction of good agricultural practices in the Prespa region. Agri-environmental measures are prepared by MAFWE, which they should be EU accredited.
- Areas with limited opportunities for agriculture are defined in the Law on Agriculture and Rural Development (Article 77). Generally, it covers areas over 700 m asl, but a bylaw to define direct payments hasn't been drafted yet (activities, conditions, beneficiaries, etc.).

Biodiversity in agriculture consists of local varieties and populations of agricultural plants, as well as indigenous breeds of domestic animals. The richness of agrobiodiversity in RN Macedonia is large and many indigenous

varieties and populations of crops are still grown, some of these indigenous varieties or breeds being commercially grown and appreciated by consumers. Besides to additional direct payments to local breeds of animals, biodiversity conservation programs are also being funded. More information on conservation of agrobiodiversity is given in Chapter 3, NT-5.

Use of pastures

Pastures in the Republic of North Macedonia are an important resource managed by the Public Enterprise for Pastures Management. The Law on Pastures is outdated and does not incorporate modern regulations on sustainable use of pastures. It is necessary to create pastures inventory in order to prescribe appropriate measures for use and protection. There is an overlap of pasture management responsibilities in protected areas, especially national parks where some of the best high mountain pastures are located. In the past period, Shar Mountain Pasture Management Plan was developed to preserve the biodiversity in Shar Mountain grazing areas (for three pastures Lera, Vrben and Duf) which were estimated by productivity and number of herds.

Sustainability of forest use

Forests occupy about 39% (1,007,095 ha) of the territory of the state according to the 2018 data. Deciduous forests are dominant forest types (58%), followed by mixed forests (30%), evergreen forests (7%), and a small percentage (5%) of degraded forests. In the period 2014-2018 the forest area was increasing, more specifically the area under deciduous and mixed forests was increasing, and the area of coniferous forests was decreasing, which may indicate that some forest habitats are at a disadvantage (more information is given in Chapter 3, NT-2 and indicators 2.2 and 2.3 in Annex I.

About 90% of the forests are state owned by the National Forests Public Enterprise, except for forests in national parks/protected areas managed by protected area management entities, but supervision is under the responsibility of the State Environmental Inspectorate and the State Forestry and Hunting Inspectorate. According to the Law on Forests, the planning and management of forests and forest land is accomplished through special forest management plans, forest management program and annual forest management plans. In the planning documents for use of forests, the measure of pure logging is gradually abandoned (the area under pure logging is reduced). The protected area management plans, developed in accordance with the Law on Nature Protection, contain a program for the management of forest habitats and ecosystems.

According to the State Statistical Office data for the period 2014-2018, the amount of wood cut was between 655 000 m^3 in 2014 to 890 000 m^3 in 2016 or a total of 4 003 000 m^3 of cut wood in five years. Most of the cuttings are about 91% in deciduous forests (beech and oak), while 9% are in coniferous forests (pine). Felling quantity (etat) is a planned quantity of timber for use according to the special plans for forest management. It is forbidden to surpass the felling etat in the forestry unit laid down in the special plan or program. The total possible annual felling etat is about 75% of the total annual growth. However, due to objective reasons, the total used annual felling etat is around 47%. More information on cut wood mass by species by year is given in Chapter 3, NT -7 and indicator 7.2 in the Annex I.

For Maleshevo region in 2019, the Regional Plan for the management of forests was made as a pilot regional plan prepared for a micro region in North Macedonia within the framework of the Nature conservation Program in North Macedonia. It is a developmental strategic document that will help establish sustainable forest use. The idea for this regional plan came as a necessity for the forestry sector in the Eastern Planning Region to introduce innovations in forest planning and management, while taking into account the needs of other forest users.

Activities are underway to identify forests of high natural values in accordance with international criteria

implemented in cooperation with the PE National Forests within the GEF/UNEP project: "Achieving biodiversity protection through effective management of protected areas and maintaining biodiversity through a process of land use planning". Appropriate conservation/management measures will be prescribed for two selected pilot areas of the corridors identified in the Proposal of Macedonian National Ecological Network (MAK-NEN).

Sustainable use of wild plants and fungi

In the last 20 years as a result of the economic situation in the country, the collection of wild plant species and fungi has played an important role in providing income for many families, especially in mountainous and rural areas.

The Ministry of Environment and Physical Planning (MoEPP) in accordance with the Law on Nature Protection issues permits for the collection of endangered and protected wild plant species, fungi and their parts. In accordance with this Law and the Convention on International Trade in Endangered Species of Wild Plants and Animals (CITES), the MoEPP issues a D4 permit and a CITES permit/certificate to regulate import-export, re-export of wild plant and animal species. Wild plants and fungi collected from nature are important ecosystem services provided by forest ecosystems and therefore need to be given due importance. A fee has been introduced in the national parks for the collection of wild plant species. On the other hand, the PE National Forests in accordance with the Law on Forests also issues licenses for the collection of non-forest forest products outside the boundaries of protected areas.

Wild plants are usually collected from the following species: juniper (Juniperus communis), bearberry (*Arctostaphylos uva-ursi*), Sharplanine tea (*Sideritis scardica*), yellow St. John's wort (*Hypericum perforatum*), wild oregano (*Origanum vulgare*), *Valeriana officinalis*, Dog Rose (*Rosa canina*), Blueberry (*Vaccinium myrtillus*), Raspberry (*Rubus idaeus*), Blackberry (*Rubus occidentalis*), Elderberry (*Sambucus nigra*), Common mallow (*Malva sylvestris*), Marshmallow (*Althaea officinalis*), Nettle (*Urtica dioica*), dandelion (*Taraxacum officinale*) and others. The following types of fungi are commonly collected for commercial purposes and for export: the common fern (*Boletus edulis*), the black fern (*Boletus aereus*), the pine fern (*Boletus pinophilus*), the summer fern (*Boletus aestivalis*), the ovine (*Amanita caesarei*), the fern), yellow hedgehog (*Hydnum repandum*), saffron milk cap (*Lactarius deliciosus*), black trumpet (*Cratarellus cornucopioides*), mortar (*Morchella* sp.) and others. Information on collected and exported quantities of wild species of plants and fungi for the period 2016-2019 is given in Chapter 3, NT-7 and indicator 7.1 in the Annex which is based on the issued permits by MoEPP.

In addition to the importance of the wild species of plants and fungi concerned as a natural resource of the state, there is a lack of data on the quantities of wild plants and fungi harvested, primarily due to non-compliance with nature and forestry legislation. Also, the licensing of wild species collectors has not been regulated and harmonized nationally.

There are no sufficient data on the quantities/biomass of commercial plants and fungi in their natural habitats in the country. A study on oak lichen quantities and a study on the status of populations and quantities of bearberry (2019) has been conducted. A quota for sustainable collection has been established for this species, collected from the Jakupica mountain range. In addition, a study on the estimation of juniper quantities at only three sites near Pehchevo (2019) has been prepared.

Some attempts have been made to stimulate the cultivation of medicinal and aromatic plants in order to reduce the pressure on natural populations but so far, no significant results have been achieved. One such example was the attempt to cultivate mountain tea in the Prespa region, with successful examples on the Albanian and Greek sides.

Sustainability in hunting

In the Republic of North Macedonia wild game consists of 23 species of mammals and 84 species of birds. According to the Law on Hunting, wild game can be: protected and wild game without protection. Wildlife protection, temporary and permanent hunting bans shall be established for protected game. Hunting for bear, lynx, wild cat, badger, otter, jackal, squirrel and 90 species of birds is permanently prohibited.

According to the Decision of the Government of the Republic of N.Macedonia, a total of 256 hunting grounds were established on the territory of the Republic of N.Macedonia, of which 112 were hunting grounds for large game (20-year concession) and 144 were hunting grounds for small game (10-year concession). All hunting grounds according to the General Hunting Management Basis are grouped in 11 hunting areas. For the use of wild game in hunting grounds, users develop a special hunting management basis with a validity of 10 years. The introduction of concessions in hunting should overcome certain problems with regard to the care of the survival and reproduction of the game. By allocating the game to the hunting grounds under concession, the concessionaires shall take all measures for the cultivation, protection and use of the game in the hunting grounds.

Hunting grounds are not established in protected areas as no commercial hunting is permitted. Where necessary, sanitary hunting of wild species shall be controlled and in accordance with the provisions of the Law on Hunting and the Law on Nature Protection. Pelister, Galicica and Mavrovo National Parks develop Annual programs for the protection, breeding and management of wildlife. As part of the administrative procedure, the MoEPP issues an opinion which has to be submitted to the MAFWE. In the past period, NP Mavrovo has prepared five (5) Annual programs for the protection, breeding and management of the game.

According to data from the State Statistical Office for the period 2015-2018, the number of slaughter deer is constantly increasing, while the number of slaughter brown rabbits, gray partridge, rock partridge and wolf decreases. More information on the number of game shot per species per year is given in Chapter 3, National Target 5 and indicator 5.6 in the Annex I .

Hunting as an economic activity besides hunting activities, primarily has to have a commitment to the preservation and enhancement of biodiversity in the country.

A Synthetic report on hunting in selected hunting grounds in Western pats of North Macedonia (under the "Balkan Lynx Recovery Program") is under way, which will show how hunting works in selected hunting grounds and provide appropriate recommendations for its improvement. and promoting sustainable hunting practices.

In the period 2014-2019, several trainings were held for representatives of hunting associations (HA) and protected areas (NP Mavrovo, NP Pelister, NP Galicica, Multipurpose area Jasen, HA Malesia - Struga, HA Chern Kamen-Vevcani, HA Piton-Ohrid, HA Nidze-Bitola, HA Sokol-Z - v. Zajas, HA Osogovo-Kriva Palanka, HA Bukovac-Kratovo and HA Makedonska Kamenica-Sasa) for the application of the most common methods for monitoring and studying of large mammals, with special emphasis on the photo-method to include them in biodiversity monitoring.

Sustainability of fishing

Fishing shall be carried out on all fishing waters within the framework and under conditions established by law. Fishing waters in RN Macedonia cover about 56,000 hectares of which 83% are fishing areas that include natural lakes (Ohrid, Prespa and Dojran), about 11% are fishing zones and recreational zones of artificial lakes - reservoirs, 4% are fishing and fishing lakes and 1% are aquaculture facilities where fish farming is completed. A concession for commercial fishing and recreational fishing for a period of 6 years is given for fish from fishing waters.

The lack of concessionaires over a period of time, the relatively inadequate physical protection of Lake Ohrid, Prespa and Dojran Lake, the emergence of large-scale fishing, the fishing of small and immature individuals,

have caused uncontrolled fish stocking.

The main threats arising from fishing are related to unplanned commercial exploitation of lakes, fishing, exploitation and water pollution. Concerning natural lakes, specific problems for Lake Ohrid are reduced trout (endemic species) and belly populations, expansion of the plaice, submerged bottom nets; for Lake Dojran, dominant invasive species of silver caras and decreased density of native fish populations, while Lake Prespa is characterized by increased numbers of non-native fish, presence of pesticides and heavy metals in fish tissues and endangered fish species.

In the past period, the Hydrobiological Institute of Ohrid carried out activities for ecological examination of the fish population in Lake Ohrid and made an assessment of their health status, detection of possible environmental risks, and environmental impact on fish nets and their development. Artificial netting of endemic Ohrid trout has also been carried out (Salmo letnica Karaman, 1924).

Aquaculture fish production affects biodiversity through the introduction of new non-native species into aquatic bodies and the nutrient load on aquatic ecosystems.The largest number of cage farms are found in the accumulation "Tikves" - 19 in total, of which 517 cages for breeding carp. The cage production recorded an upward trend and reached (in 2010) 1407 tons: 1188 tons of trout, 178 tons of carp and 41 tons of catfish.

More information on the commercial display and number of carp fisheries in the country is shown in Chapter 3, NT-5 and indicators 5.7 and 5.9 in the Annex I.

Sustainability in tourism

The state abounds in natural beauties, as well as traditional and cultural landmarks, which are the basis for tourism development. The main institutions that promote and support tourism are: Ministry of Economy-Sector for Tourism, Agency for Promotion and Support of Tourism, Tourism Chamber of the Republic of North Macedonia, Association of travel agencies and other associations in which hotel and catering businesses are mainly organized. In addition to the National Tourism Strategy of RN Macedonia (2016-2021), which includes many of the protected areas as natural attractions, a separate National Strategy for Rural Tourism (2013-2017) has been developed. In an effort to provide different tourism offers, RN Macedonia has established 6 tourist development zones: in Ohrid, Shar Planina, Kozuf, Galicica and 2 in Dojran.

In recent years, activities have been intensified to develop alternative forms of tourism that are particularly related to protected areas.

Special studies/programs for eco-tourism have been made for NP Galicica, NP Pelister, NP Mavrovo, PN Ezerani, which currently generate modest funds. A Study on the Status of Tourism Development Potentials in the East Planning Region in 2019 has also been prepared, with a strong emphasis on eco-tourism.

Along Ohrid and Dojran Lakes, where a network of hotel and catering facilities that are used for holidays or weekends was developed, an offer of one-day visits to nearby protected areas or rural areas is being launched. A good example is the offer of rural tourism in the village of Kuratica near Ohrid. Some of the artificial lakes (Tikves, Matka and Kozjak) represent a common tourist destination, but for a day or weekend stay. In the Prespa region, initiatives for the development of rural tourism started 20 years ago, and the villages of Brajcino, Ljubojno and Stenje are worth mentioning. Last year, the PONT Small Grants Program supported eco-tourism activities in the Prespa region.

Mountain resorts offer opportunities for skiing/snowboarding, hiking, cycling or enjoying of nature. Several ski infrastructure sites are currently being offered - the largest being Popova Shapka on Shara Mountain and NP Mavrovo, both located in the western part of the country. Apart from the ski resorts, these areas are a desirable destination for rural tourism, associated with traditional accommodation and food, hunting, fishing, and enjoying the beautiful forests, fast and clean rivers and unobstructed pastures. Smaller ski areas with only

a few lifts are in Krusevo, Kopanki (NP Pelister) and Kozuf.

There are high quality hot mineral springs in RN Macedonia, only a few are currently used for health purposes and tourism activities.

Due to its geographical location and favorable climate conditions, North Macedonia has a long history of wine production. About 85% of the Macedonian wine produced comes from the Vardar Valley around the cities of Kavadarci and Demir Kapija. The largest winery in North Macedonia (Tikves) is located in Kavadarci. Wine tourism has become more attractive in recent years.

The development of skiing capacities, as well as attractive lake sports are seen as a pressure on biodiversity, hence the need for the next National Tourism Development Strategy is to focus on sustainable forms, in order to protect the natural values of attractive tourist destinations.

National Aichi Biodiversity Goal and Objective to which this measure contributes:

The measure for sustainable use of resources is associated with: NT-2, NT-3, NT-5 and NT-7 and NT-18.

This measure is related to the following strategic goals of the Global Biodiversity Strategy: Aichi Targets 7, 14, 2 and indirectly towards Aichi Targets 3, 4, 13, 15 and 18.

Assessment of the effectiveness of the implemented implementation measures in achieving the desired results:

☐ The measure taken is effective

☒ The measure taken is partially effective

☐ The measure taken is not effective

☐ Unknown

The evaluation of this measure takes into account a number of indicators elaborated in Chapter 3. This measure is directly related to the measure of incorporating biodiversity into the Spatial Plan, national sectoral strategies and local plans. In this regard, the preparation of strategic documents from the relevant sectors (agriculture, forestry, hunting, fishing, tourism), as well as the harmonization of the legislation of these sectors with the legislation on nature protection can contribute to the improvement of the protection and sustainable use of biodiversity.

Taking into account the implemented activities related to the use of natural resources, the progress of this measure on a national level is evident.

Relevant web-pages

http://www.mzsv.gov.mk/cms/Upload/docs/GZI-2017.pdf

http://www.maksoil.ukim.mk/masis/

http://agrometeo.mk/

http://www.mkdsumi.com.mk/proizvodi_i_uslugi.php?page=5&s=5

http://www.sf.ukim.edu.mk/

http:www.fznh.ukim.edu.mk.

http://www.maksoil.ukim.mk/masis/

http://www.hio.edu.mk/

http://www.bregalnica-ncp.mk/2016/07/08/integrirano-upravuvanje-sumi/

https://www.youtube.com/watch?v=FCVMdOjM8tc

http://tourismmacedonia.gov.mk/wp-content/uploads/2018/08/NAcionalna-strategija-za-ruralen-turizam.pdf

http://bregalnica-ncp.mk/wp-content/uploads/2016/07/Studija_Turizam_vo_IPR_MK-1.pdf

https://kuratica.eu/

Other relevant information

In order to improve the state of sustainable use of natural resources, appropriate measures should be taken to suppress illegal logging, which significantly impacts biodiversity loss.

It is necessary to intensify the preparation of studies to assess the quantities/biomass of wild plants and fungi in their natural distribution areas on a national level; to establish national quotas for sustainable use and to introduce plantation breeding of certain commercial species, which are collected and exported by the State.

Obstacles and scientific and technical needs related to the measures taken:

The obstacles and challenges in implementing this measure, which are related to the forestry, hunting and fishing sectors, can be highlighted as follows:

- Lack of capacity at central and local level
- Insufficient funds
- National legislation on agriculture and rural development, forestry, hunting and fisheries is not fully aligned with the legislation on nature/biodiversity protection
- Biodiversity conservation is not properly recognized and incorporated in sectoral policies and local plans in the field of forestry, hunting and fishing
- Insufficient cooperation between competent institutions.

2.6. Measure 6

Measure 6. Implementation of the ecosystem services concept (identification, assessment, valuation)

The basis for introduction of the ecosystem services concept was established in the National Strategy for Biological Diversity (2018-2023), but also in the Strategy for Nature Protection with Action Plan (2017-2027). In the Strategy for Nature Protection, under National Target 3, activity 3.1 envisages the development of studies for economic values of the ecosystem services in protected areas (with the possibility for further financing of protected areas), the activity 3.2 envisages the implementation of procedures for evaluation of ecosystem services within different sectors and their implementation in the process of adopting strategies, plans and programs, whereas activity 3.3 – incorporation of procedures for assessment of ecosystem services in the legislation.

Through the “Nature conservation programme in North Macedonia – phase II”, activities related to ecosystem services on a national and local level are being undertaken. Primarily, an identification and selection of the ecosystems mapped throughout the country was prepared. Following this, by using the analysis which was made in accordance with MAES (Mapping and Assessment of Ecosystems and their Services) methodology, the status of every ecosystem type was determined and maps were produced about the status of ecosystems regarding their provision of ecosystem services. More information is given in the case study 16.1 presented in the Annex I. The process of selection and assessment of ecosystem services for forest ecosystems on a national level is currently underway. As a result, maps will be created, with an analysis of the capacity to provide

ecosystem services for forest ecosystem types. Furthermore, an analysis on a local level will be undertaken for the Natural Monument "Vevchani Springs", and ecosystem services payment mechanism will be developed. In parallel to the analyses, several institutions and stakeholders interested in the ecosystem services concept are part of modules for strengthening of administrative capacities of the ecosystem services concept. To this end, the brochure "Ecosystems and ecosystem services" was prepared, which serves to inform different sectors and other stakeholders. A *Manual for payment mechanisms for ecosystem services* is in development. This way, support is provided primarily to the protected areas in the country, encouraging alternative sources of financing and sustainability in the use and management of natural resources.

Regarding further activities related to this topic, a Feasibility Study about water as an ecosystem service in National Park Pelister was prepared in 2019. This study contains the basic information about ecosystem services, an analysis of national and international practices in the use of ecosystem services in protected areas, an analysis of the international experience with payment mechanisms for ecosystem services, existing data about aquatic ecosystems in NP Pelister, management and use of waters in NP Pelister, and an analysis about how informed the employees in the protected area are about the ecosystem services concept and the principle of payment mechanisms. A more detailed analysis of the flow of the water quantity of all outflowing rivers used by NP Pelister is recommended, in order to acquire a real payment price for water ecosystem services.

In 2019, NP Galichica prepared a draft *Study for tourism, ecosystem services and a comparative analysis.* In this analysis, which determines the economic value of ecosystem services provided by the protected area, the approaches (classifications) of TEEB (The Economics of Ecosystems and Biodiversity) and CICES (The Common International Classification of Ecosystem Services) were combined. This analysis does not establish a total valuation system, but is indicative and mostly pays attention to market valuations. Undoubtedly, the identified ways of use of space are directly related to the ecosystem services the Park provides, and parts of them have been analyzed in the Study.

To which National target and Aichi Biodiversity Target(s) this measure contributes

The ecosystem services measure is related to: NT-5 and NT-16.

This measure is directly related to Strategic Goal D from the Global Biodiversity Strategy: Enhance the benefits to all from biodiversity and ecosystem services, more precisely Aichi Target 14. Indirectly, these measures are related to Aichi Targets 4 and 11.

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes:

☐ Measure taken has been effective
☒ Measure taken has been partially effective
☐ Measure taken has been ineffective
☐ Unknown

Taking into consideration the activities directly related to the ecosystem services concept, the progress regarding this topic on a national level is evident from several aspects. The results from the past three years are an indicator of the significant progress of the country in this area, and the basis established is being currently upgraded. Alongside direct activities, a national network of stakeholders is being developed by strengthening of capacities.

Nature conservation programme in North Macedonia – phase II: http://www.bregalnica-ncp.mk/?lang=en

http://ceprosard.org.mk/MK/zs_p8.aspx

Other relevant information

Certain aspects of the ecosystem services concept can be indirectly found in a large number of studies and documents, for example, studies for valorization of biological diversity of protected areas, forest management plans, identification of forests with natural values etc. Although not analyzed according to the recommended analysis methods, they nevertheless represent a data source for a large part of the services provided by the ecosystems in the country. Considering the fact that the ecosystem services concept is relatively new on a European level as well, the application of results from this type of studies represents a basis in the current implementation of the concept in the country.

The preparation of the "Study for sustainable use of reed in the Prespa Region" in 2019 should also be mentioned. This study analyzes the sustainable use of reed and its market value, which is indirectly related to the concept.

Obstacles and scientific and technical needs related to the measure taken:

Considering the lack of experience in this area, the overcoming of challenges is being done through intensive communication and collaboration with experts from Europe. With their help, activities for development of capacities are undertaken.

Other obstacles for undertaking measures are: the lack of institutional capacities, national expertise, basic data and information on a national level, such as digital and precise maps, digital data and maps for distribution of habitats and species of national and EU importance, quantitative indicators for different ecosystem aspects (biotic and abiotic), etc.

The ecosystem services concept should be improved on a national level by an upgrade of the improvement of the national legislation for nature protection, in regards to an upgrade of the Law on Nature Protection and the addition of bylaws to this field.

2.7. Measure 7

Measure 7. Conservation of species and habitats

Conservation of species

For the conservation of plant and animal species in the Republic of North Macedonia, national documents are still missing, such as red lists for some taxonomic groups and action plans. These documents are based on scientific data and years-long research and provide guidelines for protection, conservation and appropriate management of sustainable population of species of national, European or international importance. Alongside this, on a very practical level, there is a lack of institutions, experts and infrastructural objects for reintroduction, restoration or *ex-situ* protection of plant and animal species.

In the past period, progress has been made in regards to the preparation of national red lists. The MoEPP in cooperation with IUCN ECARO and local experts on herpetofauna, have conducted an assessment of all 46 amphibian species and reptiles on a national level, supported by the GEF/UNEP project "Achieving Biodiversity Conservation through Creation and Effective Management of Protected Areas and Mainstreaming Biodiversity into Land Use Planning". On the basis of the assessment, the first National Red List of Herpetofauna was prepared, in accordance with the criteria, guidelines and procedures of IUCN. Furthermore, an assessment of

14 species of vascular plants with international and national importance has been done, and a Priority List of Flora Taxa on a national level has been prepared, to serve as basis for further selection and determination of a final list of priority taxa for the Red List of Flora of the Republic of North Macedonia. All data is available at the new red list website. The preparation of red lists for fungi and carnivores is underway, as part of the EBRD project which supports the program of building biodiversity capacities of the country. Previously, in 2015, a status assessment of the Balkan lynx was done as a part of the Balkan Lynx Recovery Programme, which is assessed as critically endangered – CR.

The preparation and implementation of action plans for the conservation of protected species is a significant activity, although their preparation is not prescribed in the Law on Nature Protection. In general, the actions for protection are undertaken as plans derived as an obligation of existing regional or European initiatives, such as:

- In November 2014, the parties to the Convention on migratory species (Bonn Convention) as part of COP11 in Ecuador, adopted Resolution 11.14 - Programme of Work on Migratory Birds and Flyways, and are obliged to prepare an Action plan for protection of the African-Eurasian vulture species. This action plan was adopted in March 2017, and it covers 128 countries among which is R. of N. Macedonia. All vulture species which live or have lived on the territory of R. of N. Macedonia are subject to protection under this Action Plan. The nesting territories and colonies of the Egyptian Vulture and the Griffon Vulture are constantly monitored, and a significant decrease in population has been noted (one third of the nesting couples of the Egyptian and around half of the Griffon vulture couples by 2019). The nesting population of the Imperial eagle shows stability, but the population of the Lesser Kestrel notes a drastic drop of more than 60%. A work group for combating poisoning was formed by the MoEPP in February of 2019, and a Draft Action Plan for combating wildlife poisoning has been prepared.
- The numbers of the Dalmatian pelican, which comes to feed in the Prespa Lake and the Golem Grad island, notes growth for the 2013-2018 period.
- As part of the programme for establishment of white stork nesting platforms throughout the territory of R.N. Macedonia, the electricity supply company EVN Macedonia (since 2010) upon the suggestions of the Macedonian Ecological Society, sets up a minimum of 10 white stork platforms on their own overhead power lines. This both decreases the negative impact of electrocution on storks and the break in the electric energy distribution.
- The action plan for protection of the Balkan lynx was prepared at the end of 2013 through a series of workshops (MES, NP Mavrovo and key stakeholders), with the aim of providing significant contribution towards the protection of the population of the critically endangered Balkan lynx. The plan is mainly targeted at the core population area of the lynx, which is currently on the territory of NP Mavrovo. The plan has been implemented since 2018 onward (MES in cooperation with NP Mavrovo).
- Regarding bats in the RN Macedonia, mainly separate and short-term researches of the bat fauna are being done (main presence and distribution). Regarding protection, in accordance with EUROBATS suggestions, main protection measures are installment of protective doors at the entrances of several significant bat caves in the Poreche region. An Action plan on bats is yet to be prepared, both on a national or local level.
- In 2012, Transboundary conservation action plans for the Prespa region of mountain tea (*Sideritis raeseri*), reed, Greek juniper (*Juniperus excelsa*), brown bear (*Ursus arctos*) and cave bats as their habitat. A very small part of the actions has been realized.

Implementation of reintroduction of extinct species. Only several modest reintroduction examples of extinct

species can be mentioned. Part of the reintroduction activities have been analyzed as part of the "Project for ex-situ conservation and reintroduction of Zingel balcanikus (Karaman 1937) into the water of N. Macedonia" by the Macedonian Fishing Federation (MFF) and the Association of leasure fishing Vardar Skopje, financed by UNDP/GEF. The main goal of the research was to see if this type of fish is still present in the waters of R.N. Macedonia, and if not, to prepare actions for its reintroduction.

Implementation of *ex-situ* conservation of autochthonous wild species. Oftentimes, the work with wild species includes finding devasted remains of rare or endemic plant species, or hurt or dead animals. These cases are being solved separately using the facilities of the Faculty of Natural Sciences and Mathematics, the Natural History Museum of RN Macedonia, the Zoological Garden in Skopje, or private veterinary clinics.

Initial examples of *ex-situ* conservation have been done by moving *Astragalus physocalix* samples to the Botanical Garden in Skopje and keeping seeds in the gene bank. The transfer of samples to the Botanical Garden was done successfully and the situation is being monitored. Activities for *ex-situ* conservation have been undertaken in NP Pelister and NP Galichica by construction/establishment of arboretums for important wild plant species found in the two parks. However, on a national level, the appropriate infrastructure is still lacking, as is the expert knowledge on implementation of *ex-situ* conservation of autochthonous wild plant and animal species. The initial activities taken to tackle this status should be helped by appropriate funding programs, which will enable long-term functionality of these institutions.

Conservation of habitats

From the aspect of Conservation of habitats in the Republic of North Macedonia in the period 2015-2020, there are two main areas of activity:

1) Specific habitat types (specific type of forests, swamp and riparian habitats etc.) by definition and implementation of measures for protection, conservation and/or revitalization.

1.1 Identification of forest and non-forest habitats with high natural value and definition of measures for their protection and conservation. As part of the GEF/UNEP project "Achieving Biodiversity Conservation through Creation Effective Management and Spatial Designation of Protected Areas and Capacity Building, Component 2", activities for the identification of forests with high natural value (FHNV) on a nationl level are ongoing. The criteria for identification of HNV forests in North Macedonia have been defined, by organization of purposeful training with representatives of PE National forests, MoEPP, MAFWE and national parks. The identification criteria have established a basis for the developed monitoring protocol for identification of these forests. The data is in the analysis and database entry phase. On the basis of this data, a study for identification of FHNV and near-virgin forests in RN Macedonia will be prepared. This activity is the closest possibility of action towards forestry practices on a national level and the inclusion of biological diversity in land use measures. Measures for management/protection of 2 pilot areas identified as HNVF will be developed soon.

Mapping important habitats along Prespa Lake was undertaken in 2018-2019 as part of the project for protection of the Prespa Region financed by PONT, and the report with recommended measures for management/revitalization of these important habitats is prepared.

As part of the EU Twinning project "Strengthening the capacities for effective implementation of the acquis in the field of nature protection" during preparation of valorization studies of the Natura 2000 part for National Park Pelister and Natural Monument Prespa Lake, an identification of habitats from Annex 1 of the EU Habitats Directive was done. Through field activities, new types of habitats have been identified, present in both protected areas, which are also of EU protection interest. These activities have led to an upgrade of the Draft National List of Habitats from Annex 1 of the Habitats Directive.

1.2 Restoration of habitats. Specific plans for restoration of key ecosystems in N. Macedonia exist only due to

the activities for restoration of riparian habitats along the Bregalnica River.

As part of the component for restoration of the riparian belt of Bregalnica River, part of the Nature Conservation Programme of North Macedonia, phase II (2019/2020), pilot measures for restoration of this belt have been taken. In December of 2019, a total of 1500 poplar and willow seedlings were planted directly at the belt of Bregalnica River in the vicinity of municipality Shtip and the reach between Soilari – Ubogo villages.

2) On an ecosystem level, by defining and mapping the ecosystem types on a national level and by an analysis of their status

2.1 Identification, mapping and status assessment of ecosystems on a national level.

During the preparation of the NBSAP in 2014, 28 basic ecosystem groups were identified, reaching the third level of EUINIS habitat classification. The process of identification and mapping of ecosystems in the country was finished as part of the Nature Conservation Programme of North Macedonia, phase II. Eight main ecosystem types have been mapped, which include 22 subtypes. The ecosystem status is assessed for 15 of the ecosystem subtypes (natural and seminatural), i.e. 7 subtypes belonging to the anthropogenic ecosystems have not been assessed. The ecosystem status assessment has been done for the whole territory of the country, using 10km*10km UTM network as a spatial unit. Furthermore, on the territories of the three national parks, and for 2 areas proposed for protection (Protected area "Osogovo Mountains" and National Park "Shar Mountain") a more precise ecosystem subtype status estimate has been done, using 5km*5km UTM network as a spatial unit.

Conservation of agrobiodiversity

The biodiversity in agriculture is comprised of the local variants and populations of crops, as well as native livestock breeds. In R.N. Macedonia, many native agricultural plant species and populations are still being cultivated. The conservation of agrobiodiversity is the subject of several laws whose implementation is under competnecies of the Ministry of Agriculture, Forestry and Water Economy. The Law on Agriculture and Rural Development prescribes the manner of monitoring and analyzing the conditions and measures for conservation of autochthonous varieties of crops and breeds of domestic animals based on their extent of threat and prohibition of their extinction. The Law on Seed and Seeding Material regulates the operation of the Gene Bank. Informatio about the status and potential change of the existing diversity of PGRFA and activities for conservation of autochthonous and local varieties of plant genetic resources for food and agriculture (PGRFA) in gene banks are presented in Chapter 3, NT-5 and NT-13, and indicators 5.3 and 13.1 in the Annex.

The Law on Animal Husbandry defines 11 autochthonous breeds and/or lines of domestic animals. It gives a legal basis for the preparation of the Programme for conservation of biodiversity in domestic animals (prepared for the period 2013-2017 and continuing for the period 2018-2024). More information about the conservation of agrobiodiversity is provided in Chapter 3, NT-5 and NT-13, and indicators 5.4 and 13.2 in the Annex I.

The GEF Small Grants Programme (Action for conservation of biological diversity) in the period 2005-2018, has supported over 40 local projects in the field of biological diversity, most of which are aimed at agrobiodiversity (e.g. Conservation of the Macedonian honey bee population, Busha cattle, domestic goat, sheep Pramenka, shepherd's dog Sharplaninec, different species of fruit crops etc.)

To which National target and Aichi Biodiversity Target(s) this measure contributes

The measure contributes towards the achievement of NT-3, NT-5, NT-10, NT-12, NT-13, NT-14, NT-15 and NT-16.

This measure is directly related to the achievement of Aichi Targets 2, 5, 7, 12, 13 and 17 and indirectly to targets 3, 10 and 18.

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes:

☐ Measure taken has been effective

■ Measure taken has been partially effective

☐ Measure taken has been ineffective

☐ Unknown

Withing the framework of this group of actions, there is partial realization on a national level, which is the result of the lack of expert and institutional capacities, lack or nonexistence of financial instruments (especially significant for infrastructural actions), as well as dedicated resources to ease the process. It is notable to take into account that a large part of the actions has been implemented on a national level.

The assessment has been done by taking into account the implemented activities for the preparation of national red lists, action plans for protection of autochthonous wild and domestic animals and plant species, but the implementation of activities is required to continue. On the other hand, there is a lack of resources allocated for conservation and restoration of endangered habitats.

Relevant websites, web links and files

http://redlist.moepp.gov.mk/

https://www.iucnredlist.org/species/68986842/68986849

http://www.gefsgpmacedonia.org.mk/proekti.html

https://drive.google.com/file/d/0B2QUW-yX9KNATDZsbVBOZVk4Yzg/view

https://drive.google.com/file/d/0B2QUW-yX9KNAeGhVV3lnRVdSSm8/view

https://www.cms.int/raptors/en/publication/multi-species-action-plan-conserve-african-eurasian-vultures-vulture-msap-1

http://www.gefsgpmacedonia.org.mk/proekti.html

http://www.bregalnica-ncp.mk/?lang=en

https://tinyurl.com/sjljeqv

https://drive.google.com/file/d/0B2QUW-yX9KNAZVNQTGx2MEV1S0E/edit

https://docs.google.com/file/d/0B2QUW-yX9KNAcWtVN244bmZmeUk/edit

http://www.gefsgpmacedonia.org.mk/dokumenti/BR_Aronija_stari_ovoski.pdf

http://www.gefsgpmacedonia.org.mk/dokumenti/letok_stari_jabolka_i_krusi.pdf

https://drive.google.com/file/d/0B2QUW-yX9KNAT0NSUllEQUlkQmc/view

https://drive.google.com/file/d/0B2QUW-yX9KNAaXZSemJjSHZJcGc/view

https://docs.google.com/file/d/0B2QUW-yX9KNAczlBTHI5cW0tNmc/edit

https://docs.google.com/file/d/0B2QUW-yX9KNAdEJ4YVYxZ1FSNE0/edit

https://docs.google.com/file/d/0B2QUW-yX9KNANDlSbVNNeEpwWnc/edit

https://drive.google.com/file/d/0B2QUW-yX9KNAU2RRdFhZb1h6OTA/edit

http://www.gefsgpmacedonia.org.mk/dokumenti/brosura_bukovska_piper.pdf

https://drive.google.com/file/d/0B2QUW-yX9KNAMUxFX21uOFhRREU/view

https://drive.google.com/file/d/0B2QUW-yX9KNAZzNsamFQbkE5RDg/view

http://www.gefsgpmacedonia.org.mk/dokumenti/BR_Slou_Fud_Balkanska_koza.pdf

http://www.gefsgpmacedonia.org.mk/dokumenti/BR_Slou_Fud_kozarstvo.pdf

http://www.gefsgpmacedonia.org.mk/dokumenti/BR_Slou_Fud_kozjo_sirenje.pdf

http://www.gefsgpmacedonia.org.mk/dokumenti/BR_BUSHA_domasno_magare.pdf

https://docs.google.com/file/d/0B2QUW-yX9KNATEZVMzFOeWU5S0k/edit

https://drive.google.com/file/d/0B2QUW-yX9KNAYXozRFpHN09lZ0k/edit

https://drive.google.com/file/d/0B2QUW-yX9KNAMENwYUl2OFZzaW8/edit

https://drive.google.com/file/d/0B2QUW-yX9KNAU3NDTVNlZGFGUWc/edit

https://drive.google.com/file/d/0B2QUW-yX9KNANEg3Q2dESjR5TVk/edit

https://drive.google.com/file/d/0B2QUW-yX9KNAWEFydkpyeXhUZDQ/edit

http://www.gefsgpmacedonia.org.mk/dokumenti/BR_Egri_svinja.pdf

Other relevant information

The red lists for reptiles and amphibians, the action plans for the Balkan lynx and the African-Eurasian vultures, the forests with high natural value and the riparian habitats are developed as case studies (rarely even as indicators) in Chapter 3 of this report.

Also, more information on *ex-situ* conservation of the autochthonous species/varieties as well as the autochthonous livestock species are presented in Chapter 3, national target 5.

More information on identification, mapping and status of ecosystems is presented in Measure 6 (ecosystem services) of this report.

Obstacles and scientific and technical needs related to the measure taken:

- Lack of capacities (expert and institutional)
- Lack of funding and instruments for funding of actions for protection of the abovementioned habitats and infrastructural actions (stationaries for wounded animals and for reintroduction, as well as *ex-situ* capacities).

2.8. Measure 8

Measure 8. Increase and improve the network of protected areas

A large number of activities have been realized in the period 2015-2020 related to protected areas, improvement of management, promotion of values as well as the identification of proposed Natura 2000 sites.

Increase the network of protected areas

Since the designation of the first national park in 1948 and until now, 86 areas covering 230,083 ha or around 8,9% of the territory of the Republic of North Macedonia are included in the network of protected areas. The largest part of the surface (around 4,5%) belongs to the three national parks Pelister, Mavrovo and Galichica.

Although since 2014, the number of protected areas and the surface they cover has remained the same, several procedures for the designation of new protected areas and re-designation of protected areas have been started, which will mean progress towards achievement of the national target to increase the surface of protected areas to 15%. Information about the number and surface of protected areas by category in the country are presented in the indicator 11.1 in the Annex I.

Through the "Nature conservation programme in North Macedonia – phase II", activities were undertaken related to the preparation of required documentation for designation of part of Osogovo Mountains as a protected area in the category protected landscape (category V, IUCN). Furthermore, the preparation of the required documentation for designation of part of Maleshevo Mountains as a protected area is underway. Activities for the designation of a part of Shar Mountains as a national park (category II) have been initiated, and the required documentation has been prepared through the UNEP/GEF project "Achieving Biodiversity Conservation through Creation and Effective Management of Protected Areas and Mainstreaming Biodiversity into Land Use Planning". Also, the required documentation for designation of Vodno as a protected area has been prepared as part of the EU/UNDP project "Improving the Management of Protected Areas". Municipality Ohrid has supported the preparation of the required documentation to designate Studenchishte Swamp as a protected area. Preparation of Valorization study for the Nature Monument-Dojran Lake has been supported by REC.

As an additional nature protection model, prescribed in the Law on Nature Protection, seven natural rarities have been designated: Oriental plane (Platanus orientalis), Morodvis, Pubescent oak – v. Beli, Black mulberry – Lesnovo, Specific geological profile - Zvegor, Paleontological site - Stamer and Kiselichka cave. Furthermore, the old Platan Chinar in Ohrid has also been designated as a natural rarity.

The "Programme for nature conservation in North Macedonia" has been supporting the designation of natural rarities through financial help for the preparation of the analysis of valorization of natural rarities in the East Planning Region. More information about the trend in designation of natural rarities are presented in the case study- 11.4 in the Annex I.

Improving the management of protected areas

Different activities for strengthening of capacities of the bodies managing protected areas have been undertaken with the support of several EU funded projects, such as: the EU twinning project "Strengthening the capacities for effective implementation of the acquis in the field of nature protection", the EU/UNDP project "Improving the Management of Protected Areas", projects supported by the Prespa-Ohrid Nature Trust (PONT), etc., which have included the procurement of appropriate equipment for efficient implementation of the prescribed measures, strengthening capacities of PAs, training for monitoring of species and habitats, etc.

Progress has been made in the preparation of management plans of protected areas. The Management Plan for Natural Monument Vevchani Springs was adopted in 2019. The same year, the Management Plan for NM Markovi Kuli was prepared, and its adoption procedure is underway. A Management Plan for NM Prespa Lake was prepared in 2019, and the adoption procedure is underway. The preparation of new management plans for NP Pelister and NP Galichica is underway. In order to assess the effectiveness of the management of protected areas, we have been using the METT tool, which has been providing good guidelines for improvement of the management of protected areas. More information about the number of prepared and adopted management plans are presented in indicator 11.2 in the Annex. Also the effectiveness of current management of PAs in the country have been scored with the METT tool and resented in the indicator 11.5 in the Annex I.

Management plans for Natura 2000 parts of NP Pelister and NM Prespa Lake have been prepared, as part of the EU Twinning project "Strengthening the capacities for effective implementation of the acquis in the field of

nature protection". In accordance with the Law on Nature Protection, the adoption of spatial plans is obligatory for national parks. A draft Spatial Plan for NP Pelister was prepared in 2019, but it requires harmonization with the new zoning. A draft Spatial Plan for NP Mavrovo was prepared in 2015, but it requires harmonization with the new adoption act. A draft Spatial Plan for NP Galichica was prepared in 2015, but needs to be reworked.

Natura 2000

The implementation of the provisions from the EU Birds and Habitats Directive and the establishment of the Natura 2000 ecological network is one of the obligations in the EU accession process. In the past few years, these potential Natura 2000 sites have been identified: three (3) special protection areas (SPA) according to the Birds Directive (Dojran Lake, Ohrid Lake, Prespa Lake), six (6) Sites of Community Importance (SCI) according to the Habitats Directive (Mavrovo, Jakupica, Ovche Pole, Ubavica Cave, Galichica, Pelister) for which the Standard Data Forms (SDF) for Natura 2000 have been completed, and Shar Mountain, Mariovo and Kozuf have been identified as areas with high natural potential as part of the project "Strengthening the capacities for implementation of Natura 2000". Furthermore, during 2018-2019, three (3) more potential Natura 2000 sites have been identified in the East Plan Region (Lower Bregalnica, Ovce Pole, and Chengino Kale in the Maleshevo Mountains), as part of the Nature conservation programme, phase II, for which the SDF will be completed.

Through the twinning project "Strengthening the capacities for effective implementation of the acquis in the field of nature protection", an inventory of habitats and species of EU importance was prepared. The standard forms for Natura 2000 in NP Pelister and Natural Monument Prespa Lake have been revised with new data. Additionally, a Natura 2000 SDF was completed for Golem Grad Island.

In order to harmonize the national legislation to EU acquis, a new Law on Nature and drafts of the following bylaws in regards to the establishment of the Natura 2000 network have been prepared:

- Draft Rulebook for form and content of SDF for Natura 2000 sites,
- Draft Charter for List of European habitats and European species, including priority European habitats and priority species, which require designation of European areas and a List of Birds, which require designation of European bird areas,
- Draft Rulebook for the contents and procedure of appropriate assessment (AA) of the impacts from a plan or project which is not directly related or necessary for the management of the proposed or designated European area and/or the European Birds Area. The bylaws will enter into force when the country becomes a member of the EU,
- Number of identified Natura 2000 sites,
- Draft Rulebook for the establishment of a National Information System for Nature (NISN).

Towards further implementation of the EU Birds and Habitats Directive, the following drafts have been prepared:

- Draft National List of Habitats in Annex I of the Habitats Directive,
- Draft National List of Plant and Animal Species, listed in Annex II of the Habitats Directive for each of the two biogeographical regions (continental and alpine), and
- Draft National List of Bird Species from Annex I of the Directive for birds, migratory birds and other important birds which regularly appear in the country.

More information regarding the number and surface of identified potential Natura 2000 areas are presented in indicator 11.3 in the Annex.

International protected areas

The network of protected areas in the Republic of North Macedonia includes areas with international importance from the Ramsar List and UNESCO areas.

The transboundary biosphere reserve Ohrid-Prespa was designated by UNESCO in 2014, as part of the "Man and the Biosphere Programme". The biosphere reserve of protected areas in R. of N. Macedonia includes: NP Galichica, NP Pelister, NM Prespa Lake, Park of Nature Ezerani, NM Ohrid Lake and NM Vevchani Springs.

Two areas from R. of N. Macedonia have been nominated as Ramsar sites (Prespa Lake and Dojran Lake). In 2019, a draft application for nominating Ohrid Lake and Studenchishte Swamp to join the World Ramsar list.

In 2019, the UNESCO initiative for designation of old beech forests in Europe includes Republic of North Macedonia, by nominating the "Dlaboka River" site in NP Mavrovo to the Preliminary List of UNESCO.

The Preliminary List of UNESCO from R.N. Macedonia also includes NM Markovi Kuli and NM Cave Slatinski Izvor (2004). A Management Plan for NM Markovi Kuli was prepared in 2019 and is in adoption phase, whereas a valorization of natural values has been prepared for NM Cave Slatinski Izvor. This measure contributes for implementation of NT-15 and more information about the transboundary protected area are presented in the indicator 15.1 in the Annex I.

For the implementation measure, please indicate to which national or Aichi Biodiversity Target(s) it contributes

The measure for the increase and improvement of protected areas is directly related to NT-11, and indirectly contributes towards the achievement of NT-10, NT-12, NT-5, NT-14 and NT-16.

This measure is related to Strategic Goal C from the Global Biodiversity Strategy, Aichi 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.

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes:

☐ Measure taken has been effective

☒ Measure taken has been partially effective

☐ Measure taken has been ineffective

☐ Unknown

In the assessment for this measure, the following indicators have been considered: trends in number and surface of protected areas, trends in adopted management plans for protected areas, trends in surface of identified potential Natura 2000 sites, trends in designation of natural rarities and trends in effectiveness in management of protected areas which were elaborated in Chapter 3.

Taking into consideration the realized activities related to the increase of the protected areas network and the improvement of their management, as well as the identification of Natura 2000 sites, the progress regarding this topic on a national level is evident from several aspects. The assessment is lower, because in the past 5 years, despite the efforts and actions by the MoEPP, a new protected area has not been designated. A greater inclusion of biological diversity protection in other sectors is required, in order to make progress in increasing

the protected area percentage, but also making sure legislation for nature protection is followed, and in that regard also for the protected areas in other sectors (forestry, agriculture, energy, economy, transport, tourism, etc.).

Nature conservation programme in North Macedonia http://www.bregalnica-ncp.mk/

Natura 2000 (www.natura2000.gov.mk

National Biodiversity Strategy and Action Plan for the period (2018-2023)

http://www.moepp.gov.mk/wp-content/uploads/2014/12/NATIONAL-BIODIVERSITY_MKD.pdf

National Strategy for Nature Protection (2017-2027)

http://www.moepp.gov.mk/?page_id=3197

Other relevant information

The ecosystem services concept is relatively new in Europe, but there is interest for its implementation in our country's protected areas in order to improve their management. The "Study for sustainable use of reed in the Prespa Region" from 2019, analyzes the sustainable use of reed and its market value, which is indirectly related to the ecosystem services concept and should help the Municipality of Resen to improve the management of Park of Nature "Ezerani". The ecosystem services part is listed in other studies such as the Socio-economic study for proposed protected area National Park Shar Mountain (2019) and the Valorization Study for the protected area Park forest Vodno (2019).

Obstacles and scientific and technical needs related to the measure taken:

In order to acquire the required documentation for designation of an area as protected, a high number of experts are needed and the undertaking of different field activities as well, which requires appropriate resources most often obtained from foreign donations.

Designation of areas depending on protection category is done by enactment of a law in a Parliamentary Procedure for categories 1-4 or by a decree of the Government of the RNM for categories 5-6. The process of designation of protected areas requires the involvement of all stakeholders since the initial activities in the designation procedure. Different stakeholders often have different interests and attitudes about the designation of a protected area, especially regarding outside borders and the spread of zones. The harmonization of all stakeholders is a complex and difficult process and together with securing appropriate subjects for management of the protected areas possessing financial and human resources, present the greatest challenges which can slow down the process of designation of protected areas.

In terms of management, several areas have nominated subjects for management but are lacking capacity, and several areas do not have a subject in charge of management at all; furthermore, the process of creation of management plans should be intensified, which requires appropriate resources.

2.9. Measure 9

Measure 9. Research and monitoring of biological diversity

In the Republic of North Macedonia, in general there is a lack of data on the status of biodiversity which should provide a solid basis for prescription of appropriate conservation and restoration measures.

Research of biodiversity

Progress in regard to research in the past 5 years has been made from several different biological diversity aspects.

In 2016, the Study on Geodiversity and Geological Heritage of the Republic of North Macedonia and other components of nature (Biological and Landscape Diversity) was prepared, which includes relevant scientific data for the mentioned thematic areas and for the first time, it analyzes landscapes as well. The Study was prepared by national experts in coordination by the MoEPP and was used as the scientific basis for the preparation of the National Strategy for Nature Protection.

Over 100 new species for science from the Republic of North Macedonia have been described (see Chapter III, National Target 18), as well a large number of new flora and fauna findings. Additionally, many new phytocenoses have been described. The scientific papers on the spread and ecology of allochthonous species in the aquatic and land ecosystems are also of note. All these scientific achievements are the result of different applicative projects, especially the undertaken valorization studies for designation of new protected areas. From the monography editions, we should mention the ground beetle species catalogue (Coleoptera, Carabidae), as well as the monography on spiders in the Osogovo Mountains.

The Macedonian Academy of Sciences and Arts (MASA) issues the "Flora of the Republic of N.Macedonia" which includes systematic research of vascular plants on the territory of RN Macedonia. Unfortunately, in the analyzed period, a new volume of the Flora of the Republic of North Macedonia has not been published.

Several regular scientific journals are published in the country:

- The Institute for Biology at the Faculty of Natural Sciences and Mathematics in Skopje (University "Ss. Cyril and Methodius) publishes a scientific journal, which in these past few years has been irregularly published and with little scientific papers. In the course of 2013, 5 papers were published, in the period 2014-2015 the number of papers was 7, whereas in 2016-2017 the total was 21 papers.
- MASA, a Section of natural, mathematical and biotechnical sciences publishes the journal PRILOZI – Contributions twice a year. The Journal publishes original scientific works, short communiques, reviews, scientific papers and educational papers of all areas of the natural sciences – physics, chemistry, biology, geography, geology, mathematical sciences – mathematics, informational science, biotechnical sciences – agriculture and food, forestry.
- The reissuing of the journal Acta Musei Macedonici Scientiarum Naturalium by the Natural History Museum of North Macedonia should be noted. This journal has published data from the collections in the Museum of ground beetle species (Carabidae) and birds, as well as other floristic and faunistic contributions.
- The Macedonian Journal of Ecology and Environment (MJEE) is regularly published twice a year, containing scientific papers for that area.
- The Hydrobiology Institute and the Institute of Biology at the Faculty of Natural Sciences and Mathematics – Skopje, publishes their periodic scientific journals at an irregular interval. The situation is similar with the editions in the field of forestry, agriculture and animal sciences.

A draft referential list – List of identified habitat types and species in accordance with the Birds and Habitats Directive and also the first potential Natura 2000 sites in the North Macedonia have been identified, explained in detail in the Measure 8.

Unfortunately, in the past 5 years, not a single scientific-research project has been financed by the Ministry of

Education and Science. As such, we cannot list any significant national research projects. In this context, we may only mention the cooperation between the science academies from North Macedonia and Bulgaria and the flora research on the mountains Galichica (North Macedonia) and Slavyanka (Bulgaria). The endemic flora of the Balkan Peninsula in Serbia and North Macedonia is also a bilateral project of the Macedonian Academy of Sciences and Arts with the Serbian Academy of Sciences and Arts.

The Ministry of Environment and Physical Planning supports activities through the Annual environmental investment programme, where scientific-research projects for biological diversity are partially supported.

The continuous activity of the Biology Students Research Society since 1996 should be noted. In the past 5 years, 15-day research camps have been organized on Pelister, Shar Mountain, Jakupica and Deshat, with 30-40 young researchers participating.

In 2016, the 5th Congress of Ecologists of N.Macedonia with International Participation took place, with around 300 participating researchers from N.Macedonia and the neighboring countries. In several sections of the Congress, different aspects of biological diversity were encompassed (*population, communities and ecosystems; hydrobiology, management and monitoring of waters, biodiversity and conservational ecology, forestry and agriculture, urban ecology, management of natural resources, environmental education,* etc.).

Scientific data on biological diversity can be found in the valorization studies for Shar Mountain, Osogovo Mountains, Maleshevo Mts., Studenchishte Swamp, Vodno and in the Study for revalorization of Pelister National Park.

Implementation of biodiversity monitoring

The Department of Nature at the MoEPP is the competent authority for implementation of biological diversity and geo-heritage monitoring, and takes protection and conservation measures in accordance with the Law on Nature Protection (article 154) which stipulates the adoption of monitoring methodology. As part of the EU Twinning project "Strengthening the capacities for effective implementation of the acquis in the field of nature protection", a guidebook/manual for monitoring protocols of selected habitats and taxonomic groups of species was prepared. These protocols will be used by all subjects and experts when implementing monitoring of biological diversity on a national level in future.

At present, the biodiversity monitoring is mainly conducted by several scientific institution, some of the management authorities of protected areas, several NGOs whose main goal is nature conservation (Conservation NGO-s) with the support of different international projects, and we point out the following:

- Monitoring protocols for 20 habitats, 20 plants and animals and 20 bird species have been prepared via the EU Twinning project "Strengthening the capacities for effective implementation of the acquis in the field of nature protection".
- As part of the GIZ project: Conservation and Sustainable Use of Biodiversity at Lakes Prespa, Ohrid and Shkodra/Skadar (CSBL), monitoring of the habitats and species of EU and national importance of Ohrid and Prespa Lakes was implemented. Monitoring of two wetland habitats, the otter, eight species of aquatic birds, four species of dragonflies and two species of amphibians in the course of 2017 was done. A manual for monitoring of lake species and habitats of the Prespa and Ohrid Lakes was prepared.
- A monitoring of large carnivores (2019-2020) is being implemented in NP Pelister, whereas in NP Galichica, a multiyear monitoring of selected 4 habitat types and 32 species is being done, and the monitoring activities are ongoing.
- As part of the Balkan Lynx Recovery Programme (with the focus on NP Mavrovo and its surroundings), a multiyear monitoring of the Balkan lynx is being implemented by an NGO Macedonian Ecological

Society and NP Mavrovo in cooperation with state authorities.

- Through an EU/UNDP project for the improvement of monitoring of protected areas (Grant scheme), a Manual for monitoring of key fungi species, plants and animals and key habitat types was prepared for the Natural Monument Vevchani Springs (2019).
- In the Prespa Region, monitoring of several species of plants, amphibians and reptiles, birds and mammals is being implemented, as well as important habitats on a transboundary level by several NGOs (PrespaNet) in cooperation with the management authorities of protected areas in the region (NP Pelister, NP Galichica, NM Prespa Lake and PN Ezerani) and with financial support by PONT and other donors.
- The monitoring of birds is supported by several projects implemented on a national and transboundary level in cooperation with different partners. More information is given in Chapter 3, NT-12 and NT-15.

As a member of the European Environment Agency, the Republic of North Macedonia reports about the environment status annualy on the basis of selected national indicators, which include three biological diversity indicators. On the basis of the indicators, a publication Environmental Statistic is prepared and delivered every two years by the State Statistical Office in cooperation with MoEPP.

Detailed information about the prepared species and habitats monitoring programmes in the past five-year period, as well as the realized species and habitats monitoring activities have been presented in Chapter 3, NT-14, where the indicators for a number of prepared key species and habitats monitoring protocols and monitoring trends have been presented, including Natura 2000 habitats too; in NT-15 the case study for established transboundary monitoring of the Balkan lynx is presented. The implemented activities for plants monitoring are presented in Chapter 5.

National Information System for Nature

Despite years long effort, a National Information System for Nature is yet to be established. Activities which will help in the establishment are underway. A Draft Rulebook for the Establishment of a National Information System for Nature has been prepared (which will be adopted when the new Law on Nature enters into force), as well as a Draft Rulebook for exchange of biological diversity data. Technical and software support is required in its establishment. A regional Biodiversity information management and reporting Guide (BIMR) was prepared in cooperation with the Open Regional Fund for Biodiversity (ORF BD), aimed at improving institutional capacities so that they are in accordance with the reporting requirements to the Convention on Biological Diversity and other EU requirements (e.g. the Natura 2000 network), through the development of regional guidelines.

Monitoring of forests

Complete monitoring of forest habitats and species living in them (forest biodiversity) is not fully implemented, because the monitoring is primarily directed towards forest diseases and insects causing calamitous occurrences and serious forest damage, i.e. it is mainly directed at the forest as a resource. The monitoring is done by the Faculty of Forestry and the Public Enterprise National forests. In the future, it is necessary to extend the monitoring to cover the biodiversity aspect.

Regarding forest fires monitoring, a modern early warning and notification system has been implemented, under the authority of the Crisis Management Center.

Monitoring of water, ambient air and soil

The monitoring of all *aquatic ecosystems* is regulated by the Law on Waters, and falls under the authority of the National Hydrometeorological Service in Skopje and the Hydrobiological Institute in Ohrid. There is an ongoing

transformation of the monitoring in the last few years, due to the requirements of the EU Water Framework Directive. Long-term training for monitoring of physical, chemical and biological parameters has been undertaken. Several pilot projects have been implemented, and the activities for monitoring of the Strumica River basin and Bregalnica River basin are particularly important.

A Study of the quality of waters and sediments from the river basins in the Republic of North Macedonia has been prepared on the basis of the quality of river water and sediments of main river basins in R.N. Macedonia. Many chemical elements haven been analyzed from samples taken from several sampling sites, as well as river sediments and alluvial sediments (soils). The following river basins have been explored: the rivers Vardar, Bregalnica, Crna Reka, Pcinja, Strumica and Crn Drim, and the main river pollution sources from potentially toxic elements have been identified, alongside the pollution size. A Macedonian Water Information System (http://wis.moepp.gov.mk/) has been prepared.

A continuous monitoring of the *ambient air quality* is being done in city centers throughout RN Macedonia. Collection and analysis of data on air emissions is done continuously throughout the year as part of the work done by the Macedonian Environmental Information Center at the MoEPP, managing the State Automatic Ambient Air Quality Monitoring System, comprised of 17 stationery and one mobile monitoring station. An Emission inventory of all air pollutants for 2017 has been prepared, with a complete emission trend for the period 1990-2017, as well as a Report on national inventories in accordance with the Guidelines by EMEP/EEA and delivered to the European Environment Agency (EEA) and to the UNECE Secretariat. Throughout 2019, the Inventory for 2018 was actively prepared for all sectors and pollutants. The air pollution analyses were done by the Faculty of Chemistry, Faculty of Natural Sciences and Mathematics – Skopje, by using moss as bioindicator, and the collection of mosses as samples in RN Macedonia in 2002, 2005, 2010 and 2015. The results have been implemented into the Study of heavy metal air pollution in the Republic of North Macedonia.

Soil monitoring has not been established and the Law on Soil Protection has not been adopted yet (a draft has been prepared). The first Geochemical atlas of the Republic of North Macedonia was prepared for the assessment of the soil quality (prepared by the Faculty of Chemistry, Faculty of Natural Sciences and Mathematics – Skopje). This atlas describes the basic geochemical soil properties and an analysis of the findings has been done. A Macedonian Soil Information System has been prepared with the support of FAO, containing 61 maps in 1:50.000 scale and a legend.

More information on the quality of waters and soils and the bio-monitoring of air pollution have been presented in Chapter 3, NT-6 and indicators 6.1, 6.2 and 6.3 in the Annex I.

To which National target and Aichi Biodiversity Target(s) this measure contributes

The measure for research of biological diversity and monitoring of biodiversity components is directly related to: NT-18, NT-6 and NT-14, but it also indirectly contributes towards the achievement of the rest of the national biodiversity targets.

This measure is directly related to the Strategic Goal E of the Global Biodiversity Strategy: Enhance implementation through participatory planning, knowledge management and capacity building, more specifically Aichi Target 19.

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes:

☐ Measure taken has been effective

■ Measure taken has been partially effective

☐ Measure taken has been ineffective

☐ Unknown

The assessment has been given after taking into account the intensified biodiversity monitoring activities in the past few years, but it is necessary for the activities to continue. On the other hand, not enough funds are being allocated for research projects.

www.moepp.gov.mk
www.natura2000.gov.mk
http://wis.moepp.gov.mk/
http://air.moepp.gov.mk/
https://balkangreenenergynews.com/wp-content/uploads/2018/03/BIMR_ENG_publication_Final-Preview.pdf
http://manu.edu.mk/contributions/NMBSci/index.html
www.mjee.org.mk
www.acta.musmacscinat.mk-index.php/acta/index
https://idsbiolozi.com/
http://www.pmf.ukim.edu.mk/PMF/Chemistry/members/stafit.htm
https://icpvegetation.ceh.ac.uk/
http://www.pmf.ukim.edu.mk/PMF/Chemistry/members/stafit.htm
https://www.researchgate.net/profile/Trajce_Stafilov
https://www.researchgate.net/project/GEOCHEMICAL-ATLAS-OF-THE-REPUBLIC-OF-MACEDONIA
http://www.maksoil.ukim.mk/masis/

Other relevant information

Obstacles and scientific and technical needs related to the measure taken:

- Lack of institutional capacities, national expertise
- Nonexistence of central, shared base of available data
- Lack of finances or discontinued finances
- The Ministry of Education and Science has not financed a single scientific-research project
- A continuous biological diversity monitoring on a national level has not been established.

3. Section III. Assessment of progress towards each national target, presented in regular template

3.1. National target 1

Strategic goal A: Address the underlying causes for biological diversity loss through its mainstreaming across the society

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

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☒ On track to achieve target

☐ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

Numerous public awareness activities were undertaken by the Ministry of Environment and Physical Planning. In most of the cases, public awareness activities were targeted to different aspects of biodiversity (Natura 2000, ecosystem services, protected areas, etc.) and some of them were based on the surveys of the awareness level on the specific topic. National parks administrations undertook different education activities concerning nature protection. Efforts, has been done to the establishment of Natura 2000 network in the country, include development of a Program for public information and consultation and implementation of different activities/campaigns on a different levels There is a long list of international environmental days that are celebrated throughout the year, many events were organized by the MoEPP, protected areas administrations and NGOs.

However, such activities were also implemented by many civil society organizations in the frames of different projects. General public and specific stakeholders were engaged in these activities. The most intensive public awareness campaigns were undertaken in the process of establishment of new protected areas (e.g. Osogovo, Maleshevski Planini, Shar Planina) as well as in the process of identification of Natura 2000 sites, conservation of threatened species (especially Balkan lynx and birds of prey), conservation of specific habitats, etc.

Indicators used in the assessment

Only one indicator was designed for the assessment:

- Number of activities for public awareness implemented by MoEPP

Other tools or ways of assessing the progress

The activities undertaken for the achievement of National target 1, that include both awareness raising and educational activities, are summarized in Chapter II – Measure 1 (public awareness) and Mesure 2 (biodiversity education activities).

Relevant websites, web links, and files

https://www.facebook.com/Natura2000MK

http://www.bregalnica-ncp.mk/

www.npmavrovo.mk

www.galicica.org.mk

http://park-pelister.com/en/

www.vevcani.mk

www.mes.org.mk

www.tourismmacedonia.gov.mk

Level of confidence of the above assessment

☐ Based on comprehensive evidence

☒ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

There were numerous activities implemented but their efficiency was only occasionally assessed.

Adequacy of monitoring information to support assessment

☐ Monitoring related to this target is adequate

☒ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

Assessment of the efficiency of public awareness campaigns is not measured on a national level. Such information was provided only for the Eastern planning region and partially for national parks. The Ministry of Environment and Physical Planning has established Office for Public Communication with two units: Unit for public affairs and Unit for public awareness and education.

3.2. National target 2

Strategic goal A: Address the underlying causes for biological diversity loss through its mainstreaming across the society

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, national and local development plans, etc.)"

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☐ On track to achieve target

☒ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

Mainstreaming the biodiversity policy into economic sector was implemented with activities for public awareness raising among specific target groups (agriculture, rural development, energy) and still should be improved. Supporting agri-environmental measures still missing in practice to encourage farmers to protect and enhance the environment and biodiversity on their farmland. In the reporting period (2014-2018) in the Republic of North Macedonia there is constant increase in the forest areas generally on broadleaved species as well as in mixed forests. The number of killed wolves in the period 2015-2019 trend shows decrease in the number of paid rewards.

Indicators used in the assessment:

- Number of sector development plans and policies incorporating biodiversity and ecosystem services
- Changes in land use in accordance with CORINE Land Cover
- Changes in forest area
- Number of paid rewards for killed wolves

Case study: Comparing NBSAP compliance with a National Strategy for Agriculture and Rural Development (2014-2020)

Other tools or ways of assessing the progress

Activities are described in Chapter II measure 4 (Incorporate biodiversity into the Spatial Plan, national sector strategies and local plans) and measure 5 (Sustainable use of resources). Some indicators presented in the National Targets 5 and 7 are also contributing for the assessment of progress.

Relevant websites, web links, and files

http://app.gov.mk/PP-na-RM-2002-2020.pdf

http://www.economy.gov.mkStrategy_FINAL%20DRAFTpublicConsultations.pdf

http://manu.edu.mk

http://www.economy.gov.mk/

http://www.southwestregion.mk

http://www.macefdrr.gov.mk/

http://www.mzsv.gov.mk/

http://www.moepp.gov.mk/NationalnaStrategijazaVodi

http://www.moepp.gov.mk/Strategija-za-otpad-mak.pdf

http://www.moepp.gov.mk/Nac.plan-za-upravuvanje-so-otpad-2009-2015.pdf

http://www.moepp.gov.mk/Predlog_National_Transportna_Strategija_2018-2030.pdf

http://www.mtsp.gov.mk

http://mtsp.gov.mk/WBStorage/Files/revidirana_str_siromastija.pdf

http://www.economy.gov.mk/TourismStrategyMacedonia.pdf

http://tourismmacedonia.gov.mk/wp-content/uploads/2018/08/Nationalna-strategija-za-ruralen-turizam.pdf

http://www.moepp.gov.mk/Strategija za biodiv.pdf

http://www.moepp.gov.mk

http://www.moepp.gov.mk/wp-content/uploads/2018/03/%D0%9C%D0%9A_NAP.pdf

http://www.unfccc.org.mk/content/Documents/TNC_MK_draft.pdf

http://zdravstvo.gov.mk/wp-content/uploads/2012/12/strategija-klimatski-promeni.pdf

http://www.moepp.gov.mkNationalen-plan-za-zastita-na-vozduhot-2013-2018.pdf

http://www.moepp.gov.mk/wp-content/uplo

http://www.mzsv.gov.mk/NSARD.pdf

Level of confidence of the above assessment

☐ Based on comprehensive evidence

☒ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

There were numerous activities implemented but their efficiency was only occasionally assessed

Adequacy of monitoring information to support assessment

☐ Monitoring related to this target is adequate

☒ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

The State Statistics Office of the Republic of North Macedonia is the only national institution that processes the data. Also, Ministry of Environment and Physical Planning will follow the level of mainstreaming activates across different sectors in the society, thought realized actions from the NBSAB. Because of the complexity of this National Target additional indicators needs to be developed.

3.3. National target 3

Strategic goal A: Address the underlying causes for biological diversity loss through its mainstreaming across the society

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"

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☐ On track to achieve target

☒ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

The Ministry of Environment and Physical Planning receives a share of earmarked revenues from vehicle registration fees. The forestry sector is mostly self-financed, through the sale of timber and primary wood processing. Protected areas (national parks) depend to a large extent on their own generated revenues, such as entrance fees and payments for collection of wood and non-wood forest products. Systemic change to national budget is needed and greater support for financing of the protected areas. The Government amended the Renewable Energy Action Plan until 2025 with vision until 2030 to take into account lower biomass baseline data. Country stimulate solar energy use and has been successfully implementing the activities for realization of a simulative measure by subsidizing part of the expenses for purchased and installed solar thermal collector systems in households. However, the number of small hydro power plants which use preferential tariff for production of electricity is 93 with an installed capacity of 79,629 MW, and compared to other renewable energy sources, they are still big challenge to protect the biodiversity. Subsidies for rural areas and agrobiodiversity are also important part of the incentives in the country.

Indicators used in the assessment:

- Environmental taxes - quantity and purpose

Case study: Premiums and preferential tariffs for production of electricity from photovoltaics

Other tools or ways of assessing the progress

Implemented activities are described in Chapter II, Measure 3 (Institutional and legal framework for biodiversity and financing). Some information about agrobiodiversity supporting programs is presented in National Target 13.

Relevant websites, web links, and files

http://www.economy.gov.mk/

http://www.stat.gov.mk/Publikacii/ZivotnaSredina2019.pdf

https://www.unece.org/fileadmin/DAM/env/epr/epr_studies/ECE.CEP.186.Eng.pdf

www.mafwe.gov.mk

Level of confidence of the above assessment

☐ Based on comprehensive evidence

☒ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

/

Adequacy of monitoring information to support assessment

☐ Monitoring related to this target is adequate

☒ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

The State Statistics Office of the Republic of North Macedonia is the only national institution that processes the data.

3.4. National target 4

Strategic goal A: Address the underlying causes for biological diversity loss through its mainstreaming across the society

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

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☐ On track to achieve target

☒ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

The environmental investments are implemented by several stakeholders in the country, such as the Ministry of Environment and Physical Planning (MoEPP), Ministry of Transport and Communications (MTC), Ministry of Local Self-Government (MLS), Ministry of Agriculture, Forestry and Water Economy (MAFWE), as well as the Ministry of Economy (MoE) in the area of energy efficiency. The Ministry of Environment and Physical Planning has been supporting activities of civil society organizations through the Annual Environment Investment Programme of approximately €1 million, which is divided into grants to municipalities. In 2019 with funds in the amount of 1,593,935 euros for financing and co-financing of projects in the area of environment including biodiversity protection.

In the reporting period Investment from the central budget in the past years for Conservation of biodiversity and nature is growing steadily but is not yet enough. In order to ensure sustainable financing of protected areas at the national level, it is necessary to develop various models for providing funding. Payments for ecosystem service is a new model for financing protected areas which is developing by the country.

Indicators used in the assessment:

- Trends in central budget investments intended to implement the NBSAP

Case study: Provided funds for Protected areas

Other tools or ways of assessing the progress

Assessing was made by analyses of all relevant data in the country. Activities are described in Chapter II, Measure 3 (Institutional and legal framework for biodiversity and financing).

Relevant websites, web links, and files

http://www.stat.gov.mk/Publikacii/ZivotnaSredina2019.pdf

https://www.unece.org/fileadmin/DAM/env/epr/epr_studies/ECE.CEP.186.Eng.pdf

Level of confidence of the above assessment

☒ Based on comprehensive evidence

☐ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

/

Adequacy of monitoring information to support assessment

☒ Monitoring related to this target is adequate

☐ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

The State Statistics Office of the Republic of North Macedonia is the only national institution that processes the data. Data are provide by the Ministry of Environment and Physical Planning other relevant ministries, international donors and NGOs implementing biodiversity related projects in the country.

3.5. National target 5

Strategic goal B: "Reduce direct and indirect pressures on ecosystems and other components of biological diversity"

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 "

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☐ On track to achieve target

☒ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

This national target is very complex and prescribed actions in Biodiversity Action Plan aiming to reduce direct and indirect pressures on ecosystems and ecosystem services they provide. Progress towards the implementation was assessed based on 9 indicators listed below but also other indicators such as land use change and change in forest area presented under national target 2. Incorporation of biodiversity and ecosystem services into sectoral development plans and policies is the first important step (indicator presented under national target 2), but much more efforts are needed for their enforcement. Strengthening of inspectorates is important activity, and even though different activities have been implemented for strengthening Environmental inspectorate in the last few years, more intensive activities should continue in order to be able to deal with different cases of the environment crime.

Indicators used in the assessment:

- Riparian forest changes (area, average belt width, level of connectivity)
- Area of large lowland wetlands
- Trend of conserved autochthonous and local varieties of PGRFA in gene banks
- Cryopreservation of semen
- Areas under organic farming
- Number of game by years and regions
- Fish commercial catch from commercial waters (Prespa, Dojran and Ohrid Lake)
- Number of proceedings for biodiversity inspection and crime
- Number of carp fish farms and carp production in Republic of North Macedonia

Other tools or ways of assessing the progress

Additional information about sustainable use practices in forestry, agriculture and rural development, hunting, fishing, use of pastures and tourism development are presented in Chapter 2, Measure 5.

Relevant websites, web links, and files

http://www.maksoil.ukim.mk/masis/

https://eunis.eea.europa.eu/habitats/1736

http://www.stat.gov.mk/Publikacii/ZivotnaSredina2019.pdf

http://www.sei.gov.mk/index_en.asp

Level of confidence of the above assessment

☒ Based on comprehensive evidence

☐ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

All the indicators are with the satisfactory level of confidence because they are developed based on the GIS and satellite images, scientific long-years expertise, data available in the Faculty of Agricultural Sciences and Food, MoEPP and MAFWE, State Statistical Office and relevant institutes and agencies.

Adequacy of monitoring information to support assessment

☐ Monitoring related to this target is adequate

☒ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

This target will be monitored through regular or periodical review of the available data in the MoEPP, MAFWE, State Statistic Office, and regular od periodical analysis of the GIS and satellite images (e.g. Google Earth maps, ESRI maps, Bing maps, etc.), regular or periodical site investigations. Additional

indicators for management of pastures needs to be developed.

3.6. National target 6

Strategic goal B: "Reduce direct and indirect pressures on ecosystems and other components of biological diversity"

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"

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☐ On track to achieve target

☒ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

The activities related to protection of the environment (air, soil, water) such as pollution prevention of ecosystems, waste management etc., continued at rather slow rate in certain aspects. The knowledge on the soil pollution was significantly improved and some important steps were already undertaken although intensification of activities and funding should be much improved. One of the major achievements was considerable raise of public awareness, especially when air pollution is concerned. As regards the quality of water bodies no significant improvement was noted.

Indicators used in the assessment:

- Soil quality
- Biomonitoring of air pollution
- Trends in the quantity and quality of municipal wastewater discharged after treatment from pollution sources and populations covered by treatment plants
- Percentage of water bodies by ecological status/potential classification in a river basin

Other tools or ways of assessing the progress

The assessment of the progress was based on the four indicators as well as analyses of the implemented projects and other activities in the last 5-years period. These projects relate to measurements of pollution of air, water and soil as well as waste management and more importantly to

direct activities towards pollution reduction.

Relevant websites, web links, and files

www.msksoil.ukim/mk/masis

http://www.moepp.gov.mk/?page_id=16565&lang=en

http://www.moepp.gov.mk/wp-content/uploads/2014/12/MACEDONIAN-WATER-STRATEGY-FINAL-DRAFT-VERSION_10092011_EN.pdf

http://ws.vodamk.mk/

http://www.moepp.gov.mk/?page_id=3967&lang=en

www.undp.org.mk

www.drincorda.org

www.moepp.gov.mk

www.giz.de

www.uhmr.gov.mk

www.uhmr.gov.mk

Level of confidence of the above assessment

☒ Based on comprehensive evidence

☐ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

The topics of environmental pollution are related to biodiversity conservation. However, the science of the environment is very complex topic. Thus, the assessment of the state of the environment was based on other reports produced.

Adequacy of monitoring information to support assessment

☒ Monitoring related to this target is adequate

☐ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

The monitoring system of air and waters is established and certain improvement was noticed (e.g. there is increase in air-monitoring stations; the water monitoring is implemented in compliance with European Water Framework Directive). Nevertheless, we expect significant improvement in the next period. Monitoring of soil pollution should be strengthened considerably.

3.7. Nacional target 7

Strategic goal B: "Reduce direct and indirect pressures on ecosystems and other components of biological diversity"

National target 7: "Develop and implement plans for sustainable production and sustainable consumption for the purpose of natural resources use within safe ecological limits"

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☐ On track to achieve target

☒ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

In accordance with the Law on Nature Protection, the Ministry of Environment and Physical Planning issues licenses for collection, import and export of endangered and protected wild plant species and fungi and their parts. The need to define the conservation status of the species at a national level is ever more growing in the country, also followed by assessments and quantities. The monitoring and the assessment of habitats, the status of the populations and the assessment of the resources at the sites for commercial use should be done in parallel, depending on the species and their distribution. In the report period statistic show the greatest collected and exported quantities of plant resources are the berries of Common juniper *(Juniperus communis*) and Common bearberry (*Arctostaphylos uva-ursi*). The collection of wild plant species and fungi can control through quotas define by the Government for different plant types and fungi which could be established in future.

The planning and management of the forests shall be carried out based on the special forest management plan, forest management programme, and annual forest management plans. In the reporting period most of the forest cuttings are about 91% of broadleaved tree species and the remaining 9% of coniferous species. From the broadleaved species, the biggest amount of harvested tree volume from beech forests. Strengthening of the communication with the local population is required, as well as raising public awareness regarding inappropriate collection of the natural resources.

Indicators used in the assessment:

- Trends in sustainable collection of commercial wild plants and fungi (according to licenses issued)
- Timber harvested by species in the forest, by years

Other tools or ways of assessing the progress

Activities are described in Chapter II, Measure 5 (Sustainable use of resources)

Relevant websites, web links, and files

www.moepp.gov.mk

http://www.mzsv.gov.mk/

http://www.mkdsumi.com.mk/

http://www.stat.gov.mk/

Level of confidence of the above assessment

☐ Based on comprehensive evidence

☒ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

/

Adequacy of monitoring information to support assessment

☐ Monitoring related to this target is adequate

☒ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

Yearly reports for the collected plants and fungi prepared by the MoEPP, yearly reports for CITES also prepared by the MoEPP, Reports from the State Statistical Office.

3.8. National target 8

Strategic goal B: "Reduce direct and indirect pressures on ecosystems and other components of biological diversity"

National target 8: "Develop and establish appropriate policy for recording, control and protection of non-native and invasive species"

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☐ On track to achieve target

☒ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

The topic of invasive species received deserved attention only in the last 5-10 years. Several projects were implemented in this period, capacity of research institutions were considerably improved (e.g. monitoring of Asian mosquito, comprehensive information on non-native plant species and invertebrates was established, ecological data were obtained for fishes in aquatic ecosystems, etc. On the other hand, the situation on the ground is not improving. We witnessed introduction of fish species in rivers and natural lakes, spread of some invertebrate and plant species, etc. However, we believe that the acquired knowledge and awareness on this topic will result in sound conservation activities and further improvement of the capacities to deal with invasive species.

Indicators used in the assessment:

- Introduced fish species (alien/allochtone/non-native/non-indigenous, translocated fish) from the Republic of North Macedonia
- Alien plant species in the Republic of North Macedonia
- Introduced terrestrial invertebrate species from the Republic of North Macedonia

Other tools or ways of assessing the progress

The assessment was performed on the basis of indicators and review of the activities related to non-native and invasive species. These activities were already presented in Chapter II.

Relevant websites, web links, and files

http://www.dojran-info.com/media/studija-valorizacija-dojransko-ezero/Studija-za-valorizacija-na-Dojranskoto-Ezero-Septemvri-2018.pdf

https://www.researchgate.net/publication/225250963_Fish_and_fisheries_of_the_Prespa_lakes

https://www.researchgate.netFish_and_Fisheries_Lake_Ohrid

Level of confidence of the above assessment

☒ Based on comprehensive evidence

☐ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

The newly established indicators and review of the activities in Chapter II cover all of the topics related to non-native and invasive species in the last 5-years period.

Adequacy of monitoring information to support assessment

☐ Monitoring related to this target is adequate

☒ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

Three comprehensive indicators were established in order to monitor the number, distribution, trends, ecology and damages of the non-native and invasive species. We are sure that all of these aspects will be integrated in the new National Biodiversity Information System which will enable information sharing among key stakeholders.

3.9. National target 9

Strategic goal B: "Reduce direct and indirect pressures on ecosystems and other components of biological diversity "

National target 9: "Integrate measures for climate change effects adaptation and mitigation and combat against desertification "

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☐ On track to achieve target

☒ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

The Country has developed several crucial strategies which have a direct link to the climate change effects adaptation and mitigation and combat against desertification, as follows: Strategy for Energy Development until 2040, Strategy for the utilization of renewable energy sources in the Republic of North Macedonia until 2020; Energy Efficiency Strategy in the Republic of North Macedonia; National Strategy for Sustainable Development (2009-2030); National Strategy for Agriculture and Rural Development (2014-2020); National Water Strategy (2011-2041); National Waste Management Strategy (2008-2020); National Transport Strategy.

Due to the fact that desertification is threatening the livelihoods of 1 billion people over the World, and each year 12 million hectares of arable land are lost to drought. As a party of UNCCD, linked to the UNFCC and UN Sustainable Development Goals, such as Goal 15, Target 3, the Country has drafted Land Degradation Neutrality Report on the base of 3 main indicators: a) Land cover changes, b) Land productivity dynamics and c) Carbon stocks (bellow and above ground). These indicators are chosen to be used since they provide a good evaluation of the eco system services arising from the soil, these soil variables give a good hint of soil quality, and a part of the 6 Progress indicators used by UNCCD to

monitor the extent of implementation of obligations defined with the Convention.

Indicators used in the assessment:

- Dynamics in Land productivity
- Renewable electricity
- Forest fires
- GHG Emissions
- GHG Emissions from Agriculture

Other tools or ways of assessing the progress

National Communications on Climate Change and Biennial Update Reports. Up to now, three National Communications (2003, 2008 and 2014) and two Biennial Update Reports (2015 and 2018) have been delivered to the UNFCCC.

Relevant websites, web links, and files

www.stat.gov.mk

www.moepp.gov.mk

www.economy.gov.mk

www.klimatskipromeni.mk

https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

https://www.ipcc-nggip.iges.or.jp/public/2019rf/vol4.html

https://www.ipcc-nggip.iges.or.jp/software/index.html

http://www.unfccc.org.mk/Default.aspx?LCID=246

Level of confidence of the above assessment

☒ Based on comprehensive evidence

☐ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

The information, presented in the indicators are based on the official National data and reporting to the State Statistical Office, EU/EEA, UNFCC, UNCCD etc.

Adequacy of monitoring information to support assessment

☐ Monitoring related to this target is adequate

☒ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

Monitoring system on air emission is established and maintenance by the Ministry of environment and physical planning, as well as the emissions by the industry are monitored and evaluated through the IPPC permits and National air emission Cadaster

3.10. National target 10

Strategic goal C: "Improve the status of biological diversity components to increase the benefits from biological diversity and ecosystem services"

National target 10: "Prevent loss, degradation and fragmentation of natural habitats of national and international importance"

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☒ On track to achieve target

☐ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

In the reporting period, there is significant intensification of activities towards study of natural habitats, their formal protection (under the umbrella of Natura 2000 process) as well as some pilot habitat restoration measures were implemented.

Indicators used in the assessment:

- Riparian Forest Quality (QBR)
- Case study: Revitalization of riparian ecosystems
- Shorezone Functionality Index (SFI)
- Case study: Rehabilitation and improvement of the state road A2, section Kriva Palanka - Deve Bair (Aspects of mammals in a biocoridor)

Other tools or ways of assessing the progress

A review of all of the major implemented activities is presented in Chapter II. Most of them were conducted in the protected areas, especially national parks Galicica, Pelister and Mavrovo as well as in Ezerani Nature Park, Vevchani Nature Monument, etc.

Besides these indicators, an array of other indicators (used for other National targets) were also taken

into consideration (land use changes, forestry, wetlands status, water quality, non-native species per aquatic ecosystems).

Relevant websites, web links, and files

http://www.moepp.gov.mk/wp-content/uploads/2015/01/RBMP_Bregalnica_Final.pdf

https://www.researchgate.net/publication/326246732_SHOREZONE_FUNCTIONALITY_-_OHRID_LAKE_-_Implementing_the_EU_Water_Framework_Directive_in_South-Eastern_Europe

https://www.researchgate.net/publication/326265222_SHOREZONE_FUNCTIONALITY_-_LAKE_PRESPA_-_Implementing_the_EU_Water_Framework_Directive_in_South-Eastern_Europe

Level of confidence of the above assessment

☒ Based on comprehensive evidence

☐ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

The information collected was satisfactory in order to assess the progress towards the prevention of loss, degradation and fragmentation of natural habitats of national and international importance.

Adequacy of monitoring information to support assessment

☐ Monitoring related to this target is adequate

☒ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

The monitoring of the target was based on two newly established indicators (both of them concern riparian vegetation) as well as other indicators related to forests and forestry, different aspects of aquatic ecosystems and wetlands, etc. There is need to establish indicators that will monitor the status of grasslands habitats (hill pastures, mountain pastures, meadows, etc.)

The topic of habitat management is primarily included in the process of identification and designation of Natura 2000 sites in the country. Thus, the monitoring of Natura 2000 may be used to improve the monitoring of the habitat status as well.

3.11. National target 11

Strategic goal C: "Improve the status of biological diversity components to increase the benefits from biological diversity and ecosystem services"

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"

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☒ On track to achieve target

☐ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

Many activities were implemented in the period 2015-2020 related to protected areas, improvement of management, identification of Natura 2000 areas, promotion of natural values and transboundary cooperation.

According to the Law on Nature Protection, the MoEPP has initiated several procedures for the proclamation of new protected areas and the re-proclamation of protected areas which would make progress towards achieving the national target of increasing the area of protected areas to 15%. As an additional model of nature protection, seven natural rarities were declared.

Progress has been made in the process of identification of Natura 2000 areas at national level and by-laws in relation to development of Natura 2000 network were also drafted. Management Plans in relation of chapter for Natura 2000 for two protected areas (National park Pelister and Natural Monument Prespa Lake) were prepared. In order to evaluate the effectiveness of protected areas management in recent years, the METT tool has been used to provide good guidance for improving the management of protected areas.

Capacity building activities of protected area management bodies have been carried out with support from several EU-funded projects and other international donors.

Indicators used in the assessment:

- Trend in the number and surface of protected areas by category (% in relation to total area of the country)
- Trends for adopted protected area management plans
- Trends in surface of identified potential Natura 2000 areas
- Trends in proclaiming natural rarities
- Trend of protected areas management efficiency (METT)

Other tools or ways of assessing the progress

The activities undertaken for the achievement of National target 11 are summarized in Chapter II – Measure 8 (Increasing and improving the network of protected areas).

Relevant websites, web links, and files

http://app.gov.mk/wp-content/uploads/2015/04/%D0%9030104-PP-na-RM-2002-2020.pdf

http://www.moepp.gov.mk/wp-content/uploads/2018/05/STRATEGIJA%20ZA%20BIOLOSKA%20RAZNOVIDNOST%20SO%20AKCISKI%20PLAN%202018_2023.pdf

http://www.moepp.gov.mk/wp-content/uploads/2014/12/%D0%9D%D0%B0%D1%86%D0%B8%D0%BE%D0%BD%D0%B0%D0%BB%D0%BD%D0%B0-%D1%81%D1%82%D1%80%D0%B0%D1%82%D0%B5%D0%B3%D0%B8%D1%98%D0%B0-%D0%B7%D0%B0-%D0%B7%D0%B0%D1%88%D1%82%D0%B8%D1%82%D0%B0-%D0%BD%D0%B0-%D0%BF%D1%80%D0%B8%D1%80%D0%BE%D0%B4%D0%B0%D1%82%D0%B0-2017-2027.pdf

http://www.moepp.gov.mk/wp-content/uploads/2019/04/0301_IndikatorskiIzvestaj2018_MK.pdf

http://www.moepp.gov.mk/wp-content/uploads/2019/04/0301_Indikatori2016_MK.pdf

http://www.moepp.gov.mk/wp-content/uploads/2019/04/0301_Indikatori2014_MK.pdf

https://www.cbd.int/protected/implementation/actionplans/country/?country=mk

http://www.moepp.gov.mk/wp-content/uploads/2014/10/%D0%97%D0%90%D0%9A%D0%9E%D0%9D-%D0%97%D0%90-%D0%97%D0%90%D0%A8%D0%A2%D0%98%D0%A2%D0%90-%D0%9D%D0%90-%D0%9F%D0%A0%D0%98%D0%A0%D0%9E%D0%94%D0%90%D0%A2%D0%90.pdf

http://www.moepp.gov.mk/wp-content/uploads/2015/03/CSI_Biodiverzitet_008_g3_2018EN.jpg

Level of confidence of the above assessment

☐ Based on comprehensive evidence

☒ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

There were numerous activities implemented for protected areas, which are detail describe in Chapter II. All the relevant information was collected and analyzed in order to make the assessment.

Adequacy of monitoring information to support assessment

☒ Monitoring related to this target is adequate

☐ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

The indicator is monitored by MoEPP, Sector of Nature. Environmental indicators reports for EEA preparated of MoEPP provide an overview of the situation/trend with protected areas.

3.12. National target 12

Strategic goal C: "Improve the status of biological diversity components to increase the benefits from biological diversity and ecosystem services "

National target 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"

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☒ On track to achieve target

☐ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

This national target on establishment of the extent of threat to wild species, prevention of the reduction in populations and extinction of affected species, improvement and maintenance of the status of protection, especially for species with populations in decline is very broad topic that was dealt with in many projects in the last five years.

One of the most renowned conservation projects in the Republic of North Macedonia are the once on Balkan lynx (Balkan lynx Conservation Programme) and conservation projects for birds (e.g. Vulture Conservation Project) which established reference and inspired many new conservation activities.

Evident progress was made towards the establishment of national red list of threatened species.

Indicators used in the assessment:

- Balkan lynx population trend in the Republic of North Macedonia
- National Griffon vulture population trends
- National Egyptian vulture population trends
- Population trend of Lesser Kestrel
- White Stork population size and breeding parameters
- National reptile population trends
- National amphibian population trends

Other tools or ways of assessing the progress

The most important activities are presented in Chapter II. All of them were taken into account when assessing the progress towards National target 12. More importantly, the status of the population of threatened species was assessed not only the effort devoted.

Relevant websites, web links, and files

http://redlist.moepp.gov.mk

http://www.lifeneophron.eu/#a-results-of-the-2019-balkan-population-monitoring-the-last-stronghold-holds-strong

Level of confidence of the above assessment

☒ Based on comprehensive evidence

☐ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

The information on the implemented projects as well as status of threatened species was collected for the purposes of this report.

Adequacy of monitoring information to support assessment

☒ Monitoring related to this target is adequate

☐ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

The National Biodiversity Information System should integrate all of the information regarding the status and conservation of threatened species which will enable easy and reliable monitoring in the future.

3.13. National target 13

Strategic goal C: "Improve the status of biological diversity components to increase the benefits from biological diversity and ecosystem services"

National target 13: "Improve in-situ and ex-situ conservation of genetic resources of native cultivated plants and domestic animals"

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☐ On track to achieve target

☒ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

Significant diversity of autochthonous and local varieties (landraces) of agricultural crops is found in North Macedonia, historically created by many nationalities living in its territory. Three plant gene banks for ex-situ conservation were established in 2000 and in 2013 the gene bank of Institute of Agriculture in Skopje had 2666 accessions in total, out of which 1579 in the seed and 1042 in the field collection of fruit crops and Vitis. However financial support for the gene banks was not provided in the last 5 years due to inefficient changes in legislation. In the period 2014-2018 the Faculty of Agricultural Sciences and Food in Skopje managed to collect seeds and information form the local population from more than 400 inhabited places and collected 6326 samples. Determining various landraces is a complex process, based on time- and resources-consuming activities. Accurate data may be obtained through regular inventories of different regions and through scientific data from landraces characterization. It may be linked with the indicator on plant gene banks (presented in National Target 5), after a system will be established for ex-situ conservation of PGRFA on a national level.

Autochotonous breeds have been identified in the Law on Livestock breeding. A systematic approach in characterization, inventory, monitoring of trends, risks, assessments, and research in the field of protection of genetic resources in livestock breeding begins with the Program for Biodiversity Conservation in Livestock 2013-2017 and continued with Program 2018/24 supported by the Ministry of Agriculture, Forestry and Water Economy. Monitoring of autochthonous cattle, sheep and goat breeds is established. Subsidies have been provided continuously with the unchanging payment rate, and their effect is presented in the indicator. Also, cryoconservation of semen for conserving autochthonous genetics resources is in place since 2013/14 that is presented in National Target 5.

Indicators used in the assessment:

- Genetic diversity of plant genetic resources used for food and agriculture (PGRFA) in North Macedonia
- Trends in the number of monitored populations of autochthonous breeds
- Trends of subsidies for autochthonous breeds and the number of registered animals in the national inventory

Other tools or ways of assessing the progress

Relevant websites, web links, and files

Level of confidence of the above assessment

☒ Based on comprehensive evidence

☐ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

Information presented in these indicators is provided by the Faculty of Agriculture and Food Sciences as well as the official reports form the Ministry of Agriculture, Forestry and Water Economy.

Adequacy of monitoring information to support assessment

☒ Monitoring related to this target is adequate

☐ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

Presented information in the indicators is based on regular monitoring conducted by the Faculty of Agriculture and Food Sciences but additional long-term financial support is needed in order the system to be in place (particularly for the plants agro-diversity).

3.14. National target 14

Strategic goal C: "Improve the status of biological diversity components to increase the benefits from biological diversity and ecosystem services"

National target 14: "Establish monitoring of biological diversity and natural processes"

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☒ On track to achieve target

☐ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

Assessment of progress towards this national target is based on the two indicators for monitoring protocols and monitored species. Even though there is no national monitoring program in place, many activities have been implemented in the period 2015-2020 for monitoring of key species and habitats of national and international importance (listed on the annexes of Bern and Bonn Convention, Ramsar Convention, EUROBATS, etc), including those of European importance (Natura 2000 species and habitats). Also, a number of monitoring protocols for species and habitats have been developed and tested in cooperation with scientific experts, NGOs, PA management authorities, etc. Collected

biodiversity data have been used for developing valorisation studies, management plans for PAs and other policy documents. Implementation of the EU Habitats and Birds directives requires latest data for designation of Natura 2000 sites in the country and future reporting. Establishing long-term monitoring activities and set/update the national biodiversity monitoring database is important prerequisite for scientific based solutions for conservation and restoration measures of threatened species and habitats.

Indicators used in the assessment:

Two indicators have been developed for the assessment of progress towards this national target:

- Number of developed monitoring protocols for key species and habitats
- Trends in number of monitored species and habitats in protected areas and other important sites

Other tools or ways of assessing the progress

Monitoring and research activities are closely linked thus indicators presented in National Target 18 are relevant too. Additional information regarding biodiversity monitoring is provided in Chapter 2, Measure 9 – Research and monitoring.

Relevant websites, web links, and files

http://www.moepp.gov.mk/wp-content/uploads/2014/10/%D0%97%D0%90%D0%9A%D0%9E%D0%9D-%D0%97%D0%90-%D0%97%D0%90%D0%A8%D0%A2%D0%98%D0%A2%D0%90-%D0%9D%D0%90-%D0%9F%D0%A0%D0%98%D0%A0%D0%9E%D0%94%D0%90%D0%A2%D0%90.pdf

www.natura2000.gov.mk

http://akzm.gov.al/wp-content/uploads/2019/07/Monitoring_Manual_for_Lake_bound_Species_2019.pdf

https://ekosvest.com.mk/dokumenti/publikacii/Priracnik%20za%20monitoring%20na%20klucni%20vidovi%20i%20zivealista.pdf

http://www.catsg.org/balkanlynx/20_blx-compendium/data/eng/recovery-programme.htm

Level of confidence of the above assessment

☒ Based on comprehensive evidence

☐ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

Adequacy of monitoring information to support assessment

☒ Monitoring related to this target is adequate

☐ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

There is no monitoring ng system in place however Ministry of Environment and Physical Planning (as responsible institution) is coordinating these activities conducted on the territory of protected areas based on the Annual work plan and annual report as well as through the Research permit issued to scientific institutions and NGOs for conducting monitoring in nature.

3.15. National target 15

Strategic goal C: "Improve the status of biological diversity components to increase the benefits from biological diversity and ecosystem services"

National target 15: "Promote conservation of species and ecosystems in transboundary context through undertaking of joint measures/actions"

Category of progress towards the implementation of the selected target

- ☐ On track to exceed target
- ☒ On track to achieve target
- ☐ Progress towards target but at an insufficient rate
- ☐ No significant change
- ☐ Moving away from the target
- ☐ Unknown

Assessment date:

February 2020

Additional information

There were numerous activities implemented for conservation of species and habitats on a transboundary level including transboundary protected areas.

In the recent years, intensive activities have started in the transboundary Prespa Region (Prespa Park) supported largely by the Prespa-Ohrid Nature Trust Fund as a long-term funding for the protection, conservation and sustainable management of the biodiversity in the Prespa Region for the benefit of nature and people living in the region. In 2014, UNESCO proclaimed a Transboundary Biosphere Reserve Ohrid-Prespa according to the criteria of the UNESCO Man and Biosphere Programme.

In 2019, the Dlaboka River site in NP Mavrovo has been nominated on the UNESCO Preliminary List for the old beech forests in Europe. Also, In 2019 a draft application for the nomination of Lake Ohrid and Student Swamp for inclusion on the World Ramsar List was made.

Since 2006, the Macedonian Ecological Society (MES) in cooperation with PPNEA from Albania, CZIP from Montenegro, FINCH and ERA from Kosovo, EuroNatur from Germany and KORA from Switzerland, has been working on the implementation of the transboundary research and conservation project: "Balkan Lynx Recovery Programme". The overall goal of the project is to secure the survival of the remnant autochthonous population of Balkan lynx (more information are summarized in Indicator 15.2).

The International Waterfowl Census has been continuously implemented in North Macedonia since 2010. For several consecutive years in the '90s there were sporadic counts and not on all of the tectonic lakes. Since 2015 to 2019, have been noticing fluctuations in the total numbers counted on the three tectonic lakes from Macedonian side.

Egyptian Vulture New LIFE Project was launched in July 2017 with financial support from the EU's LIFE Program and the co-financing of the AG Leventis Foundation and the MAVA Foundation. The aim of the project is to reinforce the easternmost European Egyptian Vulture population by delivering urgent conservation measures to address major known threats at breeding grounds and also along the flyway. The Macedonian Ecological Society as a partner from Republic of North Macedonia joined the project in 2018. The aim of the project is to reinforce the easternmost European Egyptian Vulture population by delivering urgent conservation measures to address major known threats at breeding grounds and also along the flyway. The main efforts under the Egyptian Vulture New LIFE project will be targeting two key components: Achieving a steady increase of the population on the breeding grounds in the Balkans; and Enhancing the context for conservation along the flyway and in the wintering grounds by minimizing loss of migrating birds, particularly mature individuals (more information are summarized in Indicator 15.3).

Indicators used in the assessment:

Number of transboundary protected areas (with surface)

Case study: Transboundary monitoring - Balkan Lynx Recovery Programme

Case Study - Urgent Actions to Strengthen the Balkan Population of the Egyptian Vulture and Secure Its Flyway" (LIFE16 NAT/BG/000874)

International Waterbird Census in N. Macedonia (IWC)

Other tools or ways of assessing the progress

The activities undertaken for the achievement of National target 15 are summarized in Chapter II – Measure 8 (Increasing and improving the network of protected areas) and Measure 7 (Conservation of species and habitats).

Relevant websites, web links, and files

http://www.moepp.gov.mk/wp-content/uploads/2018/05/STRATEGIJA%20ZA%20BIOLOSKA%20RAZNOVIDNOST%20SO%20AKCISKI%20PLAN%202018_2023.pdf

http://www.moepp.gov.mk/wp-content/uploads/2014/12/%D0%9D%D0%B0%D1%86%D0%B8%D0%BE%D0%BD%D0%B0%D0%BB%D0%BD%D0%B0-%D1%81%D1%82%D1%80%D0%B0%D1%82%D0%B5%D0%B3%D0%B8%D1%98%D0%B0-%D0%B7%D0%B0-%D0%B7%D0%B0%D1%88%D1%82%D0%B8%D1%82%D0%B0-%D0%BD%D0%B0-%D0%BF%D1%80%D0%B8%D1%80%D0%BE%D0%B4%D0%B0%D1%82%D0%B0-2017-2027.pdf

http://www.moepp.gov.mk/wp-content/uploads/2014/10/%D0%97%D0%90%D0%9A%D0%9E%D0%9D-%D0%97%D0%90-%D0%97%D0%90%D0%A8%D0%A2%D0%98%D0%A2%D0%90-%D0%9D%D0%90-%D0%9F%D0%A0%D0%98%D0%A0%D0%9E%D0%94%D0%90%D0%A2%D0%90.pdf

http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/images/map_Ohrid_prespa_zonation.jpg

the Flyway Action Plan for the Conservation of the Balkan and Central Asian Populations of the Egyptian Vulture *Neophron percnopterus*

Level of confidence of the above assessment

☐ Based on comprehensive evidence

☒ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

All the relevant information was collected and analyzed in order to make the assessment.

Adequacy of monitoring information to support assessment

☐ Monitoring related to this target is adequate

☒ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

Sector of Nature within the MoEPP is responsible for carrying out the monitoring of the status of biodiversity and is taking measures for protection and conservation of species. Biodiversity monitoring is mainly carried out by several scientific institutions, some protected area management entities, and several NGOs whose main activity is nature conservation (Conservation NGOs) with support from various international projects.

3.16. National target 16

Strategic goal C: "Improve the status of biological diversity components to increase the benefits from biological diversity and ecosystem services"

National target 16: "Improve the status of important ecosystems in terms of essential ecosystem services provision "

Category of progress towards the implementation of the selected target

☐ On track to exceed target

☒ On track to achieve target

☐ Progress towards target but at an insufficient rate

☐ No significant change

☐ Moving away from the target

☐ Unknown

Assessment date:

February 2020

Additional information

The last five years were marked by very intensive activities towards the integration and promotion of the concept of ecosystem services in different sectors, raise awareness among key institutions and other stakeholders and a broad educational campaign was launched.

Indicators used in the assessment:

- Case study: Implementation of the concept for ecosystem services in North Macedonia
- Percentage of population using safe drinking water

Other tools or ways of assessing the progress

The progress was also assessed on the basis of collected information (Chapter II, Measure on Ecosystem Services): different projects, elaborated studies, education and trainings, public awareness campaigns, etc.

Relevant websites, web links, and files

http://www.moepp.gov.mk/

http://www.bregalnica-ncp.mk/?lang=en

Level of confidence of the above assessment

☒ Based on comprehensive evidence

☐ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

We believe that all the relevant information was collected and analyzed in order to make the assessment.

Adequacy of monitoring information to support assessment

☐ Monitoring related to this target is adequate

☒ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

The number of indicators (2) is rather small and special attention should be paid to this aspect (develop new indicators).

3.17. National target 17

Strategic goal C: "Improve the status of biological diversity components to increase the benefits from biological diversity and ecosystem services"

National target 17: "Integrate the requirements of the Nagoya Protocol on access to genetic resources

in the national legislation by 2018“
Category of progress towards the implementation of the selected target ☐ On track to exceed target ☐ On track to achieve target ☐ Progress towards target but at an insufficient rate ☒ No significant change ☐ Moving away from the target ☐ Unknown
Assessment date: /
Additional information The Republic of North Macedonia has not ratified the Nagoya Protocol on Access and Benefit-sharing yet thus no indicators are developed. Some initial activities have been undertaken in 2013-2014 when obligations from the Protocol were shortly analysed and presented to the stakeholders involved in the NBSAP revision process. The responsible institution for implementation of the Nagoya Protocol - Ministry of Environment and Physical Planning, is trying to provide funding that will help the country in preparing for the ratification procedure of Nagoya Protocol and provide necessary training for implementation of its obligations.
Indicators used in the assessment: No indicators are developed/used.
Other tools or ways of assessing the progress /
Relevant websites, web links, and files /
Level of confidence of the above assessment ☐ Based on comprehensive evidence ☐ Based on partial evidence ☐ Based on limited evidence
Explanation for the level of confidence indicated above
Adequacy of monitoring information to support assessment ☐ Monitoring related to this target is adequate ☐ Monitoring related to this target is partial (egg. covers only a part of the area or the topic) ☐ No monitoring system

☐ Monitoring is not needed
Describe how the target is monitored and indicate whether there is a monitoring system in place

3.18. Nacional target 18

Strategic goal D: "Enhance knowledge and availability of all relevant information on biological diversity" **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"**
Category of progress towards the implementation of the selected target ☐ On track to exceed target ☒ On track to achieve target ☐ Progress towards target but at an insufficient rate ☐ No significant change ☐ Moving away from the target ☐ Unknown
Assessment date: February 2020
Additional information The progress towards National target 18 was assessed based on five indicators and overview of the research activities in the last 5-years period. There is continuous research activity in the country with stable progress. The capacity of research community is also improving; however more efforts should be focused on research capacity rising. The citizen science received more attention in the last period which shows the growing public interest in biodiversity research and knowledge. Biodiversity sharing system is in the process of restructuring which in the near future will provide basis for integration and sharing of different data related to biodiversity.
Indicators used in the assessment: - Trends in the number of graduates in the area of basic and applicative biology in Republic of North Macedonia - Scientific publication by Macedonian Institutions related to biodiversity - Trends in the number of experts working the area of Biodiversity in Republic of North Macedonia - New species described from the Republic of North Macedonia - Citizen science - data collected by amateur naturalist
Other tools or ways of assessing the progress The review of research activities was presented in Chapter II, Measure 9 – Research and monitoring of

biodiversity.

Relevant websites, web links, and files

Ministry of Education and Science: http://www.mon.gov.mk/index.php

Faculty of forestry: http://www.sf.ukim.edu.mk/en/

Faculty of Agricultural Sciences and Food: http://www.fznh.ukim.edu.mk/

Institute of Biology: https://ib.pmf.ukim.edu.mk/

Hydrobiological Institute – Ohrid: http://www.hio.edu.mk/index.php/mk/

State University of Tetovo: https://unite.edu.mk/en/

University Goce Delcev: https://www.ugd.edu.mk/index.php/en/

Level of confidence of the above assessment

☒ Based on comprehensive evidence

☐ Based on partial evidence

☐ Based on limited evidence

Explanation for the level of confidence indicated above

The assessment was performed on the basis of five complex indicators which measure the scientific research in the last five years, the capacity of all biodiversity-related research institutions in the country, the number of students and young researchers, the progress of citizen science as well as of a comprehensive overview of major research achievements in the last five years.

Adequacy of monitoring information to support assessment

☒ Monitoring related to this target is adequate

☐ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☐ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

The monitoring of scientific publishing is performed by different international databases (e.g. https://www.scimagojr.com/). Unfortunatelly, there is no comprehensive national database on scientific publishing. Some of the research institutions provide good overview of their publishing activities (e.g. University of Goce Delcev in Shtip). Five indicators that were established are sufficient to monitor the progress of biodiversity research. As far as biodiversity information sharing is concerned we can state that new National Biodiversity Information System will be established and it will integrated all of the existing databases related to biodiversity.

3.19. Nacional target 19

Strategic goal D: "Enhance knowledge and availability of all relevant information on biological diversity"

National target 19: "Preserve and promote traditional knowledge, innovations and practices for

conservation and sustainable use of natural resources”
Category of progress towards the implementation of the selected target ☐ On track to exceed target ☐ On track to achieve target ☒ Progress towards target but at an insufficient rate ☐ No significant change ☐ Moving away from the target ☐ Unknown
Assessment date: February 2020
Additional information Information on the implemented activities for preservation of traditional knowledge and practices for conservation and sustainable use of natural resources were limited thus the progress is an insufficient rate. In the last few years, ethnobotanical studies for sustainable use of natural resources (medicinal and aromatic plants, forest fruits and mushrooms) have been prepared for several areas - National park Pelister, Osogovo Mts, Maleshevski Mts, and Shara Mt. A very good example of documented traditional use of natural resources is produced documentary ‘Honey Land’ that got the reward ‘Impact for change’ on the film festival ‘Sundance’ (one of the total 35 rewards form prestigious film festivals throughout the world). Some activities undertaken for sustainable use of wild plants and fungi are described in Chapter 2, Measure 5
Indicators used in the assessment: No indicators were developed/used.
Other tools or ways of assessing the progress
Relevant websites, web links, and files https://www.honeyland.earth
Level of confidence of the above assessment ☐ Based on comprehensive evidence ☒ Based on partial evidence ☐ Based on limited evidence
Explanation for the level of confidence indicated above

Adequacy of monitoring information to support assessment

☐ Monitoring related to this target is adequate

☐ Monitoring related to this target is partial (egg. covers only a part of the area or the topic)

☒ No monitoring system

☐ Monitoring is not needed

Describe how the target is monitored and indicate whether there is a monitoring system in place

4. Section IV. Description of the national contribution to the achievement of each global Aichi Biodiversity Target

4.1. Aichi Biodiversity target 1

Aichi Biodiversity 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

Aichi Target 1 is corresponded with the Strategic target A and NT 1 which clearly indicates that Republic of North Macedonia recognizes the needs to raise awareness for biodiversity topics on different levels and conduct different educational activities.

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) as well as awareness raising activites for different target groups are carried out by non-governmental organizations.

More information about awareness raising and educational activities implemented in the country are presented in the Chapter II, Measure 1 and Measure 2 and Chapter 3, National Target 1.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

4.2. Aichi Biodiversity target 2

Aichi Biodiversity 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

Integration of biodiversity values in national and local development plans is one of the main topics in the NBSAP (2018-2023) and National Strategy for Nature Protection with Action Plan (2017-2027), which shows that Republic of North Macedonia has recognized the importance of vertical and horizontal integration of biodiversity. Aichi target 2 is corelated with the Strategic target A and National

target 2 that covers activities for integration of biodiversity in the National Spatial Plan of the Republic of North Macedonia, Sustainable Development Strategy (2009-2030), but also integration in different sectoral strategies (agriculture and rural development, forestry, energy, water management, transport, poverty reduction, etc). On a local level, Local ecological action plans (LEAPs) are developed in which biodiversity is streamlined.

Strategic impact assessment mechanism is introduced and implementing for all developing plans.

More information are presented in the Chapter 2, Measure 4 and Chapter 3, indicators for the National target 2.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

Identification and valuation of ecosystem services has high priority on the National agenda and there is an ongoing process on a national level for evaluation of eosystem services and establishing a mechanism for payment for ecosystem services (PES).

More information is provided in Chapter 2, Measure 6.

4.3. Aichi Biodiversity target 3

Aichi Biodiversity 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

Aichi Biodiversity Target 3 is correlated with Strategic target A and NT 3.

The Government of the RN Macedonija has developed several tools/regulations, which includes incentives and subsidies, to support physical entities, as well as small and medium enterprises (SMEs) to achieve their competitiveness on the National and International markets, mainly in production of healthy food, with ECO labelling, as well as use of renewable energy for electricity production. Some of the mentioned supporting measures have negative impacts to biodiversity.

The analysis of the impact of different subsidies on biological diversity has not been done yet.

More information are presented in the Chapter 1.3 and Chapter 3.3, as well as related indicators in Annex (National target 3).

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

4.4. Aichi Biodiversity target 4

Aichi Biodiversity 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

Aichi Biodiversity Target 4 is correlated with Strategic target B and National Target 7.

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 North 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.

In accordance with the Law on Nature Protection, the Ministry of Environment and Physical Planning issues licenses for collection, import and export of endangered and protected wild plant species and fungi and their parts. The need to define the conservation status of the species at a national level is ever more growing in the country, also followed by assessments and quantities. The monitoring and the assessment of habitats, the status of the populations and the assessment of the resources at the sites for commercial use should be done in parallel, depending on the species and their distribution. In the reporting period, statistic show the greatest collected and exported quantities of plant resources are the berries of Common juniper (Juniperus communis) and Common bearberry (Arctostaphylos uva-ursi). The collection of wild plant species and fungi can control through quotas define by the Government for different plant types and fungi which could be established in future.

More information are presented in Chapter 2, Measure 5(sustainable use of resources), Chapter 3 and related indicateors for National target 7 in Annex (Trends in sustainable collection of commercial wild plants and fungi (according to licenses issued, as well as Timber harvested by species in the forest, by years).

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

4.5. Aichi Biodiversity target 5

Aichi Biodiversity 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

Habitat loss halved or reduced

Aichi Biodiversity Target 5 is correlated with Strategic target B and National target 9 (“Integrate measures for climate change effects adaptation and mitigation and combat against desertification “), as well as Strategic target C and National Target 10 (“Prevent loss, degradation and fragmentation of natural habitats of national and international importance“)

Loss, degradation and fragmentation are the main threats identified for natural habitats in the country.

A Draft National list of habitats from Annex I of the EU Habitats Directive for each of the two biogeographical regions (continental and alpine) has been prepared. Still, field research must continue for the identification of habitats from Annex I of the Habitats Directive in order to update the list. A

Catalogue of habitats with European importance should be created in accordance to the Habitats Directive.

Forests cover around 38% of the territory of the Republic of North Macedonia. Data for the period 2003 to date shows that forest ecosystems in North 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.

More information are presented in Chapter 3-NT 9 and related indicators presented in Annex (Dynamics in Land productivity; Renewable electricity; Forest fires; GHG Emissions and GHG Emissions from Agriculture), as well as NT 10 and related indicators and case study, presented in the Annex (Indicator-Riparian Forest Quality (QBR); Case study-Revitalization of riparian ecosystems; Indicator-Shorezone Functionality Index (SFI) and Case study-Rehabilitation and improvement of the state road A2, section Kriva Palanka - Deve Bair (Aspects of mammals in a biocoridor) and Chaptter 5.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

4.6. Aichi Biodiversity target 6

Aichi Biodiversity 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

Sustainable management of aquatic living resources

Aichi target 6 is corelated with Strategic goal B: “Reduce direct and indirect pressures on ecosystems and other components of biological diversity“, 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 “ and Strategic goal C: “Improve the status of biological diversity components to increase the benefits from biological diversity and ecosystem services“, National target 17: “Integrate the requirements of the Nagoya Protocol on access to genetic resources in the national legislation by 2018“

Fishing shall be carried out on all fishing waters within the framework and under conditions established by law. Fishing waters in RN Macedonia cover about 56,000 hectares of which 83% are fishing areas that include natural lakes (Ohrid, Prespa and Dojran), about 11% are fishing zones and recreational zones of artificial lakes - reservoirs, 4% are fishing and fishing lakes and 1% are aquaculture facilities where fish farming is completed. A concession for commercial fishing and recreational fishing for a period of 6 years is given for fish from fishing waters.

The lack of concessionaires over a period of time, the relatively inadequate physical protection of Lake Ohrid, Prespa and Dojran Lake, the emergence of large-scale fishing, the fishing of small and immature

individuals, have caused uncontrolled fish stocking.

The main threats arising from fishing are related to unplanned commercial exploitation of lakes, fishing, exploitation and water pollution. Concerning natural lakes, specific problems for Lake Ohrid are reduced trout (endemic species) and belly populations, expansion of the plaice, submerged bottom nets; for Lake Dojran, dominant invasive species of silver caras and decreased density of native fish populations, while Lake Prespa is characterized by increased numbers of non-native fish, presence of pesticides and heavy metals in fish tissues and endangered fish species.

Aquaculture fish production affects biodiversity through the introduction of new non-native species into aquatic bodies and the nutrient load on aquatic ecosystems.

The largest number of cage farms are found in the accumulation "Tikves" - 19 in total, of which 517 cages for breeding carp. The cage production recorded an upward trend and reached (in 2010) 1 407 tons: 1 188 tons of trout, 178 tons of carp and 41 tons of catfish.

More information on the commercial display and number of carp fisheries in the country is shown in Chapter 3, NT-5 and related indicators in the Annex.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

4.7. Aichi Biodiversity target 7

Aichi Biodiversity Target 7: Sustainable agriculture, aquaculture and forestry

Aichi target 7 is corelated with Strategic goal B: “Reduce direct and indirect pressures on ecosystems and other components of biological diversity“, 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 “

This target is very complex and there are many actions prescribed in the Biodiversity Action Plan aiming to reduce direct and indirect pressures on ecosystems and ecosystem services they provide. Progress towards the implementation (at an insufficient rate) was assessed based on 9 indicators listed below but also other indicators such as land use change and change in forest area presented under national target 2. Incorporation of biodiversity and ecosystem services into sectoral development plans and policies is the first important step (indicator presented under national target 2), but much more efforts are needed for their enforcement.

More information on the commercial display and number of carp fisheries in the country is shown in Chapter 3, NT-5 and related indicators elaborated in the Annex, as follows: Riparian forest changes (area, average belt width, level of connectivity); Area of large lowland wetlands; Trend of conserved autochthonous and local varieties of PGRFA in gene banks; Cryopreservation of semen; Areas under organic farming; Number of game by years and regions; Fish commercial catch from commercial waters (Prespa, Dojran and Ohrid Lake); Number of proceedings for biodiversity inspection and crime and Number of carp fish farms and carp production in Republic of North Macedonia.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional)

4.8. Aichi Biodiversity target 8

Aichi Biodiversity Target 8: Pollution reduced

Aichi target 8 is corelated with Strategic goal B: "Reduce direct and indirect pressures on ecosystems and other components of biological diversity", 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"

More information related to implemented activities for protection of the environment (air, soil, water) are presented in Chapter 1 and Chapter 3, NT-6 and related indicators elaborated in the Annex, as follows: Soil quality; Bomonitoring of air pollution; Trends in the quantity and quality of municipal wastewater discharged after treatment from pollution sources and populations covered by treatment plants and Percentage of water bodies by ecological status/potential classification in a river basin. In general, there is a progress towards achieving this target, activities are continous but rather slow.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional)

4.9. Aichi Biodiversity target 9

Aichi 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

Invasive alien species prevented and controlled

Aichi target 9 for prevention and control of invasive allien species is corelated with Strategic goal B: "Reduce direct and indirect pressures on ecosystems and other components of biological diversity", NT 8: "Develop and establish appropriate policy for recording, control and protection of non-native and invasive species"

Only in the last 5-10 years the topic of invasive species received the needed attention. Many examples of negative influence of invasive species of ecosystems and other biological diversity components have been registered in the Republic of North 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.

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 monitoring.).

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.

More information on this are shown in Chapter 1, Chapter 3, NT 8 and related indicators, presented in Annex, as follows: Introduced fish species (alien/allochtone/non-native/non-indigenous, translocated fish) from the Republic of North Macedonia; Alien plant species in the Republic of North Macedonia and Introduced terrestrial invertebrate species from the Republic of North Macedonia.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

4.10. Aichi Biodiversity target 10

Aichi Biodiversity 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

This Aichi target for minimization of impact of climate change to vulnerable ecosystems iz directly related to the National Target 9.

Refugia and refugial areas predisposed to climate change impacts and vulnerable to various extents that required specific adaptation approaches have been identified even in the First nd Second National Communication to the UNFCCC (2003 and 2008). Later, in 2014, as part of preparation of the Third national communication, assessment of biodiversity was based on identification of vulnerable habitats and species and expert judgment of their vulnerability, analysis of possible invasive species, assessment of the adequacy of the national system of protected areas in relation to climate change, assessment of the functionality of bio-corridors in Macedonia, as well as modeling of selected habitats and species. Ecosystems vulnerable to climate change are still not precisely identified and elaborated, but some changes of ecosystems identified in the National Parks Pelister and Mavrovo may be a result of Climate change. Thus, monitoring activities undertaken in the national parks is expected to recognize the real loss or demages on ecosystems coused by climate change.

Progress to this target is assessed as insufficient and more informationis prresented in the chapter 2, measure 9: Research and monitoring of biological diversity and chapter 3, NT 9 and related indicators, presented in Annex, as follows: Dynamics in Land productivity; Renewable electricity; Forest fires; GHG Emissions and GHG Emissions from Agriculture.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

4.11. Aichi Biodiversity target 11

Aichi Biodiversity 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

The Target is correlated with Strategic Target C and NT 11.

The programme of work on protected areas was prepared in 2012 and the Ministry of Environment and Physical Planning is regularly tracking the progress towards achieving the target. Also, the data related to protected areas are regularly reported and updated in the Common Database on Protected Areas.

More information on the contribution to the protected areas target (that is assessed as on track to achieve the target) is presented in Chapter 2, Measure 8 and Chapter 3, NT 11 that are presenting trends in the number and surface of protected areas by category (% in relation to total area of the country), adopted protected area management plans, trends in surface of identified potential Natura 2000 areas as well as discussing the assessment of effective of management of protected areas using the METT tool.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional)

4.12. Aichi Biodiversity target 12

Aichi Biodiversity 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.

Reducing risk of extinction

Aichi Target 12 for reducing the risk of extinction is correlated with the Strategic target C, NT12.

Identification of threats to individual species, their distribution as well as causes for and level of threat, are the 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 prepared in accordance with the criteria for evaluation developed by IUCN, which define seven categories of species by the level of threat: extinct species (EX), species extinct in the wild (EW), critically endangered (CR), endangered (EN), vulnerable (VU), near threatened (NT), least concern (LC), data deficient (DD). The threatened species are critically endangered (CR), endangered (EN) and vulnerable/sensitive (VU).

These categories have been integrated in the Law on Nature Protection (Article 34). aAccording to Article 35 wild species may be designated as strictly protected or protected, thus acquiring the status of natural heritage. Measures and activities for species protection and manner and extent of use should be prescribed in a bylaw (Article 42).

This target embrace very broad topic - identification of the extent of threat to wild species, prevention of the reduction in populations and extinction of affected species, improvement and maintenance of the status of protection, especially for species with populations in decline etc. Such activities have been

part of many projects implemented in the last five years thus contributing to good progress (eventhough many activities needs to continue) towards achieving this target.

An assessment of all species of amphibians and reptiles (46 species) has been carried on a national level and the first National Red List of Herpetofauna has been developed according to the IUCN criteria. In addition, an assessment of 14 species of vascular plants of international and national importance has been carried out and a Priority List of Flora Taxa at national level has been prepared, as a basis for further selection and establishment of a final list of priority taxa for the Red List of Flora of the State. Data are publicly available on the web site developed (http://redlist.moepp.gov.mk/pocetna/). National Red List of fungi and National Red List of Large mammals (lynx, bear, wolf, jackal, otter) are expected to be ready by the end of 2020.

One of the most renowned conservation projects in the Republic of North Macedonia are the once on Balkan lynx (Balkan lynx Conservation Programme) and conservation projects for birds (e.g. Vulture Conservation Project) which established reference and inspired many new conservation activities.

More information are pesented in Chapter 1, NT 12; Chapter 2, measures: 7, 8, 9; Chpter 3, NT 12 and related indicators, listed in the Annex, as follows: Balkan lynx population trend in the Republic of North Macedonia; National Griffon vulture population trends; National Egyptian vulture population trends; Population trend of Lesser Kestrel; White Stork population size and breeding parameters; National reptile population trends and National amphibian population trends.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional)

4.13. Aichi Biodiversity target 13

Aichi Biodiversity 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

This target for safeguarding genetic diversity is coralated with National Target 13. Activities undertaken for preservation of the genetic diversity of species of cultivated plants and farmed and domesticated animals are assessed as ansufficient and presented in more details in Chapter 3, NT-13 and NT-5. Related indicators cover genetic diversity of plant genetic resources used for food and agriculture, monitored populations of autochthonous breeds as well as trend of subsidies for autochthonous breeds. Also, establishment of gene banks for conservation of autochthonous and local varieties of PGRFA and cryopreservation of semen for conserving autochthonous genetics resources is in place since 2013/14.

More information are presented in National Target 5 and related indicators in the Annex I.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

4.14. Aichi Biodiversity target 14

Aichi Biodiversity 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
The ecosystem services target is directly corresponded with National targets 16 and indirectly National target 4. This clearly shows that the Republic of North Macedonia recognizes the importance of the concept for ecosystems services and a lot of efforts have been put in the last few years for assessment of the status of ecosystems and identification of ecosystem services that will follow with introducing the payments for ecosystem services in the protected areas. *More information about the implemented activities are presented in Chapter II, measure 6 and Chapter III, Case study for implementation of the concept for ecosystem services in North Macedonia.*
Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional)

4.15. Aichi Biodiversity target 15

Aichi Biodiversity 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
This Aichi target for ecosystem restoration and resilience is correlatted (directly or indirectly) to several national targets (NT-10, NT-9) that are referring to the activities related to conservation and restoration of important and vulnerable ecosystems such as forests and wetlands thus contributing to climate change mitigation and adapation. Als National target 15 that promotes conservation of species and ecosystems in a transboundary context contributes to more effective conservation with joint transboundary actions for lake and mountain ecosystems that are shared with neighbouring countries. *More information is given in Chapter II, Measure 7 and Chapter III, NT-10, NT-9, NT-15 and relevant indicators and case studies presented in the Annex I.*
Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

4.16. Aichi Biodiversity target 16

Aichi Biodiversity 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
This Targets is corresponded with the National Target 17. In the last five-years period the Republic of North Macedonia did not ratify the Nagoya Protocol on Access and Benefit-sharing. Some initial activities have been undertaken during the process of revision of NBSAP in 2013-2014 with translation in Macedonian language of the Nagoya Protocol and Bonn Guidelines on access to genetic resource and fair and equitable sharing of benefits. Also obligations from the Protocol were shortly analysed and presented to the stakeholders involved in the NBSAP revision process. Currently the competent national authority for this protocol – Ministry of Environment and Physical Planning is preparing a project application for GEF funds aiming to provide financial support to help the country in preparing for the ratification procedure of Nagoya Protocol and provide necessary training for implementation of its obligations.
Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional)

4.17. Aichi Biodiversity target 17

Aichi Biodiversity 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
The National biodiversity strategy and action plan (the first one adopted in 2004) was revised in the period 2013-2015 through the participatory process involving all relevant stakeholders in the country (ministries, scientific institutions, protected areas, NGOs, foresters, agricultural and rural development sector, water, transport, energy sector, all relevant on-going projects, as well as different international donor, etc.). Their involvement was valuabe with providing information about the assessment of the implementation of the first Biodiversity action plan, identification of threats, defining the new national targets, as well as in designing the nw Biodiversity Action Plan. Also, Strategic Impact Assessment document was prepared and communicated in accordance to the national legislation. The NBSAP (for the period 2018-2023) was adopted by the Government of the Republic of North Macedonia in 2018 thus it becomes a policy instrument for biodiversity conservation in the country. The current NBSAP includes national biodiversity targets, as well as indicators for measuring the progress of each national target.
Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

4.18. Aichi Biodiversity target 18

Aichi Biodiversity 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

This target for traditional knowledge is coralated with the Strategic Target D and National Target 19.

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 last few years, ethnobotanical studies for sustainable use of natural resources (medicinal and aromatic plants, forest fruits and mushrooms) have been prepared for several areas - National park Pelister, Osogovo Mts, Maleshevski Mts, and Shara Mt.

A very good example of documented traditional use of natural resources is produced documentary 'Honey Land' that got the reward 'Impact for change' on the film festival 'Sundance' (one of the total 35 rewards form prestigious film festivals throughout the world).

More information are presented in Chapter 2, Measure 5

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

4.19. Aichi Biodiversity target 19

Aichi Biodiversity 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

This Target for sharing biodiversity information and knowledge is coralated with the Strategic Targets C and D and National targets 14 and 18.

In the past 10-15-year period, continuous progress has been noted in research and knowledge of the components of biological diversity in the Republic of North Macedoniahowever much more efforts are needed in order to provide enough information of all components of biological diversity due to their complexity.Besides objective, there are many subjective reasons for the lack of information on biological diversity in North 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, comprehensive research is carried out 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 North 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.

More information are presented in Chapter 1, Chapter 2, measures: 2 and 3; Chapter 3 and related indicators, presented in Annex, as follows: Trends in the number of graduates in the area of basic and applicative biology in Republic of North Macedonia; Scientific publication by Macedonian Institutions related to biodiversity; Trends in the number of experts working the area of Biodiversity in Republic of North Macedonia; New species described from the Republic of North Macedonia and Citizen science - data collected by amateur naturalist.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

4.20. Aichi Biodiversity target 20

Aichi Biodiversity 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

This target for mobilizing resources from all sources is correlated with the Strategic Targets A: "To overcome the main/underlying causes of biodiversity loss through its mainstreaming in the society" and NT-4: "To increase the level of investments and financing sources for biodiversity conservation from the central and local budget and other sources".

In the reporting period Investment from the Central budget in the past years for conservation of biodiversity and nature is growing steadily but is not yet enough. Most of the financial resources have been provided through EU funds and different international donors and foundations. In order to ensure sustainable financing of protected areas at the national level, it is necessary to develop various models for providing funding. Payments for ecosystem service is a new model for financing protected areas which is developing by the country.

More information are presented in Chapter 1, NT-3; Chapter 2, measures: 3 and 4; Chapter 3, NT-3 and related indicator and case stady, presented in the Annex, as follows: Trends in central budget investments intended to implement the NBSAP and Case study: Provided funds for Protected areas.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional).

Based on the description of your country's contributions to the achievement of the Aichi Biodiversity Targets, please describe how and to what extent these contributions support the implementation of the 2030 Agenda for Sustainable Development and the Sustainable Development Goals.

The Cabinet of the Deputy Prime Minister of the Republic of North Macedonia in charge of economic affairs and coordination with economic departments, in the role of national coordinator for implementation of Agenda 2030 and the Sustainable Development Goals of the United Nations, in the past year approached the preparation of Goodwill National Review for the Implementation of Agenda 2030 and the Goals for Sustainable Development and Preparation of the Rapid Integrated Assessment for the Implementation of the Sustainable Development Goals.

Voluntary national review, in its form and content, aims to monitor the progress of the implementation of Agenda 2030 and the Sustainable Development Goals and indicators at local, national and international level, in a way that will show the integrated approach of the state in terms of sustainability.

In the period from October 2019 to February 2020, the technical working group in the expanded composition of the Council for Sustainable Development approached the preparation of the Rapid Integrated Assessment (RIA). The Rapid Integrated Assessment is designed to be a preparatory step in missions to support alignment, acceleration and policies in order to implement sustainable development.

Representatives from Nature Department from MOEPP took part in preparation of the Rapid Integrated Assessment and the National Strategy for Biodiversity and Action Plan (2018 -2023) was selected as leading strategic document for assessment of the alignment of national goals for nature protection with sustainable development goals from the group Planet.

During January and February 2020, a set of meetings, consultations and workshops were held in order to define the content for each of the Objectives separately. In each of the Goals for Sustainable Development are represented 5 content elements: general situation, legislative-strategic initiatives, current initiatives, key challenges and next steps.

The Nature Department was engaged to prepare a narrative for SDG 15-Life on land for topics related to nature and biodiversity protection and conservation. In addition to the narrative for each Sustainable Development Goal, the Voluntary National Review contains sections describing the process of making VNR, current regulation in economic, social and environmental terms, and the implementation of Agenda 2030 through the EU integration process

5. Section V. Description of the national contribution to the achievement of the targets of the Global Strategy for Plant Conservation

Does your country have national targets related to the GSPC Targets?

☐ Yes. Please provide details on the specific targets below:

- In the Republic of North Macedonia, 19 national goals for the conservation of biodiversity have been adopted and most of them contain actions which will contribute to the protection of plants and directly or indirectly contribute to the achievement of the following GSPC Targets:

NT-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

- Almost all planned actions for this national goal include protection of plants and habitats.

NT-14: To establish monitoring of biodiversity and natural processes

- Most actions related to the establishment of regular biodiversity monitoring, the establishment of a single monitoring system and the development of appropriate indicators all include plants and habitats.

NT-10: To prevent the loss, degradation and fragmentation of natural habitats of national and European importance

- Almost all planned actions for this national goal are aimed at the identification of important habitats, mapping, taking appropriate measure for protection and habitat revitalization.

NT-7: To develop and implement plans for sustainable production and consumption for use of natural resources within safe ecological limits

- Action 7.2.1. Determination of quotas for collection of wild species plants, fungi, animals and commercially significant parts thereof
- Action 7.2.2. Identification of areas where collection of species at risk should be avoided
- Action 7.2.3 Harmonization and further regulation of the system for issuing wildlife harvesting license
- Action 7.2.7. Development of scientific studies on the status of game population for the purpose of setting more appropriate hunt quotas

NT -5: To establish management practices in forestry, agriculture, hunting and fishery that contribute to conservation of biodiversity and maintenance of ecosystem services

- Action 5.4. Fostering of the integration of biological diversity components (especially threatened species and habitats) into forestry practices
- Action 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
- Action 5.4.3. Reduced application of clearcutting over large areas and other practices in forestry that may pose threat to biological diversity

- Action 5.4.4. Transfer of knowledge and international practices in forests management and exploitation from biological diversity conservation point of view
- Action 5.4.5. Fostering of the forest inventorization process
- Action 5.4.6. Fostering of the forest certification process
- Action 5.5.1. Development of study for identification of biodiversity-rich forests, including near-virgin forests
- Action 5.5.2. Introduction of protection of near-virgin forests and old forests that may turn into near-virgin forests
- Action 5.5.3. Preparation of guidelines for introduction of good management practices in biodiversity- rich forests
- Action 5.5.4. Implementation of pilot project to test good management practices in biodiversity- rich forests and bio-corridors maintenance
- Action 5.9. Development of study for identification of biodiversity-rich agricultural areas (HNV Farmland areas) and their integration in agricultural policies

NT-13: To improve in situ and ex situ protection of genetic resources of native species cultivated plants and domestic animals

- Action 13.1.1. Foundation of central gene bank of the Republic of North Macedonia for ex situ storage of native seed and seeding material and secured funds for its maintenance
- Action 13.1.2. Creation of inventory of native species and varieties of agricultural crops represented on the territory of the Republic of North Macedonia
- Action 13.1.3. Collection of seed and seeding material of native species and varieties
- Action 13.1.4. Characterization and evaluation of collected material of native agricultural crops
- Action 13.1.5. Establishment of central database of the material in the gene banks accessible for the general public
- Action 13.2. Establishment of system of on-farm and on-garden (in situ) conservation of agricultural crops and conclusion of contracts with interested farmers
- Action 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

NT-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.)

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

NT-19: Preserve and promote traditional knowledge, innovations and practices for conservation and sustainable use of natural resources

- Action 19.1.4. Documenting the use of biological diversity in traditional treatment and

ethnopharmacy

- Action 19.1.3. Documenting the tradition of keeping hallowed forests and forests associated with legends

NT-8: To create and establish appropriate policies for the evidence, control and protection from invasive alien species

- Action 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
- Action 8.1.2. Preparation/adoption of a national list of invasive species
- Action 8.1.3. Monitoring and control of invasive plant species
- Action 8.2. Monitoring of the occurrence of invasive species resulting from climate change (including vectors of diseases)
- Action 8.3. Encouraging activities towards eradication of non-native species in riparian vegetation and their substitution with native species

NT -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

- All planned actions for this national goal contribute towards the protection of important plant species and habitats.

NT-15: To promote the protection of species and ecosystems on transboundary level through implementation of joint actions/ measures

- Action 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
- Action 15.5. Application of measures for biological diversity conservation within the European Green Belt
- Action 15.7. Designation of transboundary protected areas for which national or international initiatives exist
- Action 15.8. Strengthening cooperation and data exchange with other West Balkan countries for effective protection and sustainable use of biodiversity

NT-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

- Action 1.2.2. Organization and implementation of national campaign for public awareness raising about the values of biological diversity and ecosystem services
- Action 1.2.4. Preparation and publication of vocational and popular books/manuals/ brochures on different components, values, use of and threats to biological diversity
- Action 1.3.1. Preparation of a plan for education in the area of biological diversity (for formal and informal education)
- Action 1.3.2. Implementation of educational competition in the area of biological diversity

- Action 1.3.3. Organization of didactic topic-based excursions (positive and negative examples of biological diversity status and management.

Please provide information on any active networks for plant conservation present in your country.

There is only one Botanical garden in the R. of N. Macedonia. Also, Activities for ex-situ protection have been conducted in NP Pelister and NP Galicica with construction/ establishment of arboretums of important wild plant species, which are found in both parks

An attempt was made by the Macedonian Ecological Society for a creation of a network for identified Important Plant Areas in the country, through identification of interested individuals/local conservation groups for their protection, however, more intensive activities are required.

The network of local organizations within the framework of eight identified important plant areas in this country was formed as part of several projects by MES. Out of all of them, only Polimat 13 continued with activities for promotion and protection of IPA Bogdanci. More intensive activities for maintenance of this network are required.

Please describe the major measures taken by your country for the implementation of the Global Strategy for Plant Conservation. (Parties can report on actions taken to implement these targets if they are not covered in sections II, III or IV.)

The actions undertaken are generally covered in chapters II, III and IV or shortly described during the presentation about the progress towards the global targets for plant protection.

5.1. GSPC Target 1: An online flora of all known plants

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level

☐ On track to achieve target at national level

■ Progress towards target at national level but at an insufficient rate

☐ No significant change at national level

Please explain the selection above:

Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description.

In the Republic of N. Macedonia, as part of the Macedonian Academy of Sciences and Art, the long-term project Flora of the Republic of North Macedonia has been underway for 40 years. So far, 7 volumes have been published (6 volumes from the first tome and one volume from the second tome), and the finalization of the second volume of the second tome is ongoing, and should be ready by the end of 2020. For each family, the key for determining the genera, species and lower taxa are provided, as well as morphological description and precise data regarding the spread of the species throughout its territory.

Web site for National Red List of the Republic of Northern Macedonia has been prepared, which includes 14 plant species of national and international importance. (http://redlist.moepp.gov.mk/pocetna/).

Some of the newly published volumes are in a digital form and published on the MASA webpage

(http://manu.edu.mk), while the older volumes will be digitalized further.

5.2. GSPC Target 2: An assessment of the conservation status of all known plant species, as far as possible, to guide conservation action

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level

☐ On track to achieve target at national level

■ Progress towards target at national level but at an insufficient rate

☐ No significant change at national level

Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description.

A priority list of the flora of R. of N. Macedonia (2019) has been created, which contains 480 species and it represents the basis for the creation of a Red list of the flora of R. of N. Macedonia. So far, the endangerment degree has been assessed for the following 14 vascular types on a national level according to the IUCN methodology - *Aldrovanda vesiculosa, Angelica palustris, Astragalus physocalyx, Campanula patula* subsp*. abietina, Echium russicum, Galium rhodopaeum, Gentiana lutea* subsp*. symphyandra, Lindernia procumbens, Lycopodium clavatum, Marsilea quadrifolia, Menyanthes trifoliata, Ramonda serbica, Salvinia natans, Trapa natans.* Part of these species are found outside of the protected areas of our country and appropriate protection measure should be taken for them.

Furthermore, participation was taken in the project Red list of *Monocotyledonae* in the Mediteranean, as well as in the European Red List of Trees (Црвената листа на дрвенестите растенија на Европа - Rivers, M.C., ... Matevski, V. et al., 2019. European Red List of Trees. Cambridge, UK and Brussels, Belgium: IUCN. viii + 60pp.), where data about the distribution of the representatives of this group on the territory of North Macedonia has ben delivered.

5.3. GSPC Target 3: Information, research and associated outputs, and methods necessary to implement the Strategy developed and shared

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level

☐ On track to achieve target at national level

■ Progress towards target at national level but at an insufficient rate

☐ No significant change at national level

Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description.

The plant diversity throughout the territory of R. of N. Macedonia has been explored relatively well. According to the findings we have, there area around 3200 species of vascular plants throughout the territory, divided into around 750 genera and 147 families. From published and prepared issues so far, 111 families, 463 genera and above 1900 species have been analytically analyzed (the number of completely processed taxa – together with subspecies, varieties and forms is much higher, numbering more than 3000 taxa), which represents an analysis of around 60% of the families, genera and species

present throughout the territory. Considering that the flora publications have started in 1985, it means that the previously mentioned percentage (60%) of the complete analyzed taxa at the same time represents a percentage of revised taxa since 1970. During the field research, all parts of the territory of R. of N. Macedonia have been given attention, but the data is limited for some sites in the eastern and northeastern parts.

The national herbarium (MKNH), located at the Institute for Biology, Faculty of Natural Sciences and Mathematics in Skopje, is registered in Index Herbariorum and contains around 200 000 herbarium samples, which represents the basis for work on the project Flora of R. of N. Macedonia. Sadly, the herbarium samples have not been digitalized.

Around 700 species in R. of N. Macedonia can be placed in the group of medicinal and aromatic plants. These are species which are used in our traditional medicine and by our neighboring people, as well as species for which there exists literary and scientific data regarding their medicinal properties. However, off all these, around 220 plant species are commonly used. The number of natural resources used for commercial purposes, being cultivated or being collected as wild growing species is not high. The following wild growing species are most frequently used: 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. Resource estimates have been done only for few species (*Arctostaphylos uva-ursi*, *Juniperus communis*, etc.) but control over their collection from nature should be improve.

Due to inappropriate use, collection and trade, the collection and trade of the species *Gentiana lutea* and *Gentiana punctata* has been prohibited by a ministerial decree from 2006.

In 2019, Macedonian Ecological Society started implementing a three-year project that monitors certain rare plants within the identified significant plant areas. A total of five plants (Campanula debarensis, Aesculus hippocastanum, Centaurea rufidula, Crocus jablanicensis and Astragalus physocalyx) and four significant plant areas (Jablanica, the Black Drim Gorge, the Bogdanci and Doyran Lake) will be cover with monitoring.

5.4. GSPC Target 4: At least 15 per cent of each ecological region or vegetation type secured through effective management and/or restoration

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level

☐ On track to achieve target at national level

☐ Progress towards target at national level but at an insufficient rate

■ No significant change at national level

Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description.

The activities for habitat protection and a national network of protected areas are presented in chapters II and IV (in accordance with the Aichi Targets 11 and 15). However, a detailed analysis for areas or the % of important habitats which are part of the protected areas is difficult to produce, as there is no final list of habitats in R. of N. Macedonia. At the moment, the assumption is that we have

around 60 different habitats, and 15 of those are important (priority habitats according to HD).). A Draft National list of habitats from Annex I of the EU Habitats Directive for each of the two biogeographical regions (continental and alpine) has been prepared. Still, field research must continue for the identification of habitats from Annex I of the Habitats Directive in order to update the list. A Catalogue of habitats with European importance should be created in accordance to the Habitats Directive.

Probably 50% of these habitats are present within the borders of the protected areas in the country, however, at the moment we are unable to make such analyses.

5.5. GSPC Target 5: At least 75 per cent of the most important areas for plant diversity of each ecological region protected with effective management in place for conserving plants and their genetic diversity

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level

☐ On track to achieve target at national level

■ Progress towards target at national level but at an insufficient rate

☐ No significant change at national level

Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description.

Continuous research of the flora of the Republic of North Macedonia and steady progress in the knowledge of the values and significance of flora and vegetation diversity on its territory, constituted the basis for the implementation of the project for identification of Important Plant Areas in North Macedonia, initiated by Plantlife International, and coordinated by the Regional Environmental Centre during 2002-2003. This activity was implemented in several Balkan countries. It resulted with identification of 42 smaller and larger Important Plant Areas on the territory of the Republic of North Macedonia with preliminary assessment of the threats jeopardizing the survival of plant species and habitats in these areas. Furthermore, in the period 2007-2009, on the basis of the adopted methodology, important species and habitats were identified for each of the prior identified 42 Important Plant Areas (MES/Plantlife project in IPAs identification http://mes.org.mk/blog/identifikatsija-na-znachajni-rastitelni-podrachja-vo-makedonija/), *(www.plantlife.org.uk/international/wild_plants/IPA/ipa_online_database/)*

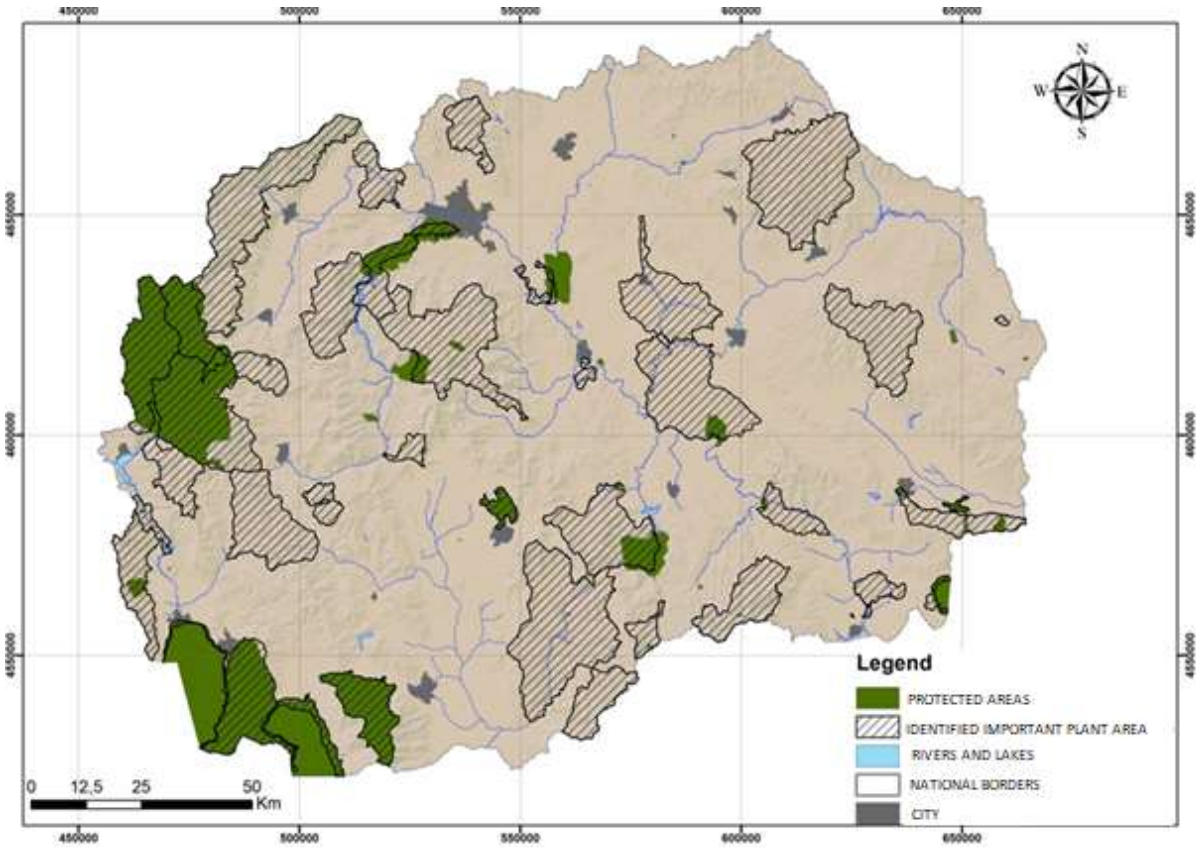
Data produced by this project established important grounds for planning of the flora and vegetation diversity in these areas (Melovski et al. 2010). As a result of the researches conducted during the past ten-year period, significant progress was achieved in the study of the flora of higher plants in the Republic of North Macedonia.

Out of 42 Important Plant Areas identified, which cover an area of around 650,000 ha, only 10 are completely or nearly completely covered by the national protected areas or around 147,500 ha (22.7%) fall under some sort of protection (map). Furthermore, 12 Important Plant Areas are transboundary, bordering with the neighboring countries. Each of them fulfills the criteria for the establishment of IPA and they are of great floristic (International and national) value. In 8 of the selected Important Plant Areas (Shar Planina, Pelister, Ilinska and Plakenska Mountain, Prespa Lake, Dojran Lake, Bogdanci, Osogovo Mountains and Judovi Livadi) during the 2012-2016 period, MES performed different activities for promotion of the importance of these areas, education on the

important species, creation of local conservation groups for monitoring and protection of the species, etc. Activities focused mainly on the promotion of the importance of these IPAs on international level, as part of them constitute, at the same time, potential Nature 2000 sites.

One good example of a local action for the protection of an IPA is the site near Bogdanci where *Astragalus physocalyx* develops, and the local population is included in the monitoring and protection (https://www.facebook.com/pg/Polymath13-Bogdanci-276864659152991/posts/?ref=page_internal)

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



5.6. GSPC Target 6: At least 75 per cent of production lands in each sector managed sustainably, consistent with the conservation of plant diversity

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level

☐ On track to achieve target at national level ☐ Progress towards target at national level but at an insufficient rate ■ No significant change at national level
Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description.

5.7. GSPC Target 7: At least 75 per cent of known threatened plant species conserved in situ

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level ☐ On track to achieve target at national level ☐ Progress towards target at national level but at an insufficient rate ■ No significant change at national level
Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description.

5.8. GSPC Target 8: At least 75 per cent of threatened plant species in ex situ collections, preferably in the country of origin, and at least 20 per cent available for recovery and restoration programmes

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level ☐ On track to achieve target at national level ☐ Progress towards target at national level but at an insufficient rate ■ No significant change at national level
Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description. There is no systematic, organized plan for ex-situ conservation. In the past period, volunteering activities have been undertaken to move a certain number of endangered plant species into the buidling for endemic, relict and rare plant species in the Botanical garden at the Institute for Biology, Faculty of Natural Sciences and Mathematics in Skopje: *Thymus oehminaus, Osmunda regais, Viola alcharensis, Ramonda nathaliae,* etc. Lately, certain activities within the framework of different projects are undertaken (financed by UNEP, PONT, CEPF) to move certain endemic plant (*Astragalus physocalyx*, *Centaurea galicicae, Edraianthus horvatii, Dianthus galicicae, Festuca galicicae, Laserpitium ochridanum, Sempervivum galicicum, Crocus cvijicii, Centaurea soskae, Rindera graeca, Jurinea micevski, Helichrysum zivojini*) to the Botanical garden.

5.9. GSPC Target 9: 70 per cent of the genetic diversity of crops including their wild relatives and other socio-economically valuable plant species conserved, while respecting, preserving and maintaining associated indigenous and local knowledge

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level

☐ On track to achieve target at national level

☐ Progress towards target at national level but at an insufficient rate

■ No significant change at national level

Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description.

The Gene bank at the Institute of Agriculture in Skopje functions as a national gene-bank. According to 2013 data, the Gene bank contains samples from wheat crops, legumes, industrial, vegetable and forage crops, grapevine, fruits as well as samples from medicinal and aromatic plants. The material which was conserved in the Gene bank comes from a different biological origin: native population, domestic and introduced varieties, different selection material and samples from spontaneous flora (wild relatives, weeds). In 2013, the Gene Bank maintained a collection of 2666 samples of 89 different species, which included 256 samples from wild species.

A large number of samples were added to the *European list of collections where plant species are kept ex situ* **(http://eurisco.ecpgr.org).**

In the past period, no appropriate funds have been secured to maintain the collections. Detailed information about the current status of the collections and the activities undertaken related to genetic diversity and the status of the genetic resources of the country are represented in chapters II and III.

5.10. GSPC Target 10: Effective management plans in place to prevent new biological invasions and to manage important areas for plant diversity that are invaded

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level

☐ On track to achieve target at national level

☐ Progress towards target at national level but at an insufficient rate

■ No significant change at national level

Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description.

5.11. GSPC Target 11: No species of wild flora endangered by international trade

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level

☐ On track to achieve target at national level

☐ Progress towards target at national level but at an insufficient rate

■ No significant change at national level

Please explain the selection above:
Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description. Information about the implementation of CITES for import/export of plant species are presented in Chapters II and IV.

5.12. GSPC Target 12: All wild harvested plant-based products sourced sustainably

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level
☐ On track to achieve target at national level ☐ Progress towards target at national level but at an insufficient rate ■ No significant change at national level
Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description.

5.13. GSPC Target 13: Indigenous and local knowledge innovations and practices associated with plant resources, maintained or increased, as appropriate, to support customary use, sustainable livelihoods, local food security and health care

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level
☐ On track to achieve target at national level ☐ Progress towards target at national level but at an insufficient rate ■ No significant change at national level
Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description.

5.14. GSPC Target 14: The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programmes

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level
☐ On track to achieve target at national level ☐ Progress towards target at national level but at an insufficient rate ■ No significant change at national level
Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description. The only Botanical garden at the Institute for Biology, Faculty of Natural Sciences and Mathematics, at the University Ss. Cyril and Methodius – Skopje, organizes programs for primary and secondary education students, who are brought closer to the problematics of biodiversity and its protection. The Macedonian Ecological Society performs activities for raising public awareness and education about the important plant areas in R. of N. Macedonia, as well as training on a local level aimed at

future protection of said areas.

5.15. GSPC Target 15: The number of trained people working with appropriate facilities in plant conservation increased, according to national needs, to achieve the targets of this strategy

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level

☐ On track to achieve target at national level

■ Progress towards target at national level but at an insufficient rate

☐ No significant change at national level

Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description.

The University Ss. "Cyril and Methodius" – Skopje, the University "St. Kliment Ohridski" – Bitola, the University "Goce Delchev" Stip and the State University in Tetovo all offer higher educational programs for plant conservation. Furthermore, the University Ss. "Cyril and Methodius" – Skopje, i.e. the Institute for Biology at the Faculty of Natural Sciences and Mathematics represents an institution with the longest tradition, which, in the past period has formed scientific and expert cadres which are leading experts in the country today, and have had a leading role in the preparation of all strategic documents and reports related to the biodiversity status and its protection in the country.

5.16. GSPC Target 16: Institutions, networks and partnerships for plant conservation established or strengthened at national, regional and international levels to achieve the targets of this Strategy

Category of progress towards the target of the Global Strategy for Plant Conservation at the national level

☐ On track to achieve target at national level

☐ Progress towards target at national level but at an insufficient rate

■ No significant change at national level

Please describe how and to what extent your country has contributed to the achievement of this GSPC Target and summarize the evidence used to support this description.

Throughout the territory of N. Macedonia, there is only one Botanical garden at the Institute for Biology, Faculty of Natural Sciences and Mathematics, at the University Ss. Cyril and Methodius – Skopje.

An attempt was made by the Macedonian Ecological Society to identify local conservation groups in eight of the important plant areas and to connect them in a network (national IPA network) which includes eight local organizations and collaborators (municipalities, PE NP Pelister, schools, etc.) These activities must be continued in order to maintain this network.

6. Section VI Additional information on the contribution of indigenous peoples and local communities

This Section is not applicable to the Republic of North Macedonia.

7. Section VII. Updated biodiversity country profiles

7.1. Biodiversity Facts

7.1.1. Status and trends of biodiversity, including benefits from biodiversity and ecosystem services

Although being small (25713 km^2) and landlocked country, with its position in the centre of the Balkan Peninsula, the Republic of North Macedonia is one of the hotspots for biodiversity in Europe. To the north it borders Kosovo[4] and Serbia, to the east, Bulgaria, Greece to the south, and Albania to the west. Airline distance from its northern to its southern borders is 155 km, and 210 km from western to eastern ones. According to the last estimates from 2012, the population number living in the Republic of North Macedonia is 2062294 inhabitants with average density of population is 83 persons per km^2. Urban population is primarily concentrated in the capital of Skopje (around 30%).

The country is characterized by a complex geological structure. Geological formations are found from almost all geological periods, starting from the Precambrian to the latest quarter, hence the various types of rocks are found. Most of the territory (44.1%) lies on altitude between 500-1000 m. Geomorphology and relief are characterized by domination of hilly terrains (almost 80% of the territory) and valleys are connected with deeply incurved canyons and gorges. The country could be categorized among medium rich in waters. Different types of waters exist such as ground waters, springs, sources, running waters, streams and rivers, as well as natural and artificial lakes. 84% of the waters in the Republic of North Macedonia are domicile, while only 16% originate outside of the country. Four watersheds exist in the country of which river Vardar's is the largest one, covering about 80% of the national territory.

In the southern lowland areas, the climate is sub-Mediterranean, it is continental throughout the country and mountainous on altitudes above 1500 m a.s.l. The average annual temperature varies between -0.4 and 14.2oC. An average annual precipitation in mountainous areas is 1.000-1.500 mm, and 600-700 mm in the valleys, Ovche Pole plain being the driest area with only 490 mm. Eight climatic-vegetation and soil regions have been defined, the largest being the warm sub-Mediterranean-continental zone of the pubescent oak.

According to the EUNIS classification (with necessary modifications) 28 most important (key) ecosystem types/groups (some of them with anthropogenic origin but with some importance for biodiversity) have been identified, which equals to 177 habitat types of level 3 (according to the same classification), indicating high diversity of ecosystems in the Republic of North Macedonia.

Forests cover about 38.5% (988.835 ha) of the country's land surface, deciduous forests are dominant forest types (58%) followed by the mixed forests (30 %), coniferous (7%) while the degraded forests (5%) are the least present. About 90 % of the forests are state-owned. Agricultural land covers about 45% of the country (1.268.000 ha) of which 510.000 ha are cultivated land (81% arable land and gardens, 12% meadows, 4% vineyards and 3% orchards). Pastures of high quality are located in almost all high mountain areas, especially in the western part of the country. Grassland ecosystems occupy a large part of the country, occurring often as secondary habitats primarily

[4] In accordance with UNSCR Resolution 1244/1999

caused by the historical degradation of forest phytocenoses and re-colonization of abandoned farmland by grassland species.

There are three larger lakes of tectonic origin (Ohrid, Prespa and Dojran) and 42 small glacial lakes of which 18 are found on Shar Planina Mt. Wetland vegetation, which used to develop over large areas of swamps and marshes in the country's entire central valley, underwent great changes due to the implementation of previous drainage measures which resulted in most of these ecosystems being converted into arable land. The relict wetland communities that are present exist in a fragmentary state (7 smaller marshes still exist) and their flora and fauna species are the most endangered.

So far, about 2095 species of algae, 3200 vascular plants and 500 mosses, over 2000 fungi and 450 lichens, 13000 invertebrates, 85 fishes, 14 amphibians, 32 reptiles, 335 birds and 90 mammals are recorded, being the major portion of yet insufficiently studied biodiversity. The endemism among these groups is large, with at least 200 endemic taxa among the algae, over 110 endemic plants and approximately 550 endemic animal taxa. Among the vertebrates, the fishes are particularly rich group, with 17 endemic species. The 3.5 million years old Lake Ohrid is the center of the endemism (with 212 endemic species), being one of the global centers for endemism as well.

The economic transition over the last decade has negatively affected the country's biodiversity. The economic benefits arising from the use of biological resources have often outweighed investments in protection measures. Although utilized on daily basis, in form of timber, erosion prevention, fish stocks and for recreation, the economic benefits from biodiversity are not widely recognized or valued. In the last 2 years, the country is working on assessment of ecosystem services prior to this the mapping and ecosystem status assessment was undertaken on a national level. This will be used as a basis for introducing the payments for ecosystem services in protected areas.

7.1.2. Main pressures on and drivers of change to biodiversity (direct and indirect)

Intensified economic growth has often been based on unsustainable use of the natural resources, particularly water and minerals, leading to habitat destruction and alteration, while continued and discontinued urbanization threatens some of the remaining lowland priority habitats. Succession of habitats due to depopulation of rural areas as a result of economical changes on one hand and intensification of agricultural production on the other also threatens many habitats. Forest fires are one of the root causes for modification of habitats – a total of 41.166 ha were destroyed by forest fires in the period between 2015 and 2019, that are characterized with high diversity and/or presence of species characteristic for Mediterranean coastal forests and maquis biome. Almost all rivers are under great direct and indirect anthropogenic pressures (e.g. reservoirs and small hydropower plants that have been built on some rivers). Other contributing factors include global economic and financial crisis, poverty, unsustainable hunting and fishing practices, unsustainable/uncontrolled collection of wild plants and fungi species, illegal logging etc. For the period 2016-2018 at national level about 1671 983 kg of *Juniperus communis*, 324744 kg *Arctostaphylos uva-ursi,* 1684054 kg *Boletus edulis* were collected etc. Poaching is widespread, and non-selective methods are often used.

Threats have been analyzed in detail during NBSAP revision process (where the whole list is included) and all of them probably have led to decrease of populations in many species, and reduction of coverage of priority habitats.

7.2. Measures to Enhance Implementation of the Convention

7.2.1. Implementation of the NBSAP

The Government of the Republic of North Macedonia in 2018 has adopted the National Biodiversity Strategy with Action Plan (NBSAP) for the period 2018-2023 and the National Strategy for Nature Protection (2017-2027).

NBSAP includes 19 national biodiversity targets that are harmonized with Aichi Targets and grouped in 4 strategic goals:

1. To overcome the main/underlying causes of biodiversity loss through its mainstreaming in the society,
2. Reduce direct and indirect pressures on ecosystems and biodiversity,
3. To improve the status of biodiversity components aiming to increase the benefits of biodiversity and ecosystem services and
4. To improve biodiversity knowledge and availability of all relevant information related to biodiversity.

Obstacles to NBSAP implementation that have been identified include, among others, insufficient financial resources, lack of capacities, not enough education and public awareness, and insufficient mainstreaming of biodiversity into different sectors.

7.2.2. Actions taken to achieve the 2020 Aichi Biodiversity Targets

Progress has been made in relation to developing legislative and institutional frameworks for nature protection, improving the system of protected areas including Natura 2000 sites and other internationally important areas (UNESCO sites, Ramsar sites, etc.), biodiversity monitoring and transboundary cooperation for nature protection. Also, many activities for raising public awareness and capacity building have been implemented.

- **Protected areas**

National network of protected areas covers about 8.9% of the national territory the highest percentage 4.48% covered by the three national parks. The National Spatial Plan (2004-2020) stipulates an increase of the protected areas coverage from the current 9% to 11.5% of the country territory. While Aichi Target 11 is incorporated in the NBSAP proposing an increase of protected areas to 15%, ensuring their functional connectivity as an ecological network and establish effective management of protected areas in cooperation with local communities.

Activities for proclamation of protected areas and natural rarities continued. Valorization/revalorization studies of natural heritage and protected areas have been prepared for the following sites: Shar Mountains, Osogovo Mountains, Vodno, NP Pelister, Dojran Lake, Studenchishte Swamp and Chengino Kale. There are several ongoing processes for (re)proclamation of protected areas (Mavrovo NP, Shar Mt., Osogovo Mt., etc.). Some efforts are put for improving management of protected areas through preparation of several management plan and strengthening capacities of PAs management bodies. In addition, seven natural rarities were proclaimed including old trees or important caves or paleontological sites.

Two sites (Prespa and Dojran Lakes) are designated as wetlands of international importance (Ramsar sites) and Nomination for Ohrid Lake is drafted. Ohrid Region is put on the UNESCO World natural and cultural heritage list and a Plan for the Management of the Ohrid Region's Natural and Cultural Heritage has been adopted. Dlaboka River site in NP Mavrovo has been nominated for the UNESCO Preliminary List of Beech forests.

- **Natura 2000**

Even though the EU negotiation process has not started yet, the Republic of North Macedonia has already undertaken steps for alignment with EU Birds and Habitats Directives (drafted a new Law on Nature Protection and several by-laws) that will support their implementation. National Draft List of in Annex I habitats (from the Habitats Directive), National Draft List of species of plants and animals listed in Annex II of the Habitats Directive as well as Draft List of bird species from Annex I of the Birds Directive, migratory birds and other birds of importance regularly occurring in the country have been prepared. So far, eight potential sites of Community Importance (SCIs) under the Habitats Directive and three potential Special Protected Areas (SPAs) under the Birds Directive have been identified and the activities for identification are on-going especially in the Eastern part of the country. Identification of Natura 2000 sites requires a lot background scientific research and new data for biodiversity thus a Plan for implementation of Habitat and Bird directives and Plan for future field research work were also developed followed by establishing GIS system for nature protected sites in compliance with the Natura 2000 network. Two Natura 2000 management plans have been drafted. Draft Stakeholder Involvement Plan for the implementation of Natura 2000 and a Long-term training plan for the implementation of the EU Habitats and Birds Directives were prepared. In order to inform the citizens in a timely manner, dissemination of information on current developments on NATURA 2000 continued through the web portal www.natura2000.gov.mk as well as through social networks.

- **Monitoring of biodiversity**

Regular monitoring of species and habitats is conducted only for selected species or concentrated on some protected areas. Balkan Lynx Recovery Program (2006-2020) at a national level (with the main focus in NP Mavrovo and the surrounding areas) is implemented by NGO in collaboration with state authorities where activities focus on: better knowledge of the ecology and biology of this species, raised public awareness, conservation of species, protection and management of its habitats and prey and capacity building. Intensive monitoring of the Balkan lynx population has been and is being carried out. Continuous monitoring of vultures in North Macedonia has been carried out since 2003. NP Pelister and NP Galicica are conducting monitoring of selected species/habitats. NP Pelister is currently conducting monitoring of large carnivores, including the possible occurrence of lynx.

The Midwinter Waterfowl Census on the three natural lakes, also including given artificial lakes and fishponds, is performed regularly in the last years with synchronized activities with the neighbouring countries Greece and Albania. Another example of transboundary cooperation is monitoring of large carnivores in transboundary Prespa Region conducted by NGOs and protected areas administrations supported by PONT. A Manual for transboundary species and habitats monitoring in Ohrid, Prespa and Shkodra Lake has been developed and tested by the three countries, supported by GIZ.

As part of the EU approximation process, draft protocols for the monitoring of 20 habitats, 20 plants and animal species and 20 birds in accordance with the EU Habitats and Birds Directives were developed and tested for selected species in NP Pelister and Monument of Prespa Lake. Five-year National Biodiversity Monitoring Program for Natura 2000 species and habitats was prepared to be

used for collection of required data for establishment of national Natura 2000 network and nature conservation in the country in general.

- **Species protection**

An assessment of all species of amphibians and reptiles (46 species) has been carried on a national level and the first National Red List of Herpetofauna has been developed according to the IUCN criteria. In addition, an assessment of 14 species of vascular plants of international and national importance has been carried out and a Priority List of Flora Taxa at national level has been prepared, as a basis for further selection and establishment of a final list of priority taxa for the Red List of Flora of the State. Data are publicly available on the web site developed (http://redlist.moepp.gov.mk/pocetna/). National Red List of fungi and National Red List of Large mammals (lynx, bear, wolf, jackal, otter) are expected to be ready by the end of 2020.

In 2010, a List indicating the conservation status of the species of the country was prepared as a comparative review of the species which are on the lists of international conventions, EU habitats and birds' directives and IUCN Red List of globally endangered species. Based on the list, the Lists for establishing strictly protected and protected wild species has been prepared (2011). The adoption of this by-law was an obligation arising from the National Programme for the Adoption of the Acquis (NPAA). Despite the negative reaction of the scientific public in relation to the by-law, this legal act is a good mechanism for legal protection of the species. In the coming period, it is necessary to revise the Lists for establishing strictly protected and protected wild species on the basis of previous scientific researches and analyzes of the state, trend and the extent to which the species are threatened. In this regard, the preparation and adoption of national red lists is a priority issue.

Collection and trade of threatened and protected wild species of plants, fungi and animals and their parts is conducted only upon prior acquisition of license for collection and trade license/CITES certificate. Analysis of the needs for improvement of the CITES implementation (including the EU CITES Regulation) was discussed with support of TAIEX expert mission. Aiming to establish sustainable use of species the Bearberry biomass (Arctosatphylos uva ursi) was assessed and quotas for sustainable use established.

- **Transboundary cooperation for nature protection**

Transboundary actions are very much important for effective management of many important mountainous or lake cross-border areas.

Following the Declaration for the Transboundary Prespa Park (established by three countries North Macedonia, Albania and Greece), in the recent years, intensive activities have started in the transboundary Prespa Region supported largely by the Prespa-Ohrid Nature Trust Fund as a long-term funding for the preservation, conservation and sustainable management of the biodiversity in the Prespa Region for the benefit of nature and people living in the region. A Framework Agreement has been signed between the Prespa - Ohrid Nature Fund (PONT) and the Ministry of Environment and Physical Planning. The first phase of the PONT is providing grants for NP Pelister, NP Galicica PP Ezerani and SP Prespa Lake.

Transboundary Biosphere Reserve Ohrid-Prespa was established by UNESCO in 2014.

The Regional List of Endemic Species in South East Europe for several taxonomic groups is prepared and uploaded to GBIF.

The Republic of North Macedonia supports the promotion of the European Green Agreement in the countries of EU enlargement with the proposals for post 2020 global biodiversity targets to be approved at the CBD COP 15. Also, the country participates in the Regional Biodiversity Working Group (intergovernmental technical and advisory body of the Regional Environmental Working Group) aiming to harmonize regional activities, to facilitate the implementation of the SEE 2020 and provides a framework for more efficient implementation of the biodiversity conservation policy as part of the EU approach.

7.2.3. Support mechanisms for national implementation (legislation, funding, capacity-building, coordination, mainstreaming, etc.)

General principles and measures for biodiversity conservation are described in the Law on Nature Protection (adopted in 2004) with many amendments, mainly due to the ongoing process of transposition of EU Acquis into national legislation. Biodiversity conservation measures and activities are being implemented by the National Biodiversity Strategy with Action Plan (2008-2013), National Strategy for Nature Protection with Action Plan (2017-2027) and Spatial Plan of the country (2004). Implementation of NBSAP is dependent on a number of legal acts relevant for biodiversity conservation and the sustainable use of natural resources (e.g. legislation on water management, forestry, hunting, agriculture and rural development, fishing, etc.) that still needs to be harmonized. Most of the multilateral environmental agreements relevant to the nature protection have been ratified by the Republic of North Macedonia.

However, biodiversity is still not considered an important issue outside of nature conservation and environment sectors. To date, other sectoral policies have been weak in covering the need for protecting biodiversity by placing its importance secondary to other issues and often on a formal basis.

Sector of Nature protection has been established as a part of the Ministry of Environment and Physical Planning to be responsible for the execution of the expert works in the field of nature protection.

Funding support from international donors is strong in the country such as SDC, UNEP, UNDP, PONT, GEF, GIZ, DBU, CEPF as well as EU funding.

The Republic of North Macedonia recognizes that a change in attitude towards biodiversity, within society at large and among officials with decision-making responsibilities, is key to implementing the CBD. Environmental and nature awareness-raising, as well as nature education are high priorities among development needs.

7.2.4. Mechanisms for monitoring and reviewing implementation

The monitoring and implementation of the Biodiversity Action Plan is implementing by the Nature Sector in MoEPP on annual basis. Regular reports are prepared for implementation of other relevant nature protection conventions (Bern Convention, CITES, Bonn Convention etc.)

8. ANNEX I

8.1. Methodology of work

8.1.1. Selection of indicators

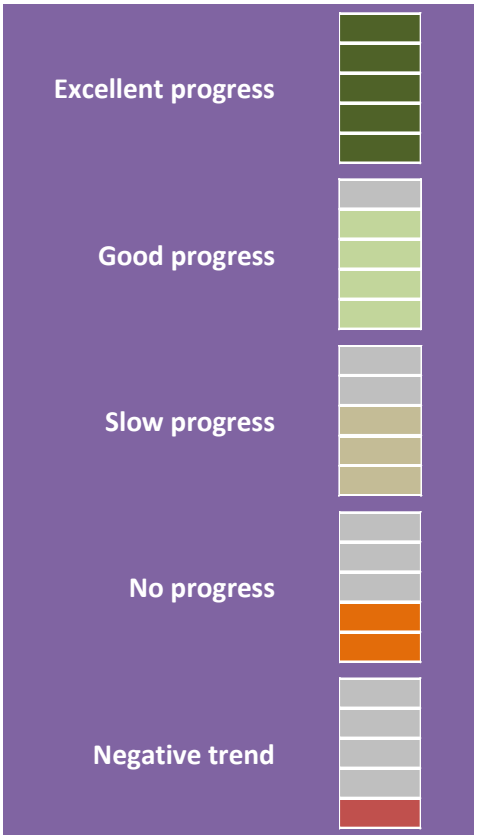
In order to select the indicators for the VI - National report on Convention on biological diversity, an expert team comprised of activities coordinators and representatives from Ministry of environment and Physical planning complied a broad list of possible indicators. The list was prepared in accordance with the activities proposed in the National Biodiversity Strategy with an Action Plan. After the broader list of indicators was prepared, a workshop was organized, with a large number of experts. The main purpose of this workshop was to analyze the proposed indicators from the broader list and to specify the indicators that will be part of the VI - National report to CBD. As a result of this workshop a list of indicators was developed which were elaborated in the following period. This list was supplemented by the authors who were responsible for the preparation of the relevant indicators.

8.1.2. Elaboration of the indicators

Once the indicators were determined, another workshop was held with the purpose to present the forms and the method of preparation of the indicators. The working group of this workshop was composed of representatives from the Ministry of environment and physical planning, Faculty of natural and sciences and Mathematics, “Hans Em” Faculty of forest sciences, landscape architecture and environmental engineering, Faculty of agricultural science and food from “Ss. Cyril and Methodius” University in Skopje, Macedonian academy of science and arts, Macedonian museum of natural history, Hydrobiological institute - Ohrid, National parks administrations, independent experts, representatives of several Citizens' Associations etc. The period after this workshop was used for preparation of the proposed indicators. The indicators, prepared by the authors, were submitted to the Coordinators of the process, who were responsible for archiving, translation (if needed) and analyzing the results from the obtained indicators.

8.1.3. Assessment of the progress according to the specific indicators

Each of the indicators contains information on the progress made towards implementation of envisaged activities of the Action Plan of the National Biodiversity Strategy. The progress was assessed according to the following scale:



8.2. 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

8.2.1. Indicator: Number of activities for public awareness implemented by MoEPP

8.2.1.1. Fact sheet

Author: *Ministry of Environment and physical planning*

Indicator Name: Number of activities for public awareness implemented by MoEPP
Lead Agency: Ministry of Environment and Physical Planning
Use and interpretation: **Key question(s) which indicator helps to answer** What is the level of public awareness about biodiversity and other relevant topics in the country which can be measured by the number of public events organized by MoEPP per year. **Use of indicator** The number of organized public events for biodiversity protection and promotion and celebration of different "biodiversity/environmental" days is an indication of the intensity of on-going activities for public awareness. **Scale of appropriate use** The indicator should be used on national scale and should include both local and nation-wide public events.
Potential for aggregation: This indicator is separate from others indicators. However, it should be used with other indicators aiming to show the status of public awareness in the country regarding biodiversity.
Meaning of upward or downward trends („good or bad") Upward trend should be considered as positive, especially regarding the implemented events/celebration on a local level.
Possible reasons for upward or downward trends: Increased awareness for biodiversity and nature protection should result in increase in the number of public events.
Implications for biodiversity management of change in the indicator: The number of public events should indicate the level of public awareness. Local celebrations should be supported by the Ministry of Environment and Physical Planning in cooperation with local stakeholders
Units in which it is expressed: Number of public events per year.
Description of source data:
Calculation procedure: Preparation of a list of public events and celebrated biodiversity days with additional information
Most effective forms of presentation:

List of public events (date, number of participants, place, etc.)
Limits to usefulness and accuracy: The number of local public events is difficult to assess.
Updating the indicator: The indicator should be updated annually.
Closely related indicators
Additional information and comments

8.2.1.2. Assessment of the indicator

There is an obvious increase in the number of public events organized by the Ministry of Environment and Physical Planning in the period 2015-2019, especially in 2019. We expect this trend to be positive in the next period, as well.

Table 1 Number of public events organized by the Ministry of Environment and Physical Planning in the period 2015-2019

Year	2015	2016	2017	2018	2019
Number of public events	4	5	7	10	17

8.3. 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, national and local development plans, etc.)

8.3.1. Indicator: Number of sector development plans and policies incorporating biodiversity and ecosystem services

8.3.1.1. Fact sheet

Author: *Ministry of Envirponment and Physical planning*

Indicator Name: Number of sector development plans and policies incorporating biodiversity and ecosystem services
Lead Agency: Ministry of Environment and Physical Planning
Use and interpretation: **Key question(s) which indicator helps to answer** 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 Biodiversity Action Plan requires involvement of all stakeholders and each individual. The indicator gives an overview of all relevant documents incorporating biodiversity and ecosystem services. **Use of indicator**

The indicator should be used in order to present the status of mainstreaming biodiversity in different sectors. **Scale of appropriate use** This indicator should be used on national scale and relates to national strategic documents and plans/programes .
Potential for aggregation:
Meaning of upward or downward trends („good or bad") Integration of issues of biological diversity conservation in the relevant plans (Local environmental action plans LEAP) goes on up level. Almost all developed LEAP has measures/actions regarding biodiversity protection. It is expected that more sectoral strategies are incorporating biodiversity related activities better level of conservation would be achieved and undertaking activities to provide 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.
Possible reasons for upward or downward trends: Mainstreaming the biodiversity policy in to economic sector was implemented with activities for public awareness raising among specific target groups (agriculture, rural development, energy) and still should be improved.
Implications for biodiversity management of change in the indicator: Reduce direct and indirect pressures on ecosystems and other components of biological diversity from various sectors
Units in which it is expressed: Number of sector development plans and policies incorporating biodiversity and ecosystem services.
Description of source data: Relevant ministries, public enterprices and local self-govrnments
Calculation procedure: Analyze of sector development plans and policies incorporating biodiversity and ecosystem services
Most effective forms of presentation: In 22 national strategic plans, 17 of them mentioned biodiversity and ecosystem services.
Limits to usefulness and accuracy:
Updating the indicator: The indicator should be followed in 5-years periods
Closely related indicators
Additional information and comments

8.3.1.2. Assessment of the indicator

This is a newly established indicator that should be followed in the next period. The following is a list of strategic plans that should be analyzed in the future period in order to assess the number of sector development plans and policies incorporating biodiversity and ecosystem services.

Spatial Plan of the Republic of North Macedonia (2002-2020). http://app.gov.mk/PP-na-RM-2002-2020.pdf

Strategy for Energy Development in the Republic of North Macedonia until 2040. http://www.economy.gov.mkStrategy_FINAL%20DRAFTpublicConsultations.pdf

Strategy for the utilization of renewable energy sources in the Republic of North Macedonia until 2020. http://manu.edu.mk
Energy Efficiency Strategy in the Republic of North Macedonia NO. http://www.economy.gov.mk/
Regional Development Strategy of the Republic of North Macedonia (2009-2019). http://www.southwestregion.mk.
National Strategy for Sustainable Development (2009-2030). http://www.macefdrr.gov.mk/
National Strategy for Agriculture and Rural Development (2014-2020). http://www.mzsv.gov.mk/
National Water Strategy (2011-2041). http://www.moepp.gov.mk/NationalnaStrategijazaVodi.rar
National Waste Management Strategy (2008-2020). http://www.moepp.gov.mk/Strategija-za-otpad-mak.pdf
National Waste Management Plan (2009-2015). http://www.moepp.gov.mk/Nac.plan-za-upravuvanje-so-otpad-2009-2015.pdf
National Transport Strategy of the Republic of North Macedonia (2007-2017). http://www.moepp.gov.mk/Predlog_National_Transportna_Strategija_2018-2030.pdf
Strategy for Demographic Development of the Republic of North Macedonia, 2008-2015. http://www.mtsp.gov.mk
National Strategy for Poverty Reduction and Social Exclusion in the Republic of North Macedonia 2010-2020. http://mtsp.gov.mk/WBStorage/Files/revidirana_str_siromastija.pdf
National Tourism Development Strategy (2009-2013). http://www.economy.gov.mk/TourismStrategyMacedonia.pdf
National Strategy for Rural Tourism (2012-2017). http://tourismmacedonia.gov.mk/wp-content/uploads/2018/08/Nationalna-strategija-za-ruralen-turizam.pdf
National Biodiversity Strategy with Action Plan, (2018-2023). http://www.moepp.gov.mk/Strategija_za biodiv.pdf
National Strategy for Nature Protection (2017-2027). http://www.moepp.gov.mk
National Action Plan for Combating Desertification in the Republic of North Macedonia, 2018-2024. http://www.moepp.gov.mk/wp-content/uploads/2018/03/%D0%9C%D0%9A_NAP.pdf
Third National Plan of the Republic of North Macedonia to the UN Framework Convention on Climate Change (2014). http://www.unfccc.org.mk/content/Documents/TNC_MK_draft.pdf
Strategy for Adaptation of the Health Sector to Climate Change (2011-2015). http://zdravstvo.gov.mk/wp-content/uploads/2012/12/strategija-klimatski-promeni.pdf
National Plan for Ambient Air Protection (2013-2019). http://www.moepp.gov.mkNationalen-plan-za-zastita-na-vozduhot-2013-2018.pdf
National Strategy on Environment and Climate Change, 2014, (draft). http://www.moepp.gov.mk/wp-content/uplo

8.3.2. **Case study:** Comparision of NBSAP compliance with a National Strategy for Agriculture and Rural Development (2014-2020)

Author: *Ministry of Environment and physical plnning*

In accordance with the Law on Agriculture and Rural Development ("Official Gazette" No. 49/10, 53/11, 126/12, 15/13, 69/13, 106/13), the Government of the Republic of North Macedonia in December 2014, adopted the National strategy on agriculture and rural development for the period 2014-2020 (http://www.mzsv.gov.mk/NSARD.pdf). It is a major long-term strategic document in the field of agriculture and the rural development on which the setting and implementation of the

objectives is based, policies and measures for development of agriculture and rural areas in the Republic North Macedonia. The mainstream of the priorities and actions from Agriculture and Rural Development in the coming period towards generally beneficial functions of ecosystem as well as protection of and care for nature and environment is target of this indicator.

National Strategy for Agriculture and Rural development for 2014-2020 reflects the continuity of the Macedonian state's interest in the development of agriculture and rural areas, by further enhancing existing policies and increasing their effectiveness. The ultimate goal remains to further enhance growing the competitiveness of the agricultural sector on an open and changing market and sustaining the development of rural areas through optimal utilization of the engaged natural resources.

In order to achieve a satisfactory level of hazard prevention pollution rules of good agricultural practice (which are voluntary) the basis will be implemented by farmers and a comprehensive program for training and promotion of the rules of good agricultural practice for protect the environment.

Support to agri-environmental measures still missing in practice to encourage farmers to protect and enhance the environment on their farmland. Also intensive agricultural productions increasingly requires the application of commercial and high-yielding species with higher productivity that suppresses and threaten indigenous livestock breeds and plant varieties.

In terms of water and soil protection, intensive livestock breeding is considered as a major source of nitrates, whose uncontrolled management leads to an imbalance of soil components and contamination of the surrounding surface and ground water and affect to biodiversity.

The vision of the strategy "Increasing the competitiveness of Macedonian agricultural production and food industry, rural development and sustainable management of natural resources" is in line with NBSAP

In the frame of strategy separate chapters are dedicated to protecting biodiversity:

Chapter 1.3 Agriculture, biodiversity and environment

Chapter 1.3.1 Agro-biodiversity-Related to Indigenous varieties of plants and breeds of cattle make up the national one agro-biodiversity due to their centuries-old adaptation to local conditions of adapting

Chapter 1.3.2 Agriculture and the Environment-Related to Agricultural activity has a great environmental impact - positive from the point of view of maintaining extensive agricultural landscapes activities

Chapter 2.2.10 Beekeeping-In the frame of increasing production of honey and strengthening the capacity to prove it as a supporting activity of protection of biodiversity.

Chapter 6.1 Preservation and improvement of the forest fund-In direction that forests play a key role in moving towards a shrinking economy carbon, for biodiversity conservation, sequestration carbon, protection of ecosystems and economic valorisation of resources in direction of development of rural areas.

Chapter 6.4 Biodiversity - related to protection of indigenous breeds and varieties. The main goal will be to increase the share of agriculture and forestry in maintaining and enhancing biodiversity by integrating biodiversity in support of environmental social goods through direct payments. The measures 'protection of indigenous breeds and varieties' from Action plan are in direct connect for implementation of NBSAP.

8.3.3. Indicator: Landcover changes in accordance with CORINE Land cover

8.3.3.1. Fact sheet

Authors: *Nikolov Lazar and Avukatov Vasil (Macedonian Ecological Society)*

Indicator Name: Trends of landcover changes in RN Macedonia in accordance with CORINE Land Cover
Lead Agency: Ministry of Environment and Physical Planning
Use and interpretation: **Key question(s) which indicator helps to answer** Landcover change processes are continuous. They can be a result of both natural and anthropogenic causes. Natural ecosystems have been under strong pressure in the last few decades, as a result of the increased demand and exploitation of natural resources, expansion of urban areas and newly built infrastructure. On the other hand, rural and agricultural areas have been in decline, as a result of the socio-economic processes and migration. The indicator gives a good and spatially explicit overview of all land cover changes, that can be considered relatively detailed when used on a national scale **Use of indicator** This indicator takes the changes of all CORINE landcover categories into account, on the most detailed (third) level available. As there are 33 land cover types present in the country, many potential combinations of landcover changes exist, which can be appropriately grouped into more general processes, for clarity purposes. The dominant and all other processes that will be identified as important can be detected, and national policies can be based upon this information. **Scale of appropriate use** This indicator takes the changes of all CORINE landcover categories into account, on the most detailed (third) level available. As there are 33 land cover types present in the country, many potential combinations of landcover changes exist, which can be appropriately grouped into more general processes, for clarity purposes. The dominant and all other processes that will be identified as important can be detected, and national policies can be based upon this information
Potential for aggregation: The reduction of the natural and semi-natural areas can be generally considered as indicator for bad trends, in terms of biodiversity conservation. However, there are some exceptions, and therefore it is always recommended to use the most detailed information available, as the generalized analyses may produce incorrect conclusions or very often – miss important non-dominant land use processes. Additionally, if the data is being analyzed for scales lower than the national level (local or regional), it is recommended to combine and assess the data with local and regional knowledge, if possible, in order to properly assess the trend details relevant for particular cases and regions, before using the data for policy making.
Meaning of upward or downward trends („good or bad“) The reduction of natural areas, and their replacement with non-natural or semi-natural areas can be generally considered bad trend for biodiversity, and the opposite processes and the conversion of non-natural to semi-natural land cover can be considered generally positive trends. There are exceptions

though, as some short term "positive" trends of natural land cover increase can result in long term negative trends. For example, the conversion of semi-natural agriculture areas into scrubland and forests (due to succession) may be indicative of agricultural land abandonment and migration, which on long term will likely result in increased loss of biodiversity, due to loss of important habitats that are dependent on human activities (ex. meadows and high-mountain pastures). Assessing trends when there is replacement of one for another natural land cover type is case specific and it is dependent on biodiversity conservation priorities. The case is similar with semi-natural to semi-natural land cover conversions.

Possible reasons for upward or downward trends:

. The reduction of natural and semi-natural areas is dominantly anthropogenic in nature, mainly as a result of increased demand for natural resources. The upward trends for some of the natural areas can be anthropogenic in nature, but are mainly result of natural processes (succession).

Implications for biodiversity management of change in the indicator:

In general, the changes of the indicator should warrant adaptation of conservation strategies, which should be directed towards mitigation of negative effects, presumably as a result of reduced natural ecosystems. These measures should primarily focus on restoration of lost habitats. However, in cases when the restoration will not be possible, the measures should be focused on species that are mainly impacted by the negative effects.

Units in which it is expressed:

The absolute values of the areas of land cover changes are expressed in hectares and square kilometers, and percentages are used for the relative changes, when used on national scale. (Alternatively, m2 can be used on regional and local level).

Description of source data:

The CORINE programme was initiated in 1985. The first dataset was created in 1990 and updates were produced in 2000, 2006, 2012 and 2018. CORINE maps homogeneous landscape patterns, i.e. more than 75% of the pattern has the characteristics of a given class from the 3-level hierarchical classified nomenclature. On level-1 the data that CORINE contains is divided in 5 major classes: (1-artificial surfaces, 2-agricultural areas, 3-forests and semi natural areas, 4-wetlands and 5-waterbodies), and on level-3, which is the most detailed level it has 44 classes in the European continent, 33 of which are present in the country.

Calculation procedure:

The CORINE landcover (for years 2000, 2006, 2012 and 2018) and landcover change (for the 2006-2012 and 2012-2018 periods) datasets were downloaded from the Copernicus Land Monitoring Service website (https://land.copernicus.eu/pan-european/corine-land-cover), available as vector "ArcGIS geodatabase" format, in the ETRS89/LAEA geographic projection (EPSG:3035). The datasets cover the area of Europe. The data was re-projected into WGS84/UTM34N geographic projection prior to the analyses, using the "Arc Toolbox/Data management tools/Projections and transformations/Project" tool, available in the ArcGIS Desktop software. The spatial extent of the data was reduced to the size of the national borders using the "Arc Toolbox/Analysis tools/Extract/Clip" tool. The area coverages of the landcover and the landcover changes, which refer on the national level, were calculated, and the tabular data was processed with Microsoft Excel.

The overall area coverage and the cumulative changes of all landcover types were calculated in absolute and relative values, for all the 6-year periods, as well as for the whole 18-year period (since the CORINE landcover data is available for the country).

The detailed analysis of the individual landcover changes were calculated for the last two periods (2006-2012 and 2012-2018). For better overview of the trends, these changes have been grouped into categories, and the data is presented in tabular format and as maps, separately for the both periods.

Most effective forms of presentation:

All landcover change processes can be presented as maps and in tabular form. The changes of cumulative landcover areas can be presented in tabular form.
Limits to usefulness and accuracy: The CORINE Landcover datasets have a 100m*100m pixel resolution, which is adequate for national and regional level analysis, but the use on local level is limited. The minimum size of a polygon is 25ha, which limits the precision of the dataset, as smaller landcover types are not represented. Additionally, the minimum change required for detection is 5ha, and therefore smaller changes are not being detected, and subsequently some of the processes can't be identified. This is especially important for wetlands and other biodiversity rich habitats that occupy smaller areas. The landcover categorization, which sometimes includes multiple landcover types in one category, or potential presence of one habitat type in multiple categories, can have a limiting effect on identification of some (subtle) habitat changes that can have a significant impact on biodiversity.
Updating the indicator: The CORINE Landcover datasets are being updated every six years. The next update should refer to year 2024, and in accordance with the experience so far, the data can be expected one year later, in its validated form, in 2025.
Closely related indicators Trends in the indicators regarding riparian forests, lowland wetlands and general forest area.
Additional information and comments The State Statistics Office of the Republic of North Macedonia is the only national institution that processes the data. Previous analyses of these datasets have been performed and are available in the State Statistical Office. It is unfortunate that those analyses were performed using the most generalized level of the classification of the CORINE landcover datasets, and most of the information about the landcover change trends is lost.

8.3.3.2. Assessment of the indicator

CORINE landcover area coverage and cumulative landcover area changes

The indicator shows the overall changes on the land area according to the CORINE Land COVER nomenclature. Out of 44 CORINE landcover level 3 classes present in Europe, only the 33 are found in R.N. Macedonia.

According to this nomenclature, seen on the level 1, the highest percentage of the land, is under forests and semi-natural areas that cover 15 770 km2, or 61.3% of the total surface area. The category of agricultural areas takes 9 248 km2 or 36% of the total area, the category of water bodies takes 577 km^2 or 2.2% of the total area, the category of artificial surfaces takes 464 km2 or 1.8% of the total area and the smallest area of 22 km2 or 0.1% of the total area belongs to the category of swamps. Figure 1 shows areas presented in km^2, level 1 of the Nomenclature, comparatively for 2000, 2006, 2012, and for 2018. According to CORINE Land COVER, differences between 2012 and 2018 occupy a territory of around 28985 ha or approximately 1.13% of the total national territory. For the period of 2002-2018, major changes can be noted in artificial areas where new of 2302 ha are generated. Another negative trend is decreasing of the area of agricultural land by 1996 ha. Other changes are minor, from decreasing the water bodies by 24 ha to increasing the swamps by 32 ha, to decreasing the total area of forests and semi-natural areas by 288 ha. (Figure 1)

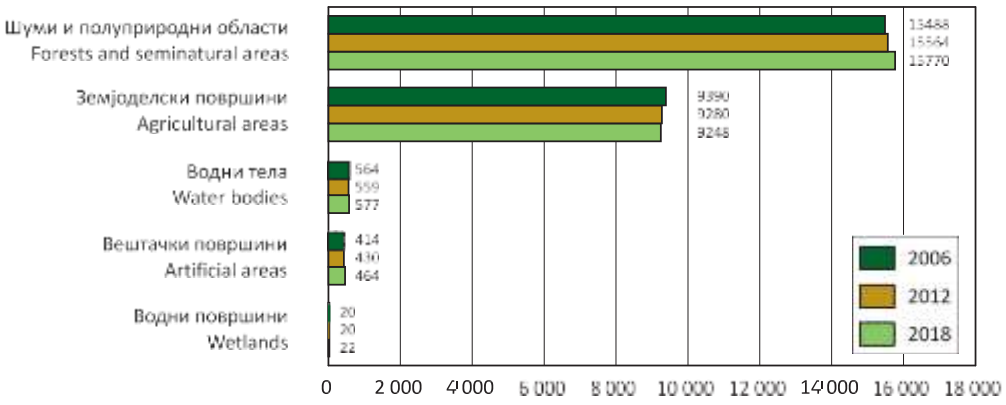


Figure 1 Changes in the land use of level 1 categories of Corine land cover types (Source: Ministry of Environment and Physical Planning)

Results of the previous analyses (State Statistical Office) refer only to the changes of the first level of the CORINE Landcover datasets, and therefore significant information about the landcover trends is lost in the generalized results. The cumulative areas of all landcover categories and the respective absolute and relative changes are presented in the table below, using the most detailed - third level of the landcover classification. The areas of each landcover class, and the respective absolute and relative values of the changes in all 6-year periods, as well as the cumulative changes for the whole 18-year period are presented in Table 2.

Table 2 Table Cumulative area changes according to CORINE landcover (leve3) categories from 2000 to 2018 (positive absolute and relative changes are colored green, the negative changes are colored red)

Landuse level 3	Area 2000	Cumulative change 2000-2006		Area 2006	Cumulative change 2006-2012		Area 2012	Cumulative change 2012-2018		Area 2018	Cumulative change 2000-2018	
	ha	ha	%	ha	ha	%	ha	ha	%	ha	ha	%
Continuous urban fabric	109	-2	-1.86%	107	94	87.56%	201	0	0.00%	201	92	84.08%
Discontinuous urban fabric	29796	2816	9.45%	32612	896	2.75%	33507	146	0.44%	33653	3857	12.95%
Industrial or commercial units	2907	1002	34.48%	3910	382	9.76%	4291	434	10.12%	4726	1819	62.55%
Road and rail networks and associated land	71	48	67.83%	119	7	6.22%	126	0	0.00%	126	55	78.28%
Airports	430	-20	-4.68%	410	34	8.32%	444	0	0.00%	444	14	3.25%
Mineral extraction sites	2269	571	25.14%	2840	541	19.05%	3381	490	14.49%	3871	1601	70.57%
Dump sites	1586	-397	-25.03%	1189	-97	-8.14%	1092	-5	-0.47%	1087	-499	-31.46%
Construction sites	0	283	oo	283	-101	-35.77%	182	950	522.99%	1132	1132	oo
Green urban areas	349	-44	-12.73%	304	31	10.19%	335	0	0.00%	335	-13	-3.84%

Sport and leisure facilities	335	131	38.97%	466	-26	-5.48%	440	0	0.00%	440	105	31.35%
Non-irrigated arable land	253827	-68630	-2.69%	246997	-3666	-1.48%	243332	-864	-0.36%	242468	-11359	-4.48%
Permanently irrigated land	25955	-12440	-4.78%	24715	1214	4.91%	25930	0	0.00%	25930	-26	-0.10%
Rice fields	6065	-253	-4.18%	5812	962	16.55%	6774	73	1.08%	6847	782	12.90%
Vineyards	25703	2541	9.89%	28244	-175	-0.62%	28068	-353	-1.26%	27715	2013	7.83%
Fruit trees and berry plantations	3205	-1245	-38.86%	1959	7548	385.21%	9507	13	0.14%	9520	6316	197.08%
Pastures	209403	-122533	-5.85%	197150	403	0.20%	197553	-1023	-0.52%	196530	-12873	-6.15%
Annual crops associated with permanent crops	226	-226	-100.00%	0	0	0.00%	0	0	0.00%	0	-226	-100.00%
Complex cultivation patterns	232703	-2667	-1.15%	230036	-10175	-4.42%	219861	-132	-0.06%	219729	-12974	-5.58%
Agriculture with significant natural vegetation	192280	-4512	-2.35%	187768	-2812	-1.50%	184956	-569	-0.31%	184387	-7893	-4.10%
Agro-forestry areas	0	96	oo	96	0	0.00%	96	0	0.00%	96	96	oo
Broad-leaved forest	768279	-362775	-4.72%	732004	-4644	-0.63%	727360	-6981	-0.96%	720380	-47899	-6.23%
Coniferous forest	45794	144	0.31%	45939	-239	-0.52%	45700	-786	-1.72%	44914	-880	-1.92%
Mixed forest	52471	-1136	-2.16%	51336	-159	-0.31%	51177	22	0.04%	51198	-1273	-2.43%
Natural grasslands	167942	31841	18.96%	199783	909	0.45%	200692	-856	-0.43%	199836	31894	18.99%
Moors and heathland	19019	-5197	-27.32%	13822	211	1.53%	14033	0	0.00%	14033	-4986	-26.21%
Sclerophyllous vegetation	27506	697	2.53%	28203	-187	-0.66%	28015	-2069	-7.39%	25946	-1560	-5.67%
Transitional woodland-shrub	410807	27815	6.77%	438622	8297	1.89%	446919	2736	0.61%	449655	38848	9.46%
Beaches, dunes, sands	516	-13	-2.59%	502	47	9.41%	549	-13	-2.38%	536	21	4.04%

Bare rocks	188	216	114.77 %	404	17	4.17 %	421	0	0.00 %	421	233	123.73 %
Sparsely vegetated areas	7633	2511	32.90 %	10144	254	2.51 %	10398	-60	-0.57 %	10338	2706	35.45 %
Burnt areas	0	0	0.00%	0	160	oo	160	8823	5522.64%	8983	8983	oo
Inland marshes	1827	98	5.34%	1924	199	10.33%	2123	31	1.44 %	2154	327	17.90 %
Water courses	791	85	10.74 %	876	80	9.17 %	956	-8	-0.81 %	948	157	19.91 %
Water bodies	51634	1416	2.74%	53051	-5	-0.01 %	53045	0	0.00 %	53045	1411	2.73%

The results show that the most dominant landcover class in 2000 are the broadleaved forests, covering 7683km^2. At the same time, the broadleaved forests were the landcover class with the highest loss of cumulative absolute area in 2000-2006 and 2012-2018 periods. For the whole 18-year period, 479 km^2 of broadleaf forests were lost, which represents 6.23% of their relative area in year 2000. The transitional woodland and shrubs landcover category had the largest increase of 388 km^2, or 9.46 % in the 18-year period, followed by the natural grasslands, that gained 319 km^2 or 18.99%. Burnt areas covered 90 km^2 in 2018, urban areas covered additional 39 km^2 in 2018 compared to 2000, and there are increases in mining, industrial areas and construction sites. There are also significant increases of fruit trees and berry plantations, and vineyards of 83 km^2, but there are much larger decreases in multiple agriculture area classes, that exceed 365 km^2 combined.

The cumulative change analyses are useful, but they only show limited information about the actual processes taking place. Therefore, additional analyses of the detailed trends of landcover changes and land conversion processes are needed. In order to have an insight of the landcover change trends, we used the "landcover change" data from the CORINE Landcover dataset.

In conclusion, based on the analyses made for the landcover changes for the periods from 2006 to 2012 and from 2012 to 2018 the forest degradation trends are the landcover changes from the non-degraded broadleaf, coniferous and mixed forests to the transitional woodland and shrub landcover. These trends are dominating in both analyzed periods, and the natural forest regeneration areas (succession, regrowth, plantations etc.) aren't enough to compensate for the forest loss. The forest fires are a general threat, that had a very large impact on all the natural landcover classes, but mostly on the forests in the last 6-year period. It is obvious that the trends of forest loss and predominantly the forest degradation should become a national priority, based on this indicator.

8.3.4. Indicator: Changes in forest area

8.3.4.1. Fact sheet

Author: *NikolchoVelkovski (Faculty of Forest Sciences, Landscape Architecture and Environmental Engineering, Hans Em, Ss. Cyril and Methodius University, Skopje)*

Indicator Name: Changes in forest area

Lead Agency: Ministry of Agriculture, Forestry and Water Economy

Use and interpretation:

Key question(s) which indicator helps to answer

The changes in the forest area are an important factor for the stability of the forest ecosystems, their sustainability as well as the conservation of the biological diversity in the forest ecosystems.

Use of indicator

This indicator should be used to assess the changes of the forest area i.e. for an instance the forest increase and decrease. In addition the changes in the areas in total and separately by species should be assessed.

Scale of appropriate use

This indicator can be used on a National scale.

Potential for aggregation:

The data of the forest area changes is important factor for the sustainability of the forest ecosystems in the Republic of North Macedonia. Nevertheless, the distribution of the forest areas by species is also important. This indicator has a direct influence on the other factors such as the tree volume, increment, the annual allowable cut and etc.

Meaning of upward or downward trends („good or bad")

The increase in forest areas is a good benchmark for the number of species in total and separately per species. If the forest areas are decreasing that can negatively influence the species, putting additional pressure and possible decline in the population number, increasing the risk of endangerment and extinction.

Possible reasons for upward or downward trends:

The changes in the forest areas can be caused by various factors. The forest fires, illegal logging, calamities etc. have an influence in the decrease in the forest areas. Nevertheless, the natural succession processes as well as the good practices of the silviculture and forest management can influence the increase in forest areas. Having in mind that the previously mentioned occurrences are currently very common in North Macedonia and these kind of changes can be expected in thefuture, especially on the level of species and associations.

Implications for biodiversity management of change in the indicator:

The changes in the trend of the indicators should be carefully analyzed. The eventual decrease in forest areas of some of the species can show that the pressure on the biological diversity has increased.

Units in which it is expressed:

The change should be expressed inquantity of gross total gross tree volume in cubic meters per year.

Description of source data:

The only reliable source of such data, which unites the data of all of the institutions in the country is the State Statistics Office of Republic of North Macedonia and it should be used as an important source of data.

Calculation procedure:

Review of thepublished data by the State Statistics Office of Republic of North Macedonia.

Most effective forms of presentation:

The best way to present the trends is to present by lines trends. This indicator is best to be presented in 5-year intervals with data from every species and and annual data in total and per each year separately.

Limits to usefulness and accuracy:

The analysis of the datafor the cut of the gross total gross tree volume by quantities and species is limited, due to the lack of other institutions which will process and own the data.

Updating the indicator:

The indicator should be followed annually, but the results should be compared in 5-years periods.

Closely related indicators
Trends in the indicators regarding riparian forests.
Additional information and comments
The State Statistics Office of the Republic of North Macedonia is the only national institution that processes the data on the dynamics of the forest per total areas and separately by species. The data is collected from all forest management entities. However, the data needs to be further processed in order to obtain more information especially on the species that are distributed on smaller surfaces, due to their endangerment and vulnerability to the potential negative influence resulting with biodiversity loss.

8.3.4.2. Assessment of the indicator

According to the data from the State Statistics Office of the Republic of North Macedonia in the period of 5 years from 2014-2018 there is constant increase in the forest areas. The total recorded forest area of 983 388 ha in 2014 increased to 1 007 095ha in 2018. There is an increasing trend in broadleaved species as well as in mixed forests. There is an unfavorable trend in reducing the area under coniferous tree species which in 2014 were distributed over 68 670 ha and in 2018 on 66 608 ha. In addition, the unfavorable trend is the increase of areas under degraded forests which in 2014 were distributed on 43 346 ha and in 2018 on 44 559 ha. The previously mentioned information indicates that despite the overall increase in forest areas in the country there are certain types of forests with unfavorable conditions that affect both the stability and sustainability of forest ecosystems and the biodiversity conservation.

Table 3 Forest area of different forest types (hectares)

2014	600 847	68 670	270 525	43 346	983 388
2015	610 228	65 091	276 230	42 854	994 403
2016	605 661	66 774	286 315	42 915	1 001 665
2017	602 279	65 032	289 822	44 356	1 001 489
2018	608 211	66 608	287 717	44 559	1 007 095

Based on the data above, it can be concluded that in future special attention should be drawn on the conservation of the coniferous species for an examplepreventing their decline. They are also the most vulnerable forest ecosystems in the territory of the country in terms of climate change and forest fire damages. The degraded forests should not be increased but revitalized, thereby contributing to the restoration of natural forests and the conservation of biodiversity.

8.3.5. Indicator: Number of paid rewards for killed wolves

8.3.5.1. Fact sheet

Indicator Name: Number of paid rewards for killed wolves
Lead Agency: Ministry of Agriculture, Forestry and Water Economy
Use and interpretation:
Key question(s) which indicator helps to answer
Wolves in the Republic of North Macedonia are still regarded as pest animals and a reward is paid for every

wolf killed. **Use of indicator** This indicator shows the number of paid rewards i.e. killed wolves in the country. Indirectly, it shows the strength of the compensation system as well as the awareness among hunters. **Scale of appropriate use** The indicator relates to national scale.
Potential for aggregation:
Meaning of upward or downward trends („good or bad") Upward trends show wolf population size in the country (good) and it also shows the attitude of hunters and policy-makers (bad).
Possible reasons for upward or downward trends: Downwards trends in the number of paid rewards points to a negative population trend in wolf.
Implications for biodiversity management of change in the indicator: The analysis of the trends of the paid rewards for wolves requires change to the hunting policy and regulations.
Units in which it is expressed: Number of paid rewards for wolves per year.
Description of source data: Ministry of Agriculture, Forestry and Water Economy: data sheets for paid rewards for wolves.
Calculation procedure: Compilation of the information in data sheets for paid rewards for wolves.
Most effective forms of presentation: Line charts and tables.
Limits to usefulness and accuracy: The number of paid rewards for wolves depends on the amount of the rewards. In recent period the amount is substantial. Decrease of the reward will likely result in lower number of reported killed wolves (lower than real figures).
Updating the indicator: The indicator should be updated annually.
Closely related indicators • Number of sector development plans and policies incorporating biodiversity and ecosystem services
Additional information and comments It is highly recommended that the payment of killed wolves is cut, as such measure will discourage active wolf persecution. A robust census of the wolf population in the country is lacking. This indicator shows a negative population trend.

8.3.5.2. Analysis of the indicator

The number of killed wolves in the period 2015-2019 averaged to 147.6 killed wolves per year. The maximum number was recorded in 2015 when 182 wolves were killed and reward paid for. It is obvious that the trend in this period shows decrease in the number of paid rewards.

The reward for killed wolves is significant:

- Male wolf MKD 3300.00 (=US$ 60)

- Female wolf MKD 3300.00 (=US$ 60)
- Wolf cub MKD 1300.00 (=US$ 24)

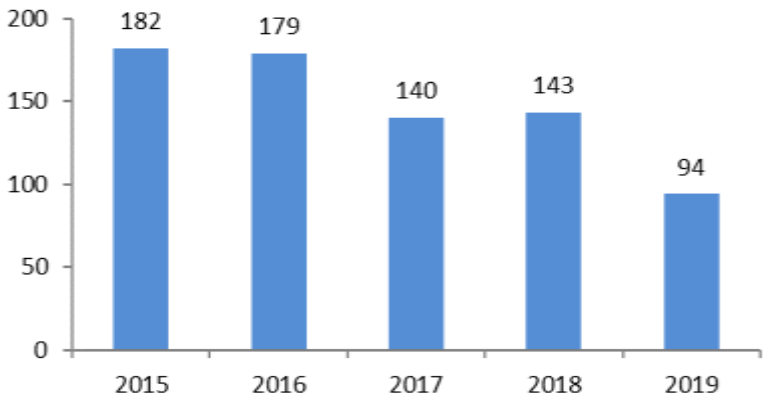


Figure 2 Total number of paid rewards for killed wolves in the period 2015-2019

Table 4 Number of paid rewards for killed wolves (males, females and cubs) in the period 2015-2019

2015	85	84	13
2016	101	63	15
2017	66	68	6
2018	73	68	2
2019	48	46	/
Total	373	329	36

8.4. 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

8.4.1. Indicator: Environmental taxes - quantity and purpose

8.4.1.1. Fact sheet

Author: *Ministry of Environment and physical plnning*

Indicator Name: Environmental taxes - quantity and purpose
Lead Agency: Ministry of Environment and Physical Planning (MoEPP)
Use and interpretation: **Key question(s) which indicator helps to answer** The country has developed a range of strategic documents for various environmental domains but many of them do not deal with the issue of financing of investments. The Strategy also suggested establishing an interministerial taskforce to address the lack of coordination and streamline investment activities, but such a taskforce has not been established. **Use of indicator** Expenditures on environmental protection are financed by a number of different funding sources, depending also on the particular environmental domain. The main general funding sources are the state budget and loans and grants from other countries and international financial institutions. There is no national environmental fund with a variety of earmarked revenues. To some extent, payments of water-use-related fees are earmarked for financing water sector management. **Scale of appropriate use** This indicator is used nationally.
Potential for aggregation: Economic instruments, such as taxes, user charges and subsidies, aim to change the behaviour of economic agents, including private households, towards the environment and the use of natural resources via their impact on price structures. Instruments such as pollution charges are often contrasted to "commandand-control" measures that set pollution limits and define allowable technologies, but both tools can also operate effectively in tandem.
Meaning of upward or downward trends („good or bad") Environmental tax revenues, in past 3 years goes upward as a result of fiscal discipline of the Government of the Republic of North Macedonia and MOEPP
Possible reasons for upward or downward trends: Long-term economic growth and development has a high relevance to any economy, because if the country achieves high and sustainable economic growth rates, all its economic and social performance will improve. In fact, from the dynamics and quality of the growth ultimately depends on the well-being of the citizens of the country and through that a refund Environmental tax.
Implications for biodiversity management of change in the indicator:

The Ministry of Environment and Physical Planning receives a share of earmarked revenues from vehicle registration fees. The forestry sector is mostly self-financed, through the sale of timber and primary wood processing. Protected areas (national parks) depend to a large extent on their own generated revenues, such as entrance fees and payments for collection of wood and non-wood forest products. Investments in municipal utilities (waste and water) are dependent on government budget resources and foreign funds. Private sector investments are financed from own resources and loans, but there is no information on the total resources spent on environmental protection.
Units in which it is expressed: in million denars
Description of source data: During develop the indicator was used official data from State statistical office (Environmental statistics in 2019. http://www.stat.gov.mk/Publikacii/ZivotnaSredina2019.pdf)
Calculation procedure: Environmental taxes accounts are an economic instrument for controlling and managing the pollution and exploitation of natural resources, with the main aim of influencing the behaviour of business entities, producers and consumers.
Most effective forms of presentation: The best way to present data for, tables and graphs. Monitoring should provide insight into how much the effects in the environment. From the income from this tax and taxes will allow for arrangement and protection of the environment, and of the accomplished income will open up the opportunity legal and physical persons to improve the conditions for a healthy environment
Limits to usefulness and accuracy:
Updating the indicator: The indicator should be monitored annually
Closely related indicators On the basis of the “polluter pays” principle, a number of environmental fees are collected in the Republic of North Macedonia, as set out in the Law on Environment, Law on Waters, Law on Waste Management, Law on Nature, Law on Packaging and Packaging waste and the Law on Management of Batteries and Car Batteries and Waste Batteries and Car Batteries, for the purpose of environmental protection.
Additional information and comments

8.4.1.2. Assessment of the indicator

Environmental investments are carried out by several entities in North Macedonia, such as the MoEPP, Ministry of Transport and Communications, Ministry of Local Self-Government, Ministry of Agriculture, Forestry and Water Economy, and Ministry of Economy in the domain of energy efficiency. Investments are also carried out on the local level by municipalities and public enterprises, public institutions and national parks, as well as by the business sector.

Wastewater treatment and waste management are still ranked high, on the Government’s priority list, to which low energy efficiency has been added. The financial resources for investment in environmental infrastructure and technology to achieve compliance with the EU environmental and climate change acquis were estimated in the 2008 National Strategy for Environmental Approximation 2007–2014 to amount to €2.3 billion (at 2006 prices). About half of these costs are associated with the industrial pollution sector, which includes all the major measures taken by industry to reduce its environmental impact, i.e. emissions to air, releases into water and to abate noise. The other major sectors in terms of “adjustment costs” are the water quality and waste

management sectors. These are the three sectors that require substantial programmes of capital investment, either by industry or in municipal infrastructure. Implementation of these projects in water and waste management also require substantial support from donors and efficient use of resources.

Table 5 Environmental taxes, 2014-2017 (in million denars)

Total	9 045.8	10 252.2	11 108.0	11 422.9
Energy taxes	5 987.5	6 521.3	7 141.1	7 355.0
Transport taxes	2 942.0	3 631.8	3 862.7	3 968.9
Pollution taxes	116.4	99.1	104.1	99.0

Source: State Statistical Office

The indicator shows the share of the categories of taxes in total environmental taxes. In 2017, energy taxes had the greatest share (64.4%), followed by transport taxes (34.7%), while pollution taxes had the lowest share (0.9%).

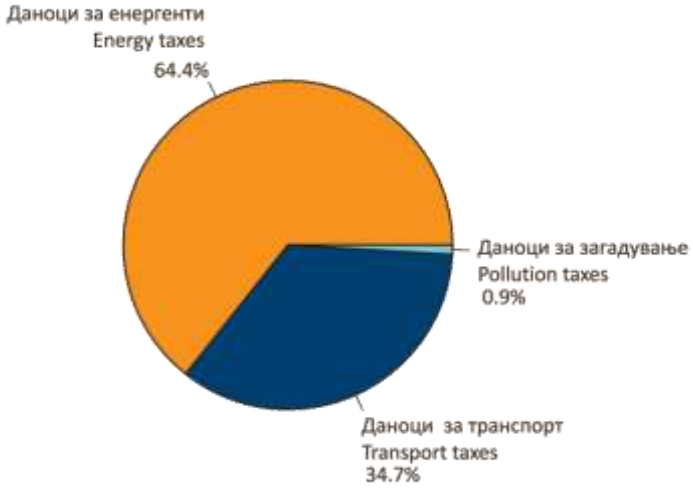


Figure 3 Structure of the environmental taxes, 2017 Source: State Statistical Office

8.4.2. Case study: Premiums and preferential tariffs for production of electricity from photovoltaics

Author: *Ministry of Economy*

In 2019, the Ministry of Economy issued two tender procedures for awarding an agreement for the right to use premium for electricity produced from photovoltaic power plants constructed on land owned by the Republic of North Macedonia. The awarding a premium for photovoltaic power plants on a land owned by the state is being realized at two different locations: Amzabegovo – Sveti Nikole and Makedonski Brod. In Amzabegovo, the photovoltaic power plants will have a total installed capacity of 25 MW over an area of 45 ha divided into 10 parcels. Over an area of 20 ha, the photovoltaic power plant constructed in Makedonski Brod will have an installed capacity of 10 MW.

The investors are obligated to construct the photovoltaic power plant within three years from the date of the signing of the agreement. After the start of work, the investors will receive the agreed premium according to the electricity produced in a period of 15 years, and they will sell the electricity on the electricity market.

1	AZ_10_1	Amzabegovo, Sveti Nikole	~15,87	10	14.303
2	AZ_5_1		~9,52	5	7.153
3	AZ_2_1		~3,67	2	2.840
4	AZ_2_2		~3,37	2	2.841
5	AZ_1_1		~2,80	1	1.418
6	AZ_1_2		~1,81	1	1.421
7	AZ_1_3		~2,16	1	1.421
8	AZ_1_4		~1,72	1	1.421
9	AZ_1_5		~1,76	1	1.421
10	AZ_1_6		~2,04	1	1.422
11	MB_10_1	Manastirec, Makedonski Brod	~19,37	10	13.578

The procedure for awarding premiums for the construction of photovoltaic power plants on private land is still under process. In the archive of the Ministry of Economy, 42 offers have been received for the construction of a power plant with installed capacity ranging within four parts: part 1 (0-200 kW), part 2 (201-500 kW), part 3 (501-1000 kW) and part 4 (1001-3000 kW), with a total installed capacity of 27 MW. The name of the awarded, the total installed capacity and the construction locations will be known after the procedure ends, i.e. when the agreements are signed. It should be noted that in this procedure, the private investors provide the land for construction of photovoltaic power plants, and they compete with an appropriate quote with installed capacity (as mentioned in parts 1, 2, 3 and 4) for receiving a premium as a further refund and a support during realization of the investment.

Furthermore, 102 photovoltaic power plants with installed capacity of 16,713 MW use preferential tariff for electricity production.

In North Macedonia, so far there is only one functioning wind power plant in Bogdanci with installed capacity of 36,8 MW, which uses preferential tariff. The second phase of the final construction of a wind plant in Bogdanci (13,2 MW) is underway, and two additional are in construction as well (70 MW) at different locations.

By 2019, the number of small hydro power plants which use preferential tariff for production of electricity is 93 with an installed capacity of 79,629 MW.

Other producers from renewable sources with preferential tariff:

- thermal power plants using biogas for electricity production (6,99 MW)
- 1 biomass thermal plant (0,6 MW), 4 under construction (2,494 MW)

In order to stimulate solar energy use in the Republic of North Macedonia, since 2007 the Ministry of Economy has been successfully implementing the activities for realization of a simulative measure by subsidizing part of the expenses for purchased and installed solar thermal collector systems in households. Up until 2019, 7301 households have received subsidies, from a total of 17,435 applications, which are given a refund of 30% of the finances used to purchase and install the solar collector, but not exceeding EUR 300 in denar equivalent value, and around 106,000,000 denars from the Budget of the Republic of North Macedonia have been paid so far. In accordance, the

analyses made show that as a result of this measure, final energy savings of 981 MWh annually have been made, and the reduction of CO_2 emissions is 897 t annually.

8.5. National target 4: Increase the level of investments in and funding of biological diversity conservation from central and local budgets and other sources

8.5.1. Indicator: Trends in central budget investments intended to implement the NBSAP

8.5.1.1. Fact sheet

Author: *Ministry of Environment and physical plnning*

Indicator Name: Trends in central budget investments intended to implement the NBSAP
Lead Agency: Ministry of Environment and Physical Planning (MoEPP)
Use and interpretation: **Key question(s) which indicator helps to answer** A part of the entire MoEPP environmental investment program is designed for intended to implement the NBSAP. The Ministry receives a share of earmarked revenues from vehicle registration fees. This indicator helps to follow the investments from the central budget for the implementation of NBSAP. **Use of indicator** Indicator is used to prepare Annual work plan of the Nature Sector as well as to follow progress in implementation of designed actions in Biodiversity Action Plan. **Scale of appropriate use** This indicator is used nationally
Potential for aggregation: Decentralization requires identification of numerous priorities and actions to facilitate the process of allocation of the responsibilities from central to local level. Emphasis has also been placed on the strengthening of regional and local structures, by which the Republic of North Macedonia will be prepared both for implementation of the legislation and full utilization of EU funds. In this context, measures should be intended at providing assistance in the process of strengthening the decentralised system for project management, identification of human resources required for preparation and implementation of investment projects at central and local level and their capacity strengthening, as well as establishment/ strengthening of departments and units for preparation and implementation of biodiversity conservation projects. Thus, investments from local budgets will be added
Meaning of upward or downward trends („good or bad") Environmental investment to implement the NBSAP, in past years goes upward as a result of the prioritization of areas by the Government of the Republic of North Macedonia and MOEPP generally connected by National strategy for Biodiversity 2018-2023 and National strategy fop Natrue protection 2017-2027 are where basis for budget planning and nature conservation actions. Incresing of the investments for biodiversity conservation from the Central budget will easy the implementation of the NBSAP (2018-2023) and National Strategy for Nature protection (2017-2027). Increasing allocations from the Central budget (as co-financing) will also increase the support from European/international donnors to the country. Increasing support from the Budgets of the Local Self-

Governments is also desirable. Without investments from the Central Budget, the commitment of the Government for biodiversity conservation is unconvincing.
Possible reasons for upward or downward trends: The lack of complete and accurate data regarding the status of species and valorization of natural heritage is a results of the lack of integrated approach to solving environmental problems, especially in the biodiversity important areas, as well as the lack of capital investments to finance the infrastructure in these areas, which results in further slowing down of the processes for setting up an efficient system for environmental protection in the Republic of North Macedonia.
Implications for biodiversity management of change in the indicator: Green economy strategies see environmental sustainability as a major potential economic opportunity, a driver of investment, economic growth and green job creation. A generic definition of green jobs distinguishes two main groups of jobs: (i) jobs in companies that produce goods or provide services that benefit the environment or conserve natural resources; and (ii) jobs in activities that involve making production processes of a company more environmentally friendly or lead to a reduced use of natural resources.
Units in which it is expressed: in million denars
Description of source data: During development of the indicator official data from State statistical office were used.
Calculation procedure: These programs are part of the so called "Development Budget" of the Republic of North Macedonia, which includes the multi-annual capital investment projects. The planning of these assets is carried in the medium term, i.e. planning is done for a period of three years.
Most effective forms of presentation: The best way to present data are tables and graphs.
Limits to usefulness and accuracy: n/a
Updating the indicator: The indicator should be monitored annually
Closely related indicators One of the instruments for financing projects in the area of environment implemented by the MoEPP is the annual Environmental Investment Program adopted under the Law on Environment, with funds raised from environmental protection fee when registering motor vehicles and boats
Additional information and comments Environmental statistics in 2019. http://www.stat.gov.mk/Publikacii/ZivotnaSredina2019.pdf

8.5.1.2. Assessment of the indicator

The environmental investments are implemented by several stakeholders in the country, such as the Ministry of Environment and Physical Planning (MoEPP), Ministry of Transport and Communications (MTC), Ministry of Local Self-Government (MLS), Ministry of Agriculture, Forestry and Water Economy (MAFWE), as well as the Ministry of Economy (MoE) in the area of energy efficiency. Additional investments are also made locally by the municipalities and the public enterprises, the public institutions for the National Parks and by the business sector.

In 2012, the Unit for Strategic Environmental Assessment in the Ministry of Environment and Physical Planning was transferred from the Department for Sustainable Development and Investments to the Department for Physical Planning. In the Department for Sustainable Development and Investments, most people work on investments. Apart from the preparation of related inputs to policy documents, the Department does not work on sustainable development issues as this mandate has been assigned to the Cabinet of the Deputy Prime Minister responsible for Economic Affairs. The Department works with projects, financed through the annual environmental investment programme (formed from the funds collected from tax on vehicle registration), which are selected from the project proposals developed by municipalities and other stakeholders.

Since 2007, the Ministry of Environment and Physical Planning has been supporting activities of CSOs through the Annual Environment Investment Programme of approximately €1 million, which is divided into grants to municipalities (60–70 per cent) and to CSOs, businesses and academia (30–40 per cent). About 40–50 grants are approved to CSOs annually. Grants under the Programme are for projects with duration of up to one year. In addition, awards are given by the Ministry to individuals and legal entities in recognition of their environmental protection achievements.

The National Strategy for Environmental Investment for the period 2009–2013 was developed to measure broadly the financial resources required to achieve compliance with EU environmental legislation in the major environmental domains. One part of the entire MoEPP investing program is designed for intended to implement the NBSAP.

The Ministry of Environment and Physical Planning receives a share of earmarked revenues from vehicle registration fees. The forestry sector is mostly selffinanced, through the sale of timber and primary wood processing. Protected areas (national parks) depend to a large extent on their own generated revenues, such as entrance fees and payments for collection of wood and non-timber forest products. Investments in municipal utilities (waste and water) are dependent on government budget resources and foreign funds. In 2019, the implementation of priority investment projects continued, in particular in the area of waste water collection and treatment, thus making progress in the implementation of the national legislation. In the area of wastewater treatment, several projects for construction of treatment plants were implemented, as well as for preparation of feasibility studies and technical and tender documentation for implementation of investment projects in the waste management.

The Government adopted **the Environmental Investment Program for 2019 (**Official Gazette of RNM No.17/2018**)** with funds in the amount of 98,000,000.00 denars (1,593,935 euros) for financing and co-financing of projects in the area of environment for 2019. Pursuant to the Program, the MoEPP published a Competition (Official Gazette of RNM No.19/2019) for financing and implementation of programs, projects and other activities in the area of environment for 2019 which allocated funds in the amount of 67million denars (items from the Program 1, 2, 3 and 4) to 88small-scale projects in the following areas:

- Preparation of technical documentation and construction of sewerage and waste water drainage and treatment systems in the amount of 53,000,000.00 denars;
- **Implementation of projects and activities in the area of protection of nature and biodiversity in the amount of 2,000,000.00 denars;**
- Implementation of projects and activities in the area of awareness raising, education and training in the area of environment, in the amount of 8,000,000.00 denars;

- Stimulation of educational, research and development studies, programs and project for protection and improvement of the environment and nature, in the amount of 4,000,000.00 denars;

Table 6 Investment from the central budget for biodiversity and nature conservation in the past years (In 000 denars)

Conservation of biodiversity and nature	**34061.47**	**67478.22**	**64226.67**	**206803**	**118179.7**	**134222.1**

Source: Environmental statistic in 2019. http://www.stat.gov.mk/MetodoloskiObjasSoop.

Most of the projects were implemented during the reporting period. Some of them will resume with implementation in 2020.

Also, the **Environmental Investment Program for 2020 (**Offical Gazette of RNM No. 277/2019**)** was adopted, with funds in the amount of 98,000,000.00 denars (1,593,935 euros) for financing and co-financing of projects in the area of environment. The Competition for financing was announced during January and published in the Offical Gazette of RNM No. 14/2020.

Investment expenditures by environmental domain are dominated by four sectors: waste management (average share of 40.6 per cent during the period 2013–2017); wastewater management (23.1 per cent); water supply (15.8 per cent); and air protection (12.7 per cent). Together, these four sectors accounted for 92.2 per cent of all environmental investment expenditures during the period 2013–2017.

8.5.2. Case Study: Provided funds for Protected areas

Author: *Ministry of Environment and physical plnning*

The financing of the protected areas is regulated by the Law on Nature Protection (Official Gazette No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16). Article 161 of this Law prescibes the fees through which nature protection i.e. protected areas can be financed. In this respect, as stipulated in the Law, funds for the protected areas may be provided from:

- protected area entrance and visit fee,
- parking fee in the protected area,
- fee for visits to special facilities in the protected area,
- fee for collection of wild plant species, fungi and animals and their parts and sustainable use of natural resources (management of forest habitats and ecosystems in protected areas),
- fee for the visit in a protected area,
- funds acquired through activities in a zone of active management and a zone of sustainable management,
- fee for performing an activity in a protected area,
- fee for the use of the logo of a protected area on products and services for commercial purposes,
- fee for sailing in a protected area,

- fee from ecosystem services
- other sources (donations, grants, loans, renewable loans, gifts, etc.).

In addition, Article 141-a of the Law on Nature Protection specifies the same fees, but refers to the financing of public institution - national parks.

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

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

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

8.5.2.1 Annual Program for Nature Protection

Article 162 of the Law on Nature Protection prescribes that the funds for nature protection, and therefore for the protected areas, may be provided from the State Budget and the budgets of the local self-government units.

The funds can be used for the realization of the objectives set in the National Strategy for Nature Protection and NBSAP, for development and implementation of plans and programs for nature protection, management plans for protected areas, preparation and updating the Red List of wild species and the Red Book, and other plans and programs adopted pursuant to Law of Nature Protecton.

Upon proposal of the Minister managing the state administration responsible for the affairs of nature protection, the Government shall adopt an Annual program for nature protection.

The Annual Program for Nature Protection for 2019 (Official Gazette of the RM No.18/2019) adopted by the Government allocated funds in the amount of 715.580.106,00 denars, which were provided by:

1. The State Budget at amount of 1.150.000,00 denars,
2. The Budget of the Municipality of Ohrid at amount 635,594,00 denars,
3. Part of the budget was provided from donor funds from projects of the Ministry of Environment and Physical Planning in the amount of 714.430.106,00 denars as follows:
   - EU Twinning Project “Strengthening the Capacity for Effective Implementation of European Union Legislation in the Field of Nature Protection” at amount of 67,647,823.00 denars,
   - EU / UNDP Project “Improving the Management of Protected Areas” at amount of 240,955,374,00 denars,

- GEF/UNEP Project "Achieving Biodiversity Conservation through Creation and Effective Management of Protected Areas and Integrating Biodiversity into Land Use Planning" in the amount of 197.949.713,00 denars and
- SDC project: “Nature Conservation Programma of Macedonia, Phase II” in the amount of 207.871.224,00 denars

The Annual Program for Nature Protection for 2020 adopted by the Government allocated funds in the amount of 245.856.693,00 denars that will be provided by:

1. State Budget at amount of 500.000,00 denars (only for Improving the management of natural resources by the ranger service in the National parks Pelister, Mavrovo and Galichica,
2. Part of the funds will be provided by donor funds from projects of the Ministry of Environment and Physical Planning in the amount of 245.356.693,00 denars, as follows:
   - GEF/UNEP Project "Achieving Biodiversity Conservation through Creation and Effective Management of Protected Areas and Integrating Biodiversity into Land Use Planning" in the amount of 197.949.713,00 denars,
   - SDC “Nature Conservation Program of North Macedonia, Phase II” in the amount of 32.000.000,00 denars,
   - Ohrid-Prespa Nature Fund (PONT) in the amount of 12,300,000.00 denars and
   - GIZ Open Regional Biodiversity Fund in the amount of 1,230,000.00 denars.
   - European Bank for Reconstruction and Development Project: "Building Biodiversity Capacity in the amount of 1,876,980.00 denars

8.5.2.2 Annual Environmental Investment Programme

Funding activities in the field of environment and nature is carried out on the basis of the Annual Environmental Investment Programme (Article 172 of the Law on Environment). The programme is prepared in accordance with NEAP, Spatial Plan of the Republic of North Macedonia, other strategies, programmes and acts in the field of environment and in accordance with international agreements ratified by the Republic of North Macedonia. The programme includes the preparation of educational, research and development studies, programmes and projects for the protection and improvement of the environment and nature, including projects for the protection of biological diversity and nature, supporting scientific research and raising public awareness and education. The beneficiaries of the programme funds are municipalities or associations of municipalities, legal and natural persons, universities and other scientific institutions, non-profit and non-governmental organizations, non-governmental organizations that implement programmes and projects in the field of environment and nature protection.

8.5.2.3 International donors in the Republic of North Macedonia for nature protection activities

Activities for nature protection in the Republic of North Macedonia are to the greatest extent financed by European and international donors such as:

- EU through IPA funds and the Interreg Program
- EU Programm LIFE +. This Programme is an EU financial instrument for the environment and climate actions. The main objective of the program is to contribute to the implementation and development of EU environmental and climate policies and regulations. The Programme

Life + program contain three thematic areas: Life + Nature and Biodiversity, Hivpt + Environmental Policy and Governance, Life + Information and Communication

- Global Environment Facility (GEF), implemented through United Nations Development Program (UNDP), United Nations Environment Program (UNEP)
- Donations/grants from other countries, among which Switzerland through Development and Cooperation Agency (SDC), Germany through GIZ, DBU and KfW Bank, Netherlands, Austria and other countries have provided the most significant support
- KfW Bank, World Bank, European Bank for Reconstruction and Development etc.

8.5.2.4 Financial models for financing of protected areas

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

Payment for ecosystem services is a good opportunity for providing funding for protected areas. Pursuant to Article 164-a of the Law on Nature Protection, the payment for ecosystem services is regulated by means of negotiations and is carried out on the basis of a contract. The entity that manages the protected area concludes contracts for collecting ecosystem service fee with all operators who benefit from the ecosystem services. The payment for ecosystem services is, in fact, the implementation of the "User pays" principle.

Payments for ecosystem services have two main objectives:

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

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

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

8.6. National target 5: Establish practices for forestry, agriculture, hunting and fishery management that contribute to the conservation of biological diversityand maintenance of ecosystem services

8.6.1. Indicator: Riparian forest changes (area, average belt width, level of connectivity)

8.6.1.1. Fact sheet

Authors: *Lazar Nikolov and Vasko Avukatov* (Macedonian Ecological Society)

Indicator Name: Riparian forest changes (area, average belt width, level of connectivity)
Lead Agency: Ministry of environment and physical planning / Ministry of agriculture, forestry and water economics
Use and interpretation: **Key question(s) which indicator helps to answer** Riparian forests have been under strong pressure for the last few decades, mainly from the agriculture activities, due to the fertile land and the water proximity. In the same period, riparian forests have been exploited for firewood, and riparian forest areas have been exploited by the mineral extraction industry. Small dump sites are also an increasing threat for the riparian forest ecosystems. **Use of indicator** The riparian forest ecosystems are important for a multitude of reasons, like the maintenance of the water quality of rivers and streams, the protection of the river banks from erosion, flood control, waste matter control from the wider watershed area etc. Riparian forest has positive influence on microclimate and increase habitat complexity of the river valleys. Riparian forests also have a unique value for supporting biological diversity, by providing suitable habitats and movement corridors for terrestrial species. Riparian forests are important bird nesting sites, but also serve as feeding grounds for migrating birds. The most developed riparian forests can be found on the middle and lower courses of the large rivers that mainly flow in the lowlands. As such, riparian forests of rivers Babuna, Boshava, Bregalnica, Crn Drim, Crna Reka, Kriva Reka, Lakavichka Reka(Gostivar), Lepenec, Pchinja, Pena, Radika, Raec, Sateska, Topolka, Treska and Vardar should be analyzed **Scale of appropriate use** The indicator can be used in order to assess the national policy on riparian forests protection and their active revitalization.
Potential for aggregation:
Meaning of upward or downward trends („good or bad“) The trend of the surface of riparian forests is directly connected to the health of the ecosystem, as well as to the viability of species populations. The decline in the surface area signals for negative trends and riparian forests diversity and reduction of its ecosystem services capacity. It is the same with the average width of the riparian forest belt and its level of connectivity, which also are important indicators for its capacity to provide ecosystem services and its biodiversity value.
Possible reasons for upward or downward trends:

The recent negative (downward) trends are caused by conversion of riparian forests surface into agricultural land, small dump sites, industrial capacities etc. The increase of riparian forests (positive/upwards trends) is constant due to ongoing process of succession, however the areas with negative trends have been dominant in the past few decades. There also recent activities for regeneration of the riparian forests, by planting new and reallocating suitable tree species.

Implications for biodiversity management of change in the indicator:

Most of the riparian forests in the country are unprotected. Their importance's should be estimated focusing on the landscape connectivity analyses, due to impotence for riparian forests as corridors, and new protected areas should be established in order to protect the most important riparian belts. However, the corridor functionality of all riparian forests, regardless of the protection status, should be analyzed prior to provisioning permits for activities that would (could potentially) destroy or disrupt the ecosystem. The decline in surface, width and connectivity of riparian forests should initiate restoration activities, or offset activities which can be compensated by use of ecosystem services payment mechanism.

Units in which it is expressed:

The riparian forest area changes can be expressed in m^2, hectares or square kilometers. The riparian forest average width is displayed in meters, and the connectivity is displayed in percent.

Description of source data:

The historical distribution and coverage of the riparian forests is not possible to obtain/reconstruct. Thus, the starting point for the riparian forests should be the state of the ecosystem in 2018/2019, provided with the map of ecosystems produced in the frame of Nature Conservation Programme in North Macedonia – phase 2.

Calculation procedure:

Mapping of the surface of the riparian forests in five years periods using GIS and satellite images (e.g. Google Earth maps, ESRI maps, Bing maps, etc.). Calculating the average width and connectivity of the riparian forest belts is performed in GIS, using the ecosystem's surface and the river locations.

Most effective forms of presentation:

The best way to present the trends is to present the areas where changes occurred in maps, and with tables.

Limits to usefulness and accuracy:

The rate of changes is not assessed so far. Some processes, mainly of anthropogenic nature are quite dynamic and changes are visible and measurable, even on annual basis, however, some processes are very subtle. As already noted, the historical surface of riparian forests cannot be estimated, but trends can be theoretically assessed going back from 2002, when the first high resolution satellite imagery (Google Earth Satellite) became available, at least on a regional level, as not all areas were covered with detailed imagery. The time requirements of detailed mapping of the national riparian forests are significant. Therefore, it is recommended to use the 2018-2019 data as baseline, and map only the changes in the ecosystem. Special attention should be payed to the delineation of the riparian forests from other broadleaf forests and other riparian (non-forest/shrubland) habitats. The other two indicators are calculated based on the riparian forest area coverage, and therefore the quality of the trend assessment of these indicators is directly dependent on the quality and the detail of the mapping.

Updating the indicator:

The indicator should be followed in 5 years periods (e.g. 2009-2014, 2014-2019, 2019-2024...) by analyses of ecosystem changes based on detailed satellite imagery.

Closely related indicators

- Diversity of herpetofauna in riparian forest ecosystems
- Number and area of industrial and mining entities, dump sites etc. in the proximity of the riparian forest ecosystems

- Agriculture areas in the proximity of the riparian forest ecosystems
- Organic matter content in the top layers of the riparian forest soils

Additional information and comments

- The riparian forests are usually within the boundaries of the areas managed by the national forest management agency, but in most cases, the riparian forests are not exploited. Measures should be taken in order to formalize this state, that is to keep the riparian forests out of the exploitation plans.
- The indicator is also very useful for other initiatives/processes that aim for biodiversity conservation (e.g. Ramsar Convention, NATURA 2000, Macedonian National Ecological Network MAK-NEN, PES, etc.).
- The information on biodiversity, ecosystem services and other values of riparian forest can be found in different documents:

Daniela Jovanovska, Valentina Slavevska-Stamenković, Vasko Avukatov, Slavcho Hristovski & Ljupcho Melovski (2019) Applicability of the 'Watershed Habitat Evaluation and Stream Integrity Protocol' (WHEBIP) in assessment of the stream integrity in Bregalnica River Basin, International Journal of River Basin Management, 17:2, 209-218, DOI: 10.1080/15715124.2018.1533558

Hawes, E., and Smith, M. (2005). "Riparian buffer zones: Functions and recommended widths." Rep. to the Eightmile River Wild and Scenic Study Committee, (Feb. 28, 2008).

Jovanovska D., Avukatov V., Melovski Lj. & Hristovski S. (2013): Rapid assessment of stream integrity on stream segments in the upper Vardar watershed in Skopje region. Macedonian Journal of Ecology and Environment. 15 (1): 33-48.

Lazar Nikolov and Vasko Avukatov (2020) – Mapping and analyses of the state of ecosystems on a national level, as part of the goal 1.1. Establishment and testing of ecosystem services payment mechanism. Ecosystem type: Riparian forests (in Macedonian) (in prep)

Melovski Lj., Jovanovska D., Avukatov V. (2015). Landscape Diversity in Bregalnica Watershed. Final report of the project "Ecological Data Gap Analysis and Ecological Sensitivity Map Development for the Bregalnica River Watershed", Book 3, Skopje.

Macedonian soil information system - MASIS: http://www.maksoil.ukim.mk/masis/.

EUNIS habitat classification 2012: https://eunis.eea.europa.eu/habitats/1736

Цветкоска Ц., (2014): Функционални карактеристики на рипариската вегетација на реката Пчиња во Македонија, Дипломска работа

ПОПОВСКА, Цветанка, Прирачник за реставрација на реки/Цветанка Поповска, Светислав Крстиќ. – Скопје: UNDP, 2010, - 234 стр.: илустр.: 21 цм.

Светлана Пејовиќ и Љупчо Меловски (2018). Извештај за спроведени активности од Потцел 2.1 Поткомпонента – Ревитализација на рипариска вегетација - Зголемување на површината со крајречна вегетација долж река Брегалница за 2018 година.

8.6.1.2. Assessment of the indicator

Alluvial forests and gallery woods of the mediterranean region are typical for big part of Europe, also in Balkan Peninsula. Dominance may be of a single species, of few species or mixed with many species including *Fraxinus*, *Liquidambar*, *Platanus*, *Populus*, *Salix*, *Ulmus, etc.* (*EUNIS, 2012*). At our country, wood species which dominated in riparian belts are *Populus alba, Salix alba, Salix fragilis, Acer negundo, Alnus glutinosa* etc.

In the past few years in our country, several researches have been conducted related to the identification, determination, and then analysis on the condition of riparian belts. Significant activities have been carried out through master thesis and other papers assessing the ecological

integrity of watercourses. All current activities have provided data about the location and distribution of riparian belts in MKD (Figure 4), as well as calculated areas of riparian belts surrounding most of the rivers. Riparian forest belts are usually distributed along the course of all the larger and smaller rivers in our country.

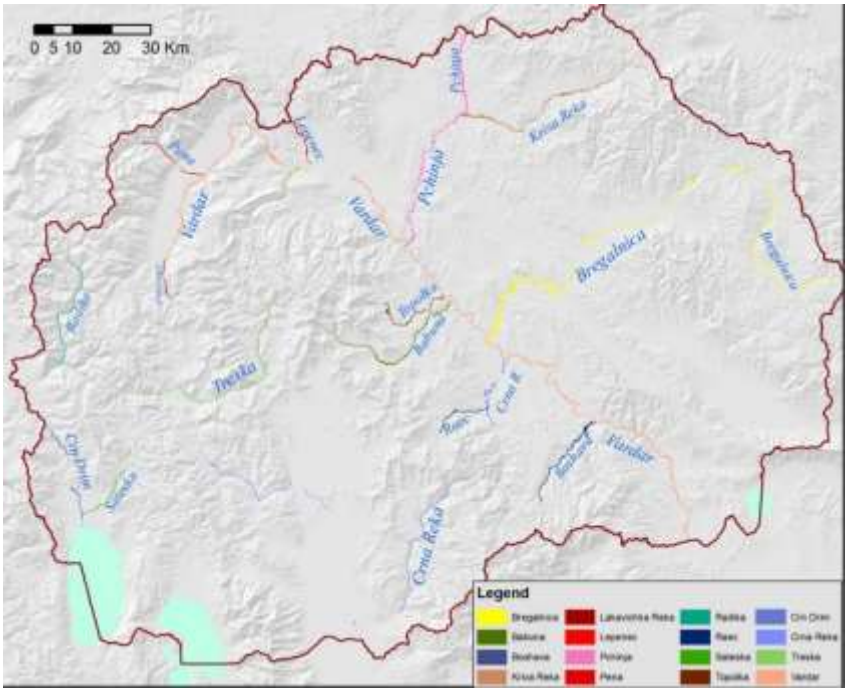
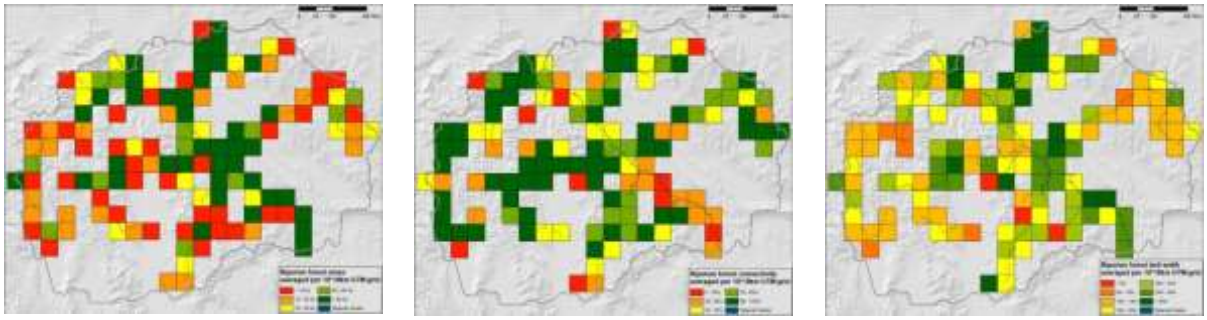


Figure 4 Distribution of riparian forest belts in MKD

Well developed, preserved and connected riparian forest belts provide suitable living, feeding and breeding habitat for many micro and macroinvertebrates, amphibians, reptiles, birds, mammals, etc. They are especially important for nesting and migrating bird species, which find all the necessary conditions for their survival in this type of habitat. One of the main features of well-developed riparian forest belts is the provision of favorable habitat microclimate features.

Table 7 Surfaces of riparian forest belt along rivers

Babuna	267,5
Boshava	235,7
Bregalnica	1017,9
Crn Drim	165,3
Crna Reka	554,1
Kriva Reka	433,5
Lakavichka	20,7
Lepenec	125,4
Pchinja	785,8
Pena	81,1
Radika	121,3
Raec	53,9
Sateska	55,0
Topolka	84,7
Treska	469,4
Vardar	1698,4
TOTAL	**6169,7**



Surface area *Connectivity* *Width*

Figure 5 Average surfaces, average connectivity and average width of riparian forest belt's at UTM (10*10) grid cells

From the maps displayed, we can conclude that the biggest connectivity gaps occur in the Crna Reka, in the part of Pelagonija valley and Tikvesh Lake, as well as in the Treska River in the part of the artificial lake Treska (Matka), obviously along the river Vardar in the valleys and settlements.

The greatest threats to the connectivity of riparian belts and watercourses are agricultural activities, artificial lakes and reservoirs, settlements and cities (urbanization), separations and concessions for sand exploitation, etc. To a lesser extent the negative impact on the surfaces, connectivity and width of the riparian forest belts is due to some industrial capacities, small dump sites, etc. It should be noted, however, that the natural features of the terrain, such as slope of terrain, soil type, altitude, climatic characteristics, etc., are crucial for the width and surface area of the belt.

The above-mentioned anthropogenic activities cause significant reductions in the surface areas of the reef corridors, as well as the creation of complete gaps and breaks in the belt boundary.

Disruptions in the connectivity of the riparian belt significantly affect habitat diversity, and thus biodiversity in general. In those places where has a suspended riparian belt, many animal species are unable to move normally and provide sustainability of their populations.

The widest riparian corridors in North Macedonia are spread along the big rivers like Vardar, Bregalnica and Pchinja. The thinnest belt of riparian forests and smallest surfaces was observed on smaller rivers such as Lakavichka River (*Gostivar*), Sateska River, Pena, Raec, Topolka, etc. The widest belts are in the lowlands where smaller rivers flow into the larger rivers as mentioned above.

The width of the riparian forest belt is very important for biodiversity and for maintaining the water quality of rivers and streams. That's why a survey map was prepared for the average width of the riparian belts surrounding our rivers per UTM quadrant 10*10 km.

8.6.2. Indicator: Area of large lowland wetlands

8.6.2.1. Fact sheet

Author: *Marija Trencheva*

Indicator Name: Area of large lowland wetlands

Lead Agency: National Ramsar Committee

Use and interpretation:

Key question(s) which indicator helps to answer

North Macedonia is a country with considerably low surface of wetlands. The surface area of lowland wetlands was diminished mostly during the 1950s and 1960s because of malaria prevention and enlargement of agricultural land. Nowadays, only few integral and sizeable wetlands areas are in existence: Monospitovo, Prespa, Katlanovo, Studenchishte and Belchishta wetlands.

Use of indicator

Lowland wetlands hold unique biological diversity. This indicator can be used in order to assess the national policy on wetlands protection and their active revitalization.

Scale of appropriate use

This indicator can be used on national scale wherever this type of ecosystem is present.

Potential for aggregation:

The indicator is part of a group of indicators showing the status of other ecosystems (forests, riparian forests, pastures, etc.)

Meaning of upward or downward trends („good or bad")

The trend of the surface area of lowland wetlands is directly connected to the health of wetland habitats as well as with the viability of species populations.

The decline in the surface signals for negative trends and wetland diversity. The upward trends indicate restoration and revitalization of these ecosystems and increment in wetland biodiversity.

Possible reasons for upward or downward trends:

The recent negative (downward) trends are caused by conversion of wetlands surface area into agricultural land (e.g. Monospitovo swamp), conversion into dumpsites (e.g. Studenchishte swamp), urbanization and infrastructure development (e.g. Belchishta swamp), new melioration (drainage) activities (e.g. Katlanovo swamp), fires (e.g. Prespa wetlands) and probably to natural processes (decrease in rainfall, capacity of sources, water flow, high average temperatures).

However, some of the lowland wetlands are growing in surface due to the abandonment of agriculture (e.g. Katlanovo swamp).

Implications for biodiversity management of change in the indicator:

The decline in surface areas of individual wetlands as well as on national level should initiate restoration activities, proclamation and active management of new protected areas, better management of existing Ramsar sites, etc.

Units in which it is expressed:

For individual wetlands, change should be expressed in m^2 or %.

Description of source data:

The historical distribution and coverage of the lowland wetlands in North Macedonia is not possible to obtain/reconstruct. Thus, the starting point for the five-targeted lowland wetlands should be obtained from the valorization studies that were carried out in the last 10 years.

Calculation procedure:

Mapping of the surface areas of the five wetlands in five years periods using GIS and satellite images (e.g. Googled Earth maps).

Most effective forms of presentation:

The best way to present the trends is overlapping maps and tables.

Limits to usefulness and accuracy: The rate of changes is not assessed so far. However, it seems that the processes are quite dynamic and changes are measurable even on annual basis. As already noted, the historical surface of wetlands cannot be estimated.
Updating the indicator: The indicator should be followed in 5-years periods (e.g. 1990-1995, 1995-2000, 2000-2005...) by analyses of satellite imagery.
Closely related indicators: - Population of waterfowl birds - Network of protected areas - Restoration of natural ecosystems/habitats
Additional information and comments: The indicator is also very useful for other initiatives/processes that aim biodiversity conservation (e.g. Ramsar Convention, etc.). The information on biodiversity, ecosystem services and other values of lowland wetlands can be found in different documents: Micevski, B., & Velevski, M. (2002). Inventory of Macedonian wetlands: as natural resources. Bird study and protection society of N.Macedonia (BSPSM). Melovski, Lj., Ivanov, Gj., Angelova, N., Velevski, M., Hristovski, S., eds. (2008). Monospitovo swamp - the last swamp in N.Macedonia. Bosilovo Municipality publ., 56 pp. Melovski, Lj., Hristovski, S., (2010) Comparative analysis of the plant diversity in several swamp in N.Macedonia by altitudinal gradient. Report to the Ministry of Environment and Physical Planning. Apostolova, N., Scarry, D., & Verhoeven, J. T. (2016). Studenchishte Marsh as an Integral Part of Ancient Lake Ohrid: Current Status and Need for Protection. Wetland Science & Practice, 33(2), 35-35. Spirovska, M., et al. 2012. Integrated study on the state of the remaining of Studenchishte Marsh and measures for its revitalization. Dekons-Ema. Drustvo za ekoloshki consulting. Available via http://www.ohrid.gov.mk/Ekologija/Proekti/Ekologija%20arhiva/Menka-Blato-13_02_2012%20%20lektorirano-final.pdf Melovski, Lj., Fotiadis, G., Fanikos (2018). Habitat map of Prespa lake. Macedonian Ecological Society, Skopje.

8.6.2.2. Assessment of the indicator

The number of lowland wetlands in the Republic of North Macedonia is almost 80. They are widespread throughout the country and most of them have small surface areas. The largest lowland wetlands are the ones among Prespa lakes' shore, than Katlanovsko, Monospitovsko, Belchishko and Studenchishko Blato respectively (Figure 6). In the past, these wetlands had significantly larger areas, which were lost primarily due to anthropogenic pressures. As for today, they still face extraction of water for irrigation, intensive agriculture, pollution, waste disposal, fires, urbanization and infrastructure development.

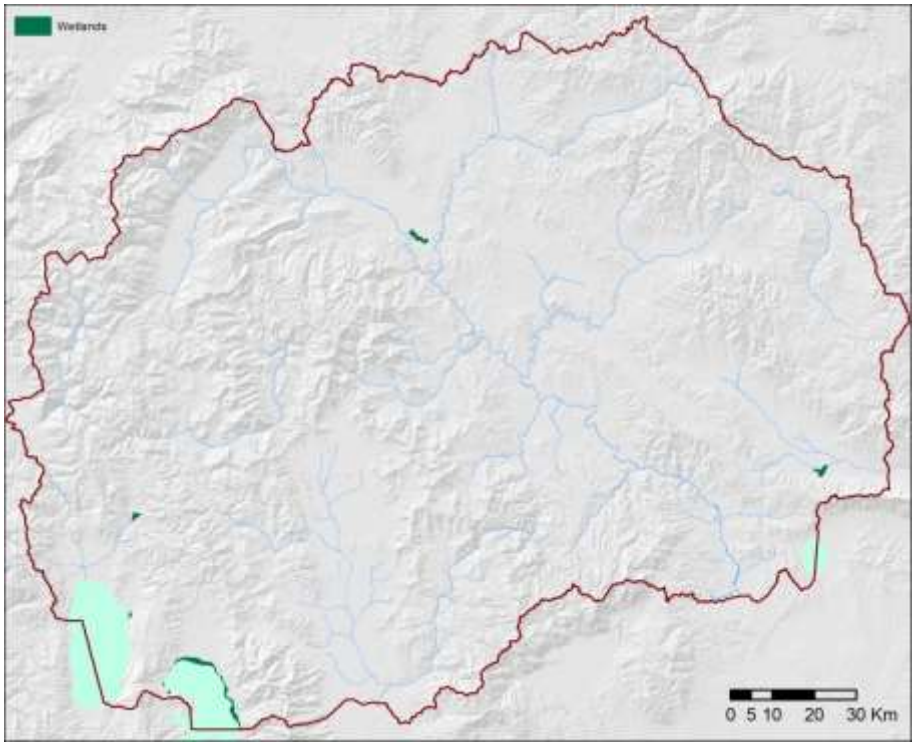


Figure 6 Map of wetlands along Prespa Lake shore, Katlanovsko, Monospitovsko, Belchishko and Studenchishko Blato wetlands

Changes in the surface area (their size) of lowland wetlands indicate changes in their condition regarding functionality and structure. Besides direct anthropogenic pressures, changes in the size can be a product of climate changes. Wetlands, as fragile ecosystems, are very sensitive to temperature and water fluctuations. Following an indicator such their size, will set baseline for creating ongoing measures for restoration or conservation.

The changes in the surface area between 2014 and 2020 for five large lowland wetlands in North Macedonia are presented in the following Table 8. The wetlands along Prespa Lake are the largest in the country, but have the biggest surface area lost (-16.46%) in this five year period. Each year, more and more land is being transformed in agricultural land. Besides the land use, there is great amount of pollution that additionally puts pressure on these ecosystems in Prespa. Fluctuations of the lake water levels should also be considered as threat for these ecosystems, as it varies often. It is important to be noted that these wetlands are part of protected area. Similar situation with size lost is noted in Studenchishko Blato. From the table, we can conclude that this is enormous change for a five-year period, considering the fact that this one is the smallest analyzed wetland area. Most of the land is being used for agriculture. If this trend continues (as it is observed in the past as well) and with the combination of pressures, Studenchishko Blato will face extinction.

Table 8 Surface area change between 2014 and 2020 in five large lowland wetlands in North Macedonia

Name	Area m² 2014	Area m² 2020	Change 2014-2020 (m²)	Change 2014-2020%
Belchishko wetland	1350103	1387088	36985	2,74%
Prespa wetlands	12158352	10157509	-2000843	-16,46%
Katlanovsko Blato	2132490	3202304	1069814	50,17%
Monospitovsko Blato	2174133	2769132	594999	27,37%
Studenchishko Blato	344202	288697	-55505	-16,13%

As for the other three, there is a positive trend for their sizes. Biggest land gain is in Katlanovsko Blato which has 50.17% expansion. This wetland had much bigger size in the past but was suppressed due to land use. As people slowly abandoned intensive agricultural practices in the region, natural restoration of the wetland occurred. Belchishko Blato has also small positive trend from which we cannot take out conclusions, simply because it can be due to multiple reasons. It should be monitored in the next period, so we can understand if the trend is truly positive. The size of this wetland should be followed closely, since it faces some urbanistic threats. Monospitovsko Blato had been intensively and rapidly transformed in agricultural land. The positive trend indicates retaining some balance to this ecosystem, which should be followed to endure in the next period.

Even though wetlands are considered to be protected in our country, direct measures have not been taken. From this five-year period, we can easily observe that biggest land lost is present where there are intensive human activities, which directly contribute for this trend. It is also alarming that some of these wetlands are in managed areas. The positive trends on the other side indicate that these types of ecosystems are capable to restore on their own. With just elimination of pressures and no direct restoration measures, they manage to regain sizes. This should be closely followed in the upcoming period.

8.6.3. Indicator: Trend of conserved autochthonous and local varieties of PGRFA in gene banks

8.6.3.1. Fact sheet

Authors: *Sonja Ivanovska, Mirjana Jankulovska (Department of Genetics and Plant Breeding, Institute of Plant Biotechnology, Faculty of Agricultural Sciences and Food, Ss. Cyril and Methodius University)*

Indicator Name: Trend of conserved autochthonous and local varieties of PGRFA in gene banks
Lead Agency: Faculty of Agricultural Sciences and Food, Ss. Cyril and Methodius University, Skopje
Use and interpretation: **Key question(s) which indicator helps to answer** North Macedonia has significant diversity of autochthonous crops and local varieties (landraces) of agricultural crops. Large areas are planted with commercial varieties, except for the cultivation of beans based exclusively on the landrace Tetovo bean. Small farmers and local inhabitants are maintaining large number of different landraces, mainly of pulses, vegetables and maize. They have unique genetic diversity for many valuable traits, especially contributing to resistance to abiotic and biotic stresses and taste. Only small share of this diversity is conserved in the established gene banks. **Use of indicator** The indicator can be used to assess the national policy on conservation of PGRFA, its implementation and specifically, the national support given to the gene banks. **Scale of appropriate use** This indicator can be used on national scale.
Potential for aggregation: This indicator may be considered as additional information for the indicator on the genetic diversity of PGRFA.

Meaning of upward or downward trends („good or bad")

The unchanged trend of the conserved autochthonous and local PGRFA in the established gene banks means that the number of accessions remained unchanged in the last 5 years due to lack of any support. Positive trend in establishment of gene banks refers to the inventory seeds collection and fruit crops collection started in 2014.

Possible reasons for upward or downward trends:

The reasons for the lack of national support for gene banks are not expected to be overcome in the following period, therefore any possible increase of the number of conserved PGRFA will depend on other sources. On the other hand, part of the inventory collection which is currently under multiplication and characterization process, and the fruit collection are established and maintained by own resources, independently of the national support and will be restructured as gene bank collection.

Implications for biodiversity management of change in the indicator:

The existing gene bank and inventory collections are threatened to be lost if support is not provided. It will lead to inevitable loss of biodiversity, as some landraces may be not grown by farmers any more. National support is urgently needed for preservation, multiplication and characterization of the conserved accessions.

Units in which it is expressed:

Change should be expressed in number of new accessions of landraces per crop per year.

Description of source data:

The only source of such data are the research institutions which are preserving the collections. List of accessions of landraces with codes should be reported each year to one institution or to MAFWE in order to monitor the changes. A national database of conserved accessions needs to be created and updated annually as the most reliable source.

Calculation procedure:

Exact distribution and share of different landraces in the collections is not possible due to lack of characterization data for distinguishing the landraces. Therefore, the share and distribution of accessions of landraces is presented per crops.

Most effective forms of presentation:

Gene bank collections are most effectively presented in 1-year intervals in tables or graphs.

Limits to usefulness and accuracy:

Changes in the collections are not assesses so far. Neither exact passport data on the majority of the accessions are available. There is a need of following the EURISCO passport data for all accessions. In that case, this indicator can be measurable on annual basis.

Updating the indicator:

The indicator should be followed annual.

Closely related indicators

Genetic diversity of PGRFA

Additional information and comments

This indicator is presented previously for the collection of the Institute of Agriculture only. If an accurate system of reporting or national collection database is not introduced at MAFWE, data collection should be performed by a researcher that is familiar with the current reporting. The proposed database should be linked with the National Biodiversity Information System.

8.6.3.2. Assessment of the indicator

North Macedonia has established three plant gene banks for ex-situ conservation in 2000, within three research institutions: Institute of Agriculture in Skopje (IA), Faculty of Agriculture (FA) in Shtip and Scientific Institute of Tobacco (SIT) in Prilep, equipped with cold chambers for long-term seed storing. They were receiving small and irregular support from MAFWE through the Directorate for Seeds and Planting material. This support is not provided in the last 5 years due to inefficient changes in laws.

SIT preserves 163 tobacco accessions only, but considering that this crop is not listed in the conservation strategies for PGRFA, it is not presented in the analysis.

The trend of conserved material may be only partially evaluated. Data for 2013 are presented for the IA's collection only and they refer compared to the active and base collection, while the present data refer to the base collection only. Precise data for 2013 are not available presently, due to the change of gene bank managers.

In 2013 the gene bank of IA had 2666 accessions in total, out of which 1579 in the seed and 1042 in the field collection of fruit crops and Vitis. More than 50% of collections were commercial varieties and breeding material. Passport data on 2158 accessions were uploaded in EURISCO catalogue. Since 2014 till present the number of the samples in IA collection remains unchanged and significantly decreased, compared to 2013. The Vitis collection and large share of the fruit crops collection were lost due to land denationalization. The land with the rest of the fruit collection (around 412 accessions), which was in critical condition, was transferred in possession of the Faculty of Agricultural Sciences and Food in Skopje (FASF) in 2014. Presently IA preserves a base seed collection of 721 samples, out of which 43% are commercial cultivars (nearly all in the rice collection) and breeding material (mainly in the cereal collection). The rest of the accessions are consisted of landraces (48%) and wild material (9%). Additionally, IA preserves large active seed collection of breeding material, mainly consisted of cereals and maize.

Table 9 Trend of conserved material in the Institute of Agriculture in Skopje

Cereals	304	114		418	327	351	0	95	773	45.9%
Fodder crops	10	4	63	77	9	22	209	1	241	68.0%
Industrial crops		25		25	21	11		0	32	21.9%
Pulses		9		9	18	78	2	34	132	93.2%
Vegetables		194		194	28	368	0	5	401	51.6%
MAPs					0	0	45	0	45	100%
Fruit crops					466	123	0	14	603	100%
Vitis					204	234	0	1	439	100%
Total	314	346	63	723	1073	1187	256	150	2666	

C/BM = cultivars/breeding material, L = landraces, WM – wild material, UKN - unknown

In theTable are presented the number of landraces in the base collection of both gene banks, except for the 52 samples of *Festuca* sp. wild material that are integrated under landraces in IA. Nearly half of the landraces maintained by IA are vegetables, out of which 56% are pepper (109) and 21% are tomato samples. Almost all of the cereal collection is consisted of rice (68), wheat (20) and oat (25) samples, into the industrial crops only sesame (10) and groundnuts (15) are included, similarly like the pulses presented with bean (7) and pea (2) samples.

FA maintains a base collection of 152 landraces accessions from 9 crops only, out of which the largest share of samples is consisted of beans (63), pepper (42), melon (13), sesame (10) and cotton (10). Eight more accessions of adzuki bean, broad bean, lentil and oat are maintained into the active collection.

Table 10 Distribution of landraces accessions in the gene banks base collections

Fodder crops	12	67	0	0	67
Industrial crops	2	25	4	30	55
Pulses	8	9	1	63	72
Cereals	4	114	1	3	117
Vegetables	15	194	3	56	250
Total	41	409	9	152	561

Since 2014, FASF has started the revitalization of the fruit crops collection transferred in possession from IA, and includes small number of new accessions. Currently, the field collection of four fruit crops is consisted of 52 old and domesticated varieties (Figure 7). It is established at two locations: in Skopje, 5 plum and cherry plum varieties and 7 apple varieties, and the rest of the varieties are planted in Resen.

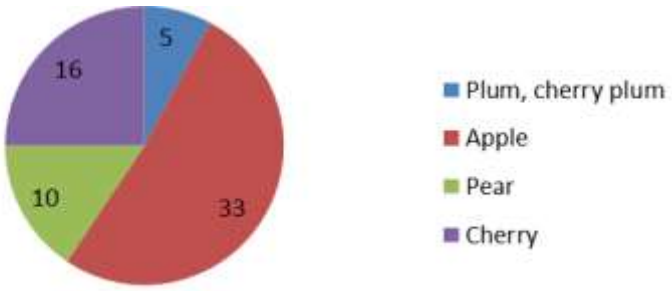


Figure 7 Number of old and domesticated varieties of fruit crops in the field ex situ collection of the Faculty and Agricultural Sciences and Food

In 2014, FASF has started collecting missions in order to establish new seed collection, consisted of landraces only. Until present, seed samples are collected from the local population of 440 inhabited sites in North Macedonia. It is important to stress that the samples have small number of seeds, they are not multiplied, regenerated, characterized or evaluated so far, considering that FASF has not received any governmental support for these activities. They are stored as active collection at 4°C, meaning that this collection is not preserved according to the gene bank standards in respect of quantity, packaging and storing of seeds. It is expected that it will contain large number of duplicate samples. Therefore, it has a status of inventory-collection that represents a solid material for establishing a new gene bank. Currently, this collection has 6311 samples from more than 65 crops. Around 200 samples of embroidered peppers are undergoing characterization in 2019/20. A research for evaluating genetic diversity has been carried out for the common bean and scarlet runner bean collection, as well. More details on the inventory collection are presented in the indicator: Genetic diversity of PGRFA.

There is no communication among the gene banks, no public data are available for the content and status of the collection, except for the data uploaded at EURISCO. Almost all of the samples are not properly characterized or evaluated.

Organized *in-situ* conservation, based on agreements with the farmers, has not been established so far. Isolated examples of *in-situ* conservation, without participation of the gene banks, were conducted for several autochthonous varieties of fruit crops. The activities were carried out within specific projects, supported by foreign donors. For example, around 100 old trees of cherry varieties were marked in their natural habitat in Resen and Strumica regions. Additionally, collaboration with farmers was initiated for on farm conservation of pear, apple, plum and apricot varieties in different regions of the country.

National funding for ex situ conservation of PGRFA is completely ceased in the last five year. The support predicted into the budget of MAFWE remains unused each year. Partially this problem may be overcome with the harmonization of the laws referring to the seed, agriculture and rural development. Nevertheless, this budget is not realistically predicted considering that ex-situ conservation includes activities for collecting missions, multiplication, characterization and evaluation of the samples. There is a need of a national strategy and action plan for conservation of PGRFA with clearly defined priorities.

The financial support has to be sufficient and regular. Moreover, to preserve the already created collections FASF has urgent need for storage facilities, while IA does not possess trial fields for seeds regeneration. It is also very important to re-establish the Vitis collection, having in mind that many autochthonous and domesticated grapevine varieties are still cultivated.

All institutions working in the field of agrobiodiversity have a lack of young researchers that will continue the work in this field. Another problem for successful monitoring of this indicator is that the research institutions and MAFWE are not horizontally and vertically integrated. Systems for regular communication and reporting have to be established. Within the system one institution should be appointed to establish a national online catalogue with passport data for all gene bank accessions.

8.6.4. Indicator: Cryopreservation of semen

8.6.4.1. Fact sheet

Author: *Vladimir Djabirski (Faculty of Veterinary Medicine, Faculty of Agriculture and Food Science)*

Indicator Name: Cryopreservation of semen
Lead Agency: Faculty of Veterinary Medicine, Faculty of Agriculture and Food Science.
Use and interpretation: **Key question(s) which the the indicator helps to answer** Development and operational level of a gene bank. **Use of indicator** Cryoconservation of semen is only one among several options available for conserving autochthonous genetics resources. Storing of gerplasm should in most cases be regarded as a form of insurance against the loss of

genetic variability or extinction, and thus as a complement to (rather than a substitute for) programmers for the management of animal genetics resources *in vivo*. Estimation in the progress in conservation programs for Busha Cattle, Balkan Goat and strains of Pramenka sheep breeds (ovchepolian, shapralnenian, karakachanen). **The scale of appropriate use**
Potential for aggregation:
Meaning of upward or downward trends („good or bad")
Possible reasons for upward or downward trends:
Implications for biodiversity management of change in the indicator:
Units in which it is expressed: 0,5ml doses of dip-frizzed semen
Description of source data: Data from Report of State in Biodiversity in Livestock 2014-2019 (Institute of animal biotechnology, Faculty of Agriculture and Food Science, Faculty of Veterinary Medicine
Calculation procedure: Number of collected semen doses from Busha Cattle, Balkan Goat and strains of Pramenka sheep breeds through 5 years series.
Most effective forms of presentation: Graphic
Limits to usefulness and accuracy:
Updating the indicator: Continuously collection and deep-freezing of semen and other germplasm (oocyte, embryos)
Closely related indicators - Trends in the number of monitored populations of autochthonous species and breeds - Trends of subsidies for autochthonous breeds and the number of registered animals in a national register.
Additional information and comments A systematic approach in characterization, inventory, monitoring of trends, risks, assessments, and research in the field of protection of genetic resources in livestock breeding in the Republic of North Macedonia begins with the Program for Biodiversity Conservation in Livestock 2013-2017and continued with Program 2018/24. It has started a continuous work in collecting data on genetic resources in livestock breeding in the Republic of North Macedonia, which refers to indigenous breeds of domestic animals. Conservation is only one of the four strategic priority areas of the *Global Plan of Action for Animal Genetic Resources*, and cryoconservation is only one among several options available for conserving autochthonous breeds.

8.6.4.2. Assessment of the indicator

Conserving genetic diversity includes storing semen, embryos, oocytes and somatic cells. Based on the state of national technical capacity and infrastructure for ex-situ conservation, cryopreservation of semen from autochthonous breeds was in place since 2013/14. As it was shown there is a notable increasing trend on numbers of doses from Ovcehepolian sheep and a slight increase of doses from Busha cattle and Balkan goat.

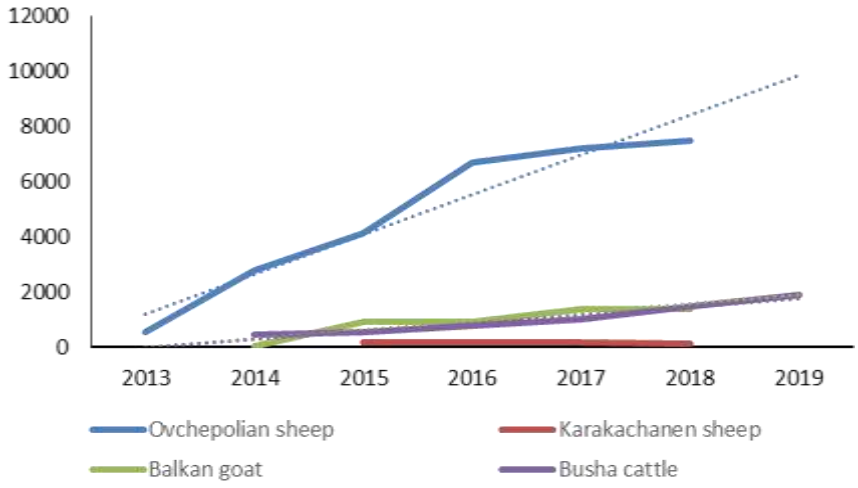


Figure 8 Trends in the number of 0,5 ml semen doses colected from autochthonous species and breeds

8.6.5. Indicator: Areas under organic farming

8.6.5.1. Fact sheet

Indicator Name: Areas under organic farming
Lead Agency: State Institute for Statistics
Use and interpretation: **Key question(s) which indicator helps to answer** Changes in areas under organic production. **Use of indicator** This indicator can be used in order to assess mainstreaming biodiversity in agricultural sector. **Scale of appropriate use** This indicator is used on a national level.
Potential for aggregation: This indicator shows the trend of areas under organic farming and is part of the indicators that show integration of biodiversity in agriculture sector.
Meaning of upward or downward trends ("good or bad") The increase in areas under organic farming shows positive trends.
Possible reasons for upward or downward trends: Positive subventions by the state are primary incentive for the increase of areas under organic farming as well as changes towards sustainable agriculture.
Implications for biodiversity management of change in the indicator: The increase of areas under organic farming is beneficial for biodiversity especially compared to intensive agriculture practices.
Units in which it is expressed: Changes in hectares (ha)
Description of source data: Statistical Yearbooks (http://www.stat.gov.mk/Publikacii/ZivotnaSredina2019.pdf)
Calculation procedure:

Sum of areas under organic production (expressed in ha) in the total agricultural area (expressed in ha).
Most effective forms of presentation: Graphical presentations of areas under organic production compared to to the total agricultural area
Limits to usefulness and accuracy: n/a
Updating the indicator: Annualy
Closely related indicators n/a
Additional information and comments The trend can be easily followed by the analyses of Statistical Yearbooks

8.6.5.2. Assessment of the indicator

The total utilized agricultural area amounts to 1.2 billion ha out of which 0.5 billion ha are cultivable area (Figure 9).

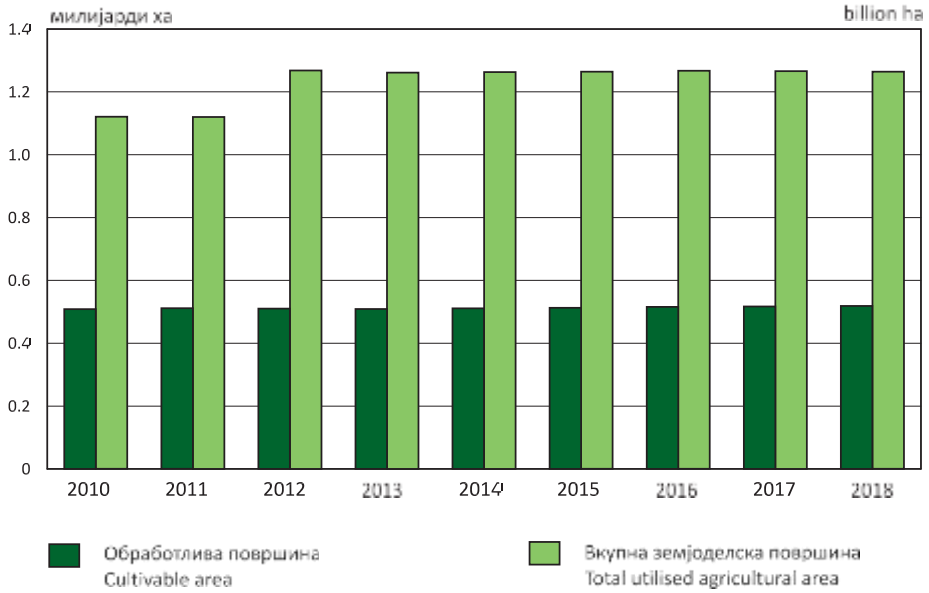


Figure 9 Cultuvable area vs total utilized agricultural area (Ministry of Environment and Physical Planning)

Organic farming is a production system where the application and the intake of synthetic chemicals like synthetic chemical fertilisers, pesticides, hormones and growth regulators, as well as the use of genetically modified organisms, are reduced and eliminated, while the use of good practices in the management of agricultural ecosystems for farming and livestock breeding is promoted. Organic agriculture is also distinct from the conventional one by the application of rules in production, labelling schemes and certificates under the Law on Organic Farming and bylaws harmonised with the European regulations.

Areas under organic farming and the number of operators had been constantly growing in the period from 2010 to 2011; from 2011 to 2018, variable trend was noted both in areas under organic farming and the number of operators. In 2018, the areas under organic farming amounted to 3909 hectares and the share of organic production in the total cultivated area was 0.75%, while in the total agricultural area it was 0.31% (Figure 10).

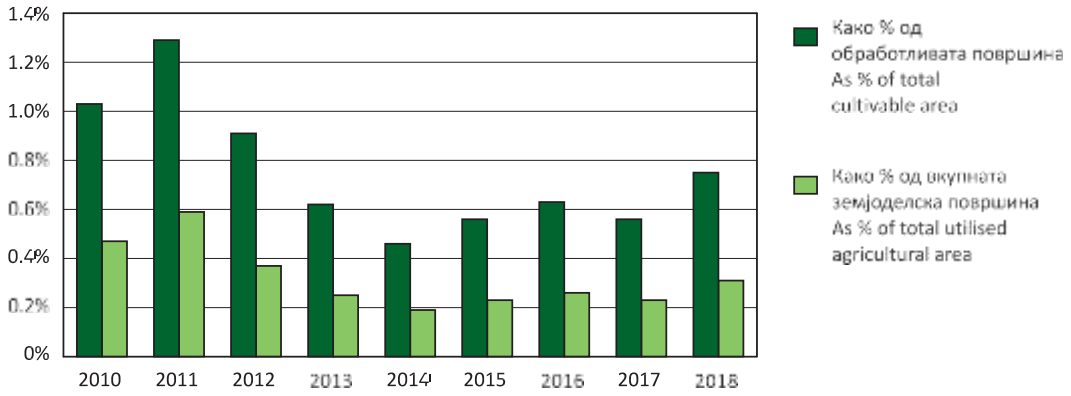


Figure 10 Area under organic production (Ministry of Environment and Physical Planning)

8.6.6. Indicator: Number of game by years and regions

8.6.6.1. Fact sheet

Author: *Ministry of Environment and Physical planning*

Indicator Name: Number of game by years and regions
Lead Agency: Ministry of Agriculture, Forestry and Water Economy
Use and interpretation: **Key question(s) which indicator helps to answer** In North Macedonia, game consists of animals (23 mammals) and 84 birds which live freely in nature or in fenced areas (hunting grounds) where they are being intensively bred, protected and hunted according to a specific hunting management plan (a planned document). The breeding, protection and sustainable use of game reflects the readiness of the country in providing and maintaining a natural balance between game species. **Use of indicator** The indicator is used to assess the status of game by years and regions. This should be a result of the efficient management of game in nature and in the hunting grounds, especially the effects from the measures for survival, growth and breeding of game. In order to fulfill this indicator, collaboration between all stakeholders is required, as game falls under state ownership and is considered as goods of general interest, while the management, breeding, protection and sustainable use of game and its parts depends on the authorities in charge of game management. **Scale of appropriate use** This indicator is used on a national level.
Potential for aggregation: This indicator shows the trend of game by species throughout the years.
Meaning of upward or downward trends ("good or bad") An upward trend may be presented through measures undertaken for providing breeding and protection

conditions for game, maintenance of a proportionate number of game, and securing temporary or permanent prohibition for hunting of certain game species, whereas the downward trend may be shown through the threats present such as poaching, stray dogs, destruction and seizure of newborns, lairs, nests, eggs, etc.

Possible reasons for upward or downward trends:

The positive trend will be presented through strengthening of capacities of the subjects in charge of game management, and a decrease in threats will be done through strengthening of the inspection supervision of hunting and nature protection, as well as the use of misdemeanor and criminal provisions.

Implications for biodiversity management of change in the indicator:

The change in trends will enable conservation and improvement of the status of game species which are of community interest, and this will allow for a change in the practices of management and use of game and its parts.

Units in which it is expressed:

On the basis of the available data for annual number of game, the trend of change is expressed through increased or decreased game number, through comparative parameters from the previous and the current year. When the parameters of several continuous annual periods are equal, that points to a stable population. The increase of population enables the use of game which does not fall under protection in order to maintain natural balance, and should a downward trend of some population appear, breeding, nurturing and protection measures for certain game species are undertaken.

Description of source data:

A trustworthy source of the number of game are plan documents such as General Hunting Management Plan, Specific Hunting Management Plan and the Annual Plan for Implementation of Specific Hunting Management Plan enacted by the Ministry of Agriculture, Forestry and Water Economy, as the state body in charge of performing tasks related to hunting.

Calculation procedure:

Comparative data for the number of game by years.

Most effective forms of presentation:

The best way to present game trends is graphic and tabular, where the number of game is presented. For a more precise data and continual monitoring of the status, yearly intervals are most acceptable.

Limits to usefulness and accuracy:

Data is based on scientific-research knowledge by determination of game and its distribution, previous and current numbers, health status of game, etc. The accuracy of the data is based on an analysis of the current and comparison of the normal status of the game, the time period for achieving normal numbers of game, as well as population growth.

Updating the indicator:

The negative trend or the threat towards the game is continuous, and the it depends on the health status of game, therefore, the indicator should be followed annually, whereas the population trend, especially for species under permanent protection, may be compared on a 5-year period.

Closely related indicators

Strengthening of capacities of subjects in charge of game management.

Additional information and comments

This indicator imposes the need of establishment of a national database for game in the Republic of North Macedonia.

References

Law on Hunting (Official Gazette of the RM No. 26/09, 82/09, 136/11, 1/12, 69/13, 164/13, 187,13, 33/15,

147/15, 193/15);

Law on Nature Protection (Official Gazette of the RM No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16);

Ministry of Agriculture, Forestry and Water Economy: Strategy for sustainable development of forestry in the Republic of N.Macedonia, 2006;

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Velkovski, N., Nikolovski, G. (2016): The legal situation and institutional structures of the hunting system and wildlife management in the Republic of N.Macedonia.

8.6.6.2. Assessment of the indicator

Game in the Republic of North Macedonia is represented by 23 mammal species and 84 bird species. Part of these species are game under protection and game without protection. Closed hunting season, temporary and permanent prohibition for hunting are stipulated for the game under protection. In accordance with national hunting legislation, the hunting of 9 mammal species (bear, lynx, wild cat, badger, otter, jackal, squirrel, dormouse and European ground squirrel) and over 80 bird species is prohibited permanently. During closed hunting season, the game under protection cannot be hunted, chased or disturbed. The game without protection may be hunted only if its permanent survival is not threatened.

The breeding, protection and use of game is done in hunting grounds which can be open (unobstructed movement) or fenced (with natural of artificial obstacles). A total of 256 hunting grounds with a total territory of 2,345,652 ha have been designated on the territory of the R. of N.M. In the protected areas, there are no hunting grounds because commercial hunting is prohibited, and if needed, the hunting of wild species (controlled shooting) is done in a controlled manner and in accordance with the provisions from the Law on Nature Protection. The analysis of the number of game has been done for the period 2015-2018 throughout the territory of the R. of N. M. and has been divided into 8 regions.

The data for the population of game species in the presented tables, show no significant changes in the period 2015-2018 with several exclusions. The populations of chamois, badger,northern goshawk, hooded crow, rook, common quail, common pigeon show slight increase while the population of brown hare, grey partridge, hazel grouse show some decrease.

The analyses of the trend of hunted (killed) game show that the numbers of killed roe deers is constantly increasing, while number of killed brown hares, grey partridge, rock partridge, wolf, northern goshawk is decreasing.

In terms of the hunted game as percentage of the estimated population one can conclude that the pressure on roe deer is increasing while pressure on grey patrridge, rock partridge, wolf, northern goshawk and rook is decreasing. Nevertheless, in some cases the percentage of hunted animals is very high (wild boar: 14.4-22.7%; european hare: 6.4-9.3%; grey partridge 9.8-12.9%; wolf: 22.2-

35.0%; rook up to 10.85%; fox: 31-75%; pheasant 30-65%; marten: 32-55%, etc.). The quality of the presented data in Statistical Yearbooks should be taken with caution since some of them show higher numbers of killed animals than the estimated population size.

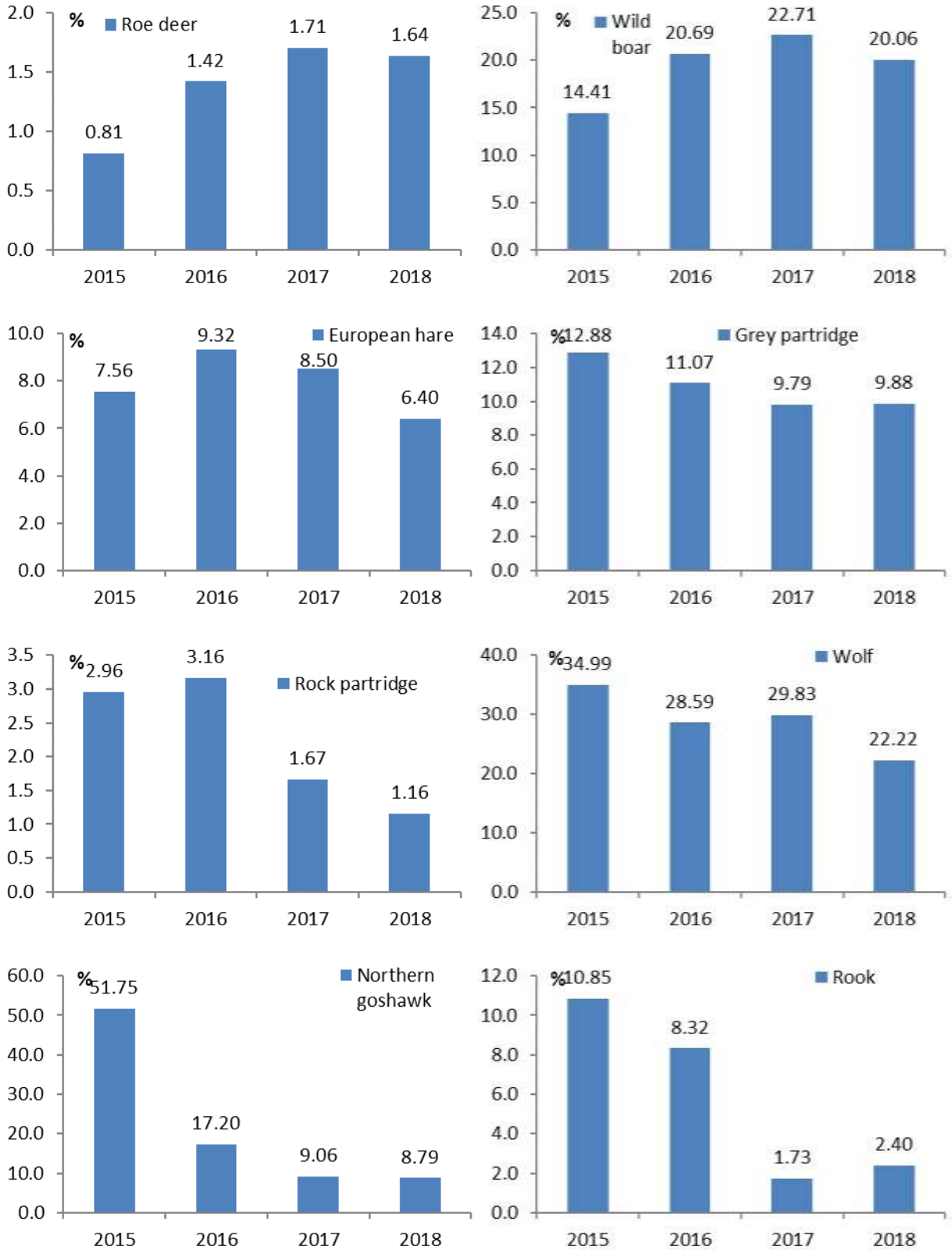

Figure 11 Percentage of killed game species of the total estimated population size (selected species)

Table 11 Number of game, 2015

Red deer	604	-	110	4	169	6	151	-	164
Fallow deer	348	30	185	12	121	-	-	-	-
Roe deer	7 142	328	464	998	1 735	523	1 269	1 159	666
Chamois	1 692	-	-	-	27	75	1 387	-	203
Mouflon	40	-	-	-	-	-	-	-	40
Brown bear	424	6	1	-	105	63	177	2	70
Wild boar	6 945	264	689	993	1 157	1 254	1 031	1 028	529
European hare	26 705	3 171	3 792	4 337	1 343	1 178	1 563	5 752	5 569
Grey partridge	21 112	2 419	3 626	3 985	668	1 540	583	3 372	4 919
Rock partridge	5 042	235	250	603	298	585	1 185	960	926
Hazel grouse	165	-	-	-	-	115	50	-	-
Pheasant	4 674	100	659	1 090	700	1 210	65	250	600
Wolf	583	22	148	38	89	34	142	-	110
Badger	309	5	112	45	46	68	10	10	13
Fox	1 597	44	682	135	194	101	221	-	220
Marten	1 289	4	680	80	178	72	160	-	115
Otter	130	-	22	3	26	63	10	6	-
Weasel	174	1	-	45	70	18	20	-	20
Other hairy game	-	-	-	-	-	-	-	-	-
Waterfowls	-	-	-	-	-	-	-	-	-
Falcon and Hawk	-	-	-	-	-	-	-	-	-
Northern goshawk	228	4	-	-	64	75	40	-	45
Hooded crow	595	380	-	-	75	60	80	-	-
Rook	645	300	-	-	210	25	20	-	90
Other feather game	-	-	-	-	-	-	-	-	-
Common quail	670	-	-	130	180	260	100	-	-
European turtle dove	750	-	10	-	40	500	200	-	-
Common wood pigeon	1 300	-	-	-	940	60	200	-	100
Eurasian Woodcock	351	-	38	98	55	40	80	-	40
Mallard	290	-	-	70	20	80	60	-	60
Eurasian teal	350	-	-	220	-	20	50	-	60

Table 12 Number of game, 2016

Red deer	442	16	120	16	44	-	120	-	126
Fallow deer	423	-	128	111	12	12	-	-	160
Roe deer	7 878	723	641	1 110	1 794	592	1 250	1 201	567
Chamois	2 018	-	-	-	115	75	1 420	-	408
Mouflon	226	-	4	64	-	-	-	-	158
Brown bear	392	12	3	-	112	105	142	2	16
Wild boar	6 539	437	995	1 067	1 172	430	1 019	906	513
European hare	27 869	4 433	4 039	2 555	1 361	2 362	1 382	5 784	5 953
Grey partridge	25 183	3 452	4 362	2 666	773	4 650	897	3 373	5 010
Rock partridge	5 216	514	316	419	290	669	1 236	958	814
Hazel grouse	139	64	-	-	15	30	30	-	-
Pheasant	4 860	700	696	650	560	1 100	104	150	900
Wolf	787	40	151	26	132	70	215	40	113
Badger	332	2	130	40	61	20	30	15	34
Fox	2 647	82	1 474	115	218	131	360	30	237
Marten	1 552	57	712	75	235	40	310	-	123
Otter	106	-	24	-	59	6	17	-	-
Weasel	355	-	-	40	80	5	200	-	30
Other hairy game	-	-	-	-	-	-	-	-	-
Waterfowls	-	-	-	-	-	-	-	-	-
Falcon and Hawk	-	-	-	-	-	-	-	-	-
Northern goshawk	407	-	25	-	100	50	152	-	80
Hooded crow	250	-	-	-	90	30	130	-	0
Rook	505	-	-	-	235	50	120	-	100
Other feather game	-	-	-	-	-	-	-	-	-
Common quail	305	-	-	-	35	200	70	-	-
European turtle dove	721	71	-	-	-	500	150	-	-
Common wood pigeon	1 170	-	200	-	660	80	80	-	150
Eurasian Woodcock	246	-	-	-	67	30	99	-	50
Mallard	180	-	-	-	30	50	30	-	70
Eurasian teal	280	-	-	110	-	70	30	-	70

Table 13 Number of game, 2017

Red deer	412	-	120	16	10	-	140	-	126
Fallow deer	141	-	112	6	12	11	-	-	-
Roe deer	7 437	686	460	1 156	1 737	684	1 488	661	565
Chamois	2 117	-	-	-	78	77	1 511	-	451
Mouflon	200	200	-	-	-	-	-	-	-
Brown bear	564	2	3	-	172	95	239	2	51
Wild boar	5 803	216	858	931	1 002	604	1 212	492	488
European hare	23 919	3 071	1 578	2 983	1 291	1 673	2 027	5 478	5 818
Grey partridge	22 041	2 693	2 640	2 805	752	3 090	951	3 348	5 762
Rock partridge	5 098	278	90	561	257	405	1 645	893	969
Hazel grouse	80	-	-	-	-	70	-	-	10
Pheasant	3 398	102	968	604	615	80	100	150	779
Wolf	647	44	107	53	61	54	144	30	154
Badger	584	5	352	41	66	35	50	10	25
Fox	2 157	96	530	190	167	425	389	40	320
Marten	1 338	77	407	114	180	135	283	-	142
Otter	113	2	51	10	26	2	22	-	-
Weasel	390	-	194	-	70	15	63	-	48
Other hairy game	-	-	-	-	-	-	-	-	-
Waterfowls	-	-	-	-	-	-	-	-	-
Falcon and Hawk	-	-	-	-	-	-	-	-	-
Northern goshawk	662	-	200	14	46	230	124	-	48
Hooded crow	581	60	200	18	63	50	120	-	70
Rook	1 155	35	500	10	200	50	130	-	230
Other feather game	-	-	-	-	-	-	-	-	-
Common quail	650	-	-	180	50	300	-	-	120
European turtle dove	2 024	-	254	-	20	1 600	-	-	150
Common wood pigeon	2 238	200	800	-	648	250	30	-	310
Eurasian Woodcock	195	-	35	48	42	10	-	-	60
Mallard	1 850	440	200	-	50	1 000	-	-	160
Eurasian teal	650	150	150	90	-	150	-	-	110

Table 14 Number of game, 2018

Red deer	462	-	54	12	90	-	180	-	126
Fallow deer	109	34	5	6	52	12	-	-	-
Roe deer	7 741	347	954	871	1 914	544	1 457	1 142	512
Chamois	2 125	16	-	-	86	78	1 561	-	384
Mouflon	-	-	-	-	-	-	-	-	-
Brown bear	532	8	1	-	91	102	278	2	50
Wild boar	6 788	210	1 223	924	1 197	507	1 253	1 036	428
European hare	19 023	3 997	1 945	3 154	1 349	1 164	2 122	1 248	4 044
Grey partridge	14 013	1 978	1 679	2 691	733	1 402	1 070	345	4 115
Rock partridge	4 056	305	201	436	262	354	1 671	119	708
Hazel grouse	66	21	-	-	-	25	20	-	-
Pheasant	3 806	700	937	630	538	276	238	120	367
Wolf	648	30	188	23	81	86	92	30	118
Badger	657	4	353	53	68	63	51	40	25
Fox	2 111	56	759	118	175	442	326	45	190
Marten	1 124	67	455	50	174	110	184	-	84
Otter	171	-	68	6	34	45	18	-	-
Weasel	288	-	109	-	70	49	30	-	30
Other hairy game	-	-	-	-	-	-	-	-	-
Waterfowls	-	-	-	-	-	-	-	-	-
Falcon and Hawk	-	-	-	-	-	-	-	-	-
Northern goshawk	808	-	575	-	31	50	107	-	45
Hooded crow	1 727	-	1 490	-	67	20	150	-	-
Rook	2 210	-	1 720	-	200	60	170	-	60
Other feather game	-	-	-	-	-	-	-	-	-
Common quail	2 242	-	1 600	200	42	150	250	-	-
European turtle dove	1 098	-	330	-	-	500	268	-	-
Common wood pigeon	4 547	-	2 550	-	567	630	600	-	200
Eurasian Woodcock	391	-	165	50	35	-	91	-	50
Mallard	1 070	-	310	-	50	600	30	-	80
Eurasian teal	677	-	147	60	-	210	40	150	70

Table 15 Number of hunted game, 2015

Red deer	5	-	-	-	-	-	1	-	4
Fallow deer	-	-	-	-	-	-	-	-	-
Roe deer	58	-	-	1	34	10	10	3	-
Chamois	78	-	-	-	-	-	12	-	66
Mouflon	4	-	-	-	-	-	-	-	4
Brown bear	-	-	-	-	-	-	-	-	-
Wild boar	1 001	46	127	121	248	206	53	164	36
European hare	2 019	34	503	323	90	141	53	696	179
Grey partridge	2 719	154	674	483	48	433	31	632	264
Rock partridge	149	13	-	15	17	-	-	27	77
Hazel grouse	-	-	-	-	-	-	-	-	-
Pheasant	2 019	-	260	450	160	85	20	888	156
Wolf	204	18	42	27	24	30	9	35	19
Badger	-	-	-	-	-	-	-	-	-
Fox	1 147	40	116	138	93	111	23	593	33
Marten	621	3	28	61	67	46	5	406	5
Otter	-	-	-	-	-	-	-	-	-
Weasel	29	1	-	5	12	3	8	-	-
Other hairy game	-	-	-	-	-	-	-	-	-
Waterfowls	-	-	-	-	-	-	-	-	-
Falcon and Hawk	-	-	-	-	-	-	-	-	-
Northern goshawk	118	6	-	40	17	20	11	159	5
Hooded crow	408	20	26	107	82	14	-	-	-
Rook	70	36	-	24	-	10	-	-	-
Other feather game	-	-	-	-	-	-	-	-	-
Common quail	1 926	120	620	546	60	55	-	505	20
European turtle dove	1 773	150	30	660	140	100	-	663	30
Common wood pigeon	1 061	80	35	240	160	5	-	516	25
Eurasian Woodcock	50	15	-	26	8	1	-	-	-
Mallard	244	10	12	25	13	-	-	173	11
Eurasian teal	233	20	18	180	-	-	-	-	15

Table 16 Number of hunted game, 2016

Red deer	2	-	-	-	-	-	-	-	2
Fallow deer	4	-	-	-	-	2	-	-	2
Roe deer	112	24	2	-	22	47	8	9	-
Chamois	70	-	-	-	-	-	11	-	59
Mouflon	72	-	-	24	-	48	-	-	-
Brown bear	-	-	-	-	-	-	-	-	-
Wild boar	1 353	51	152	174	267	325	76	261	47
European hare	2 598	231	469	206	107	603	47	796	139
Grey partridge	2 789	127	547	243	50	880	18	639	285
Rock partridge	165	3	-	28	16	88	7	21	2
Hazel grouse	90	-	-	90	-	-	-	-	-
Pheasant	3 113	700	180	220	180	70	13	1 650	100
Wolf	225	54	21	21	23	3	25	33	25
Badger	-	-	-	-	-	-	-	-	-
Fox	1 396	60	159	142	112	78	19	751	75
Marten	546	28	49	68	60	52	4	277	8
Otter	-	-	-	-	-	-	-	-	-
Weasel	14	-	-	10	-	-	4	-	-
Other hairy game	-	-	-	-	-	-	-	-	-
Waterfowls	-	-	-	-	-	-	-	-	-
Falcon and Hawk	-	-	-	-	-	-	-	-	-
Northern goshawk	70	-	7	5	16	-	8	23	11
Hooded crow	416	-	-	110	61	-	14	231	-
Rook	42	-	-	-	-	-	10	32	-
Other feather game	-	-	-	-	-	-	-	-	-
Common quail	4 141	330	2 045	237	80	375	-	1 074	-
European turtle dove	3 917	450	393	475	180	620	-	1 799	-
Common wood pigeon	1 210	80	171	130	140	110	-	549	30
Eurasian Woodcock	68	-	5	39	6	3	-	15	-
Mallard	612	-	125	2	8	230	-	237	10
Eurasian teal	395	-	90	120	-	150	-	-	35

Table 17 Number of hunted game, 2017

Red deer	8	-	-	-	-	-	6	-	2
Fallow deer	1	-	-	-	-	1	-	-	-
Roe deer	127	-	4	-	18	67	20	12	6
Chamois	149	-	-	-	1	-	85	-	63
Mouflon	22	-	-	-	-	-	-	-	22
Brown bear	-	-	-	-	-	-	-	-	-
Wild boar	1 318	80	116	201	294	236	116	202	73
European hare	2 034	237	268	296	154	87	51	740	201
Grey partridge	2 157	155	323	366	35	175	30	654	419
Rock partridge	85	5	-	7	15	26	2	30	-
Hazel grouse	-	-	-	-	-	-	-	-	-
Pheasant	1 008	-	220	268	220	-	-	-	300
Wolf	193	19	23	22	21	33	13	22	40
Badger	-	-	-	-	-	-	-	-	-
Fox	1 607	45	228	121	78	47	24	969	95
Marten	731	28	71	47	81	16	2	470	16
Otter	-	-	-	-	-	-	-	-	-
Weasel	55	-	50	-	-	4	1	-	-
Other hairy game	-	-	-	-	-	-	-	-	-
Waterfowls	-	-	-	-	-	-	-	-	-
Falcon and Hawk	-	-	-	-	-	-	-	-	-
Northern goshawk	60	4	-	-	31	4	1	20	-
Hooded crow	786	-	100	-	124	-	-	562	-
Rook	20	-	20	-	-	-	-	-	-
Other feather game	-	-	-	-	-	-	-	-	-
Common quail	3 100	-	620	82	38	430	-	1 900	30
European turtle dove	3 669	450	164	440	-	1 100	-	1 390	125
Common wood pigeon	1 058	110	280	140	158	250	-	-	120
Eurasian Woodcock	424	-	4	-	7	2	-	381	30
Mallard	389	-	68	-	20	250	-	19	32
Eurasian teal	714	-	95	67	-	230	-	307	15

Table 18 Number of hunted game, 2018

Red deer	7	-	-	-	1	-	1	-	5
Fallow deer	-	-	-	-	-	-	-	-	-
Roe deer	127	2	7	2	48	48	4	14	2
Chamois	102	-	-	-	-	-	23	-	79
Mouflon	-	-	-	-	-	-	-	-	-
Brown bear	-	-	-	-	-	-	-	-	-
Wild boar	1 362	49	150	187	390	173	71	224	118
European hare	1 218	148	273	287	129	123	65	84	109
Grey partridge	1 384	138	106	337	30	475	68	-	230
Rock partridge	47	-	-	-	23	23	1	-	-
Hazel grouse	-	-	-	-	-	-	-	-	-
Pheasant	1 525	700	170	240	220	60	5	-	130
Wolf	144	21	22	13	21	21	7	13	26
Badger	-	-	-	-	-	-	-	-	-
Fox	663	65	164	62	82	47	12	164	67
Marten	367	25	82	30	74	30	5	112	9
Otter	-	-	-	-	-	-	-	-	-
Weasel	29	1	25	-	-	-	3	-	-
Other hairy game	-	-	-	-	-	-	-	-	-
Waterfowls	-	-	-	-	-	-	-	-	-
Falcon and Hawk	-	-	-	-	-	-	-	-	-
Northern goshawk	71	-	12	1	55	-	1	2	-
Hooded crow	278	-	195	-	80	-	3	-	-
Rook	53	-	50	3	-	-	-	-	-
Other feather game	-	-	-	-	-	-	-	-	-
Common quail	1 570	300	600	40	30	600	-	-	-
European turtle dove	2 396	1 000	256	340	150	360	40	250	-
Common wood pigeon	1 622	300	710	155	120	120	-	100	117
Eurasian Woodcock	141	-	26	6	11	-	-	-	98
Mallard	438	-	100	55	18	250	-	-	15
Eurasian teal	307	-	85	102	-	100	-	-	20

8.6.7. Indicator: Fish commercial catch from commercial waters (Prespa, Dojran and Ohrid Lake)

8.6.7.1. Fact sheet

Authors: *Vasil Kostov and Irina Manevska (Institute of Animal Sciences, Ss. Cyril and Methodius University, Skopje-Fishery department)*

Indicator Name: Fish commercial catch from commercial waters (Prespa, Dojran and Ohrid Lake)
Lead Agency: Institute of Animal Sciences, Ss. Cyril and Methodius University, Skopje
Use and interpretation: **Key question(s) which indicator helps to answer** Fish production – through commercial capture, is one of the most important provisioning services of ecosystem service. Ecosystem services are the benefits provided by ecosystems to humans, and commercial capture as an indicator through which can be followed the status of populations of certain economically important fish species (including some endemic ones), and thus contributes to the conservation of biodiversity and the maintenance of ecosystem services. **Use of indicator** This indicator can be used to follow the annual capture of commercial fish species in the water bodies where commercial capture is performed (3 natural lakes and two reservoirs). **Scale of appropriate use** Considering the fact that 3 natural lakes are transboundary, this indicator can be used on national and international scale.
Potential for aggregation: This indicator consist parameters that show the annual commercial capture of native fish species from the lakes in N. Macedonia, favoring as a good indicator that can be used to scan the anthropogenic pressure.
Meaning of upward or downward trends („good or bad“) The increase in the number of commercially significant fish species, exposed more than the quota allowed in the regulations, indicates the improper use of ecosystem services, which will have negative impact to the biodiversity.
Possible reasons for upward or downward trends: Positive trend during the years (under the allowed quota) may indicate a good population status of some commercial fishes, but also as indicator can lead to conclusion that all whole catch (over a period of 6 years) is reported in the annual report by the concessionaires. The reduced fish stock (the absence of certain fish species in the catch) may indicate bed ecological status of fish populations or not complete data from the concessioners.

Upward or downward trends in population density of some species also could be due to the methodological procedure of fish sampling during the years.
Implications for biodiversity management of change in the indicator: Increasing or decreasing the catch of commercially important fish species above and below the allowable quota should, alert to negative situation for which certain relevant institutions have taken appropriate action plans.
Units in which it is expressed: The preferred units for this indicator are: t (tones) per year or kg (kilograms) per year.
Description of source data: Official data can be gained from the Ministry of Agriculture, Forestry and Water Economy (MAFWE), Institute of Animal Science (IAS) – Fishery Department.
Calculation procedure: Processed data obtained from MAFWE and IAS – Fishery Department, expressed in tons or kilograms per year.
Most effective forms of presentation: Different forms can be used: description, tables, graphic display, and combined display.
Limits to usefulness and accuracy: The data obtained through the concessionaire's annual reports do not reflect the true picture of the status of populations of commercially important fish species. If the data is obtained through an executable according to the prescribed standard protocols (Water Framework Directive-WFD) that performed regularly every 3 years then the data will represent the real situation.
Updating the indicator: Regular monitoring according WFD on every 3 years.
Closely related indicators - alien fish species - public awareness raising acivities - publicly available data from monitoring of species
Additional information and comments Considering the weak monitoring efforts in our country, lack of filed data about the ecology of commercial important fish species and knowing the fact that not always official data are correct is a reason that makes this indicator complex. The data of commercial catch by fish species, present here are based on scarce published data and archive data that exist in relevant institutions, but this data are based on information's from the concessionaire and they are not always real. This data should be collected only through regular national monitoring programs.

8.6.7.2. Assessment of the indicator

The indicator (commercial fish catch) is consisted by following parameters: (1) number of commercial fish species, (2) total annual catch of commercial fishes, (3) annual catch of commercial

fishes by species and (4) relative fish species composition based on number of individuals in the annual catches in the three natural lakes Ohrid, Prespa and Dojran.

Over the past thirty years in the natural lakes, there has been a significant change in the representation of fish in the total fish population in the Republic of North Macedonia, ie there is a change in the percentage of species in the total catch. In general, all fishery waters have reduced densities of economically valuable fish species at the expense of the higher prevalence of less economically valuable fish species. The presence of indigenous fish species has a direct impact on the reduction of populations of economically valuable species (carp, catfish, trout, etc.).

Over a period of time, especially since independence, and more prominently since 1994, there has been a decline in the ecosystem approach to fisheries, ie the sustainable use of resources. This results in unplanned fish exposure and overfishing in certain fishing waters. This has also had a direct impact on changing fisheries and disturbing the ecosystem balance. Special attention should be paid to this phenomenon and the mistakes and damages that have been done in the past.

8.6.7.3. Commercial catch in Prespa Lake

In Lake Prespa, four species of fish are recorded as commercially significant: carp (*Cyprinus carpio*), nase (*Chondrostoma prespense*), black (*Alburnus belvica*) and *Rutilus prespensis* all other species (trout, catfish, prussian carp, roach etc.) are recorded in the group “others ”. The Prespa Lakes population has seen an expansion of the *Lepomis gibbosus* population and a certain tendency to increase the population of *C. gibelio*.

The total fish catch in Lake Prespa is up to a maximum of 173 tonnes in 1963 and 1964. Since then total catch has been declining until 2000, with peaks in 1977 and 1979. From 1979 until today the catch is usually below 100 tonnes, except in 2004 when the catch is above 100 tonnes. It is evident that there are gaps, periods for which there is no relevant catch data (1987 to 1989, 2001 to 2003, 2007 to 2013). The reasons for the lack of data are various, most often due to the lack of a concessionaire and organized commercial fishing, as well as a lack of record keeping.

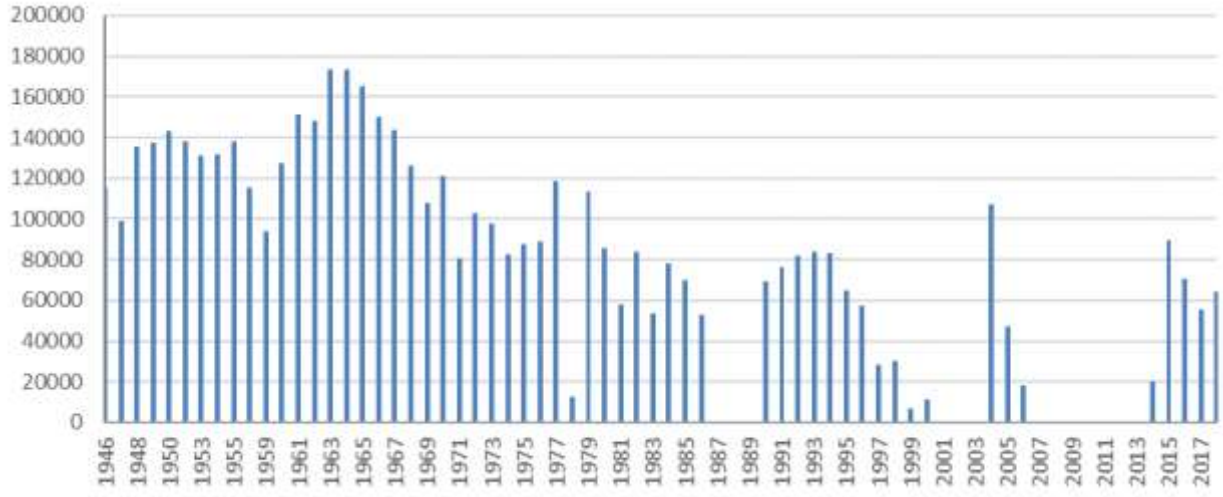

Figure 12 Total annual catch of commercial fishes in macedonian part of Prespa Lake

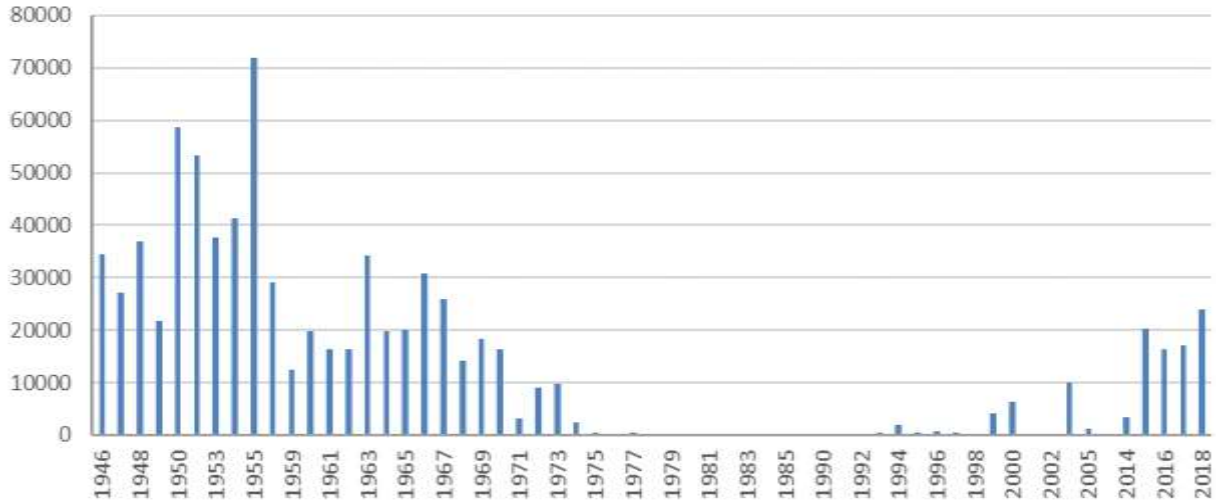

Figure 13 Annual catch of carp (*Cyprinus carpio*) in macedonian part of Prespa Lake

The largest carp catch in Lake Prespa was recorded in 1955 when more than 70,000 kg were caught. From 1955 to 1975 there was a trend of decreasing in catch. In the period from 1971 to 2014 the catch was below 10,000 kg. Between 1975 and 2000 insignificant amounts of carp in the catch were recorded.

The catch of nase in Lake Prespa has been increasing since 1946 to 1962, when the largest catch of nase in the lake was recorded (over 70,000 kg). From 1963 to 1978 the catch ranges in the range of about 50 to 70 tonnes. From 1978 to 1986, there was a marked reduction in the catch of nase in the lake. Insignificant quantities of nase have been hunted since 1986.

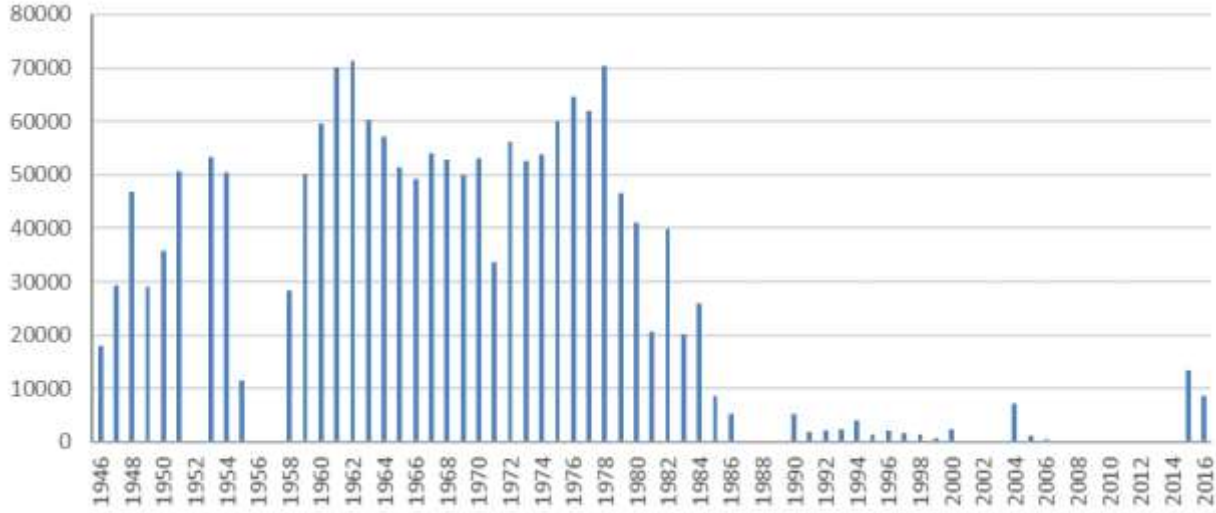

Figure 14 Annual catch of nase (*Chondrostoma prespense*) in Prespa Lake

The catch of *Alburnus* in Lake Prespa has varied dramatically over the years. There are increasing trends in catches from 1946 to 1964 and from 1973 to 1993, as well as declining trends from 1964 to 1973 and drastic declines from 1993 to 2000. In 2004 there was a catch of over 60,000kg and a decrease by 2004. There are no data on catches of alburnus in the lake from 2007 to 2013.

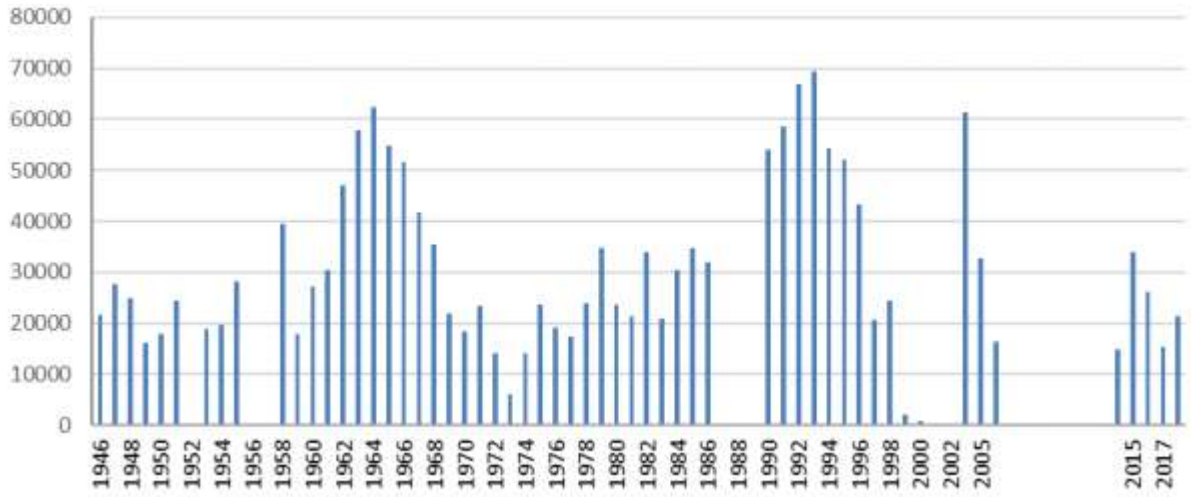

Figure 15 Annual catch of bleak (*Alburnus belvica*) in macedonian part of Prespa Lake

Rutilus prespensis has large oscillations in the catch of Prespa Lake. In the period from 1946 to 1973 it was generally in the range of over 10,000 to 25,000 kg, with a few catches of over 30,000 kg. Since 1973, there has been an evident trend in the reduction of catches, reaching about 5,000 kilograms by 1995. From 1999 to 2014, the catch of *Rutilus prespensis* in Lake Prespa is not recorded at all. It is most likely placed in the "other species" group. In recent years, the catch of rutilus has been around 15,000 kg.

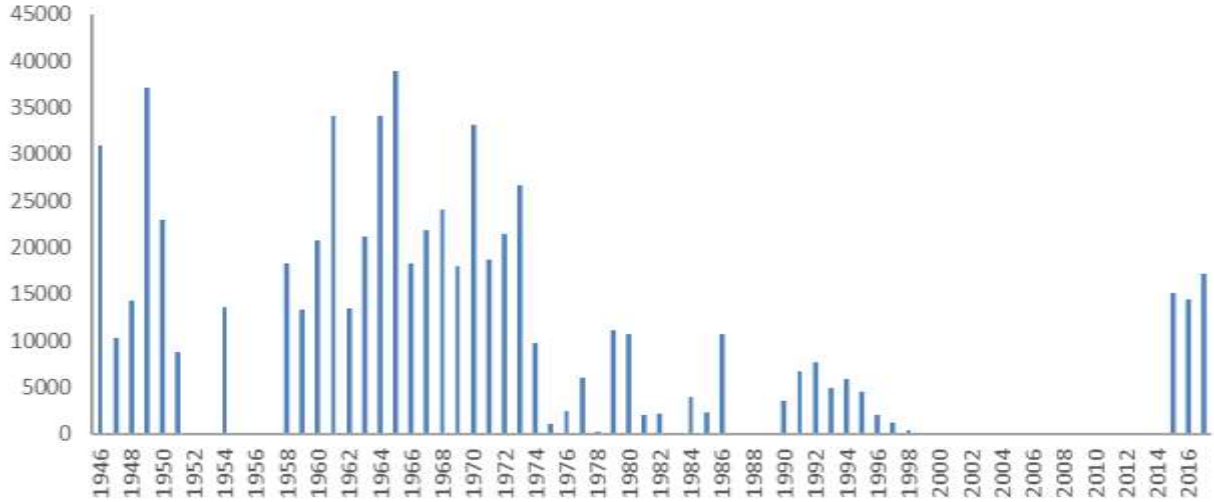

Figure 16 Annual catch of prespa roach (*Rutilus prespensis*) in macedonian part of Prespa Lake

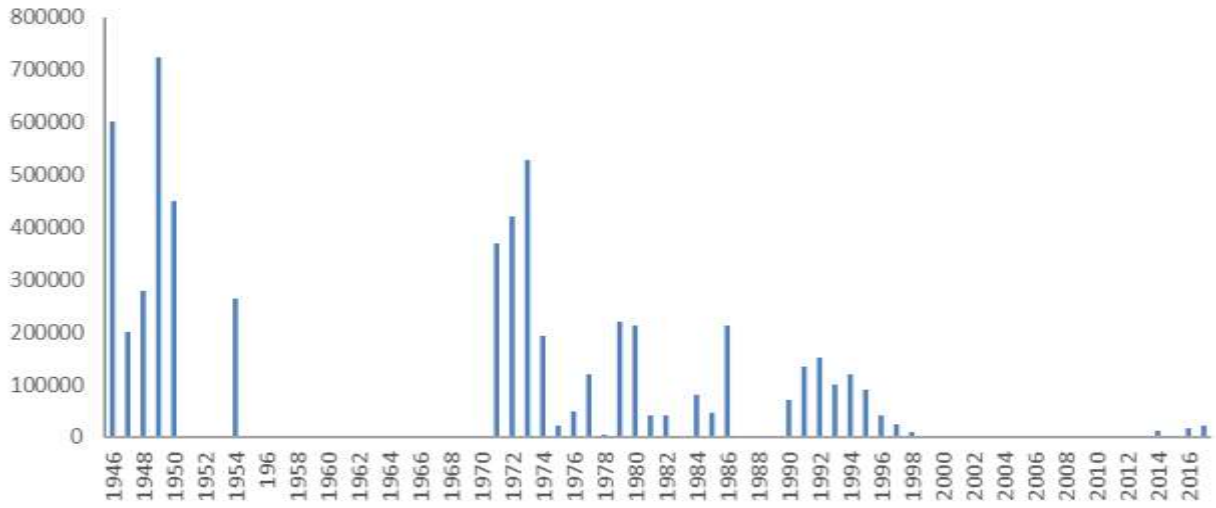

Figure 17 Annual catch of "other species" in macedonian part of Prespa Lake

There is incomplete data for the "other species" group because the fish in this group were not always recorded. There are times when this group has not registered fish at all. The largest catch, of over 70 tonnes, was registered in 1949.

8.6.7.4. Commercial catch in Dojran Lake

In Dojran Lake, as commercially significant, five species of fish have been recorded: *Rutilus rutilus, Perca fluviatilis, Alburnus macedinicus, Cyprinus carpio, Silurus glanis* and for the last ten years *Carrassius gibelio* is recorded like commercialu significant.

The total fish catch in Dojran Lake has been steadily declining since 1951 when a record fish catch from the lake was recorded. In 1951, over 880,000 kilograms of fish were caught. Until 1986 the annual catch of fish is in the range of 300 to 500 tonnes. Since 1992 the catch has been steadily declining and is below 300.000 kg. In the last seven years the catch has been below 100.000 kg and has been declining.

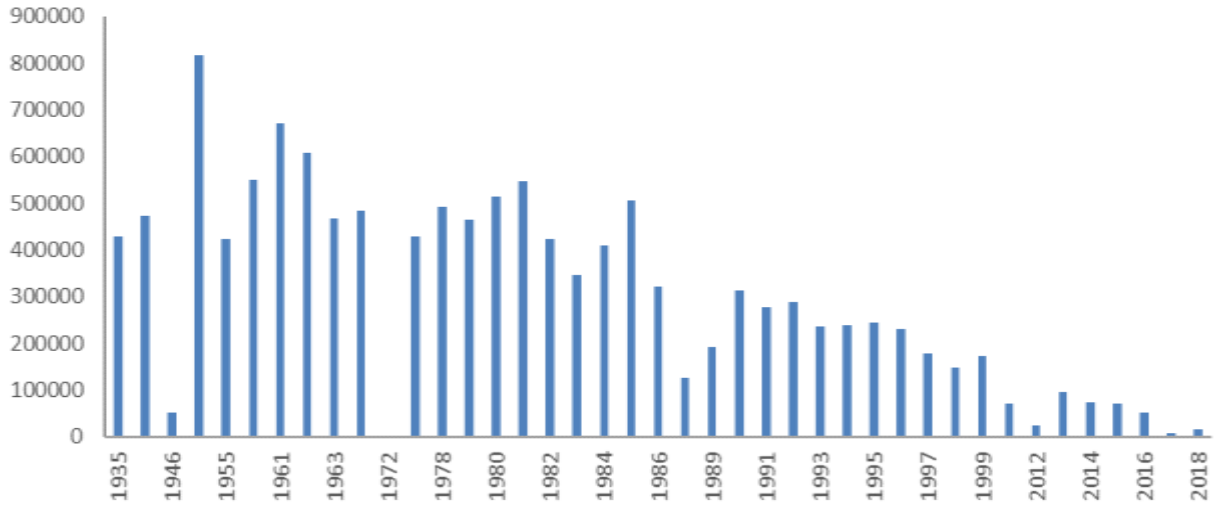

Figure 18 Total annual catch of commercial fishes in macedonian part of Dojran Lake

The role of *R. rutilus* in Dojran Lake has changed over the years. The largest catch, recorded in 1961, was over 500 tonnes. From 1961 to 1985, catches were usually above 300 tonnes with peaks in 1980 and 1981 of over 40 tons. Since 1981, the catch of *R.rutilus* in Lake Dojran has seen a continuous decline. In the last seven years the catch has been below 10 tonnes.

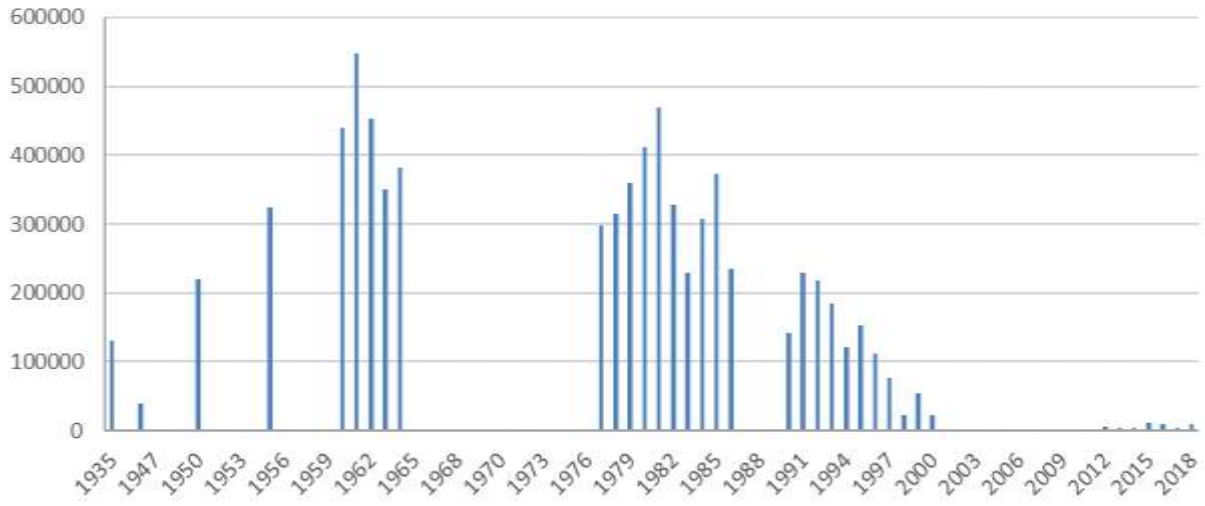

Figure 19 Annual catch of roach (*Rutilus rutilus*) in macedonian part of Dojran Lake

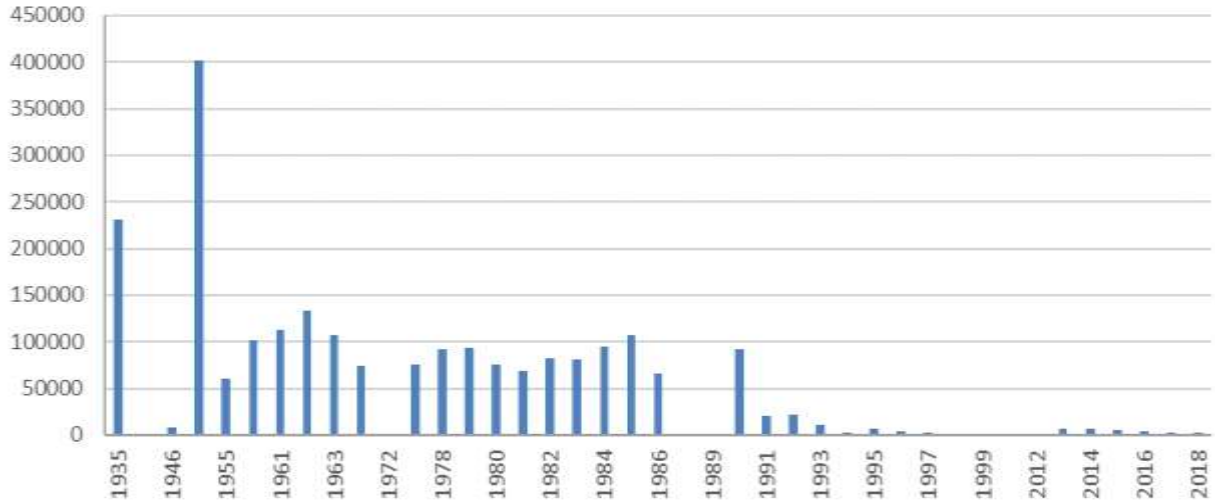

Figure 20 Annual catch of perch (*Perca fluviatilis*) in macedonian part of Dojran Lake

The catch of *P. fluviatilis* in Dojran Lake from 1955 to 1990 ranges from 50 to 140 tonnes. The largest catch was registered in 1950 and was over 400 tonnes. Since 1993, the catch of *P. fluviatilis* in the lake has been significantly reduced and is below 10 tonnes.

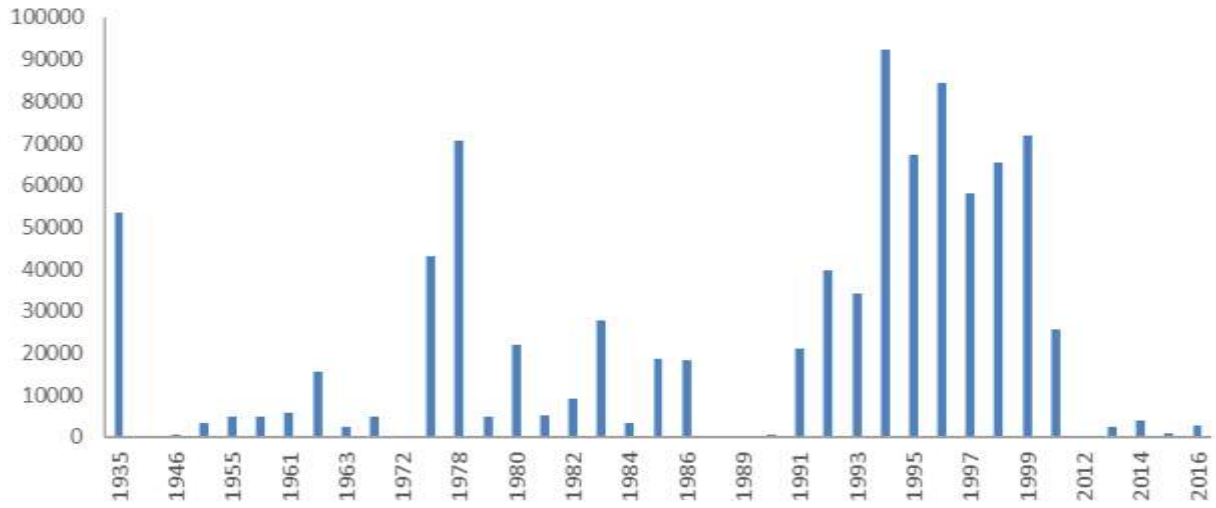

Figure 21 Annual catch of bleak (*Alburnus macedonicus*) in macedonian part of Dojran Lake

The catch of *A. macedonicus* in Dojran Lake varies from a few tons to a maximum of 92 tons in 1994. The catch is directly linked to market demand and the catch of other important lake fish species. This fish is not caught when there are enough other fish in the catch. In the absence of other important fish species, it becomes a species for commercial fishing. The large catches of *A.macedonicus* are an indicator of the lack of other important fish species.

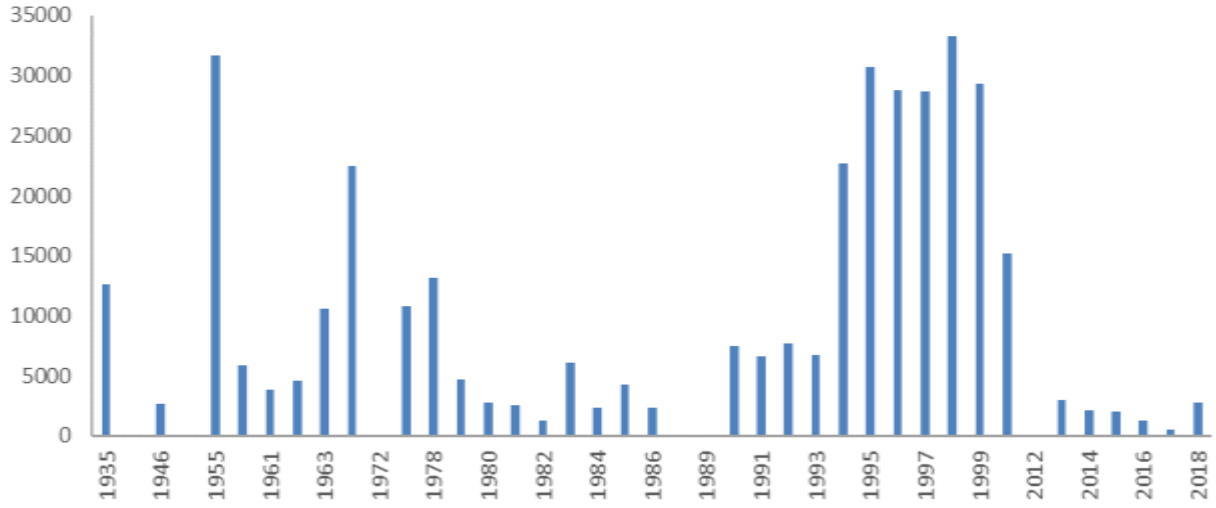

Figure 22 Annual catch of carp (*Cyprinus carpio*) in macedonian part of Dojran Lake

The carp catch in Lake Dojran is significantly variable and ranges from several hundred kg to over 30 tons. In 1950, an extremely high carp catch in the lake of 188 tons was recorded (data not shown in the chart). For the last seven years carp catches have been below 5 tons.

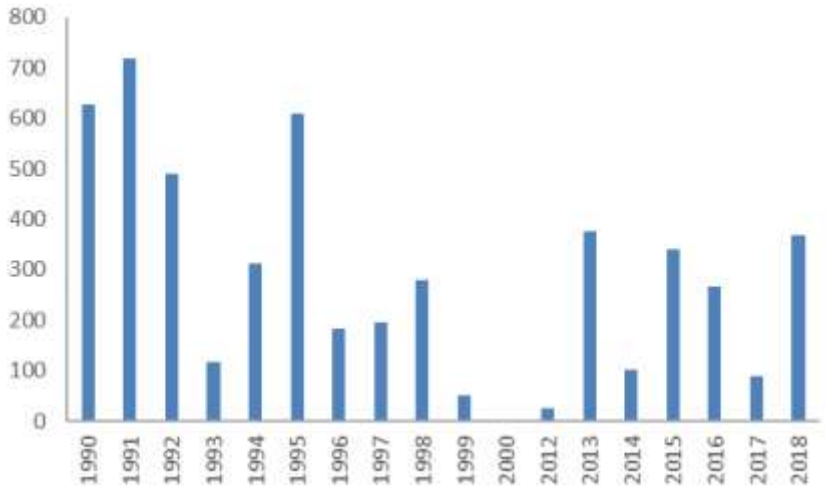

Figure 23 Annual catch of catfish (*Silurus glanis*) in macedonian part of Dojran Lake

Although considered as an important species, the catch of catfish in the lake is insignificant and is below 800 kg.

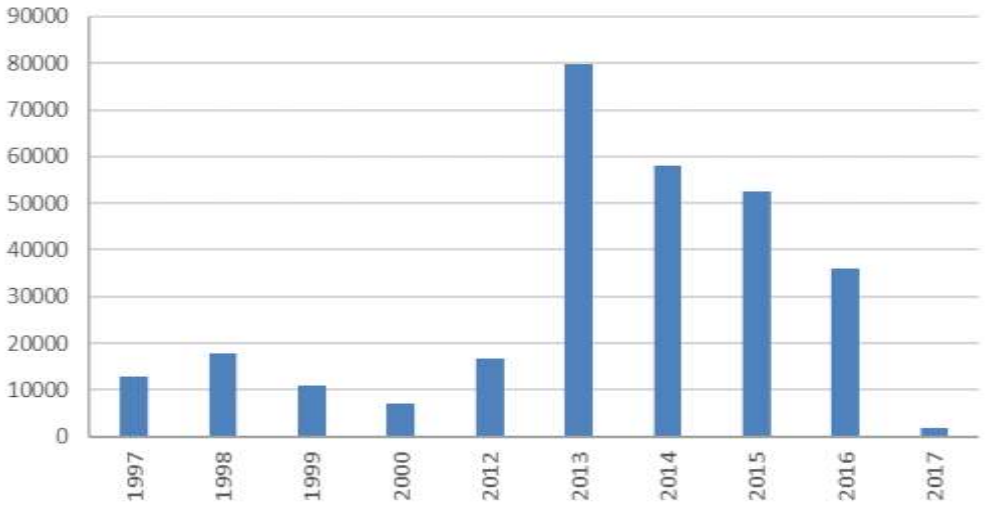

Figure 24 Annual catch of prussian carp (*Carrassius gibelio*) in macedonian part of Dojran Lake

Introduced and invasive fish species have also appeared in the group of economically important species in Dojran Lake since 1997. The population of Prussian carp has increased significantly so it is at one time the largest fish in the lake. The maximum catch was found in 2013 when approximately 80 tonnes were caught. Since 2013, its catch has tended to decrease. The reason for this is certainly the measures taken to reduce its population. Namely, there is no prohibition or restriction on his fishing. It can be fished in unlimited quantities at any time.

Carrassius gibelio is the dominant fish species in the concessionaire's catch in recent years of lake management. The population of *C. gibelio* has a negative impact on the populations of the noble and indigenous fish species in the lake and on the reduction of the total value of the fishery in the lake. As a result of a number of factors, the densities of the populations of the noble species of carp, catfish and perch are decreasing year by year.

8.6.7.5. Commercial catch in Ohrid Lake

In Lake Ohrid, as commercially significant, five species of fish have been recorded: *Salmo letnica, Salmo ohridanus, Cyprinus carpio, Alburnus scoranca* and *Anguilla anguilla*, and all other species (chub, nase, barbel, roach, etc.) have been recorded in the "other species" group.

According to statistics on the annual catch of fish for the period 1930/50, for the Macedonian part of Lake Ohrid it is 211,000 kg, ie 9 kg/ha. In the catch in this period, *S. letnica* is represented by 38.85% to 42.85% or together with the *S.ohridanus* about 46%. Eel is represented by 5.31%, black by 27.21%, *carp* 9.04%, chub by 7.05%, roach by 3.27%, nase by 1.82% and others by 0.3%.

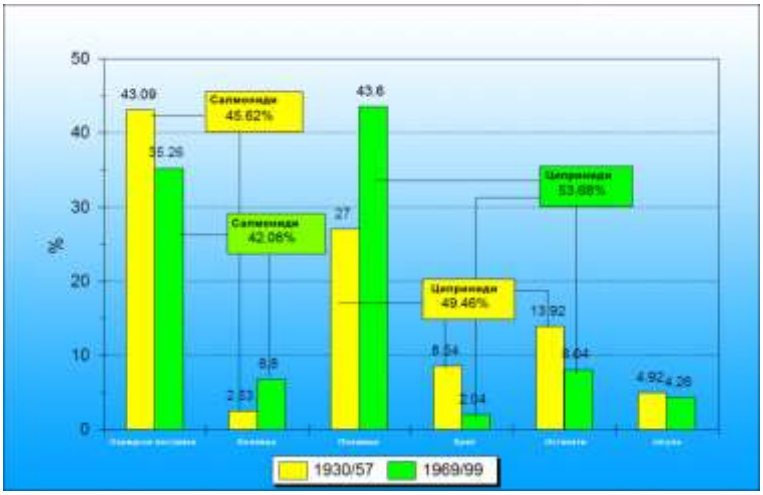

Figure 25 Comparison of the share of the main fish species in the total commercial catch of the Macedonian part of Ohrid Lake in 1930/57 and 1969/99

Figure 26 Total annual catch of commercial fishes in macedonian part of Ohrid Lake

For the period 1969-2001, the situation regarding the representation of species in the catch has changed, ie there is a dominance of cyprinid fish. Also, the average annual catch values decrease and accordingly, the total fishery yield expressed on one hectare of lake surface for the Macedonian part of the Lake is reduced from the previous 9 kg to 7.7 kg.

According to fishery statistics for the 1969/2001 period for the Macedonian part of Lake Ohrid, an average catch of 185 tons was recorded, a maximum of 302 t in 1988 and at least 53 t in 1998 (Figure 26). The catch mainly consists of *S. letnica* and *S. ohridanus* (both endemic to Lake Ohrid) and *Alburnus*. The presence of ohrid trout and belvica with 42% (trout 35.3%; belvica 6.8%), on the other hand, gives the lake the attribute of "trout lake" - while the plaice was represented by 43.7%.

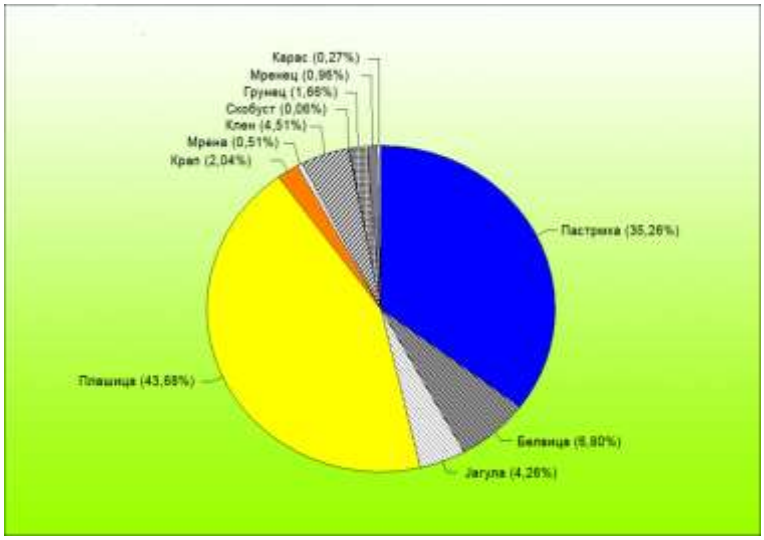

Figure 27 The share of fish species in the total commercial catch of the macedonian part of Ohrid Lake for the period 1969/99

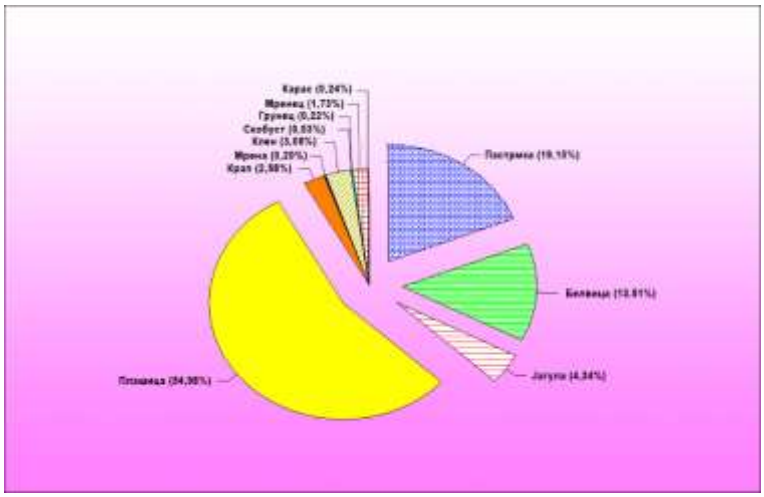

Figure 28 The share of fish species in the total commercial catch of the macedonian part of Ohrid Lake for the period 1999/01

Unfortunately, in the 1999/2001 period the two salmonids together were present in statistics at a much reduced rate, 19% for ohrid trout and 13.5% for belvica. Contrary to the tendency to reducing of the salmonid fish species in annual catch, the catch of *Alburnus* is increased to 55%. The 2003 data shows huge changes in the statistics on trout fishery composition.

Ohrid trout as the most economically valuable fish species from Lake Ohrid in the past period has been, and is still, under the greatest pressure. The lack of a concessionaire in a period of time, the relatively poor physical protection of the lake, the emergence of large-scale fishing, the fishing of

small and sexually immature individuals, caused an uncontrolled catch. This situation is alarming and in the long run unsustainable and leads to unforeseen consequences. As a result of the reduced ohrid trout and belvica populations in the lake, there is an expansion of the alburnus population in the lake, which is gradually taking over the ecological niche and environment of the Ohrid trout.

8.6.8. Indicator: Number of proceedings for biodiversity inspection and crime

8.6.8.1. Fact sheet

Author: *Ministry of Environment and Physical Planning*

Indicator Name: Number of proceedings for biodiversity inspection and crime
Lead Agency: State Environment Inspectorate (SEI), State court
Use and interpretation: **Key question(s) which indicator helps to answer** The level of law enforcement regarding biodiversity conservation (poaching, illegal woodcut, animals wellbeing, etc.) **Use of indicator** The indicator should be used to assess the law enforcement regarding biodiversity conservation and environmental protection in general. **Scale of appropriate use** National scale
Potential for aggregation:
Meaning of upward or downward trends („good or bad") The enforcement of environmental legislation needs effective supervision which can be achieved through re-structuring the organisational set up and continuous capacity building of the State Environmental Inspectorate, the Authorized Environmental Inspectors of local selfgovernments and other relevant bodies. EU law requires that efficient inspection control is in place in order to combat environmental offences on national, European and international level.
Possible reasons for upward or downward trends: The current institutional set up is developed to meet the national requirements, however it needs further development in order to be able to adequately implement the EU's environmental inspection requirements. Sector specific implementation gaps were identified for IPPC/IED, water and nature protection and air quality. A general implementation gap that applies to all sectors relates to the lack of adequate human capacity on local level in terms of number and skills.
Implications for biodiversity management of change in the indicator: It needed EU supply which providing equipment to inspection authorities and developing a system for the processing of data from inspection for biodiversity protection.
Units in which it is expressed: total number of inspection and crimes against the environment and nature

Description of source data: State inspectorate yearly report, Statistical office
Calculation procedure: Statistical data
Most effective forms of presentation:
Limits to usefulness and accuracy: n/a
Updating the indicator: The indicator should be followed in per year
Closely related indicators /
Additional information and comments 1. Perpetrators of Criminal Offences in 2017 2. State inspector report

8.6.8.2. Assessment of the indicator

The State Environmental Inspection is separate governmental body responsible for inspection and enforcement of measures for the protection of air, waters, soil, degradation and pollution of flora and fauna, protection of geo-diversity and biodiversity, and areas protected by law (national parks, monuments of nature, forest parks, ornithological reserves etc.), protection of the ozone layer, protection from harmful noise in the environment and the protection of ionizing radiation.

Since January 2007 the inspectorate's activities have been planned on the basis of annual and monthly work plans, with the exception of non-routine site visits and cases of emergency. For each investigation it prepares a Record of Statement.

The Law on Local Self-Governments of 2002 delegated a variety of tasks to municipal level, including competence to perform urban and rural planning, protection of environment, nature and spatial regulation, municipal services such as water supply, waste water treatment, collection, transport and disposal of municipal waste and supervision of the performance of activities carried out under municipal competency. Thus, implementation and inspection responsibilities of municipal importance have been delegated to the local self-government units (LSGU's). The law also introduces the possibility of Inter-municipal Cooperation in performing the functions under municipal competences. This requires a mutual agreement among the municipalities involved.

The Environmental legislation also places a large number of competences onto municipal level. Legal and institutional assessment According to the Plan for Institutional Development of the National and Local Environmental Management Capacity 2009 – 2014, main administrative functions of LSG Units in the area of environment was decentralised.

Insufficient administrative capacity for implementation at municipal level is considered to be a serious challenge. Although some trainings have been provided the administrative capacity to deal with environmental laws at municipal level for implementation and enforcement of environmental legislation are not sufficiently built.

Regarding State inspector report in the past years regards Law on Nature protection it was made regular inspection.

Table 19 Number of inspection per year (Source: State inspector report)

Number of inspection	118	106	182	200	606

According to State Environment Inspectorate, in the period 2014–2017, only two cases in the water and waste sectors were registered as criminal. The 2018 publication of SSO, "Perpetrators of Criminal Offences in 2017", presents the total number of crimes against the environment and nature:

- usurpation of real property – 72;
- devastation of forests – 7;
- unlawful hunting – 13;
- unlawful fishing – 28;
- torturing animals – 25;
- and other – 6.

The majority of the criminal cases were in the forestry sector. They were processed by the State Inspectorate for Forestry and Hunting. The measures undertaken by the state inspectors are decisions. For most of the crimes related to unlawful fishing and torturing animals, the decision was for the complaint to be dismissed; for the remainder of the crimes, when the perpetrators were known, the decision was indictment.

In the period 2010–2017, a total of 1514 environmental crimes were reported, including 461 by unknown perpetrators. In 2017, of 151 reported crimes, 43 were reported by the victim (individual suffering damage), 4 by other individuals, 4 by the victim (business entity suffering damage), 9 by inspection, 88 by the Ministry of Internal Affairs, 1 by the Public Prosecutor's Office and 1 other.

In 2017, the duration of the procedure in environmental cases, from receiving a complaint to indictment, varied: the majority (30 cases) lasted 2–4 months, 29 cases lasted for up to 1 month, 21 cases lasted 1–2 months, 19 cases lasted 6–12 months, 16 cases lasted more than 12 months and 13 cases lasted 4–6 months. As at September 2018, there is no register of public complaints received and petitions on environmental matters submitted to SEI. Reportedly, there are about 10 complaints received from the public each year. Complaints are often made by telephone and mostly relate to waste management and air pollution. SEI responds to the complaints received within eight days, including by providing the minutes from the inspection.

Table 20 Criminal offences against the environment and nature for the period 2010–2017 (Source: State Statistical Office, 2018)

Pollution of the environment and nature	26	4	9
Destruction of forests	109	19	66
Unauthorized hunting, keeping and sale of wild animals and birds	7	7	0
Illegal hunting	209	106	45
Illegal fishing	77	35	28
Torturing animals	113	47	32

8.6.9. Indicator: Number of carp fish farms and carp production in Republic of North Macedonia

8.6.9.1. Fact sheet

Author: *Vasil Kostov and Irina Manevska (Institute of Animal Sciences, Ss. Cyril and Methodius University, Skopje-Fishery department)*

Indicator Name: Number of carp fish farms and carp production in Republic of North Macedonia
Lead Agency: Institute of Animal Sciences, Ss. Cyril and Methodius University, Skopje-Fishery department
Use and interpretation: **Key question(s) which indicator helps to answer** What are the impacts of carp aquaculture on biodiversity. Instances of major impacts on biodiversity conservation arising from aquaculture, such as land use, effluent discharge, effects on wild populations and alien species, among others are highlighted and critically examined. Species that escape from aquaculture can become invasive in areas where they are nonnative, effluents from aquaculture can cause eutrophication, aquaculture species may consume increasingly scarce fish meal, and cultured species may transmit diseases to wild fish in the water basins. The influence of paradigm changes in development strategies and modern day market forces have begun to impact on aquaculture developments. Consequently, improvements in practices and adoption of more environmentally friendly approaches that have a decreasing negative influence on biodiversity conservation and the maintenance of ecosystem services. **Use of indicator** This indicator can be used for following the annual production of carp in ponds and number of carp farms/ponds in the drainage basins of NRM, where carp aquaculture is practiced. **Scale of appropriate use** Considering the fact that carp aquaculture is performed in water bodies, which are interconnected in the frame of drainage basins, this indicator can be used as a tool to monitor the current state of total drainages in the country.
Potential for aggregation: This indicator includes parameters that present the annual carp production and number of carp ponds, favoring as a good indicator that can be used for further scanning of aquaculture practices that will not hamper or degrade the environmental balance rather, it would enhance the possibility of environmental sustainability over long run.
Meaning of upward or downward trends („good or bad“) The increase of the number of aquaculture carp ponds and production of carp, may indicate and facilitate the inclusion of aquaculture in environmental planning and development of state strategies, in order to protect species diversity.

Possible reasons for upward or downward trends:

Positive trend of carp production and number of carp ponds during the years may indicate the status of intensive carp aquaculture in regions where rivers and reservoirs are eventually already degraded by other stressors may undermine efforts to conserve biodiversity. Instances of major impacts on biodiversity conservation arising from aquaculture, such as land use, effluent discharge, effects on wild populations, alien species among others should be highlighted and critically examined.

The decreased trend of carp production and number of carp ponds, may indicate the declined trend of it's current sustainability, or not complete data from the aquaculture producers.

Upward or downward trends of carp production and number of carp ponds, also could be due to the methodological data collection during the years.

Implications for biodiversity management of change in the indicator:

Increasing or declining of carp production and number of carp ponds, alert to changed situation for which certain relevant institutions should have taken appropriate action plans and environmental strategies.

Units in which it is expressed:

The preferred units for this indicator are: number of fish ponds and t (tones) per year.

Description of source data:

Data can be gained from the Ministry of Agriculture, Forestry and Water Economy (MAFWE), Institute of Animal Science – Fishery Department (IAS-FD).

Calculation procedure:

Processed data obtained from MAFWE or IAS-FD, expressed in tons per year and number of fish rarms.

Most effective forms of presentation:

Different forms can be used: description, tables, graphic display, and combined display.

Limits to usefulness and accuracy:

Gained data through the MAFWE annual reports and IAS-FD, may not reflect the complete picture of the carp ponds and carp production impact on fish fauna biodiversity in drainage basins in Republic of North Macedonia. If the data is obtained through an executable according to the prescribed standard protocols then the data will represent the real situation.

Updating the indicator:

Permanent monitoring or regulation prescribing the procedure for data collection.

Closely related indicators

- fully utilization of projected capacities
- regular report of all carp production from aquaculture producers
- management of biodiversity in aquaculture
- biodiversity at species level
- recources for sustainable fisheries and aquaculture

Additional information and comments

Considering the fact of incomplete and improper monitoring practice in our country, lack of filled data about the carp production and number of carp ponds is a reason that this indicator makes more intricate and complexed. The list of the carp production and number of carp ponds in Republic of North Macedonia presented above, are based on available data and archive data that exist in relevant institutions, gained by the aquaculture producers. The indicator is further complicated by eventually inadequate data recording by the aquaculture producers, in certan period. Data about the real and actual carp production and number of carp ponds, should be collected only through regular national monitoring programs.

8.6.9.2. Assessment of the indicator

The indicator (number of carp fish farms and carp production) is consisted by following parameters: (1) number of carp fish farms, (2) total annual carp production.

Production of carp in RSM today takes place in classical earth pond fish farms and in cage system fish farms.

Production of carp in the Republic of North Macedonia dates back to 1961 with the construction of the "Bukri" and "Bel Kamen-Zabeni" fishery in the Bitola region. Ten years later several more carp fisheries were built, such as “Dubrovo” in Negotino region, “Ezereni” in Resen region and “Sarandinovo” in Prilep region. "Bel Kamen-Zabeni" fish farm covers an area of 170 hectares. "Bukri" covers 55 hectares, "Sarandinovo" covers 200 hectares, Dubrovo Fisheries covers area of 140 hectares and Ezerani an area of 120 hectares. The production of carp in these fish farms in the period 1986 to 1991 ranged from 650 to 1050 kg of fish per hectare. Total carp production in 1986 was 609,000 kg and in 1991 758,000 kg.

The period from 1991 to 1995 was a period of complete stagnation in ciprinid fishing production. During this period, the "Dubrovo", "Ezerani" and "Sarandinovo" fisheries stopped working. Only the fish farms in the Bitola region "Bel Kamen - Zabeni" and "Bukri" remained in operation, but fish production was also slightly reduced here.

In the transition period from 1993 to 1998, most of the state-owned enterprises collapsed, and some abandoned such production, which was essentially a supplementary occupation to their core business. However, existing private fisheries are being strengthened and new ones are being built.

In the period from 1995 to 2001, only the fisheries of ZK Pelagonija Bitola were in operation, and the period from 2001 to 2018 were characterized by the occasional fish production in the Prilep fishery and the continuous operation of the Bitola fisheries, as well as the initial ones.

Table 21 Registered carp fish farms of drainage basins/reservoirs in RNM (data from MAFWE)

Middle part of Vardar river basin	6	94
Lower part of Vardar river basin	2	32
Bregalnica river basin	4	78
Pchinja river basin	2	62
Crn Drim river basin	1	5
Globochica reservoir	1	7
Crna reka river basin	3	500
Kozjak reservoir	1	50
Strumica river basin	1	15
Mantovo reservoir	2	40
Tikvesh Lake reservoir	21	602
TOTAL	44	1485

The register of fish farms maintained in MAFWE by the end of 2018 has recorded a total of 44 carp fisheries with a total production capacity of 1485 t. Of these, 19 fisheries are classic earth pond farms, and 25 are cage farms. The classic earth ponds have a total projected capacity of 786 t, of which only the three fish farms in the Crna River watershed have a projected capacity of 500 t. All other (16) fish farms have a projected capacity of 286 t.

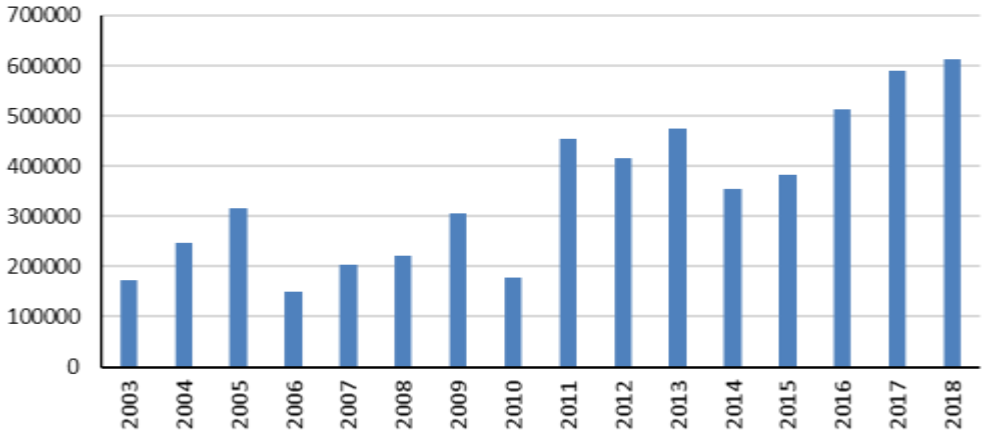

Figure 29 Carp production in the period 2003/2018 (data from MAFWE)

The cage fish farms have a projected production capacity of 699 tonnes of carp per year. Most of the cage fish farms (21) with a total capacity of 602 t are located in Lake Tikves.

It can be concluded that carp production in N.Macedonia is concentrated in the Crna River watershed, with projected production capacities of 1102 t (602 t in cage fish farms and 500 t in earth pond fish farms).

Data of carp production in N.Macedonia are different from the data of projected carp production capacities. According to the 2018 MAFWE records, North Macedonia has projected production capacities of 1485 tons of carp, and at the same time reported production of 613 tons. The reasons for this difference can be cited:

- the projected capacities are not fully utilized, that means that fisheries do not operate at full capacity
- owners do not report all carp production
- some fisheries do not work at all.

From the results presented in Figure 29, it can be concluded that carp production in North Macedonia has increasing trend. From approximately 200 tonnes in 2003 production in 2018 has increased to over 600 tonnes.

8.6.10. Case study: High Nature Value Farming (HNV Farming)

Author: *Kiril Ristovski (Florozon, NGO)*

High Nature Value Farming (HNV Farming) is an important precondition to maintain biodiversity and to protect animal welfare in agricultural landscapes of the Western Balkans countries. It represents an important factor for rural development, environmental protection and European Union integration of the targeted countries.

The idea that nature values, environmental qualities and even cultural heritage are linked to or dependent on farming also underlies and supports the concept of a multifunctional 'European model of farming' which provides benefits other than food. The 'High Nature Value Farming' idea thus ties the preservation of the diversity and wildlife value of the countryside to the need to safeguard the continuation of farming in certain areas and the maintenance of specific farming systems associated with the long term management of these areas.

The project "Sustainable agriculture for sustainable Balkans: Strengthening advocacy capacities of CSOs and developing policies in the Western Balkans" aims to strengthen capacities of CSOs for advocacy and policy development in the Western Balkans through research, training and networking. Regional Working Platform (RWP) gathers representatives of relevant institutions, CSOs and experts on relevant topics and aims to analyze the state and perspectives for biodiversity conservation and animal welfare in agricultural landscapes in the Western Balkans region. The work of the RWP is supported by the European Union and German Federal Agency for Nature Conservation. NGO Florazon was main partner of the project. More info for project http://www.sasb-eu.org/en/

Within the framework of the project we conduct a comparative analysis of strategic and legal frameworks in the field of protection of biodiversity and animal welfare of the countries in the Western Balkans and the European Union, as well as the analysis of the examples of good practice of sustainable agriculture in the member states. Together with relevant data collected from the Western Balkan countries, this comprehensive analysis will be the foundation on which to build Regional report on biodiversity protection in agricultural landscape in Western Balkans. National programs for identification and monitoring of high nature value agricultural landscapes in the Western Balkans will be based on this report. Members of the RWP with the purpose of providing an overview on the state and perspectives of the following aspects:

- Policy (strategic and legislation) framework at the national level,
- Institutional setting for implementation of relevant policies,
- Data availability, and
- Problems and solutions

In the national level for developing and implementing policies relevant for biodiversity conservation in agricultural landscapes - HNVF policies, we identify responsible following national institutions: Ministry of Agriculture, Forestry and Water Economy as a responsible for development and implementation of policies on agricultural development (including organic production), protection of cattle and crops from diseases, plant protection, agricultural land management, rural development, forestry (including use and management of forests, afforestation, reforestation and forest protection), hunting and irrigation and drainage. Ministry of Environment and Physical Planning as a responsible for monitoring the condition of the environment; protection of water, soil, flora, fauna, air and ozone layer against pollution; protection against noise, radiation, protection of the biodiversity, national parks and protected areas; Natura 2000, restoration of the polluted areas of the environment; proposing measures for treatment of solid waste; spatial planning; spatial

information system; supervision within its competence; and other activities. Public Enterprise Pastures where include encouraging and providing support for the cultivation (or re-introduction) of traditional agricultural and land-use practices in meadows and pastures (e.g., haymaking, sheep grazing) which largely enhances the protection of biodiversity and nature, and prevents the natural succession of shrub and forest vegetation over the abandoned, previously grazed and mowed meadows, situated in remotely located rural areas (e.g., high mountain regions), rapidly depopulating due to the extensive migration from villages to urban settlements. Pastures are available to users through separate agreements signed for a 5-year period.

Figure 30 HNV Farmland Osogovo Mountain

Concerning agri-environmental policy the main related strategic documents are the Government Work Programme (2017-2020) for support of the measures related to agri-environmental zoning.

Legal basis for Legal basis for Agri-environmental measures (AEM) is set up and defined in the National Strategy for Agriculture and Rural Development 2014-2020 and in the Law for Agriculture and Rural Development. In addition, some activities started in the form of measures at the national level.

In the National Programms for Financial Support in Agriculture and Programmme for Financial Support in Rural Development, several agri-environmental measures exist:

- Measures related to soil protection: - Analysis of the physical and chemical properties of the soil including organic agriculture and – direct payments for areas under green manuring and fallowing included in crop rotation.
- Measures related to bees: - direct payments for overwintered bee families and support for production of selected bees for queens production.
- Less Favourable Areas (LFA or ANC) measure is related to the direct support for investments in the areas above 700m and less than 100 inhabitants. In addition, direct payments can be realized as additional financial support per ha, per head or product unit if the agricultural property is in the LFA.
- Measures related to agrobiodiversity are in the Programme for Financial Support in Agriculture and in the Programme for Financial Support in Rural Development.
- Measure supported in the Programme for Financial Support in Agriculture is:
- Direct support per registered head and additional support for local breeds.

Measures supported in the Programme for Financial Support in Rural Development are:

- Activities related to establishing, monitoring and analysis of the state of autochthonic agriculture plants and ensuring compulsory genetic reserves;
- Establishing, monitoring and analysing of the state of autochtounous breeds and storage and security of compulsory genetic reserves of autochthonous breeds;
- Preservation of genetic diversity of autochtounous breeds (Busha cattle, sheep-Karakacanka, Ovchepolka, Sharplaninska, goat:Balkanska Koza, dog: Sharplaninec, water buffalo: Domestic water buffalo).
- Measures related to organic production in the Programme for Financial Support in Agriculture:
- Aditional direct support for plant and animal production and production in transition;
- Direct support for processing domestic organic products and organic products in transition.
- Direct support on income of the agriculture holdings per head, ha, unit of agriculture product and purchase of agriculture products (for agriculture purchasers).

Other measures related to environmental protection in the Programme for Financial Support in Rural Development are:

- Submeasure: purchase of drop by drop irrigation system;
- Investments in improvement of the economic value of forests (sustainable forest management);
- Support for preservation of rural areas and their traditional characteristics (payment for shepherd for cattle, sheep and goat);

From 2013, all farmers applying for financial support need to be familiar with the list for minimal specific requirements for GAP and environmental protection according to the Rulebook.

Within the IPARD Programme, AEM are not accredited. However, every measure is in away connected to environmental concerns especially form the aspect of energy efficiency, controlled climate conditions, manure handling and storage, waste and by-product treatment, water treatment etc., as well as electricity and/or heating using renewable resources to meet the needs of the holding for its agricultural production activities.

Measure “Investments in physical assets of agricultural holdings” from IPARD II Programme, contributes to the implementation of the measure “Agri-environment-climate and organic farming measure” by promoting investments proposed by certified organic agriculture producer and investments to improve efficiency of nitrogen fertiliser use (e.g. reduced use, equipment, precision agriculture). In addition, recipients under this measure may benefit support i.e. is entitled for payment under “Agri-environment-climate and organic farming measure”.

Measure “Agri-environment-climate and organic farming measure” contributes to the implementation of the measure "Investments in physical assets concerning processing and marketing of agricultural and fishery products" by promoting organic farming for production of processed organic products. (Not accredited)

Figure 31 Organic bee keeping

Main concussion is that High Nature Value Farming is a comparatively new term used to describe the most biodiversity rich farming systems in the country and region, which until recently were still widespread across much of the EU. Intensification and simplification of farming systems on more productive land and abandonment of marginal land led to the large-scale loss of HNV farming systems and land management. Maintaining the integrity of HNV farmland with a mosaic of low intensity agriculture and natural and structural elements, which provide landscape scale habitat diversity and connectivity, depends on the farm management decisions of many individual farmers.

North Macedonia made initial efforts to identify the extent and location N2K sites, Red list, Organic production etc which means future HNV farmland, many of them undertaking needs attritional research because sufficient relevant data was not available. Major problems are lack of intersectoral cooperation and integration of all relevant data for HNVF.

The following steps should be taking in consideration:

- Integration of data systems (GPS) with all institutions,
- Intensive research, monitoring and identification of N2K sites in the country,
- Promoting and preservation and development of HNV farming and pasture systems and traditional agricultural landscapes,
- Ensuring relevant agri-environment-climate payments are available on all HNVF land, giving priority initially to full coverage of Natura 2000 farmland and to land outside Natura 2000 areas as well protected areas in the country.

NGO Florazon with partners institution will continue activities for future mapping and supporting for areas of HNV farming in the country.

8.7. **National target 6:** Reduce pollution, including waste and excessive inlet of nutrients, to levels that are not detrimental tobiological diversity, ecosystems and ecosystem services delivery

8.7.1. Case Study: Soil quality

Author: *Trajce Stafilov*

In the Republic of North Macedonia there are areas polluted with heavy metals due to the mining, metallurgical and urban activities.

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www.msksoil.ukim/mk/masis

8.7.1.1. Assessment

In 2015, the development of the Pedological (soil) Map of the Republic of North Macedonia was completed. The map was developed in digital (www.msksoil.ukim/mk/masis) and printed form (1:50,000), with appropriate interpretation and a general pedological map of the Republic of North Macedonia in a scale of 1:200,000 including an interpretation (Filipovski, 2015; Filipovski et al.,

2015). Although the Republic of North Macedonia is a small territory, it has a highly heterogeneous soil cover, consisting of many soil types and lower taxonomic units. North Macedonia is a “natural museum” with almost all soils occurring in Europe, which is explained by the heterogeneity of pedogenetic factors (geographical position and relief, hydrographic features and erosion, parent rocks, climate, vegetation, weather and anthropogenic influence). The division of soils in the Republic of North Macedonia in five groups is conducted according to relief and geographical characteristics of the areas of their representation: the soils of plain terrain, hills slopes, wavy hills and lake terraces, mountainous terrain and anthroposols (anthropogenic soils). As mentioned before, the soils covering the Republic of North Macedonia are highly heterogeneous, with large variations over small distances. Fields cover 60.8% of the total of productive land of about 2.1 million ha of soil in the country, 31.8% are covered by forests, 43.57% by agricultural land, of which 23.65% are pastures, 19.9% are arable land (16.1% field crops and vegetables, 0.56 orchards, 0.81% vineyards and 2.39% meadows) and 18.25% are unproductive land (Mukaetov, 2013a, 2013b).

The following soil types have been established: lithosols, regosols, arenosols, colluvial soils, rendzinas on hard limestones and dolomites, rendzinas, rankers, vertisols, chernozems, chromic cambisols, red soils (terra rossa), brown soils on limestones and dolomites, brown forest soils, illimerised soils, brown podzolic soils, alluvial soils, fluviatile-meadow soils, hydromorphic black soils, gleyic soils, peat soils (histosols), pseudogleys, solonchaks and solonetz (Mitkova & Mitrikeski, 2005).

Due to climatic conditions and other factors relating to soil acidification, this type of soil degradation is insignificant in the Republic of North Macedonia. There are only 11,000 ha of naturally salty soils located in the driest region of the Republic of North Macedonia. In general, an area of about 30,000–80,000 ha is irrigated and could be defined as vulnerable in respect of salinisation and land degradation. The loss of organic matter, nutrients and bioactivity is normal for areas with intensive agriculture, emphasised by the use of agro-technical measures. In addition, an area of agricultural land was sealed by various kinds of infrastructure and according to some studies, the annual loss of agricultural land as a result of urbanisation is as high as 0.5 percent.

The main sources of soil pollution in the Republic of North Macedonia are mineral fertilisation, municipal waste and urban and industrial activities. Large quantities of industrial and hazardous wastes of more than 20 million t/y (De Koning et al., 2005; Stafilov et al., 2009) are generated in mining, metallurgical, fertiliser and chemical industries as well as by power plants. Erosion processes contribute to the high rate of soil degradation in North Macedonia and contribute to high losses of topsoil, humus and nutrients from agricultural land (EEA, 1995).

Geochemical investigations of soil across the whole country were performed, and this information is being addressed to prepare the first Geochemical Atlas of the Republic of North Macedonia (Stafilov & Šajn, 2016, 2019). In this atlas, the basic geochemical properties of soils are described, as revealed by a detailed large-scale survey across the country and analyses of the findings. The Atlas includes soil sampling and analysis from 1,024 locations with a grid of 5×5 km distance between the sampling locations. Areas which are known as polluted areas (surroundings of mines, metallurgical factories or larger towns) are investigated taking additional samples on a much denser sampling grid (1×1 km or 0.5×0.5 km). All samples are analysed for contents of about 60 elements. All data are statistically processed, and appropriate maps of distribution are prepared for 39 chemical elements. Based on a comparison of statistical parameters, spatial distribution of particular elements and results of cluster and factor analysis, four main geochemical associations were identified: 1. The association connected with the Neogene and Quaternary volcanism (Ba, Be, Ce, Hf, K, La, Rb, Th, Tl, U and Zr); 2.

Association of siderophile elements (Co, Cu, Fe, Mn, Sc, Ti, and V); 3. Association connected with ophiolites and Mesozoic ultrabasic magmatic rocks of Vardar zone (Cr and Ni) and 4. Chalcophile (sulphide) elements (As, Bi, Cd, Pb, Sb, Sn, and Zn). The regional distribution was prepared according to the eight statistical regions in North Macedonia, dis¬tribution according to 15 most common geological formations and distribution according to 13 pedological units.

It was concluded that some regions are intensively polluted with potentially toxic elements even over the intervention values. Such area polluted with As, Cd, Pb and Zn are those in the towns of Veles and Probishtip due to the Pb-Zn metallurgical and mining activities in the past and at the present time, respectively (Stafilov et al., 2008, 2010; 2014), with As, Cd, Ni, Pb and Zn around the thermoelectric power plant near the towns of Bitola and Kihevo (Stafilov et al., 2014b, 2018), soil in the industrial areas in the city of Skopje with Cd, Cu, Pb and Zn (Stafilov et al., 2017, 2019).

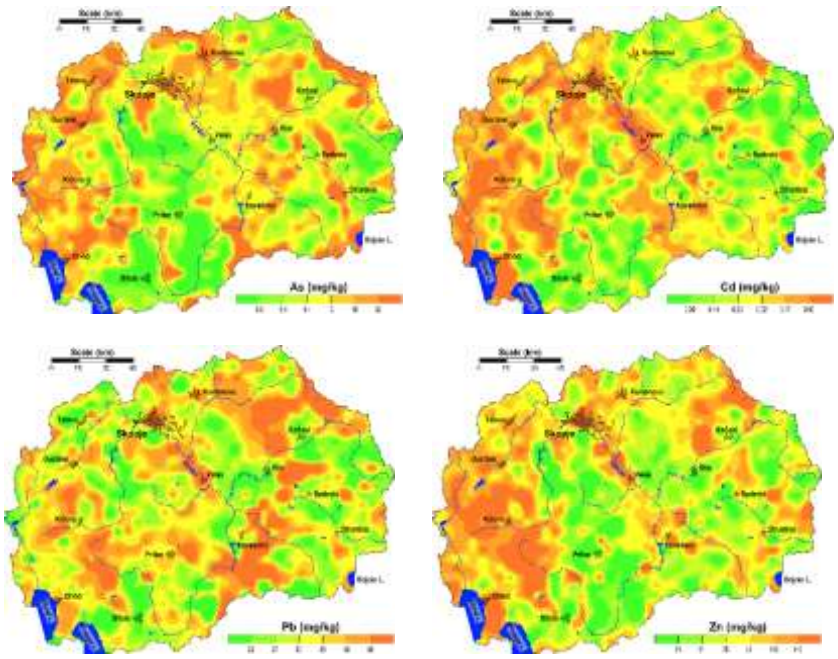

Figure 32 Spatial distribution of As, Cd, Pb and Zn in soil

Significantly good correlation is found in the distribution of U and Th (Fig. 3) which represent the main radioactive elements in the soil. The highest contents of Th and U are linked to Younger Neogene-Quaternary volcanism as well as to the Kratovo–Zletovo. Th and U are also characterized by their enrichment in the area of metamorphic rocks of the Pelagonian massif. The contents of Th and U in the other defined litho-geochemical units vary around the level of the average.

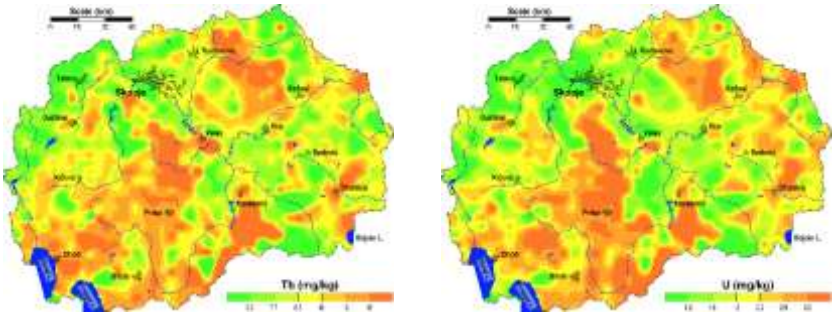

Figure 33 Spatial distribution of Th and U in soil

8.7.2. Case study: Biomonitoring of air-pollution

Author: *Trajce Stafilov*

In North Macedonia there is a slightly declining trend of air pollution with potentially toxic elements.

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8.7.2.1. Assessment

The bio-indicator species of moss *Hypnum cupressiforme* and *Camptothecium lutescens* are used in North Macedonia for the assessment of air quality with potentially toxic elements (passive bio-monitoring). In North Macedonia, from 2002 to 2015, there is a slightly declining trend of air pollution with potentially toxic elements. The potential cause for such trend is the cessation of the operation of numerous industrial plants and/or introduction of environmental protection measures in individual industrial capacities.

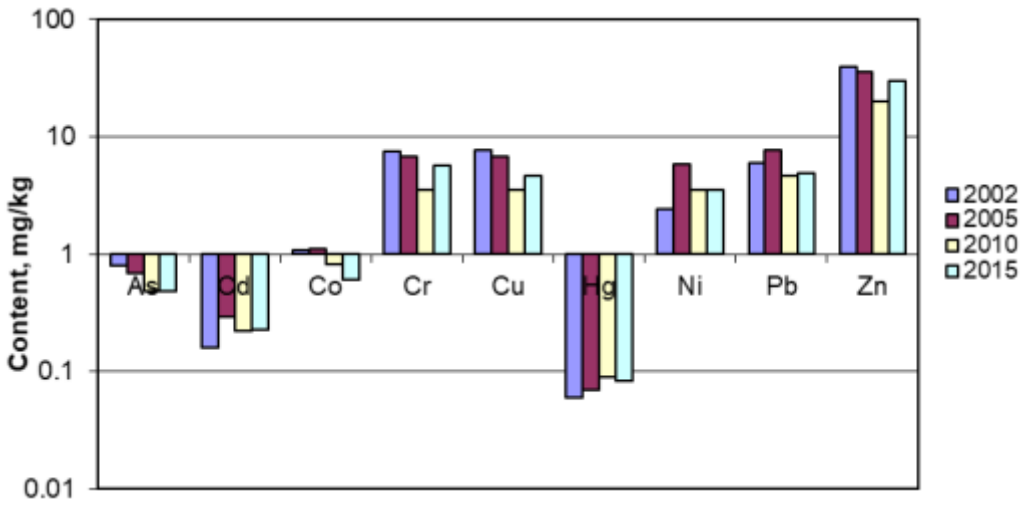

Figure 34 Concentration of heavy metals in mosses as indicators of air pollution

By the statistical processing of data and spatial distribution maps of the element contents in the moss in North Macedonia in 2015 two associations of elements were established, Cd, Pb and Zn and Co, Cr, Ni and Mo. It was found that the first group of elements have higher content in mosses from the region of the capital city of Skopje as a result of urban and industrial activities; then in the area of the town of Veles due to the soil pollution and slag landfill from the former work of the Pb and Zn smelter in the town and in the eastern part of the country, the area with higher contents of Cd, Pb and Zn in the moss samples, which is due to the emission of particles from the flotation tailings the landfills from the mine and flotation processes from the Pb-Zn mines "Zletovo" near the town of Probištip, "Sasa" near Makedonska Kamenica and "Toranica" near Kriva Palanka.

The association of Ni, Cr, Co and Mo is a geogenic and anthropogenic association. Higher content of these elements are found in the central part of the country due to the increased content of these elements in the Neogene clastitic sediments and due to the pollution from the ferronickel smelter plant located near the town of Kavadarci processing ore reach with elements. If we compare the distribution maps of Ni, Cr and Co, it can be concluded that their distribution is similar, especially in the Kavadarci region where high contents of these elements occur as a result of the work of the ferronickel smelter located in the surroundings of Kavadarci.

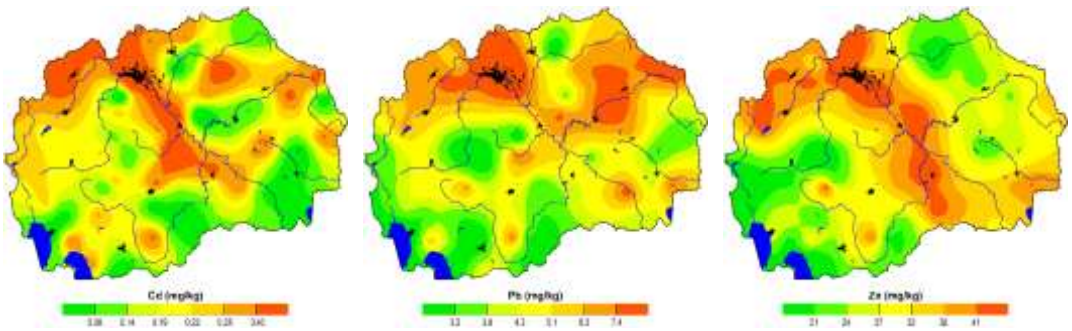

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Figure 35 Spatial distribution of Cd, Pb and Zn in moss

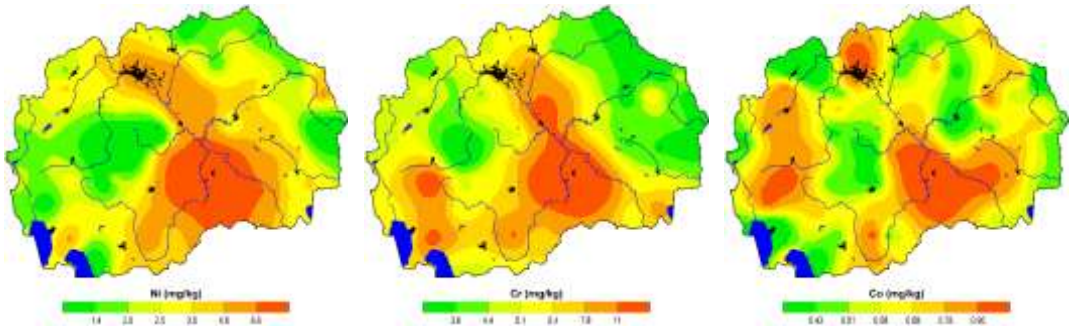


Figure 36 Spatial distribution of Ni, Cr and Co in moss

8.7.3. Indicator: Trends in the quantity and quality of municipal wastewater discharged after treatment from pollution sources and populations covered by treatment plants

8.7.3.1. Fact sheet

Author: *Ministry of environment and physical planning*

Indicator Name: Trends in the quantity and quality of municipal wastewater discharged after treatment from pollution sources and populations covered by treatment plants
Lead Agency: Ministry of environment and physical planning, Skopje
Use and interpretation: **Key question(s) which indicator helps to answer** To what extent will the improvement of the urban waste water collection, drainage and treatment system improve the status of waters in the Republic of North Macedonia? **Use of indicator** This indicator should be used in order to present the Percentage of population connected to primary, secondary and tertiary wastewater treatment plants. The indicator shows: 1. changes in wastewater treatment; 2. conformity with respect to providing primary, secondary and tertiary treatment; 3. Wastewater treatment levels in large cities (agglomerations> 150 000 p.e.). **Scale of appropriate use** This indicator can be used on national scale.
Potential for aggregation The indicator is also very useful for other initiatives/processes that aim for implementation of (Urban Waste Water Treatment Directive (WWTD) and River Basin Management Plans (RBMPs) and SDG 6 indicators. The indicator is easy to monitor because present the annual trends of quality and quantity of waste-water after treatment, what is measure by each waste water treatment plants
Meaning of upward or downward trends („good or bad") Data aggregation is consistent with the degree of treatment of wastewater from the public sewerage

network, also p.e. connected to Urban waste water treatment plants (UWWTPs) and trend of BOD5 by national basins.

Possible reasons for upward or downward trends:

Data collected from 2001-2018 show an upward trend and a positive trend of the population connected with wastewater treatment systems. This is especially evident in the period from 2008-2018 when the % of treatment plants with secondary-biological treatment increased by three times. The biggest trend is observed in 2017 and 2018 when WWTPs were constructed for larger agglomerations (Gevgelija, Prilep, Kocani, Radovis, Strumica and Kicevo)

This indicates that this positive trend will continue in the future how to meet the legal requirements for full implementation of EU UWWTD.

Implications for biodiversity management of change in the indicator:

A positive change in the indicator's trend will have a positive implication on biodiversity. This means that in the future we can expect an improved biological status and diversity, as establishing appropriate waste water treatment systems what will directly affect to the quality of recipients - rivers where wastewater are discharge.

Units in which it is expressed:

Percentages of population related to primary, secondary and tertiary wastewater treatment. Consumption of BOD 5 annually by river basin and population connected to sewage network by region

Description of source data:

The data are collated from State Statistical Office, ADKOM, PUCs and date base from state institutions responsible for developing water infrastructure projects. The problem is that these data are not yet managed in one place.

Calculation procedure:

Indicator calculation methodology in accordance with EUROSTAT and requirements and UWWTD

Most effective forms of presentation:

Limits to userfelness and accuracy:

The rate of changes will be expect to be happen, according to many infrastructure projects for construction of UWWTP on biggest agglomeration is the country. As already noted, the problem is that these data are not yet managed in one place.

Updating the indicator:

Every 2 years

Closely related indicators

Percentage of water bodies by ecological status/potential classification in a river basin

Additional information and comments

The information on improvement of the urban waste water collection, drainage and treatment system can be found in different documents:

Water law http://www.moepp.gov.mk/?page_id=16565&lang=en

National Water Strategy http://www.moepp.gov.mk/wp-content/uploads/2014/12/MACEDONIAN-WATER-STRATEGY-FINAL-DRAFT-VERSION_10092011_EN.pdf

Development of Water Study, EuropeAid/136505/IH/SER/MK. http://ws.vodamk.mk/

River Basin Management Plans http://www.moepp.gov.mk/?page_id=3967&lang=en

Financial aspects of institutional strengthening of the water sector in N.Macedonia - SDC &Point pro

8.7.3.2. Assessment of the indicator

The Republic of North Macedonia has consistently implemented the requirements of the EU UWWT Directive. Accordingly, the introduction of this indicator will contribute to monitoring the degree of its implementation on national level and will support the decision makers to create appropriate policy and programs.

In accordance with the Urban Wastewater Treatment Directive, EU Member States in all agglomerations larger than 2000 equivalent inhabitants are required to ensure that they are connected to a collection system. Secondary treatment - biological treatment must be provided for all agglomerations in excess of 2000 equivalent population that discharge wastewater directly into the fresh water recipient

Special requirements with different terms, ie fulfillment times depending on the susceptibility of the recipient waters, have been set for agglomerations with more than 10 000 equivalent inhabitants. The treatment performance is monitored in relation to 5 different determinants: BOD, COD, total suspended solids, total nitrate and total phosphorus. For smaller agglomerations and for those provided or connected to the collecting system, the effluent treatment of the outlet must be in accordance with the recipient's quality objectives.

The Law on Environment transposes the IPPC Industrial Pollution Prevention and Control Directive (96/61 /EEC) which aims to control and prevent industrial water pollution.

The Law on Waters prescribes an integrated approach, stipulating the conditions and ways of use and use of waters and their allocation, protection against harmful effects of waters, as well as standards and values of water quality and pollution control, taking into account the integration of measures and water protection activities in all development, strategic planning and program documents.

According to the results obtained for the distribution of the percentage of population in the treated communal waters only by mechanical treatment, biological treatment and the latest treatment technology and in terms of public sanitation it was found that the percentage of such population is very small. Although there is a growing trend, this situation with regard to EU requirements is unsatisfactory.

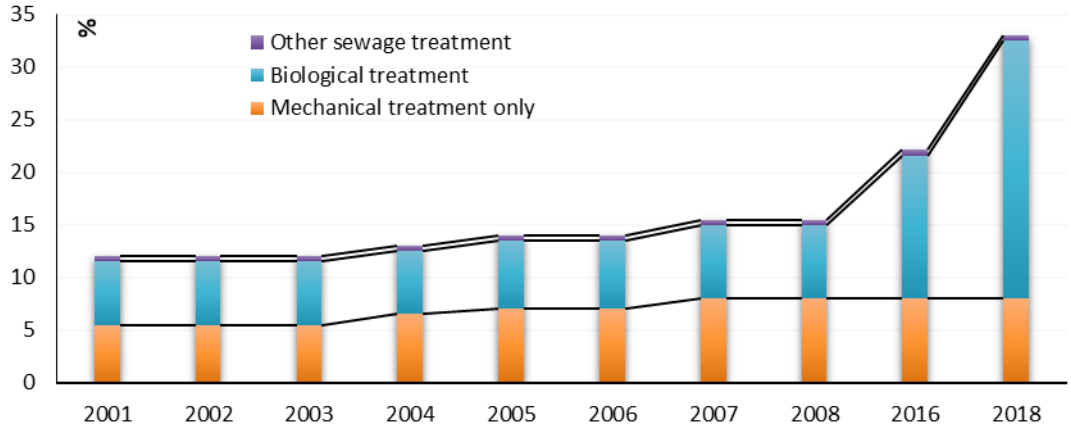


Figure 37 Percentage (%) of population connected with treatment

According to the results of the distribution of the population of the Republic of N. Macedonia to the treated communal waters only by mechanical treatment, biological treatment and latest treatment technology, present that: the percentage of the population treated with communal waters with

biological treatment is still not satisfactory. Therefore, the introduction of regular wastewater treatment in the country is the highest political priority at local and national level.

In the Republic of North Macedonia there has been no decrease in BOD 5 and ammonia concentrations in rivers in the past period. Some monitoring stations located on the rivers Crna Reka and Vardar have eutrophic status of waters with high levels of BOD. These results may reflect the state of inefficient treatment of urban and industrial wastewater in the country, as well as inadequate protection of river basins.

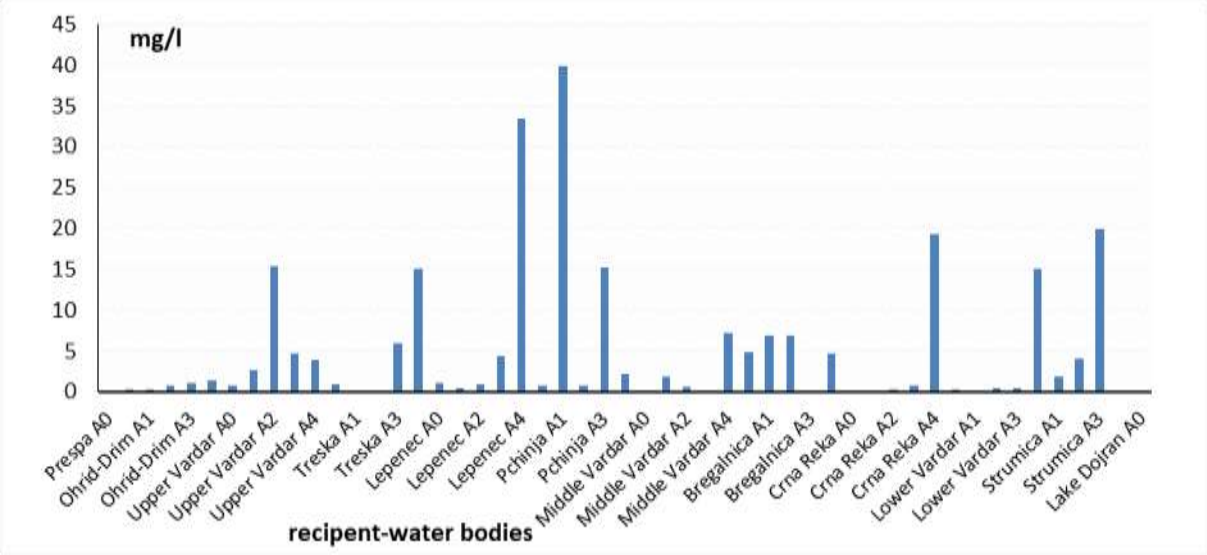


Figure 38 Calculated annual BOD by sub basin

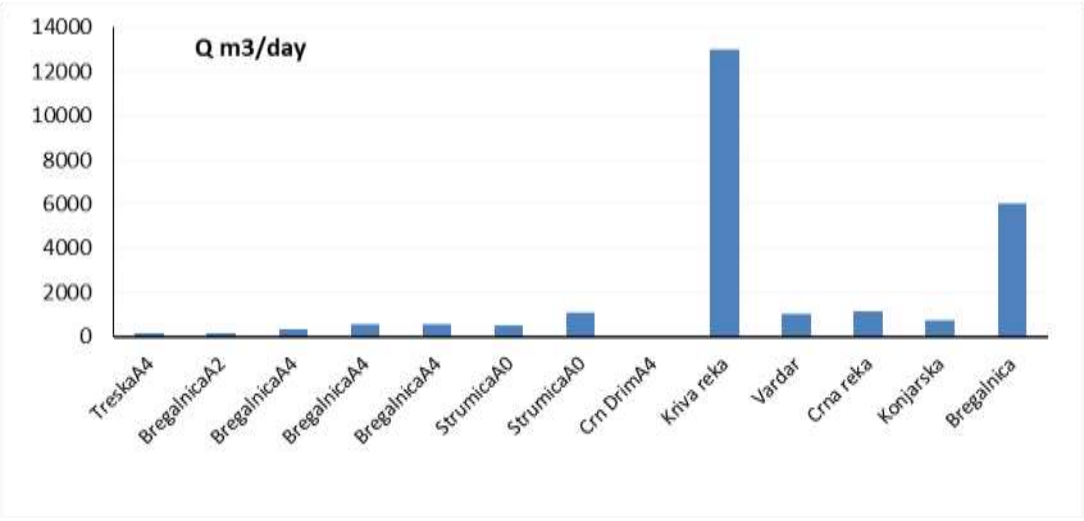


Figure 39 Quantity of disharge water from water permits for 2018

8.7.4. Indicator: Percentage of water bodies by ecological status/potential classification in a river basin

8.7.4.1. Fact sheet

Author: *National Hydrometeorological service*

Indicator Name: Percentage of water bodies by ecological status/potential classification in a river basin

Lead Agency: Ministry of environment and physical planning / Hydrometeorological service

Use and interpretation:

Key question(s) which indicator helps to answer

This indicator shows the ecological status of river bodies.

Use of indicator

The indicator can be used to show the ecological status of river bodies based on the methodology prescribed by the Water Framework Directive.

Scale of appropriate use

National scale, all river bodies

Potential for aggregation

Meaning of upward or downward trends („good or bad")

Classification of the ecological status/potential (high, good, moderate, poor and bad)

Ecological status classification	Colour code	
High	Blue	
Good	Green	
Moderate	Yellow	
Poor	Orange	
Bad	Red	

Ecological potential classification	Colourcode		
	Artificial Water Bodies	Heavily Modified	Colour
Good and above	Equal green and light grey stripes	Equal green and dark grey stripes	
Moderate	Equal yellow and light grey stripes	Equal yellow and dark grey stripes	
Poor	Equal orange and light grey stripes	Equal orange and dark grey stripe	
Bad	Equal red and light grey stripes	Equal red and dark grey stripes	

Possible reasons for upward or downward trends:

Certain nutrients are important for aquatic ecosystem health, but can become pollutants at elevated levels. Phosphorus, for example, is a crucial nutrient for growth of plants and algae and a key regulator of the overall productivity of inland aquatic ecosystems and coastal watersheds, but elevated levels can be harmful to the health of freshwater ecosystems, negatively impacting fish and other wildlife, drinking water quality, swimming safety and the visual appearance of lakes. Lakes and rivers that are phosphorus enriched often have excessive growth of aquatic plants and algae, leading to low-oxygen conditions when thi sgrowth decays. This can occur when artificial or natural substances, such as nitrates and phosphates are added to an aquatic ecosystem from sources such as detergents and fertilizers.

Implications for biodiversity management of change in the indicator:

Units in which it is expressed:

Percentage of water bodies with high, good, moderate, poor and bad ecological status/potential.

Description of source data:

The data from National Monitoring Program will be used, the data from Management Plan for river basin Strumica, MP for Prespa Lake, MP for Bregalnica, MP for Ohrid Lake, Draft MP for Vardar.

Calculation procedure:

For surface water categories, the ecological status classification for the body of water shall be represented by the lower of the values for the biological and physico-chemical monitoring results for the relevant quality elements.

Most effective forms of presentation:

MoEPP will provide a map for each river basin district illustrating the classification of the ecological status/potential for each body of water, colour-coded to reflect the ecological status classification of the body of water.

Limits to userfelness and accuracy:

Depending on the duration and frequency of surveillance monitoring, the accuracy of the data also depends.

Updating the indicator:

The indicator should be followed in 6-years periods because a river basin management plan is developed for each river basin for a period of six years.

Closely related indicators

Additional information and comments

The information on ecological status/potential and other values can be found in different documents:

- Watershed Management plan for Prespa Lake, MOEPP and UMDP, www.undp.org.mk
- Watershed Management plan for Ohrid Lake, GWP med, www.drincorda.org
- Bregalnica River Basin Management Plan, MOEPP, North Macedonia and State Secretariat for Economic Affairs, Switzerland, www.moepp.gov.mk
- Initial Characterisation of Lakes Prespa, Ohrid and Shkodra/Skadar, bublishd by GIZ, www.giz.de
- Annual for Water Quality 2018, Hydrometeorological Service, www.uhmr.gov.mk
- Twinning Reference Number: MK 13 IPA EN 01 16 Publication reference: EuropeAid/ 138-144/DH/ACT/MK Project "*Strengthening the capacities for effective implementation of the acquis in the field of water quality*", www.moepp.gov.mk
- GEF Project "*Enabling transboundary cooperation and integrated water resources management in the*

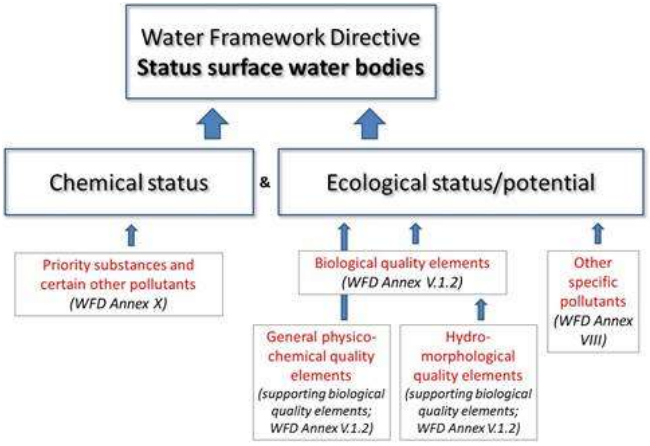
extended Drin River Basin", www.drincorda.org

- UNDP on behalf of project 00096178 "*Restoration of the Strumica River Basin*", Monitoring of water quality and water quantity in the river basin Strumica, www.uhmr.gov.mk
- IPA EuropeAid/132108/D/SER/MK Project "*Technical Assistance for Strengthening the Institutional Capacity for Approximation and Implementation of Environmental Legislation in the Area of Water Management*", www.moepp.gov.mk

8.7.4.2. Assessment of the indicator

North Macedonia is country with four river basins (river basin of river Vardar, Strumica, Black Drim and South Morava) according to the Law on waters. A river basin management plan is developed for each river basin for a period of six years. The river basin management plan contains along with other elements and information and mapping of the registered protection zones.

The purpose of the WFD (Water Framework Directive) is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems. Pursuant to Article 6 of the WFD, the State undertakes to establish a register or registers of all areas lying within each of the riverbasin districts designated as areas requiring special protection, with specific national legal acts, for the protection of their surface and groundwater or for the conservation of habitats and species directly dependent on water.



Water body	ID	Algae	IBMWP	Fish	QBR	IHF	Biological Status	Ph-Ch Status	Ecological Status	Chemical Status	WB Status
Rivers											
Bregalnica01	SR_01	M	G	H	G	M	M	P	P	Gc	Fgs
Bregalnica02	SR_02	P	P	G	M	M	P	B	B	F	Fgs
Bregalnica03	SR_03	P	M	G	M	M	P	B	B	F	Fgs
Bregalnica04	SR_04	P	P	G	P	P	P	B	B	F	Fgs
Bregalnica05	SR_05	P	P	G	M	M	P	B	B	F	Fgs
Bregalnica06	SR_06	P	P	G	B	M	B	B	B	F	Fgs
Bregalnica07	SR_07	P	P	G	P	P	P	B	B	Gc	Fgs
Bregalnica08	SR_08	P	M	G	P	M	P	B	B	F	Fgs
Bregalnica09	SR_09	P	P	G	P	M	P	B	B	F	Fgs
Bregalnica10	SR_10	P	M	G	G	M	P	B	B	F	Fgs
Ratevska 01	SR_11	M	H	B	G	M	B	P	B	Gc	Fgs
Ratevska 02	SR_12	P	M	G	M	M	P	B	B	Gc	Fgs
Zelevica	SR_13	P	M	G	P	M	P	M	P	F	Fgs
Kamenica	SR_14	P	P	B	M	M	B	B	B	F	Fgs
Osijnica	SR_15_01	M	H	G	M	M	M	P	P	Gc	Fgs
Osijnica	SR_15	P	P	G	B	B	B	P	B	F	Fgs
Znovska	SR_16_02	P	B	B	B	P	B	B	B	F	Fgs
Orizarska	SR_17_02	P	P	G	P	P	P	B	B	F	Fgs
Kocanska 01	SR_18	P	H	G	G	M	P	P	P	F	Fgs
Kocanska 02	SR_19	P	B	M	P	P	B	B	B	F	Fgs
Zletovska	SR_20	P	P	G	P	M	P	B	B	Gc	Fgs
Kozjacka	SR_21	N/A	B	B	P	P	B	P	P	F	Fgs
Otinja	SR_22	P	P	B	M	B	P	B	B	F	Fgs
Kriva Lakavica01	SR_23_02	P	M	B	G	M	B	M	B	F	Fgs
Kriva Lakavica02	SR_24_01	B	B	B	P	P	B	B	B	F	Fgs
Madenska	SR_24_02	B	B	B	M	M	B	B	B	F	Fgs
Svetinikolska 01	SR_25_02	B	B	B	P	M	B	B	B	F	Fgs
Nemanjica	SR_26	P	P	B	B	P	P	B	B	F	Fgs

Figure 40 Final assessment of water quality status for river (lotic) water bodies in River Basin Bregalnica

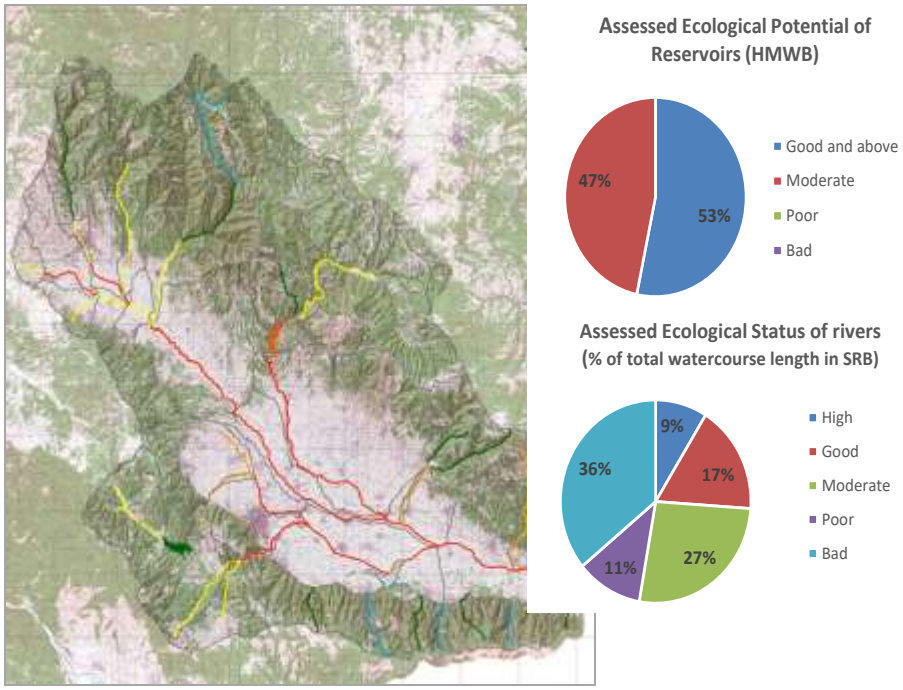


Figure 41 Surface water body status River Basin Strumica

8.8. National target 7: Develop and implement plans for sustainable production and sustainable consumption for the purpose of natural resources use within safe ecological limits

8.8.1. Indicator: Trends in sustainable collection of commercial wild plants and fungi (according to licenses issued)

8.8.1.1. Fact sheet

Author: *Ministry of environment and physical planning*

Indicator Name: Trends in sustainable collection of commercial wild plants and fungi (according to licenses issued)
Lead Agency: Ministry of environment and physical planning (MOEPP)
Use and interpretation: **Key question(s) which indicator helps to answer** Due to the rich biodiversity, many wild plant species (medicinal and aromatic plants) and fungi are growing in the country. Hence, the need to collect them from the natural ecosystems is a tradition which has been kept and practiced, and also is of great importance to the local population as additional income source. In the last 20 years, as a result of the economic situation of the country, the collection of wild plant species and fungi plays an important role in the existence of many families, especially in the mountainous and rural regions. **Use of indicator** This indicator is important because through it, we may identify the wild plant species and fungi collection trend. **Scale of appropriate use** This indicator is used on a national level to determine the quantities of collected wild plants and fungi species.
Potential for aggregation: This indicator is complex and includes the following of parameters which determine the trend of collected wild plants and their parts (root, leaf, flower) and fungi.
Meaning of upward or downward trends („good or bad") The collection of wild plant species and fungi has a negative trend because it is done in an unplanned manner as there are no quotas for different plant types and fungi which could be collected. Allthou their biomass production is very much related to the specific climate conditions each year. The lack of a system for sustainable use of the plant resources is a threat to biodiversity. The lack of a functional system of control and monitoring has a negative impact on the resources gathered from nature and is the cause of the appearance of some deviant acts (fires, illegal forest activities and inappropriate collection of plant species, as well as the lack of terrain control) are a serious threat to the biodiversity.
Possible reasons for upward or downward trends:

The lack of data about the biomass of the wild plants and fungi in their natural habitats in our country, as well as the quantity of collected, processed and sold/exported self-seeding plants and fungi, complicates and limits the analysis of this sector. The dynamic way of life, as well as a lot of international trends, causes the institutions responsible for the management of these resources to face great challenges, because the sustainable management and preservation of the ecosystems is in the shared interest of all, both the subjects which manage the natural resources and the local population.

In order to determine the degree of sustainable use of the species, it is required to complete the lack of information regarding their quantities. This assessment will provide information about the availability of resources in the country and, through planning activities, that information may significantly improve the rural economy. Introducing quotas (i.e. the maximum quantity of a specific species which could be collected in a certain period and area) is not applicable for all species. The quotas are tightly connected to the sustainability of the species. If the collection impacts the sustainability and stability of certain species, the quotas could be limiting. It is recommended that during the first step of defining the quotas, an assessment of the natural resources with commercial interest to be made and according to this, to define the quotas for collection of wild plant species and fungi or their parts. Furthermore, a functional monitoring of the complete system of the use of endangered and protected wild plant species and fungi should be established: collection, trading-purchasing, processing and export of species. It is also required that the information about collected and exported quantities of wild plant species and fungi to be compared with the feedback information from the Customs service regarding the actual exported quantity and the collection licenses issued.

Our country possesses good conditions for plantation style cultivation of many plant species which traditionally have been collected in nature; this is encouraging rural development, increasing the export quantities of endangered and protected wild plant species and fungi, and will alleviate the pressure on the populations in nature and above all, increase their protection and survival.

Implications for biodiversity management of change in the indicator:

By law, the control of collection and export of endangered and protected wild plant species and fungi falls under the Law on Nature Protection. The control of the collectors about their license, whether they are collecting using the appropriate gear and in an appropriate manner in accordance to the Law on Nature Protection is done by the State Environmental Inspectorate. The collection of wild plants and fungi in protected areas is being followed and being regulated by the subjects authorized to manage the protected areas. For example, in the national parks, the collection of wild plants and fungi is regulated by the public enterprises NP Pelister, NP Galicica and NP Mavrovo.

Outside of the protected areas, the collection of wild plants and fungi is regulated by the PE “Nationalni Sumi”, whereas the control falls under the authority of the State Forestry and Hunting Inspectorate.

Strengthening of the communication with the local population is required, as well as raising public awareness regarding inappropriate collection and the appearance of forest fires.

Units in which it is expressed:

The unit in which the collected or exported quantities of wild plant species and fungi are expressed is a kilogram of fresh/dry mass.

Description of source data:

Yearly reports for the collected plants and fungi prepared by the MOEPP, yearly reports for CITES also prepared by the MOEPP, Reports from the State Statistical Office, studies about valorization/revalorization of the protected areas, plans for management of protected areas, studies about assessment of the population and quantities of commercial wild plants and fungi, etc.

Calculation procedure:

An overview of relevant documentation about the quantities of collected and exported wild plant species,

fungi and their parts according to the delivered yearly reports from the companies requiring licenses for collection and export, which are obligated by law to deliver reports to the MoEPP each year.

The same procedure is used with the CITES licenses/certificates about trade with endangered species of wild flora and fauna. The MOEPP prepares yearly reports which are delivered to the CITES Secretariat each year.

Most effective forms of presentation:

The best way to present the indicator trend data is through a narrative description, charts and graphs.

Limits to usefulness and accuracy:

At the moment, accurate information about the quantities of wild plant species and fungi which are most often used and traded at the domestic market or traded abroad is unavailable on a national level. The goal of nature preservation, and thus preservation of the plant resources is very difficult to achieve due to the lack of appropriate data. The need to define the conservation status of the species at a national level is ever more growing in the country, also followed by assessments and quantities. The monitoring and the assessment of habitats, the status of the populations and the assessment of the resources at the sites for commercial use should be done in parallel, depending on the species and their distribution.

In order to meet the increased demand for plant species and fungi in the national and international markets, the need to control the manner of plant collection is increasing.

Updating the indicator:

The indicator should be monitored on a yearly level, but the results should be compared every two or three years, in order to note the trend of wild plant species collection, i.e. to check if it is an upward or a downward trend.

Closely related indicators

Trends in number of key species and habitats which are being monitored in the protected areas and ecological networks,

The population trend of key conservation species,

Forestry and hunting plans with measures for biodiversity protection,

Trends about the use of pastures – case studies,

Collaborative projects for monitoring and research,

Trends about the use of biodiversity in traditional medicine,

Establishment of ecosystem services and preparation of studies for payment of ecosystem services,

Strengthening capacities,

Activities for raising public awareness about biodiversity protection.

Additional information and comments

A balance should be achieved between protection, preservation and sustainable use of biodiversity and encouragement of the local economy.

A good inter-institutional collaboration and coordination is of crucial importance.

The policies and laws for the protection of nature and forestry should be harmonized.

8.8.1.2. Assessment of the indicator

The collection and trade of endangered and protected wild plant species, fungi, animals and their parts is prescribed in the Law on Nature Protection ("Official Gazette of RNM" no. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 и 63/16).

The main aim of the Law on Nature Protection is to regulate the protection of biodiversity by establishing a system of measures and activities for protection of wild species, their habitats, the ecosystems and to secure their sustainable use.

The National biodiversity strategy and action plan for the period (2018-2023) includes measures and activities for:

- Determination of quotas for collection of wild plant species with commercial interest and their parts.
- Determination of areas where the collection of endangered wild species should be avoided,
- Harmonization and completion of the wild species collector licensing system,
- Assessment of the status and determination of measures for (commercial) species protection from Annex V of the EU Habitats Directive,
- Encourage research and documentation of best practices for traditional use of biodiversity.

The measures and actions are also part of the National Strategy for Nature 2017-2027.

In accordance with the Law on Nature Protection, the MOEPP issues licenses for collection, import and export of endangered and protected wild plant species and fungi and their parts.

Regarding the import-export, reexport in accordance with the Law on Nature Protection, the MOEPP issues a D4 license and a CITES license / trade certificate.

The Ministry of Environment and Physical Planning in accordance with the Rulebook for issuing licenses for collection of endangered and protected wild plant species, fungi and their parts ("Official Gazette" no. 102/09), has the authority to issue licenses for collection.

The lack of data about endangered and protected wild plant species and fungi creates a major problem with the analysis in our country.

The collection of endangered and protected wild plant species and fungi data is updated at the MoEPP, being original data from yearly reports and CITES reports.

The quantities of collected and exported self-seeding wild plants (expressed in kilograms) according to issued licenses for collection and export from the MOEPP for 2016, 2017 and 2018 are presented in the following tables.

Table 22 Quantities of collected and exported self-seeding wild plants (expressed in kilograms) in 2016

Berries of Common juniper (*Juniperus communis*)	598 415 kg	440 411 kg
Common bearberry (*Arctostaphylos uva-ursi*)	124 331 kg	120 014 kg
Mountain tea (*Sideritis scardica*)	6 243 kg	4 886 kg
St. John's wort (*Hypericum perforatum*	25 209 kg	20 486 kg
White mallow (*Althaea officinalis)*	5 460 kg	5 302 kg
Common Dandelion (*Taraxacum officinale)*	5 295 kg	3 660 kg
Hairy rupturewort (*Herniaria hirsuta*)	1 326 kg	1 326 kg
Nettle	10 050 kg	5 887 kg

(*Urtica dioica*)

Table 23 Quantities of collected and exported self-seeding wild plants (expressed in kilograms) in 2017

Berries of Common juniper (*Juniperus communis*)	562 308 kg	458 397 kg
Common bearberry (*Arctostaphylos uva-ursi*)	94 412 kg	94 412 kg
Elder, elderberry (*Sambucus nigra*)	8 075 kg	9 848 kg
Mountain tea (*Sideritis scardica*)	5 921 kg	5 023 kg
St. John's wort (*Hypericum perforatum*)	16 825 kg	16 000 kg
Common Dandelion (*Taraxacum officinale*)	5 859 kg	5 247 kg
Nettle (*Urtica dioica*)	9 188 kg	8 999 kg

Table 24 Quantities of collected and exported self-seeding wild plants (expressed in kilograms) in 2018

Berries of Common juniper (*Juniperus communis*)	511 260 kg	511 260 kg
Common bearberry (*Arctostaphylos uva-ursi*)	106 001 kg	98 578 kg
Elder, elderberry (*Sambucus nigra*)	1 565 kg	1 500 kg
Mountain tea (*Sideritis scardica*)	5 003 kg	5 003 kg
St. John's wort (*Hypericum perforatum*)	11 175 kg	9 959 kg
Common Dandelion (*Taraxacum officinale*)	7 246 kg	7 240 kg
Nettle (*Urtica dioica*)	11 515 kg	11 127 kg

The tables show that the greatest collected and exported quantities of plant resources are the berries of Common juniper *(Juniperus communis*) and Common bearberry *(Arctostaphylos uva-ursi)*.

From fungi according to licenses issued by the MOEPP in 2016, 2017 and 2018, mostly collected were: Common bolete (*Boletus edulis*), Chanterelle (*Cantharellus cibarius*), Red pine mushroom (*Lactarius deliciosus*), Black trumpet (*Cratarellus cornucopioides*), Caesar's mushroom (*Amanita caesarea*), St. George's mushroom (*Calocybe gambosa*), Hedgehog mushroom (*Hydnum repandum*), Fairy ring mushroom (*Marasmius oraedes*) etc. The collection trend for fungi for the period 2016, 2017 и 2018 is presented in the following Table.

Table 25 Collection trend for fungi for the period 2016, 2017 и 2018

Common bolete (*Boletus edulis*)	841 298 kg	327 196 kg	515 560 kg
Red pine mushroom (*Lactarius deliciosus*)	215 548 kg	114 877 kg	129 028 kg
Morels	3565 kg	9751 kg	15 852 kg
Fairy ring mushroom (*Marasmius oraedes*)	6326 kg	1742 kg	4954 kg
Chanterelle (*Cantharellus cibarius*)	229 837 kg	207 302 kg	107 255 kg
St. George's mushroom (*Calocybe gambosa*)	8497 kg	6554 kg	30 679 kg
Caesar's mushroom (*Amanita caesarea*)	22 081 kg	2091 kg	30 679 kg
Black trumpet (*Cratarellus cornucopioides*)	46 441 kg	1950 kg	3815 kg
Hedgehog mushroom (*Hydnum repandum*)	21 725 kg	/	2489 kg

8.8.2. Indicator: Timber harvested by species in the forest, by years

8.8.2.1. Fact sheet

Authors: *Nikolcho Velkovski (Faculty of Forest Sciences, Landscape Architecture and Environmental Engineering, Ss. Cyril and Methodius University)*

Indicator Name: Timber harvested by species in the forest, by years
Lead Agency: Ministry of Agriculture, Forestry and Water Economy
Use and interpretation: **Key question(s) which indicator helps to answer** The Republic of North Macedonia is a countrywith long tradition in forest management. In the past, as well as today significant amounts of total gross tree volume are cut from the forests. The largest quantities of total gross tree volume are cut from beech and oak, which on the territory of N. Macedonia occupy the largest areas but also produce the largest amounts of total gross tree volume. **Use of indicator** This indicator should be used to assess the trend of total forest use, as well as to assess different species. **Scale of appropriate use** This indicator can be used on national scale.
Potential for aggregation: This indicator contains a large dataset concerning the annual felling of separate forest species. On the other hand, this indicator may be considered as part of the group of indicators showing the total amount of total gross tree volume cut in the North Macedonia forests.
Meaning of upward or downward trends („good or bad") The Increase or the decrease in gross total gross tree volume cut of different species and in total will show the increase or decrease of pressure on thecurrent state of the biodiversity.
Possible reasons for upward or downward trends: The enlarged fellingsof the total gross tree volume in the forests will show that the pressure on the biological diversity has increased. In the moment, despite the annual and the 10 years plan of cutting the total gross tree volume in the forest, it can be noticed difference in the quantity of the cut total gross tree volume. This unstable variations of the annual total gross tree volume cut are expected to continue in the forest.
Implications for biodiversity management of change in the indicator:

Changes in the trend of the indicator should be carefully analyzed. The intensified logging of the total gross tree volume in the coming years may also indicate an increase in pressure on biodiversity.
Units in which it is expressed: The change should be expressed inquantity of gross total gross tree volume in cubic meters per year.
Description of source data: The only reliable source of such data, which unites the data of all of the institutions in the country is the State Statistics Office of Republic of North Macedonia and it should be used as an important source of data.
Calculation procedure: Review of the published data by the State Statistics Office of Republic of North Macedonia.
Most effective forms of presentation: The best way to present the trends is to present by lines trends. This indicator is best to be presented in 5-year intervals with data from every species and and annual data in total and per each year separately.
Limits to usefulness and accuracy: The analysis of the datafor the cut of the gross total gross tree volume by quantities and species is limited, due to the lack of other institutions which will process and own the data.
Updating the indicator: The indicator should be followed annually, but the results should be compared in 5-years periods.
Closely related indicators - Capacity building - Number of professionals - Number of institutions
Additional information and comments The State Statistics Office of Republic of North Macedonia is the only national institution that processes the data on the annual total gross tree volume. The data is collected from all forest management entities. However, the data needs to be further elaborated in order to obtain more information especially on the forests types and the cut species.

8.8.2.2. Assessment of the indicator

According to data from the State Statistics Office of the Republic of North Macedonia in the period of 5 years from 2014-2018 the tree volume cut between 655 000 m³ in 2014 and 890 000 m³ in 2016 or in total of 4 003 000 m³ gross timber cut in 5 years. Most of the cuttings are about 91% of broadleaved tree species and the remaining 9% of coniferous species. From the broadleaved species, the biggest amount of harvested tree volume from beech forests was 1 687 000 m³ and 1 491 000 m³ in oak forests for a period of 5 years. The largest amount of tree volume from coniferous species (pine) is 219 000 m³ for a period of 5 years.

Figure 42 Timber harvested by species (in '000 m³)

Year	Total gross volume	Deciduous					Coniferous			
		total	oak	beech	other hard wood	other soft wood	total	fir and spuca	pine	other
2014	655	588	216	311	51	10	67	8	38	21
2015	849	762	341	324	52	45	87	6	55	26
2016	890	810	336	380	46	48	80	6	47	27

2017	807	746	310	352	41	43	61	6	36	19
2018	802	728	288	320	97	23	74	7	43	24

It should be noted that these data refers to cuttings that are in accordance with the planning documents which are prepared and implemented in the country. Unfortunately, there are still illegal logging activities in the country, for which there is no data about the quantities and the species.

In the future, the focus shoud be on recording of the timber volume cut illegal logging, as well as to apply appropriate measures to suppress the illegal logging, which significantly affects the loss of biodiversity.

Table 26 Gross felled timber by tree species in forest in national level, by year

Total gross volume	807 000	848 192	764 968	747 880
Pure tree stands	742 371	793 716	714 284	673 250
Broad-leaved	679 283	735 007	670 577	622 941
Beech	324 494	380 426	352 279	320 428
Oaks (all)	340 763	335 904	309 769	288 153
Other hard	6 239	10 388	6 515	11 307
Poplar	1 457	1 118	456	643
Other soft	6 330	7 171	1 558	2 410
Conifers	63 088	58 709	43 707	50 309
Spruce	73	51	-	48
Fir	6 154	5 607	6 025	6 459
Black pine	42 489	34 094	25 514	31 366
Scots pine	12 860	13 172	9 995	12 436
Other	1 512	5 785	2 173	-
Mixed tree stands	64 629	54 476	50 684	74 630
Broad-leaved species	41 312	33 082	33 931	53 319
Conifers species	23 317	21 394	16 753	21 311
Broad-leaved and conifers spec.	-	-	-	-

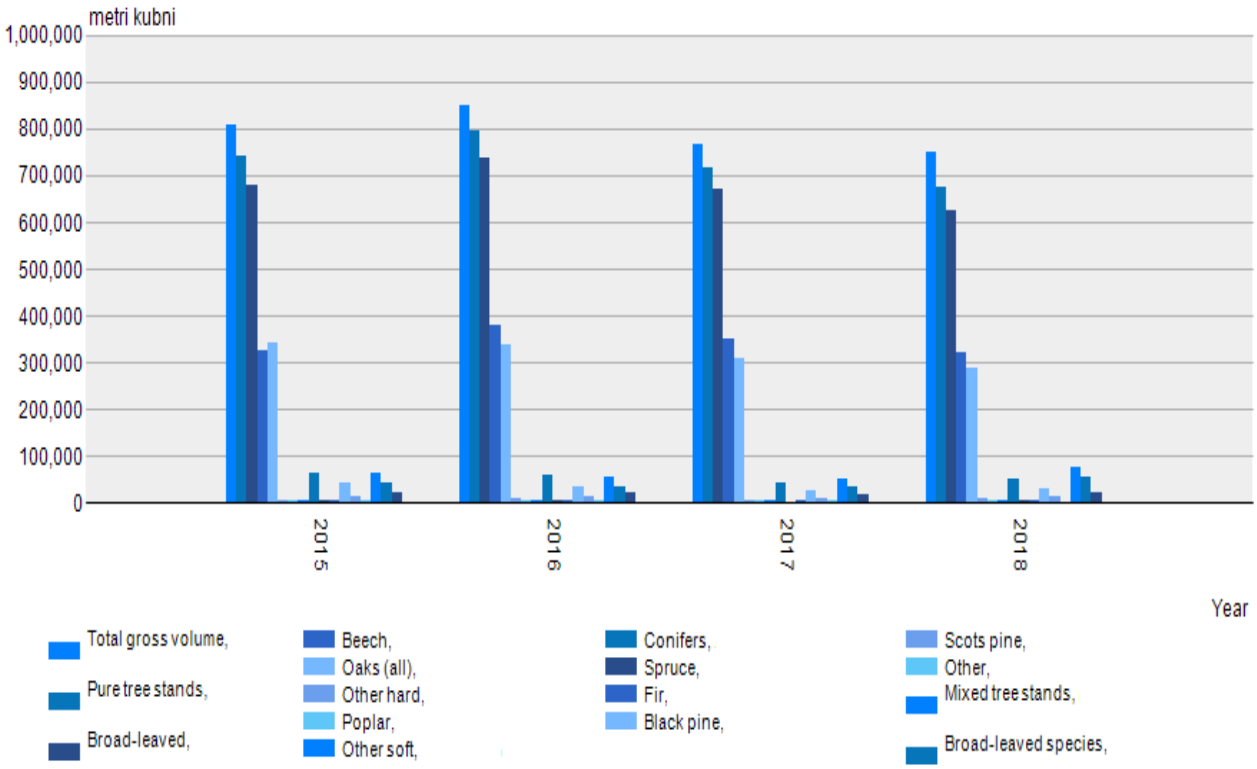


Figure 43 Gross felled timber, 2015-2018

Table 27 Gross felled timber, by species and ownership, by year

	Total	Broad-leaved	Coniferous	Total	Broad-leaved	Coniferous	Total	Broad-leaved	Coniferous	Total	Broad-leaved	Coniferous
State forests	618239	540146	78093	655208	585738	69470	579837	530815	49022	588816	530568	58248
Private forests	231095	221865	9230	234874	223892	10982	227604	215381	12223	213126	197648	15478
Total	849334	762011	87323	890082	809630	80452	807441	746196	61245	801942	728216	73726

Table 28 Gross felled timber, by assortments and ownership, by year

	Industrial wood	Fuel wood	Residue	Industrial wood	Fuel wood	Residue	Industrial wood	Fuel wood	Coniferous	Industrial wood	Fuel wood	Residue
State forests	112877	470415	34947	114323	505395	35490	96626	446317	36894	102 531	452 439	33 846
Private forests	13384	212671	5040	18365	207674	8835	23729	197607	6268	18 842	186 740	7 544
Total	126261	683086	39987	132688	713069	44325	120355	643924	43161	121 373	639 179	41 390

8.9. **National target 8:** Develop and establish appropriate policy for recording, control and protection of non-native and invasive species

8.9.1. Introduced fish species (alien/allochtone/non-native/non-indigenous, translocated fish) from the Republic of North Macedonia

8.9.1.1. Fact sheet

Authors: *Milica Ristovska and Julijana Arsovska*

Indicator Name: Introduced fish species (alien/allochtone/non-native/non-indigenous, translocated fish) from the Republic of North Macedonia
Lead Agency: Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje

Use and interpretation:

Key question(s) which indicator helps to answer

Although most evidence about the impacts of alien fish is circumstantial, some of the problems identified from introduced fish include significant alterations to freshwater ecosystems such are: (1) damage to biodiversity, causing significant declines in the diversity, range and abundance of freshwater fish within; (2) competition with native species, including threatened and vulnerable species; (3) decline of macroinvertebrates and gastropods; (4) degradation of aquatic habitats and water quality; (5) introduction of parasites; (6) negative impact on agricultural and aquaculture industries making economic impacts and social impacts .The ability of many introduced fish species to thrive in degraded aquatic habitats and their potential to impact on aquatic ecosystem structure and function suggest that introduced fish may represent both a symptom and a cause of decline in river health and the integrity of native aquatic communities. Successful adaptation of non-native fish species is considered to be highly successful and likely in anthropogenic disturbed environments. In that way they are good indicators for anthropogenic pressure.

Use of indicator

This indicator can be used to follow the vectors/pathway of their introduction, to review the distribution and current status of non-native fish species in North Macedonia as well as their ecological implication. This indicator is of paramount importance for designing and implementing appropriate control and mitigation actions.

Scale of appropriate use

Given the high rate of alien fish species introductions in the Balkans and the threat they represent to the local endemic fish fauna, including the fact that most major rivers and lakes are transboundary, this indicator can be used on national and international scale.

Potential for aggregation:

This indicator consists of parameters that show the vectors/pathways of introduction, distribution, establishment, and ecological implications of alien species in the waters of N. Macedonia, favoring as a good indicator that can be used to scan the anthropogenic pressure.

Meaning of upward or downward trends („good or bad“)

The increasing number of alien species and their dispersion, combined with increasing the density of their population is a “bad” trend that will have a negative impact on biodiversity.

Possible reasons for upward or downward trends:

The negative impact of alien fish species has led our country in developing legislation to regulate fish movements and introductions (Law of Fishery and Aquaculture (LFA) Official gazette 7/2008 data 15.01.2008). With this law started a period of greater control over the production, introduction and stocking of fishes in all water bodies.

Positive trends in dispersion of some alien fish species could be due to intensive research in particular water basins (e.g. natural lakes), compared to other waters.

The rapid dispersion of alien species in some particular parts of the country may be due to the significant number of reservoirs. Usually the interest (attractive fish ponds for recreational fishing) by sport fishermen is a reason for deliberate input of alien fish.

Upward or downward trends in population density of some species also could be due to the methodological procedure of fish sampling.

Implications for biodiversity management of change in the indicator:

Their response to various climate- and ecosystem-change scenarios makes alien fish as one of the most powerful threats to the biodiversity, and if the relevant structures fail to take timely action, there may be significant difficulties in managing national biodiversity. Threatened ecosystems that are infected with a large number of invasive species need to be prioritized for action plans on a national level, in order to reduce their pressure and save the natural structure of the system.

Units in which it is expressed:

The preferred units for this indicator are: (1) the number of introduced species per years; (2) pathway/vectors; (3) current distribution and prevalence of alien species in all waters defined here as a "fish ground/ponds" (described Fishing Master Plans /FMPs, for fishing grounds, accordance with the Law on Fisheries and Aquaculture); (4) Relative fish species composition based on number of individuals in the annual catches in the three natural lakes.

Description of source data:

The only reliable source of such data are published scientific articles; reports by specific project activities carried out by the relevant institutions: Institute of Animal Sciences in Skopje; Hydrobiological Institute in Ohrid; Faculty of Natural Sciences and Mathematics in Skopje; concessionaires' Annual reports about fish caught from the lakes. Some details for distribution of alien fish species in the waters of North Macedonia could be found in Fishing master plans (FMP). Fishing master plans (FMPs) are developed for fish management based on expert studies. They are in force for 6 years.

Calculation procedure:

Review of literature data dealing with alien species, followed by online databases especially from the work of scientific institutions in the country.

Most effective forms of presentation:

Different forms can be used: description, tables, graphic display, mapping, and their combined display.

Limits to usefulness and accuracy:

We should emphasize that the density of the populations of non-native species in the natural lakes detected in the last few years are calculated in different way: for Ohrid and Prespa lakes using MMG (according WFD), while in Dojran Lake based on the regular catchment represented in the Annual reports from the holders of concessions. The data processed in this way do not provide an equally relevant picture of the status of non-native species. The relevant picture of the distribution of non-native species and the status of their populations will be obtained only by monitoring all water bodies in the country that will be at least 3 to 5 years old, according to WFD with standard protocols. Bearing in mind that the establishment of protocols according to WFD is a long process and requires a considerable amount of funds, there is a reasonable doubt that in the coming years this approach cannot be applied.

Another way to track the situation is through annual reports provided by concessionaires themselves. These datas are still not yet transparent (they should be accessible on-line).

The lack of scientific interest in this issue is due to insufficient motivation, primarily because of the lack of national projects. Without relevant scientific knowledge it is not possible to constantly update data.

Updating the indicator:

Updating of the data will mostly depend on the results obtained from surveys carried out in the coming period and updated data from the relevant institutions (Ministry of agriculture, forestry and water economy). Updates of the indicator should be made annually, while for the monitoring of introduction, distribution and establishment five year period is preferred.

Closely related indicators

- Capacity building
- Number of professionals
- Number of published articles

Additional information and comments

Considering the weak monitoring efforts in our country, lack of filed data about the ecology of all alien fishes and knowing the fact that not always some taxon's deserved to have the status "introduced species" is a reason that makes this indicator complex. The list of alien fish species present here are based on scarce published data and archive data that exist in relevant institutions, but data about the ecology and real impact of alien fish species should be collected only through regular national monitoring programs.

http://www.dojran-info.com/media/studija-valorizacija-dojransko-ezero/Studija-za-valorizacija-na-Dojranskoto-Ezero-Septemvri-2018.pdf

https://www.researchgate.net/publication/225250963_Fish_and_fisheries_of_the_Prespa_lakes

https://www.researchgate.netFish_and_Fisheries_Lake_Ohrid

8.9.1.2. Assessment of the indicator

The indicator (alien fishes) was evaluated through the following parameters: (1) the number of introduced species per years; (2) pathway/vectors; (3) current distribution and prevalence of alien species in all waters defined here as a "fish ground/ponds" (described Fishing Master Plans /FMPs, for 32 fishing grounds, accordance with the Law on Fisheries and Aquaculture); (4) Relative fish species composition based on number of individuals in the annual catches in the three natural lakes.

So far, according to official literature data in waters of North Macedonia there are 20 introduced and 6 translocated species. The list of indigenous species is not conclusive because there are still debates as to whether some of them are indigenous or non-indigenous (e.g. *S. marmoratus*, *Rhodeus* sp. *C. carpio,*), whether some of them still exist in the waters of our country (e.g. *Alosa* sp. *P. pekinensis*), whether are translocated (*O. bureschii*), and whether were misidentification in the past (*I. punctatus*, *Carassius carassius vs, Carassius auratus, Gambusia affinis* vs. *Gambusia holbrooki, Ameiurus melas vs. Ameiurus nebulosus*).

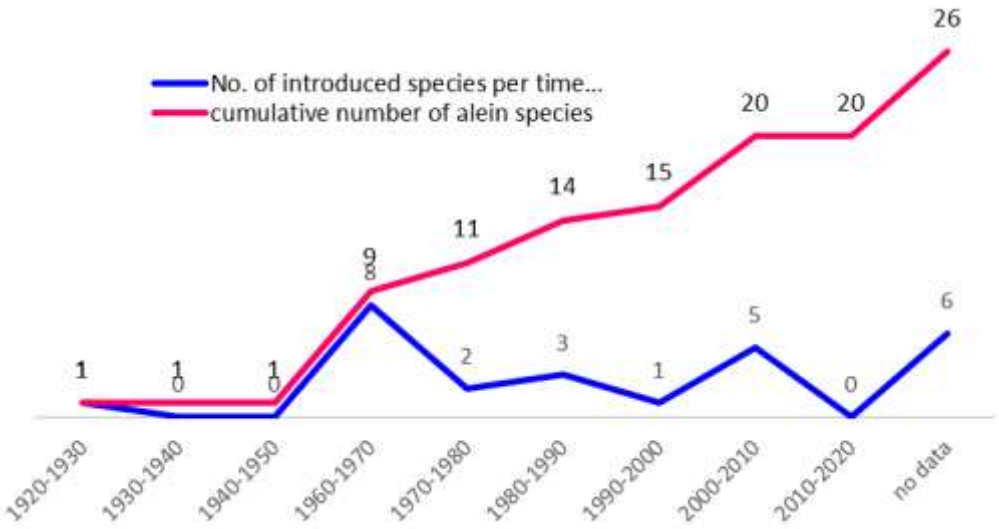


Figure 44 Trend of introduction of alien species in North Macedonia for time period of 100 years.

Introduction of fish species started hundred years ago (1924) with introduction of *G. affinis.* This fish was intentionally introduced for mosquito biological control purposes, after which the number of introduced species increases. The period between 60th and 70th, is when the country started aquaculture fish farming. In the above Figure are represented the suspected pathways of their introduction. Based on the graphic presentation it could be concluded that most of the alien fish (10 species) are introduced for aquaculture purpose. Most of these fishes were introduced to fishing farms located in the Crna River Basin and Vardar River Basin. The trend of introduction continued untill 2008 when started a period of control over the production, introduction and stocking of fishes regulated by the Law of Fishery and Aquaculture (LFA) (Official gazette 7/2008 data 15.01.2008). But despite the existence of this law as well as the existing Law on Protection of Lakes Ohrid, Prespa and Dojran (from 1977), the dispersal of introduced species, including translocated species, is clearly out of control.

It is well known that translocation represents the introduction of a species from one part of a political entity, where it is native, to another part of the same country, where it is not native and that may have notable impacts upon the indigenous populations in the receiving ecosystem. The list of translocated fish species from our country is not final, their negative impact has not be documented yet, except concerns regarding the translocation of native trout's in different water sheds and their effect on native endemic salmonids have been confirmed. The promotion of such introductions is supported by hydropower operators. All included parameters below confirm this.

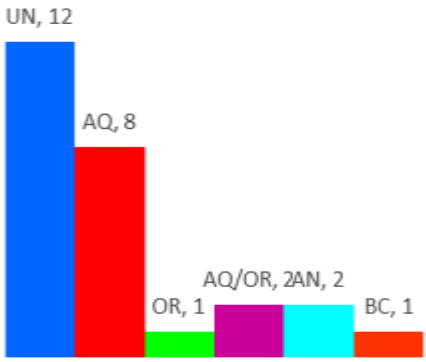


Figure 45 Number of alien species related to the suspected pathway/vector for introduction - unintentional (UN), aquaculture (AQ), ornamental (OR), angling (AN) and biological control (BC)

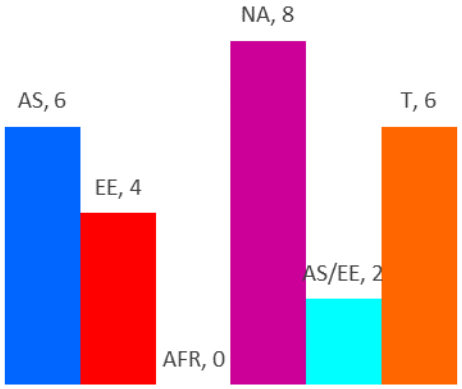


Figure 46 Number of alien species related to their continent of origin - Asian (AS), eastern European (EE), African (AFR), and North American (NA), including translocated (T) species originating from different water basins from North Macedonia.

Analysis of the distribution of alien species show that *O. mykiss, C. gibelio, L. gibosus* and *P. parva* are widespread fish, distributed in most of the "fish ponds/grounds" (defined by FMPs). Knowing the fact that rainbow trout production is one of the fastest growing farming sectors in the country, it is not surprising the presence of this fish in many open waters across the country. However the real impact of this fish has not been evaluated. Based on many studies it has been shown that *C. gibelio*, *L. gibosus*, *P. parva* have established self-sustaining populations in many water bodies including natural lakes. *A. melas* has moderate distribution establishing substantial populations primarily in reservoirs, causing quantitative changes in fish community structure (Tikvesh Resirvoir). *G. holbrooki* also have established self-sustaining populations in some water bodies but it seems that due to different hunting techniques during field surveys or commercial hunting, it is not always recorded in the catch.

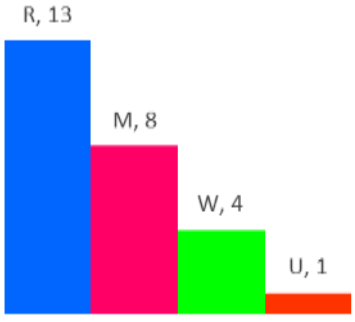


Figure 47 Number of alien species with restricted (R), moderate (M), widespread (W) and unknown (U) prevalence in water bodies (defined by FMP) of North Macedonia

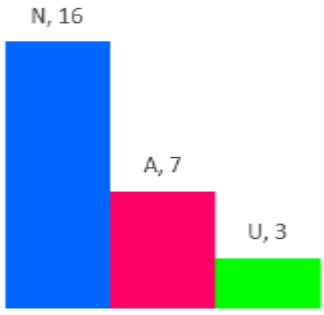


Figure 48 Number of alien species with acclimatized (A), naturalized (N) and unknown (U) current status in North Macedonia

Upward trends of dispersion of some alien fishes show that they have fast adaptation, while cumulative number of alien species in different fish ponds may be due to specificity of the habitats they prefer, such as reservoirs. It is well known that In North Macedonia there is more than 121

reservoirs. They are used for water supply, hydro energy production, irrigation and fishing farming. At the beginning, their ichthyofauna have been formed by the existing native fishes but later on, most of them, especially the large one, were widely stoked in a way to provide economic benefits. But this intentional stocking is the main pathway of spreading and distribution of the unintentional freshwater fishes. The most alarming is the situation with Tikvesh Resirvoir. At this reservoir from 20 fish species 8 are non-native such are *C. gibelio, A. gueldenstaedtii, A. ruthenus, L. gibbosus, A. nebulosus, G. cernua, P. parva*. The last investigation shows that *A. nebulosus* becomes dominant in the lake, as well as the population of introduced *G. cernuua.*

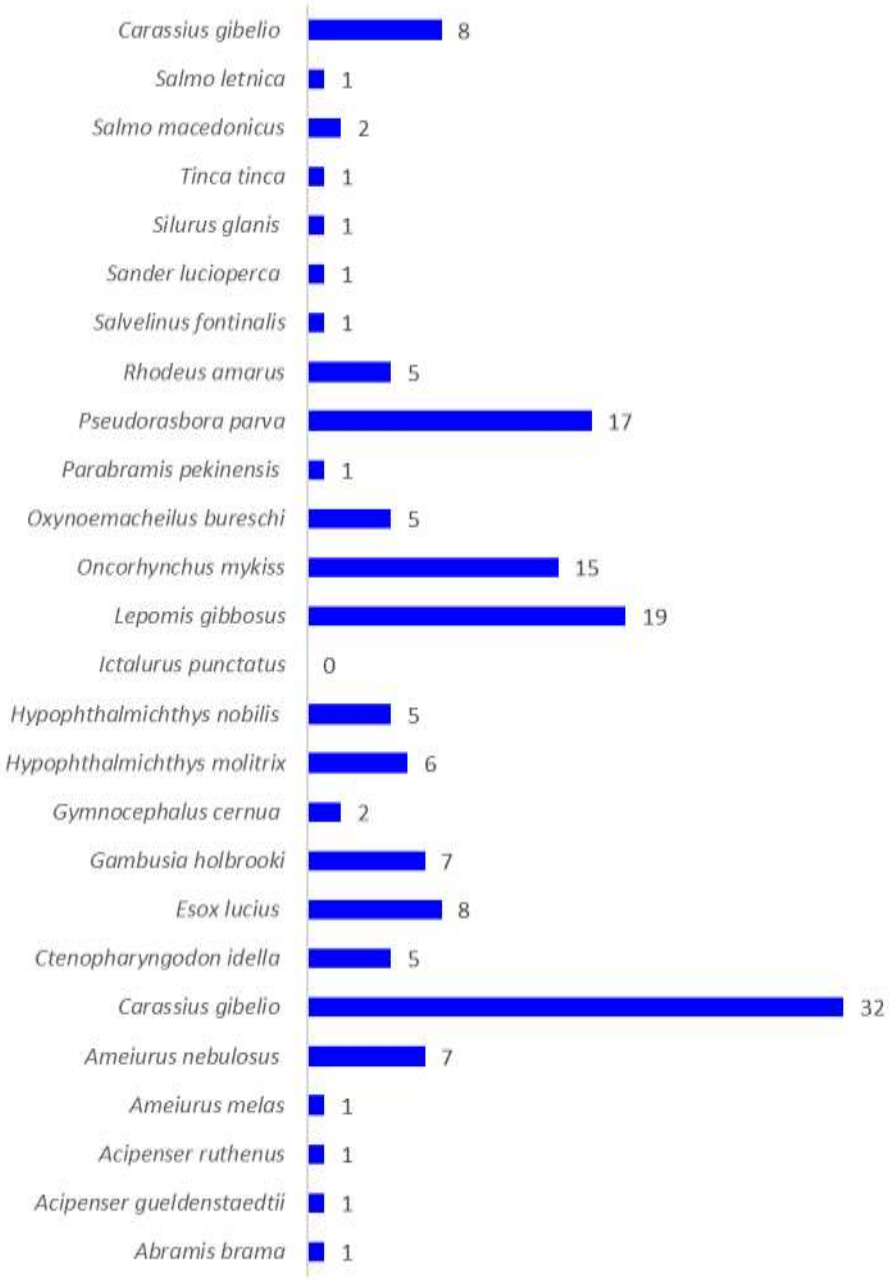


Figure 49 Distribution of alien species in certain number of water bodies (defined by FMPs) in North Macedonia.

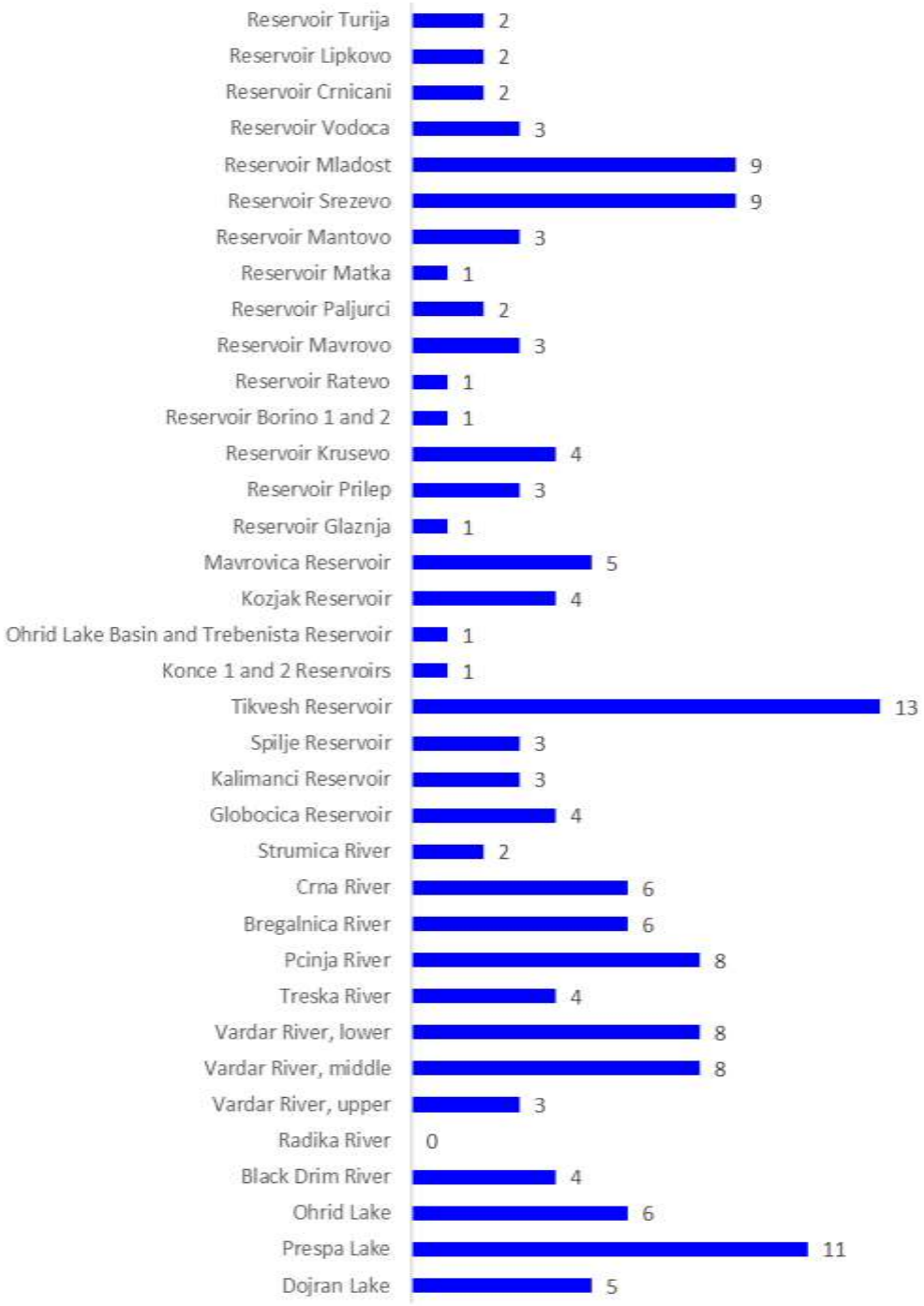


Figure 50 Number of alien species present in natural lakes, reservoirs and main rivers based on the data of fishing master plans (FMP).

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. During the investigation period of 3 years (2013-2015) 15 fish species were found including 5 alien species. Among them *Lepomis gibosus, Pseudorasbra parva* and *Rhodeus amarus* dominated in the catches.

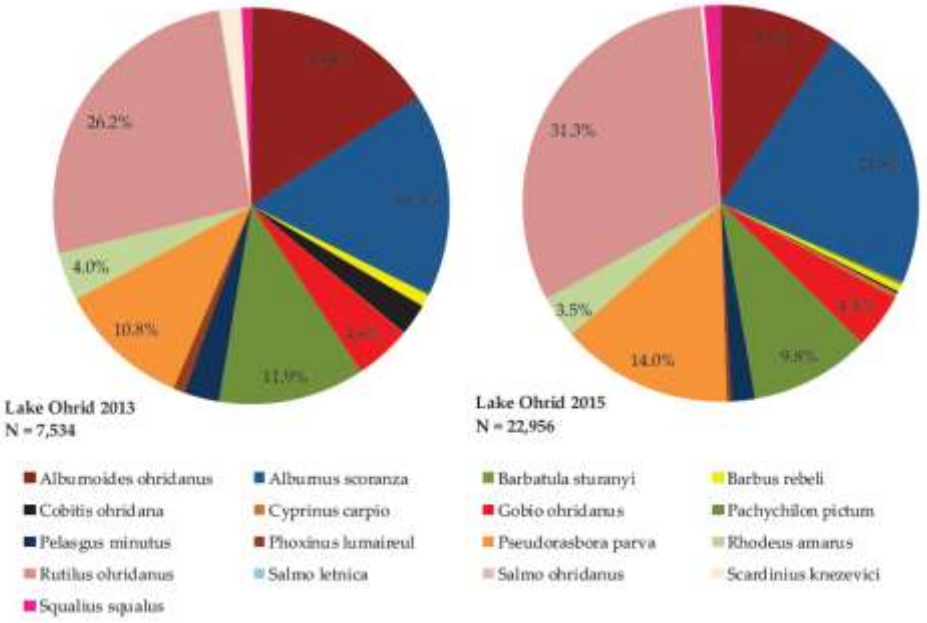


Figure 51 Relative fish species composition based on numbers in the total catches of Lake Ohrid.

Last survey in **Ohrid Lake** showed that from 6 reported alien species for the lake, stone moroko and bitterling are widely distributed and represent 15 % from the total catch. There is a doubt that alien mosquitofish, most probably, did not appear in the samples because of its small body size and preferred habitat while Prussian carp, rainbow trout and pumpkinseed, were not sampled either assuming that these species are large enough to get caught with the used techniques of sampling.

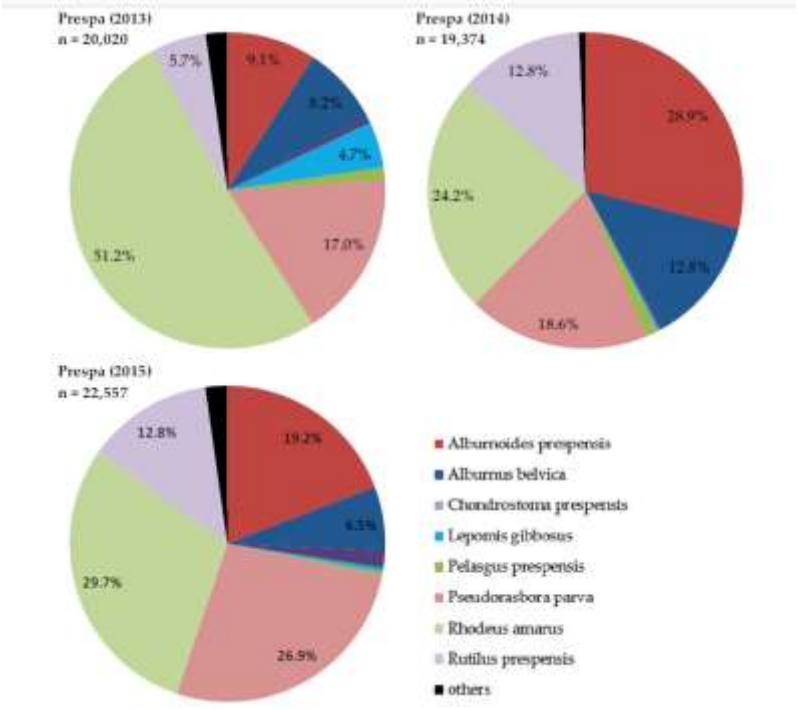


Figure 52 Relative fish species composition based on numbers in the total catches of Lake Prespa (page 39).

The most dramatic scenario on the impact of the invasive fish occurred in **Dojran Lake**. Namely, for the period 1997/2000 of the total catch of fish 8,86% belong to *C. gibbelio* while in 2006 Prussian carp become dominant - 46%.Recent published data show that *C. gibbelio* is still dominant fish species in this lake.

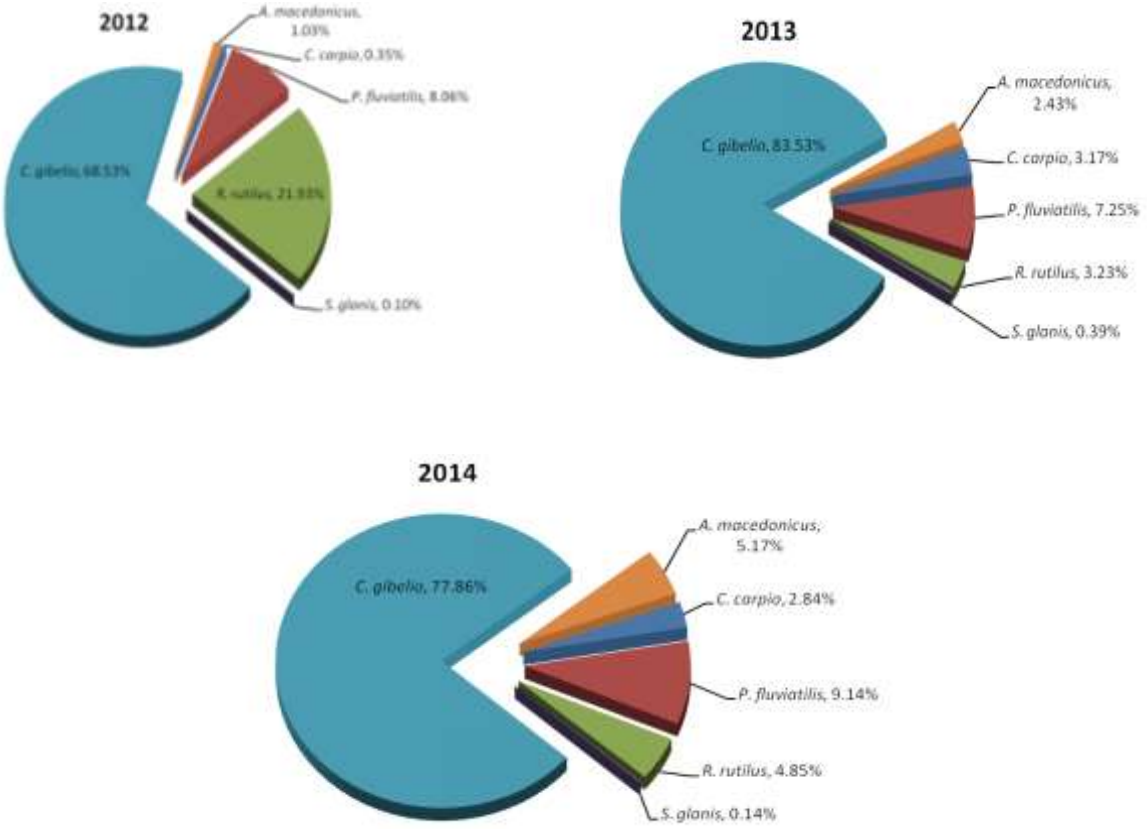


Figure 53 Relative fish species composition of total catchment in Dojran Lake in 2014.

The incised number of alien fish species, especially in natural lakes imposes urgent need of : (1) resolving inconsistencies in jurisdictional species listings; (2) broadscale intensive field research for screening all watercourses in the country; (3) monitoring programs with standardized techniques and protocols; (4) developing a national database of alien fish species information; (5) making data management and infrastructure arrangements with relevant stakeholders/ jurisdictions; (6) developing a rapid response plan for solving the negative impact. Only in that way this indicator will be useful and there will be justification for its purpose.

8.9.2. Indicator: Alien plant species in the Republic of North Macedonia

8.9.2.1. Fact sheet

Author: *Renata Ćušterevska (Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University)*

Indicator Name: Alien plant species in the Republic of North Macedonia

Lead Agency:

Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje

Use and interpretation:

Key question(s) which indicator helps to answer

Alien plant species have impact on environment, ecosystem services and human health

- *environment* - alien plant species have an impact on the diversity of local species, they affect water availability and damage the quality of soil nutrients. Once an alien plant has invaded a habitat, it changes the conditions of that environment. It does so by changing the light, solar radiation and temperature levels in the invaded patches. The quality and availability of food, shelter, nest sites, basking sites and perches are changed for a number of animals. They can also inflict big changes on native vegetation, altering the frequency of fires, nutrient cycling, water availability and soil erosion.
- *ecosystem services* - changes in species and community structure can affect ecosystem services both directly and indirectly. Direct effects include the decline in abundance of economically valuable species, in particular those used for food, forage, fiber, fuel, or medicine. Aesthetic values are commonly lost with the arrival of “nui-sance species” such as aquatic floating plants.
- *human health* - in Europe, common ragweed (*Ambrosia artemisiifolia*) has become notorious for its highly allergenic pollen

In a few cases, some benefits of alien plants have been reported. For example, they can provide firewood for local communities or add resources for animal species. But these benefits typically do not surpass the negative effects.

This indicator helps to enrich the knowledge of the existing alien plant species and to develop monitoring programs of their distribution.

Use of indicator

This indicator can be used to follow the pathways of introduction, to review the ecology, distribution and current status of alien species in North Macedonia, and to outline a framework for policy to control their number and impacts.

Scale of appropriate use

Alien plant species as an indicator can be used on national and international level

Potential for aggregation:

The pathways of introduction, distribution and establishment of alien species can be monitored in accordance with other indicators such as the national biodiversity databases, biodiversity monitoring and ecosystem processes, as well as the number of published scientific biodiversity articles, number of alien aquatic species and alien land invertebrates..

Meaning of upward or downward trends („good or bad“)

The analyses of data regarding alien plant species in North Macedonia clearly indicated positive trend of introduction (increase in their number), which means increased negative impact on biodiversity.

Possible reasons for upward or downward trends:

As a result of agriculture, tourism, trade, transport, land use changes, forest alterations and climate change, positive trend of the introduced alien species is expected. Some representatives of flora from other

continents or other parts of Europe are often cultivated as ornamental plants, later appearing as self-cultivating or as wild plants.

Implications for biodiversity management of change in the indicator:

Positive trends of introduction and establishment of alien species stipulates monitoring and mitigation measures.

Units in which it is expressed:

Number of introduced species per year

Description of source data:

There are several instruments that address the threats from alien species: scientific papers, databases, institutions and organizations. Some of them are given below:

Databases:

Euro+Med (2006-): Euro+Med PlantBase - the information resource for Euro-Mediterranean plant diversity.

Published on the Internet http://ww2.bgbm.org/EuroPlusMed/ [accessed DATE].

Institutions:

MKNH (Macedonian national herbarium) Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje

Publications:

Micevski (1956, 1962, 1969, 1970, 1987, 1991, 1992), Matvejeva (1965, 1973), Bukliev (1980, 1988), Micevski & Matevski (1983), Matevski & Kostadinovski (1990), Matevski (2000, 2002-2003, 2007), Matevski et al. (2001), Matevski & Teofilovski (2004, 2011), and other authors.

Calculation procedure:

Review of literature data dealing with alien species and analyses of the existing online databases.

Most effective forms of presentation:

Cumulative representation of the number of alien plant species in line charts, analyses of origin, families and life forms.

Limits to usefulness and accuracy:

Many aspects highlight the limitation of this indicator:

- North Macedonia has no official data bases and online information system for introduced species.
- Low scientific potential for this indicator (reflected through very low number of Macedonian authors and coauthors in scientific papers dealing with introduced species).
- Lack of national funding (funded national projects)
- Low priority on the issues related to alien

Updating the indicator:

Updating of the data will mostly depend on the results obtained from surveys carried out in the coming period and updated data from the relevant institutions. Updates of the indicator should be done annually.

Closely related indicators

Other relevant indicators which can be related with introduced species are:

- national biodiversity databases,
- biodiversity monitoring and ecosystem processes,
- published scientific biodiversity papers.

Additional information and comments

Considering the weak monitoring efforts in our country, lack of field data about the ecology of all alien plants and knowing the fact that not always some taxa deserved to have the status "alien species" especially that some species have been introduced long time ago and domesticated in our country is a reason that makes this indicator complex. The list of alien plant species present here are based on scarce published data and archive data that exist in relevant institutions, but data about the ecology and real impact of alien plant species should be collected only through regular national monitoring programs and included in National Biodiversity Information System. Also, assessment should be performed in order to elaborate a list of introduced invasive plant species.

8.9.2.2. Assessment of the indicator

Invasion of alien plant species in recent times has been recognized as the second worst threat after habitat destruction (Convention on Biological Diversity, 2005). Alien species indicators provide vital information to the biodiversity policy sector on the status-quo and trends of biological invasions and on the efficacy of response measures. It is applicable at different levels, but in North Macedonia without official data bases, alien species as indicator struggle with data availability and quality.

Due to the lack of data on the paths they are introduced to, population data, growth trend, negative impact to biodiversity, alien plant species can be used as an indicator only by following the number of introduced species per years.

According to the National Biodiversity Strategy with Action Plan of the Republic of Macedonia 2018-2023 The number of registered archaeophytes (introduced) a long time ago) and neophytes (newly introduced species) in the flora of North Macedonia has not yet been precisely determined, but it is thought to be more than 110 species (list is not presented) and this number is constantly growing.

For the purpose of this analyze, we restricted the analysis to 59 neophytes plant species to be used as suitable indicator.

Introducing of the alien plant species has begun long ago in the past, but there has been published literature data since 1899 from Grecescu. Since then, over 120 years there are data for about 60 alien plant species registered on the territory of the Republic of North Macedonia. The analysis shows that the number of introduced species is constantly increasing. The graph shows two peaks of an increasing number of registered species, in the period 1960-1970 and 1980-1990, when few papers have been published which are listing a large number of newly registered alien plant species Micevski (1962, 1969, 1987), Matvejeva (1965, 1982) and Bukliev (1980, 1986).

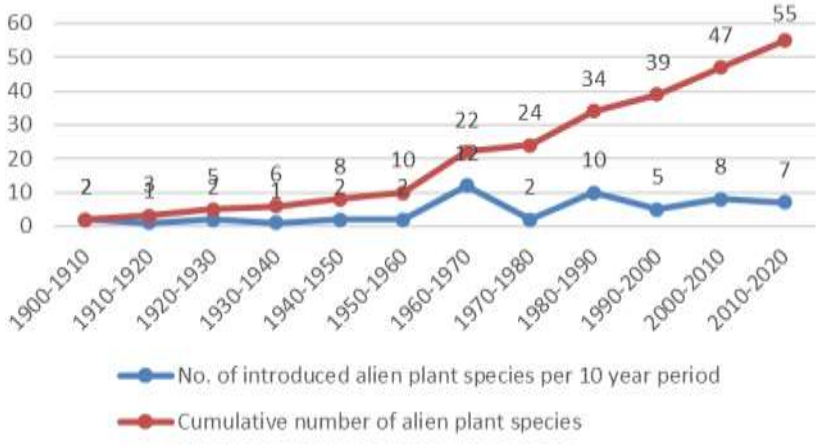


Figure 54 Trend of introduction of alien plant species in North Macedonia for time period of 120 years

According to the analysis of presence of plants by families, the representatives of the *Compositae* family significantly dominate. Knowing that *Compositae* is the largest family of flowering plants and constitutes almost 8.4% (Mabberley 1987) of the world flora it is not surprising that the *Compositae* play an important role in alien floras worldwide. The data sets of alien species from 26 global regions indicate an average value of 13.47% presence of *Compositae*. Comparison of this value with the representation of the family in the world (8.4) indicates that the family is over-represented among aliens. The reasons for this percentage representation of *Compositae* among others alien species are most likely due to large proportion of self-pollinated species, increased dispersal by special structures such as hooks, adhesive mechanisms etc., as well as by ants, and relatively less importance of water, self-dispersal and vegetative spread.

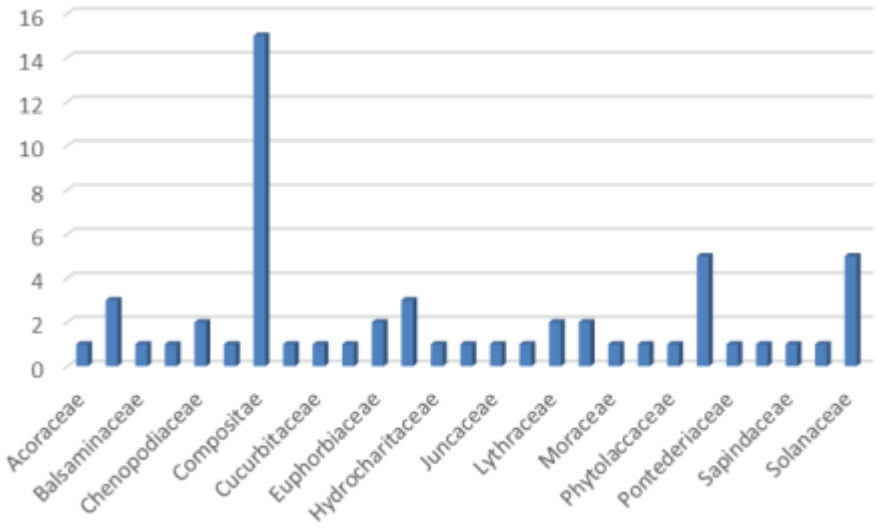


Figure 55 Presence of alien plant species per families

The predominant life form among alien plant species in Republic of North Macedonia is therophytes. Higher percentage of the therophytes is because they were found to be more adaptive and survive in adverse season in the form of seeds, and therefore are predominantly found in dry, hot or cold conditions.

In the second part of the 19th century, therophytes predominated, as they were mostly brought accidentally with dynamically developing transportation systems, while the second part of the 20th century (and particularly its last two decades) was the time when many new species were introduced into cultivation. This phenomenon reflected a growing human interest in new species of woody plants and perennials in recent period.

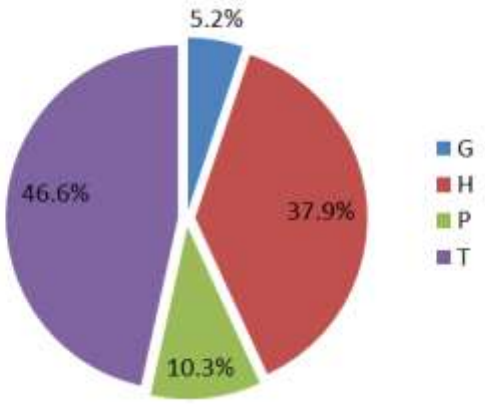


Figure 56 Life forms of alien plant species in Republic of North Macedonia (G - Geophytes ; H - Hemicryptophytes ; P - Phanerophytes; T - Therophytes)

The majority of the plant invasive alien species originate from North America.

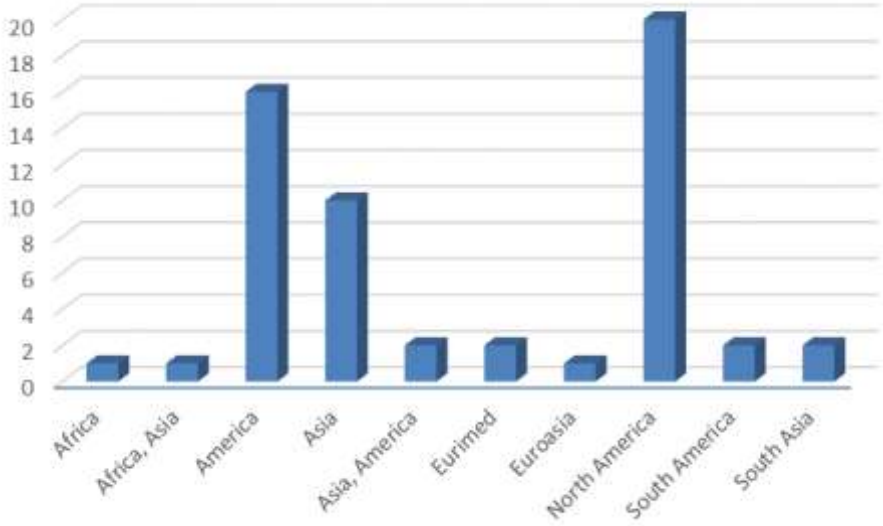


Figure 57 Origin of alien plant species in Republic of North Macedonia

The analyses of alien species literature published in the period 2014-2019 revealed a list of 3 newly registrated species for Republic of North Macedonia.

Solanum pseudocapsicum is reported for the first time for the flora of the Republic of North Macedonia it was found in Ohrid, on walls near the Monastery of St. Jovan Kaneo.

Bidens frondosus is reported for the first time as an alien species for the flora of the Republic of North Macedonia, on the shore of Prespa lake, E-SE of Stenje village.

Erigeron sumatrensis is reported for the first time for the flora of the Republic of North Macedonia. The taxon was recorded in several localities across the country. It seems, the species was introduced several decades ago, however, it remained unrecognized, mainly due to misidentification with *E. bonariensis*. Distribution in the Republic of North Macedonia: many localities in Skopje, Veles, Gradsko, Star Dojran, Kočani, Makedonska Kamenica and Prilep.

In the process of publishing is an article of 5 newly registered non-native plant species on the territory of the Republic of North Macedonia in co-authorship by Matevski, V., Kostadinovski, M. and Ćušterevska, R.

Table 29 List of alien plant species in Republic of North Macedonia

***Abutilon theophrasti* Medik.**	Malvaceae	T	South Asia	I	Micevski 1998
***Acer negundo* L.**	Sapindaceae	P	North America	I	
***Acorus calamus* L.**	Acoraceae	H	Asia		
***Ailanthus altissima* (Mill.) Swingle**	Simaroubaceae	P	Asia	I	
***Alcea rosea* L.**	Malvaceae	H	Asia		Matvejeva 1965
***Amaranthus hybridus* L.**	Amaranthaceae	T	North America		Micevski 1995
***Amaranthus retroflexus* L.**	Amaranthaceae	T	North America		Matvejeva 1965
***Amaranthus spinosus* L.**	Amaranthaceae	T	America	I	Micevski 1987
***Ambrosia artemisiifolia* L.**	Compositae	T	North America	I	Milkovska 2007
***Ammannia baccifera* L.**	Lythraceae	H	Asia	I	Matevski & Teofilovski 2011
***Ammannia verticillata* (Ard.) Lam.**	Lythraceae	H	Asia		Micevski 2001
Amorpha fruticosa L.	Fabaceae	P	North America	I	
Azolla filiculoides Lam.	Salviniaceae	H	America	I	Bukliev, 1986; Custerevska 2016
Broussonetia papyrifera (L.) Vent.	Moraceae	P	Asia	I	
Bryonia dioica Jacq.	Cucurbitaceae	G	Asia	I	
***Commelina communis* L.**	Commelinaceae	H	Asia	I	
***Cuscuta campestris* Yunck.**	Convolvulaceae	T	North America	I	Micevski 2010
***Datura stramonium* L.**	Solanaceae	T	North America	I	Черњавски 1943; Матвејева 1982;
***Dysphania ambrosioides* (L.) Mosyakin & Clemants**	Chenopodiaceae	T	America		Rudski, 1943; Micevski 1963
***Dysphania multifida* (L.) Mosyakin & Clemants**	Chenopodiaceae	H		I	Micevski 1995
***Elaeagnus angustifolia* L.**	Elaeagnaceae	P	Asia	I	
***Eleusine indica* (L.) Gaertn.**	Poaceae	T	Africa	I	Micevski 1983
***Elodea canadensis* Michx.**	Hydrocharitaceae	H	America	I	Talevska 2011
***Erigeron annuus* (L.) Desf.**	Compositae	T	North America	I	Micevski 1983
***Erigeron annuus* subsp. *septentrionalis* (Fernald & Wiegand) Wagenitz**	Compositae	T	North America		Micevski 1983
***Erigeron bonariensis* L.**	Compositae	T	America		Micevski & Matevski 1983
***Erigeron canadensis* L.**	Compositae	T	America		Beck. 1904
***Erigeron sumatrensis* Retz.**	Compositae	T	America		Vladimirov et al 2016
***Euphorbia maculata* L.**	Euphorbiaceae	T	North America	I	Micevski 1987
***Euphorbia prostrata* Aiton**	Euphorbiaceae	T	North America	I	
***Galinsoga parviflora* Cav.**	Compositae	T	North America	I	Drenkovski 1969, Matvejeva 1973
***Galinsoga quadriradiata* Ruiz & Pav.**	Compositae	T	America		Matevski & Kostadinovski 1990
***Helianthus tuberosus* L.**	Compositae	G	North America	I	
***Heteranthera limosa* (Sw.) Willd.**	Pontederiaceae	H	America	I	Bukliev, 1980
***Heteranthera reniformis* Ruiz & Pav.**	Pontederiaceae	H	America		Karov et al 2005
***Impatiens balfourii* Hooker f.**	Balsaminaceae	T	Asia	I	Matvejeva 1965

***Juncus tenuis* Willd.**	Juncaceae	H	America	I	
***Lindernia dubia* (L.) Pennell**	Linderniaceae	T	Asia, America	I	
***Lobularia maritima* (L.) Desv.**	Brassicaceae	H	Eurimed	I	Micevski 1969
***Matricaria discoidea* DC.**	Compositae	T	Asia, America	I	Matevski, V. , Čarni, A. & Kostadinovski, M. (2001)
***Medicago sativa* L.**	Fabaceae	H	Asia		Matvejeva 1965
***Oenothera biennis* L.**	Onagraceae	H	North America	I	Мицевски 2001
***Paspalum distichum* L.**	Poaceae	H	America		Micevski 1956
***Phalaris canariensis* L.**	Poaceae	T	Eurimed	I	Шопова & Сековски, 1982
***Phytolacca americana* L.**	Phytolaccaceae	H	America		Grecescu 1899
***Robinia pseudoacacia* L.**	Fabaceae	P	North America	I	
Rudbeckia laciniata L.	Compositae	G	North America	I	Matevski 2007
***Sisyrinchium angustifolium* Mill.**	Iridaceae	H	North America		Micevski 1956, 1963
***Solanum elaeagnifolium* Cav.**	Solanaceae	H	America	I	Matevski 2000
***Solanum pseudocapsicum* L.**	Solanaceae	H	America		Matevski 2017
***Solanum rostratum* Mill.**	Solanaceae	H	America		Matevski 2000
***Solanum sisymbrifolium* Lam.**	Solanaceae	H	South America		
***Sorghum halepense* (L.) Pers.**	Poaceae	H	Euroasia	I	Bornmüller 1928; Дренковски 1969;
***Sporobolus indicus* (L.) R. Br.**	Poaceae	T	Africa, Asia	I	Micevski 1991
***Tagetes minuta* L.**	Compositae	T	South America	I	Micevski 1970
***Xanthium orientale* subsp. *italicum* (Moretti) Greuter**	Compositae	T	North America		Matvejeva 1965
***Xanthium spinosum* L.**	Compositae	T	North America	I	Petkov 1910; Урумов 1923; Славниќ 1939; Матвејева 1965; Дренковски 1969;
***Bidens frondosus* L.**	Compositae	T	North America		Vladimirov et al 2019

8.9.3. Indicator: Introduced terrestrial invertebrate species from the Republic of North Macedonia

8.9.3.1. Fact sheet

Author: *Aleksandra C. Georgievska*

Indicator Name: Introduced terrestrial invertebrate species from the Republic of North Macedonia
Lead Agency: Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje
Use and interpretation: **Key question(s) which indicator helps to answer** Alien terrestrial invertebrates have socio-economic (affect human and animal health, act as pests, biocontrol agents, affect the agriculture, horticulture, forestry, stored products etc.) and environmental impact (affecting

native biodiversity, populations or communities of native species, disturb natural ecosystem processes etc.). The impact of alien species is usually negative, with exceptions when alien species act as biological control agent on pests, reducing losses or preventing the use of pesticides.

This indicator helps to enrich the knowledge of the existing allochtonous fauna and to develop national monitoring programs of their distribution. The data regarding this indicator can confirm that impacts of socio-economic and environmental trends are due to the alien invertebrate introductions.

Use of indicator

This indicator can be used to follow the pathways of introduction, to review the ecology, distribution and current status of non-native species in North Macedonia, and to outline a framework for policy to control their number and impacts.

Scale of appropriate use

Non-native species as an indicator can be used on national and international level

Potential for aggregation:

The pathways of introduction, distribution and establishment of alien species can be monitored in accordance with other indicators such as the national biodiversity databases, biodiversity monitoring and ecosystem processes, as well as the number of published scientific biodiversity articles.

Meaning of upward or downward trends („good or bad")

The analyses of data regarding alien terrestrial invertebrate species in North Macedonia clearly indicated positive trend of introduction (increase in their number), which means increased negative impact on biodiversity, socio-economic and ecosystem processes.

Possible reasons for upward or downward trends:

As a result of globalisation, tourism, trade, transport, land use changes, forest alterations and climate change, positive trend of the introduced invertebrate species is expected.

Implications for biodiversity management of change in the indicator:

If positive trend of introduction and establishment of alien species continues, measures should be taken to avoid or minimize their negative impact on biodiversity, socio-economic and ecosystem processes. In contrast, negative trend of introduction shows the effects of regulation measures and control.

Units in which it is expressed:

The preferred unit for this indicator is the number of introduced species per year/ per hectar//per $1m^2$//per area.

Description of source data:

There are several instruments that address the threats from alien species: scientific papers, databases, institutions and organizations. Some of them are given below:

Databases:

EASIN – European Alien Species Information Network

DAISIE (Delivering Alien Invasive Species Inventories for Europe)

IUCN/SSC Invasive Species Specialist Group (ISSG)

NOBANIS – European Network on Invasive Species

ESENIAS – East and South European Network for Invasive Alien Species

CABI – Invasive Species Compendium

EPPO – Global Database

Institutions:

Convention on Biological Diversity (CBD, implemented into European legislation by Council Decision

93/626/EEC)

European Commission – Environment – Invasive Alien Species

Bern Convention Group of Experts on Invasive Alien Species

CBD – Convention on Biological Diversity – Invasive Species

Organizations:

Neobiota – The European Group on Biological Invasions

IUCN

Calculation procedure:

Review of literature data dealing with alien species, followed by online database search and review of museum collections.

Most effective forms of presentation:

Preferred form of presentation will be the list of published alien species per year, supplemented with graphic form of the ongoing trends for a period of five years.

Limits to usefulness and accuracy:

Many aspects highlight the limitation of this indicator:

- Despite many international source data addressing alien species (scientific papers, databases, institutions and organizations), some of them have limited access for updating and expanding the indicator.
- North Macedonia has no official data bases and online information system for introduced species.
- Low scientific potential for this indicator (reflected trough very low number of Macedonian authors and coauthors in scientific papers dealing with introduced species).
- Low government awareness for this indicator (shown with the absence of funded national projects).
- The data regarding the presence and distribution of invasive species in North Macedonia is far from satisfactory. Due to a lack of information and awareness, the issue of alien species and their effects is often underestimated and adequate prevention and mitigation measures are lacking.

Updating the indicator:

Updates of the indicator should be made annually, while for the monitoring of introduction, distribution and establishment five year period is preferred.

Closely related indicators

Other relevant indicators which can be related with introduced species are:

- national biodiversity databases,
- biodiversity monitoring and ecosystem processes,
- published scientific biodiversity papers.

Additional information and comments

8.9.3.2. Assessment of the indicator

Alien terrestrial invertebrates have socio-economic (affect human and animal health, act as pests, biocontrol agents, affect the agriculture, horticulture, forestry, stored products etc.) and environmental impact (affecting native biodiversity, populations or communities of native species, disturb natural ecosystem processes etc.). The impact of alien species is usually negative, with exceptions when alien species act as biological control agent on pests, reducing losses or preventing the use of pesticides.

This indicator helps to enrich the knowledge of the existing allochtonous fauna, to follow the pathways of introduction, to review the ecology, distribution and current status of non-native species in North Macedonia. Also, helps to outline a framework for national control policy and monitoring programs of their distribution. The data referring to this indicator can confirm that impacts of socio-economic and environmental trends are due to the alien invertebrate introductions.

The advantage of this indicator is that it can be used on national and international level, by communication with national and international experts, organizations and institutions.

The disadvantages of this indicator are following:

Despite many international source data addressing alien species (scientific papers, databases, institutions and organizations), some of them have limited access for updating and expanding the indicator.

- North Macedonia has no official data bases and online information system for introduced species.
- Low scientific potential for this indicator (reflected trough very low number of Macedonian authors and coauthors in scientific papers dealing with introduced species).
- Low government awareness for this indicator (shown with the absence of funded national projects).
- Due to a lack of information and awareness, the issue of alien species and their effects is often underestimated and adequate prevention and mitigation measures are lacking.

The analyses of data regarding alien terrestrial invertebrate species in North Macedonia clearly indicated positive trend of introduction (increase in their number), which means increased negative impact on biodiversity, socio-economic and ecosystem processes.

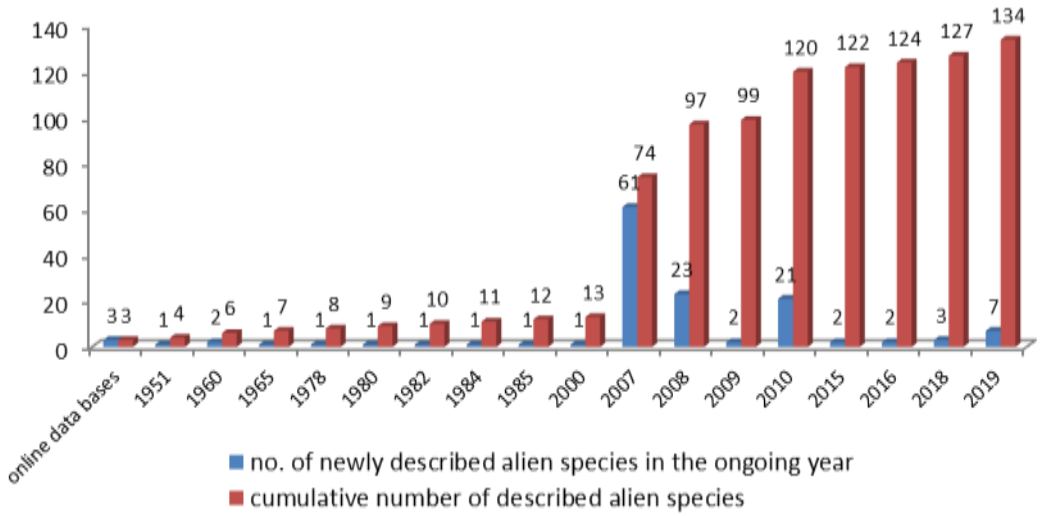


Figure 58 Number of newly recorded vs. cumulative number of alien species in North Macedonia, by year

Positive trend of introduction and establishment of alien species mainly is a result of globalisation, tourism, trade, transport, land use changes, forest alterations and climate change. In that case, measures should be taken to avoid or minimize their negative impact on biodiversity, socio-

economic and ecosystem processes. In contrast, negative trend of introduction will show the effects of regulation measures and control.

The data regarding presence and distribution of alien species in North Macedonia is far from satisfactory. The review of literature data (around 36 scientific papers and online databases) in the period of 68 years (1951-2019), showed the presence of 134 non-indigenous species on the territory of North Macedonia. Most of them belong to the order Coleoptera (42 species, 12 families), Hemiptera (30 species, 11 families) and Lepidoptera (22 species, 11 families).

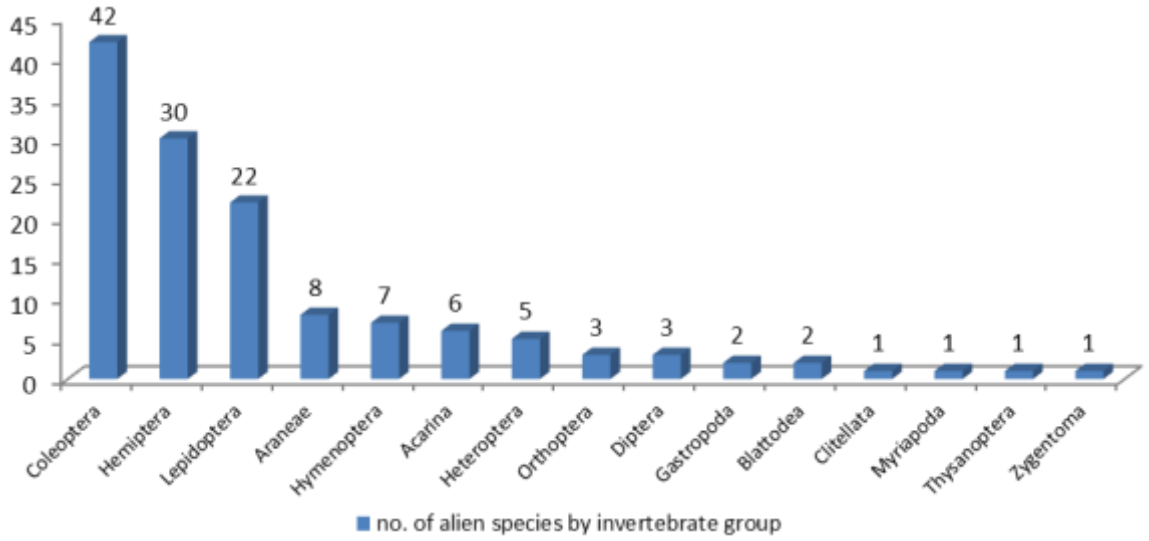


Figure 59 Number of alien species by invertebrate group

The most research activities of alien fauna were made during 2007, as part of the ongoing international project “Non-indigenous insects and their threat to biodiversity and economy in Albania, Bulgaria and Republic of North Macedonia”. Unfortunately, before and after 2007, there are no national or international projects concerning alien invertebrate species. The only exception is the project “Asian tiger mosquito (Aedes albopictus Skuse, 1894) in North Macedonia as a joint effort between Macedonian ecological society and World Health Organization, and the project known as ESENIAS “East and South European Network for Invasive Alien Species”.

Also, most of the scientific papers are made by foreign researchers, mainly focusing on Lepidoptera, Coleoptera and Hemiptera.

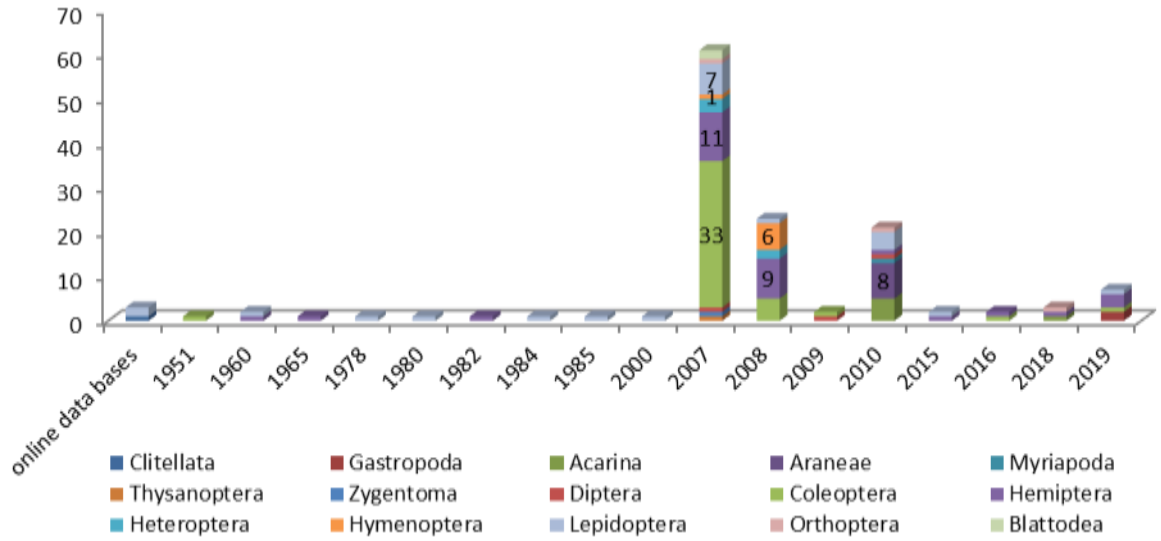


Figure 60 Number of alien species (belonging to different invertebrate groups), by year

As shown on Tab. 1 and Fig. 4, Aphidids (Hemiptera, Aphididae) have the highest share of non-native species (18) in North Macedonia, and probably their introduction will continue, mainly with the import of horticulture and stored products.

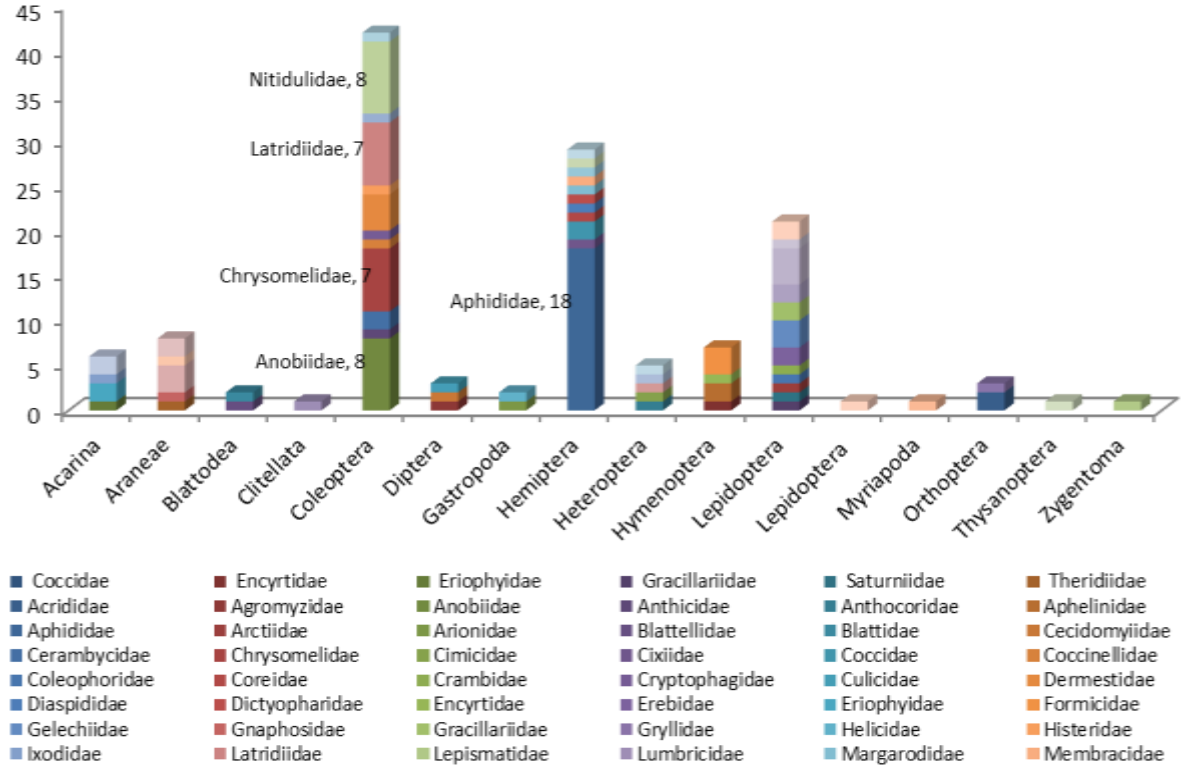


Figure 61 Number of alien species (belonging to different family), by invertebrate group

8.10. National target 9: Integrate measures for climate change effects adaptation and mitigation and combat against desertification

8.10.1. Indicator: Dynamics in Land productivity

8.10.1.1. Fact sheet

Author: *Dusko Mukaetov (Institute of Agriculture – University "Ss Cyril and Methodius")*

Indicator Name: Dynamics in Land productivity
Lead Agency: Institute of Agriculture – University "Ss Cyril and Methodius"
Use and interpretation: **Key question(s) which indicator helps to answer** Land in North Macedonia, is under constant pressure of various processes, responsible for gradually degradation of this valuable natural and loss of its key functions in the ecosystem. All of the processes are result to the pressures aroused from various drivers. Having in mind the complexity of the processes causing land degradation and the spatial variability of land properties, it is very difficult to trace its extent and intensity. **Use of indicator** Land productivity Dynamics as an indicator related to the overall land status, points to long-term changes in the health and productive capacity of the land and reflects the net effects of changes in ecosystem functioning on plant and biomass growth. Land productivity is also important for assessing changes in the carbon stocks of natural and managed systems, and thus their contribution to climate change mitigation efforts **Scale of appropriate use** National scale
Potential for aggregation:
Meaning of upward or downward trends („good or bad") Land productivity data set provides 5 classes of land productivity, among which the first 3 classes are considered to be an indication of potential land productivity decline, as an indicator of land degradation
Possible reasons for upward or downward trends: As a result of the intensive industrialization, the unsustainable practices in agricultural and improper forest management, the processes of land degradation are intensified, causing severe damage of land in certain areas and significant influence on biodiversity, especially soil biodiversity. Another, reason for downward trends of land productivity is the intensification of negative influence of climate change, which significantly influences certain land properties, closely related to land productivity, like: soil organic matter, soil structure, soil moisture, soil reaction etc.
Implications for biodiversity management of change in the indicator: Downward trends of land productivity can have serious impacts on the biodiversity, especially soil biodiversity and agro-biodiversity. As mentioned before, land productivity can be considered as a global indicator, closely related to most of the land degradation processes and land properties which on the other

hands define the suitability of land as a habitat for the most of the species in the ecosystem. For these reasons, imbalance of any of the soil parameters or intensifying of any of the degradation processes, leads to decrease of land productivity and thus to implications on biodiversity.

Having in mind that land productivity is related and depends to numerous factors, changing of trend seeks a complex and long term activities. Many of these activities are related to different sectors and drivers, like agriculture, forestry, water economy, industry etc.

Particular interest should be payed to the mitigation of the processes, like soil erosion, SOC depletion and soil sealing, through implementing of e.g.: agro-ecological measures and adaptation measures in agriculture, implementing of anti-erosive measures on-farm in agriculture and on a catchment level in forestry. Delineation of agricultural and forest land, and inclusion of the issue of soil sealing in urban planning.

Units in which it is expressed:

Land productivity and land productivity dynamics is expressed in tones of dry matter per hectare per year (tDM/ha/year)

Description of source data:

Estimation of land productivity is based on remotely sensed data, like: satellite imagery and high resolution aerial photographs as an auxiliary data source.

For the process of estimation of land productivity and land productivity dynamics for the period 2000-2010, the Joint Research Centre's Land Productivity Dynamics datasets (LPD) were used. The dataset has been derived from a 15-year time series (1999 to 2013) of SPOT Vegetation NDVI observations composited in 10-day intervals at a spatial resolution of 1 km.

Calculation procedure:

The indicator can be calculated across large areas from Earth observation data on net primary productivity (NPP).

There are numerous indexes that can be derived from remotely sensed data and used as a proxy for or land productivity, like: FAPAR, LAI, but in the moment the Normalized Difference Vegetation Index (NDVI) is by far the most commonly used vegetation index. The following sources of NDVI time series are accessible at low cost or no cost, inter alia:

LandSat 1972-present, 30 m resolution

MODIS: 2000-present, 250m resolution

SENTINEL: 2016-present, 10 and 20 m, resolution

Proxies to measure NPP, such as NDVI and other vegetation indices, are influenced in the short-term by crop phenology, rainfall, nutrient fertilization and other variables which must be corrected to accurately interpret trends.

Due to the lack of information's on a national level, in this moment, land productivity data derived from NDVI, were further on disaggregated, based on land use/land use change and slope.

Most effective forms of presentation:

The best way to explain and overview of land productivity, is elaboration of maps, which enables presenting of the spatial and temporal trends in land productivity dynamics

Limits to usefulness and accuracy:

The land productivity is a complex and dynamic indicator, meaning that the process of its estimation is complex and consider monitoring and evaluation of various spatial data and management practices. In the moment, on a national level. Data sources are very limited, especially these related to management practices. In addition, spatial data should be gathered and processed with a high temporal resolution (10-15 days during the vegetation period) meaning a permanent engagement of experts. The indicator is derived

on the base of proxy data, to this end, its accuracy should be validated and calibrated, with exact field measurements.

Updating the indicator:

The indicator, should be monitoring permanently for the whole country territory, during the vegetation period. NDVI or other indexes should be monitored with a temporal resolution of 10-15 days, while the LU/LUC should be monitoring once a year. Management practices on land in all sectors, should be monitored and updated, every year.

Closely related indicators

Additional information and comments

This indicator is very useful as well for evaluation of the extent of the processes of land degradation

The information related to this indicator can be used in designing of suitable measures in agriculture and forestry, like: agro-ecological measures, cross compliance measures, GAP standards and adaptation of agriculture and forestry to climate change.

This indicator can be used as a baseline in evaluation of the status of biodiversity, ecosystem services provided from various ecosystems, etc.

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Davies J., Gudka M., Laban P., Metternicht G., Alexander S., Hannam I., Welling L., Vasseur L., Siles J., Aguilar L., Poulsen L., Jones M., Nakanuku-Diggs L., Zeidler J., Frits H. Land Degradation Neutrality: implications and opportunities for conservation Nature Based Solutions to Desertification, Land Degradation and Drought. Second Edition 27/08/2015

Dengiz Orhan. Potential impact of land use change on land productivity dynamics with focus on land degradation in a sub-humid terrestrial ecosystem.Theoretical and Applied Climatology,133, Issue 1–2,(2017),pp 73–88.

Geist HJ, Lambin E.F:Dynamic causal patterns of desertification. Bioscience, 54(2004), pp. 817–829.

Lal, R. (2012). Climate Change and Soil Degradation Mitigation by Sustainable Management of Soils and Other Natural Resources. Agricultural Research, 1,199-212.

Montanarella, L., Pennock, D.J., McKenzie, N., Badraoui, M., Chude, V., Baptista, I., Mamo, T., Yemefack, M., Singh Aulakh, M., Yagi, K., 2016. World's soils are under threat. Soil 2, 79–82.

8.10.1.2. Assessment of the indicator

The LPD dataset provides 5 qualitative classes of land productivity trends over the abovementioned time period. These qualitative classes do not directly correspond to a quantitative measure (e.g. t/ha of NPP or GPP) of lost or gained biomass productivity. The 5 classes are rather a qualitative combined measure of the intensity and persistence of negative or positive trends and changes of the photo-synthetically active vegetation cover over the observed period. Land productivity data set provides 5 classes of land productivity, among which the first 3 classes are considered to be an indication of potential land productivity decline, as an indicator of land degradation.

Table 30 Classes of Land Productivity Dynamics (LPD)

1	Declining productivity
2	Early signs of decline
3	Stable, but stressed
4	Stable, not stressed
5	Increasing productivity

As a result of the intensive industrialization, the unsustainable practices in agricultural and improper forest management, the processes of land degradation are intensified, causing severe damage of land in certain areas and significant influence on biodiversity, especially soil biodiversity. Another, reason for downward trends of land productivity is the intensification of negative influence of climate change, which significantly influences certain land properties, closely related to land productivity, like: soil organic matter, soil structure, soil moisture, soil reaction etc. Climate changes also accelerate certain processes of land degradation, which also provokes downward trends in land productivity, like: soil erosion, salinization, depletion of soil organic carbon etc. Particularly prone to the decreasing of the land productivity are areas under agricultural production in the south east part of the country under intensive agricultural production (Stumica, Valandovo, Bogdanci, on south: Pelagonija valley, agricultural areas around Prespa and Ohrid lake).

Increasing trends of Land Productivity is notable on areas under forest land and most of the cropland under pastures and meadows. On those areas, land productivity has an upward trend, as a result of the low human impact. In such conditions, one can expect accumulation of soil organic carbon, minimizing of soil erosion and improvement of the soil properties.

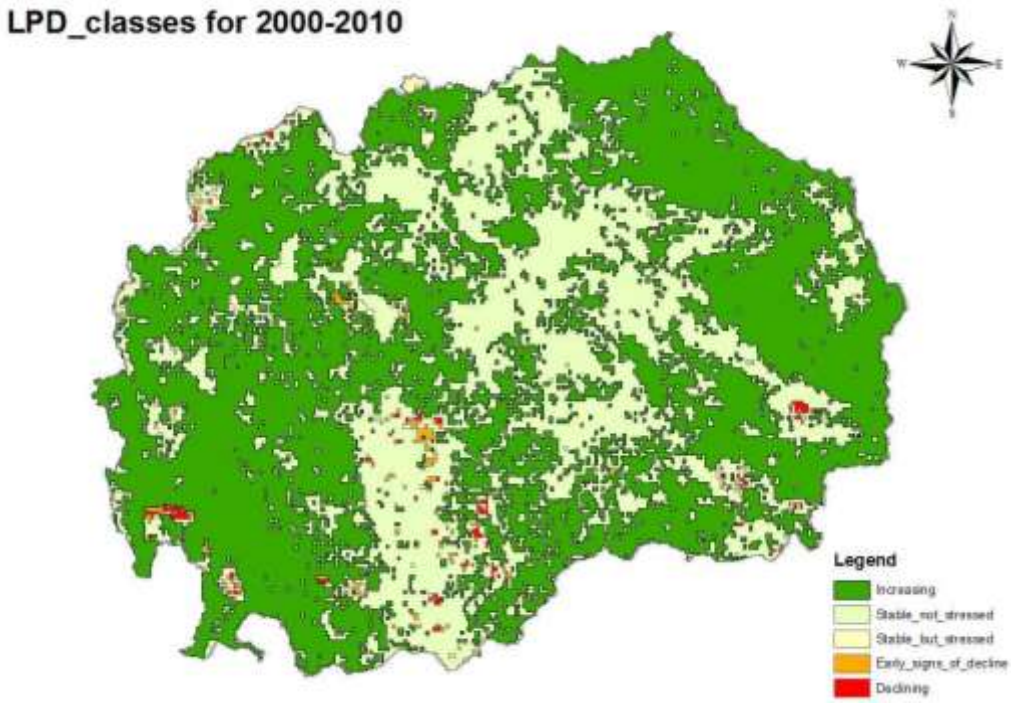

Figure 62 Land productivity Dynamic for the period 2000-2010

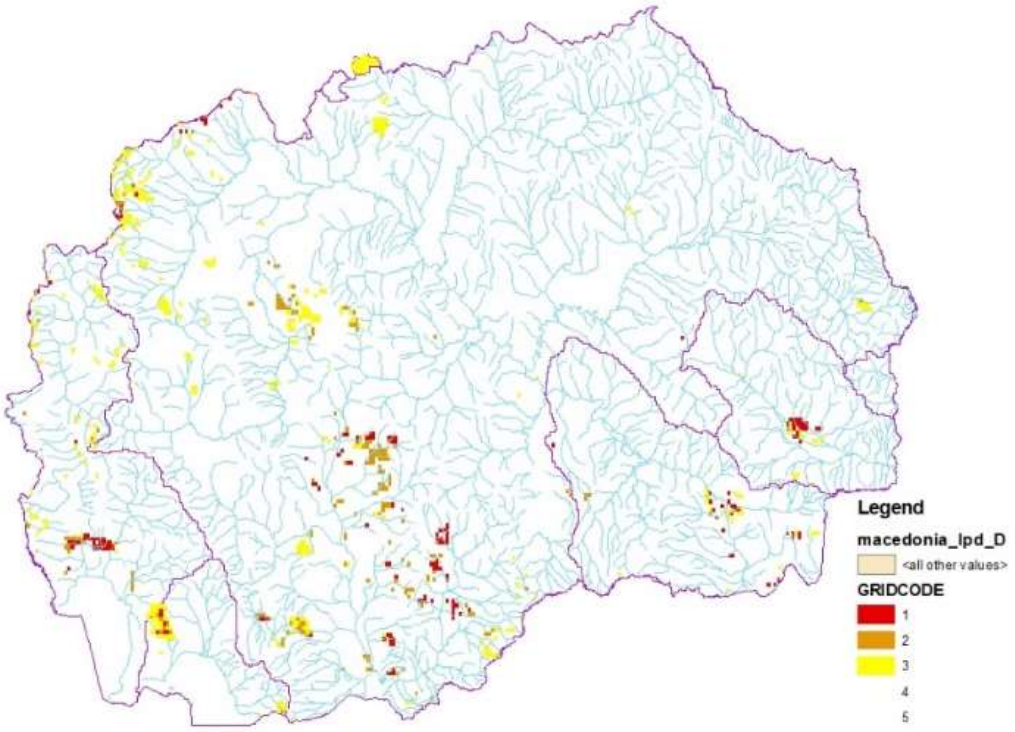

Figure 63 Areas with downwards trends of land productivity

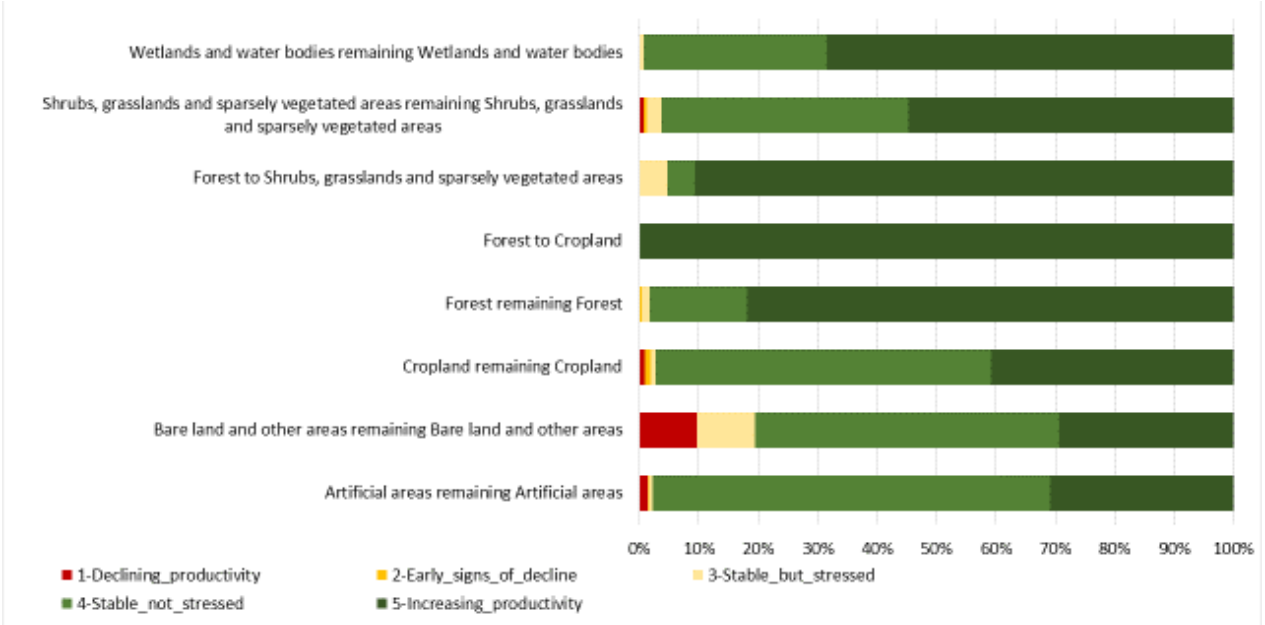

Figure 64 Trends of land productivity vs. Land Use/Land Use change (2000-2010). Source: Republic of North Macedonia Land Degradation Neutrality Target Setting Process National Report

8.10.2. Indicator: Renewable electricity

8.10.2.1. Fact sheet

Author: *Ministry of Environment and Physical Planning*

Indicator Name: Renewable electricity
Lead Agency: Ministry of Environment and Physical Planning
Scale of appropriate use The share of electrcity originating from renewable sources in the gross electricity consumption in the Republic of North Macedonia is rather low. It makes relatively high annual fluctuation depending on hydrological conditions, considering that so far only hydro and solar power from among renewable sources contribute to electricity production from renewable sources. Efforts should be made to utilize other renewable sources for electricity production.
Meaning of upward or downward trends („good or bad“) There was a variable trend in the rate of renewably energy sources utilization during the analyzed period. In 2010, resulting from favourable hydrological conditions, the share of renewable electricity in the total gross electricity consumption was the highest amounting 28%, while the lowest share was recorded in 2001 amounting 9.2%.
Possible reasons for upward or downward trends: The production of electricity from renewable sources in the Republic of North Macedonia is based on the hydropower, but in the last years, a contribution has been noted by new renewable sources (solar electricity plants, windmills and biogas plants, as well as an increase in the share from small hydropower plants). Production in large hydropower plants is predominant.
Implications for biodiversity management of change in the indicator: The indicator "Renewable electricity" measures the share of electricity produced from renewable sources in gross national electricity production (in percentage). The gross national electricity consumption is a sum of the total gross production and import of electricity minus electricity exported. The production of electricity from renewable sources in the Republic of North Macedonia, based based on the hydropower, has an impact on biodiversity
Units in which it is expressed: GWh percentage
Description of source data: Common surveys for coal, oil, natural gas, electricity and heat, renewable energy for 2005 by Eurostat, ECE/UN and IEA/OECD. “Energy Statistics Methodology Eurostat F4, 1998"
Calculation procedure: Statistical methodology for calculation
Most effective forms of presentation:

EXCEL Tables, Graphs
Limits to usefulness and accuracy: n/a
Updating the indicator: Update is every 2 years (for n-2 period, where n=current year), data are statistical, developed by the State Statistical Office Data are part of environmental set of indicators
Closely related indicators
Additional information and comments www.stat.gov.mk www.moepp.gov.mk www.economy.gov.mk

8.10.2.2. Assessment of the indicator

At present, the share of renewable electricity in the overall electricity consumption is very important and depends on hydrological conditions during the year. Variable hydrological conditions result in variations in the production of hydro energy due to lower quantities of precipitation. This indicates the fact that there is a need for larger investments in energy production capacities to enable an increase of the utilization of other renewable energy sources as well, such as solar, wind power and biogas.

During the observed period, there was a variable trend of utilization of energy from renewable sources. In 2010, resulting from favourable hydrological conditions, the share of renewable electricity in the total gross electricity consumption was the highest amounting 28%, while the lowest share was recorded in 2001 amounting 9.2%.

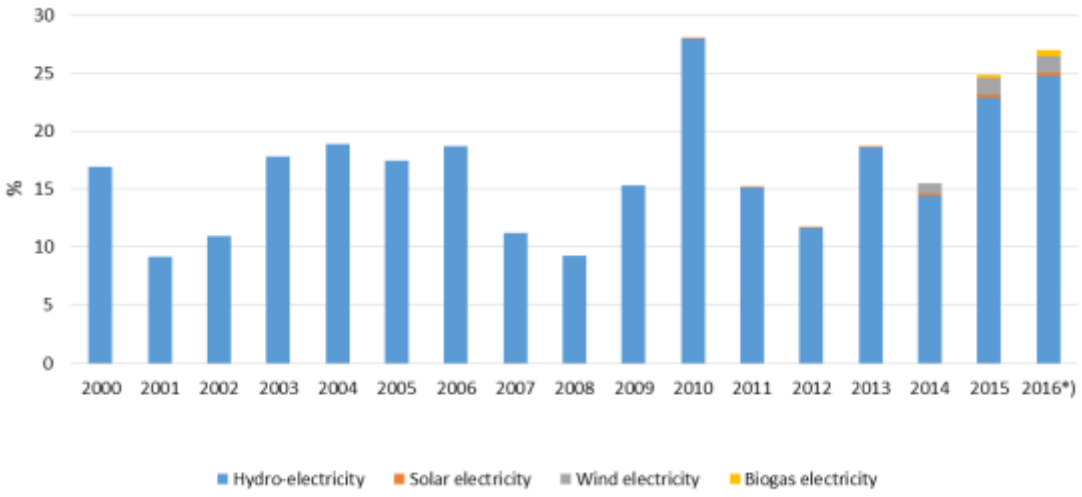

Figure 65 Share of renewable electricity in gross domestic electricity consumption

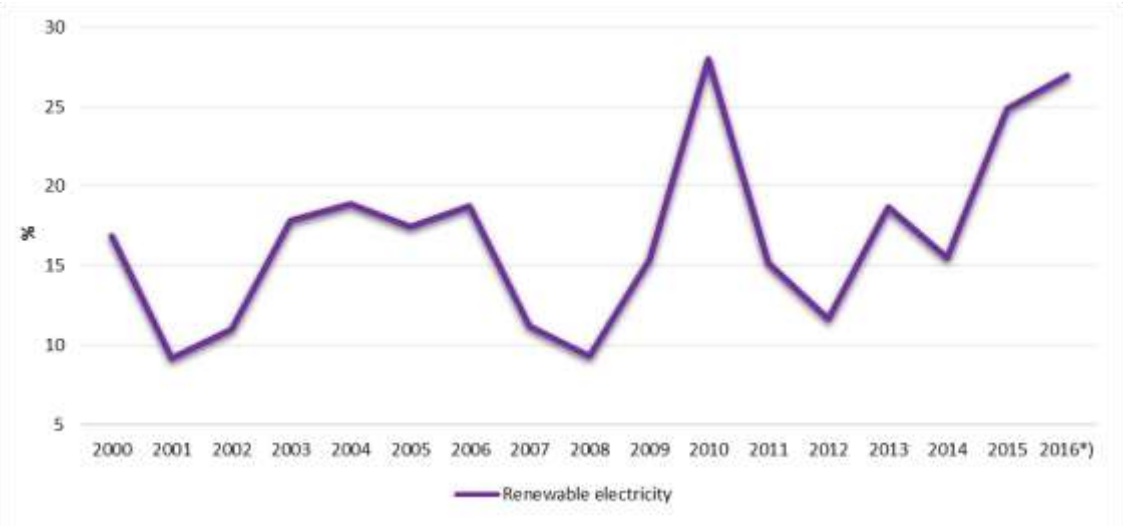

Figure 66 Trend in electricity production from renewable sources (%)

8.10.3. Indicator: Forest fires

8.10.3.1. Fact sheet

Author: *Nikola Nikolov ("Hans Em" Faculty of Forest Sciences, Landscape Architecture and Environmental Engineering)*

Indicator Name: МК-НИ 038 (FOREST FIRES)
Lead Agency: "Hans Em" Faculty of Forest Sciences, Landscape Architecture and Environmental Engineering in Skopje & Regional Fire Monitoring Center (RFMC)
Use and interpretation: **Key question(s) which indicator helps to answer** According to the official IPCC scenarios for climate change in Europe and North Macedonia we should expect more forest fires with all their negative influences at the environment. Besides we are already witnesses of a large number of forest fires and burned area in North Macedonia in the last two decades. The number of forest fires, burned area and damage caused (economical and biological) will show the capacity of the country (trough prevention, preparedness and suppression) to deal with forest fires. **Use of indicator** This indicator should be used in order to assess capacities of the institutions in North Macedonia and their efficiency to decrease appearance and influence of forest fires on environment (GHG emission, biodiversity, erosion, forest health condition etc.) and society. **Scale of appropriate use** This indicator can be used on national scale.
Potential for aggregation: This indicator is complex by itself and consists of parameters that show number of forest fires, burned area, damage caused (biological and economical) and GHG emission. Besides, this indicator may be considered as

part of the group of indicators showing the efficiency of the measures of mitigation and adaptation on climate change.
Meaning of upward or downward trends („good or bad") The downward trend of the number of forest fires, burned area, damage caused (biological and economical) means that the negative influence of the forest fires on environment is decreasing and the capacities of the institutions are strengthening.
Possible reasons for upward or downward trends: The negative trend (decrement of number of forest fires, burned area, damage caused - biological and economical) will be result of increased capacities of the institutions and efficiency of the measures conducted (especially the measures of prevention and preparedness). There could be two reasons for this, increment of the investment of the state in the institutions authorized for forest fire protection and increment of the number of international researching and applicative projects.
Implications for biodiversity management of change in the indicator: The negative trend of the indicator will show decrement of the negative influence of forest fires to environment including biodiversity.
Units in which it is expressed: Changes should be expressed in: number of forest fires per year, burned area per year-index of burned area, damage caused by year - denars/years, loss of timber mass m^3/ha, GHG emission - Gg/year.
Description of source data: There are two reliable sources of such data: Ministry for agriculture, forestry and water economy (collecting data from PE National forests, National Parks and MAKFFIS) and State statistical office.
Calculation procedure: Trough quarter and annual reports.
Most effective forms of presentation: The best way to present the trends is to present by lines trends. This indicator is best to be presented in 5-year intervals.
Limits to usefulness and accuracy: Practically there is no limit to usefulness. In terms of the accuracy, it depends of the way of collection of the data (satellite, ground, combination etc) and the methodology used.
Updating the indicator: The indicator should be followed annually, but the results should be compared in 5-years periods.
Closely related indicators - Capacity building - Land cover changes - GHG's emission
Additional information and comments No additional information and comments

8.10.3.2. Assessment of the indicator

One of the most detrimental factors for forests and nature in the Republic of North Macedonia are forest fires. According to data from the Ministry of agriculture, forestry and water economy – PE National forests, in the period between 2015 and 2019 there were a total of 4.644 forest fires in the country, the total burned area was 41.166 ha of forest and forest land, and the total volume of

burned timber 234.773 m^3. Within the same period, there were an average of 262 forest fires per year and the average size of the burned area was 8.233 ha annually.

The total damage (burned timber volume plus suppression costs plus post-fire management measures) caused by forest fires in this period has been estimated at around 69.679.522 EUR and annually in average 13.935.904 EUR.

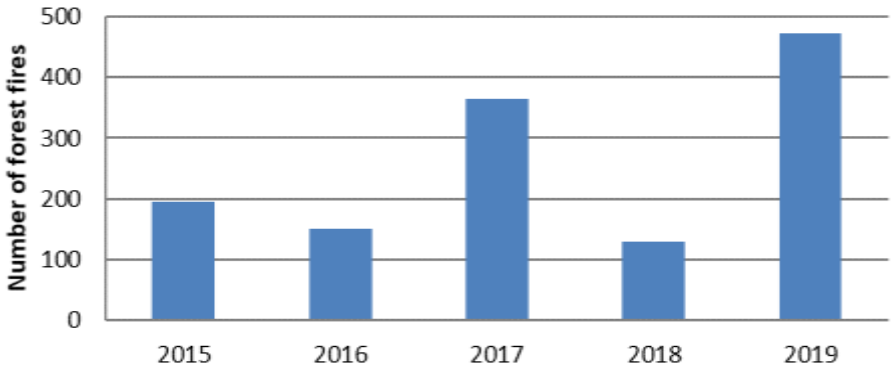

Figure 67 Number of forest fires the Republic of North Macedonia in the period 2015-2019

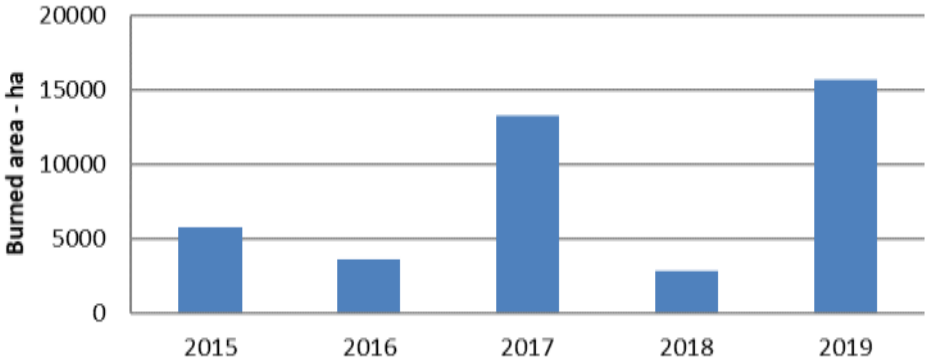

Figure 68 Burned area in the Republic of North Macedonia in the period 2015-2019

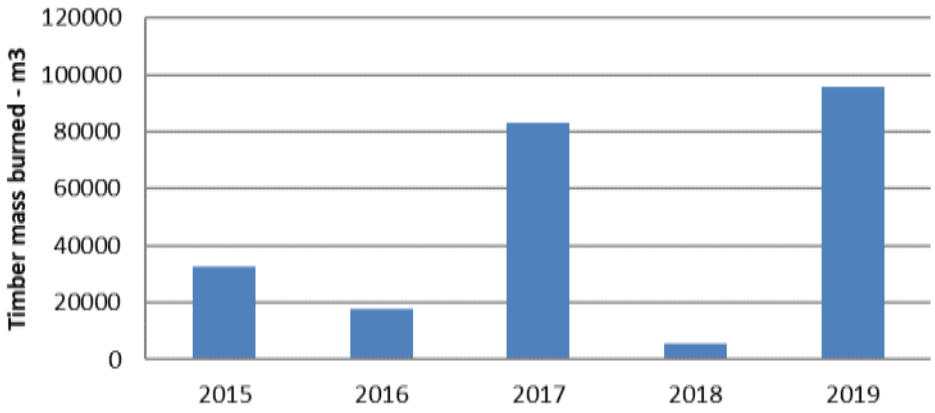

Figure 69 Timber mass burned in the Republic of North Macedonia in the period 2015-2019

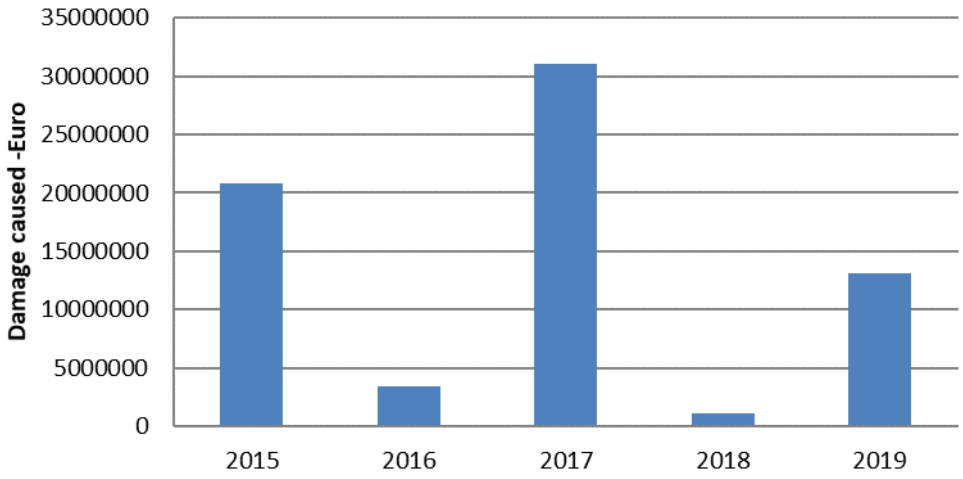

Figure 70 Damage caused by forest fires in the Republic of North Macedonia in the period 2015-2019

8.10.4. Indicator: GHG Emissions

8.10.4.1. Fact sheet

Author: *Ministry of Environment and Physical Planning*

Indicator Name: GHG Emissions
Lead Agency: Ministry of Environment and Physical Planning
Use and interpretation: **Key question(s) which indicator helps to answer** By analyzing the overall GHG emissions as well as GHG emissions per sector and by gas, information on the effectiveness on policies and measures for climate change mitigation can be assessed. **Use of indicator** The indicator shows the quantities of emissions by sources and removals by sinks of GHGs emitted to or removed from the atmosphere at national level. The emissions are presented by as total GHG emissions (CO_2 equivalent) and by gas. The indicator provides information on emissions in the following sectors: energy, industrial processes and product use, agriculture, forestry and other land use and waste **Scale of appropriate use** National scale in order to ensure comparability internationally and at regional level (i.e. Energy Community contracting parties, Southeast European countries, etc)
Potential for aggregation: Disaggregation at sectoral level. This enables identification of the key-sources and effective planning of mitigation polices and measures.
Meaning of upward or downward trends („good or bad") The targets are GHG emissions reductions, so decreased growth rates and downward trend will indicate effectiveness of the undertaken mitigation efforts.

Possible reasons for upward or downward trends: Upward trend would mean different things in different sectors, for example: more fossil fuels used for energy production or inefficient energy use in energy demand sectors (residentials, transport, industry, commercial and services), more fires or deforestation, not appropriate agricultural practices, not apprprite waste management etc.
Implications for biodiversity management of change in the indicator: Forest fires and land use change have impact on biodiversity and biodiversity lost
Units in which it is expressed: Gg (CO2, CH4 and N2O) and Gg CO2 eq
Description of source data: MoEPP, Biennial update reports
Calculation procedure: The inventory activities under the Third Biennial Update Report (TBUR) continue the work done in the previous BURs and include developing the GHG inventory for 2015 and 2016 in line with the IPCC 2006 Guidelines (and their Refinements from 2019). The latest version of IPCC Inventory Software (version 2.54 – from July 6, 2017) is used in this process.
Most effective forms of presentation: Tables and graphs
Limits to usefulness and accuracy: Activity data availability and lack of national emission factors. Higher tier methodologies are used wherever possible, particularly for key-sources in order to maintain satisfactory level of accuracy.
Updating the indicator: Data are produced for n-4, where n=current year. Every second year, for the period n-2 (for ex. In 2020 for the period up to 2016)
Closely related indicators • Forest fires • Land use change • Renewable electricity
Additional information and comments **www.klimatskipromeni.mk** **www.moepp.gov.mk**

8.10.4.2. Assessment of the indicator

The Republic of North Macedonia, as a Non-Annex I Party to the UNFCCC, has been developing Inventory of the anthropogenic emissions by sources and removals by sinks of GHGs emitted to or removed from the atmosphere since 2000 as a part of its National Communications on Climate Change and Biennial Update Reports. Up to now, three National Communications (2003, 2008 and 2014) and two Biennial Update Reports (2015 and 2018) have been delivered to the UNFCCC.

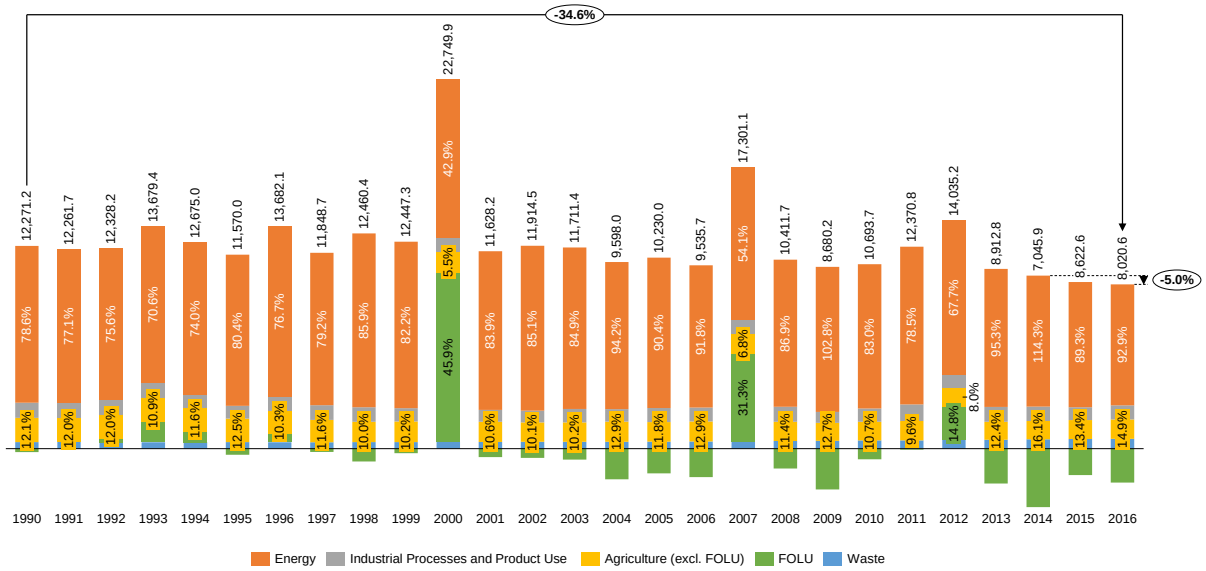

Figure 71. GHG emissions and removals by sector (in Gg CO2-eq)

The aggregate GHG emissions and removals (net emissions) in 2016 are estimated to 8,020 Gg CO_2-eq (including the FOLU sector). If the removals from FOLU sector are not accounted for, then the total GHG emissions in 2016 are 10,111 Gg CO_2-eq. The greatest share of emissions is from the Energy sector, accounting for 73.7% in 2016, followed by the Agriculture (excluding FOLU) with 11.8% and IPPU sector with 8.5% and Waste sector with 6% share. The dominant share of emissions for the Energy sector is evident throughout the whole time series. Excluding FOLU the emissions in 2016 are reduced by 19% competed to 1990.

It is evident that emissions/removals from FOLU sector (with impact on biodiversity) has an impact on the total GHG emissions. There are significant fluctuations in the net emissions in 2000, 2007, 2008 and 2012, where increased emissions can be noticed in the FOLU sector (instead of removals) as a result of the intensified forest fires/wildfires. The GHG emission in 2016 are reduced by 34.6% and 5% compared to 1990, and 2014 respectively. This is mainly result of reduced electricity production from lignite, fuels switch (residual fuel oil for electricity and heat production is replaced with natural gas), and lower industrial production especially after 2012.

Forestry sector is the major contributor of GHG sinks in North Macedonia within the Land subsector of AFOLU, with exception of several years when the amount of forest fires (burned areas) were significantly above the annual average. The area of forestland, the species composition (conifers, broadleaved, mixed), as well as the annual increment and removals from the forests are relatively stable. The estimated GHG sinks in this sector for 2015 is estimated on 1,608.31 Gg CO_2 eq and in 2016 2,120.65 Gg CO_2 eq.

The other land use like Cropland, Grassland, Settlements and Other land, participate in the emission of CO_2, and in some years can be considered as a significant source of emissions of this GHG. This emission is mainly result to the conversion of one to another category of land use, when significant amounts of above and below ground biomass is rapidly removed and is considered as a direct loss. For the other areas, which remains under same category of land use, gains and losses, are in balance (Tier 1) and are considered as carbon neutral.

8.10.5. Indicator: GHG Emissions from agriculture

8.10.5.1. Fact sheet

Authors: *Vjekoslav Tanaskovikj, Ordan Chukaliev* (Institute of Environment, Faculty of Agricultural Sciences and Food, Ss. Cyril and Methodius University)

Indicator Name: GHG Emissions from Agriculture
Lead Agency: Ministry of Environment and Physical Planning. Faculty of Agricultural Sciences and Food, Ss. Cyril and Methodius University, Skopje. Institute for Agriculture-Skopje.
Use and interpretation: **Key question(s) which indicator helps to answer** About one half of the N. Macedonia territory is Agricultural land. The climate change (CC) already affects the agricultural sector, but also agricultural sector contributes to the emission of the Green House Gasses (GHG). Agriculture is the biggest source of Methane and Nitrous oxide, and significantly contribute to the total emission of GHG in the country. The indicator will answer: • The amount of GHG emitted from the Agricultural sector and contribution of the sector to the total national emission; • Capacity of the scientific community in use of International Panel for Climate Change (IPCC) methodology and development of national emission factors based on continuous research and Tier used; • Capacities of the scientific community to assess the land use and land use changes in high resolution on national scale. **Use of indicator** • The indicator will contribute to the estimating effect of agriculture in total GHG emission and can be used in order to assess the intensity of research and capacity of the scientific community in North Macedonia as well as international cooperation. Moreover, this indicator should be used for: • Preparation of the Biennial Update Reports (BUR) to the United Nations Framework Convention on Climate Change (UNFCCC); • Preparation of the National Communications to the UNFCCC; • Development of Mitigation measures for Agricultural Subsector and monitoring of their effects. **Scale of appropriate use** This indicator can be used on national and international scale.
Potential for aggregation: This indicator can be aggregated with emission from the forestry sector and emission from the other land use changes and to be presented according to the IPCC approach of Agriculture, forestry and other land use sector (AFOLU). Moreover, all of subsectors of AFOLU should be presented and monitored.
Meaning of upward or downward trends („good or bad“) The positive trend (increase) of the GHG emission from agriculture means that agricultural sector is emitting more GHG in the atmosphere, and opposite negative trend means lower emission of the GHG. Therefore the good and bad approach is not really usable. More GHG can be increase agriculture production and shouldn't be considered as a bad.

Possible reasons for upward or downward trends:

Possible reasons for upward trends is increasing of emission of GHG while opposite downward trends is decreasing of emission of GHG from agriculture.The IPCC methodology used for calculating the indicator are based on national activation data (number of livestock, areas of grassland and cropland, land use changes from and/or to these two categories…) and emission factors that vary on type of land use change, management practices in livestock subsector, as well as in cropland and, grassland management etc.). Therefore, positive changes (increase) cannot be always considered as "bad". It is possible that changing of management practices will increase total emission, but if productivity increases in final can be less emission for a unit of product, that is finally considered as mitigation practice according the IPCC Assessment Report 5 (AR5). From the other hand if lowering the GHG emissions from agriculture will reduce productivity and production, higher emission per unit of product is possible. Other Land Use reason can be in increasing of number of livestock, changes in land use, changes in emission factors, changes in management practices, etc.

Implications for biodiversity management of change in the indicator:

The GHG emissions are important for agrobiodiversity, because some of practices for reducing the GHG emissions can be related to use of the domestic races and varieties, which sometimes can be more adapted to the local conditions, therefore produced with less GHG emissions. However the increased GHG emission will support the temperature rise and it can influence moving of the species on higher elevation and additional pressure to the natural environment for moving the agricultural production on higher elevated areas.

Units in which it is expressed:

Gg CO2 eq

Description of source data:

The activation data are based on national official statistic, as well as on Landsat/Sentinel satellite imagery analyses. The emission factors and management practices are used according the IPCC manuals, but there is need for development of national emission factors trough intensive research.

Calculation procedure:

The indicator is calculated according the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Agriculture, Forestry - https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html and 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Agriculture, Forestry and Other Land Use - https://www.ipcc-nggip.iges.or.jp/public/2019rf/vol4.html) as well as software developed by IPCC - IPCC Inventory Software - https://www.ipcc-nggip.iges.or.jp/software/index.html.

Most effective forms of presentation:

The best way to present the trends is to present by lines trends. This indicator is best to be presented in annual intervals.

Limits to usefulness and accuracy:

The indicator is based on the IPCC methodology and limits in accuracy are associated by the input data quality and availability. However, the accuracy of the output data will improve from shifting from Tier 1 calculation procedures to Tier 2 procedures. The indicatory is widely appreciated by international organizations, scientific society.

Updating the indicator:

The indicator should be updated annually, and historical series from 1990 should be developed

Closely related indicators

Additional information and comments

This indicator is periodically calculated an updated as part of the National communications to the UNFCC and as BUR to fulfill national reporting obligations to the UNFCCC. However, the consortia composed from 3 institutions of Ss. Cyril and Methodius University in Skopje (Institute of Agriculture, Faculty of Agricultural

Sciences and Food and Faculty for Forestry Sciences and Landscape Architecture "Hans Em") was established in 2019 in order to undertake responsibility for supporting the National reporting obligations on GHG inventory of the AFOLU sector.

8.10.5.2. Assessment of the indicator

The indicator is adapted from the Macedonian Second Biennial Update Report on Climate Change (SBUR) (2017). The SBUR according the positive IPCC methodology reports AFOLU as aggregation of several subsectors. The emissions from agriculture are extracted from the Table 31 entitled as "Emissions and sinks of GHG in AFOLU sector by categories in Gg CO_2-eq" (in Macedonian http://www.unfccc.org.mk/Default.aspx?LCID=246). The table presents GHG emission for the whole AFOLU sector, and emissions from Agriculture for the purpose of creating of this indicator are considered as aggregation of the:

- Livestock data,
- Agricultural land data as sum of cropland and grassland emission and
- Aggregate sources and non-CO2 emissions sources on land.

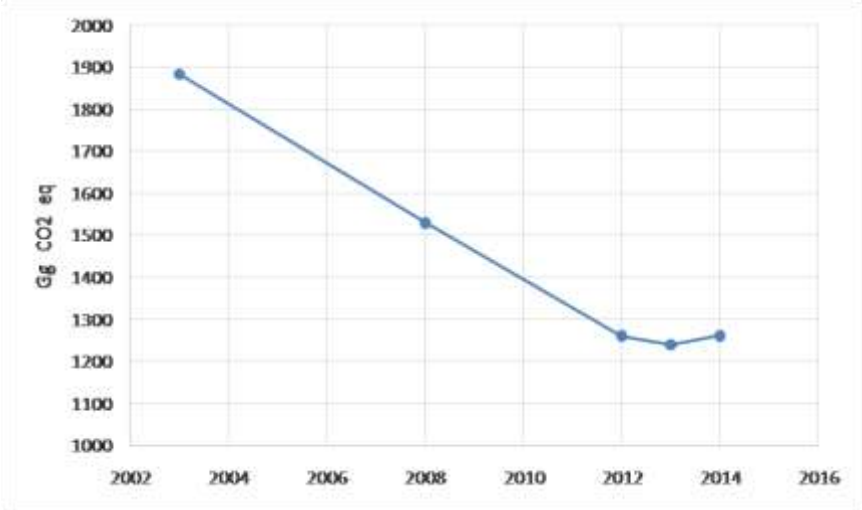

Figure 72 Emissions and sinks of GHG in Agriculture in Gg CO_2-eq for North Macedonia in the period 2003-2016

From the presented chart it is noticeable that the GHG emission from Agriculture is decreasing from the year 2003 to 2013 and later there is slight increase in year 2014. However, the Third BUR is in preparatory Stage and it will present period up to year 2016. Therefore, with each BUR the indicator will add 2 additional years of data. The source data for preparation of the graphical trend is presented in the Table bellow.

Table 31 Emissions and sinks of GHG in Agriculture by categories in Gg CO2-eq for North Macedonia in the period 2003-2016

	2003	2008	2012	2013	2014
AGRICULTURE	1882.4	1529.4	1260.2	1239.8	1260.6
Livestock	761.8	714.2	692.6	666.4	673.7
Agricultural land	810.8	457	240.8	250.6	258.7
Aggregate sources and non-CO_2 emissions sources on land	309.8	358.2	326.8	322.8	328.2

However the data present only 5 years, but the indicator will be further upgraded with the Third BUR, and consortium established for preparation of the GHG inventory and CC mitigation options for AFOLU sector will further upgrade the data for this indicator with idea to establish data series from year 1990 till last year available.

Figure 73 Introduced Climate Change mesures in agriculture

8.11. National target 10: Prevent loss, degradation and fragmentation of natural habitats of national and international importance

8.11.1. Indicator: Riparian Forest Quality (QBR)

8.11.1.1. Fact sheet

Authors: *Mitko Kostadinovski and Renata Ćušterevska (Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University)*

Indicator Name: Riparian Forest Quality (QBR)
Lead Agency: Institutions and persons qualified to perform the protocols: PMF - Institute of Biology
Use and interpretation: **Key question(s) which indicator helps to answer** Riparian vegetation is an important element of riparian habitats. In conservation practice today, many protocols are used to determine the degree of conservation of this type of habitats. The QBR index, which can be used to determine "high ecological status" (defined by the EC Water Framework Directive) of riparian habitats, can be used to establish an indicator of the status of these habitats. **Use of indicator** Changes in the ecological status of riparian vegetation, identified by the QBR protocol, can be used as an indicator of the status of this type of habitats, as well as the readiness of institutions to reduce the threats present to them. The protocol allows assessing the degree of conservation of vegetation structure and identifying the most significant direct threats to habitat - the degree of vegetation fragmentation, as well as the presence of non-indigenous species, different buildings and different types of waste. **Scale of appropriate use** The indicator is applicable to all river flows in Republic of N. Macedonia
Potential for aggregation: The QBR index, together with other protocols for estimating the conservation status of riparian habitats, it can be used to create an indicator of the conservation status of habitats.
Meaning of upward or downward trends („good or bad“) The establishment of regular monitoring practices with the help of this index enables relatively easy identification of the directions in which the status of the riparian forest of a river moves. Thus, the upward trend in monitoring results may speak of a functional society, aware of the importance of riparian vegetation. On the other hand, the downward trend could be a result of further disruption to the institutions responsible for monitoring threats.
Possible reasons for upward or downward trends: The positive trend of the results of monitoring can be the result of growing awareness and increased responsibility among the local population about the importance of coastal habitats, and / or improved functioning of institutions at local or national level. On the contrary, a downward trend would mean that some of the social factors (institutions, NGOs,

individuals ...) responsible for controlling threats are not at the required level.
Implications for biodiversity management of change in the indicator: Any changes identified by the indicator directly affect the management of riparian vegetation - the positive trend will require further development of the measures taken until then, while the negative trend should encourage a change in the existing strategy for protection and implementation of more appropriate activities.
Units in which it is expressed: The QBR results are expressed on a scale of four values (excellent, good, moderate, bad), which can refer to a whole river basin, or to separate water bodies or cuttings with riparian vegetation.
Description of source data: “Ecological monitoring in the River Bregalnica catchment” (2013 – 2014) http://www.moepp.gov.mk/wp-content/uploads/2015/01/RBMP_Bregalnica_Final.pdf
Calculation procedure: *(include appropriate methods and constraints for aggregation):* Determining the direction of the index is based on collecting data from SFI monitoring over a period of time considered as most appropriate.
Most effective forms of presentation: *(graph types, maps, narratives,etc.-give examples where possible):* Можат да се користат различни форми: опис, графички приказ, картирање, како и нивно комбинирано прикажување. Different forms can be used: description, graphic, mapping, and their combined display.
Limits to userfelness and accuracy: *(e.g. slow change in response to pressures, poor quality data, limited scope for updating)* The results of the protocol have a relative character and a fairly high degree of subjectivity. It is therefore advisable to make the measurement at least two estimators. In addition, in a short period of time, only more noticeable changes in the structure of the riparian forests can be registered.
Updating the indicator: *(how often? Whats is the process?)* It usually depends on the tasks of the project where the method is applied. Monitoring should be done once a year, or in bi-annual cycles.
Closely related indicators • Number of public awareness raising activities for biodiversity conservation • Number of sector development plans and policies incorporating biodiversity and ecosystem services • Changes in land use • Trends in the degree of conservation of essential ecosystems (waters, forests, marshes, riparian vegetation, grasslands) • Percentage of water bodies by water quality categories • Trends in the quantity and quality of municipal waste water discharged after treatment of the sources of pollution and population include in treatment plants
Additional information and comments

The QBR protocol is a relatively easy and economically viable method for monitoring the conservation status of riparian vegetation. The assessments made in the framework of the project “Ecological monitoring in the river Bregalnica catchment” (2013 - 2014) have created conditions for continuous monitoring of the state of riparian vegetation of this river in the future. The protocol can be applied to other rivers in North Macedonia without major problems.

8.11.1.2. Assessment of the indicator

The QBR index, in a simple and quick way is assessing the quality of the riparian vegetation and can be used for defining the "high ecological status" under EC Water Framework Directive. The index is based on four components of the riparian habitats: overall cover of riparian vegetation, structure and quality of cover, and eventual changes of the channel. It also considers the differences in the river geomorphology.

Referent habitats of riparian vegetation are characterized by well-preserved riparian forests, build of various native species, which extend continuously along the water flow and gradually merge with the adjacent natural vegetation, undisturbed with longitudinal or cross-bed structures or roads and other buildings nearby.

The values from the QBR index, in specific points are given in the presented Table and Figure. The QBR index in the first campaign ranges from 25 (bad) to 90 (good). High values of the index has been spotted on eight measuring places: SR 01 (QBR 90), SR 02 (QBR 90), SR 03 (QBR 85), SR 10 (QBR 90) SR 11 01 (QBR 80), SR 12 (QBR 80), SR 15 (QBR 90) and SR 17 (QBR 90). Low values of the index were recorded at the measuring points SR 04 (QBR 34), SR 06 (QBR 25), SR 18 (QBR 25) and SR 16 (QBR 35). The remaining measuring points are characterized by moderate values of the index (QBR 50-68).

The QBR index values for the second campaign ranges from 25 (bad) to 95 (high). Values that indicate high status index (QBR ≥ 95) were observed in SR 28 (Ravna Reka) and SR 29 (Brbusnica). Good status (QBR 70-90) characterized several measurement locations Bregalnitsa (SR 01, SR 02, SR 03, SR 09, SR 10), Ratevska (SR 11 01), Kamenicka (SR 14 01), Zrnovska (SR 15 01), Orizarska (SR 17 01), Kocanska (SR 18), Kriva Lakavica (SR 25 02), Madenska (SR 24 02) and Svetinikolska (SR 25 02).

Table 32 Values for QBR index by measuring points

Bregalnica SR 1	90	75
Bregalnica SR 2	90	70
Bregalnica SR 3	85	70
Bregalnica SR 4	34	35
Bregalnica SR 5	75	65
Bregalnica SR 6	25	50
Bregalnica SR 7	40	30
Bregalnica SR 8	40	60
Bregalnica SR 9	45	70
Bregalnica SR 10	90	90
Ratevska SR 01		80
Ratevska SR 02	85	55
Ravna Reka		95
Kamenica SR 01		70
Kamenica SR 02	65	65
Osojnica SR 01		60
Osojnica SR 02	25	25
Zrnovska SR 01	45	85
Zrnovska SR 02	35	40

Orizarska SR 01	90	85
Orizarska SR 02	70	40
Brbusnica		95
Kocanska SR 01		85
Kocanska SR 02	30	30
Zletovska SR 02	40	55
Kriva Lakavica SR 01		85
Kriva Lakavica SR 02	40	35
Madenska	70	80
Svetinikolska SR 2		75

Moderate status (QBR 55-70) was registered at the measuring points SR 05, SR 08 (both on Bregalnica), SR 12 (Ratevska), SR 14 02 (Kamenicka), SR 15 01 (Osojnicka), SR 20 02 (Zletovska), SR 25 02 (Madenska) and SR 25 02 (Svetinikolska). Poor status (QBR 30-50) was measured at SR 04, SR 06, SR 07 (Bregalnitsa), SR 16 02 (Zrnovska), SR 17 02 (Orizarska), SR 19 02 (Kocanska) and SR 24 (Kriva Lakavica). Bad status (QBR 25) was observed only at the measuring point 15 SR 02 (Osojnicka).

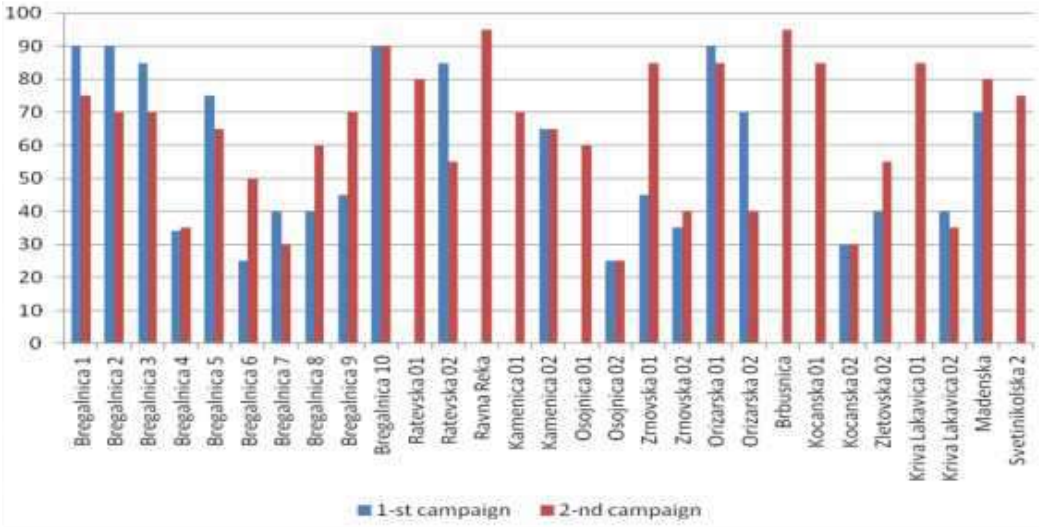

Figure 74 QBR index: values for measuring points from the both campaign.

The water bodies of Bregalnica are characterized by expressed diversity of the index values: bad (SR 06, the first campaign), poor (SR 04, SR 07, SR 08, SR 09 in the first, and SR 04, SR 06, SR 07 in the second campaign), moderate (SR 05 in the first, and SR 05, SR 08 in the second campaign) to good (SR 01, SR 02, SR 03, SR 10 in the first, and SR 01, SR 02, SR 03, SR 09, SR 10 in the second campaign).

The values for the two bodies of Ratevska River indicate different status in the two campaigns - the first good and moderate in the second campaign. Kamenicka River in upper part shows good status (72-74), and moderate in the lower reaches.

The status of IHF index in the upper reaches of rivers Osojnica, Zrnovska and Orizarska ranges from moderate to good and bad trends in the lower / poor (bad / poor). Notice that the index values are increasing in the upper parts of the rivers. This is confirmed by the values of the index Brbushnica, a tributary of Osojnica in its upper course, which also has high values (74) and good status.

Deviations of the QBR index values for individual water bodies were spotted in both of the campaigns, mainly due to the different locations of the measuring points. The water bodies of Bregalnitsa are characterized by good (SR 01, SR 10), good to moderate (SR 02, SR 03, SR 05), poor to moderate (SR 08, SR 09), poor (SR 04) and the bad/poor (SR 06) status. The upper flow of the tributaries (separated as distinct water bodies or parts of a water body) mostly have good status (SR

11 01, SR 14 01, SR 16 01, SR 18 01, SR 23 01), while the lower flows have mostly moderate (SR 12 02, SR 14, 02) or poor (SR 16 02, SR 17 02, SR 19 02, SR 20 02, SR 24 02), and in individual cases bad (SR 15 02) or good (SR 27 02). Ravna Reka and Brbushnica rivers are the only water bodies with high status index.

Figure 75 QBR index values for individual water bodies in both campaigns.

Bregalnica 1	Good	good
Bregalnica 2	Good	moderate
Bregalnica 3	Good	moderate
Bregalnica 4	Poor	poor
Bregalnica 5	Good	moderate
Bregalnica 6	Bad	poor
Bregalnica 7	poor	poor
Bregalnica 8	poor	moderate
Bregalnica 9	poor	moderate
Bregalnica 10	good	good
Ratevska 1		good
Ratevska 2	good	moderate
Ravna Reka		High
Kamenicka 1		moderate
Kamenicka 2	moderate	moderate
Osojnica		bad to moderate
Zrnovska	poor	poor to good
Orizarska	poor to good	poor to good
Brbushnica		High
Kocanska 1		Good
Kocanska 2	poor	Poor
Zletovska	poor	moderate
Kriva Lakavica 1		Good
Kriva Lakavica 2	poor	Poor
Madenska	moderate	Good
Svetinikolska		Good

The most common reason for the lower values of the QBR index are the low abundance of the tree species, low cover of the riparian vegetation, and the smaller or bigger presence of the no-native trees and shrubs species, which on several places are forming communities.

8.11.2. Case study: Revitalization of Riparian ecosystems

Author: *Svetlana Pejovic (MES)*

Water is one of the most important resources for the mankind and riparian forests have been under strong pressure for the last few decades. Continuous, intensive and unsustainable anthropogenic practices (use of riverbeds and surrounding areas for urbanization, sand excavation, infrastructure, economic activity, agriculture) often lead to partial or complete degradation of river ecosystems and surrounding habitats. Small dump sites are also an increasing threat for the riparian forest belts.

The riparian forest ecosystems are important for series of ecological processes and plays an important role in the metabolism of the river system: it naturally protects the riverbank from erosion, acts as a filter and purifies and reduces the impact of surface runoff waters. Littoral vegetation positively impacts the microclimate, contributes to the creation of meanders and

increases habitat complexity in the valleys. Riparian forests also have a unique value for supporting biological diversity, by providing suitable habitats and movement corridors for terrestrial species. Riparian forests are important bird nesting sites, but also serve as feeding grounds for migrating birds. The most developed riparian forests can be found on the middle and lower courses of the large rivers, that mainly flow in the lowlands.

In order to mitigate the negative consequences of degradation of river ecosystems, it is necessary to take measures to revitalize and restore the functionality of riparian habitats, which requires additional investment. Revitalization areas along the rivers should have the greatest contribution in improving the functionality of riparian habitats with the lowest revitalization costs without conflicting with the interests of the local population. In order to enable objective selection of priority areas for revitalization along the rivers, an initial assessment of the status of riparian habitats along the river should be made. Their conservation and proper and sustainable management are key to providing the above functions.

The second phase of the Nature Conservation Programme (NCP) started in 2017. This project is in coordination of Farmahem, financial support of SDC and supervision of Helvetas Swiss Intercooperation. It is implementing in cooperation with several national partner organizations. The regional and local emphasis of the NCP is put on the Bregalnica River Basin. One of the specific project objectives is the improvement of the status of the protected areas in the region. In that direction a specific component is related to the revitalization of riparian ecosystems which is under implementation in the lower flow of the river.

The main goal is to improve the status of the riparian zones and it is expected that by the end of 2020, when this project will end, an area of 6 ha to be reforested in the lower flow of Bregalnica River. This area is insignificant for the entire flow of Bregalnica, but if reforestation proves successful, it can be replicated elsewhere in North Macedonia. If this reforestation is successful, it is possible to obtain a new core area which will provide conditions for the return of some important wild species, but primarily it will help in regulation of lost ecosystem link. These activities will contribute to the improvement of the status of natural values in the Bregalnica region.

Identification of priority areas for revitalization

In order to enable objective selection of priority areas for revitalization along the lower Bregalnica River, an initial assessment of the status of riparian habitats (connectivity and riparian belt width) was made. A team of 5 national experts were actively working on identification of the methodology for reforestation and revitalization of degraded and fragmented areas.

For that purpose, the following steps were implemented:

- Update of all existing data on the riparian belt along the lower flow of Bregalnica River,
- Estimation of the width and continuity of the riparian belt along the lower flow of Bregalnica River,
- Analysis of land ownership and identification of potential plots/parcels for the reforestation,
- Visualizing the actual state of the riparian vegetation and correcting the aberrations made by the desktop analysis,
- Additional analysis of the initially allocated plots/parcels in order to distinguish those which by area and type of vegetation have the potential for revitalization,
- Determining the status and land use of the potential plot/parcel.

8.11.2.1. Assessment of the riparian vegetation condition

The total surface of riparian vegetation along the rivers in the Republic of North Macedonia is 61.55 km^2 (6154.4 ha) of which, 6.11 km^2 (611 ha) are representing the vegetation along the lower flow of River Bregalnica. Of these, about 133 ha are degraded, fragmented and open areas of which 75.31 ha are state-owned degraded areas, and about 18% of the degraded riparian belts are privately owned along the entire length of Lower Bregalnica. A 28.86 ha of the state-owned areas are under the concession of PE Water Management and the rest of the state-owned degraded sites is no-managed. The privately owned areas were mainly converted from forest to agricultural land for the purpose of growing cereals or crops. The total area they occupy is 7.7% or 57.6 ha.

Taking into consideration the fact that the lower part of the river is almost without any active population, the main factor that negatively affects the recovery of the riparian belts are local livestock farmers (cattle and sheep) that practice uncontrolled grazing especially in the parts along the river which are degraded and mostly transformed in meadows, pasture areas with a few shrubs. The cattle grazing is carried out without supervision of both private property and state-owned land.

The condition of the riparian belt was determined, more precisely the width and continuity of the riparian belt in the lower part of the river Bregalnica. The average width of the riparian forest zone was calculated as a percentage surface area of the riparian forest relative to the surface of 50 m and 150 m buffer around the river segment. Tree coverage of up to 10% is the lowest coverage, while percentage coverage of over 60% is highest. The continuity of the riparian forest zone was calculated according to the percentage ratio of the river segment intersected with the 5 m and 15 m buffer of the riparian forests.

The continuity (longitudinal connectivity) of the riparian vegetation was defined as the ratio of the lengths of the segments overlapped with the buffer of the riparian forests and the total length of the river segment.

The results showed that most of the riparian vegetation along the river Bregalnica is represented by riparian shrubs, wet habitats and high grasses (40%) which are almost evenly represented in the upper, middle and lower flow along the river Bregalnica.

Figure 76 Habitat types in the riparian forest belt along Bregalnica river

A significant part of the riparian vegetation along the river Bregalnica is represented by riparian forests (33%) which are most dominant in the upper and lower part of the river Bregalnica. A large proportion of the riverbank along the river Bregalnica accounts for significantly altered anthropogenic habitats (21%). Significantly altered anthropogenic habitats dominate where human presence is most noticeable and anthropogenic pressure is strongest in the middle part of the Bregalnica River. The lowest part of the riverbank along the river Bregalnica is meadows and pastures (6%).

In order to minimize the conflicts during the revitalization of the riparian areas, land ownership analysis was performed by using official digital data downloaded from the Real Estate Cadastre Agency of the Republic of North Macedonia (data processed using ArcGIS 10.2 software package).

Subsequently, based on the desktop analysis and initial plot/parcels selection, field surveys were conducted for identification of the actual status of the riparian vegetation and final selection of parcels for revitalization. Almost all potential forests have been visited in order to get acquainted with the terrain and the condition of the riparian vegetation.

Riparian vegetation structure

According to the findings, a significant part of the riparian vegetation in the lower part of the river is represented by riparian forests that are predominantly represented by white poplar and willow trees, with an evident presence of acacia as an indigenous species, riparian shrubs and grassy shrubs, but no presence of alder trees/or the presence of individual trees in some places. Significantly altered anthropogenic habitats dominate where human presence is most obvious (near populated areas).

It was evident that in most of the potential sites there is already natural succession and healing, so there is no need for further afforestation activities on such parcels. This is evident for the parcels that are near the already abandoned villages (Chereska, Jamularci, Testemeci). In almost all locations along the river, especially near populated areas, free grazing of livestock (cattle and sheep) was recorded, both on private and state-owned parcels.

Identification and selection of priority areas for revitalization

After determining the condition of the potential locations in the field, a selection of the most suitable plots/parcels was followed by using scoring criteria for the selection of afforestation sites. For minimizing conflict with local population, only state-owned parcels were taken into consideration.

For the scoring process, additional desktop analysis and necessary calculations were performed by the expert team. The exact coverage of the potential sites was calculated, as well as the lengths of access roads to each site, both asphalt and land. The size of the potential surface was particularly important, and areas with coverage below 0.2 ha were excluded from further evaluation. Larger parcels were taken into consideration because will establish better connectivity and strengthen the riparian habitat. The calculations for the financial-economic aspect indicate the amount of additional costs necessary to carry out the final afforestation activity, which will indicate whether the execution itself will require more or less financial and human resources. Scoring and analysis of potential sites resulted with the list of the most appropriate degraded areas for reforestation.

Seedlings production in nursery houses

In order of revitalization of riparian vegetation, it was necessary to provide autochthonic planting material originating from indigenous tree species that are naturally distributed around the riparian belt. For this purpose, trees with positive genotypic and phenotypic characteristics were identified and plant material was collected and transported to a nursery houses where quality seedlings were produced during a vegetative season. Direct planting of willow cuttings was also applied at certain favorable conditions. Cutting plant material was done before the vegetation season in the period November - March, and planting was at the end of the vegetative season, usually in November or December. Reforestation was conducted with bedding plants of white poplar (*Populus alba*) and willow species (*Salix alba* and *Salix fragilis*).

The main partner in the process of producing seedlings for afforestation were the nurseries of PE Macedonian Forests. Workshops were organized for involved nursery representatives where they were trained in the production of white poplar, withe and brittle willow seedlings. Nurseries were also provided with the equipment needed for seedling production.

No seedlings of these types of trees have been produced in North Macedonia so far. The process itself is very specific, requiring watering, constant supervision and care, and sufficient human resources that will constantly take care of them. The process does not require specific type of equipment and is common as in the production of all other tree species. Lack of sufficient workers taking care of the whole production process, irresponsibility and frivolity are the main reasons for the low percent of produced poplar and willow seedlings in the previous two years of project implementation.

Reforestation in riparian belt of lower flow of Bregalnica River

In 2018, 120 seedlings of these tree species were planted on an area of 0.58 hectares near the village Penush in the municipality of Stip. In 2019 on the territory of this municipality, 1650 seedlings were planted in three locations with a total area of 3.94 ha. In total in 2018 and 2019 an area of 4.52 hectares were reforested with 1770 seedlings.

For 2020, about 3000 poplar and willow cuttings were collected in a different sites along riparian forest belt of lower flow of Bregalnica, and transported to the different nurseries for additional care and production of reforestation trees.

8.11.3. Indicator: Shorezone Functionality Index (SFI)

8.11.3.1. Fact sheet

Authors: *Mitko Kostadinovski and Renata Ćušterevska (Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University)*

Indicator Name: Shorezone Functionality Index (SFI)
Lead Agency: Institutions and persons qualified to perform the protocols: PMF - Institute of Biology; Hydrobiological Institute
Use and interpretation: **Key question(s) which indicator helps to answer** Lake costal habitats are of great importance for the normal functioning of the lakes, so any disturbance to their functionality may adversely affect the ecological status of the lakes. The indicator is based on results obtained with the Shorezone Functionality Index (SFI), which measures the extent of coastal lakeside conservation. **Use of indicator** Longer-term monitoring of lake coastal habitats with the help of SFI can serve as an indicator of the anthropogenic disturbance rate of this type of habitat and point out major threats. At the same time, it will point to the power of institutions at the local and / or national level to deal with the threats that arise during the monitoring period. The SFI method allows to obtain a synthetic value for the functionality of lake costal habitats. The results

obtained by this method allow, in a short period of time and with relatively little means, to obtain an immediate general picture of the state of the entire coastline around the lakes. The results can also be used to easily identify locations and actions needed in potential restoration sites, protected area locations, locations of significant economic value, and so on. This enables the harmonization of environmental protection with human use of the lake, facilitating eco-sustainable city planning and water body management.

Scale of appropriate use

The indicator is applicable to all lakes in North Macedonia.

Potential for aggregation:

The indicator is based on hydromorphological and biological information on coastal habitats. It can be used in conjunction with other protocols to assess the ecological status of other components of the lake ecosystem.

Meaning of upward or downward trends („good or bad")

The upward trend in monitoring results may indicate positive changes in society regarding the treatment of lake shores in North Macedonia.

On the contrary, the downward trend would mean that the social factors responsible for controlling threats are not at the required level.

Possible reasons for upward or downward trends:

The positive trend in monitoring results may be a result of increased awareness and increased accountability of locals to the importance of coastal habitats, and / or improved functioning of institutions at local and national level.

On the contrary, the downward trend would mean that some of the social factors (institutions, NGOs, individuals ...) responsible for controlling threats are not at the required level.

Implications for biodiversity management of change in the indicator:

The SFI protocol provides the opportunity to identify the reasons for the changes in the status of the lake coastal zone that the indicator has identified and thereby enables possible corrective actions to be identified.

Units in which it is expressed:

SFI results are expressed on a scale of five values (excellent, good, moderate, not good, bad), which can refer to individual offshore or entire coastlines.

Description of source data:

Conservation and Sustainable Use of Biodiversity at Lakes Prespa, Ohrid and Shkodra/Skadar (CSBL) (2016)

https://www.researchgate.net/publication/326246732_SHOREZONE_FUNCTIONALITY_-_OHRID_LAKE_-_Implementing_the_EU_Water_Framework_Directive_in_South-Eastern_Europe

https://www.researchgate.net/publication/326265222_SHOREZONE_FUNCTIONALITY_-_LAKE_PRESPA_-_Implementing_the_EU_Water_Framework_Directive_in_South-Eastern_Europe

Calculation procedure:

(include appropriate methods and constraints for aggregation):

Determining the direction of the index is based on collecting data from SFI monitoring over a period of time considered most appropriate.

Most effective forms of presentation:

Different forms can be used to display the indicator: description, graphic, mapping, and their combined display.

Limits to userfelness and accuracy:

To follow the trend of this indicator it is necessary to provide well trained team and appropriate equipment. It is probably necessary to obtain a license to use the software.
Updating the indicator: It depends on the project tasks where the method is applied. It should be enough to monitor the situation once a year.
Closely related indicators • Number of public awareness raising activities for biodiversity conservation • Number of sector development plans and policies incorporating biodiversity and ecosystem services • Changes in land use • Trends in the degree of conservation of essential ecosystems (waters, forests, marshes, riparian vegetation, grasslands) • Percentage of water bodies by water quality categories • Trends in the quantity and quality of municipal wastewater discharged after purification from pollution sources and populations covered by treatment plants • Trends in the presence of indigenous species in Ohrid / Prespa
Additional information and comments The SFI protocol was used to assess the ecological status of the Ohrid and Prespa Lakes coastal zones, thus creating a basis for further monitoring of the state of this zone and establishing an indicator of the extent of its disturbance.

8.11.3.2. Assessment of the indicator

Prespa lake

In the Macedonian section of Macro Prespa Lake's shorezone, 27 stretches with a total length of 47.5 were identified. Four length classifications were also applied to these stretches: (1) shorter than 1,000 m, (2) between 1,000 and 2,000 m, (3) between 2,000 and 3,000 m and (4)greater than 3,000 m. The shortest stretch (no 10, the beach at Stenje village) is 337.30 metres long, while the longest (no 17, between Dolno Perovo and Asamati) extends 7,074.16 metres.

Table 33 Total number, length and percentage of length of sections with various SFI values (Prespa, Macedonian territory)

SFI value	No. of stretches identified	Total km	Percentage
1 – high	13	30.7	64.6
2 – good	4	7.2	15.2
3 – moderate	6	7.3	15.4
4 – poor	1	1.0	2.0
5 – bad	3	1.3	2.8
TOTAL	27	47.5	100.0

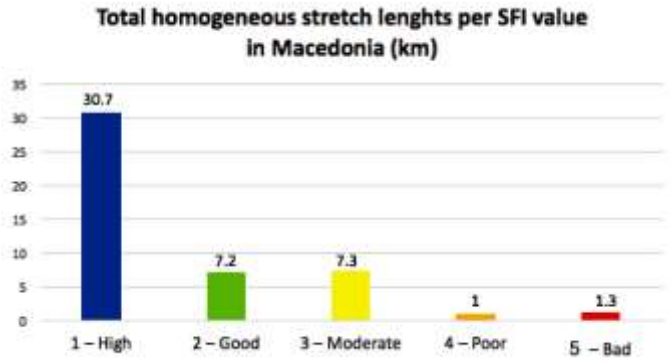

Figure 77 Total length (in metres) of homogenous stretches per SFI value on the Macedonian side of Macro Prespa

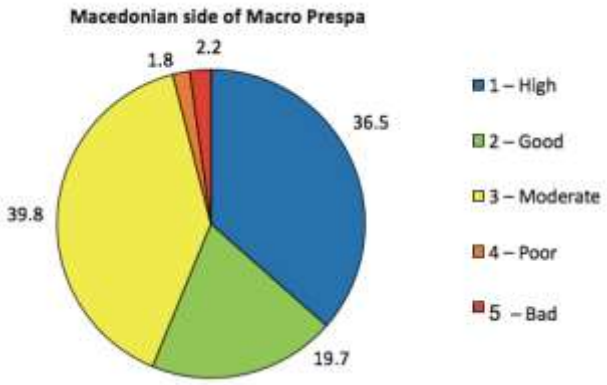

Figure 78 Percentages of the SFI values for the Macedonian side of Macro Prespa Lake

Classification of stretches according to their status

SFI category 1 – high

In North Macedonia, 13 stretches, together totaling 30.7 km (or 64.7% of the Macedonian shore), fall into the high category. Three of these are up to one kilometer long, seven are between one and two kilometers, two are between two and three kilometers, and three are longer than three kilometers. The average length of category 1 stretches is 2.1 km. Six of these stretches are located on the west coast, two on the north coast, and the remainder on the east coast. Seven stretches lie in areas of flatter shoreline and eight occupy fairly hilly areas. Interestingly, eight stretches are affected by very high anthropogenic pressures in their surrounding territory, while the other seven experience very low levels of human impact.

The stretches usually contain well-developed belts of vegetation that contribute to their functionality, and their reed belts are characterized by great structural stability. With the exception of three or four stretches, the reed belt is continuous, and in some places it is exceptionally wide (in the Ezerani wetlands area more than 400 meters). The belt of riparian vegetation is usually well developed in category 1 stretches (particularly stretches 21, 23, 25, 35, 36 and 41) but also tends to show a certain level of structural distortion (usually a greater or lesser level of interruption, dominance of shrubs, occurrence of exotic species, etc.).

SFI category 2 – good

Four stretches, together totaling 7.2 km (or 15.1% of the Macedonian shore), fall into the good category. The average length of these category 2 stretches is 2.1 km. The stretches on the west coast experience moderate levels of anthropogenic influence (in only one stretch is this influence absent), and the stretches on the east coast experience a fairly high level of anthropogenic pressure (from the combined impacts of agriculture and tourism). The riparian vegetation in category 2 stretches suffers from different degrees of structural disturbances (for example, limited width of functional vegetation, interruption of riparian vegetation). These disturbances are responsible for the decreased overall functionality.

Well-developed, continuous belts were recorded in only one stretch (no 30, between Stenje village and the Carina Resort). The other stretches contain regular interruptions.

SFI category 3 – moderate

Six stretches, together totaling 7.3 km or 11.7% of the Macedonian shore, fall into the moderate category. One is one kilometer long, two are between one and two kilometers long, and one is between two and three kilometers long. The average length of category 3 stretches is 1.4 km. They are all located on hilly land along the west coast that experiences minimal levels of human influence. The vegetation – both riparian and reeds – shows different degrees of disturbance. Interruptions in the functional shore zone are much more pronounced than in the two preceding categories and the percentage of bare land is much higher. The riparian vegetation mainly comprises bushes and shrubs.

SFI category 4 – poor

Only one stretch (no 22, 960 meters long) falls into the poor category. Anthropogenic pressure is the main reason for the disturbance identified here: the terrain has been heavily modified and the riparian vegetation removed to provide people with better access to the lake.

SFI category 5 – bad

Three stretches, together totaling 1.3 km or 2.7% of the Macedonian shore, fall into the bad category. All of them are shorter than one kilometer and their average length is 0.4 km. These stretches are small sections of lake shore that have been converted for use as beaches. One is located on the west coast (Stenje) and the other two lie on the east coast (Pretor and Slivnitsa). In these stretches, (natural) riparian vegetation is completely absent, as it has been removed to make way for tourism-related developments.

Conclusions

- The large majority of the Macedonian shore zone of Macro Prespa Lake has a high level of shore zone functionality.
- The stretches falling into the high category make up 64.7% of the overall Macedonian shoreline. They are fairly evenly distributed around the shores of HGM areas I, II and III, especially where the terrain is flatter.
- Counter-intuitively, category 1 stretches in HGM area II are found in areas where human pressure (pollution) is most intense.
- Category 5 stretches (bad) occupy the smallest area of the Macedonian shoreline: just 2.8%. The reason these stretches are categorized as bad is directly related to anthropogenic pressures and urbanization. Future plans to further extend urban areas should avoid deteriorating shorezones that are ecologically important.

- The number and length of the stretches is primarily determined by the topography: shores comprising flat terrain generally form longer homogenous stretches, whereas shores associated with more complex reliefs lead to definition of smaller stretches.

Management recommendations

Restoration and/or protection

- The main pathways of pollution of Macro Prespa Lake are its tributaries. For this reason, it is essential to:
    - fully implement measures to improve water quality proposed in the Prespa Lake Watershed Management Plan and
    - conduct a Fluvial Functionality Index (FFI) assessment of the four main rivers in the basin (Istočka Reka, Golema Reka, Kranska Reka and Kurbinska Reka), as these transport substantial amounts of nutrients and pesticides from apple orchards located along their courses.

Ohrid Lake

The Macedonian section of Ohrid Lake's shorezone was divided into 64 stretches, which were determined by assessing the different levels of human pressure exerted there and the presence of exotic and/or hygrophilous species.

Table 34 Total number, length and percentage of length of sections with various SFI values (Macedonian territory)

SFI value	# stretches identified	Total km	Percentage
1 - high	6	6.2	11
2 - good	9	9.4	16.8
3 - moderate	17	12.2	21.9
4 - poor	1	0.6	1.1
5 - bad	31	27.5	49.2
TOTAL	64	55.9	100

In all, 64 stretches totalling nearly 56 kilometres were identified during the study. The shortest stretch (no. 55 with 0.2 km) is the beach at Trpejca village, while the longest stretch (no. 57 with 3.7 km) is located between Trpejca bay and the village of Ljubanista.

The overall results (total length of homogenous stretches per SFI value and percentage of SFI values) are shown in the following Figure.

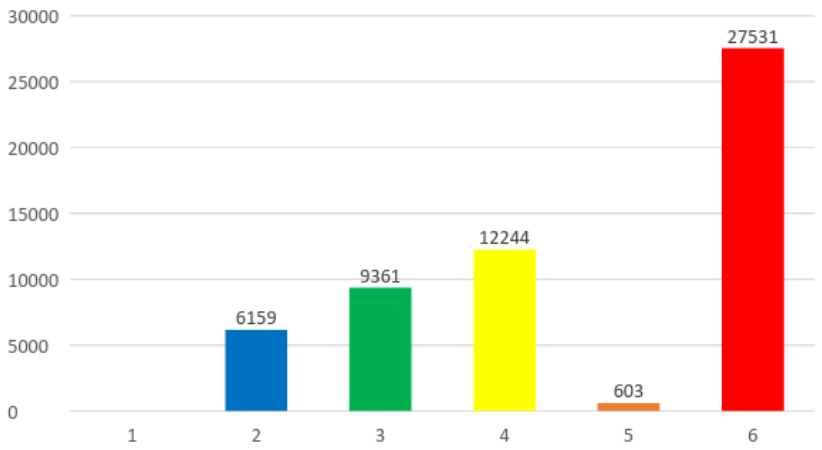

Figure 79 Total length (in metres) of homogenous stretches per SFI value on the Macedonian side of Ohrid Lake

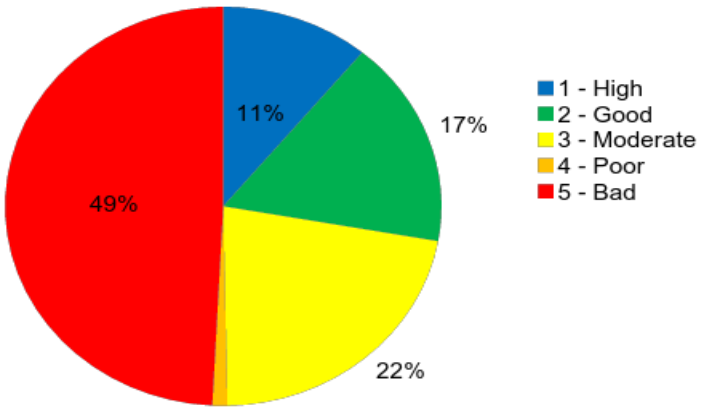

Figure 80 Percentages of the SFI values for the Macedonian side of Ohrid Lake

Classification of stretches according to their status

SFI category 1 – high

Six stretches fall into the high category and their combined length totals 6.2 km or 11% of the Macedonian shore. The average length of the stretches with this value is one kilometre. Five of the stretches lie along the east coast of the lake (mainly HGM area IV), most commonly within the Galitsica National Park. The other stretch is located on the west coast (HGM area I). In most of these stretches, riparian vegetation displays a certain level of disturbance. This is particularly true of the reed belt, which is only fully developed at stretch no. 22 (HGM area III, near the Andon Doukov resort). In the remaining stretches reeds are often completely absent or significantly degraded. The riparian vegetation for most high-status stretches comprises well-preserved diversified native riparian vegetation (usually present in 70% to 100% of the whole length of the stretch). The stretches are, however, short sections located between beaches and hotels. In the surrounding territory, fragments remain of the former, and probably far richer, riparian forest. Most of the stretches display moderate but continuous human influence, mainly owing to the presence of the tourism industry in the region. Only stretches no. 1 (Radožda on the border with Albania: SFI category 2 – good), no. 53 (cliffs north of Trpejca village) and no. 57 (cliffs along Mal Osoj – Little Osoj, part of Osoj hills – in Galitsica National Park) show no obvious signs of anthropogenic pressure.

SFI category 2 – good

Nine stretches, totaling 9.4 km in length or 16.8% of the Macedonian shore, fall into category 2. The average length of the stretches in this category is one kilometer. One stretch is located on hilly terrain on the west coast of the lake (HGM area I), three stretches on the northern shore (HGM area II), and the remaining five along the north-eastern shore (HGM area III). Most of the stretches are situated on flat or nearly flat land. All of these stretches contain well-developed riparian forest and reed belts. Stretch no. 7 (between Livadishte and Elen Kamen in HGM area I) has well-preserved riparian vegetation whereas, in the remaining stretches, native riparian vegetation is rare and of low diversity. The state of the reed belt is neither excellent nor poor, but comes somewhere between the two. There are, however, well-developed strips of reed between the villages of Kališta and Struga (HGM area III). It is important to note that, in most of these stretches, the reed belt is likely to deteriorate further, which will undoubtedly lead to the downgrading of their status.

SFI category 3 – moderate

A total of 17 stretches, with a total length of 12.2 km or 21.9% of the Macedonian shore, fall within the moderate category. The stretches in HGM area II (two stretches), HGM area III (five stretches) and HGM VI (two stretches) are situated in urbanized areas, and the four stretches in HGM area IV are experiencing moderate anthropogenic pressure. The absence of riparian vegetation in stretches 38, 50 and 52 is not caused by human activity but is in fact due to the local topography as these stretches contain cliffs which inhibit the development of hygrophilous vegetation. This is a classic example of situations where the naturalness of an area does not equate to a higher level of functionality. Anthropogenic impacts are absent in stretches with cliffs, but are moderate or significant in the other stretches in this category.

Reed belts are absent in almost all of the category 3 stretches, with the exception of stretch no. 40 located in Odmoraliste (HGM area IV) where reeds form around 50% of the riparian vegetation. Riparian vegetation is also relatively well developed in stretches 18 (HGM area III) and 48 (HGM area IV), whereas it is largely fragmented or completely absent in the remaining stretches.

SFI category 4 – poor

Only one stretch is classified as category 4. Located in Eleshec village (HGM area IV), it is 0.6 km long and constitutes 1.1% of the Macedonian shore. The stretch comprises a wide belt of reeds. However, the belt is largely disconnected from the terrestrial zone, which is barren and cut off in large part by a sustaining stone wall. Even though the terrestrial and the littoral zones are not connected, reeds are important as habitats for aquatic fauna.

SFI category 5 – bad

The most common category identified along the Macedonian shore is category 5 – bad. In all, 31 stretches totaling 27.5 km in length or 49.2 % of the whole Macedonian shore are classified as bad. The average length of these stretches is 0.8 km.

Category 5 stretches are found at points all the way round the lake's perimeter, and particularly in areas near or within the region's main cities and villages.

Good riparian vegetation cover (covering 60% of the area of homogeneous stretches) was registered in only two stretches: no. 2 near the Watchtower at Radožda and no. 8 lying between Ellen Kamen and Hotel Izgrev. In 17 other stretches riparian vegetation is either absent (nos. 3, 6, 13, 19, 25, 28, 32, 33, 35, 37, 39, 42, 43, 47, 54, 58 and 63) or present at very low coverage (0.05–0.30% cover).

Reed belts were hardly present. Poorly developed stands of reeds were recorded in three stretches only (no. 4 where reeds make up to 50% of the total vegetation of the stretch, no. 9 up to 15%, and

no. 10 up to 20%), while the remaining 30 bad-status stretches have no reed belt at all. Almost all the stretches are experiencing high levels of anthropogenic influence, which are most commonly artificially formed sand or masonry (concrete and stone) beaches, urban or rural docks, ports and roads.

Conclusions

- Ohrid Lake's coastal zone in North Macedonia is experiencing a high level of anthropogenic influence.
- In the majority of the stretches, disturbances in functionality are due to these anthropogenic influences (primarily related to tourism).
- Most of the stretches (31) fall into the bad category, and these constitute the majority of the shoreline (49%). The presence of these category 5 stretches in each HGM area are summarised in the table below:

Table 35 Assessment of the stretches according to SFI

I	16.25	9.72	59.8
II	7.23	3.57	49.4
III	13.38	5.96	44.5
IV	23.47	10.42	44.4
V	1.39	1.39	100.0
VI	5.87	2.52	42.9
VII	18.73	13.99	74.7

- Of the remaining 33 stretches, 23% are classified as either poor or moderate, and only 18% of the lake's perimeter has shorezone classified as either good or high functionality.
- Most of the stretches (45%) are shorter in length than one kilometer, 13 (20%) are between one and two kilometers' long, five (about 8%) between two and three kilometers', and only one (1.5%) exceeds three kilometers' in length.
- The impaired state of the lake's coastal zone is, among other factors, due to the fragmentation of riparian and reed vegetation. This process likely began a long time ago and has accelerated owing to continued and often unsustainable tourism development which is largely ignorant of the ecological importance of the lake.

Recommendations

In the Macedonian part of Ohrid Lake, high levels of human impact can be observed along the entire shoreline. Various measures to reduce the anthropogenic influence and to improve shorezone functionality are therefore required. These measures should focus on the following lines of action:

Restoration and/or protection

- Category 1 (high) stretches lacking official protection (5, 22, 53, 57 and 62) should be designated as protected areas in line with N.Macedonia's Law on Nature and Law on Water. Human activity must be forbidden in these stretches because of their high functionality.
- For category 2 (good) stretches (especially nos. 1, 7, 11, 14, 21, 24, 34, 36 and 60) and category 3 (moderate) stretches that are under slight anthropogenic influence (nos. 12, 16, 17, 18, 20, 27, 29, 31, 32, 38, 40, 48, 50, 51, 55, 59 and 61) it is recommended to:
    - monitor these stretches for changes in shorezone functionality;

- ensure that future human activities are limited and ecologically friendly;
- enhance or restore riparian and helophyte vegetation within and around the zone;
- replace non-native with autochthonous hydrophilic tree species;
- restore abandoned construction or industrial sites and
- revise the legal basis of the newly defined tourism development zones.

Planning and further research

- Given UNESCO's recognition of Ohrid Lake and its surroundings, a significant number of plans and projects have been proposed to protect the area's natural and cultural heritage (see 3.4.1, Planning and further research). The implementation of all these plans will contribute to enhancing the status of the lake's shorezone, and the reports produced as part of these initiatives can be used to inform the future planning of the lake.
- Rivers are significant sources of the pollution that ends up in the lake, as they collect large quantities of pollutants and nutrients from agricultural fields. It is therefore recommended to carry out a project to define the Fluvial Functionality Index for the lake's four main tributaries: the Sateska, Koselska, Grasnica and Çerava rivers (shared by North Macedonia and Albania).
- • It is important to harmonized or align the SFI with the watershed management plan that will be produced for Ohrid Lake (see 3.4.1, Planning and further research).

Infrastructure measures

- Appropriate wastewater collection and treatment facilities should be restored and/or installed in the urban centers of Struga and Ohrid.

8.11.4. Case study: Rehabilitation and Improvement of the state road A2, section Kriva Palanka-Deve Bair (aspect of mammals in a biocorridor)

Author: *Saska Bogdanova Ajceva*

The European Bank for Reconstruction and Development (EBRD) is providing supporting loan to the Public Enterprise for State Roads (PESR) to finance the construction works for the rehabilitation and improvement of a single two-lane carriageway road section, 13.5 km in length, between Kriva Palanka and Deve Bair near the Bulgarian border which is part of the eastern section of the Pan-European Road Corridor VIII. EBRD conducted an Environmental & Social (E&S) Due Diligence Assessment (ESDD) of the Project against applicable EBRD Performance Requirements. The Environmental Assessment Report (EAR) has identified a need to undertake additional biodiversity surveys prior to construction. As a response to this gap, EBRD commissioned a rapid biodiversity assessment (RBA) that included review of available data and rapid biodiversity surveys on specific locations along the route. TNear the border crossing Deve Bair a linear bio-corridor was defined which connects the core area of the Osogovo Mountains with the area for revitalization of Kozjak/German/Bilina Planina with total surface area of 3998 ha. This bio-corridor refers to fauna representatives of large mammals, and it has been defined within the Project for development of national ecological network in the Republic of North Macedonia (MAK-NEN) implemented by the Macedonian Ecological Society (MES) and the ECNC – European Centre for Nature Conservation in cooperation with the Ministry of environment and spatial planning.

Figure 81 Boundaries of the linear bio-corridor Osogovo-Bilina Planina. (Marked location of the subject location)

The linear corridor Osogovo-Bilina Planina spans in direction South-North from the northern slopes of the Osogovo Mountains, in the area of the villages of Krklja and Uzem, along the road of the border crossing Deve Bair to the Bilina Planina in the area of the villages of Kiselica and Trnovo. This linear corridor should provide the main connection between the large carnivores population from the territory of the Osogovo Monuntains to the mountain areas along the north border of the Republic of North Macedonia, especially Billina Planina. It is a part of the wider corridor from the Pan-European ecological network of south-east Europe.

During the assessment, the presence of 18-20 species of mammals was confirmed. The number of species varies as some of the bat species cannot be identified to species level based on the call parameters. The most common mammalian species in this area are red fox, stone marten, and brown hare from the large mammals group, and common noctule and Kuhl's/Nathusius's pipistrelle. There is a wolf pack of a minimum of 4 individuals registered in the area of Deve Bair - Toranica mine. Old spraints of otter were registered at 3 sites: under the smaller bridge leading to the restaurant in the village of Zhidilovo, under the bridge planned for rehabilitation in the village of Zhidilovo and at the confluence of the Kiselichka Reka and the Kriva Reka. Presence of otter in the area of interest for this project gives it priority biodiversity status. However, it is assumed that measures that will be undertaken during construction works and road operation to prevent damages of river and riparian habitats will contribute for maintaining otter population as well. The complete list of all recorded mammalian species is presented in the following Table.

Table 36 List of all mammal species recorded during the assessment

1	Eulipotyphla	*Erinaceus roumanicus*	LC		
2	Rodentia	*Apodemus sp.*	LC		
3	Rodentia	*Sciurus vulgaris*	LC		Strictly protected
4	Lagomorpha	*Lepus europaeus*	LC		
5	Carnivora	*Martes foina*	LC		
6	Carnivora	*Meles meles*	LC		Strictly protected
7	Carnivora	*Lutra lutra*	NT	Annex II&IV	Strictly

8	Carnivora	*Felis silvestris*	LC	Annex IV		protected Strictly protected
9	Carnivora	*Vulpes vulpes*	LC			
10	Carnivora	*Canis lupus*	LC	Annex II, IV & V		
11	Cetartiodactyla	*Capreolus capreolus*	LC			
12	Cetartiodactyla	*Sus scrofa*	LC			
13	Chiroptera	*Pipistrellus pipistrellus*	LC	Annex IV	Appendix II	
14	Chiroptera	*Pipistrellus kuhlii*	LC	Annex IV	Appendix II	
15	Chiroptera	*Pipistrellus nathusii*	LC	Annex IV	Appendix II	
16	Chiroptera	*Hypsugo savii*	LC	Annex IV	Appendix II	
17	Chiroptera	*Eptesicus serotinus*	LC	Annex IV	Appendix II	
18	Chiroptera	*Myotis myotis*	LC	Annex II&IV	Appendix II	
19	Chiroptera	*Myotis blythii*	LC	Annex II&IV	Appendix II	
20	Chiroptera	*Nyctalus noctula*	LC	Annex IV	Appendix II	

According to the criteria, the most important and priority species are the otter (*Lutra lutra*), greater mouse-eared bat (Myotis myotis) and the lesser mouse-eared bat (*Myotis blythii*). Wolf (*Canis lupus*) should also be mentioned as it is a priority species on European level listed in Annex II, IV and V of the Habitats Directive. The presence and distribution of these species should be considered when planning and performing the road rehabilitation activities or any other activity that will have larger or smaller negative impact on the species or their habitats, since these species represent PBF of the affected area.

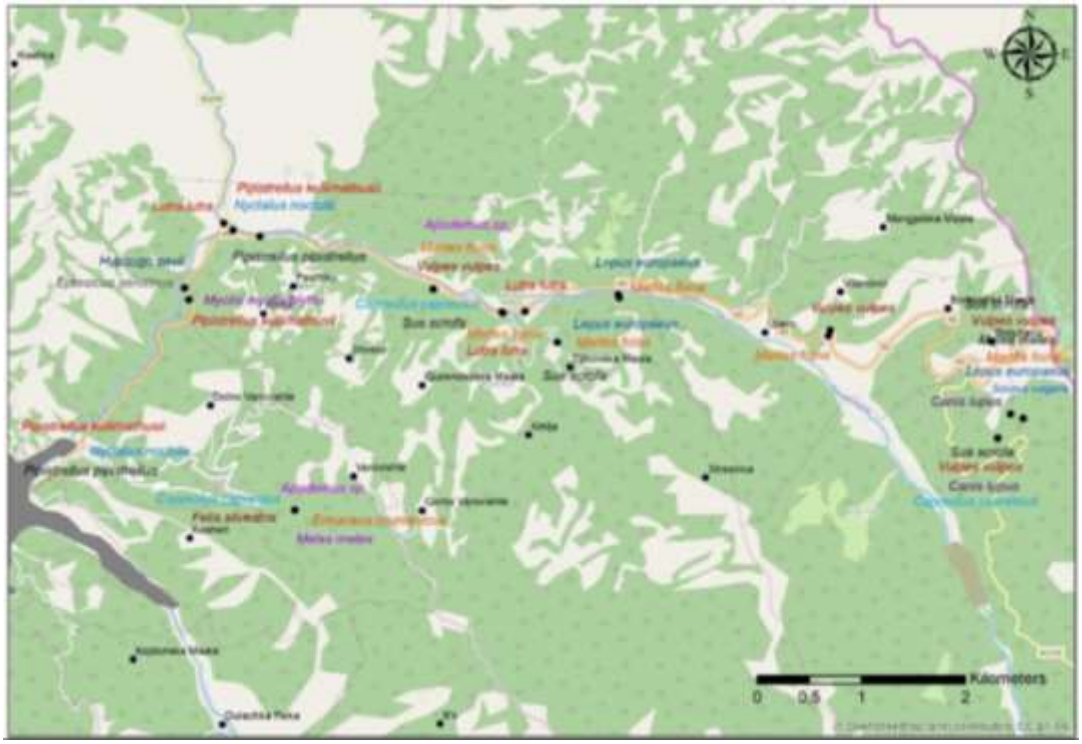

Figure 82 Locations of all mammalian species found during the assessment

In general, any major impact on the populations of the mammal species found in the area planned for road rehabilitation is not expected, and the most significant negative impact should be expected for the otter. Considering the two priority bat species, greater and lesser mouse-eared bat, no major negative impacts on them or their habitat are expected, as they were registered in the section of the road where no intensive work is planned.

The existing A2 road has been already identified as a barrier that bisects the linear corridor Deve Bair. Although there are six possible crossing points for the large mammals, there is no evidence that they are used by the animals. This corridor should provide the main connection between populations of large carnivores from the mountains Osogovski Planini to the mountains at the northern border, specifically the mountain Bilina Planina. The planned road widening and bridge reconstruction works will additionally affect the corridor. There will be increased disturbance caused by the construction works and the increased presence of humans and machinery, especially on the existing crossing points. Thus, the animals might avoid presence and crossing at these sites.

The most affected mammal species is the otter. The destruction of the habitats, potential resting and feeding places and holts, as well as the pollution of the water and decrease of prey species may have significant negative impact on the scarce otter population. This mainly refers to the sections of the road from the junction to the village of Kiselica up to the village of Zhidilovo, at the sites where bridge rehabilitation and construction of new 4 bridges are planned. The assessment also showed that there is already negative impact on the otter caused by the small hydropower plant construction. Hence, the cumulative effect both from the penstock construction and road rehabilitation will be unfavourable for the otter. For sure, it is not possible to exclude otter from the construction site. But, adequate mitigation measures will ensure that impacts on watercourses are limited during the construction phase and the severance of the otter population resulting from the road scheme is only temporary.

To avoid or minimalize the negative impact, especially on the otter population, the following mitigation measures are recommended:

- Avoid or minimize works on or near the water body and known otter habitat,
- Envisage a buffer zone along the river,
- Avoid night works,
- Restoration of the riparian vegetation cover,
- Avoid or minimize the pollution of water during the construction phase,
- Regular monitoring on otter presence during construction and three years after the start of the road operation to determine the success of the mitigation measures.

8.12. 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

8.12.1. Indicator: Trend in the number and surface of protected areas by category (% in relation to total area of the country)

8.12.1.1. Fact sheet

Author: *Ministry of Environment and Physical Planning*

Indicator Name: Trend in the number and surface of protected areas by category (% in relation to total area of the country)
Lead Agency: Ministry of Environment and Physical Planning (MoEPP)
Use and interpretation: **Key question(s) which indicator helps to answer** Protected areas as part of as part of the national natural heritage and international ecological networks represent an important tool for the protection of biodiversity. Proper management of protected areas contributes to a favorable conservation status of the habitats and species. Key question for this indicator is what is the trend of number and surface of national protected areas. National targets for protected areas are included in the Biodiversity Strategy and Action Plan (2018-2023), National Strategy for Nature Protection with Action Plan (2017-2027) and Spatial Plan of the Republic of North Macedonia (2004). Also, National Action Plan for implementing the Programme of Work on Protected Areas of the CBD was developed (2012). The action plan covers protected areas activities for the period 2015- 2017. The Sectoral Study for the Protection of Natural Heritage for the Period until 2020 stipulates an increase of the percentage of protected areas of the current around 9% to 11.5% of the territory of the Republic of North Macedonia. Aichi Global Target 11 of the Convention on Biological Diversity regarding protected areas is incorporated in the Action Plan of the Biodiversity Protection Strategy (in the phase of adoption). In line with this target, it is proposed that the area of protected areas be increased to 15%, ensure their functional connectivity as an ecological network and establish effective management of protected areas in cooperation with local communities. **Use of indicator** The indicator can be used in order to implementation the national policy for protected areas and conservation of biodiversity. The indicator is a a very useful tool for monitoring of implementation of CBD Aichi targets, as well the

objectives, measures and actions for conservation and protection of biodiversity according to National Biodiversity Strategy and Action Plan (2018-2023) and National Strategy for Nature Protection with an Action Plan (2017-2027).

The indicator can be used to monitor the implementation of the EU Habitats and Birds Directive. especially for Natura 2000 and preparation of national reports on international conventions for nature conservation (CBD, Bern, CITES, Bonn, UNESCO, Ramsar, etc.

The indicator can also be used for activities to related transboundary protected areas (Ohrid-Prespa Transboundary Biosphere Reserve-UNESCO, Prespa Park, Green Belt initiative within IUCN, etc.)

Scale of appropriate use

National and international scale.

Potential for aggregation:

The indicator is complex and encompasses parametars as a trend in the number of protected areas, total area coverage of protected areas, area of protected areas by category of protection, share of individual national categories of protected areas in the overall territory of the country.

Meaning of upward or downward trends („good or bad")

Positive trend in the number and surface of protected areas by category (% in relation to total area of the country) would be expected in the coming years. It is directly related to the valorisation/ revalorisation of nature values, process of proclamation and reproclamation of protected areas, institutional capacities for management and finance of protected areas.

Possible reasons for upward or downward trends:

In practice, process of proclamation of protected areas requires involvement of all stakeholders (relevant sectors and each individual). The process of proclamation of protected areas involves different stakeholders who often have different interest and views. Compliance with all stakeholders, as well as the provision of a suitable protected area management entity that has the financial resources and human resources, are major challenges that can slow down the process of declaring a protected areas.

In order to ensure a positive trend, it is necessary to speed up the process of proclamation or re-proclaiming protected areas. Simplifying the procedure for proclamation according to Law of Nature Protection and reducing certain requirements of the Study for the Valorization or Revalorization of a Protected Area, as well as determining the primary purposes of protection for each category of protected area and appropriate zoning in accordance with the IUCN criteria are the key priority tasks to ensure positive trend.

Implications for biodiversity management of change in the indicator:

Increase the % of protcted areas at national level will be benefit for biodiversity. Also, it will be enable improve the national policy for nature conservation trought implementation of measures and activities for protection, conservation and sustainable use of biodiversity.

Negative change in the indicator will lead to some challenges as inability to respond to nature protection requirements from Law of nature Protection, ratified international nature protection documents and EU Habitats and Birds Directives.

Units in which it is expressed:

Number of sites, ha, km2 and %.

Description of source data:

Relevant data sources in MoEPP:

Environmental indicators reports, CDDA data for protected areas, Cadastre of protected areas, Emerald database, Natura database, National Information System for Nature, studies for valorization/revalorization of protected areas, management plans for protected areas, reports as obligation from international conventions (CBD, Ramsar, Bern, UNESKO, etc), EEA reports, reports of other projects related to protected areas and nature conservation, annual reports for realized activities of Nature Sector including the progress in proclamation of protected areas, Laws of proclamation/reproclamation of protected areas etc.

Calculation procedure:

Review of relevant documentation: CDDA data for protected areas, Emerald database, Natura 2000 database, National Information System for Nature, Recommendations by EEA , etc.

Most effective forms of presentation:

The best way to present the trends is narrative explanations, graphes and tables.

Limits to userfelness and accuracy:

The limitis in the increase of number and surface of protected areas at national level is regarding of lack of financial and human resources and complex process of proclamation of protected areas.

There is no national GIS database for the all protected areas.

Updating the indicator:

The indicator should be followed in period od one year. It is related to conducting a procedure for valorisation/revalorisation of protected areas and conducting a procedure for proclamation protected areas in accordance with the Law on Nature Protection.

The indicator can be easily monitored by MoEPP, national parks and other protected area management bodies

Closely related indicators

This indicator is associated with following indicators as well:

- Trends for adopted protected area management plans,
- Number of transboundary protected areas (with area),
- Trends in areas of identified potential Natura 2000 areas,
- Trend of Protected Areas management efficiency (METT index),
- Provided funds for protected areas,
- Capacity building
- Trends in the number of key species and habitats monitored in protected areas and ecological networks,
- Number of protocols developed to monitor key species and habitats,
- Trend of populations of key conservation species,
- Trends in the degree of conservation of essential ecosystems (waters, forests, marshes, riparian vegetation, grasslands),
- Establishment of ecosystem services and PES case study,

- Number of public awareness raising activities for biodiversity conserv etc.

Additional information and comments

Continuously collecting data, monitor and preparation this indicator is needed.
Is needed regularly updating data for protected areas in National Information System for Nature and in international networks for protected areas as World Database on Protected Areas (WDPA).
Indicator can help to improve of transboundary cooperation in the field of nature/biodiversity conservation and management.

Relevant national planning documents

Spatial Plan of the Republic of N.Macedonia (2002-2020). http://app.gov.mk/PP-na-RM-2002-2020.pdf
National Biodiversity Strategy with Action Plan for period (2018-2023)- MoEPP, 2018. http://www.moepp.gov.mk/STRATEGIJA_BIOLOSKA_RAZNOVIDNOST
National Strategy for Nature Protection with Action Plan (2017-2027) - MoEPP 2018
http://www.moepp.gov.mk/National Strategy for Nature Protection with Action Plan
Environmental Indicator Report (MoEPP, 2018). http://www.moepp.gov.mk/ IndikatorskiIzvestaj2018_MK.pdf
Environmental Indicator Report (MoEPP, 2016). http://www.moepp.gov.mk/ Indikatori2016_MK.pdf
Environmental Indicator Report (MoEPP, 2014).
MEPP (2012). Action Plan for Implementing the Programme of Work on Protected Areas of the Convention on Biological Diversity. https://www.cbd.int/protected/implementation/actionplans/country/?country=mk
Law of Nature Protection ("Official Gazette" No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16). http://www.moepp.gov.mk/
Total area of designated areas. http://www.moepp.gov.mk/CSI_Biodiverzitet_008_g1_2018EN.jpg
Area of protected/designated areas by category of conservation. http://www.moepp.gov.mk/CSI_Biodiverzitet_008_g2_2018EN.jpg
Share of individual national categories of designated areas in the overall territory of the Republic of North Macedonia. http://www.moepp.gov.mk/Biodiverzitet_008_g3_2018EN

8.12.1.2. Assessment of the indicator

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

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

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

By proclaiming the protected area, it acquires the status of natural heritage. With the adoption of the Law on Nature Protection in 2004, a new categorization of protected areas was adopted in accordance with the criteria of the World Union for Conservation of Nature (IUCN), enabling inclusion of national protected areas in the worldwide network of protected areas.

For the purpose of determining the real situation and providing an expert basis for the preparation of the act proclaiming protected areas, a Study for the Valorization or Revalorization of a Protected Area is being prepared. The preparation of the study is required by law and is the basis for initiating a procedure for proclaiming a protected area. The content and the chapters of the study are prescribed in accordance with the bylaw - Rulebook on the Content of the Study of Valorization or Revalorization of a Protected Area ("Official Gazette of RM" No. 26/12).

This indicator is showing the trends in the:

- Number of protected areas,
- Total area of protected areas,
- Area of protected areas by category of conservation,
- Share of individual national categories of protected areas in the overall territory of the country

Official data for the indicator in the overall territory of the country until to 2017 were published in the last Environmental indicator report (2018).

The new data of protected areas will be reported in the CDDA database for protected areas (2020).

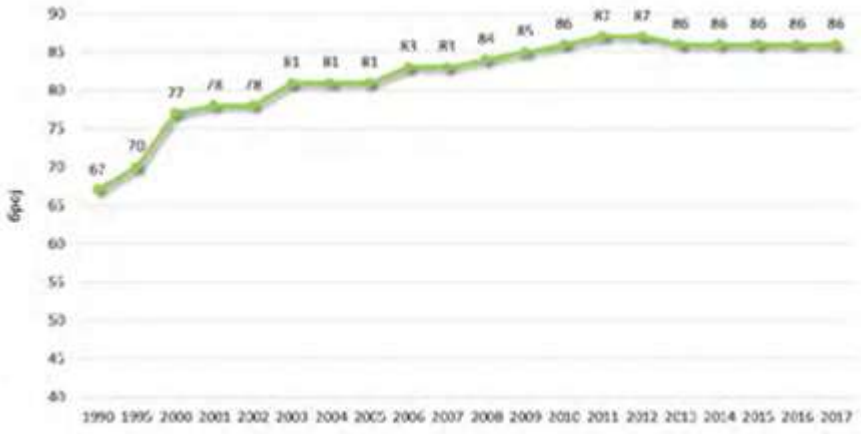

Figure 83 Total number of protected areas

According to Environmental indicators reports (2014,2016,2018 MoEPP) beginning in 1948, when due to the exquisite beauties of nature, the historic and scientific importance of forests and forest landscapes, part of the Pelister Mountain was proclaimed as a national park, which at the same time is the first protected natural resource in the country; continuing with the proclamation of forest landscapes around the Mavrovo Lake as a national park (1949) and the proclamation of Mount Galichica as a national park (1958); encompassing the period before and after the adoption of the Law on Nature Protection, the number of protected areas is increasing at the national level.

Graphe 1 shows trend of increasing the total number of protected areas for the period 1990-2017. In the period 2013-2017 trend of the number of protected area is not change, so number of protected areas are 86.

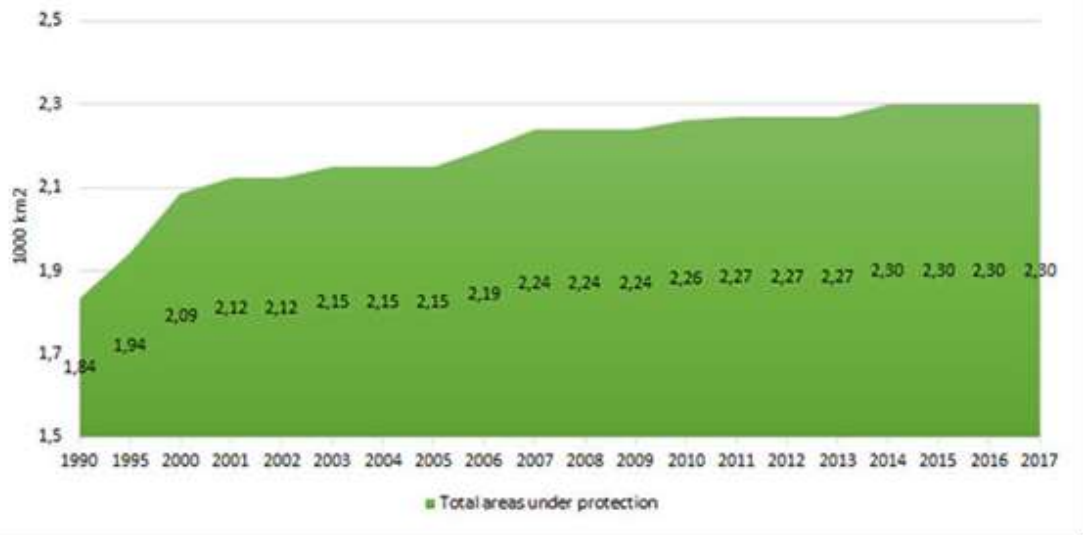

Figure 84 Total area of protected areas

The following Figures shows trend of increasing of total area of protected areas in km^2. In the period of 2014-2017 is not registered change for trend of total area of protected areas at national level.

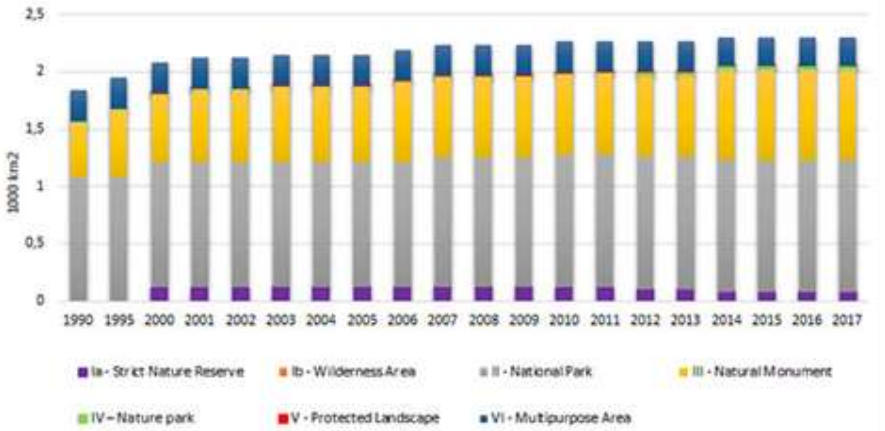

Figure 85 Area of protected areas by category of conservation

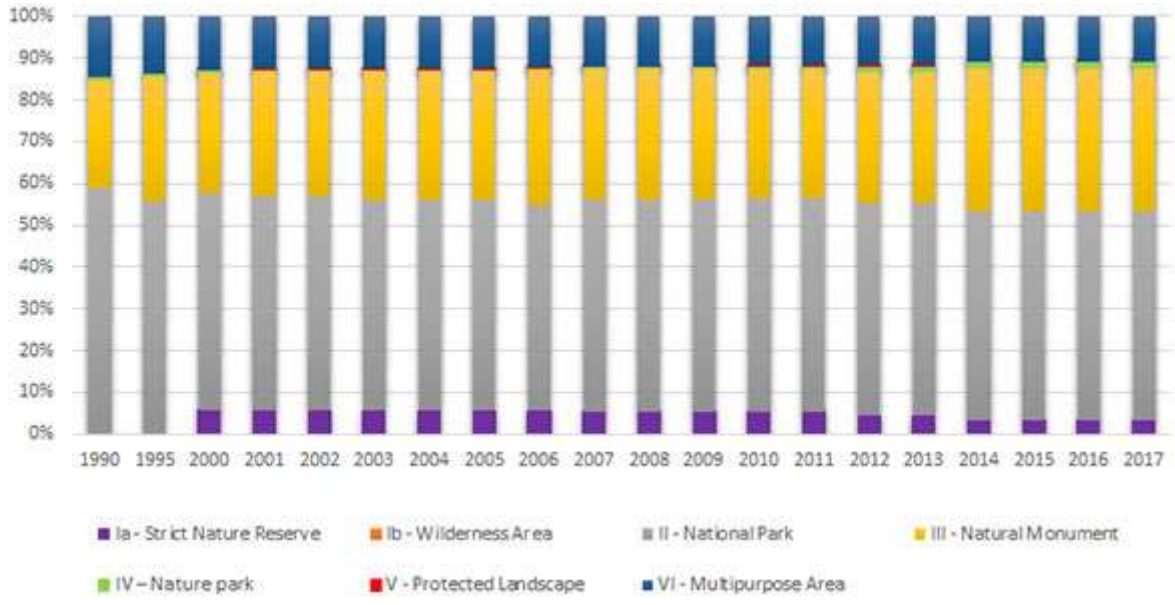

Figure 86 Share of individual national categories of protected areas in the overall territory of the country

Table 37 Number of protected areas by categories of protection

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: Nature Park	12	3045	0,12
V: Protected Landscape	1	108	0,004
VI: Multipurpose Area	1	25305	0,9
TOTAL	**86**	**230083**	**8,9**

Source: National Strategy for Nature Protection with Action Plan (2017-2027) - MoEPP, 2018

According to graph 3-Area of protected areas by category of conservation and 4 graph-Share of individual national categories of protected areas in the overall territory of the country, National network of protected areas cover about of 230.083 ha or 8.9 % of the national territory.

They are represented with national parks (4.48% of the national territory), monuments of nature (3.0 of the national territory) and other categories of protected areas (1.4 %. of the national territory).

At present, the first four categories of protected area (strict nature reserve, national park, monument of nature and park of nature) have been established in the country and there is only one multi-purpose area (Jasen), while 1b category of protected area-Wilderness Area has not been established yet.

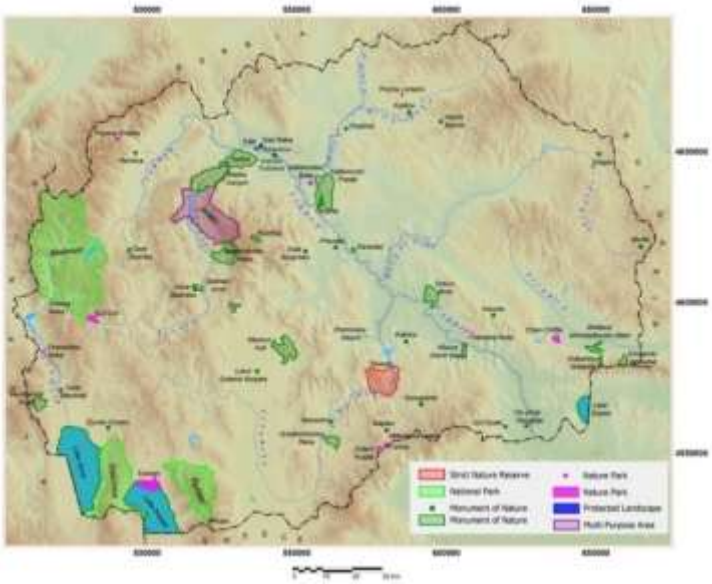

Figure 87 Distribution of protected areas (without individual plants). Source: National Strategy for Nature Protection with Action Plan (2017-2027) (MoEPP, 2018)

8.12.2. Inndicator: Trends for adopted protected area management plans

8.12.2.1. Fact sheet

Author: *Ministry of Environment and Physical Planning*

Indicator Name: Trends for adopted protected area management plans

Lead Agency: Ministry of Environment and Physical Planning (MoEPP)

Use and interpretation:

Key question(s) which indicator helps to answer

Key question for this indicator is what is the trends in adopted protected area management plans according to national legislation.

Measures and activities prescribed with the management plan give directions to the management body for effective conservation of biodiversity and sustainable use of resources providing benefits to the local population. Developed and adopted management plan is a first step towards effective management of PA.

National targets for management of protected areas are included in Law on Nature Protection ("Official Gazette " No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16), Biodiversity Strategy and Action Plan (2018-2023) and National Strategy for Nature Protection with Action Plan (2017-2027).

According to Law of Nature Protection for the purpose of protection of protected areas, the entities responsible for the execution of management and protection activities shall adopt Management Plans and Annual Programmes for nature protection.

Adopted protected area management plans include of appropriate programs, which are containing the measures and activities to be implemented to protect, conserve and sustainable biodiversity use.

Use of indicator

The indicator can be used in order to monitoring of implemented measures and activities for management of protected areas according to national legislation. Also, this indicator can be used to monitoring of implemented activities for conservation and sustainable use of bidodiversity, monitoring of habitats and species, activities for Natura 2000, ecosystem services, management of forest habitats and ecosystems, management of cultural heritage, development of sustainable tourism and recreation etc.

Scale of appropriate use

National and international scale.

Potential for aggregation:

The indicator is simple and includes monitoring the trend of adopted protected area management plans.

Meaning of upward or downward trends („good or bad“)

There is a upward trend in the adoption of protected area management plans. The trend of this indicator is directly connected with of process of proclamation and reproclamation of protected areas.

Possible reasons for upward or downward trends:

In practice, process of preparation of management plans for protected areas requires involvement of all stakeholders. The provision of a suitable protected area management entity that has the financial resources and human resources, is major challenges that can slow down the process of adoption a management plan for protected area.

Study for valorization/revalorzation of the protected area is baseline for developing a management plan. Law on Environment (Official Gazette No. 53/05, 81/05, 24/07, 159/08, 83/09, 48/10, 124/10, 51/11, 123/12, 93/13, 187/13, 42/14, 44/15, 129/15, 192/15, 39/16) requires for plans (including protected area management plans), programs and strategies, which are likely to have a significant environmental impact, are subject to Strategic Environmental Assessment (SEA).

In order to ensure a positive trend, it is necessary to speed up the process of adoption protected area management plans. Reducing certain requirements of the Rulebook on the Content of the Protected Area

Management Plans and the Annual Nature Protection Programmes ("Official Gazette" No.26/2012) is the key priority task to ensure positive trend.

Implications for biodiversity management of change in the indicator:

Positive trend of adopted protected area management plans will be benefit for nature values. With that will be improve the national policy for nature conservation through implementation of measures and activities of the management plans for protected areas.

Units in which it is expressed:

Number of management plans.

Description of source data:

Relevant data sources in MoEPP:

Adopted and draft managemnt plans for protected areas, Emerald database, Natura database, National Web site for Red Lists, National Information System for Nature, studies for valorization/revalorization of protected areas, reports as obligation from international conventions (CBD, Ramsar, Bern, UNESKO, etc), EEA reports, reports of other projects related to protected areas and nature conservation, annual reports for realized activities of Sector of Nature etc.

Calculation procedure:

Review of relevant documentation: adopted and draft managemnt plans for protected areas, laws of proclamation/reproclamation of protected areas, Emerald database, Natura 2000 database, National Information System for Nature etc.

Most effective forms of presentation:

The best way to present the trends in for adopted protected area management plans is narrative explanations and tables in according to data of MoEPP, national parks and other protected area management bodies.

Limits to usefulness and accuracy:

Preparing management plans requires strong administrative capacity of protected area, expertise and financial resources. The limitis and obstacles are regarding of lack of financial and human resources, expertise etc.

Updating the indicator:

The indicator should be followed in period od two years. It is related to conducting a procedure for proclamation and reproclamation of protected areas in accordance with the Law on Nature Protection.

The indicator can be easily monitored by MoEPP, national parks and other protected area management bodies.

Closely related indicators

This indicator is associated with following indicators as well:

- Trend in the number and surface of protected areas by category (% in relation to total area of the country)
- Trends in areas of identified potential Natura 2000 areas,
- Trend of Protected Areas management efficiency (METT index),
- Provided funds for protected areas,
- Trends in the number of key species and habitats monitored in protected areas and ecological networks,
- Establishment of ecosystem services and PES case study,
- Number of public awareness raising activities for biodiversity conservation etc

Additional information and comments

Continuously collecting data and monitoring this indicator is needed.

Financial support from State Budget for protected areas is needed, in particular for the preparation of management plans

Increased interest of international donors for financing is bigger when have estabilish protected area with a management entity is already in place and an appropriate management plan is in preparation.

Relevant national planning documents

Spatial Plan of the Republic of N.Macedonia (2002-2020).http://app.gov.mk/PP-na-RM-2002-2020.pdf

National Biodiversity Strategy with Action Plan for period (2018-2023)- MoEPP, 2018

http://www.moepp.gov.mkSTRATEGIJA_BIOLOSKA_RAZNOVIDNOST

National Strategy for Nature Protection with Action Plan (2017-2027) - MoEPP 2018

http://www.moepp.gov.mk/National Strategy for Nature Protection with Action Plan

MEPP (2012). Action Plan for Implementing the Programme of Work on Protected Areas of the Convention on Biological Diversity https://www.cbd.int/protected/implementation/actionplans/country/?country=mk

Law of Nature Protection ("Official Gazette" No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16). http://www.moepp.gov.mk/Law of Nature Protection

Management plans for protected areas. source: MoEPP and national parks and other protected area management bodies

8.12.2.2. Assessment of the indicator

Article 98 of the Law on Nature Protection stipulates that for the purpose of protection of protected areas, the entities responsible for the implementation of management and protection activities shall adopt management plans and Annual programmes for nature protection.

According to this article of Law of Nature Protection the Management Plans shall be adopted by the entity responsible for the execution of management and protection activities, according to the proclamation act, upon prior consent of the body of the state administration responsible for the affairs of nature protection.

The Rulebook on the Content of the Protected Area Management Plans and the Annual Nature Protection Programmes (“Official Gazette”, No.26/2012) have been adopted.

Administrative structure for management of protected areas

The Law on Nature Protection established the administrative structure for management of national parks and other protected areas.

Management and conservation of Protected areas is carried out by entities responsible for management provided in a manner determined by the act of this law declaring.

- Management, supervision, and protection of the National parks shall be carried out by public institutions - National Park in accordance with the provisions of this Law and the act for proclamation of the national park. This includes establishment of Public Institutions – National Parks, a separate entity for each national park, which are responsible for management and protection of the parks. These are: Public Institution National Park Mavrovo, Public Institution National Park Pelister, and Public Institution National Park Galicica. The legal mandate for the public institution administering and carrying out management of a national park includes monitoring and direct protection of the national park, implementation of management practices stipulated in the management plan, enabling and facilitating scientific research, etc.

- Management and protection of the Multi-Purpose Area shall be carried out by a Public Enterprise established by the Government of the Republic of North Macedonia, in accordance with mentioned law.

- With regard to the management of Monuments of Nature, administrative responsibility is delegated to some municipalities.

According to Law on Nature Protection legal grounds have been established for the entities mandated with the management of protected areas to establish Council of Stakeholders and Scientific Council, as advisory bodies of the entity..

The Law on Local Self-Government (2002) requires municipalities in the Republic of North Macedonia to develop general competencies in environmental management.

The Law on Nature Protection provides a mechanism for representation of municipalities in National Park Management Boards.

General types of governance for protected areas

Borrini-Feyerabend et al (2004) identified four general types of governance for protected areas around the world, in a categorization that is now widely used.

1. Governance Type A: Government protected areas: owned and managed by government agencies
2. Governance Type B: Co-Management
   - Collaborative co-management
   - Joint co-management
3. Governance Type C: Private ownership and management
4. Governance Type D: Community conserved areas

In the Republic of North Macedonia, type B joint co-management is applied in managing national parks.

Adopted protected area management plans

The number of adopted protected area management plans, including the number of draft protected area management plans developed and not yet adopted are presented in the table below.

Table 38 Number of adopted and draft protected area management plans at national level

National park Pelister	**√**	
National park Galichica	**√**	
Monument of Nature - Vevchani Springs	**√**	
Nature Park - Ezerani on Prespa Lake	**√**	
National park Mavrovo		**√**
Monument of Nature Prespa Lake*		**√**
Monumnet of Nature Markovi towers*		**√**
Strict nature reserve-Tikvesh		**√**
Monument of Nature Canyon-Matka		**√**
Monuments of Nature - Smolare Falls and Koleshino Fall		**√**
Multi purpose area-Jasen		**√**

Management plans for National park (NP) Pelister, NP Galichica, Nature Park (NP) - Ezerani on Prespa Lake and Natural Monument (NM)-Vevchani Springs have been adopted.

Revision and preparation of new management plans for NP Pelister and NP Galicica in progress.

Management plan for NP Mavrovo has been developed, yet it has not been adopted.

Management Plans for the NM-Prespa Lake and NM-Markovi Towers (marked with * in the table) were developed and expected to be adopted as soon as possible.

Draft management plans for Natura 2000 part for NP Pelister and for NM Prespa Lake as potential identifed Natura 2000 sites have been prepared.

For other categories of protected areas (Strict nature reserve-Tikvesh, NM Canyon-Matka, NM Smolare Falls and NM Koleshino Falls and Multi purpose area-Jasen) draft management plans have been prepared.

It is planned to start developing plans for the management of NM-Ohrid Lake and future protected areas: Sharr Mountain, Osogovo Mountains, Chengino Kale etc.

8.12.3. Trends in surface of identified potential Natura 2000 areas

8.12.3.1. Fact sheet

Author: *Ministry of Environment and Physical Planning*

Indicator Name: Trends in surface of identified potential Natura 2000 areas
Lead Agency: Ministry of Environment and Physical Planning (MoEPP)
Use and interpretation: **Key question(s) which indicator helps to answer** European Ecological Network Natura 2000 is the largest of protected areas network set up to conservation the natural values of the territory of the European Union (EU). The Natura 2000 network protect more than 1000 animal and plant species and more than 200 species of habitats. Law on Nature Protection ("Official Gazette" No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16) provides a legal basis for the establishment of Natura 2000 network. National targets, measures and activities for identification of Natura 2000 are included in the Biodiversity Strategy and Action Plan (2018-2023) and National Strategy for Nature Protection with Action Plan (2017-2027). Key question for this indicator is what is the trends of surface of identified potential Natura 2000 areas. **Use of indicator** The indicator can be used to monitor of the transposition and implementation of the EU Habitats and Birds Directive in national legislation for protection of nature. The indicator can be used in order to assessment of process of identification and implementation of Natura 2000 network at national level. The indicator is a useful tool for monitoring and implementation of national policy for nature protection, especially of protected areas. Also, this indicator can be use to assess of implementation of measures and actions for Natura 2000, which are cover with National Biodiversity Strategy and Action Plan (2018-2023) and National Strategy for Nature Protection with an Action Plan (2017-2027). Indicator can be used to preparation of national reports for international conventions for nature

conservation (CBD, Bern, CITES, Bonn, UNESCO, Ramsar, etc.)

Scale of appropriate use

National and international scale.

Potential for aggregation:

The indicator is simple and includes monitoring the trends in surface of identified potential Natura 2000 areas in the overall territory of the country.

Meaning of upward or downward trends („good or bad")

At the national level process of identification for eligible areas for Natura 2000 started in 2016.

Positive trend in surface of identified potential Natura 2000 areathe would be expected in the coming years. New countries wanting to join the EU have an obligation to here establish Natura 2000 network within their own countries until the day of becoming an EU member state.

Possible reasons for upward or downward trends:

The process of identification potential Natura 2000 areas requires involvement of all relevant institutional capacities (state authorities, scientific institutions, individual experts for habitats and different taxonomic groups of plants and animals and birds, non-governmental organizations, etc.).

In order to ensure a positive trend of this indicator on national level it is necessary to speed up the process of identification of habitats, plant and animal species and birds of according to requirements of EU Habitatas and Birds directives and to speed of the process of identification of eligible areas for Natura 2000.

Also, National Draft List of Habitats in Annex I of the Habitats Directive, National Draft List of species of plants and animals listed in Annex II of the Habitats Directive for each of the two biogeographical regions (continental and alpine) and Draft List of bird species from Annex I of the Birds Directive, migratory birds and other birds of importance regularly occurring in the country should be amedmend.

Catalog of habitats of European importance under the Habitats Directive should be developed.

Implications for biodiversity management of change in the indicator:

Increase % o f surface of identified potential Natura 2000 areas.

Progress will be made in the harmonization of national legislation on nature/biodiversity protection with relevant EU legislation.

Units in which it is expressed:

ha, km^2 and %.

Description of source data:

Relevant data sources in MoEPP:

Natura database, Emerald database, CDDA data for protected areas, Plan for implementation of Habitats and Birds directives, Plan for future field research work, Long-term training plan for the implementation of the EU Habitats and Birds Directives, Study for development of GIS for protected natural areas in accordance with the Natura 2000 requirements, digital GIS maps for the proposed nine areas as potential areas for Natura 2000, Corine Land Cover 2012, digital map with borders of the country, digital map with borders of protected area, digital map of the lake, digital map of settlement , digital map of EU biogeografical regions, digital map of Natura 2000 sites in Greece and Bulgaria, National Draft List of Habitats in Annex I of the Habitats Directive, National Draft List of species of plants and animals listed in Annex II of the Habitats Directive for each of the two biogeographical regions (continental and alpine) and Draft List of bird species from Annex I of the Birds Directive, migratory birds and other birds of importance regularly occurring in the country; distribution maps of EU habitats and species, studies for valorization and draft plans for management for the Natura 2000 part for Pelister and for SP Prespa Lake - as potential Natura 2000 sites, Draft protocols for the monitoring of 20 habitats, 20 plants and animal species and 20 birds with conservation status assessment in accordance with the EU Habitats and Birds Directives, National

Web site for Red Lists, National Information System for Nature, reports as obligation from international conventions (CBD, Ramsar, Bern, UNESCO, etc), EEA reports, reports of projects related to Natura 2000 and nature conservation, Annual reports for realized activities of Sector of Nature, etc.

Calculation procedure:

Review of relevant documentation: Natura 2000 database, Emerald database, Study for development of GIS for protected natural areas in accordance with the Natura 2000 requirements, digital GIS maps for the proposed nine areas as potential areas for Natura 2000, Corine Land Cover 2012, Studies for valorization and draft plans for management for the Natura 2000 part for Pelister and, Plan for implementation of Habitats and Birds directives, National Draft List of Habitats in Annex I of the Habitats Directive, National Draft List of species of plants and animals listed in Annex II of the Habitats Directive for each of the two biogeographical regions (continental and alpine) and Draft List of bird species from Annex I of the Birds Directive, migratory birds and other birds of importance regularly occurring in the country; distribution maps of EU habitats and species, CDDA data for protected areas, National Information System for Nature, reports of projects related to Natura 2000 and nature conservation, Recommendations by EEA, etc.

Most effective forms of presentation:

The best way to present the trends is narrative explanations, maps and tables.

Limits to usefulness and accuracy:

The limitis in the increase of surface of identified potential Natura 2000 areas is regarding of lack of financial and human resources (experts for habitatas and different taxonomic groups for plants, animals and birds) lack of assessments of habitats, plants, animals and birds from EU Habitats and Birds directives, lack of institutional capacity of all level (central and local).

Updating the indicator:

The indicator should be followed in period od one year. It is related to conducting of identification of habitats, plant and animal species and birds of according to requirements of EU Habitatas and Birds directives and identification of eligible areas for Natura 2000. The indicator can be easily monitored by MoEPP.

Closely related indicators

This indicator is associated with following indicators as well:

- Trends in the number and surface of protected areas by category (% in relation to total area of the country)
- Trends for adopted protected area management plans,
- Number of transboundary protected areas,
- Provided funds for protected areas,
- Capacity building
- Trends in the number of key species and habitats monitored in protected areas and ecological networks,
- Trend of populations of key conservation species,
- Establishment of ecosystem services and PES case study,
- Number of public awareness raising activities for biodiversity conservation etc.

Additional information and comments

Continuously collecting data, monitor and preparation this indicator is needed.

Is needed regularly updating data for Natura 2000 in Geographic Information System for nature protected sites in compliance with the Natura 2000 network and National Information System for Nature.

Relevant national planning documents

National Biodiversity Strategy with Action Plan for period (2018-2023)- MoEPP, 2018.

http://www.moepp.gov.mk/STRATEGIJA_BIOLOSKA_RAZNOVIDNOST

National Strategy for Nature Protection with Action Plan (2017-2027) - MoEPP 2018. http://www.moepp.gov.mk/National Strategy for Nature Protection with Action Plan

Law of Nature Protection ("Official Gazette " No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16).http://www.moepp.gov.mk/Law of Nature Protection

Web portal www.natura2000.gov.mk

Report on proposed Natura 2000 sites (MoEPP,2017). IPA Project: Strengthening the capacities for implementation of NATURA 2000- EUROPEAID/136609/IH/SER/MK

Methodology for Natura 2000 Sites selection (SCI and SPA) (MoEPP, 2017). IPA Project: Strengthening the capacities for implementation of NATURA 2000- EUROPEAID/136609/IH/SER/MK

Study on development of Geographic Information System (GIS) for nature protected sites (MoEPP, 2017). IPA Project: Strengthening the capacities for implementation of NATURA 2000- EUROPEAID/136609/ IH/SER/MK

8.12.3.2. Assessment of the indicator

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

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

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

Article 52 of Law of Nature Protection ("Official Gazette" No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16) prescribes that ecologically important area for the European Union - Natura 2000 is an area that is important for conservation of wild species of birds and other wild species of plants and animals and their habitats, as well as habitat types which are declared threatened and/or protected on EU level.

The Government of the Republic of North Macedonia, upon proposal of the Minister managing the state administration responsible for the affairs of nature protection shall determine the proposal of ecologically important areas for the European Union - Natura 2000 and the conservation objectives, the manner of their management on the national territory, monitoring and other rules necessary for their protection in accordance with the provisions of this law.

The management of the ecologically important areas for the European Union-Natura 2000 shall provide for the conservation and improvement of the characteristics important for the conservation of the favorable status of the type of habitat or of the wild species.

MoEPP is the competent state Authority for establishment and Implementation of Natura 2000 and leads and coordinates the entire inventory and selection of areas for this ecological network.

MoEPP should be prepare the List of proposed Natura 2000 Areas with cooperation of scientific institutions and experts. The Government should be adopts the List of Natura 2000 areas.

In relation to the requirements of Habitats and Birds Directives in 2016/2017 nine (9) sites were identified as potential Natura 2000 sites. It is important to note that were selected diversity of sites

(mountains-flatlands, forests-grasslands-wetlands, cave, lake) and a proposal of several SPAs and SCIs.

In regards to the nine (9) potential Natura 2000 sites, draft Standard Data Form (SDFs) of Natura 2000 has been prepared).

In order to complete these forms, further multi annual research will be needed on habitats, species and birds of EU importance, as well as adoption of new legislation on nature protection.

Out of the nine identified as potential Natura 2000 sites, three have been suggested as potential Special Protected Areas (SPA), under the Birds Directive, whereas six areas were proposed as Sites of Community Importance (SCI) under the Habitats Directive as follows:

- Dojran Lake (SPA).
- Ohrid Lake (SPA).
- Prespa Lake (SPA).
- Mavrovo (SCI).
- Mountain Jakupica (SCI).
- Ovce Pole (SCI).
- Ubavica Cave (SCI).
- Galicica (SCI).
- Pelister (SCI)

The total surface of the nine (9) identified as potential Natura 2000 sites is 1026 km^2 or 102600 ha. They cover about 3.99% of the country's territory.

Additionaly areas with high natural potential were identified.

- Mariovo and Kozuf with high natural potential.

- Shar Planina, mountain with high natural potential.

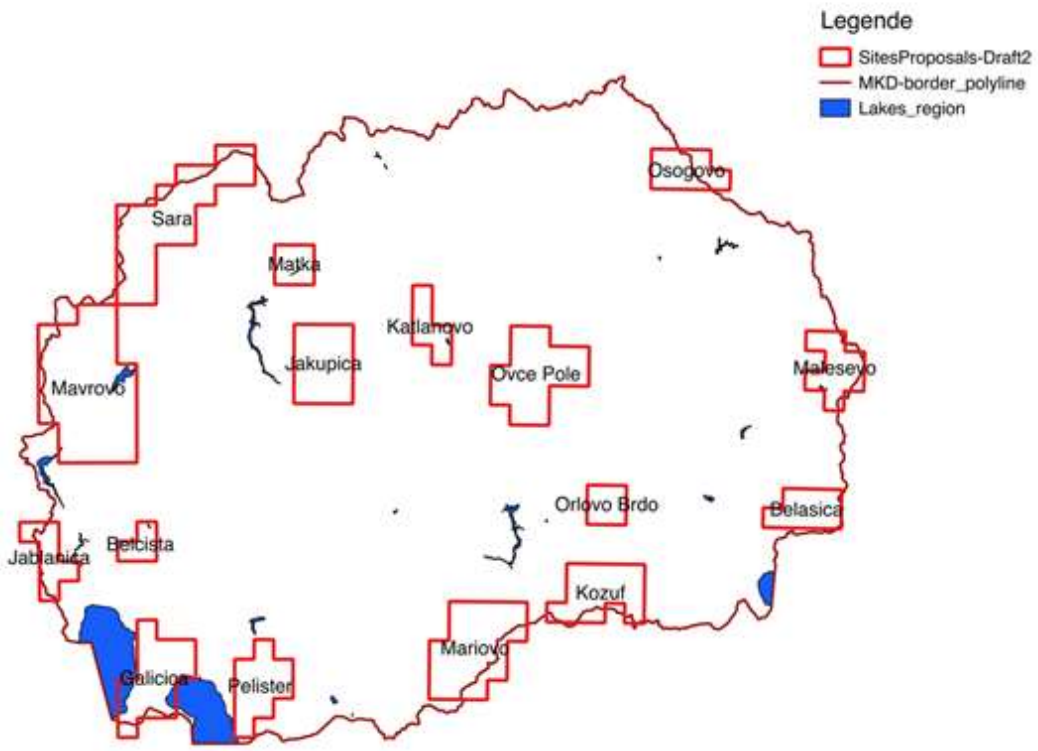

Figure 88 Map of identified potential 2000 areas and other areas with at high natural potential
Sources : MoEPP, 2017

In 2018 and 2019, the MoEPP together in cooperation with national experts in the field biology, ecology and forestry, after the collected overall literature data and the field research carried out within the East Planning Region boundaries, it identified five potential Natura 2000 areas (Ovche Pole, Lower Bregalnica, Plachkovica, Osogovski Mountains and Maleshevo Mountains). Activities continue of towards of preparation of SDFs for Natura 2000 and delineation for three potential Natura 2000 areas (Ovche Pole, Lower Bregalnica and Maleshevo Mountains). It is therefore expected that the surface of identified potential Natura 2000 sites will be increase.

8.12.4. Case study: Trends in proclaiming natural rarities

Author: *Ministry of Environment and Physical Planning*

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

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

According to Article 92 of the Law on Nature Protection, natural rarities are proclaimed by the Minister of Environment and Physical Planning, and with the proclamation of parts of nature a natural rarity, they acquire the status of natural heritage.

Pursuant to Article 94 of the Law, proposals for the proclamation of a natural rarity may be given by the state administration bodies, the municipal council, the municipal council of the City of Skopje and the Council of the City of Skopje on the territory of which they are located, as well as other scientific institutions, other bodies, organizations, institutions and associations of citizens and legal and natural persons.

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

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

According to the Law on Nature Protection, the following certain parts of nature were proclaimed as as natural rarities so far:

- Dona Duka Cave (Official Gazette No. 182/2011).
- Platanus trees (*Platanus orientaslis*)-Morodvis (Official Gazette No. 65/2016)
- The old Chinar (*Platanus orientaslis*)-Ohrid (Official Gazette No. 205/2019)
- Black mulberry (*Morus nigra* L.)-Lesnovo (Official Gazette No. 205/2019)

- Pubescent Oak (*Quercus pubescens* Willd.)-Beli (Official Gazette No. 205/2019)
- Characteristic geological profile-Zvegor (Official Gazette No. 205/2019)
- Kiselichka Cave (Official Gazette No. 174/2019)
- Paleontological site Stammer (Official Gazette No. 2017/2019)

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

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

These are mainly individual or group of stems (oak, pubescent oak, etc.), small forest stands (Golem Kozjak – Scots pine reserve, Gornjan – Turkey oak reserve, Murite – mixed stand of fir, beech, Scots pine and spruce, Temniot Andak - black pine reseve, etc.)., speleological objects, small geomorphological, hydrological or paleontological sites etc.

Pubescent Oak (*Quercus pubescens* Willd.)- v. Beli

Black mulberry (*Morus nigra* L.)- Lesnovo Monastery

The old Chinar (*Platanus orientalis*)-Ohrid

Figure 89 Some old trees protected as natural rarities

8.12.5. Indicator: Trend of protected areas management efficiency (METT)

8.12.5.1. Fact sheet

Author: *Ministry of Environment and Physical Planning*

Indicator Name: Trend of protected areas management efficiency (METT)
Lead Agency: Ministry of Environment and Physical Planning (MoEPP)
Use and interpretation: **Key question(s) which indicator helps to answer** To increase the potential of protected areas and improve the management process, each country needs to understand the strengths and weaknesses of its protected area management and the threats it faces. The Management Effectiveness Tracking Tool (METT) on World Bank/WWF has been developed to help monitor progress in effectiveness protected area management, particularly for projects financed through the World Bank / WWF. METT is made as a simple and fast field assessment system. The tool has begun to provide an useful data on protected areas globally, which should encourage all parties involved to contribute additional questions that address specific circumstances. Key question for this indicator is what is the trend of protected areas management efficiency. **Use of indicator** This indicator can be used more generally for monitoring of protected area management effectiveness. METT is obligatory for all Global Environment Facility protected area projects to use this tool three times during the projects lifespan. METT can help managers track progress in implementing management protected areas under the Convention on Biological Diversity and the Ramsar Convention on Wetlands and can provide harmonised reporting system for forest protected area assessment within both the World Bank and WWF. METT is suitable for replication, able to supply consistent data to allow tracking of progress over time, relatively quick and easy to complete by protected area staff, so as not to be reliant on high levels of funding or other resources, easily understood by non-specialists etc. **Scale of appropriate use** National and international scale.
Potential for aggregation: The indicator is simple and includes monitoring the trend of protected areas management efficiency.
Meaning of upward or downward trends („good or bad“) The positive trend of this indicator is directly connected with of process of valorization/revalorization of protected areas and management of protected areas. Human capacities and expertise of protected areas management entity should be strengthened.
Possible reasons for upward or downward trends: There has been progress for some protected areas in the efficiency and effectiveness of protected area management, which is demonstrated by the increase in the scores/points from the METT assessment. After the last years METT analysis for protected area management effectiveness has been conducted by the protected area management entities in cooperation with the MoEPP, IUCN, national experts and

stakeholders.

Implications for biodiversity management of change in the indicator:

Positive progress for efficiency and effectiveness protected areas management is demonstrated by the increase in the scores/points from the METT assessments and preparation of more METT assessments for protected areas. This means that some biodiversity conservation measures and activities are implemented through the programmes of management plans of protected areas.

Units in which it is expressed:

Scores/ points od METT assessment of protected areas management efficiency.

Description of source data:

Relevant data sources in MoEPP: Adopted and draft management plans for protected areas, data of METT analysis for protected areas, National Information System for Nature, studies for valorization/revalorization of protected areas, reports as obligation from international conventions (CBD, Ramsar, Bern, UNESKO, etc), reports of other projects related to protected areas and nature conservation, annual reports for realized activities of Sector of Nature etc.

Calculation procedure:

Review of relevant documentation: adopted and draft management plans for protected areas, studies for valorization/revalorization of protected areas, data of METT analysis for protected areas etc.

Most effective forms of presentation:

The best way to present the trends for protected areas management efficiency is narrative explanations and tables in according to data of MoEPP, national parks and other protected area management bodies.

Limits to usefulness and accuracy:

There is a lack of institutional capacities (human resources, expertise etc).

Updating the indicator:

The indicator should be followed in period of one year.

The indicator can be monitored by MoEPP, national parks and other protected area management bodies.

Closely related indicators

This indicator is associated with following indicators as well:

- Trend in the number and surface of protected areas by category (% in relation to total area of the country)
- Trends for adopted protected area management plans
- Trends in areas of identified potential Natura 2000 areas,
- Provided funds for protected areas,
- Trends in the number of key species and habitats monitored in protected areas and ecological networks etc.

Additional information and comments

Continuously collection data and preparation METT assessments of protected areas management efficiency.

Relevant national planning documents

Spatial Plan of the Republic of N.Macedonia (2002-2020).http://app.gov.mk/PP-na-RM-2002-2020.pdf

National Biodiversity Strategy with Action Plan for period (2018-2023)- MoEPP, 2018. http://www.moepp.gov.mkSTRATEGIJA_BIOLOSKA_RAZNOVIDNOST

National Strategy for Nature Protection with Action Plan (2017-2027) - MoEPP 2018. http://www.moepp.gov.mk/National Strategy for Nature Protection with Action Plan

Law of Nature Protection ("Official Gazette" No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16). http://www.moepp.gov.mk/Law of Nature Protection

Management plans for protected areas. source: MoEPP and national parks and other protected area management bodies.

Report: Protected areas in N.Macedonia (MoEPP,2007). GEF/UNDP/MoEPP project: Strengthening the Ecological, Institutional and Financial sustainability of N.Macedonia's Protected Area system.

8.12.5.2. Assessment of the indicator

Article 98 of the Law on Nature Protection stipulates that for the purpose of protection of protected areas, the entities responsible for the implementation of management and protection activities shall adopt management plans and annual programmes for nature protection.

According to this article of Law of Nature Protection the Management Plans shall be adopted by the entity responsible for the execution of management and protection activities, according to the proclamation act, upon prior consent of the body of the state administration responsible for the affairs of nature protection.

The Rulebook for contents of the valorization study or revalorization of protected areas ("Official Gazette" No.26/2012) covers part for effectiveness management protected area. Assessment of the effectiveness and efficiency of the current protected areas management only applies for a study for revalorization.

The Management Effectiveness Tracking Tool (METT) is an internationally recognised and widely used means for providing a quantified assessment based on standard criteria of how effective an individual protected area is at meeting its objectives for planning, protection, management and monitoring.

A preliminary METT assessment in the country was conducted for 80 protected areas during the GEF/UNDP/MoEPP project: Strengthening the Ecological, Institutional and Financial sustainability of N.Macedonia's Protected Area system. The results are shown in the following Table.

In general, a score above 50 might be considered a minimum acceptable level of effectiveness for a protected area. Only two sites in the country achieved this level, National Park Pelister, achieved a score above 60 and Galichica achived score of 51.

Table 39 METT scores/points of protected areas in the country

No.	Name of Protected Area	IUCN Category	Area (ha) (0=Tree Monument)	Total METT Score
1	Pelister (National Park)	II	12500	69
2	Mavrovo (National Park)	II	73088	38
3	Cave Mlechnik	III	1	7
4	Cave Gorna Slatinska	III	0	5
5	Galichica (National Park)	II	22750	51
6	Kalnica	III	17	8
7	Prevalec	III	50	7
8	Demir Kapija	III	200	8
9	Garska River	IV	4	7
10	Drenachka River	IV	2	8
11	Manastir, Manovo	III	0	12
12	Platan, Tetovo	III	0	7
13	Suvi Dol	IV	287	7
14	Crna Dudinka	III	0	6
15	Iberliska River	IV	30	6
16	Crni Orevi (Juglans nigra)	III	0	5
17	Merakova Livada	IV	4	6
18	Tumba	IV	5	6
19	Golem Kozjak	IV	0	9
20	Arboretum	III	3	9
21	Katlanovsko Blato (wetland)	IV	70	8
22	Popova Shapka	IV	5	9
23	Rechica	III	0	8
24	Rupa	IV	8	6
25	Nepetka	IV	9	6
26	Kolojzana	IV	5	5
27	Karshi Bavchi	III	10	8
28	Crni Bor	III	0	6
29	Platan, Kalishte	III	0	7
30	Jasika	III	0	5
31	Chempresovi Stebla 2	III	0	6
32	Alepski Bor	III	0	8
33	Platanovi Stebla	III	0	9
34	Makedonski Dab	III	0	6
35	Grupa Chempresovi Stebla	III	0	6
36	Chempresovi Stebla	III	0	9
37	Bor	III	0	9
38	Vodno	III	1953	28
39	Cave Ubavica	III	2	9
40	Chuni Chaflik	IV	428	8
41	Rachica	IV	1785	8
42	Stebla od Platan	III	0	7
43	Ohridsko ezero (Ohrid Lake)	III	23000	47
44	PrespanskoEzero/PrespaLake	III	17680	48
45	Dojransko Ezero/Dojran Lake	III	2730	24
46	Dovalo	III	0	7
47	Ostrovo	III	13	7
48	Orashac	III	2	6
49	Morodvis	III	1	7
50	Platanovo Stebло	III	0	7
51	Karaslari	III	148	7
52	Kale Banjichko	III	97	7
53	Kozjle	III	85	10
54	Konopishte	III	70	9
55	Zvegor	III	75	7
56	Stebla od Platan I brest	III	0	6
57	Koleshanski Vodopad (waterfall Koleshino)	III	0	25
58	Murite	III	10	6
59	Sostoina od platan	III	0	6
60	Dab	III	0	5
61	Gol Chovek	III	5	6
62	Monospitovsko Blato	IV	250	9
63	Gladnica	III	52	6
64	Konche	III	1	7
65	Drenachka Klisura	III	26	8
66	Katlanovsko Predel	III	5442	16
67	Matka Canyon	III	5443	36
68	Zrze	III	100	6
69	Gradeshka River Canyon	III	0	6
70	Ezerani	I	2080	38
71	Div Pmar	III	0	5
72	Taksesh	I	10650	26
73	Beleshnica River	III	4180	11
74	Kosten	III	0	5
75	Orlovo Bedo	III	0	5
76	Markovi Kuli	III	2300	12
77	Smoloarski Vodopadi (Waterfalls Smolare)	III	0	38
78	Lokvi Golemo Konjare	I	50	6
79	Ploche Litotelmi	I	75	11
80	Majden	III	0	Inconclusive

(2007)

Based on the analysis of the METT tools for some protected areas it is established that it exists some discrepancies in the score/points of the preliminary METT assessment (2007) with compared of METT analysis in last years. This is probably a result of the fact that the METT analysis is now being done in greater detail with the active involvement of all stakeholders.

Also, assessment the effectiveness of protected area management with the METT analysis can be subjective. For example NP Pelister in 2007 with the METT preliminary analysis received 69 points and 58 points in 2019. In the meantime NP Pelister has adopted a Management Plan. This point to some errors in the preliminary METT analysis (2007).

On the other hand, NP Galicica with the preliminary METT analysis (2007) had a score of 51 points, 66 points in METT of 2017 and 71 points in 2019.

Also, Park of Nature Ezerani in 2007 had 38 points and 66 point with METT assessment in 2017.

In these two cases it is probably the result that a Management Plan for NP Galichica (2011) and Management Plan for Nature Park-Ezerani (2012) have been adopted. In the meantime in the protected areas measures and activities of management plans for protection and sustainable management of the natural heritage are being implemented.

NP Mavrovo had 38 points (2007) and with the METT assessment and 67 point in 2011 .

Natural Monument-Markovi Towers with preliminary METT assessment (2007) had 12 points and 27 points with METT assessment in 2019. Management Plan for this protected area was prepared (2019) and the plan should be adopt as soon as possible.

It means that there has been progress for some protected areas in the efficiency and effectiveness of management, which is demonstrated by the increase in the scores/points from the METT assessment.

8.13. National target 12: Establishment of the extent 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

8.13.1. Indicator: Balkan lynx population trend in the Republic of North Macedonia

8.13.1.1. Fact sheet

Authors: *Dime Melovski, Aleksandar Stojanov* and *Aleksandar Pavlov* (Macedonian Ecological Society, Skopje)

Indicator Name: Balkan lynx population trend in the Republic of North Macedonia
Lead Agency: Macedonian Ecological Society, Skopje
Use and interpretation:
Key question(s) which indicator helps to answer
The Balkan lynx (*Lynx lynx balcanicus*, Bureš 1941) is the smallest and most endangered autochthonous population of Eurasian lynx in Europe. It has been listed as critically endangered (CR) on the global level back in 2015 (https://www.iucnredlist.org/species/68986842/87999432), based on 10 years research and

monitoring. Its population inhabits the western part of the Republic of North Macedonia, with core of the population being in Mavrovo NP.

The population trend hints to the conservation prospects of this animal, i.e. where its conservation is headed.

Use of indicator

This indicator will provide measure of the success of the conservation efforts undertaken in regards to recovery of the Balkan lynx population in North Macedonia.

Scale of appropriate use

This indicator can be used on national scale.

Potential for aggregation:

This indicator measures the trend of a specific species. However, it may be viewed in a group of indicators showing general conditions of specific habitats (forests) and management of game species.

Meaning of upward or downward trends („good or bad")

Data collected during 10-year monitoring programme within Balkan Lynx Recovery Programme indicate a positive trend of Balkan lynx population at least in Mavrovo NP and its adjacent areas, which means that population started to recover. The conservation efforts should continue in the next decades in order to maintain positive trend of the population that will enable spreading of the population in new areas in North Macedonia and broader, as well as downgrading the red list status of the Balkan lynx from CR to EN.

Possible reasons for upward or downward trends:

The positive trend is a result of increased conservation efforts in the country, regular monitoring of the population and raised awareness among the population. Positive trend or steady state can be expected in the next few decades.

Implications for biodiversity management of change in the indicator:

Changes in the trend of the indicator should be carefully analysed, in order to ensure implementation of proper conservation and protection measures.

Units in which it is expressed:

Change should be expressed in population density estimates (number of individuals per 100 km^2) in a reference area.

Description of source data:

Reliable source of such data are published scientific articles for Balkan lynx, project reports and databases, mainly generated within the project Balkan Lynx Recover Programme in the period 2006-2019.

Calculation procedure:

Density estimates using specific methodology (camera trapping and CR/SCR analysis of data).

Most effective forms of presentation:

The best way to present the trends is to present by lines trends. This indicator is best to be presented in 2-3 year intervals.

Limits to usefulness and accuracy:

Monitoring of the Balkan lynx population is limited by the available funds and available expertise on specific monitoring methods.

Updating the indicator:

The indicator should be monitored every 2-3 years.

Closely related indicators

- Forest and hunting economy plans for biodiversity protection

- Trends of surface of protected areas by category (% in relation to total area of RM) - Trends in the number of key species and habitats monitored in protected areas and ecological networks - Joint monitoring and research projects - case study - Trends in the number of key species and habitats monitored in protected areas and ecological networks
Additional information and comments This indicator has been elaborated for Mavrovo NP, North Macedonia for the period 2008-2018 by relevant experts in the frame of the project Balkan Lynx Recovery Programme. The project is implemented by Macedonian Ecological Society in cooperation with EuroNatur-Germany, KORA-Switzerland, PPNEA-Albania and ERA-Kosovo since 2006.

8.13.1.2. Assessment of the indicator

The trend of the Balkan lynx population in Mavrovo NP, North Macedonia was assessed using camera trapping methodology and CR/SCR analysis. Data were collected by conducting five deterministic camera-trapping studies in the period 2008-2018 in the frame of the project Balkan Lynx Recovery Programme. Relevant experts from Macedonian Ecological Society conducted the studies in close cooperation with the employees from Mavrovo NP and experts from KORA – Switzerland.

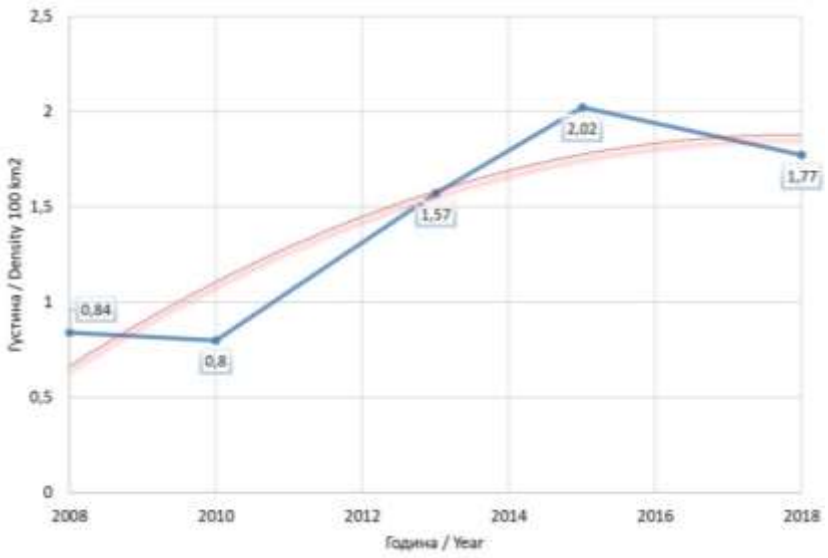

Figure 90 Trend of the Balkan lynx population in Mavrovo NP, North Macedonia in the period 2008-2018

The comparison of results from all five camera-trapping sessions in Mavrovo National Park points to a positive trend in the population density ever since 2008, and suggests the Balkan lynx population in Mavrovo National Park in the last few years is maintained at a stable and satisfactory level. However, these estimations have to be confirmed through continuation of lynx monitoring activities in the next period.

Monitoring the population of Balkan lynx in North Macedonia will improve the knowledge about the status of this rare and threatened species in the country, which is the base for drafting and implementing proper conservation measures that will enable recovery of the population. Thus, it is very important to continue monitoring the trend of the Balkan lynx in North Macedonia in the next period. On the other hand, future activities should focus more on the protection of lynx and its habitats outside Mavrovo NP, thereby providing conditions for full recovery of the entire population in the country and beyond.

Unfortunately, there were no projects or monitoring programmes for Balkan lynx that were nationally funded, and all data for Balkan lynx population trend were collected only within the Balkan Lynx Recovery Programme. There is a need of establishment of a National monitoring programme for monitoring rare and endangered species and secure funding (national or external funds) for implementation of such programme. The capacity of the responsible institutions for lynx monitoring in North Macedonia are low. The only organization conducting Balkan lynx monitoring is Macedonian Ecological Society. Partially, the National park's personnel have a capacity on implementing common monitoring methods for lynx, as they had trainings and were involved in implementation of several camera-trapping studies.

Figure 91 Photo of a Balkan lynx captured on a camera trap in Mavrovo NP, North Macedonia in 2018 (Photo: Macedonian Ecological Society)

8.13.2. Indicator: National Griffon vulture population trends

8.13.2.1. Fact sheet

Authors: *Nenad Petrovski and Metodija Velevski (Macedonian Ecological Society)*

Indicator Name: National Griffon vulture population trends
Lead Agency: Macedonian Ecological Society, Skopje
Use and interpretation: **Key question(s) which indicator helps to answer** Nationally, the population of breeding pairs of Griffon vultures has been well documented since 2003, with missing data for 2015-2017. The Griffon vultures are monogamous birds that breed in colonies. During the nesting season they forage in relative vicinity around their colonies, but after their chicks fledge, they tend to disperse over great distances. Although, according to the IUCN, Griffon vultures are classified as least threatened on global scale, their population trend in North Macedonia shows that they are critically endangered on national level. Therefore, continuous monitoring of its population and breeding performance is necessary for the purpose of assessing the effectiveness of the implemented conservation measures and the threats. **Use of indicator**

The indicator should be used to assess the population viability of the national Griffon vulture population. The presence of this species serves as a fairly good indicator for the overall welfare of the environment in terms of: viable population of wild megafauna, presence of extensive livestock husbandry, healthy agricultural practices, low impact of agricultural and other types of dangerous chemicals, level of disturbance etc. In addition, it is also possible to monitor the effectiveness of the conservation measures that are being implemented.

Scale of appropriate use

This indicator can be used on a national scale.

Potential for aggregation:

/

Meaning of upward or downward trends („good or bad")

Since the national population has collapsed, and the current number is just a fraction of the population that used to live here, an upward trend would show good progress for the conservation measures or positive change in the environment, or both.

Possible reasons for upward or downward trends:

The single most important threat for the Griffon vultures is the use od poison baits in the countryside. While illegal, this remains a common practice for resolving human-wildlife conflicts and predator control. Poison use has proven to have devastating effects on the population, and it is thought that it is the main reason for the collapse of the population. Other reasons for downward trends are: habitat degradation and disturbance, inadequate planning and development of energy infrastructure that could increase the collision and electrocution rate.

Upward trend could mean effective conservation measures, better control on the use of poison, adequate amount of food and low disturbance rate.

Implications for biodiversity management of change in the indicator:

Since the species is already showing a continuous negative trend, it is crucial that conservation measures continue and even expand, both on local and international level.

Units in which it is expressed:

When suitable data is available population trends should be expressed as the finite rate of increase of the population in one time step [preferably year] i.e. lambda (λ) = Nt+1/Nt, where Nt is "population size at time *t*" and Nt+1 is the same parameter the following year. When lambda=1 the population is stable, $\lambda<1$ translates to a decreasing population trend and $\lambda>1$ marks an increasing population trend. When solid data isn't available population trends are expressed verbally i.e. increasing, stable or decreasing.

Description of source data:

The most reliable sources are private or published datasets of territory monitoring studies.

Calculation procedure:

Review of chronological continuous population size data.

Most effective forms of presentation:

Graphically, displaying the relationship between population size and time (year).

Limits to usefulness and accuracy:

Acquiring population data in order to calculate population trends is always laborious. This requires continuous financial support and workforce. When possible, exact continuous data should be acquired and analyzed.

Updating the indicator:

Since threats can appear at any time and the response of the species can be immediate, the indicator

should be followed annually. National estimates based on extrapolations are not applicable for a population this scares.
Closely related indicators National indicator of the population of Egyptian vultures
Additional information and comments Urgent Actions to Strengthen the Balkan Population of the Egyptian Vulture and Secure Its Flyway" (LIFE16 NAT/BG/000874): http://www.lifeneophron.eu/#a-results-of-the-2019-balkan-population-monitoring-the-last-stronghold-holds-strong

8.13.2.2. Assessment of the indicator

The population of the Egyptian vulture has been systematically monitored between 2003 and 2019 (with missing data for 2015-2017). The results showed a continuous negative trend. The colonies in Matka canyon and Mariovo region are no existing any more. Other colonies (Demir Kapija, Tikves lake) have showed high fluctuations in the last 20 years.

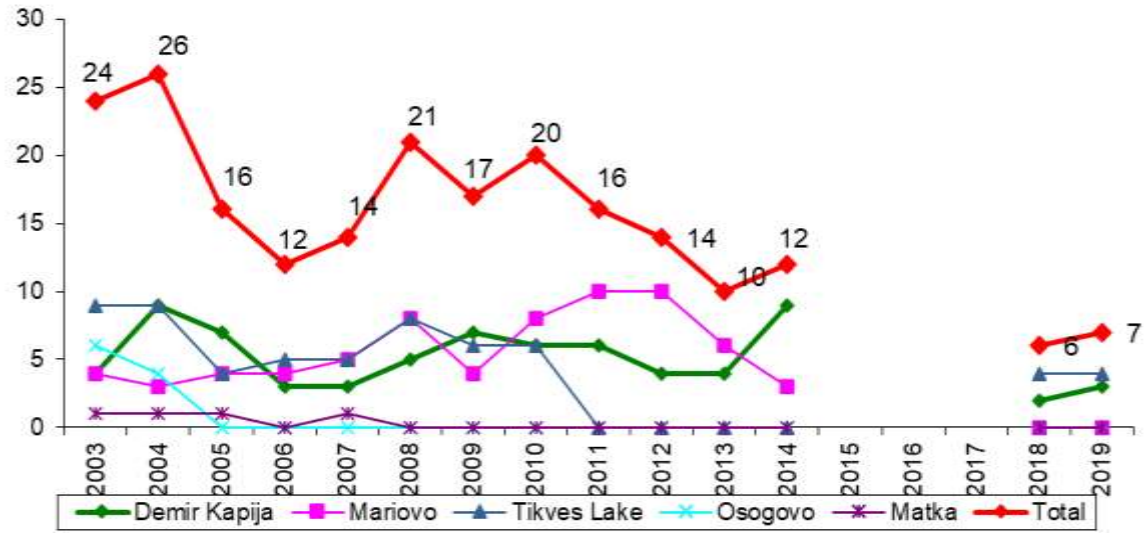

Figure 92 Trends of Griffon population in different localities

8.13.3. Indictor: National Egyptian vulture population trends

8.13.3.1. Fact sheet

Authors: *Nenad Petrovski and Metodija Velevski (Macedonian Ecological Society)*

Indicator Name: National Egyptian vulture population trends
Lead Agency: Macedonian Ecological Society, Skopje
Use and interpretation: **Key question(s) which indicator helps to answer** Nationally, the population of breeding pairs of Egyptian vultures has been well documented since 2003,

with missing data for 2015-2017. The Egyptian vultures are long-distance migratory birds that spend the winter months in Sub-Saharan Africa, but a significant fraction of the Balkan subpopulation breeds in North Macedonia. They are territorial monogamous birds that tend to come back every year to their designated territory for nesting.

The Egyptian vulture is classified as globally endangered species with negative population trends almost throughout its range. Therefore, continuous monitoring of its population and breeding performance is necessary for the purpose of assessing the effectiveness of the implemented conservation measures and the threats across its range.

Use of indicator

The indicator should be used to assess the population viability of the national Egyptian vulture population. The presence of this species serves as a fairly good indicator for the overall welfare of the environment in terms of: viable population of wild megafauna, presence of extensive livestock husbandry, healthy agricultural practices, low impact of agricultural and other types of dangerous chemicals, level of disturbance etc. In addition, it is also possible to monitor the effectiveness of the conservation measures that are being implemented.

Scale of appropriate use

This indicator can be used on a national scale.

Potential for aggregation:

/

Meaning of upward or downward trends („good or bad")

Since the whole Balkan population has collapsed, and the current number is just a fraction of the population that used to live here, an upward trend would show good progress for the conservation measures or positive change in the environment, or both.

Possible reasons for upward or downward trends:

The single most important threat for the Egyptian vultures is the use od poison baits in the countryside. While illegal, this remains a common practice for resolving human-wildlife conflicts and predator control. Poison use has proven to have devastating effects on the population, and it is thought that it is the main reason for the collapse of the population in the Balkan Peninsula. Other reasons for downward trends are: habitat degradation and disturbance, inadequate planning and development of energy infrastructure that could increase the collision and electrocution rate.

Upward trend could mean effective conservation measures, better control on the use of poison, adequate amount of food and low disturbance rate, but also mitigation of the treats along the migration flyways and wintering ranges.

Implications for biodiversity management of change in the indicator:

Since the species is already showing a continuous negative trend, it is crucial that conservation measures continue and even expand, both on local and international level.

Units in which it is expressed:

When suitable data is available population trends should be expressed as the finite rate of increase of the population in one time step [preferably year] i.e. lambda (λ) = Nt+1/Nt, where Nt is "population size at time *t*" and Nt+1 is the same parameter the following year. When lambda=1 the population is stable, $\lambda<1$ translates to a decreasing population trend and $\lambda>1$ marks an increasing population trend. When solid data isn't available population trends are expressed verbally i.e. increasing, stable or decreasing.

Description of source data:

The most reliable sources are private or published datasets of territory monitoring studies.

Calculation procedure:

Review of chronological continuous population size data.
Most effective forms of presentation: Graphically, displaying the relationship between population size and time (year).
Limits to usefulness and accuracy: Acquiring population data in order to calculate population trends is always laborious. This requires continuous financial support and workforce. When possible, exact continuous data should be acquired and analyzed.
Updating the indicator: Since threats can appear at any time and the response of the species can be immediate, the indicator should be followed annually. National estimates based on extrapolations are not applicable for a population this scares.
Closely related indicators National indicator of the population of Griffon vultures
Additional information and comments Grubac, B., Velevski, M., Avukatov, V. (2013). Long-term population decrease and recent breeding performance of the Egyptian Vulture Neophron percnopterus in North Macedonia. North-Western Journal of Zoology 10 (1): 25-35. Article No.: 131605.

8.13.3.2. Assessment of the indicator

The population of the Egyptian vulture has been systematically monitored between 2003 and 2019 (with missing data for 2015-2017). The results showed a continuous negative trend with 65% decline over 16 years.

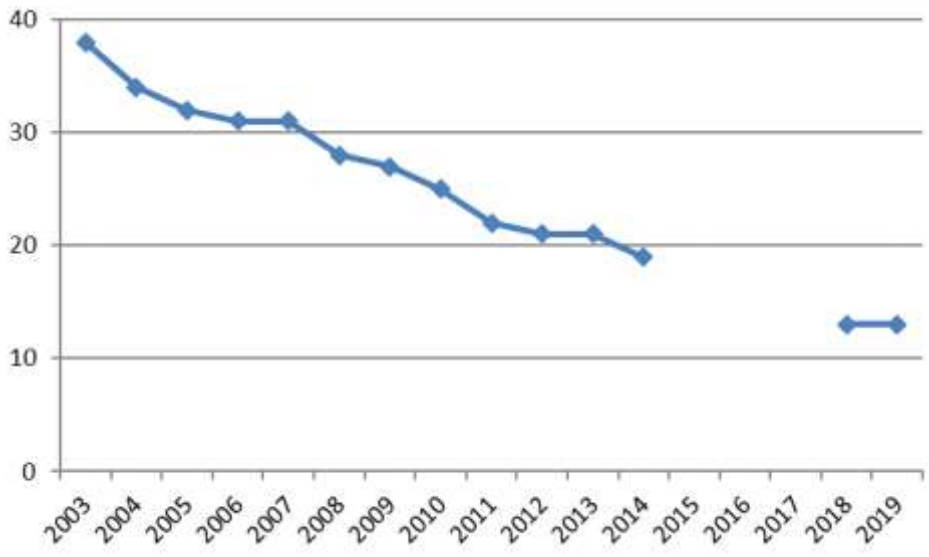

Figure 93 Trend of the population of the Egyptian vulture

8.13.4. Indicator: Population trend of Lesser Kestrel

8.13.4.1. Fact sheet

Authors: *Danka Uzunova* (Macedonian Ecological Society)

Indicator Name: Population trend of Lesser Kestrel
Lead Agency: Macedonian Ecological Society (MES), BirdLife International (International Species Working Group), European Bird Census Council (EBCC), European Union/Eurostat
Use and interpretation: **Key question(s) which indicator helps to answer** The population of Lesser kestrel is surveyed on the recommended ten-year basis, based on Iñigo and Barov (2010). Its unique ecology (a colonial migratory breeding species in N. Macedonia, linked primarily to agricultural habitats and landscapes) makes this species a good candidate for monitoring the changes in agricultural policies in the country. It should, however be combined with yearly standardized survey of other key farmland bird species (i.e. White Stork, Corn Bunting etc.) in order to develop population indices for farmland birds in N. Macedonia. **Use of indicator** This indicator (developed as a combined indicator for few other farmland birds for N. Macedonia) should be used to develop sustainable agricultural practices and policies. As this is a long-term effort, intra-institutional and cross-sectoral cooperation and collaboration is imperative to delivering science-based policies and practices. **Scale of appropriate use** This indicator can be used on national, regional and European scale.
Potential for aggregation: The trend of Lesser kestrel may be part of the more complex indicator on farmland birds and standardized and long-term monitoring scheme needs to be set in place for typical farmland birds species in N. Macedonia.
Meaning of upward or downward trends („good or bad") The positive trend (increase) of the population of the Lesser Kestrels can be an indication that good agricultural practices and long-term conservation actions for the species are established and practiced, beneficial for the national population of the species. Negative trends (decrease), as we are experiencing now, mean that there is no relevant conservation practice or policy set in place for he species. Also, the information for the decrease in population we witness is based on the data from the 10 year-apart survey data available (first is conducted in 2002 by Lisichanets, Stoynov & Ivanov, and second by MES in 2012). Consistent survey of the species' breeding population size

and several environmental factors on a yearly basis will provide an in-depth analysis of its national trend.
Possible reasons for upward or downward trends: Negative population trends (decrease), as we are experiencing now, are a combination of several factors: abandonment of traditional agricultural practices, massive depopulation of the villages in the species' core areas, conversion of arable land to abandoned ruderal habitats and grazing meadows, abandonment of crop rotations, loss of suitable nesting structures and food for the species.
Implications for biodiversity management of change in the indicator: Changes in the population trend of the Lesser Kestrels should be carefully analysed. Positive changes need to be consistent for at least five years (period of one generation of LKs, according to Iñigo and Barov (2010)) before delivering conclusions. Negative changes should be monitored along with the agricultural practices used prior to delivering conclusions if they reflect bad management practices set in place, unsuitable conservation efforts, or a combination of both.
Units in which it is expressed: Change should be expressed in population size (numeric) on yearly basis and expert assessment of the national trend (descriptive) in a 10-year period.
Description of source data: The only reliable sources are the yearly survey data of simultaneous Lesser Kestrel population size survey. In absence of consistent dataset, the 10-year mandatory survey data should be used.
Calculation procedure: Review of the yearly (or the 10-year) national population survey data.
Most effective forms of presentation: The best way to present the trends is to present by linear trends. This indicator is best to be presented in 10-year intervals, unless sudden change of the population trend occurs.
Limits to usefulness and accuracy: So far, there hasn't been established yearly standardized survey for farmland bird species in N. Macedonia. Should this continue to be the practice in future, the expert assessment for the national population trend of the Lesser Kestrels will be based on the 10-year survey dataset only.
Updating the indicator: The indicator should be followed annually, but the results should be compared in 10-years periods (e.g. 2002-2011, 2012-2021 etc.).
Closely related indicators - Number of professionals - Established national farmland bird monitoring requirements
Additional information and comments /

8.13.4.2. Assessment of the indicator

The Lesser Kestrel surveys were initiated by a local project led by Fund for Wild Flora and Fauna from Bulgaria and NCA Aquila Kavadarci from North Macedonia as a comparative analysis between the populations in the two countries and the possible effects of the agricultural practices. The overall population estimate for 2002 is 1300-2500 breeding pairs.

This effort was repeated albeit in a more organized way in 2012, a 10-year mark designated in the Action plan for the Lesser Kestrel *Falco naumanni* in the European Union. In this Action Plan data from the 2002 survey were used as baseline for the national population estimate.

Prior to the 2012 survey of the Lesser Kestrel, the core areas of national distribution of the species were identified as a means to increase the efficiency of the effort. Based on previous data and personal data from sporadic/casual observations in the years between, it was identified that there are three such areas, and going from highest to lowest numbers in 2002 they are as follows: 1) Pelagonija, 2) Ovche Pole and 3) Tikvesh. All these areas are overlapping with several Important Bird Areas (IBAs), as presented in the following Figure 94.

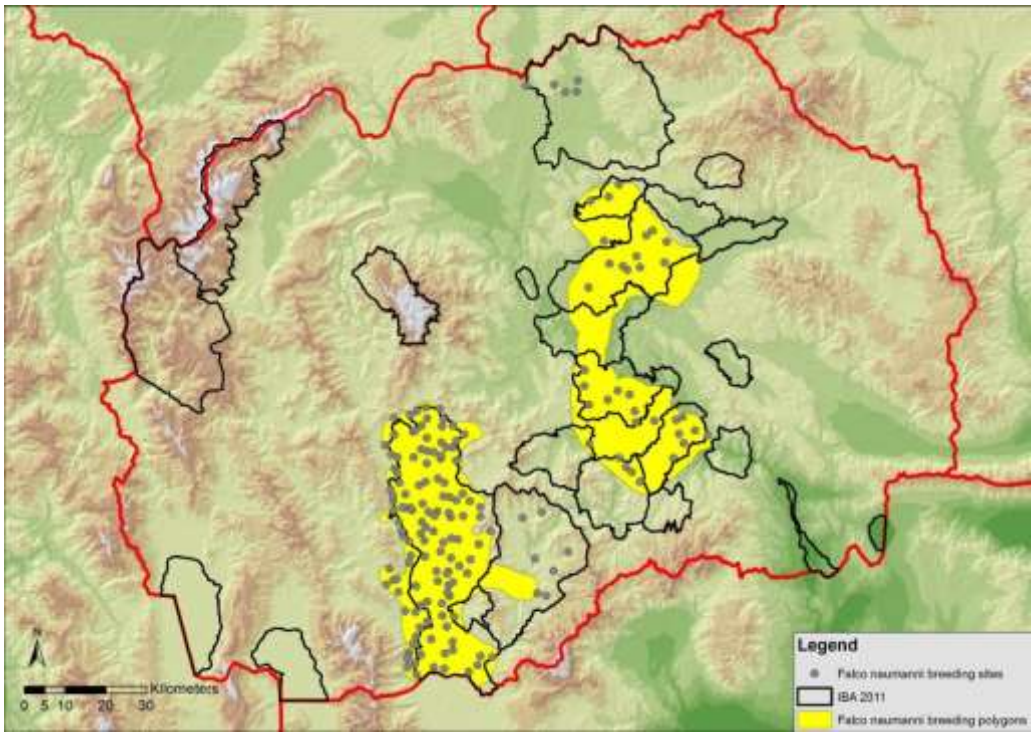

Figure 94 Area of national distribution of the three Lesser Kestrel core areas and the overlap with identified IBAs

The 2012 survey of the Lesser kestrels showed a change in the overall population size (half of the size compared to the 2002 survey) as well as a shift of core areas with highest number of breeding pairs in a colony – now Ovche Pole holds the strongest breeding colony in the country (the following figures). Even though there are striking differences in the overall Lesser Kestrel population size on a national and core area level, we can only make assumptions these changes are caused by the change in agricultural practices and by other socio-economic factors.

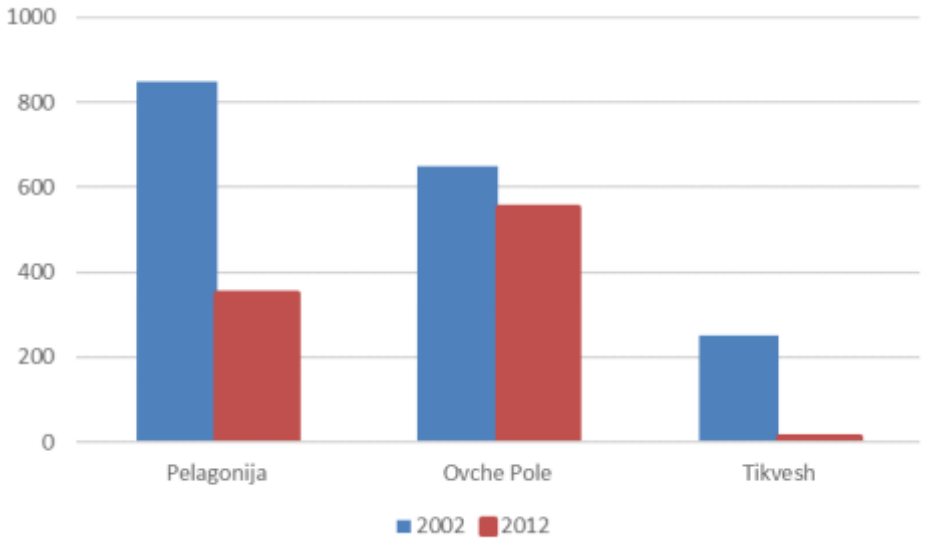

Figure 95 Difference in population size changes in the three Lesser Kestrel core areas of distribution in N. Macedonia (population size expressed in number of breeding pairs)

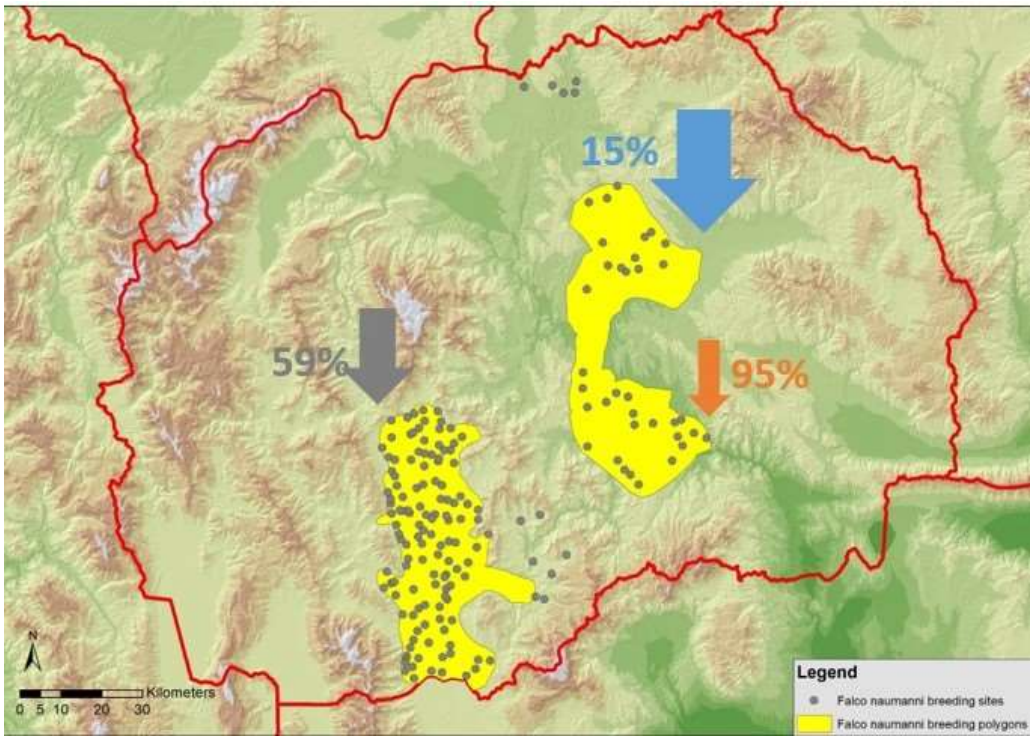

Figure 96 Decrease in population size in in the three Lesser Kestrel core areas of distribution in N. Macedonia between the surveys in 2002 and 2012 (in %)

The following survey (scheduled for 2021) will show the extent of the decrease in the overall population size of the Lesser Kestrels, which has already been witnessed in the between years of general bird monitoring conducted in these three core areas.

8.13.5. Indicator: White Stork population size and breeding parameters

8.13.5.1. Fact sheet

Authors: *Metodija Velevski* (Macedonian Ecological Society, Skopje)

Indicator Name: White Stork population size and breeding parameters
Lead Agency: Macedonian Ecological Society
Use and interpretation: **Key question(s) which indicator helps to answer** White Stork population is related to wet meadows as a typical foraging habitats, also using other types of wetlands (ponds, river banks, reedbeds etc). It is an emblematic species generally accepted by the general population. As a long-range migrant, its population also heavily depends on the conditions along the migration routes and in the wintering region. International monitoring is in place, through coordinated census of the entire population every ten years. **Use of indicator** This indicator should be used in order to follow the distribution and population size of the White stork *Ciconia ciconia* in different regions of North Macedonia, and on country-wide scale. **Scale of appropriate use** This indicator can be used on national scale, but international trends should be considered when interpreting the results. Regional trends (eg., Skopje Region, Pelagonia, etc.) should also be observed.
Potential for aggregation: This indicator can not be aggregated with other indicators. However, better interpretation of the results might be achieved when surface of appropriate habitats is also monitored by other means. Storks are highly affected from mortality of power-lines, as are other bird species. Combination with trends from other species (e.g., Lesser Kestrel) might indicate towards general reduction of this threat.
Meaning of upward or downward trends („good or bad“) Changes within 30% of the population numbers should be interpreted as fluctuations, not trends. The positive trend should be interpreted as possible long-term increase in primary productivity followed by increase of Stork's prey base and reduction of mortality factors. Wider (e.g. European) positive trend might also be indicative of the environmental changes in wintering regions and along the migration routes.
Possible reasons for upward or downward trends: Low breeding success and decreasing population trend might be result of (prolonged periods of) decreased primary productivity, contamination of food base (pesticides) and environmental changes in wintering regions and along migration routes.
Implications for biodiversity management of change in the indicator: Preservation of wet meadows and their active management might be needed as a response action to reverse possible observed decline. Such action would be beneficial for other habitats and species.
Units in which it is expressed: Numbers of pairs, Number of breeding pairs, Number of fledged jueniles.
Description of source data: National census was performed in 1956 and 2015. Regional censuses were performed in 1988 (Skopje region, 2002 and 2012 (Pelagonia region) and Southeastern parts of North Macedonia (2010).

Calculation procedure:
Direct count and statistical comparison of breeding parameters among regions.
Most effective forms of presentation:
Map, bar chart of population size, table of breeding parameters.
Limits to usefulness and accuracy:
Very easy indicator for collecting data in the field, but requires substantial man-power.
Updating the indicator:
The indicator should be updated every 10 years, that will be aligned with the International White Stork Census. 2015 is the baseline situation.
Closely related indicators
Leser Kestrel population size; Coverage of wetlands and wet meadows, changes in land-use (conversion to intensive agriculture)
Additional information and comments
It is important to cover the entire territory of the country in single year, between 15th June and 15th July.
References:
Heckenroth, H., Heins, J.-U. (2010). Weißstorch (*Ciconia ciconia*) Brutbestand im östlichen Makedonien im Jahr 2010. Manuscript
Jovetić, R. (1959). Uticaj ishrane bele rode (*Ciconia ciconia ciconia* L.) na livadarstvo Makedonije. *Godišen zbornik na zemjodelsko-šumarski fakultet* **12**: 131–171.
Jovetić, R. (1960). Roda bijela, *Ciconia ciconia*, u Makedoniji. *Larus* **14**: 75–83.
Micevski, B., Stojanovski, L., Šterjova, B. (1992). Drastično opadanje gustine populacije bele rode, *Ciconia ciconia* u Makedoniji. *Ciconia* **4**: 43–49.
Putilin-Stamkovska, K., Nakev, S., Uzunova, D., Arsovski, B., Arsovska, A., Lisičanec, E., Velevski, M. Distribution, breeding success and nest site selection of the White Stork (*Ciconia ciconia*) in North Macedonia in 2015 and 2016. Manuscript.
Štumberger, B., Velevski, M. (2002). White Stork *Ciconia ciconia* survey in Pelagonia indicates a decrease in its breeding population and colony disintegration. *Acrocephalus* **23**(112): 67–74.
Velevski, M., Putilin, K., Uzunova, D., Stumberger, B., Lisičanec, E., Grubač, B., Škorpíková, V. (2013). *State of the birds of North Macedonia 2012*. Macedonian Ecological Society, Skopje, 49 p.

8.13.5.2. Assessment of the indicator

The following graph is presented overall decline of the White Stork population in the 67 years between the two censuses, but data is insufficient to estimate national short-term trends. Long-term declines are observed in the regional populations in Skopje region, Pelagonia plain and Radovis-Strumica regions, but in all these regions populations remained stable or fluctuating in the more recent period (>2000). Long-term stable population is observed in Gevgelija-Dojran region and minor decline is observed in Bregalnica-Ovce Pole region. Declines in Skopje and Pelagonia plains have been attributed to wetland loss, and similar underlying reason might be valid for Strumica-Radovis region.

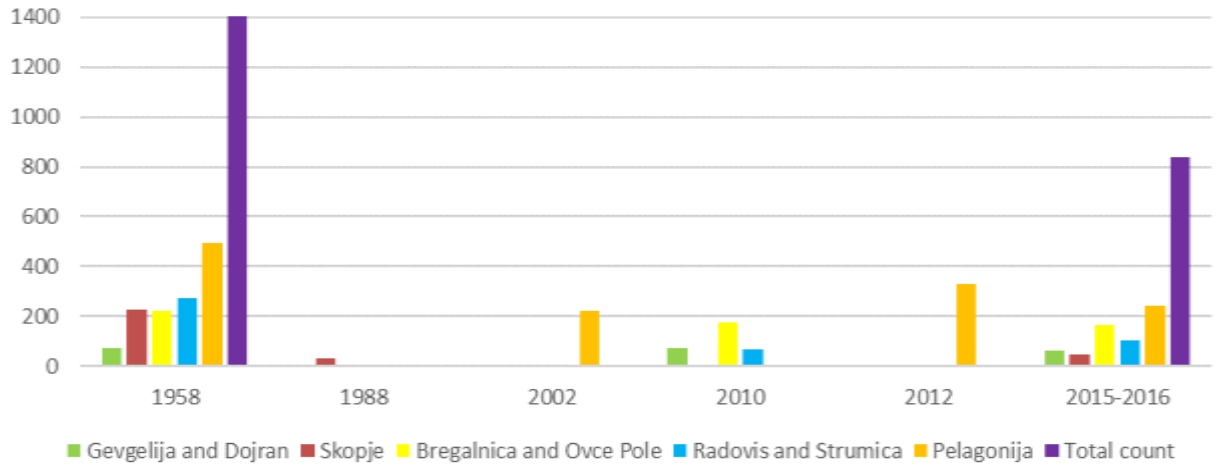

Figure 97 Number of pairs of White storks in different regions

8.13.6. Indicator: National reptile population trends

8.13.6.1. Fact sheet

Authors: *Arsovski Dragan and Bogoljub Sterijovski (Macedonian Ecological Society)*

Indicator Name: National reptile population trends
Lead Agency: Macedonian Ecological Society, Skopje
Use and interpretation: **Key question(s) which indicator helps to answer** Nationally, 36 reptile species have been observed. According to the recent national red lists 21 display decreasing population trends and there is no detailed insight for one. These are mostly based on expert guesses; continuous population size data only exist for a maximum of few populations of five species (Hermann's tortoise, Spur-thighed tortoise, Dice snake, Nose-horned Viper and Meadow Viper). Without data, experts cannot make sound inferences on the causes of changes in population trends, but rather rely only on guesses resulting with very general conservation efforts that often prove superfluous. **Use of indicator**

The indicator should be used to assess population viability of national reptile populations. This can in turn be the result of effective governance and management of natural habitats particularly in protected areas, or effectiveness of conservation efforts. Additionally, since intense field effort is required to fill out this indicator, it can be used to judge the intensity of research and capacity of the scientific community in North Macedonia as well as international cooperation.

Scale of appropriate use

This indicator can be used on a national scale.

Potential for aggregation:

/

Meaning of upward or downward trends („good or bad")

An upward trend could indicate efficient conservation measures, increase in surfaces of protected areas, or simply mark a species' adaptability to human activity; a downward trend could indicate increased threats such as habitat degradation or conversion, trafficking, climate change, direct mortality, etc.

Possible reasons for upward or downward trends:

Implications for biodiversity management of change in the indicator:

Changes from positive or stable to negative population trends would call for immediate conservation measures. Extreme positive trends could suggest invasiveness calling for management measures of the populations at hand.

Units in which it is expressed:

When suitable data is available population trends should be expressed as the finite rate of increase of the population in one time step [preferably year for all national reptile species] i.e. lambda (λ) = Nt+1/Nt, where Nt is "population size at time *t*" and Nt+1 is the same parameter the following year. When lambda=1 the population is stable, $\lambda<1$ translates to a decreasing population trend and $\lambda>1$ marks an increasing population trend. When solid data isn't available population trends are expressed verbally i.e. increasing, stable or decreasing.

Description of source data:

The most reliable sources are private or published datasets of capture-recapture studies. When these are not available expert judgements are consulted.

Calculation procedure:

Review of chronological continuous population size data.

Most effective forms of presentation:

Graphically, displaying the relationship between population size and time (year).

Limits to usefulness and accuracy:

While often necessary, acquiring population data in order to calculate population trends is also often laborious. This regularly results with inaccurate and therefore useless judgements. When possible, exact continuous data should be analyzed and consulted.

Updating the indicator:

Since threats can appear at any time and the response of species can be immediate, the indicator should be followed annually for each monitored population. National estimates based on extrapolations, can be updated on a five-year scale.

Closely related indicators

Additional information and comments

References

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8.13.6.2. Assessment of the indicator

Thirty-six reptile species have been observed on the territory of the Republic of North Macedonia. While the national herpetological diversity seems to be well known, along with mostly adequate distributional data (Sterijovski et al. 2013), population size and trend data is scarce. According to the recent national red lists 21 species display decreasing population trends and there is no insight at all for one (Sterijovski & Arsovski 2020). It has to be taken into consideration that these are mostly based on expert guesses. Exact population data is only available for a maximum of few national populations of five species (Hermann's tortoise [long-term, three populations], Dice snake [long term, one population], Nose-horned Viper [long-term, one population], Meadow Viper [long term but sporadic, one population] and Spur-thighed Tortoise [one year, one population]). Such data can be used to extrapolate to a national scale, using low- or high-end habitat suitability modelling. This would allow for expert judgements or even exact estimates, rather than guesses.

The Hermann's tortoise is the best researched reptile species in North Macedonia. National population size is estimated at 17.000.000 coming from an expert judgement of an average national density of 10 individuals per hectare, with 1.700.000 hectares of suitable habitat (Arsovski & Sterijovski 2020). Changes in population size in the Hermann's Tortoise are usually subtle due to the longevity of the species, thus detailed monitoring is required. The populations on Golem Grad Island and in Konjsko village in the Prespa region hold the densest known populations of the species in the

world (>100 adult individuals/hectare; Arsovski et al. 2018; Bonnet et al. 2016). Konjsko Hermann's tortoises display positive population trends (λ=1.04), whereas the population on Golem Grad Island is decreasing (λ=0.97) as a result of sex-specific mortality due to high mating costs imposed on females through a severely biased adults sex-ratio (Arsovski 2018; Golubović et al. 2018). Both reside in national park "Galićica", and while the latter is suffering intrinsic pressures, Konjsko tortoises are a positive example of residing in a protected area. Hermann's tortoises living in syntopy with Spur-thighed Tortoises have been monitored for only a year in Gazi Baba Park in Skopje thus no population trend estimates can be made at this point. Most tortoise populations across the country are affected by habitat destruction resulting in heavy fragmentation; many also suffer from collection for illegal trade in the south-eastern and eastern parts of the country. This has resulted with an expert guess of an overall decreasing national population trend for both species (Arsovski & Sterijovski 2020a, b).

Golem Grad Island is largely know as Snake Island due to the apparent extremely dense resident Dice Snake population (>500 snakes per hectare, Ajtić et al. 2013). Monitoring of this population in the past 13 years resulted with >7000 marked individuals (Ajtić et al. 2013; Sterijovski et al. 2014). Elevated reproductive and mortality rates were noted, suggesting a high turn-over rate; more monitoring is needed, nationally, to determine whether this is population-specific. Unfortunately, almost complete neglection of illegal fishing around the island by the authorities resulted with the drowning of likely huge numbers of snakes in fishing nets (e.g. 49 drowned individuals retrieved from only two fishing nets in Sterijovski et al. 2014) during the past decade. Coupled with very low recapture rates, this has resulted with a drastic negative population trend of Dice Snakes on Golem Grad Island. Dice Snakes are likely affected by similar threats in other lakes around the country; population trends are, nevertheless, still unknown, particularly in other freshwater ecosystems.

Capture recapture studies indicate a stable to decreasing trend of the Meadow Viper on Bistra Mt. and a stable population trend for the Horn-nosed Viper on Golem Grad Island (with a staggering population of ~1500 adult individuals on 20ha [Tomović et al. 2019]). Detailed analyses are yet to be performed. Nevertheless, expert judgement indicates decreasing national population trends for both species due to persecution by humans, especially for the Horn-nosed Viper, and due to climate change for the high-mountain Meadow Viper (Sterijovski & Arsovski 2020).

8.13.7. Indicator: National amphibian population trends

8.13.7.1. Fact sheet

Authors: Bogoljub Sterijovski and Dragan Arsovski (Macedonian Ecological Society)

Indicator Name: National amphibian population trends
Lead Agency: Macedonian Ecological Society, Skopje
Use and interpretation: **Key question(s) which indicator helps to answer** Nationally, 14 amphibian species have been observed. According to the recent national red lists 10 display decreasing population trends. Generally speaking, monitoring on this class is lacking in order to determine

the trends of the amphibians species on National level.. Throughout monitoring on several sites in eastern and south-eastern and south-western part of the country there are consequent data for several years but not for all species of this class. Without data, experts cannot make sound inferences on the causes of changes in population trends, but rather rely only on guesses resulting with very general conservation efforts that often prove superfluous

Use of indicator

This indicator should be used to assess population viability of national amphibian populations. This can in turn be the result of effective governance and management of natural habitats particularly in protected areas, or effectiveness of conservation efforts. Additionally, since intense field effort is required to fill out this indicator, it can be used to judge the intensity of research and capacity of the scientific community in North Macedonia as well as international cooperation.

Scale of appropriate use

This indicator can be used on a national scale.

Potential for aggregation:

/

Meaning of upward or downward trends („good or bad")

An upward trend could indicate efficient conservation measures, increase in surfaces of protected areas, or simply mark a species' adaptability to human activity; a downward trend could indicate increased threats such as habitat degradation or conversion, trafficking, climate change, direct mortality, etc.

Possible reasons for upward or downward trends:

Implications for biodiversity management of change in the indicator:

Changes from positive or stable to negative population trends would call for immediate conservation measures. Extreme positive trends could suggest invasiveness calling for management measures of the populations at hand.

Units in which it is expressed:

When suitable data is available population trends should be expressed as the finite rate of increase of the population in one time step [preferably year for all national amphibian species] i.e. lambda (λ) = Nt+1/Nt, where Nt is "population size at time *t*" and Nt+1 is the same parameter the following year. When lambda=1 the population is stable, $\lambda<1$ translates to a decreasing population trend and $\lambda>1$ marks an increasing population trend. When solid data isn't available population trends are expressed verbally i.e. increasing, stable or decreasing.

Description of source data:

The most reliable sources are private or published datasets of capture-recapture studies. When these are not available expert judgements are consulted.

Calculation procedure:

Review of chronological continuous population size data.

Most effective forms of presentation:

Graphically, displaying the relationship between population size and time (year).

Limits to usefulness and accuracy:

While often necessary, acquiring population data in order to calculate population trends is also often laborious. This regularly results with inaccurate and therefore useless judgements. When possible, exact continuous data should be analyzed and consulted.

Updating the indicator:

Since threats can appear at any time and the response of species can be immediate, the indicator should be

followed annually for each monitored population. National estimates based on extrapolations, can be updated on a five-year scale.
Closely related indicators
Additional information and comments References Sterijovski, B., & Arsovski, A. (2020). National Red List of Amphibians of North Macedonia. Retrieved March 11, 2020, from http://redlist.moepp.gov.mk

8.13.7.2. Assessment of the indicator

Fourteen amphibian species have been observed on the territory of the Republic of North Macedonia. While the national batrachological diversity seems to be well known, along with mostly adequate distributional data, population size and trend data is scarce. According to the recent national red lists 10 species display decreasing population trends (Sterijovski & Arsovski 2020).

Roughly population data is limited to some regions for 11 amphibian species (*T.macedonicus, T. ivanbureschi, L. vulgaris, S. salamandra, R. graeca, R. dalmatina, R. temporaria, P. ridibundus, B. viridis, B. bufo and H. arborea*). However this data is not analyzed and published yet.

Monitoring studies that were undertaken on several species in south-eastern and south-western part in North Macedonia, namely in Borov Dol (Radovis region), Ilovica – Stuka (Strumica region) and Studencisko blato (Ohrid region) and Ezerani (Prespa region) that were set up in the period 2014-2020. Also, within the process of selection of Natura 2000 sites in Bregalnica watershed, monitoring of amphibians is established on three locations in Eastern part of North Macedonia (Ovce Pole, Slan Dol and Malesevski Mt.. This monitoring scheme is for the period 2018-2020.

But still, such data can be used to extrapolate to a national scale, using low- or high-end habitat suitability modelling. This would allow for expert judgements or even exact estimates, rather than guesses.

8.14. National target 13: Improve in-situ and ex-situ conservation of genetic resources of native cultivated plants and domestic animals

8.14.1. Genetic diversity of PGRFA in North Macedonia

8.14.1.1. Fact sheet

Authors: *Sonja Ivanovska, Mirjana Jankulovska* (Department of Genetics and Plant Breeding, Institute of Plant Biotechnology, Faculty of Agricultural Sciences and Food, Ss. Cyril and Methodius University in Skopje)

Indicator Name: Genetic diversity of PGRFA in North Macedonia
Lead Agency: Faculty of Agricultural Sciences and Food, Ss. Cyril and Methodius University in Skopje.
Use and interpretation: **Key question(s) which indicator helps to answer** North Macedonia has significant diversity of autochthonous and local varieties (landraces) of agricultural

crops, historically created by many nationalities living in its territory. This diversity was enriched by extremely different climatic conditions knitted tightly in micro-locations. Large-scale agriculture rely on commercial varieties, except for the beans production which is based exclusively on Tetovo bean landrace. Small farmers and local population in the rural areas are custodians of different landraces, mainly of pulses, vegetables and maize. They possess unique valuable traits, especially for resistance to abiotic and biotic stresses and for specific taste. Only small share of this diversity is conserved in the gene banks.

Use of indicator

This indicator can be used to assess the national policy on conservation of PGRFA, the support provided for the farmers for preserving landraces, and the success of the conservation program running in the country.

Scale of appropriate use

This indicator can be used on national scale.

Potential for aggregation:

This indicator refers to the status and potential change of the existing diversity of PGRFA. Determining various landraces is a complex process, based on time- and resources-consuming activities. Accurate data may be obtained through regular inventories of different regions and through scientific data from landraces characterization. It may be linked with the indicator on plant gene banks, after a system will be established for ex-situ conservation of PGRFA on a national level.

Meaning of upward or downward trends („good or bad“)

The negative trend (decrease) of genetic diversity is expected in the following years, which will go downward even more intensively in the next decade.

Possible reasons for upward or downward trends:

Traditionally the seeds of landraces are inherited within the families for generations. Due to intensive depopulation and aging of the rural areas, large share of the seeds is already lost. This process is expected to be more striking in the following period. Few young people which decide to become business-oriented farmers are cultivating only modern cultivars. Similarly, old fruit varieties are frequently replaced with modern varieties, or the land is transformed for other uses.

Implications for biodiversity management of change in the indicator:

This negative change in the quantity and quality of genetic diversity in most of the cases represents irreversible loss of valuable traits and genes. Therefore, the management practices for conservation and sustainable use of biodiversity should be directed primarily towards urgent collection missions for saving the landraces that are presently cultivated.

Units in which it is expressed:

Change should be expressed in number and distribution of different landraces on national level per 5-years period.

Description of source data:

The only source of such data could be obtained by comprehensive inventories carried out throughout the country. Because the local population often does not have a specific name for the landraces, the inventory results should be scientifically analyzed in order to assess more accurately the distribution of various landraces.

Calculation procedure:

This indicator could be calculated through the number of different landraces preserved in one region and the percentage of their share in the total number of inventoried landraces.

Most effective forms of presentation:

Best way to present data for agricultural crops recorded by statistical office is in tables. Data for cultivation of landraces are not recorded, if such data exist they can be presented as a case study.

Limits to usefulness and accuracy: Each family preserves own seeds, so it is impossible all of them to be inventoried. Moreover, the determination of different landraces is a long-term and costly scientific process. However, this indicator may be useful to get a general idea on PGRFA diversity maintained by the local population.
Updating the indicator: The indicator should be followed and compared in 5-years periods
Closely related indicators - Trend of conserved autochthonous and local varieties of PGRFA in gene banks - Published scientific data
Additional information and comments This indicator has not been elaborated so far. Data collection should be performed by crop scientists (curators) that are familiar with different landraces in order to get more accurate information from the farmers. The inventory results should be integrated into an Agrobiodiversity database with a link to the National Biodiversity Information System.

8.14.1.2. Assessment of the indicator

The large-scale agricultural production in North Macedonia is based on commercial varieties and hybrids, except for the dry beans, based exclusively on the autochthonous population Tetovski bean. According State Statistical Office (SSO) of RNM, the area under wheat and rye in 2018 is reduced to 92%, compared to 2014, while the rice fields are reduced to 62%. Barley area remained almost unchanged, while maize and oats fields have increased for around 20%. Tobacco and sunflower are the only industrial crops cultivated for commercial production, both on reduced area to 93 and 46% in 2018. The production of vegetables has more or less unchanged trend, i.e. the area under peppers is increased for 8% and the fields with garlic, onions and lentils are increased for 1-2%. The production of other vegetables (beans, potatoes, tomatoes, cabbage, melons and watermelons) is decreased for 2-7%. Highest increase (74%) in 2018 is registered for fodder maize while the area with other fodder crops has remained almost equal to the area in 2014.

Table 40 Area and production of field and vegetable crops in 2018, compared to 2014

Wheat	70987	241106	76686	287954
Barley	42331	130028	41157	153055
Maize	36340	187676	30461	136930
Rye	3836	9379	4167	11402
Oats	3591	7338	2873	6033
Rice	3222	19732	5174	30500
Tobacco	16582	25547	17756	25578
Sunflower	2346	3379	5112	9268
Beans*	13122	12248	13614	13417
Potatoes*	12691	181931	13365	199651
Peppers	9179	182872	8522	175867
Cabbage**	5739	173141	5840	163988
Tomatoes	5569	161621	5720	175867
Melons, watermelons	5281	132091	5685	136730
Onions	3627	59030	3587	59974
Garlic	950	4134	930	4326
Lentils	81	107	80	98
Alfalfa	19698	115975	19678	130768
Fodder maize	6196	176656	3554	90392

Clover	3685	20314	3583	17203
Vetches-hay	2065	7856	2201	7488
Fodder peas-hay	1428	4976	1406	5582
Fodder beet	376	3481	378	3649

* Cumulative data for single crop and interfield; ** Cumulative data for early and late cabbage

Out of 268.922 ha of field and vegetable crops in 2018, 60% are sown with cereals (half of that with wheat), 21% with vegetables, 12% with fodder crops and only 7% with industrial crops.

SSO is not recording data for several crops that are cultivated in the country. According to MAFWE annual report (2018), poppy was produced on 60.3 ha in 2017, based on one domesticated morphine variety. This production has negative trend (113.7 ha in 2013), as well as the cucumber production on 1035 ha in 2017 and 1213 ha in 2013. The production of vegetables in plastic houses without heating and in glass houses, which includes several other crops than ones recorded by SSO, has positive trend from 3018 ha and 161 ha in 2014 (MAFWE annual report 2014) to 5139 ha and 221 ha in 2017.

SSO collects data for 9 fruit crops, although the establishment of plantations with other fruits is increasing in the last five years (e.g. hazelnuts). This production bases on new varieties and has an upgrowing trend: number of trees and production are increased for 33% and 21%, compared to 2014. Apple trees represent 51% of the total number of fruit trees (9090) with 63% participation in the total produced fruits (225863 t), while more than half of the other trees belong to plums (18%) and sour cherries (11%) with a production share of 17% and 5%, retrospectively. The other crops (pears, quinces, cherries, apricots, peaches and walnuts) share much smaller part of the fruit plantations. The number of grape vines in 2018 (86591) is increased for 2.5% only, compared to 2014, but the grape production is higher for 50%.

MAFWE has records for 47320 almond trees in 2017, which is slightly reduced number of trees compared to 2013.

Table 41 Fruit-bearing trees and grape-bearing vines (in 000) and production (t) of fruit and grape in 2018, compared to 2014

2018	No. of trees	4.724	454	64	1.671	232	1.017	203	553	172	86.591
	Production	140.296	8.055	1.573	37.719	5.824	10.538	3.904	13.128	4.826	294.497
2014	No. of trees	3.776	394	52	1.549	184	696	162	544	169	84.481
	Production	95.684	6.195	1.130	33.101	6.324	8.042	4.619	11.558	4.649	195.888

Contrary to the commercial agriculture, small farmers and local population in the rural areas maintain much larger diversity of PGRFA on the level of crops, and especially on the level of landraces. Their production is planned to satisfy their own needs and in rare cases the surplus products are sold at a niche local green markets. Landraces are planted in small field parcels or house gardens. Each household is strongly attached to a certain landrace, most often inherited in the family for decades. Therefore, in one garden several distinct landraces of onion, garlic, tomato, pepper, beans and corn are planted. This tradition relies on the farmers' choice for a specific taste or use, and on the specific landraces' trait, like good adaptability to draught or diseases. Almost all farmers apply traditional knowledge and practices for cultivation, practically following the principles of organic production. All landraces are endangered by extinction, mainly due to the intense migration of young people. Similar gardens are lately established in the urban areas as well, due to the increased trend for healthy food.

8.14.2. Case study

The Faculty of Agricultural Sciences and Food in Skopje conducted over 20 collecting missions in the period 2014-2018 in order to collect seeds and information form the local population from more than 400 inhabited places. This inventory collection of 6326 samples may provide some basic information for the PGRFA diversity preserved in North Macedonia. Crops with more than 20 samples are presented in the following Figure. Largest number of samples was collected from Phaseolus vulgaris (common and green beans), having the highest number of different landraces (>100). They are followed by pepper, squash, maize, melon, tomato, and watermelon samples, represented with over 30 landraces per crop. This indicates that several landraces of the above crops are grown in almost each garden. The cereal collection also contains high number of samples, but in case of wheat and barley they are mainly old commercial varieties.

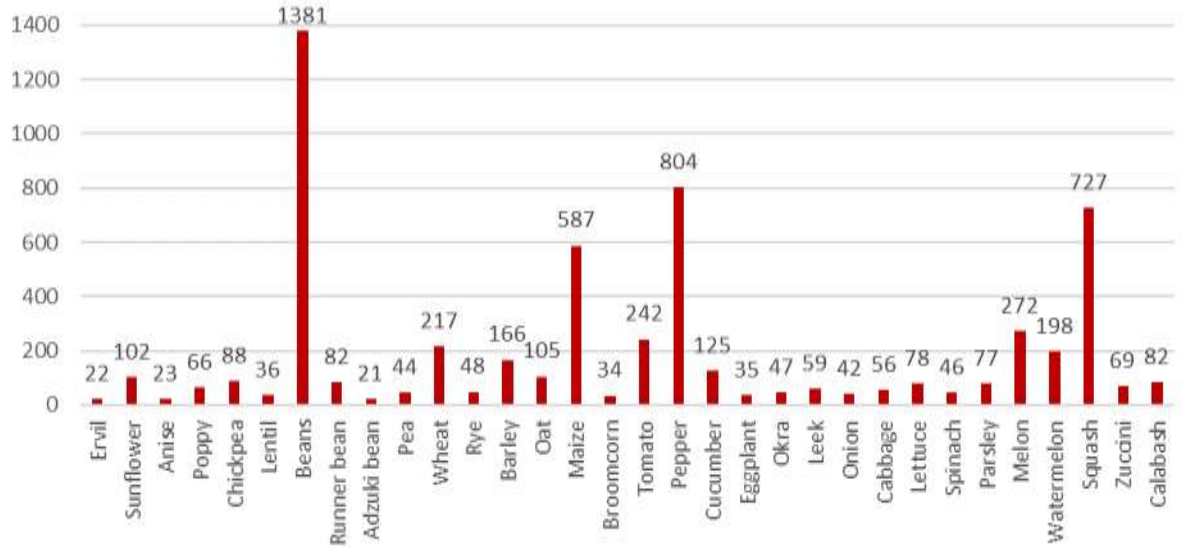


Figure 98 Number of samples per crop in the inventory collection of FASF

More than 10 landraces of scarlet runner bean and adzuki bean are registered as well, but they are rarely grown. Onion, garlic, cabbage, and some of the cereal crops (oats, rye and barley) are maintained with a several old landraces.

Some of the industrial crops are not grown for decades (hemp, cotton, hop, castor bean, rapeseed, sugar beet) which caused irreversible loss of their landraces. Others, like sesame, flax, poppy, sunflower and ground nuts are in a stage of disappearance, i.e. very small number of samples was collected from landraces of those crops. Landraces of chickpea, lentils and pea had the similar destiny, as well as of fodder crops.

There are 31 more crops into the collection with small number of seed samples: sugar beet, hop, cauliflower, asparagus and chicory with only 1 sample; sainfoin and broad bean with 2; cotton, hemp, field pea and meadow grass with 4; groundnuts, radish and orache with 5; rapeseed, sesame and parsnip with 6; castor oil plant and patience dock with 8; alfalfa and clover with 10; celery 13, flax 14; chard 15; soybean, vetch and millet with 16; carrot and red beet with 17; fodder beet 18 and rice 19. These small number of samples point out that these crops are disappearing, except for the vegetables which are often cultivated but with commercial seeds.

Old and domesticated fruit varieties are intensively replaced by modern ones, especially in the gardens and commercial orchards. However, old or wild fruit trees can be found in mountainous

villages in abandoned areas, along the roads or in meadows. Positive initiative within the last five years is the foundation of small collections of old fruit varieties in several regions, established by farmers, schools, monasteries, NGOs and researchers. Highest diversity within the fruit crops is registered for pears and apples (more than 30 different varieties), followed by plums (more than 20 varieties) and cherry and pomegranate with several old and domesticated varieties. Wild and local varieties of peach, apricot, medlar and fig, as well as wild trees of hazelnut and walnut are noticed in many yards and meadows, but their diversity is not investigated.

Grapevine was cultivated in North Macedonia since ancient times, based on many different varieties. Several of them are determined as autochthonous, while more than 20 are indigenous to the Balkan region.

This diversity of PGRFA noted during the inventory missions is largely threatened by extinction, therefore urgent actions are needed for ex-situ and in situ conservation. A support is also expected for promoting the values and quality of old landraces, especially for publishing a catalogue with their description. Such measures will motivate the urban population to plant and preserve many landraces which is best modus for sustainable conservation.

Figure 99 Part of Phaseolus vulgaris samples in the inventory collection of the Faculty and Agricultural Sciences and Food (Photo Sonja Ivanovska)

Figure 100 Part of the vegetables inventory collection of the Faculty and Agricultural Sciences and Food (Photos Sonja Ivanovska and Mirjana Jankulovska)

Figure 101 Part of the cereals inventory collection of the Faculty and Agricultural Sciences and Food

8.14.3. Indicator: Protected autochthonous farm animal breeds

8.14.3.1. Fact sheet

Author: *Vladimir Djabirski (Faculty of Veterinary Medicine, Faculty of Agriculture and Food Science)*

Indicators of protected autochthonous farm animal breeds **Indicator Name: Trends in the number of monitored populations of autochthonous breeds**
Lead Agency: MAFWE, Faculty of Agriculture and Food sciences, Institute of Animal Biotechnology
Use and interpretation: **Key question(s) which the indicator helps to answer**

Enhance knowledge of population size and monitor trends of autochthonous cattle, sheep and goat breeds.

Use of indicator

Identify and monitor threats on autochthonous cattle, sheep and goat breeds under the protection.

Threats to the biodiversity of farm animal breeds are many and diverse. Ensuring that action is taken to protect breeds from extinction requires that these threats be identified. If particular threats are becoming more significant, these trends need to be recognized.

The scale of appropriate use

The indicator is usable in planning the National Program of Livestock Biodiversity Protection. Also, it is applicable according to the *Global Plan of Action for Animal Genetic Resources* will rely on the outputs of national surveying and monitoring strategies (FAO, 2009b).

Potential for aggregation:

Estimating the conservation status of autochthonous species and breeds

Meaning of upward or downward trends („good or bad")

Comprehensive breed inventories and data on the size and structure of breed populations are prerequisites for effective management of livestock biodiversity, particularly to identify breeds that are at risk of extinction. Baseline data and regular monitoring of breed populations is thus essential.

Possible reasons for upward or downward trends:

Negative quantitative data, such as the negative trends in the numbers of animals of a particular breed, shows the tendency of their replacement with more productive breed and threat of extinction.

Implications for biodiversity management of change in the indicator:

Any changes identified by the indicator affect the management of autochthonous breeds of farm animals. The positive trend will require further development of the measures taken, while the negative trend should encourage a change in the existing strategy for the protection and implementation of more appropriate activities.

Units in which it is expressed:

According to populations size for different species: Extinct, Critical, Endangered, Vulnerable, Et risk, Not endangered.

Description of source data:

Reports of livestock biodiversity 2013-2019 (Institute of Animal Biotechnology), Data from farm animal identification and registration data base in Food and Veterinary Agency.

Calculation procedure:

Indicative number of animals and the number of animals that are categorized and registered in national breed's inventory, shown through time series.

Most effective forms of presentation:

Graphic

Limits to usefulness and accuracy:

- Fast-changing in the purity of populations as a result of a crossbreeding with most productive breeds.
- The discrepancy between the indicative number of autochthonous pure breed animals and data came out from national inventory after phenotypic characterization

Updating the indicator:

Permanent monitoring of populations

Closely related indicators

- Subsidies for autochthonous breeds - Gene bank – cryopreservation of semen
Additional information and comments A systematic approach in characterization, inventory, monitoring of trends, risks, assessments, and research in the field of protection of genetic resources in livestock breeding in the Republic of North Macedonia begins with the Program for Biodiversity Conservation in Livestock 2013-2017and continued with Program 2018/24. It has started a continuous work in collecting data on genetic resources in livestock breeding in the Republic of North Macedonia, which refers to indigenous breeds of domestic animals.

8.14.3.2. Assessment of the indicator

Regular monitoring of breed populations have been conducting since 2014 to obtain baseline data essential for local breed's inventories. According to the Program of biodiversity protection in livestock, Sharplanian, Karachanen sheep and Buffalo are extinct although their existence is noticed on the indicative locations. The population of Ovchepolian sheep and Balkan goat are not at risk, but Busha cattle is under the threat.

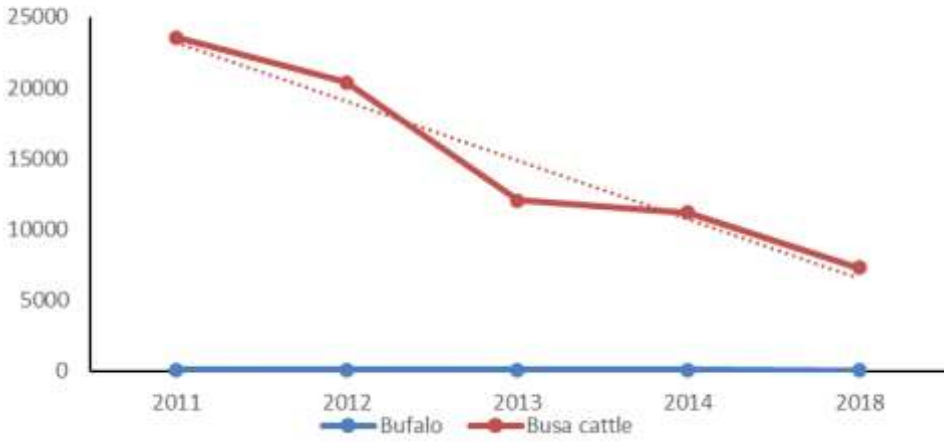


Figure 102 Trends in the indicative number of autochthonous Busa cattle and Buffalo (heads)

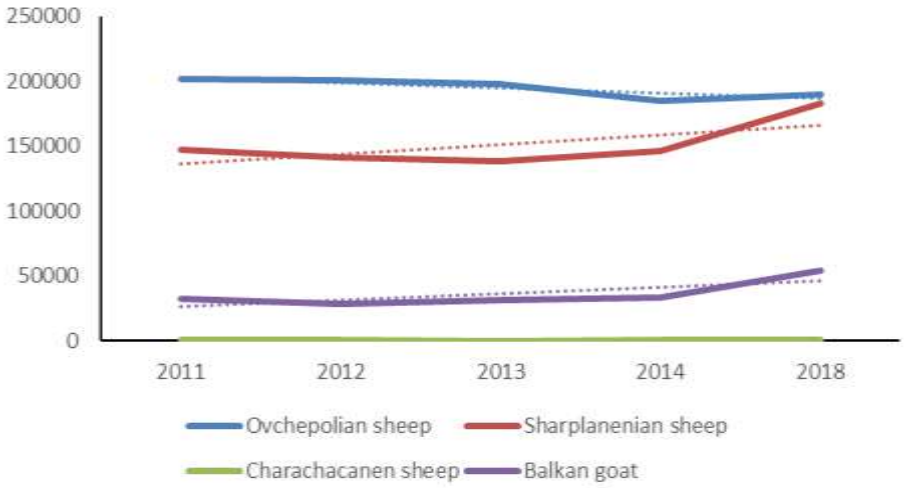


Figure 103 Trends in the indicative number of autochthonous sheep and goats breeds (heads)

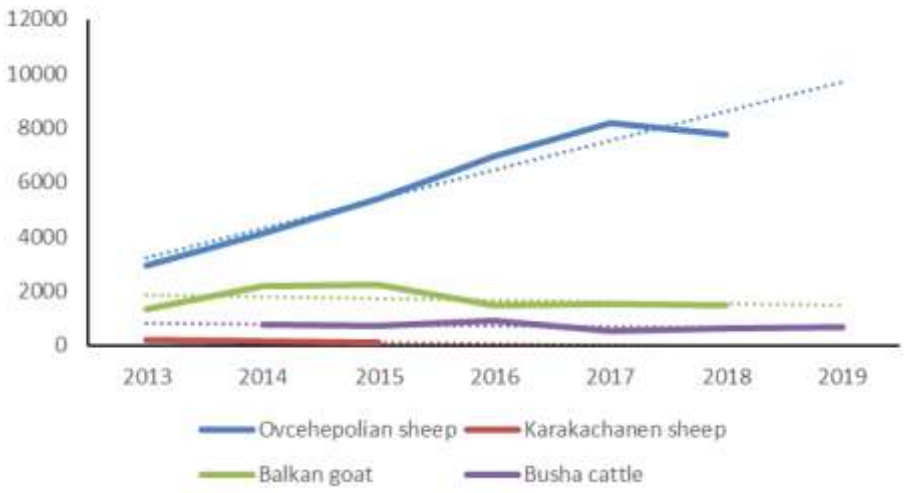


Figure 104 Trends in the number of autochthonous breeds registered in inventory herd book (heads)

8.14.4. Indicator: Supporting programs of autochthonous breeds

8.14.4.1. Fact sheet

Author: *Vladimir Djabirski (Faculty of Veterinary Medicine, Faculty of Agriculture and Food Science)*

SUPPORTING PROGRAMS OF AUTOCHTHONOUS BREEDS **Indicator Name:** **Trends of subsidies for autochthonous breeds and the number of registered animals in a national inventory.**
Lead Agency: Agency for Financial Support in Agriculture and Rural Development
Use and interpretation: **Key question(s) which the the indicator helps to answer** Effect of subsidies in stimulating breeding programs for local breeds. **Use of indicator** The the indicator is usable in planning the Program of Finical Support in Agriculture (direct payments) and Program of Rural Development. **The scale of appropriate use**
Potential for aggregation: Estimating the conservation status of autochthonous species and breeds.
Meaning of upward or downward trends („good or bad“) Inversely proportional trends of amount subsidies payment rate and number of pure breed animals of local

breeds show the low motivation of farmers to breed local breeds
Possible reasons for upward or downward trends: Negative trends in the numbers of animals from autochthonous breeds followed by the consistent supporting rate per head indicate the tendency of their replacement with more productive breed and the threat of extinction.
Implications for biodiversity management of change in the indicator: Negative changes in the indicator lead to the status of the breed towards the higher categories of threats (Et risk, Vulnerable, Endangered, Critical, Extinct)
Units in which it is expressed: According to population's size for different species threats are expressed in categories of Extinct, Critical, Endangered, Vulnerable, Et risk, Not endangered.
Description of source data: Program of Financial Support of Agriculture (2014-2019); Data from Report of State in Biodiversity in Livestock 2014-2019 (Institute of Animal Biotechnology, Faculty of Agriculture and Food Science.
Calculation procedure: Number of identified and recorded animals in the national inventory in the correlation of the subsidies payment rate per head through 5 years period.
Most effective forms of presentation: Graphic
Limits to usefulness and accuracy:
Updating the indicator: A permanent monitoring of the effective number of animals in populations versa payment rate.
Closely related indicators - Trends in the number of monitored populations of autochthonous species and breeds - Gene bank – cryopreservation of semen
Additional information and comments A systematic approach in characterization, inventory, monitoring of trends, risks, assessments, and research in the field of protection of genetic resources in livestock breeding in the Republic of North Macedonia begins with the Program for Biodiversity Conservation in Livestock 2013-2017and continued with Program 2018/24. It has started a continuous work in collecting data on genetic resources in livestock breeding in the Republic of North Macedonia, which refers to indigenous breeds of domestic animals.

8.14.4.2. Assessment of the indicator

Subsidies, as a sustainable measure that supports farm animals' biodiversity are essential in effective management only for animals identified, characterized and registered in the national recording system of autochthonous breeds. Even implemented continuously with the unchanging payment rate, effect of subsidies is an increasing trend in several breeds in the case of Ovchepolian sheep and stagnation in the case of Busha cattle (following figures).

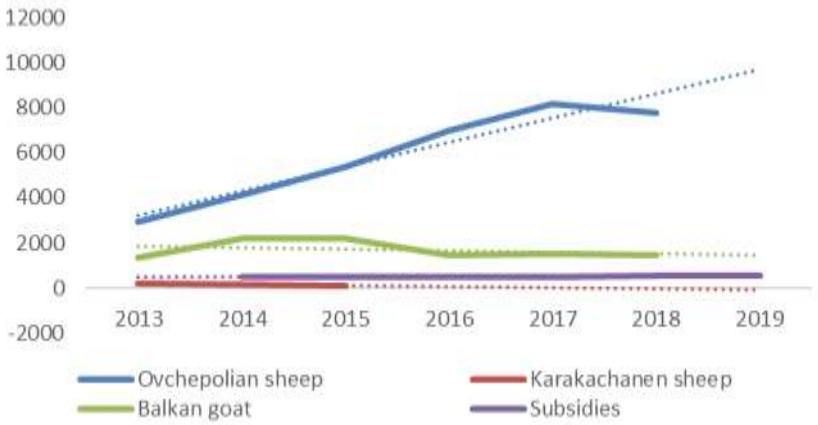


Figure 105 Trends in the autochtonous sheep and goat breeds registered in national inventory herd book and subsidies (MKD)

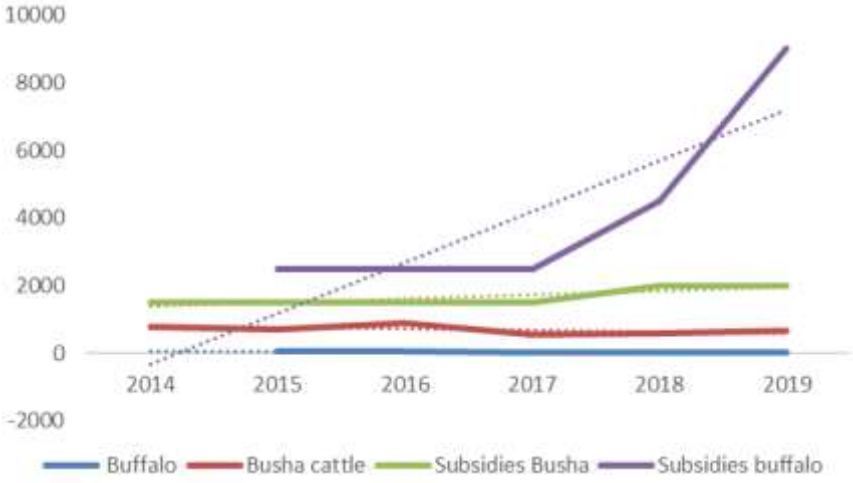


Figure 106 Trends in the number of the heads of registered busha cattle and buffalo in national inventory and subsidies (MKD)

8.15. **National target 14:** Establish monitoring of biological diversity and natural processes

8.15.1. Indicator: Monitoring protocols for key species and habitats

8.15.1.1. Fact sheet

Author: *Ministry of Environment and Physical Planning (MoEPP)*

SUPPORTING PROGRAMS OF AUTOCHTHONOUS BREEDS **Indicator Name:** **Number of developed monitoring protocols for key species and habitats**
Lead Agency: Ministry of Environment and Physical Planning (MoEPP)
Use and interpretation: **Key question(s) which the the indicator helps to answer** Ecological monitoring encompasses the assessment across time and space of biological communities and the systems in which they occur. Monitoring provides a possibility for the documentation of changes in the environment which can be natural and some are of human origin (Anthropogenic). A monitoring plan must be based on national needs. The first round of data gathering in nature is called an "inventory". It provides a baseline for the status of an area and valuable experience which can be taken into account when planning further steps in monitoring. Only after the data from the first inventory has been collected, assessed and repeated, it is possible to start gathering real evidence of the changes in the environment. Very important is to collect data from those species and habitats which are important for the decision making. Species and habitats of community interest especially should be in focus when planning national monitoring programmes. In addition data from species of national interest is needed, but requirements or need for the repeated checking may differ species by species. Pre-existing data is also needed to confirm the known past occurrences of species. This means that to accurately evaluate the status of species and habitats for every Natura 2000 area, pre-existing data is required along current data that is acquired through inventories and monitoring Key question for this indicator is what is the trends of number of developed monitoring protocols for key species and habitats. **Use of indicator** Monitoring protocols are being used to assess spatial and temporal trends of selected key species and habitats, with an emphasis on evaluating the efficiency of management policies. Also, monitoring protocols can be used for establishment and development of the Natura 2000 network, preparation of Report for the status of the sites, species and habitats for Habitats and Birds directives, reports for the European Environmental Agency (EEA), national reports for international conventions (CBD, Ramsar, Bern, Bonn etc.), development of management and restoration plans for the protected areas, assessment of conservation status for different species (Red List index), development of National Red List for the species, increasing public awareness, education activities etc.

The scale of appropriate use

National and international scale.

Potential for aggregation:

The indicator is simple and includes monitoring the number of developed monitoring protocols for key species and habitats.

Meaning of upward or downward trends („good or bad")

Monitoring protocols are being used to assess spatial and temporal trends of selected key species and habitats, with an emphasis on evaluating the efficiency of management policies. The number of developed monitoring protocols will increase the amount of collected data for different taxonomic groups and habitats and the same will be collected in standardized and systematic way.

Possible reasons for upward or downward trends:

Implementation of habitats and birds directive requires sufficient data from large number of habitats and species. By producing monitoring protocols for the selected species of habitats, birds and other species data gathering is strengthened and the process of inventory activities and monitoring activities is facilitated of biodiversity.

This can be facilitated the process of developing the Natura 2000 network and improve the national biodiversity database.

Implications for biodiversity management of change in the indicator:

It is expected this indicator to maintain the positive trend, taking into account the obligations for the country under the Plan for implementation of EU Habitats and Birds directives, requirements of these directives and national legislation of nature protection.

Units in which it is expressed:

Number of developed monitoring protocols for key species and habitats.

Description of source data:

Relevant data sources in MoEPP:

Natura database, Emerald database, National Web site for Red Lists, Environmental indicators reports, CDDA data for protected areas, Cadastre of protected areas, National Information System for Nature, studies for valorization/revalorization of protected areas, management plans for protected areas, reports as obligation from international conventions (CBD, Ramsar, Bern, UNESKO, etc), EEA reports, reports of other projects related to protected areas and nature conservation, Annual reports for realized activities of Nature Sector, etc.

Calculation procedure:

Review of relevant documentation: Natura database, Emerald database, National Web site for Red Lists, Report for Monitoring methodology and protocols for 20 habitats, 20 species and 20 birds, Report for Five Year Program for National Biodiversity Monitoring, Feasibility study for using citizen science in biodiversity monitoring, EEA reports, reports as obligation from international conventions (CBD, Ramsar, Bern, UNESKO, etc), National Information System for Nature, National Draft List of Habitats in Annex I of the Habitats Directive, National Draft List of species of plants and animals listed in Annex II of the Habitats Directive for each of the two biogeographical regions (continental and alpine) and Draft List of bird species from Annex I of the Birds Directive, migratory birds and other birds of importance regularly occurring in the country; distribution maps of habitats and species of EU interest at a national level, etc.

Most effective forms of presentation:

Fact sheets, distribution maps, graph and narratives.

Limits to usefulness and accuracy:

The resent reasons for undeveloped protocols and not gathering sufficient data from all relevant taxonomic

groups at the national level are due to insufficient expertise and a lack of human and financial resources.

Another challenge in the work is the shortage of old data from several taxonomic groups and habitat types. Some taxonomic groups (plant species, birds and mammals) are well studied, whereas some taxonomically demanding groups have not been studied almost at all.

At a national level for the establishment of Natura 2000 network, there is need to get comprehensive data for species of Annex II and of habitats of Annex I of the Habitats Directive and birds species of Annex I of the Birds Directive.

Updating the indicator:

The indicator should be followed in period of one year. The first round of data gathering in nature is "inventory". Also the first inventory provides experiences which can be taken into account when planning further steps in monitoring. Only after the data from the first inventory has been collected and assessed and repeated, it is possible to start gathering the real evidence of the changes in the environment.

Inventories with several methods should be in two new areas every year. After five years the base-line data would be collected from 10 areas.

If the five year period is started, the first year data is already providing pieces of monitoring data

During later monitoring, instead, only those methods will be used which are essential for gathering monitoring data from the area. The decision of used methods must be done case by case and it must be based on the diversity and structures of the habitats in the area. Also, the volume of used methods needs to be decided case by case, depending on the site of study area.

Developed protocols should be updated during the time for new taxonomic groups and habitat types and also if some new more effective methods occur

Area	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Pelister	inv		Mon			
Prespa lake	inv		Mon			
Mavrovo		inv		mon		
Galicica		inv		mon		
Shara mnt			Inv		mon	
Osogovo			Inv		mon	
Ohrid			Inv		mon	
Jakubizca				inv		mon
Jablanica				inv		mon
Kozuf					inv	
Belasica					inv	mon
Dojran					inv	mon
						data analyses
						from all 5 years

Sources: Report: Five Year Program for National Biodiversity Monitoring (MoEPP, 2019).

EU Twinning project: "Strengthening the capacities for effective implementation of the acquis in the field of nature protection"

Closely related indicators

This indicator is associated with following indicators as well:

- Trends in the number and surface of protected areas by category (% in relation to total area of the country)

- Trends for adopted protected area management plans,
- Number of transboundary protected areas,
- Trends in the number of key species and habitats monitored in protected areas and ecological networks,
- Trend of populations of key conservation species,
- Capacity building
- Number of public awareness raising activities for biodiversity conservation etc.

Additional information and comments

One organization should be named as a responsible body for the maintenance of national checklists of all taxa. In many countries, natural history museums have such a role.

All national data should be included in the National Information System for Nature in MoEPP, with the aim storing, processing and managing biodiversity information, geodiversity, protected areas, ecological networks and etc..

All national data should be linked with Global Biodiversity Information Facility (GBIF).

A service portal, which is linked to the database for the species observation by citizens, should be opened.

Social media or other open platforms provide many possibilities to build up volunteer based observation systems, which also allow the quality assesments of the data.

Relevant national planning documents

1. Law of Nature Protection ("Official Gazette" No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16).

http://www.moepp.gov.mk/wp-content/uploads/2014/10/%D0%97%D0%90%D0%9A%D0%9E%D0%9D-%D0%97%D0%90-%D0%97%D0%90%D0%A8%D0%A2%D0%98%D0%A2%D0%90-%D0%9D%D0%90-%D0%9F%D0%A0%D0%98%D0%A0%D0%9E%D0%94%D0%90%D0%A2%D0%90.pdf

2. **www.natura2000.gov.mk**

3. Report: Monitoring methodology and protocols for 20 habitats, 20 species and 20 birds (MoEPP, 2019). EU Twinning project: "Strengthening the capacities for effective implementation of the acquis in the field of nature protection".

4. Report: Five Year Program for National Biodiversity Monitoring (MoEPP, 2019). EU Twinning project: "Strengthening the capacities for effective implementation of the acquis in the field of nature protection".

5. Report: Feasibility study for using citizen science in biodiversity monitoring (MoEPP, 2019). EU Twinning project: "Strengthening the capacities for effective implementation of the acquis in the field of nature protection".

6. Monitoring Manual for Lake-bound Species and Habitats (2019). GIZ project:"Conservation and Sustainable Use of Biodiversity at Lakes Prespa, Ohrid and Skadar Lake "(CSBL) – Biodiversity Conservation Component

http://akzm.gov.al/wp-content/uploads/2019/07/Monitoring_Manual_for_Lake_bound_Species_2019.pdf

7. Monitoring Manual of key flora and fauna species and habitat types for the protected area Natural Monument (NM)-"Vevcani Springs"
https://ekosvest.com.mk/dokumenti/publikacii/Priracnik%20za%20monitoring%20na%20klucni%20vidovi%20i%20zivealista.pdf

8. Balkan Lynx Recovery Programme (2006-2018). MES, second edition 2018.

9. Monitoring of certain rare plants within the boundaries of the identified national Important Plant Areas (IPAs). MES/CEPF project 2019-2022.

8.15.1.2. Assessment of the indicator

Natura 2000

In creating Natura 2000 network, a member state needs to have proper data from the species and habitats of community interest. The data must cover the whole territory of the country.

Implementation of habitats and birds directive requires sufficient data from large number of habitats and species. Data gathering is strengthened by producing monitoring protocols for the selected key species of habitats, birds and other species. The main interest are the "species of community interest" (Annex II species of the habitats directive) and in bird species-especially the species in the Annex I of the Birds directive. In addition, species of national interest (endemic species and species with high international conservation value) have been taken into account in planning the monitoring protocols.

Protocols for the monitoring of birds

For the monitoring, methods used for the inventories can be applied for nearly all bird species exploiting the habitats. Two main methods used are:

- point counts of so-called land birds
- round count of waterfowl, covering together most species.
- Raptor species are an exception as their population densities are usually low, and the advisable method is active searching of territories or nests.

Protocols for the monitoring of habitat types

Habitat monitoring is mainly based on the use of data from remote sensing and field inventories. Field inventories provide also data for the monitoring of plant species especially, but additionally data from several other taxonomic groups can be collected at the same time.

All relevant national inventory data (including historical data) on habitats should be collected in one place and processed in a form that it serves monitoring and later reporting of habitats. Historical background data is valuable also in planning of inventories of those habitats which require management activities in the field. Field inventories of most of the habitat types can be done at the same time of inventories of plants and mosses.

Grassland types are the most demanding group in the identification of habitat types. Some of the grassland types cannot be identified from the satellite images and even in the field identification of some types can be demanding even for wery experienced experts.

Vascular plants and mosses will be observed with traditional methods and most of the observations need to be made by active searching.

Vertebrates: mammals, reptiles and amphibians will be mostly observed using traditional active searching (binoculars, telescopes, digital cameras, maps, GPSs, etc.) In some demanding cases, songs of some birds can be recorded, but only in the case the recording is truly needed for the identification of the species.

1. Active searching (usually with insect net, pond net, or sweeping net and camera): all taxonomic groups
2. Sieving methods: Molluscs, Pseudoscorpions and Insects
3. Window traps: Insects, mainly beetles
4. Pitfall traps: Molluscs, Pseudoscorpions and Insects
5. Tape traps: Pseudoscorpions and Insects
6. Folio traps: Molluscs, Pseudoscorpions and Insects, mainly beetles
7. Light traps: Insects, mainly moths and some beetle species
8. Odour traps: Insects, mainly butterflies and moths

Monitoring of biodiversity at national level

A Biodiversity Monitoring System in the Republic of North Macedonia is not in place and regular multi-year monitoring is only implemented for some select habitats and species.

According to artcile 154 of Law on Nature Protection ("Official Gazette" No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16) the body responsible for the execution of expert works in the field of nature protection shall monitor and organize the monitoring of the status of nature in accordance with the methodology for monitoring of the status of nature.

The monitoring of the status of nature protection shall be performed through:

- measuring, monitoring, assessment and control of the status of the species, their habitats, types of habitats, environmentally important areas, ecosystems and landscape types;
- measuring, monitoring, assessment and control of the change in geological values (occurrences of sheds, erosion, new sources etc.), and
- monitoring of the status of natural heritage.

For National park Pelister and Natural Monument (NM)- Prespa Lake in period 2018-2019 fact sheets are prepared for 17 habitats, 4 plant, 17 animals and 20 bird species of EU interest for data gathering at field.

According to Annex II of Habitats Directive and Annex I of Birds Directive for National park Pelister and Natural Monument (NM) - Prespa Lake within EU Twinning project: “Strengthening the capacities for effective implementation of the acquis in the field of nature protection”, 8 field monitoring protocols for following taxonomic groups: vascular plants, bryophytes, mammals, birds, reptiles and amphibians, fish and crayfish, invertebrate species, fungi and lichen species, were prepared In 2019.

Also, According to Annex I of Habbitats Directive 3 field monitoring protocols for different habitats: forests and other wooded habitats, open habitats (grassland, heath and scrub) and wetlands (mires, bogs, lakes and rivers) were prepared.

NP Pelister is currently conducting monitoring of large carnivores, including the possible occurrence of lynx.

Monitoring of selected 4 habitats and 32 species in NP Galicica was implemented for some years and it is ongoing until.

Monitoring protocols for 5 endemic plants (*Aesculus hippocastanum*, *Astragalus physocalyx*, *Campanula debarensis*, *Centaurea rufidula* and *Crocus jablanicensis*) and the white poplar forest is developed in 2o18-2019.

Monitoring Manual of key flora and fauna species and habitat types for the protected area Natural Monument (NM) -"Vevcani Springs" in 2019 was prepared. Field observation sheet for: forest habitats and Large mammals (Brown bear, Wolf, Balkan lynx and European wildcat), Amphibians (Greek frog and Yellow frog), Reptiles (Greek turtle), Birds (European quail, Common buzzard and Peregrine falcon), Butterflies (Mountain Apollo and Cloud Apollo) and Fungi (Hygroscopic earthstar, Satan's bolete, Golden-gilled bolete and Caesar's mushroom) were produced.

Monitoring of large carnivores in transboundary Prespa Region conducted by NGOs and protected areas administrations supported by PONT is implementing.

Balkan Lynx Recovery Program at a national level (with the main focus in NP Mavrovo and the surrounding areas) is implemented by NGO in collaboration with state authorities. Balkan lynx monitoring gudilines (2006) and a field Manuel to the Balkan lynx (2006-2018) were developed.

Monitoring Manual for lake-bound species and habitats of Prespa, Ohrid and Skadar Lake, according the requirements EU Habitats and Birds directives has been developed and tested by the three neighboring countries in 2019. The monitoring covered 21 species from flora and fauna and for 2 habitat types.

Based on the above it can be concluded that there is a positive trend in the number of developed monitoring protocols for key species and habitats.

At a national level 10 monitoring protocols for key habitats, 8 field monitoring protocols for taxonomic groups (vascular plants, bryophytes, mammals, birds, reptiles and amphibians, fish and crayfish, invertebrate species, fungi and lichen species) and aproximatly of 75 monitoring protocols for key species were prepared.

Also, 4 Monitoring Manuals for habitats and species have been prepared at a national leve.

The MoEPP will adopt the 3 field monitoring protocols for different habitats: forests and other wooded habitats, open habitats (grassland, heath and scrub) and wetlands (mires, bogs, lakes and rivers) and 8 field monitoring protocols for taxonomic groups (vascular plants, bryophytes, mammals, birds, reptiles and amphibians, fish and crayfish, invertebrate species, fungi and lichen species), which have been developed under the EU Twinning project: "Strengthening capacities for effective implementation of nature conservation legislation".

In the future, these protocols will need to be used by all entities and experts for implementatiom biodiversity monitoring at national level.

8.15.2. Indicator: Trends in number of monitored species and habitats in protected areas and other important sites

8.15.2.1. Fact sheet

Authors: *Robertina Brajanoska, Despina Kitanova (Macedonian Ecological Society)*

Indicator Name: Trends in number of monitored species and habitats in protected areas and other important sites

Lead Agency: Ministry of Environment and Physical Planning

Use and interpretation:

Key question(s) which indicator helps to answer

Collecting relevant data of different biodiversity components is important for protection of biodiversity and creation of the appropriate management and restoration measures. This indicator shows the trend in monitoring of biodiversity species and habitats in but also outside od PAs.

Use of indicator

This indicator might provide useful information for:

- status of monitored species and habitats and the state of nature in targeted sites,
- set and improve the national biodiversity monitoring database,
- publish relevant studies,
- develop protection and management measures especially for the key biodiversity species (national or international protected species and habitats, endemic or rare species),
- develop, improve and implement the PAs management plans,
- initiate proclamation of new PAs, establishment of Natura 2000 sites, or identification of Key Biodiversity Areas
- contribute in development of national, regional and local spatial plans and environmental action plans
- create appropriate policy for nature protection

Scale of appropriate use

This indicator is very complex, includes species from different taxonomic groups and different habitats, therefore it can be used at different scales e.g. for some species and habitats could be used on a national scale or to be concentrated on some small or isolated sites such as Golem Grad island.

Potential for aggregation:

The indicator is closely connected with other indicators, such as number of developed monitoring potocols for key species, population trends of species, red list index, farmland bird index, diversity and status of habitats, identification of Natura 2000 sites etc.

Meaning of upward or downward trends („good or bad")

Positive trend (increase) is expected in the number of monitoring species and habitats, that is in relation to the implemented projects that are working on development of a monitoring protocols and include more species and habitats in the biodiversity monitoring system at the same time strengthening the capacities for biodiversity monitoring. The process of identification of Natura 2000 in the country (as an obligation in the EU negotiation process) also contributes to increasing data collection in general but also monitoring of new species and habitats.

Possible reasons for upward or downward trends:

The positive trend is related with providing adequate resources for conducting regular monitoring. In this regard international projects which include or are focused on monitoring of species and habitats, increased interest in monitoring of biodiversity by the PAs, inclusion of NGOs in implementation of the monitoring activities and also EU integration process and establishing of Natura 2000 in the country etc. needs to be considered.

Implications for biodiversity management of change in the indicator:

Biodiversity monitoring provides basis for nature protection and biodiversity conservation, so any collected data for the state of the biodiversity can have an implication on biodiversity management. Thus, monitoring

data should be collected in proper database and analyzed, then used in taking decisions and reasonable management measures.

Long-term monitoring of the state of biodiversity can give us a better understanding how nature changes over time. Thus, using the results of the monitoring and its analysis specific biodiversity protection, management and restoration measures can be set on time.

Units in which it is expressed:

Number of species/habitats under regular monitoring per year in and outside of PAs .

Description of source data:

Currently, there is no national database for biodiversity monitoring that incorporate all monitoring data. Therefore the data bases of different institutions and organizations is used to present the indicator: Macedonian Ecological Society, Institute of Biology - Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje, Protected areas management bodies, Hydrobiological Institute. Relevant regional and international data bases can be used, as well.

Calculation procedure:

Review of project reports, scientific articles, etc.

Most effective forms of presentation:

List of monitored species per groups

Limits to usefulness and accuracy:

Monitoring data should be appropriately structured, stored and managed by the responsible legal entity or designated institution or organization.

Currently the data are scattered between different institutions/organizations, analysis are sometimes very difficult because the collected data are not unified, data are not collected in continuation and not submitted to the legal entity or are unavailable.

Updating the indicator:

This indicator is best to be followed each year per PA and other important sites.

Closely related indicators

- Population trends of key species
- Monitoring protocols for key species and habitats
- Red list assessment
- Trends in number and surface of protected areas
- Trends in surface of identified Natura 2000 sites
- Cross-border protected areas
- Protected areas management effectiveness
- New species described from North Macedonia
- Citizen science

Additional information and comments

This indicator is reported in the previously report only for the long-term monitoring species as Balkan lynx and vulture.

8.15.2.2. Assessment of the indicator

Monitoring of nature, as required tool for assessment and monitoring of the biodiversity components, is described in the Law on Nature Protection (Official Gazette of RM, бр. 67/04 and corresponding amendments, Article 4, 148 and 154). According to the Law, Ministry of Environment

and Physical Planning (MoEPP) is responsible entity for organization of the monitoring of the nature status and undertaking of appropriate measures for its protection and preservation. The monitoring methodology shall be prescribed by MoEPP based on a proposal by the responsible body for the execution of expert work in the area of nature protection. Monitoring can be performed by MoEPP and accredited legal entities that fulfill the relevant conditions/criteria (Article 148), but still there are no accredited entities in the country.

However, besides MoEPP, monitoring of the state of nature and its components invovles other institutions and organizations, protected areas management bodies, scientific institutions (Institute of Biology - Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje, Hydrobiological Institute, Museum of Natural History of the Republic of North Macedonia), and conservation NGOs such as Macedonian Ecological Society, BIOECO, Eco Svest, Polymath 13, etc..

On the other side, Ministry of agriculture forestry and water economy (MAFWE) as responsible national institution for management and use of forest resources, pastures and game, have obligations for monitoring of the status of those natural resources. Monitoring of the forest ecosystems is prescribed in the Law on forests, Article 12 (Official gazette no.64/09). In accordance with this Law, the Faculty of Forestry in Skopje is obliged to develop monitoring programs and to conductmonitoring. The long-term monitoring of forest is related to the 10 years forest management plans that are developed and implemented by the PE National Forests (forest management department). FAO developed A *state*-of-the-*art forest monitoring system* tailored to the country's needs designed so it is expected that this monitoring system will provide reliable data for the state of forest in the country in the future. Cooperation between MoEPP and MAFWE in regard to the data shring is not well established.

According to the Law on hunting (Official gazette of RNM No.26/09, 82/09 and related amendments, 136/11, 1/12, 69/13, 164/13 и 187/13), in scope of hunting grounds, concessioners are obliged to conduct the sessional monitoring of game species, but there is no register for monitoring data of the game. According to the Law for national statistic (Official gazette of RNM 54/97, 21/07, 51/11, 104/13, 42/14, 192/15, 27/16, 83/18, 220/18) and the Program for the national statistic, annual reports for the game in the country are produced, where the status of the game species should be reported to the State Statistical Agency. But those data are used for analysis only by the Aency and are not public data (those data are protected, as stated in the Law)

Related to the state of the fish species in accordance to the Law on fisheries and aquaculture (Official gazette of RSM no. 7/08, and appropriate amendments, Article 76) it is prescribed that monitoring of the state of fish and fisheries should be conducted by the legal entity for the needs of the MAFWE. The concessioners are obliged to conduct monitoring of the fish populations, invasive species, quality of the water bodies, etc.

Monitoring of nature as required tool for determination and monitoring of the state of the biodiversity is described in the Law on Nature Protection (Article 4, 148 and 154). To establish monitoring of biodiversity, monitoring protocols and schemes should be prescribed by the legal entity responsible for nature protection, but due to lack of financial resources and capacities, the monitoring, in general, is implemented through different project activities.

Monitoring of species

In the last five years about 345 species from different taxonomic groups were monitored for different purposes. Almost 253 species were subject of long-term monitoring activities, 46 species were covered by opportunistic (short term, irregular) monitoring and preliminary monitoring was

ddone for 46 species. As expected, the majority of monitored species are birds (93) followed by reptiles and amphibians.

Table 42 Overview of the number of monitored species per taxonomic groups.

Taxonomic groups	Long term monitoring	Oportunistic monitoring	Preliminary monitoring
Large carnivors	1	3	
Ungulates		2	
Bats		4	3
Birds	246	18	
Reptiles	5	7	4
Amphibians			9
Fish		5	17
Molluscs		2	
Decapods		1	
Dragonflies		3	2
Butterflies		1	1
Orthoptera			1
Beetles		1	1
Plants	1		4
Total	253	46	43

EU integration process and establishing of Natura 2000 in the country is an ongoing process on which North Macedonia is currently working intensively. Pre-accession commitments related to the implementation of the EU Habitat and Bird Directive and establishment of Natura 2000 network are a major challenge for the country, especially because of lack of available funding, biodiversity data and capacities. Therefore, the MoEPP is focusing on implementation of EU funded projects but also using other international funds. One of the important on-going projects in the country is the Swiss funded Nature Conservation Program in North Macedonia that supports activities for selection and potentially designation of three Natura 2000 sides in the East part of the country (Maleshevski Mountains, Dolna Bregalnica and Ovche Pole). Different type of habitats can be found on this sites where an ongoing process for collection of biodiversity data following the prescribed methodology for identification of Natura 2000 and filling in the Standard data forms. Preliminary monitoring activities are implemented in the last three years (2017-2019), covering 63 species from different biodiversity groups and several priority habitats (more detail in the next paragraphs for each taxonomic groups, if applicable).

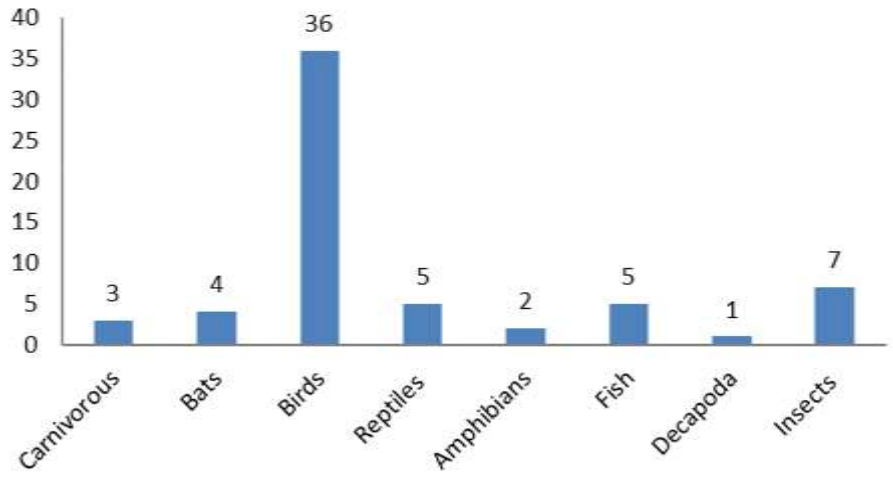


Figure 107 Number of monitored species for Natura 2000 purposes

Since 2006, the monitoring of Balkan lynx is carried out in scope of the Balkan Lynx Recovery Program, implemented by Macedonian ecological society. The Balkan lynx monitoring is a long-term monitoring which includes estimation of population abundance and trend in the core area of the specie distribution, the National Park Mavrovo and hunting ground Tajmishte near Kichevo city. The monitoring is conducted in cooperation with the park representatives in the period of 2015-2019. Outside of the core area of the Balkan lynx distribution, opportunistic monitoring is conducted in the whole potential range of its distribution in west part of the country, where presence-absence and confirmation of reproduction monitoring activities are implemented in NP Pelister, NP Galichica, Jablanica Mt. and also Stogovo and Karaorman mountains in the same period (2015-2019). In scope of the Balkan lynx monitoring program, the monitoring for the native population of Chamois (*Rupicapra rupicapra*) in NP Mavrovo, and in three hunting grounds on the border line with the Park is set and implemented in 2019.

From bats fauna only several important species are part of the monitoring activites, three species has been part of opportunistic monitoring in MN Slatinski Izvori (*Rhinolophus hipposideros, Rhinolophus ferrumequinum* and *Rhinolophus euryale*) and potentially 4 (*Miniopterus schreibersii*, *Myotis daubentonii*/*capaccinii*, *Barbastella barbastellus* and *Myotis myotis*/*blythii*) are target of preliminary monitoring set in the selected Natura 2000 sites (Maleshevski Mt. and Dolna Bregalnica).

Long-term monitoring activities for birds' species are mainly related to international monitoring activities, which were mainly conducted by the Macedonian Ecological Society (MES), in scope of different initiatives and projects. The monitoring of the birds includes resident and migrating breeding species.

International waterfowl census is conducted from 2010 and is the longest running birds species monitoring in the country which is implemented every year without interruptions, and include 60 species till now. Census type of monitoring, for determining trends on national, European and Flyway level is implemented on the most important water bodies in the country, the Monument of Nature (MN) Lake Dojran, MN Lake Ohrid and MN Lake Prespa (as protected areas), and also on reservoir Mladost and reservoir Treska.

North Macedonia was included in the development of the second European breeding bird atlas from 2015 to 2017. The data collected for the atlas species are on continental level and include 222 bird

species. Identifying the breeding evidence (on both 10x10km and 50x50km data format) and abundance categories (for 50x50km data format only) for all the known and/or newly identified breeding species is used as a type of the monitoring. Monitoring methodology includes combination of line transect, point counts, territory mapping and timed walked routes. MES with the help of both local and foreign supporters implement this monitoring activities.

Adriatic flyway project support a local monitoring for the extend for electrocution and collision of birds on powerlines in the IBA Kochani Rice Fileds and the IBA Ovche Pole conducted by MES with Local conservation groups. This monitoring is focused in 5 bird species of conservation importance, and 66 bird species are covered additionally alongside this type of monitoring,

Vultures conservation program is an international monitoring program on a flyway level of the species, which include the vulture's species present in the country (Griffon and Egyptian Vultures). MES is involved in this program for years (from 2002, with some interruptions). The monitoring includes population size and distribution and breeding success that is focused on the following localities (Osogovo, Bislimska Klisura, Dolna Bregalnica, Veleshko, Demirkapiska Klisura, Tikveshki Region, Mariovo, Matka for the Egyptian vulture and Demirkapiska Klisura, Chatino - Kozuf, Mariovo for the Griffon).

In general, 264 birds species are monitored in the country from 334 species confirmed and recorded for North Macedonia. It should be mentioned that the monitoring is conducted in continuation for some species or with some interruptions, and covering different type of habitats and locations.

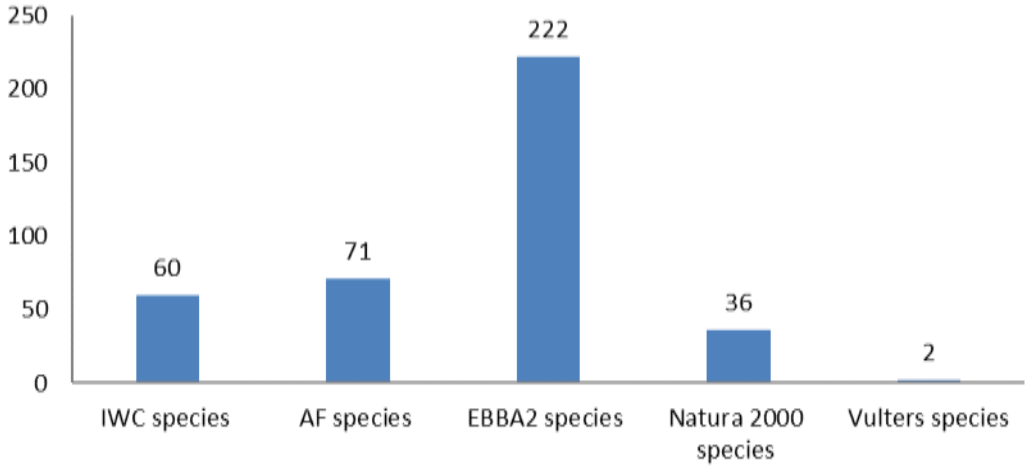


Figure 108 Number of monitored birds' species in scope of different monitoring activities

The longest running national capture-mark-recapture (CMR) continuous monitoring of reptiles is based in two localities in NP Galichica, on three species: the Hermann's Tortoise (*Testudo hermanni*) on Golem Grad island and in Konjsko village since 2008 and 2010, respectively, and only island populations of the Dice Snake (*Natrix tessellata*) and the Horn-nosed Viper (*Vipera ammodytes*) since 2008 and 2007, respectively. Additionally, presence-absence data has been collected on the Wall Lizard (*Podarcis muralis*) in both localities, and only in Konjsko: on both above-mentioned snake species along with the Caspian Whip Snake (*Dolichophis caspius*), Four-lined Snake (*Elaphe quatuorlineata*), Grass Snake (*Natrix natrix*), Aesculapian Snake (*Zamenis longissimus*), Slowworm (*Anguis fragilis*), Snake-eyed Skink (*Ablepharus kitaibelii*), Erhard's Wall Lizard (*Podarcis erhardii*) and the Dalmatian Algyroid (*Algyroides nigropunctatus*). Two more reptile species have been monitored using CMR, but opportunistically from 2010-2013, in 2015 and in 2018 on Bistra Mt. in NP Mavrovo:

the Meadow Viper (*Vipera ursinii*) and the Sand Lizard (*Lacerta agilis*). All research is part of an international collaboration of researchers from Belgrade University in Serbia, the National Center for Scientific Research (CEBC-CNRS) in France and Macedonian Ecological Society, as part of several small- and large-scale projects, funded to a large extent by the Ministry of Education and Science of Republic of Serbia. Besides, other Natura 2000 biodiversity species, 6 reptiles (listed on the EU Habitat Directive Annex II) are target of preliminary monitoring in the selected Natura 2000 sites in North Macedonia.

Regarding the available data for amphibians, 2 species (*Triturus macedonicus* and *Bombina variegata*) are included in preliminary monitoring for the selected Natura 2000 sites and for 7 more species presence absence data has been collected (2017-2019) for two localities Nature Park Ezerani and Studenchishko Blato swamp. This monitoring activities are part of the project "Monitoring Manual for Lake-bound Species and Habitats of Lakes Prespa, Ohrid and Shkodra/Skadar, Implementing the EU Nature Conservation Directives in South-Eastern Europe", financed by GIZ, in which 14 species and 2 habitats in whole from RNM are included.

Opportunistic monitoring has been conducted for five fish species (Barbus balcanicus, Rhodeus meridionalis, Romanogobio banarescui, Sabanejewia balcanica and Salmo macedonicus), using (x methods from 2017-2019), for definition of the its population status in the river catchment of upper part of Bregalnica River (Maleshevski Mt.) and lowland of the same river the area of Dolna Bregalnica. Those native fish species are included in the definition of the sleeted Natura 2000 sites.

A preliminary fish-based assessment of the ecological status of Lake Ohrid according to the WFD was obtained in 2017-2018. Monitoring with reasonably good information on fish assemblages with regard to species composition, relative abundance and biomass (CPUE), and size structure of the individual fish populations is used for 17 fish species (Spirkovski Z. et all., 2017). As a preliminary assessment and adapted monitoring methodology it provides well basis for future monitoring of the fish fauna at this important water ecosystem on national but also international level.

Invertebrate species (decapods, mollusks and insects species), have been monitored opportunistically, presence-absence data has been collected and population size for some of them is estimated using transect methods, traps e.t.c. NP Galichica and MN Vevchanski Izvori take steps in development of monitoring protocols for invertebrate species (in 2019), with a goal to implement long-term monitoring activities in the next period.

Regarding the actual monitoring data for plants (in the last five years), only one specie (*Astragalus physocalyx*) is covered with appropriate monitoring data at the locality of its occurrence (preliminary data are avalible from 2015, and population and distribution size is estimated in 2019) and for 4 more species preliminary monitoring is set in scope of the in scope of an international project financed CEPF (Critical ecosystem partnership fund) implemented by MES and in cooperation with local NGO Polimat 13. In frame of the MN Vevchanski Izvori 5 medical plants species are target of the monitoring, but is just set, and only first data for its assessment are available (for 2019).

Habitats

The monitoring or of the status of natural habitats listed on Annex I of the EU Habitats Directive is caring out using the adapted monitoring methodology in North Macedonia but relevant to the aspects of the Habitats Directive. Even, the status of the natural habitats is a crucial for definition of appropriate policy and management mesures for its protection, Noth Macedonia still have a gap in the knowledge about the state of habitats and its distribution. However, in scope of several projects for definition of Natura 2000 sites, and identification of the status of wetlands in Prespa region

several priority sites are included in the development of monitoring methodology and collecting data respectively. In scope of the activities for revitalization of the riparian habitats, the habitat type of *Salix alba* and *Populus alba* are the mean target for the monitoring in the last years (2017-2019). Structured monitoring is running out for different taxonomic groups in this belt. As part of the monitoring activities related to the management plan of NP Galichica in 2019 the monitoring methodology for Querco trojanae-juniperetum excelsae is set and data were conducted. The priority habitats listed in the following Table 43, from number 1-8 are related with the selected Natura 2000 sites, and their monitoring (ground truth data collection and definition of the pologons) is part of the required data for fulfillment of the SDF.

Table 43 Monitored habitat types and localities

1	1340* Inland salt meadows	Ovche Pole
2	1530* - Pannonic salt steppes and salt marshes	Ovche Pole Dolna Bregalnica
3	1530* Pannonic salt steppes and salt marshes	Ovche POle
4	6220* - Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	Dolna Bregalnica
5	91D0 *Bog woodland	Maleshevski Pl.
6	91AA *Eastern white oak woods	Maleshevski Pl.
7	91E0* Alluvial forests with Alnus glutinosa and Fraxinus excelsior	Maleshevski Pl.
8	7210* Calcareous fens with Cladium mariscus and species of the Caricion davallianae	Prespa, PN Ezerani
9	92A0 *Salix alba and Populus alba galleries*	Dolna Bregalnica
10	3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation and	Prespa, PN Ezerani
11	9560 Querco trojanae-juniperetum excelsae	Golem Grad island, NP Galichica

8.16. National target 15: Promote conservation of species and ecosystems in transboundary context through undertaking of joint measures/actions

8.16.1. Indicator: Number of transboundary protected areas (with surface)

8.16.1.1. Fact sheet

Author: Ministry of Environment and Physical Planning (MoEPP)

Indicator Name: Number of transboundary protected areas (with surface)
Lead Agency: Ministry of Environment and Physical Planning
Use and interpretation: **Key question(s) which indicator helps to answer** According to Law of Nature Protection ("Official Gazette of the Republic of Macedonia" No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16) protected areas can be connected across the borders with the protected areas on the territories of the neighbouring countries of the Republic of North Macedonia. The plans for management of protected areas shall be adopted by the competent bodies for protected areas management of both states by mutual agreement.

Key question for this indicator is what is the trends of number and surface of transboundary protected areas.

Use of indicator

The indicator can be used to monitor the implementation of the international conventions for nature conservation (CBD, Bern, CITES, Bonn, УНЕСКО, Ramsar, etc.

The indicator can also be used for activities to related of management transboundary protected areas (Ohrid-Prespa Transboundary Biosphere Reserve-UNESKO, Prespa Park, etc.)

Scale of appropriate use

National and international scale.

Potential for aggregation:

The indicator is simple and includes monitoring the number and surface of transboundary protected areas.

Meaning of upward or downward trends („good or bad")

The number and surface of transboundary protected areas in the coming years can be increase in the context of fulfillment of obligations for the countries, under international nature conservation agreements, the EU Habitats and Birds Directive and the IUCN Green Belt Program.

Possible reasons for upward or downward trends:

Important ecosystems (mountains, lakes, etc.) are distributed along the boundary belt and co-ordinated activities with neighboring countries are necessary for their protection.

Increased interest of international donors for financing of protected areas and activities for nature conservation in border regions of the neighboring countries.

Biocorridors of wild species can be maintaining.

Conservation of habitats and species of national and international importance will be improve.

Implications for biodiversity management of change in the indicator:

Positive trend of number and surface of transboundary protected areas will be benefit for biodiversity. This will enable the linkage of protected areas in order to maintain the biocorridors of wild species, as well and protection, conservation and sustainable use of biodiversity in a transboundary context.

Units in which it is expressed:

Number of sites, ha, km2 and %.

Description of source data:

Relevant data sources in MoEPP:

CDDA data for protected areas, Cadastre of protected areas, Emerald database, Natura database, World Database on Protected Areas (WDPA) data, National Information System for Nature, reports as obligation from international conventions (CBD, Ramsar, Bern, UNESKO, etc), reports of other projects related to protected areas and nature conservation, Annual reports for realized activities of Nature Sector, etc.

Calculation procedure:

Review of relevant documentation: CDDA data for protected areas, World Database on Protected Areas (WDPA), reports as obligation from international conventions (CBD, Ramsar, Bern, UNESKO, etc), Emerald database, Natura 2000 database, National Information System for Nature, IUCN Green Belt Program, etc.

Most effective forms of presentation:

The best way to present the trend is narrative explanations, maps and tables.

Limits to usefulness and accuracy:

The limitis in the increase of number and surface of transboundary protected areas is regarding of lack of financial and human capacities of protected areas management entities and the complex process of proclamation of national protected areas. Is needed of increase cooperation between relevant states

institutions in neighboring countries.
Updating the indicator: The indicator should be followed in period of two-three years. The indicator can be easily monitored by MoEPP, national parks and other protected area management bodies.
Closely related indicators This indicator is associated with following indicators as well: - Trends in the number and surface of protected areas by category (% in relation to total area of the country) - Trends for adopted protected area management plans, - Trends in areas of identified potential Natura 2000 areas, - Provided funds for protected areas, - Capacity building - Trends in the number of key species and habitats monitored in protected areas and ecological networks, - Trend of populations of key conservation species, etc
Additional information and comments Is needed regularly updating data for transboundary protected areas in National Information System for Nature and in international networks for protected areas as World Database on Protected Areas (WDPA). Indicator can help to improve of transboundary cooperation in the field of nature/biodiversity conservation and management. Relevant national planning documents National Biodiversity Strategy with Action Plan for period (2018-2023)- MoEPP, 2018 http://www.moepp.gov.mk/wp-content/uploads/2018/05/STRATEGIJA%20ZA%20BIOLOSKA%20RAZNOVIDNOST%20SO%20AKCISKI%20PLAN%202018_2023.pdf National Strategy for Nature Protection with Action Plan (2017-2027) - MoEPP 2018 http://www.moepp.gov.mk/wp-content/uploads/2014/12/%D0%9D%D0%B0%D1%86%D0%B8%D0%BE%D0%BD%D0%B0%D0%BB%D0%BD%D0%B0-%D1%81%D1%82%D1%80%D0%B0%D1%82%D0%B5%D0%B3%D0%B8%D1%98%D0%B0-%D0%B7%D0%B0-%D0%B7%D0%B0%D1%88%D1%82%D0%B8%D1%82%D0%B0-%D0%BD%D0%B0-%D0%BF%D1%80%D0%B8%D1%80%D0%BE%D0%B4%D0%B0%D1%82%D0%B0-2017-2027.pdf Law of Nature Protection ("Official Gazette of the Republic of Macedonia" No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16) http://www.moepp.gov.mk/wp-content/uploads/2014/10/%D0%97%D0%90%D0%9A%D0%9E%D0%9D-%D0%97%D0%90-%D0%97%D0%90%D0%A8%D0%A2%D0%98%D0%A2%D0%90-%D0%9D%D0%90-%D0%9F%D0%A0%D0%98%D0%A0%D0%9E%D0%94%D0%90%D0%A2%D0%90.pdf Transboundary Biosphere Reserve Ohrid-Prespa http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/images/map_Ohrid_prespa_zonation.jpg

8.16.1.2. Assessment of the indicator

In accordance with the obligations of the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971) the World Ramsar List includes two protected areas of the Republic of North Macedonia: Prespa Lake (1995) and Dojran Lake (2007). Nomination for Ohrid Lake is drafted.

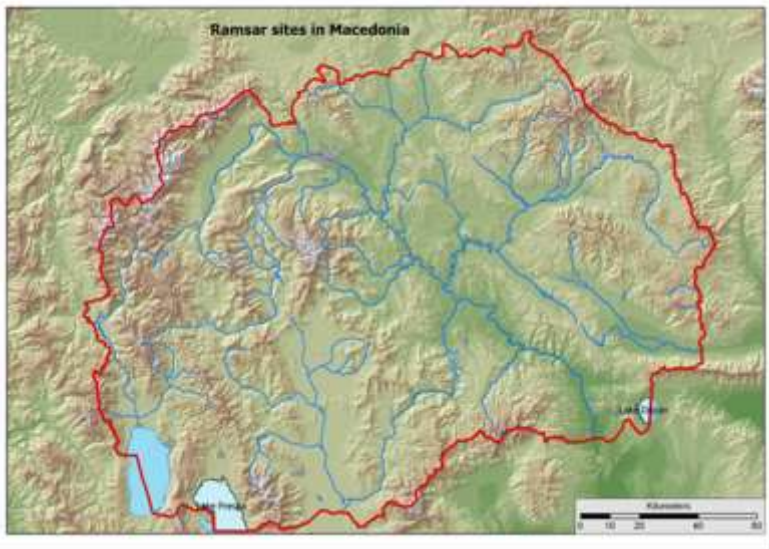


Figure 109 Ramsar sites in the Republic of North Macedonia

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

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

Figure 110 World heritage sites (included, or on tentative list) in the Republic of North Macedonia

Transboundary Biosphere Reserve Ohrid-Prespa

In the past years in the Ohrid-Prespa region, there has been significant cooperation between the Republic of North Macedonia and the Republic of Albania for the nomination and establishment of a transboundary biosphere reserve Ohrid-Prespa.

In 2014, UNESCO proclaimed a Transboundary Biosphere Reserve Ohrid-Prespa according to the criteria of the UNESCO Man and Biosphere Programme. The area is a combination of water bodies and surrounding mountain areas with a large number of endemic and relict species of plants and animals.

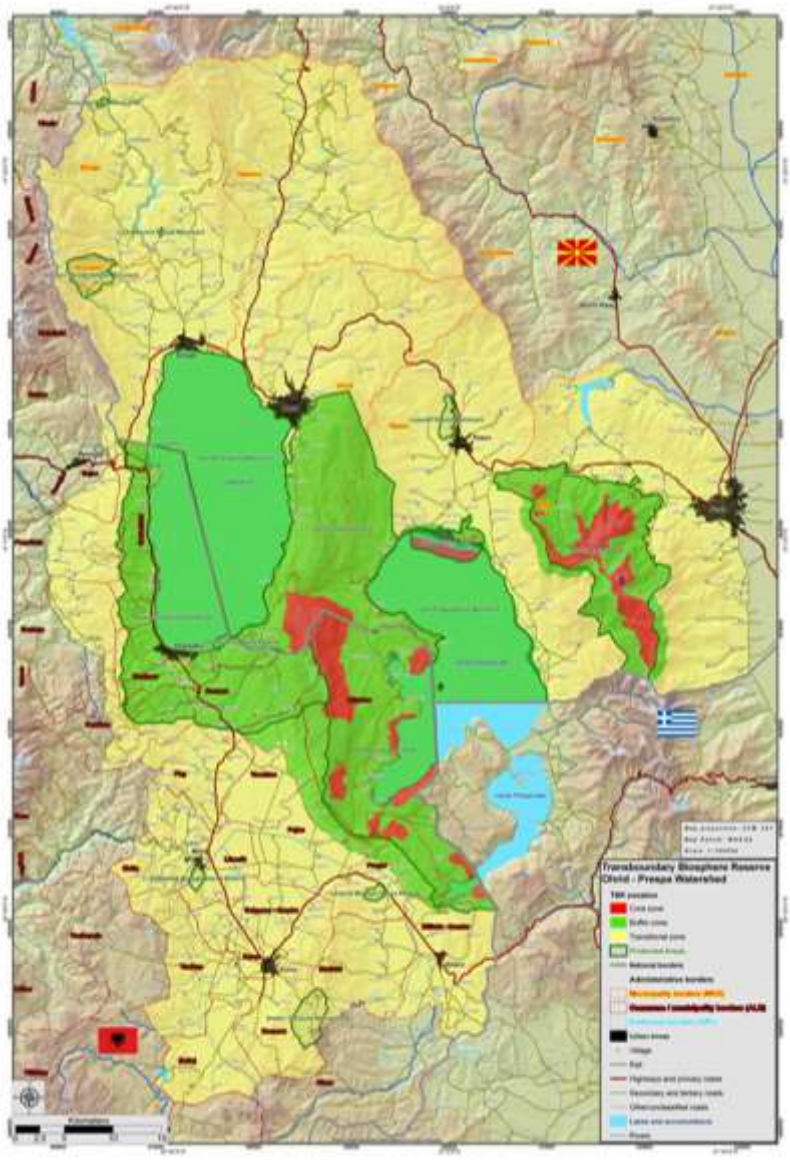


Figure 111 Border and zones of Ohrid-Prespa Transboundary Biosphere Reserve

Within the boundaries of the transboundary biosphere reserve, municipalities Ohrid, Struga, Resen, Bitola, Debarca and Vevchani have been included from Republic of North Macedonia.

Transboundary Biosphere Reserve Ohrid-Prespa covers total surface of 446,244.52 ha, (386,915.21 ha terrestrial area and 59,329.31 ha aquatic area).

The above Figure 111presents the border and zones of the transboundary biosphere reserve:

- Core area: 14,339.25 ha (13,457.81 ha terrestrial area; 881.44 ha aquatic area)
- Buffer zone: 140,479.27 ha (82,124.45 ha terrestrial area; 57,506.51 ha aquatic area) and
- -Transition area: 291,426.01 ha (291,332.96 ha terrestrial area; 941.36 ha aquatic area).

Transboundary Biosphere Reserve Ohrid-Prespa cover six (6) national protected areas as they are:

- NP Pelister (17,150 ha),
- NP Galichica (24,151 ha),
- Natural Monument-Ohrid Lake (23,000 ha),

- Natural Monument-Prespa Lake (17,788 ha),
- Nature Park Ezerani (1,917 ha) and
- Natural Monument- Vevchani springs (1,370 ha)

The total area of national protected areas that are part of the Transboundary Biosphere Reserve Ohrid- Prespa is 85,376 ha.

Balkan Green Belt

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

Figure 112 Balkan Green Belt in the Republic of North Macedonia (MoEPP, 2017)

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

The surface area of the Green Belt along the entire border of the Republic of North Macedonia with Albania, Greece and Bulgaria is 5125 km^2, which represents 19,93% of the total area of the country.

Transboundary cooperation of protected areas

Transboundary cooperation for protected areas with neighboring countries was increased in last years within projects for Ohrid and Prespa Lake, Jablanica, Shar mountain etc.

Following the Declaration for the Transboundary Prespa Park (established by three countries North Macedonia, Albania and Greece), in the recent years, intensive activities have started in the transboundary Prespa Region supported largely by the Prespa-Ohrid Nature Trust Fund as a long-term funding for the protection, conservation and sustainable management of the biodiversity in the Prespa Region for the benefit of nature and people living in the region.

The number and surface of transboundary protected areas in the coming years can be increase in the context of fulfillment of obligations for the countries, under international nature conservation agreements, the EU Habitats and Birds Directive and the IUCN Green Belt Program.

8.16.2. Case study: Transboundary monitoring - Balkan Lynx Recovery Programme

Authors: *Aleksandar Stojanov, Dime Melovski* and *Aleksandar Pavlov* (Macedonian Ecological Society, Skopje)

Since 2006, the Macedonian Ecological Society (MES), in cooperation with PPNEA from Albania, CZIP from Montenegro, FINCH and ERA from Kosovo, EuroNatur from Germany and KORA from Switzerland, has been working on the implementation of the transboundary research and conservation project dubbed "Balkan Lynx Recovery Programme". The project is financially supported by the MAVA Foundation and has been implemented in five project phases, with the last (fifth) phase ending at the end of 2020. The overall goal of the project is to secure the survival of the remnant autochthonous population of Balkan lynx in the range countries, through:

- assessing the conservation status of the Balkan lynx;
- rising public awareness;
- establishment of new protected areas;
- improve the management of the existing Pas in all range countries;
- improve national legislation related to protection and conservation of Balkan lynx, as well as its prey and habitats;
- generating the necessary basic knowledge for the lynx and its prey species;
- building capacities and establishment of a long-term conservation and monitoring programme for the partner organizations and relevant institutions (mainly PAs).

In all three countries, the project is implemented in close cooperation with the relevant institutions (existing Pas, ministries etc.) and local people (hunters, game wardens etc.) who are part of the so called Balkan Lynx Monitoring Network. There was no financial support from governments during the project duration.

Figure 113 Balkan lynx area and scope of the Balkan Lynx Recovery Programme

Main project achievements are:

- conservation status of Balkan lynx is assessed on national and regional scale
- long-term monitoring of Balkan lynx is established using common monitoring methods (camera-trapping, telemetry research and snow tracking)
- capacities for implementing monitoring programmes are built
- awareness among different local target groups is raised
- future/potential PA areas are identified
- transboundary cooperation between Mavrovo NP (North Macedonia), Korab-Koritnik NP (Albania) and Shari NP (Kosovo) is established
- Regional Balkan lynx strategy and National Conservation Action Plan were prepared

Balkan Lynx Recovery Programme is an example of good transboundary cooperation (https://www.youtube.com/watch?v=NN9A0Wd3aUA). During its 14 years implementation, it has fulfilled one of its main goals – stopping further decline of the Balkan lynx population. This is a result of a fruitful transboundary cooperation, increased conservation efforts in all range countries, regular transboundary monitoring of the Balkan lynx population and raised awareness among the population in all range countries. The Balkan lynx monitoring and conservation activities on national and transboundary level should continue in the next period, in order to prepare and implement proper conservation measures needed for recovery of the Balkan lynx population. Besides implementation of monitoring programme and awareness raising, future work should focus on the protection and management of the Balkan lynx's prey and habitats.

8.16.3. Case Study - Urgent Actions to Strengthen the Balkan Population of the Egyptian Vulture and Secure Its Flyway" (LIFE16 NAT/BG/000874)

Author: *Nenad Petrovski*

8.16.3.1. Status of the Egyptian vulture

Egyptian vulture is a globally endangered species, included in the **IUCN Red List** as "Endangered". Its global population is estimated at 21 000-67 000 individuals with a steady negative tendency. It is strictly protected by the Bern and Bon International Conventions, as well as by the Convention on International Trade in Endangered Species (CITES). In the past, the Egyptian vulture was wide-spread throughout the Balkan with high population numbers. Today the Balkan Peninsula is home to less than 70 pairs. North Macedonia has followed a similar trend if the decline of the population. In the last census in 2019, there were 13 confirmed pairs of Egyptian vultures which is a severe decline since the start of the Vulture Conservation Program in 2003 (38 pairs).

Egyptian Vulture is a Palearctic, Afrotropical and western Indo-Himalayan species: a breeding (summer) migrant across the northern part of the range, but with resident populations and non-breeding visitors further south.

In **North Macedonia** the species used to be common and widespread throughout the country. However, recent population decline and range contraction has significantly shrank the distribution to a few pairs. The remaining breeding pairs are mainly stationed in the lowland arid steppe like habitats with rocky terrains. The majority of the remaining pairs are located in the Tikvesh valley and its vicinity, around the central river Vardar in the central part of the country. The rest of the remaining pairs are on the Osogovo Mountain, Pcinja River, Mariovo and lower Bregalnica River.

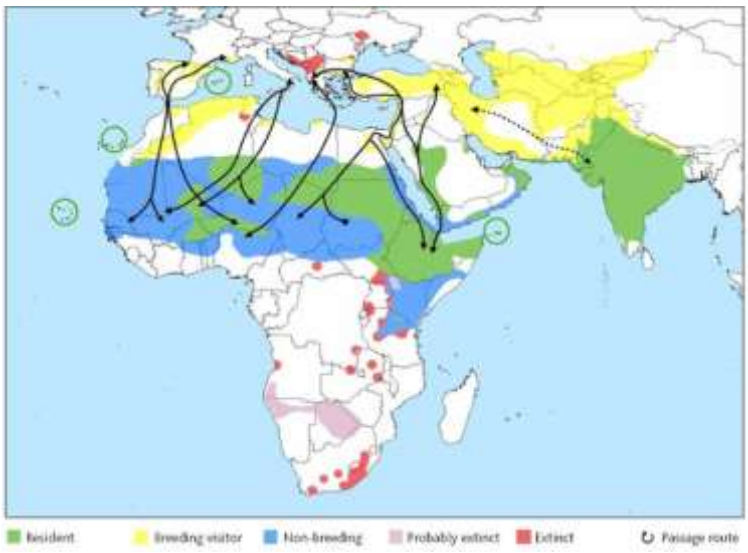


Figure 114 Distribution and migration routes of Egyptian vulture

8.16.3.2. About the Project

To save an endangered species, the Egyptian Vulture, institutions and organizations from 14 countries spanning the Balkans, Middle East and Africa have joined forces proving that political borders do not exist in these efforts. All of them have united under the project "Urgent Actions to Strengthen the Balkan Population of the Egyptian Vulture and Secure Its Flyway" (LIFE16 NAT/BG/000874), abbreviated to **Egyptian Vulture New LIFE Project**, launched in July 2017 with financial support from the EU's LIFE Program and the co-financing of the AG Leventis Foundation and the MAVA Foundation. The Macedonian Ecological Society as a partner from North Macedonia joined the project in 2018.

The Egyptian Vulture is a globally threatened species and over the last 30 years its population in the Balkans has declined by more than 80%, with no more than 70 pairs remaining. The reasons for this can be found not only on its breeding grounds on the peninsula, but also along its flyway. Among the four vulture species breeding in western Palearctic, the Egyptian Vulture is the only regular long-distant migrant. Every autumn, individual birds fly over 8,000 km to their wintering grounds in Africa, and return back to the Balkans in the following spring.

The aim of the project is to reinforce the easternmost European Egyptian Vulture population by delivering urgent conservation measures to address major known threats at breeding grounds and also along the flyway**.** The project is building on actions undertaken between 2011 and 2016 through The Return of the Neophron project. The project objectives are in line with the aims of most recent strategic document outlining the conservation tactics to save the species: the Flyway Action Plan for the Conservation of the Balkan and Central Asian Populations of the Egyptian Vulture *Neophron percnopterus* (EVFAP), as an integrated key component of the Multi-species Action Plan to Conserve African-Eurasian Vultures (Vulture MsAP) under the auspices of the Convention on Migratory Species.

The main efforts under the Egyptian Vulture New LIFE project will be targeting two key components: (1) **Achieving a steady increase of the population on the breeding grounds in the Balkans**; and, (2) **Enhancing the context for conservation along the flyway and in the wintering grounds by minimizing loss of migrating birds, particularly mature individuals.**

The Balkan regional component (Bulgaria, Greece, North Macedonia and Albania,) of the project involves creating vulture safe zones (free of poison and with sufficient safe available food) and developing the capacity and infrastructure to deploy a full scale restocking program in the near future, considered necessary to rapidly halt and reverse current populations declines. The project will actively engage with national institutions to ensure appropriate legal protection is in place and being implemented effectively. In addition, local authorities in rural settlements will be encouraged to establish controlled carcass dumps offering safe food for the vultures. The illegal use of poison baits is still an issue for all Balkan countries; hence, the project aims to replicate successful activities already implemented in Greece to raise awareness among institutions, stakeholders, and individuals affected with the aim of creating a Balkan anti-poison network. To eliminate accidental poisoning, the project will campaign to discourage the overuse of hazardous agriculture chemicals (e.g. by reducing agriculture subsidies to violators) and toxic veterinary drugs (e.g. prohibit veterinary use of Diclofenac and encourage use of alternatives).

The Flyway component of the project will undertake urgent activities proposed in the International Flyway Action Plan to tackle known threats. Unfortunately, large parts of range countries in the Middle East (Egypt, Lebanon and Syria) and some African countries (Chad, Ethiopia, Niger, Nigeria and Sudan) are subject to various levels of human military conflict. The project strategy is therefore to secure transfer of experience and to build capacity in those territories which are safe enough to do so and work with the most stable local organizations (governmental or non-governmental). The main goals are to: reduce the loss of individuals due to electrocution at the main roosting sites in Ethiopia; pilot actions to eliminate the use of Strychnine or other poisons used to control rabies (which can affect birds), specifically at key vulture congregation sites in Ethiopia and Chad; develop local capacity to combat the use of birds in the believe-based traditional healings (Nigeria); and, enhance local capacity to combat illegal killing of birds (Middle East).

A large scale awareness-raising and information campaign is built into the project. This will comprise several distinct clusters of activity specifically designed to meet the needs of key stakeholders and audiences. Within the project, two major information campaigns are planned to raise awareness about the threats for the Egyptian Vulture – from electrocution to poisoning and poaching.

8.16.3.3. Threats

Poisoning. Poisoned food is among the main threats for the species survival. The variety of food sources makes the vultures particularly vulnerable to this threat, especially due to consumption of poisoned or contaminated food. Another unresolved problem is the use of poisoned baits for predators. This has proven to be the single most severe threat that not only the Egyptian vulture but all Vultures are facing. The practice of setting poisoned bait in the countryside has been widespread across the Balkans for a few decades now and has resulted in local extinction of two species of vultures, and severe decline of the other two.

Electrocution. The Egyptian vultures quite often use electricity poles as resting or roosting sites – in their breeding territories, during migration and in the winter.

Collision With Wind Turbines. The construction of wind plants in territories with Egyptian vultures can also become a threat for the birds.

Illegal Wildlife Trade. **Wildlife trafficking** is an illegal practice that can have an irreversible effect on the population of many threatened species world-wide. The eggs are usually robed for private collections. Another illegal activity is poaching Egyptian Vultures for taxidermy purposes. These practices act as a serious threat for the species. The Macedonian Ecological Society started working together with the Customs Office and Ministry of Interior towards eliminating this threat. So far, there has been a pilot training course meant for the government authorities. Additionally, a handbook was created that describes the legal procedures for trading with wildlife and gives guidelines for interception of illegal trafficking of wildlife (mainly birds).

Poaching. In some parts of Africa (e.g. Nigeria, Cameroon) hunting for economic reasons is a serious threat to the global population of Egyptian vultures.

8.16.4. Indicator: International Waterbird Census in N. Macedonia (IWC)

8.16.4.1. Fact sheet

Authors: *Danka Uzunova* (Macedonian Ecological Society)

Indicator Name: International Waterbird Census in N. Macedonia (IWC)
Lead Agency: All IWC national coordinating organizations - Macedonian Ecological Society (MES), Albanian Ornithological Society (AOS), Society for the Protection of Prespa (SPP) in the capacity of regional representative for the Hellenic Ornithological Society (HOS), Wetlands International (WI)
Use and interpretation: **Key question(s) which indicator helps to answer** All three tectonic lakes in N. Macedonia are transboundary wetlands. With regards to transboundary research involving waterbirds, the IWC is a perfect example of collaboration in transboundary waterbird research, aimed at determining the non-breeding population status of the waterbirds researched and the national/international importance of shared wetlands. **Use of indicator** This indicator should be used to assess the state of the transboundary wetlands with the help of population trend of non-breeding wintering waterbirds. Paired up with breeding data for the IWC species it helps create national/regional/flyway conservation action plans for waterbirds with decreasing population or limited distribution. It also helps in identifying and designating new areas of international importance (i.e. Ramsar sites), and creating or updating conservation action plans for the particular wetland on national or regional level. **Scale of appropriate use** This indicator can be used on national, regional and flyway scale.
Potential for aggregation: This indicator is complex by itself because it depends on the simultaneous count conducted from all country representatives sharing the particular tectonic lake/waterbody/IWC site. Also, the final numbers of wintering species and individuals counted every January depend much on the weather conditions and hydrology of the Danube river watershed – should we experience harsh winters with low temperatures and frost, the bigger the numbers of individuals and bird species present on all the three tectonic lakes shifting from the Danube river region southwards.
Meaning of upward or downward trends („good or bad") Whether we talk about increase or decrease in the total numbers of wintering waterbirds on these three transboundary lakes, that will affect the final designation of the waterbody as a Ramsar site (Wetland of International importance). For instance, due to Criterion 5 (A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds) and Criterion 6 (A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird) on Macedonian side only two lakes – all three lakes fulfill at least one of the criteria. Prespa Lake meets the mark on both criteria, as it regularly hosts more than 20.000 wintering waterbirds and it helps sustain a local population of Dalmatian Pelicans which meets the 1% threshold for

the European population of the species.

If we consider the data gathered from the respective neighboring country, these three lakes fulfill the Ramsar criteria on a waterbody level. These designations of the Ramsar criteria are important for creating transboundary management and conservation action plans – precursors to transboundary research programmes and projects to implement those plans.

Possible reasons for upward or downward trends:

The potential for increase of numbers of wintering species and individuals is dependent on the weather conditions (the harsher, the more birds and individuals we count) and vice versa. This increase can be adversely affected if there are constant changes in the wintering habitats (reedbeds destroyed, urban sprawl, conversion of lakeshore habitat to agricultural land, uncontrolled fishing and hunting activities etc.) on these three tectonic transboundary lakes.

Implications for biodiversity management of change in the indicator:

Changes from positive or stable to negative population trends of key wintering species would call for immediate conservation and/or managment measures per locality.

Units in which it is expressed:

Numerically, with total number of individual of wintering waterbirds per locality and per year, as well as descriptively – when describing different numbers of the two sexes or differences in age according to the plumadge.

Description of source data:

The only reliable sources are the yearly census data, filled in a form following Wetlands International's requirements for reporting.

Calculation procedure:

Review of the yearly and short-term (10-year) national census data.

Most effective forms of presentation:

The best way to present the trends is to present by linear trends. This indicator is best to be presented in 10-year intervals, or if it should be presented for a particular wintering species.

Limits to usefulness and accuracy:

As this is standardized census coordinated by Wetlands International for over 5 decades, the only limits recognized are the "observer effect" which is factored in the statistical analysis for the wintering populations of the species along the African Eurasian Flyway.

Updating the indicator:

The indicator is followed annually, but its advised that the results should be compared in 10-years periods in order to estimate a short-term trend for the wintering species on national and transboundary level.

Closely related indicators

- Capacity building
- Number of professionals
- Number of transboundary collaborative projects

Additional information and comments

References

BirdLife International (2017). European birds of conservation concern: populations, trends and national responsibilitiesCambridge, UK: BirdLife International.

Voříšek P., Klvaňová A., Wotton S., Gregory R. D. (editors). A best practice guide for wild bird monitoring schemes.First edition, CSO/RSPB. 2008.

Wetlands International (2020). *"Waterbird Population Estimates"* . Retrieved from wpe.wetlands.org on Wednesday 25 Mar 2020.

8.16.4.2. Assessment of the indicator

The International Waterfowl Census has been continuously implemented in North Macedonia since 2010. For several consecutive years in the '90s there were sporadic counts and not on all of the tectonic lakes. Since 2015 to 2019, we have been noticing fluctuations in the total numbers counted on the three tectonic lakes from Macedonian side. These fluctuations are presented on the following Figure. In this period since 2010, MES reports all the census data to Wetlands International, which uses them to develop flyway level trends and reports.

A total of 11 different localities were censused in this period (IWC localities), and a total of 60 different species of wintering waterbirds were observed. The most numerous species in this period and in the three lakes are the Coot, the Great Crested Grebe and the Black-headed Gull. Rare occurrences were the Red-breasted Goose, Whiskered Tern, Red-breasted Merganser, Smew and the Tundra Swan.

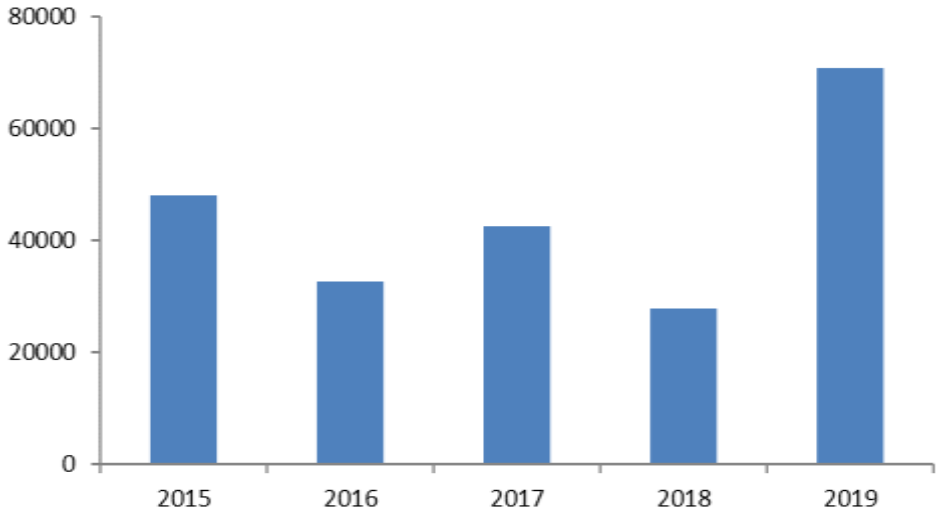


Figure 115 Difference in total counts of wintering waterbirds in all the IWC localities from 2015 to 2019 (numbers presenting total of waterbird individuals)

The short term trends calculated by Wetlands International in the 7th edition of the Conservation Status report (CSR7) are reported on a flyway and on national level, whose primary purpose is to report to the African-Eurasian Waterbird Agreement (AEWA). The CSR7 report for the wintering birds in N. Macedonia show that there is a decline in the numbers of diving ducks (duck species from the genus *Aythya, Netta* etc.). How much of this decline is caused by the changes in climate and local weather conditions, and how much of the decline is caused by habitat alterations and direct adverse human activities, remains to be studied.

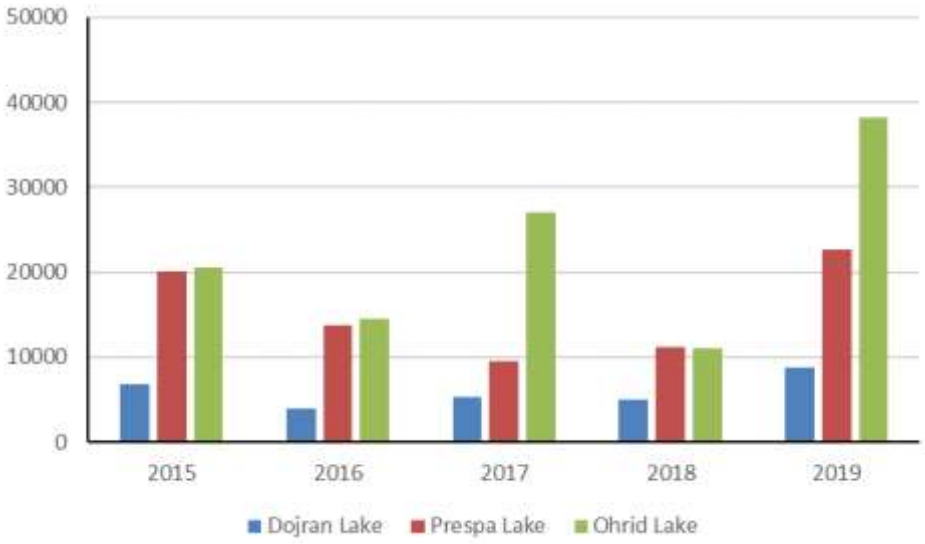


Figure 116 Difference in total counts of wintering waterbirds in the three lakes (Ohrid, Prespa and Dojran)

It can be concluded that the fluctuations in the total counts are reflected in parallel fluctuations in the total numbers of wintering waterbirds in the three tectonic lakes.

8.17. **National target 16:** Improve the status of important ecosystems in terms of essential ecosystem services provision

8.17.1. Case study: Implementation of the concept for ecosystem services in the Republic of North Macedonia

Author: *Marija Trenceva*

Establishing mechanism for payment of ecosystem services is identified as one of the priorities in the National Strategy for Nature Protection of the Republic of North Macedonia (2017-2027). It has been also mentioned in the revision of the National Strategy for Biodiversity in North Macedonia and the related Action Plan (2018-2023). Considering the fact that the concept of ecosystem services is new for North Macedonia, initial activities had been conducted, which set baseline for further steps in the process. This leads to fulfilling the obligations related to nature conservation by different international documents (conventions, directives etc.) signed and ratified by the country. The topic was already elaborated in some protected areas in the country but different methodologies and approaches were followed.

The concept of ecosystem services in North Macedonia on national level is part of the Output 1.1 of the Nature Conservation Programme in North Macedonia (NCP) – phase 2, implemented by Macedonian Ecological Society and Ministry of Environment and Physical Plannning. NCP is coordinated by Farmahem and financed by the Swiss Agency for Development and Cooperation.

The main objectives of Output 1.1 are:

- Transfer of knowledge and international practices of PES towards the Ministry of Environment and Physical Planning and other stakeholders;
- Assessing the state of the main ecosystem types in North Macedonia and their potential to provide ecosystem services;
- Identification of the important ecosystem services on national level and mapping the demand for certain ecosystem services;
- Developing methodology and preparation of guideline for PES on national level;
- Testing the PES mechanism in one pilot area.

Already accomplished activities regarding this topic cover the following:

- Introduction to the concept of ecosystem services and methodology;
- Identification of ecosystem types in North Macedonia;
- Mapping of eight ecosystem types present in North Macedonia;
- Selection of indicators and parameters and their valuation for assessing the condition of identified ecosystems;
- Mapping of the results of the condition of identified ecosystems on national level.

8.17.1.1. Identification and mapping of ecosystem types

A team consisting 20 national experts identified eight main ecosystem types on national level. The main categories of ecosystems in North Macedonia are in line with the MAES (2013) classification at Level 1 and Level 2. These ecosystem types were further subdivided into ecosystem subtypes of Level 3 which correspond to the EUNIS habitat classification system and Corine Land Cover.

Table 44 Identified and mapped types and subtypes of ecosystems in North Macedonia

Level 1 Main ecosystem categories	Level 2 Ecosystem types	Level 3 Ecosystem subtypes
Terrestrial	Heathland and shrub	Mountain heathlands and shrubs
		Lowland heathlands and shrubs
	Grassland	Pastures
		Lowland grassland
	Inland wetlands	Mountain wetlands
		Lowland wetlands
	Sparsely vegetated land	Rocks and sparsely vegetated ecosyst.
		Caves
	Woodland and forest	Deciduous forests
		Coniferous forests
		Lowland riparian forests
	Anthropogenic	Urban
		Rural
		Industrial and mining
		Fisheries
		Artificial water bodies
	Cropland	Agroecosystems
		Anthropogenic shrubland (vineyards)
Freshwater	Rivers and lakes	Big rivers
		Tectonic lakes
		Glacial lakes
		Accumulations

Several existing datasets were used for the ecosystem mapping. The baseline dataset used was the vector land use for 2002-2004, produced by the Real Estate Cadastre Agency (RECA). Additionally,

other datasets were used in the case of some specific ecosystems (e.g. caves, wetlands, riparian forests). Significant number of ecosystem subtypes were mapped by manual vectorization, thus making the map drastically more accurate.

Changes in ecosystems are constant and can be intensive considering their exposure on different pressures. Therefore, depending on precisions requirements, the obtained map can be updated for future needs. The urban and cropland ecosystem types, even though mapped (to Level 3), were not an object for further analysis regarding their condition.

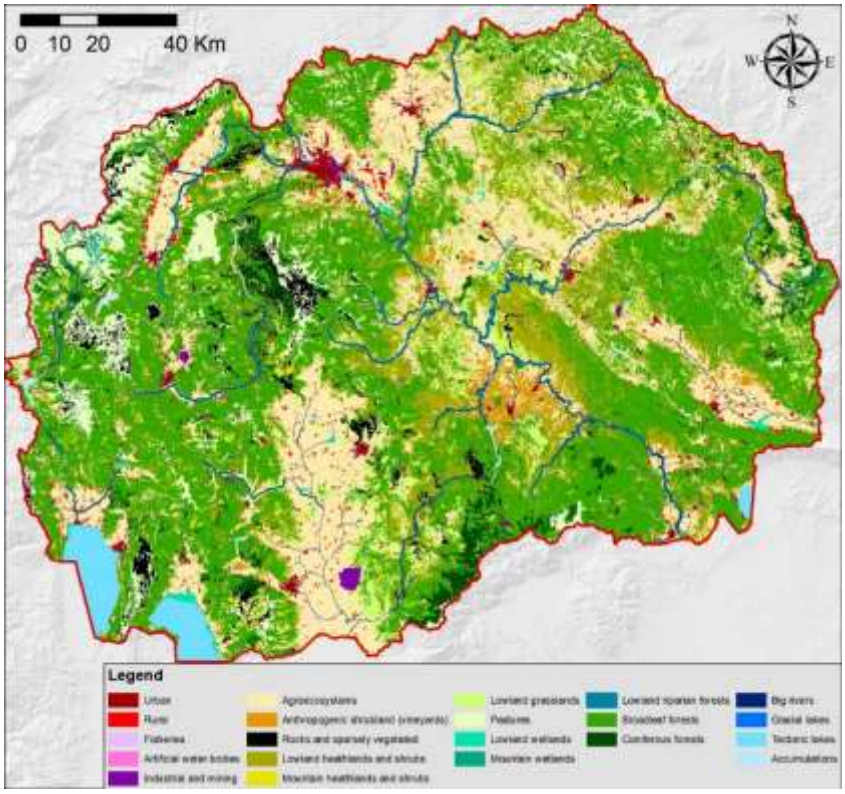


Figure 117 Map of ecosystems types and sybtypes

8.17.1.2. Assessment of ecosystem condition

Ecosystem condition is defined as the effective capacity of an ecosystem to provide services, relative to its potential capacity (Millennium Assessment, 2005). The condition (state) of an ecosystem refers to the physical, chemical and biological state of an ecosystem at a certain point in time. “Healthy” ecosystems (in good condition) have the full potential of ecosystem functions and ecosystem services delivery respectively. The capacity of an ecosystem to deliver different ecosystem services is related to the state of this ecosystem. A “good” ecosystem can provide a more and more sustainable flow of a wide variety of ecosystem services compared to an ecosystem that is managed to provide the maximum size of just one particular service (Muller et al., 2009; Muller, Burkhard, 2010). For the assessment of ecosystem condition, we followed the MAES guidelines recommendation.

8.17.1.3. Selection of indicators and parameters

Indicators are a subset of the many possible attributes that could be used to quantify the condition of a particular landscape, catchment or ecosystem (Walker 1998). Identifying indicators that are relevant to express the condition of one ecosystem had been the first step. Experts had proposed lists of indicators. The indicators for assessment of the condition of all ecosystem types in North

Macedonia were hierarchically grouped in types and groups, according to MAES (2013) recommendations.

A list of different specific indicators and parameters was elaborated for each of the ecosystem subtypes. The selection of indicators to be used in the final assessment was base on the relevance of the indicator and data availability. Defining the final indicator lists was followed by setting measurable parameters for those indicators, and evaluation grades.

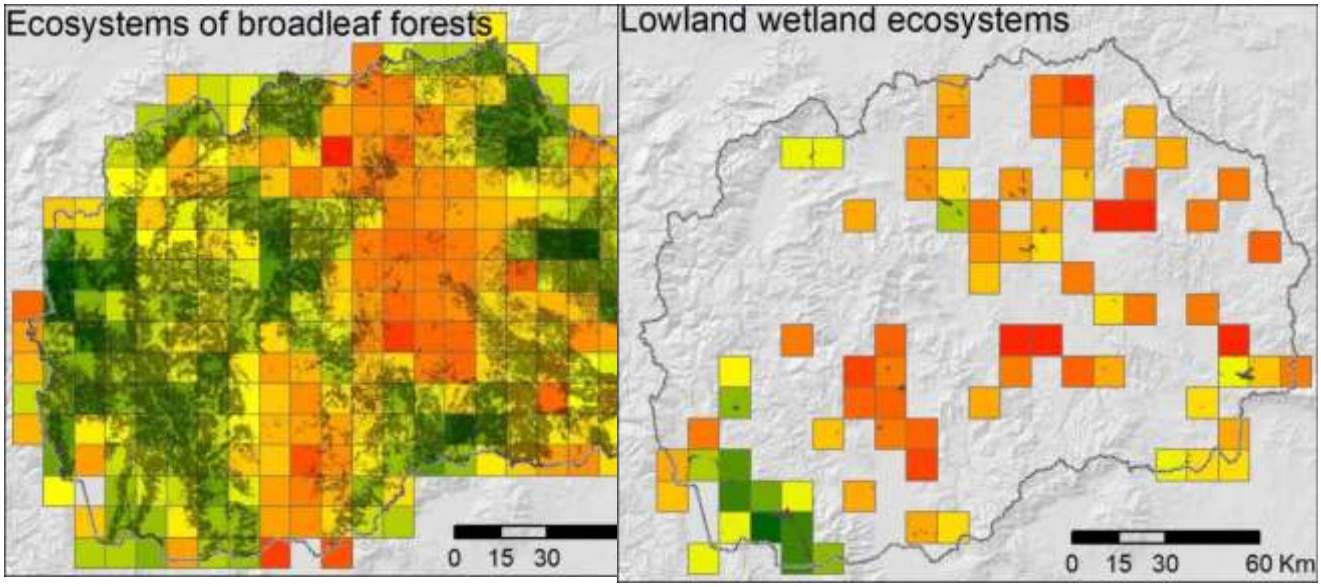
8.17.1.4. Evaluation of indicators and parameters

The assessment of the ecosystem condition was performed on 10 x 10km UTM grid. Each of the ecosystem subtypes were analysed separately by applying (calculating) values for each indicator and parameter in the specific grid cells.

Scoring of the parameters was based on scales from 1 to 5, where 1 reflects very bad condition, 2 bad, 3 moderate, 4 good and 5 very good ecosystem condition. The indicators values were calculated as average of the included parameter. The overall ecosystem condition was calculated as a sum of all indicator grades.

8.17.1.5. Mapping of ecosystem condition on national level

All the natural ecosystems were identified, mapped and had their condition assessed. The anthropogenic and cropland ecosystems were identified and mapped, but their condition was not assessed. The symbology used is the same on all maps (for all ecosystems), calculated as the sum of all indicator values for the given ecosystem, representing its' overall condition assessment. The ecosystems have different number of indicators, so in order to have a better overview of results, all maps use the same colour-mapping scheme. The lowest to highest values are coloured from dark red to light red to yellow to light green to dark green, and each map uses the particular values of the of the specific ecosystem assessments, to define the colour ramp (the grading is relative for each of the ecosystems).



Broadleaf forests Lowland wetlands

Figure 118 Examples of maps of ecosystem condition

8.17.2. Indicator: Percentage of population using safe drinking water

8.17.2.1. Fact sheet

Author: *Ministry of Environment and Physical Planning (MoEPP)*

Indicator Name: Percentage of population using safe drinking water
Lead Agency: Ministry of environment and physical planning (MoEPP)/ Institute for public health
Use and interpretation: **Key question(s) which indicator helps to answer** **Use of indicator** The indicator can be used to monitor the percentage of population using safe drinking water **Scale of appropriate use** National scale.
Potential for aggregation The indicator is simple and includes percentage of population using safe drinking water
Meaning of upward or downward trends („good or bad“) Percentage of population using safe drinking water in our country is high which is the result of the government's continuous policy of supporting building water systems.
Possible reasons for upward or downward trends: In considering the shortcomings and activities for policy completion, it is important to recognize the very significant efforts made in the reform of the water services sector in recent years, and in particular with regard to the introduction of economic regulation of water services tariffs, in accordance with the Law on Determination prices of water services.
Implications for biodiversity management of change in the indicator: The main objective of monitoring drinking water quality is to ensure safe drinking water supply to users through the water supply chain (from abstraction, treatment and storage to distribution) and to provide information on the quality of water intended for consumption by consumers. of human beings and the protection of biodiversity.
Units in which it is expressed: Number of %.
Description of source data:
Calculation procedure: The data are generally representative of the entire urban environment in our country. The indicator is subject to change from year to year depending on the introduction of new drinking water treatment plants and in line with the increasing trend of rural populations to be supplied with safe drinking water.
Most effective forms of presentation: The best way to present the trend is narrative explanations, maps and tables.
Limits to userfelness and accuracy:

N/a
Updating the indicator: The indicator should be followed in period of one per years.
Closely related indicators
Additional information and comments Relevant national planning documents: 1. Law on waters (Official gazete of RNM. no. 87/2008, 6/2009, 161/2009, 83/2010, 51/2011, 44/12 23/2013, 163/2013, 180/2014, 124/2015, 146/2015, 52/2016); 2. Law on supplay of drinking waret and discharge of urban wastewater (Official gazete of RNM. no. 68/04, 28/06, 103/08, 17/11, 54/11, 163/13, 10/15, 147/15, 31/16) 3. Law on food safety (Official gazete of R.M. no. 157/2010, 53/2011, 1/2012, 164/2013, 187/2013, 43/2014, 72/2015, 84/2015, 129/2015, 213/2015 и 39/2016); 4. Decree on the classification of waters (Official gazete of RNM no.18/99) 5. Rulebook on the safety of drinking water, spring water and bottled water (Official gazete of RNM. no.46/08) 6. Rulebook on the type of professional preparation, equipment and spatial conditions to be met by the professional legal entity for preparation of an elaboration for determining the boundaries of the protection zones, protective measures and other conditions for water intended for human consumption (Official Gazette of RNM no.29 / 2014). 7. Rulebook on the Content and Method of Preparation of the Elaborate for the Determination of Boundaries for Protective Zones, Protective Measures and Other Conditions for Water Consumed for Human Use (Official gazete of RNM no.29/2014). 8. Financial Implications of Supervision of Drinking Water Quality Determined by the National Annual Public Health Program of the Republic of North Macedonia (for 2014, published in the Official Gazette of RNM no. 15/14, 19/14, 163/14; for 2015, published in the Official Gazette of RM no. 195/14, 217/15 etc) 9. Rulebook on the form and content of the Register of Protected Areas for Water Consumed for Human Use, Protected Areas for Water Marked as Recreational Water, including Bathing Water, Water Sensitive Areas Sensitive to the Discharge of Urban Wastewater as Protective Zones (adoption pending) 10. Rulebook on the Manner of Defining and Maintaining Narrower and Wider Protective Zones and the Manner of Land Processing, Construction and Use of Facilities and Other Works may adversely affect the qualitative and quantitative status of the human body of water intended for human consumption (adoption pending)

8.17.2.2. Assessment of the indicator

According to the national legal framework, the Local Government Units are responsible for providing water supply and sanitation services. In order to ensure adequate quality of water services, the Local Self-government units may delegate the provision of services to another organization. Currently, the following modalities are used in North Macedonia to provide water services:

- PCEs established by municipalities
- PCEs established by the Government
- Private operators

There are currently 71 water service providers operating from 0.5 million in the case of the City of Skopje to less than 10,000 inhabitants in the case of several rural municipalities.

Constant control of sources and recommendations is provided by the Institute of Public Health.

The 10 Regional Centers for Public Health - Skopje, Kumanovo, Veles, Stip, Kocani, Strumica, Prilep, Bitola, Ohrid and Tetovo with their hygienic-epidemiological stations in cooperation with IC Institute of Public Health - Skopje perform regular and continuous monitoring the quality of drinking water according to the number of measuring points and the dynamics defined in the Rulebook on Drinking Water Safety, ("Official Gazette" No. 57/04). The institutes perform basic physico-chemical and bacteriological analyzes of drinking water samples, while the Institute of Public Health of the Republic of North Macedonia performs periodic physico-chemical analysis, pesticide residue analysis, contaminant analysis, parasitological and radiological analysis.

The current status of different types of water supply systems has shown that as regards water quality, monitoring, etc., so-called centralized communal water supply systems in most cases meet the requirements of the Drinking Water Directive and the harmonized national legislation.

Current coverage with centralized drinking water supply is about 82%, about 12% of the population is supplied through local, rural water supply systems, while about 6% of the population has their own water supply from separate intakes, wells and alike.

Table 45 Percentage of population using safe drinking water by regions

Administrative region	Number of inhabitants	Population served by a PCE-managed water supply system		Population supplied through the local communal system		Self-supplying population (individual wells, occupancy, etc.)	
	Assessment for 2015	**No**	**%**	**No**	**%**	**No**	**%**
Vardarski	152.917	132.882	*86,9%*	15.052	*9,8%*	4.985	*3,3%*
Istocen	176.877	152.909	*86,4%*	18.226	*10,3%*	5.742	*3,2%*
Jugozapaden	219.718	173.259	*78,9%*	41.159	*18,7%*	5.355	*2,4%*
Jugoistocen	173.552	136.662	*78,7%*	21.814	*12,6%*	15.076	*8,7%*
Pelagonski	230.771	205.796	*89,2%*	13.935	*6,0%*	11.042	*4,8%*
Poloski	320.299	192.326	*60,0%*	111.231	*34,7%*	16.742	*5,2%*
Severoistocen	176.231	116.918	*66,3%*	17.679	*10,0%*	41.634	*23,6%*
Skopski	620.913	594.586	*95,8%*	5.587	*0,9%*	20.740	*3,3%*
Total	2.071.278	1.705.338	*82,3%*	244.684	*11,8%*	121.315	*5,9%*

The above Table indicates that about 1.71 million inhabitants (82%) are supplied through centralized drinking water supply systems managed and managed by service providers - public utilities. About 0.25 million people (12%) are supplied with water through local, rural water supply systems run by local communities, while 0.12 million people (6%) have their own individual water supply. There are significant regional differences in the current coverage of the drinking water supply service, where the highest coverage with a regularly managed and maintained centralized system is observed in the Skopje region (about 96%), while the lowest coverage is in the Polog, Northeast and Northeast. region (60 to 78%).

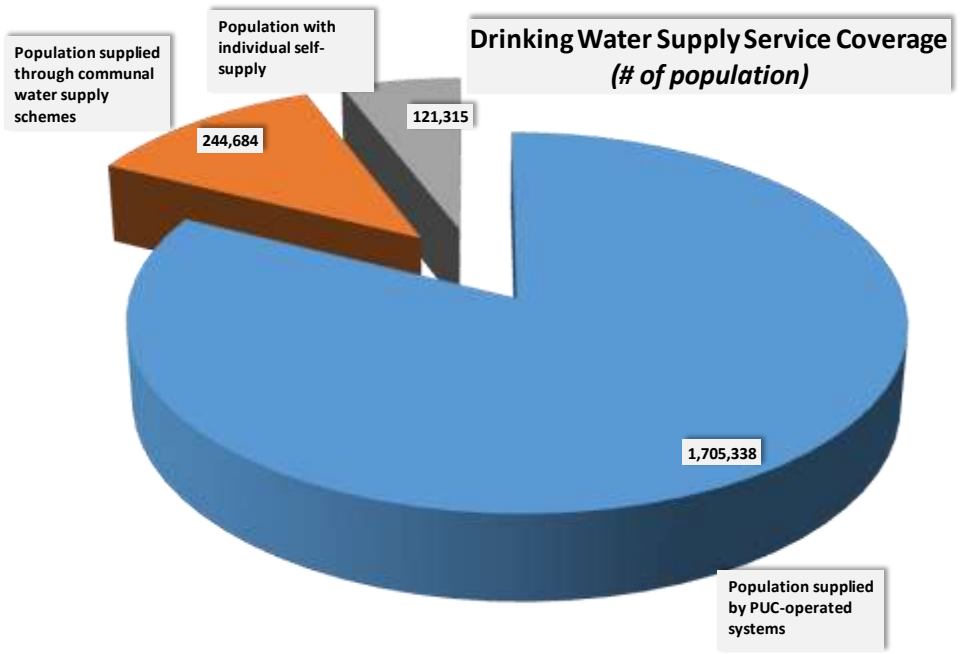


Figure 119 Drinking water supply service coverage

Access to safe drinking water in the Republic of North Macedonia is 95% (period from 2001 to 2017) indicating that in cities the population has access to safe drinking water in 99%, and in rural areas 78% of the population drinks health- proper drinking water, while the remainder is at an occasional risk of bacteriological contamination of drinking water.

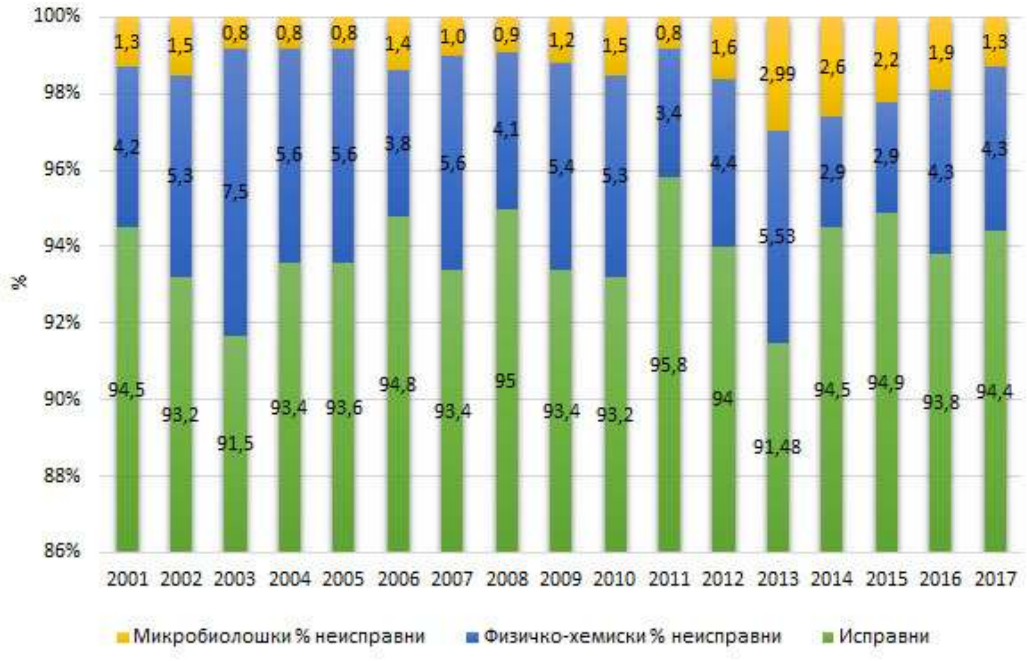


Figure 120 Quality of drinkg water (green – safe; blue – do not comply with physical and chemical standards; yellow do not comply with microbiological standards). Data source: Institute of Public Health of the Republic of North Macedonia, PH - 10 Regional http://www.iph.mk

8.18. National target 17: Integrate the requirements of the Nagoya Protocol on access to genetic resources in the national legislation by 2018

Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization was adopted on the 10th Conference of the Parties to CBD in 2010. 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 North Macedonia has not signed this Protocol yet. The description of some preparatory will be provided in Chapter 2.

8.19. 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

8.19.1. Indicator: Trends in the number of graduates in the area of basic and applicative biology in Republic of North Macedonia

8.19.1.1. Fact sheet

Authors: *Biljana Miova* (Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje)

Indicator Name: Trends in the number of graduates in the area of basic and applicative biology in Republic of North Macedonia
Lead Agency: Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje
Use and interpretation: **Key question(s) which indicator helps to answer** Basic and applicative biology is one of the fundamental study programs at the Universities in North Macedonia. Moreover, the number of new and different study programs, especially in the area of applicative biology is increasing. This indicator will help to get know with the potential of the country and the Universities to teach the students and to produce graduates in the area of basic and applicative biology. Moreover, you will be informed about the number of masters and doctorates in the above area of research. **Use of indicator** This indicator can be used to assess the level of which the Universities are educating and produce graduates and the level of scientific work (master and doctoral thesis) in the area of basic and applicative biology. **Scale of appropriate use** This indicator can be used on national scale.
Potential for aggregation: The parameters of this indicator have a relative potential for aggregation, they have different approach and

research interest, but all together complement each other.

Meaning of upward or downward trends („good or bad")

There is a different upward or downward in different level of study/ research.

1. Concerning graduate students, there are different trends in different study groups and Faculties: upward trend in some study groups and downward trend in other study groups; so the number of graduate students has a fluctuation.
2. There is a slight positive trend in the master research level.
3. There is a negative trend in the doctoral research level generally in all estimated Faculties, but the increasing number of master thesis might result in upward trend in the doctoral thesis in the future.

Possible reasons for upward or downward trends:

One of reason for the above mentioned trends is that new study groups are developed, so the students are spread between them. Still, the general number of students, and so the interest or studying basic and applicative biology, is on a satisfactory level in North Macedonia.

Implications for biodiversity management of change in the indicator:

Changes in the trend of the indicator should be carefully analyzed. Negative changes in the next few decades will probably show the decrease of interest in biodiversity research and conservation.

Units in which it is expressed:

This indicator can be expressed as a number of graduates, master or doctoral student in different Faculties and Universities in the country.

Description of source data:

As a reliable source of such data can be used the official web site of the Faculties and Universities in the country, self –evaluation report of each unit, but also direct communication with the responsible contact person or student affair contacts.

Calculation procedure:

Review of the self –evaluation report of each unit and the official data on the web site.

Most effective forms of presentation:

For the graduate students, most effective forms of presentation is separate chart graph for each Faculty. The best way to present this indicator is year by year, in a 5- or 10-year interval.

For the master and doctoral thesis, the most effective form of presentation is one common chart graph for all Faculties for the master thesis and one common chart graph for all Faculties for the doctoral thesis. This indicator is best to be presented in 5-year intervals

Limits to usefulness and accuracy:

The indicator has its limits to usefulness and accuracy, in the sense that not all study groups that are related to basic and applicative biology are directly related to biodiversity. For the master and doctoral thesis is little more precisely, since from the title of the thesis it can be seen the narrow interest of the research.

Updating the indicator:

For the graduate student, the indicator should be followed annually.

For the master and doctoral thesis the same, but the results should be compared in 5-years periods.

Closely related indicators

-Trend in number of experts employed in the scientific institutions

- Trend in number of published articles

Additional information and comments

First of all, it is necessary to encourage staff, financially support research on biodiversity components,

establish and complement a national database to share and make better use of biodiversity information.

As to our knowledge, this is first study that collects such data. Suggestions should be given to the Faculties to make these results more visible, by presenting the number of graduate student on their web sites, as well as the title of the master and doctoral thesis.

8.19.1.2. Assessment of the indicator

The basic education of young investigators in the area of biodiversity is conducted at higher education institutions, which in detail will be mention in the indicator 18.2. More detailed research activity is carried out on the 2nd and 3rd cycle studies, where through individual work with the appropriate mentor, more specific and more precise research is carried out, which finally is the defining a master's or doctoral thesis. In this way, in addition to numerous publications, the publicity of the obtained knowledge on the discovery of new species is realized.

The following graphs show the analysis of the number of students who have graduated from study programs where biodiversity research is one of the studied areas. We have analyzed the Faculties and Institutes. At the Institute of Biology at Faculty of Natural Sciences - UKIM, these are the study programs in biology and ecology, but of course the study program in molecular biology. The chart below shows that in the period from 2009/2010 to 2019/2020 there is a negative trend in the number of graduates of Biology - teaching and the number of graduates in Ecology, unfortunately, but there is a growing trend of students who have graduated in Molecular Biology. Generally, in al groups, the total number of graduate students was 39 in 2009/2010 and 25 in 2014/2015 and 16 in 2018/2019 academic year.

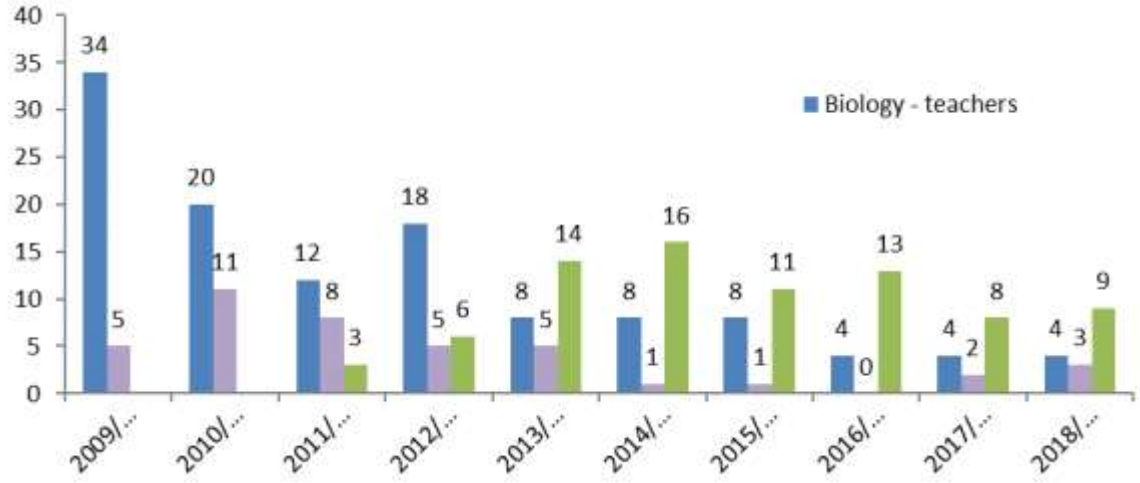
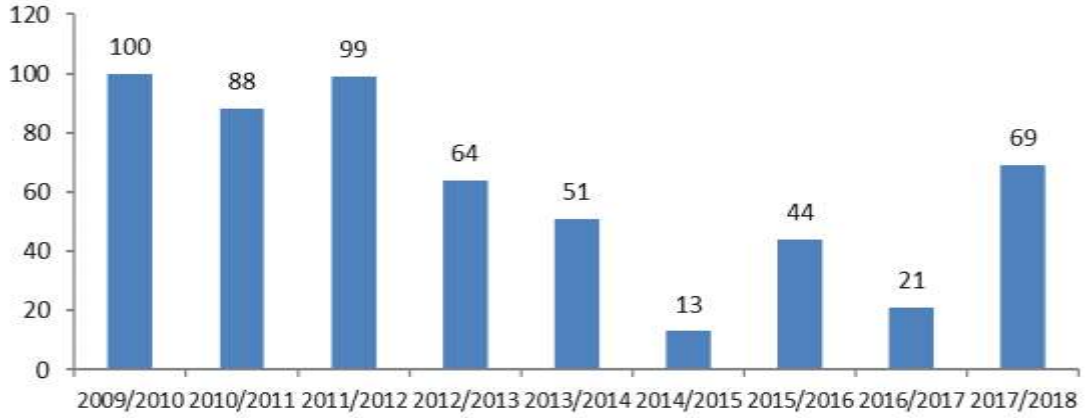


Figure 121 Number of graduated students form selected study groups of interest at Institute of Biology at Faculty of Natural Sciences and Mathematics– UKIM.

At the Faculty of Agricultural Sciences and Food - UKIM, several study groups have also been selected: Field Crop Production, Vegetable and Flower Crop Production, Animal Biotechnology, Plant Protection – Phytomedicine, Eco-Agriculture, Fruit Production with Viticulture, Viticulture and Wine Production. The results are summarized for all these study groups. What can be seen is an intensive negative trend in the number of graduates of these study programs from 2009/2010 to 2014/2015 (from about 100 do about 13 students) , but in the academic year 2017/2018 there is an increased in the number of graduates and this number reached 69 students.



122 Number of graduated students form selected study groups of interest at Faculty of Food and Agriculture – UKIM.

For the purpose of this study, we have analyzed two study groups - Greening and improving the environment and Forestry from the Faculty of Forest Sciences, Landscape Architecture and Environmental Engineering – UKIM. In the investigated period of 10 years (2010-2020), there was positive trend and about 30 students in total, but there is a negative trend in the last two years. Generally, there were 18 students in 2010/2011, 29 students in 2013/2014 and 5 graduate students in 2018/2019.

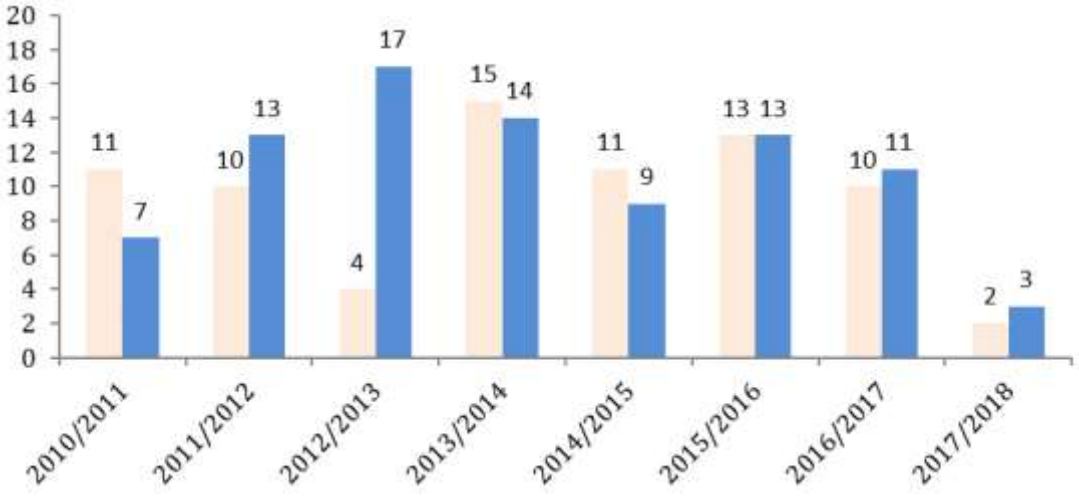


Figure 123 Number of graduated students form selected study groups of interest at Faculty of Forest Sciences – UKIM.

At the Faculty of Agriculture – UGD (which was established at 2007 year), we made an overview of all study groups at this faculty, not only of selected study groups. We notice an unusual dynamic. Namely, except for the academic years 2013/2014 and 2014/2015, when it graduated about 600 students in one academic year, in the other academic years the total number of students is much smaller. Still, there is a positive trend and in the 2018/2019 academic year this number reaches 69 students.

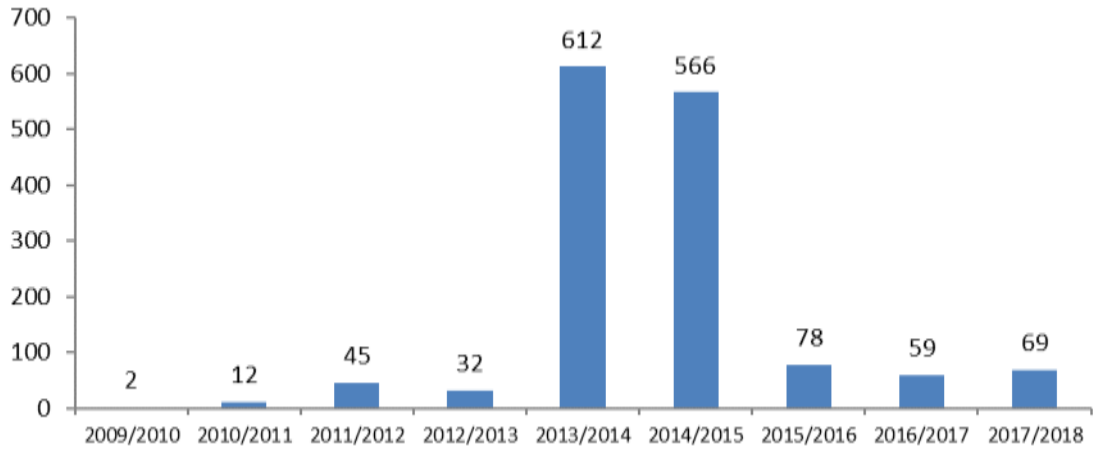


Figure 124 Total number of graduated students at Faculty of Agriculture – UGD.

Concerning **master and doctoral thesis**, we have made very detailed selection by reading the title of all theses in the investigated period. The results are presented in the following figures, respectively.

From the analyses made for the master theses it can be seen that for the period of 2010 -2014, there was 31 total number of master thesis, and in the period of 2015 -2019, the number of master theses there was a positive trend and the total number of master thesis has increased to 45 in total. The distribution between the different Faculties is given on the following figures. It can be noticed that most of the master theses are defended at Institute of Biology (Faculty of Natural Sciences and Mathematics– UKIM) and Faculty of Food and Agriculture – UKIM, few of them at the Faculty of Forest Sciences, Faculty of Agriculture – UGD and one at the Institute of Hydrobiology and Institute of Livestock Breeding.

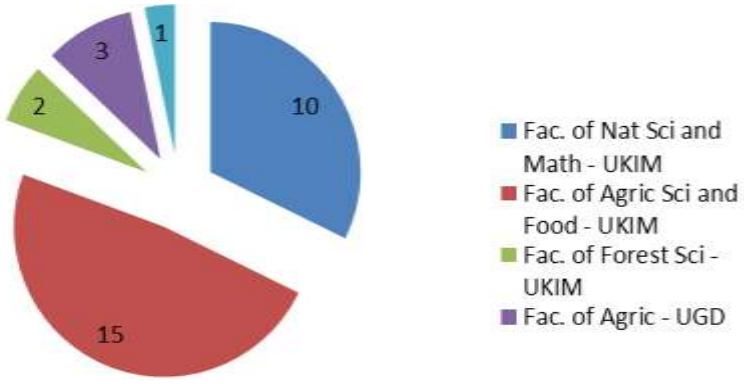


Figure 125 Total number of master thesis in the field of Biodiversity in the period 2010-2014.

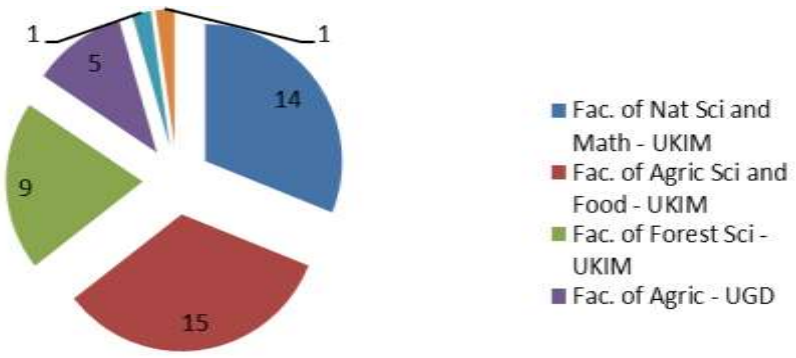


Figure 126 Total number of master thesis in the field of Biodiversity in the period 2015-2019.

We have made separate analyses of the doctoral theses, too. The total number of doctoral theses was also very precisely selected form the title of the thesis. For the period of 2010 -2014, there was 15 total number of doctoral thesis, and in the period of 2015 -2019, the number of doctoral theses has decreased to 8 in total. The distribution between the different Faculties for the period 2010-2014 and 2015-2019 are presented on the following figures. It can be noticed that most of the doctoral theses has also been defended at Institute of Biology (Faculty of Natural Sciences – UKIM) and Faculty of Food and Agriculture-UKIM and only one or two with this area of research at the Faculty of Forest Sciences and Faculty of Agriculture – UGD.

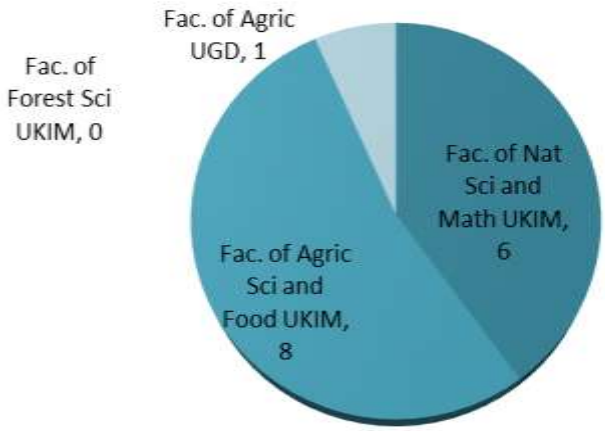


Figure 127 Number of doctoral thesis in the field of Biodiversity in the period 2010-2014.

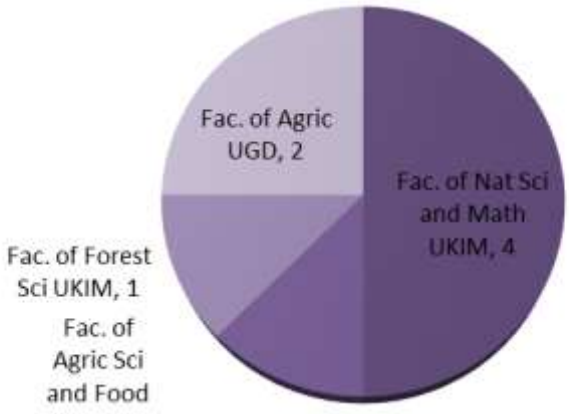


Figure 128 Number of doctoral thesis in the field of Biodiversity in the period 2015-2019.

8.19.2. Indicator: Scientific publication by Macedonian Institutions related to biodiversity

8.19.2.1. Fact sheet

Authors: *Zlatko Levkov, Slavcho Hristovski* (Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje)

Indicator Name: Scientific publication by Macedonian Institutions related to biodiversity
Lead Agency: Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje
Use and interpretation: **Key question(s) which indicator helps to answer** North Macedonia is a relatively small country with limited capacities in biodiversity research. This indicator shows the trend in scientific research that concerns various aspects of biodiversity. This indicator might provide useful information for general status of science in the country as well as capacity and ability of researchers in North Macedonia to conduct and publish relevant studies. **Use of indicator** This indicator might be used for assessment the intensity and quality of research and capacity of the scientific community in North Macedonia as well as international cooperation on the field of biodiversity studies. This indicator can also be used to assess the progress in knowledge for biodiversity. **Scale of appropriate use** This indicator can be used on national scale.
Potential for aggregation: The indicator is closely connected with other indicators, such as number of newly described species, alien species, diversity and status of habitats and many others. In the same time it is related with size of scientific communities, human resources, equipment and support by relevant national and international institutions.
Meaning of upward or downward trends („good or bad") The slight positive trend (increase) of the number of publications in the next few decades should be expected and it will show the increased scientific capacities for conducting relevant research. It is strongly dependent by the support by the national and international institutions and size of the scientific community.
Possible reasons for upward or downward trends: The positive trend is surely a result of increase possibilities for research projects funding (national and international), scientific cooperation, improved technical capacities of research institutions, motivation, scientific competition, etc.
Implications for biodiversity management of change in the indicator: Scientific research increases knowledge of biodiversity and related topics, assessment of threats, provides basis for nature protection and biodiversity conservation.
Units in which it is expressed: Change should be expressed in number of published scientific articles per year.
Description of source data: There are number of relevant databases for assessment of this indicator (Web of Science, Scopus, Mendely,

Scimago Journal & Country Rank, etc.). However, Macedonian scientific institutions have no access to many of these databases. Thus, this indicator will be assessed by the free online database Scimago Journal & Country Rank (https://www.scimagojr.com/) and its Country Ranking tool.
Calculation procedure: Analysis of the Country Ranking tool by Scimago Journal & Country Rank (https://www.scimagojr.com/countrysearch.php?country=mk).
Most effective forms of presentation: There are several ways of the presentation of the results already defined by the Scimago database (line charts, pies, histograms, etc.)
Limits to usefulness and accuracy: The Scimago database has broad scope, both in journal coverage and scientific subjects. Nevertheless, it does not cover published books, monographs, proceedings and local journals. The database provides only overview of the published papers in particular discipline, but not of exact topic (e.g. biodiversity, new species).
Updating the indicator: . This indicator is best to be followed in 5-year intervals.
Closely related indicators - number of newly described species - number of alien species - scientific community structure
Additional information and comments This indicator has not been used so far. For its proper use it is necessary to have complete database with all published papers by scientist from North Macedonia. There were several attempts for establishing such databases at Universities and National and University Library, but they are not complete or available. This indicator might be analyzed by data base administrator with cooperation of biologist with access to above mentioned databases.

8.19.2.2. Assessment of the indicator

For better assessment of the trend of number of scientific papers published by researchers from North Macedonia the indicator is presented in five years intervals in longer period (starting from 1996 to 2018). The Scimagojr.org database clustered the publications by the broader scientific subject areas (e.g. Aquatic Science, Plant Science, Insect Science etc) and detailed analyses of the number of papers closely related to biodiversity is not possible.

However, general picture for intensity and trends in publishing can be easily obtained. Composite data for Agricultural and Biological sciences show advance in the number of papers during the last 10 years. Significant increase in the numbers started in period 2004-2008 and it is continuous in the next two periods. There are few reasons for such increase: i) publication of relevant international journals was forced by the law and promotions were connected with publishing of papers; ii) increased awareness of the scientific community for publishing into international journals; iii) increased international cooperation; iv) enlargement of scientific community by establishing new universities and faculties (see Indicator 18.3). However, the number of publication is not related with national funding of scientific research, since the Ministry of Education and Sciences has not opened any call for research projects in the last 15 years. On other hand, the increased international cooperation has significant impact on the number of publication. Almost 70% of the published

papers are produced by international cooperation. It is expected that this trend will continue in the future and even be slightly increased. Although such approach has positive influence on publishing, it has significant negative impact on national journals.

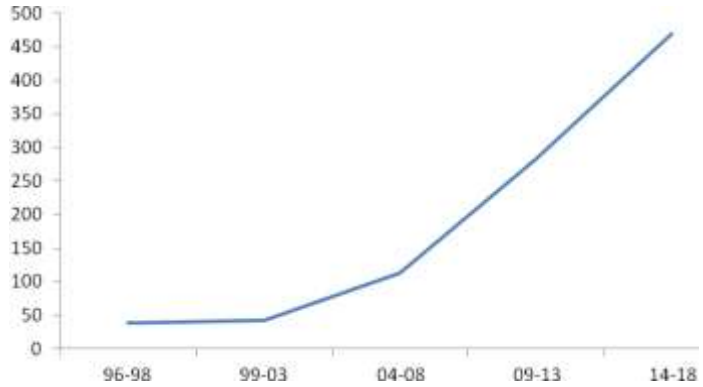


Figure 129 Total number of papers concerning Agricultural and Biological Sciences published in period of 1996-2018

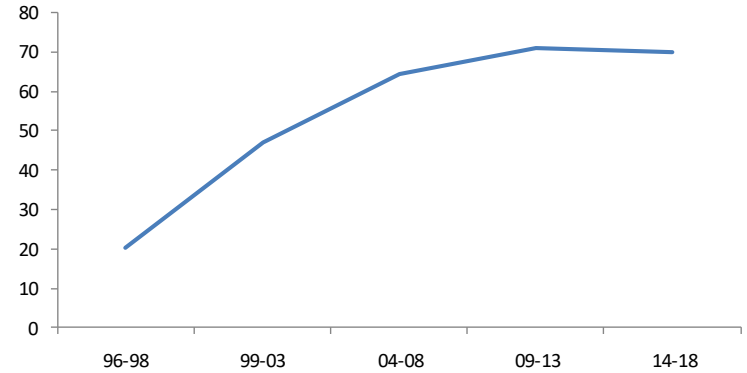


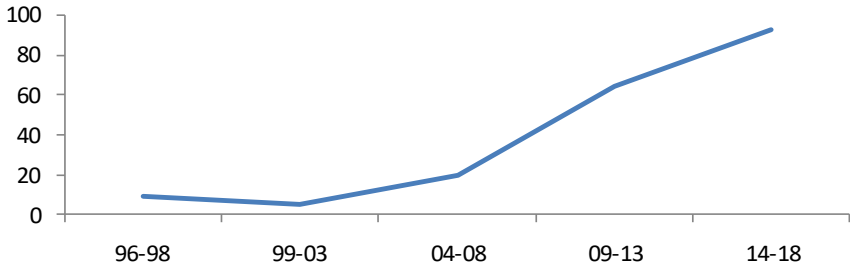
Figure 130 Percentage of papers produced by international cooperation between Macedonian and foreign researchers

Significant increase in the number of papers can be noticed in area of Animal science and zoology. Similar trend can be noticed in Aquatic science with significant increase in number of publications in the last five years. Increased interest for environmental problems that are facing ancient lakes Ohrid, Prespa and Dojran, as well as reservoirs and reactions of organisms to higher nutrient levels resulted with publishing of series of papers. Constant increase of number of publications in the last two decades can be seen in the subject of evolution and systematics. New molecular techniques and high quality electron microscopes enable researchers to have closer insight of the phylogenetic and evolutionary relations among organisms, especially from ancient lakes Ohrid and Prespa. In that sense, several important papers on phylogeny, behavior and biogeography of diatoms, gammarids, snails have been recently published. Very likely most (if not all) of these publications have been published with international cooperation, since such studies require skills, high quality equipment and expensive materials that are missing in the country. Forestry become one of the major research topic during the last decade due to the climate changes, decrease of area under forests, diseases etc. This resulted in large number of published studies in last five years.

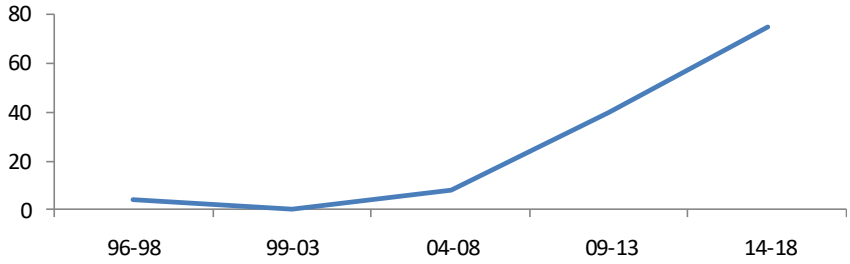
Several important papers concern taxonomy of plants and insects, resulting in many new species from different insect groups such as Coleoptera, Trichoptera Lepidoptera etc. Both scientific areas show significant increase of the number of internationally recognized publications. Steady-state to even slight decrease of number of studies can be recognized in Soil sciences and Agronomy and crop sciences.

In general, positive trend in number of publication can be noticed in the last five years. It is expected that in the next period, number of publication will be only slightly enhanced. This precautionary statement is based on several assumptions: number and age structure of scientists, number of master and PhD students, extremely limited support by national institutions, limited resources for participations on conferences, access to relevant literature, age and capabilities to maintain the current equipment. Probably as was the case in the last five years, the main progression power will be the self-motivation of scientists and their capability to sustain or upgrade the international cooperation.

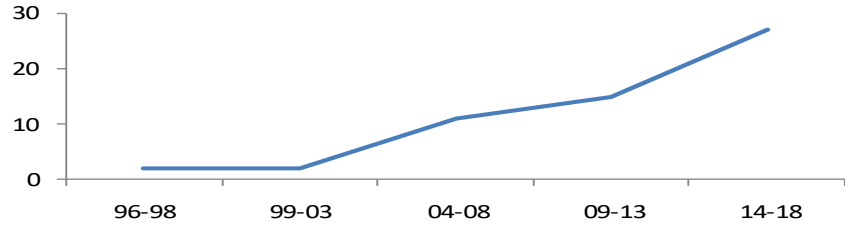
Agricultural and biological science (miscellaneous)



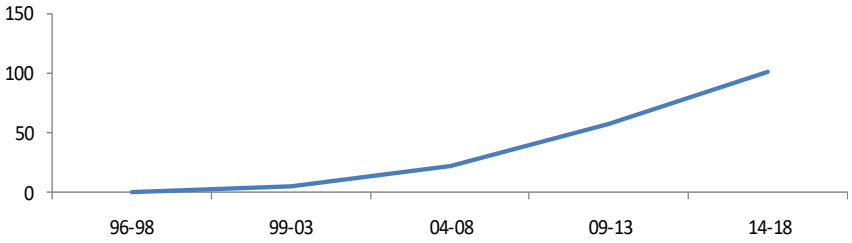
Animal Science and Zoology



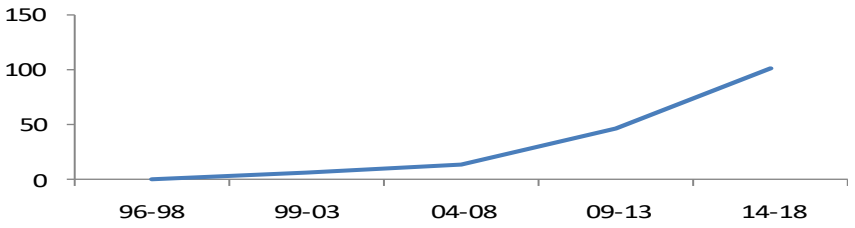
Aquatic science



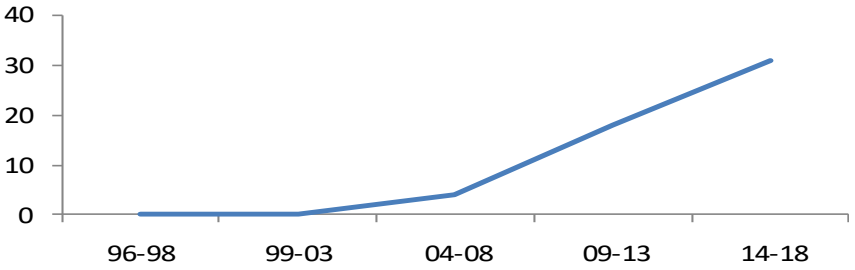
Ecology, evolution, behaviour and systematics



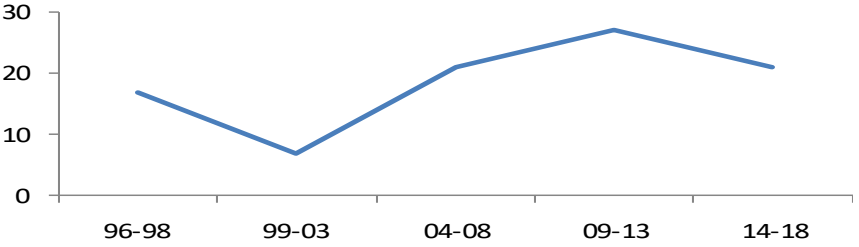
Food Science



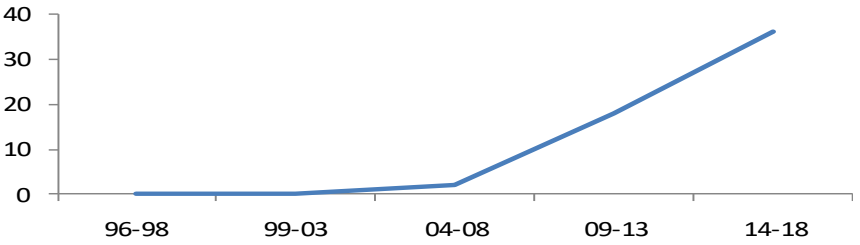
Forestry



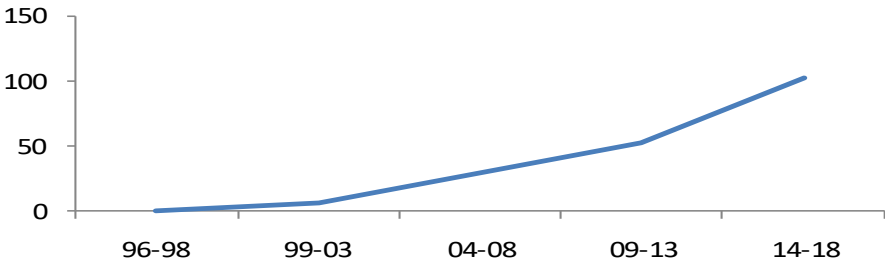
Horticulture



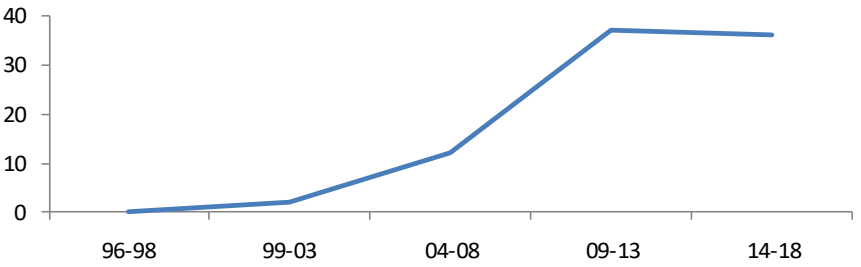
Insect sciences



Plant Science



Agronomy and crop science



Soil Science

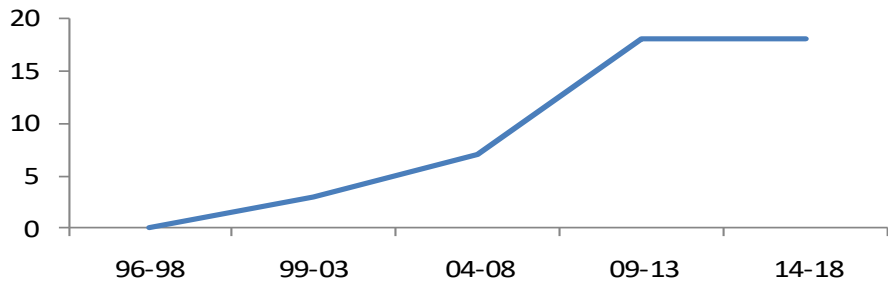


Figure 131 Number of publication for period of 1996-2018 by different subjects

8.19.3. Indicator: Trends in the number of experts working the area of Biodiversity in Republic of North Macedonia

8.19.3.1. Fact sheet

Authors: *Biljana Miova* (Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje)

Indicator Name: Trends in the **number of experts** working the area of Biodiversity in Republic of North Macedonia
Lead Agency: Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje
Use and interpretation: **Key question(s) which indicator helps to answer** In Republic of North Macedonia there a lot of experts working in the area of biodiversity. Generally, we can locate them at the different Faculties and Universities and different scientific institutes. This indicator will help to answer the question of the potential of the country to improve the knowledge by research and field work of the experts working in the area of biodiversity. **Use of indicator** The usefulness of this indicator is that by knowledge of the number of experts, we can get indirect information for the extend at which this area of applied biology is present (theoretically and practically) in the country. **Scale of appropriate use** This indicator can be used on national scale.
Potential for aggregation: The parameters of this indicator have a relative potential for aggregation since the experts have different subspecialisation, various area of expertise, different basic knowledge, but all together complement each other.
Meaning of upward or downward trends („good or bad") The analyses showed that there only small downward trend in the number of experts in the appropriate institutions working the area of biodiversity in Republic of North Macedonia
Possible reasons for upward or downward trends:

The analyses showed that there only small downward trend in the number of experts in the appropriate institutions working the area of biodiversity in Republic of North Macedonia
Implications for biodiversity management of change in the indicator: Changes in the trend of the indicator should be carefully analyzed. Negative changes in the next few decades will probably show the decrease of interest in biodiversity research and conservation.
Units in which it is expressed: This indicator can be expressed as a number of experts in different Faculties and Institutes in the Universities in the country.
Description of source data: As a reliable source of such data can be used the official web site of the Faculties and Universities in the country, self –evaluation report of each unit, but also direct communication with the responsible contact person or student affair contacts.
Calculation procedure: Review of the self –evaluation report of each unit and collecting of information from the web –site of the unit.
Most effective forms of presentation: For the presenting of the selected departments form the different Faculties and Institutes in the Universities in the country, it is good to have a table presentation (spreadsheet). For the number of experts, the most effective form of presentation separate column graph for each unit. This indicator is best to be presented in 5-year intervals.
Limits to usefulness and accuracy: The indicator has its limits to usefulness and accuracy. Namely, not all employed at certain department work in the narrow field of Biodiversity.
Updating the indicator: Both for the Departments and for the number of experts, results should be compared in 5-years periods.
Closely related indicators -Trend in number of graduate, master and doctoral students - Trend in number of published articles
Additional information and comments First of all, it is necessary to encourage Institutes and Faculties to increase the number employ of young people which will focus their carrier in the field of Biodiversity.

8.19.3.2. Assessment of the indicator

In order to complete the review of biodiversity in the Republic of North Macedonia, it is necessary to make an analysis of the number of experts which are responsible for discovering of all new species and by their constant activity contribute to the dissemination of knowledge on biodiversity. In order to fill in this indicator, a detailed analysis of the experts employed in several Faculties and Institutes of interest, at several Universities in Republic of North Macedonia. We presented the selected institutions of interest in the next Table.

For this analysis, the faculties of interest from the "Ss. Cyril and Methodius" University (UKIM) – Skopje are the following: Institute of Biology from the Faculty of Natural Sciences and Mathematics, Faculty of Agricultural Sciences and Food as well as "Hans Em" Faculty of Forest Sciences, Landscape Architecture and Environmental Engineering (Faculty of Forestry).

From the "Goce Delcev" University (UGD) – Shtip, for the purpose of this analysis, we have selected Faculty of Agriculture, while at the University of Tetovo, the Faculty of interest are Faculty of Agriculture and Biotechnology and Faculty of Natural Sciences with his two Institutes of Biology and Ecology.

In addition, this analysis also covered several scientific institutes, which are independent institutions within some of the above-mentioned Universities. The following table presents the separated Departments that have been selected which are related to educational scientific activity in the area of Biodiversity.

Table 46 Selected departments of the Faculties and Institutes of interest where the scientific and research activity is closely related to the field of Biodiversity.

University "St Cyrilus and Methodius", Skopje	
Faculty/ Institute	Selected departments
Faculty of Natural Sciences and Mathematics - Skopje **Institute of Biology –UKIM** https://ib.pmf.ukim.edu.mk/	Department of Plant Ecology Department of Animal ecology Department of Invertebarata Department of Vertebrata Department of Sistematics of Plants Department of Algology Department of Mycology Department of Genetics
Faculty of Agricultural Sciences and Food – UKIM http://www.fznh.ukim.edu.mk/	Department of Viticulture and Enology Department of Field Crop and Tobacco Production Department of Botany and Microbiology Department of Genetics and Selection Department of Gardening Department of Plant Production Department of General Field Crop Production Department of Livestock Production Department of Beekeeping Department of Populaiton Genetics Department of Animal welfare
Hans Em Faculty of Forest Sciences, Landscape Architecture and Environmental Engineering – UKIM http://www.sf.ukim.edu.mk/	Department of Botany and Dendrology Department of Forest Genetics and Tree Improvement Department of Seed Science and Forest Stands Department of Silviculture Department of Forest and Wood Protection Department of Game Management
University "Goce Delcev" Shtip	
Faculty of Agriculture – UGD http://zf.ugd.edu.mk/index.php/mk/	Department of Plant and Environmental Protection Department of Crop Production Department of Viticulture and Orchard
University in Tetovo	

Faculty of Agriculture and Biotechnology – UT https://unite.edu.mk/mk/faculty/fakultet-za-zemjodelstvo-i-biotehnologija/	Animal production Plant production
Faculty of Natural Sciences – UT https://unite.edu.mk/mk/faculty/fakultet-za-prirodno-matematicki-nauki/	Department of Biology Department of Ecology
Scientific Institutes	
Institute of Hydrobiology - Ohrid http://www.hio.edu.mk/index.php/mk/	
Insitute of agriculture - Skopje http://zeminst.edu.mk/	
Institute of livestock breeding - Skopje http://istoc.ukim.edu.mk/	
Museum of Natural Sciences – Skopje http://www.musmacscinat.mk/en/	
Scientific Institute for Tobacco - Prilep http://www.tip.edu.mk/	

Through the analysis of the selected departments, we made an assessment and generally defined the number of experts in the field of biodiversity science. The total results obtained from all Faculties and Institutes are shown in one common bar graph and are valid for 2020 year.

From the next Figure it can be seen that at the Institute of Biology from the Faculty of Natural Sciences and Mathematics – UKIM there are about 13 experts working on biodiversity and approximately the same number of experts from the Faculty of Forestry in Skopje and the Faculty of Agriculture - UGD Stip. The number of teaching and scientific staff at the Faculty of Agriculture at UKIM, whose professional engagement is related to biodiversity, is the largest, about 45 professors and associates. At the University of Tetovo, there are about 6-7 professionals working in the two faculties of interest.

As far as the scientific institutes are concerned, the analysis employs almost all staff and varies from 6 to 16, depending on the size of the institute.

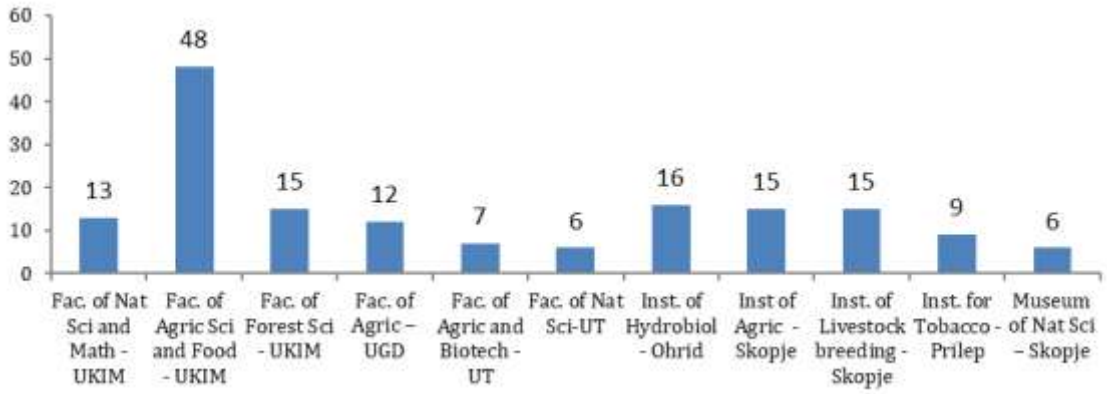


Figure 132 Number of experts in the field of Biodiversity in selected departments of the Faculties and Institutes of interest

However, in the interest of following the trend of changes in the number of professional staff at the faculties of interest, we have made a review at several points (2010/2011, 2012/2013, 2014/2017, 2017/2018 and 2019/2020) of all teaching staff employed at these faculties. The graphs show that, in general, the Institute of Biology from the Faculty of Natural Sciences and Mathematics – UKIM, Faculty of Forest Sciences – UKIM and the Faculty of Agriculture at UGD there are not significant changes during this 10-year period, while evident decrease in the number of engaged professional staff at the Faculty of Agriculture and Food at UKIM was observed.

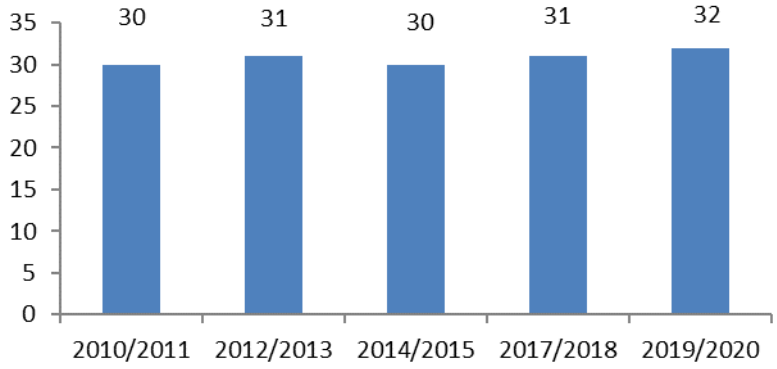


Figure 133 Total number of employed academic staff at Institute of Biology at Faculty of Natural Sciences – UKIM for the period 2010-2020.

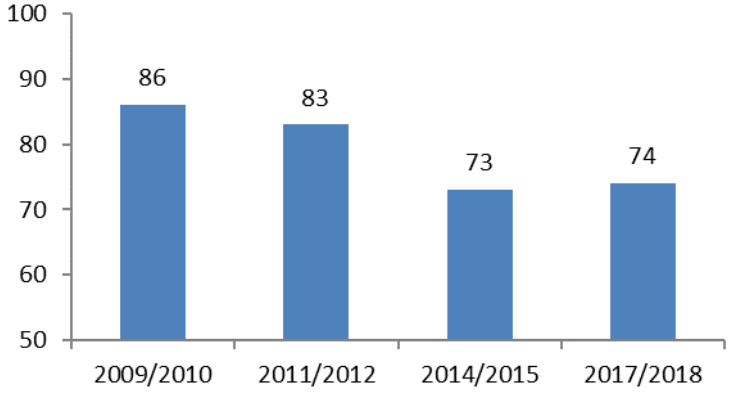


Figure 134 Total number of employed academic staff at Faculty of Food and Agriculture – UKIM for the period 2010-2020.

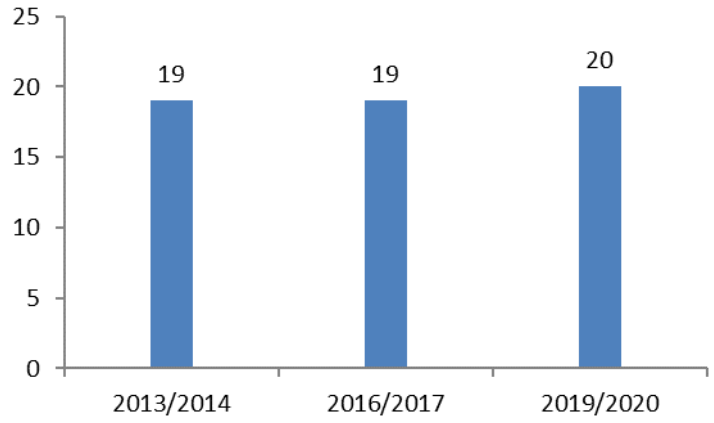


Figure 135 Total number of employed academic staff at Faculty of Forestry – UKIM for the period 2010-2020.

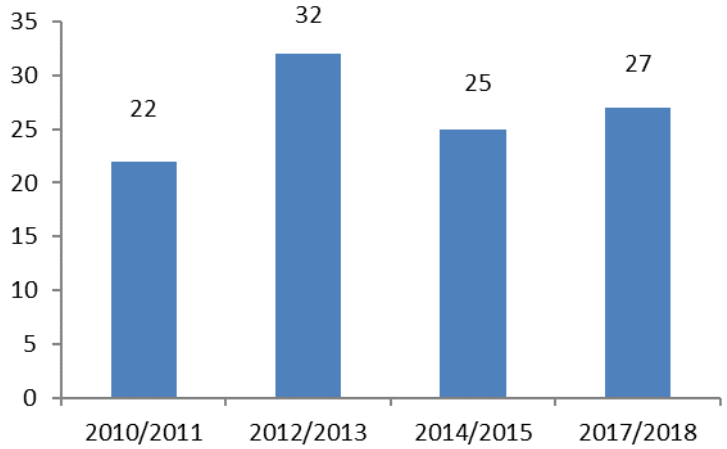


Figure 136 Total number of employed academic staff at Faculty of Agriculture – UGD for the period 2010-2020.

8.19.4. Indicator: New species described from the Republic of North Macedonia

8.19.4.1. Fact sheet

Authors: *Slavcho Hristovski, Zlatko Levkov, Valentina Slavevska-Stamenkovic* (Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje)

Indicator Name: New species described from the Republic of North Macedonia
Lead Agency: Institute of Biology, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje
Use and interpretation: **Key question(s) which indicator helps to answer**

North Macedonia is a country rich in biodiversity. However, new species are constantly described due to the low level of research among some taxonomic groups. The number of newly described species will show the research capacity of the country (and international cooperation) as well as the intensity of field research and collections' reviews.

Use of indicator

This indicator should be used in order to assess the intensity of research and capacity of the scientific community in North Macedonia as well as international cooperation. This indicator can also be used to assess the level of knowledge for diversity of particular taxonomic groups.

Scale of appropriate use

This indicator can be used on national scale.

Potential for aggregation:

This indicator is complex by itself and consists of parameters that show number of described species in different taxonomic groups (plants, algae, invertebrates and vertebrates). On the other hand, this indicator may be considered as part of the group of indicators showing the number of published scientific taxonomic articles.

Meaning of upward or downward trends („good or bad")

The positive trend (increase) of the newly described species in the next few decades is expected and it will show the increased attention to biodiversity research and conservation as well as increase in the capacity of the scientific community.

Possible reasons for upward or downward trends:

The positive trend will be a result of increased intensity of biodiversity research and/or increased funding by the national instruments or international community. Positive trend or steady state can be expected in the next few decades. At present, the increase in number of described taxa is a results of mostly international cooperation and less to the national support.

Implications for biodiversity management of change in the indicator:

Changes in the trend of the indicator should be carefully analyzed. Negative changes in the next few decades will probably show the decrease of interest in biodiversity research and conservation.

Units in which it is expressed:

Change should be expressed in number of newly described species per year.

Description of source data:

The only reliable source of such data are published scientific articles and several databases or comprehensive works (e.g. Euro+Med PlantBase, Flora Europaea, Fauna Europaea, Algaebase.org, etc.). Additionally, Google Scholar should be used as an important source of data.

Calculation procedure:

Review of the scientific literature by professional taxonomists.

Most effective forms of presentation:

The best way to present the trends is to present by lines trends. This indicator is best to be presented in 5-year intervals accompanied by the list of newly described species.

Limits to usefulness and accuracy:

Analysis of the data on new species is limited by the extent of review of taxonomic literature and available expertise on specific taxonomic groups. There is no national database that contains information on newly described species.

Updating the indicator:

The indicator should be followed annually, but the results should be compared in 5-years periods (e.g. 1990-

1995, 1995-2000, 2000-2005...).
Closely related indicators - Capacity building - Number of professionals - Number of published articles
Additional information and comments This indicator has not been elaborated so far. Data collection should be performed by professional taxonomists for plants, fungi, algae, invertebrates and vertebrates with help of broader scientific community (national and international). The National Biodiversity Information System should have possibility for input and analyses of such data.

8.19.4.2. Assessment of the indicator

The analyses of taxonomic literature published in the period 2014-2019 revealed a list of 106 newly described species for science. All of these species have their type locality from the Republic of North Macedonia or part of the paratype series. In average, about 18 species were described annually. However, the description of species varies from year to year. In this period, one new genus for science was also described (*Sumia* Glöer & Mrkvicka, 2015).

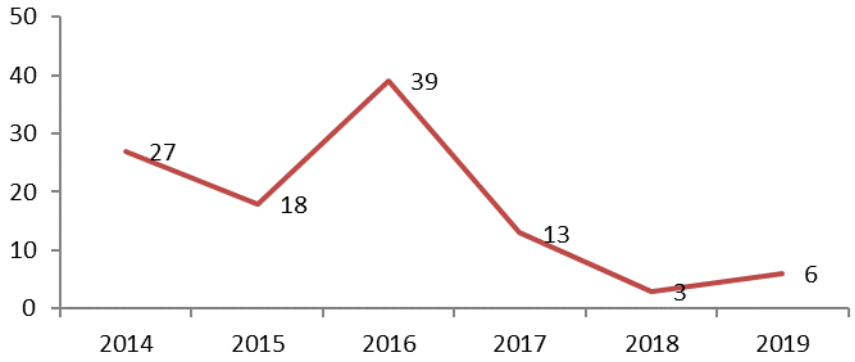


Figure 137 Number of newly described species for science from the Republic of North Macedonia in the period 2014-2019

From the presented chart it is noticeable that the most productive year was 2016 and the lowest number of species were described in 2018 and 2019. However, this trend is only showing very short period of time (2014-2019) and general conclusions cannot be drawn. The indicator should be followed in 5-years intervals and analyses in the future will provide better insight.

The majority of new species were described from the group of Diatoms (63 species). Out of the vascular plants only one species was described (*Viola pseudaetolica* Tomović, Melovski & Niketić). It is interesting to note that also one fungi species was described in the recent period (*Astraeus macedonicus* Rusevska, Karadelev, Telleria & Martín). The rest of the described species belong to different groups of invertebrates.

The majority of species were described by Macedonian scientists (78 out of 106 species) and these Macedonian authors appear as formal (co-)authors. In 70 cases (out of 78) the description of species was performed with international cooperation. Only 13 Macedonian scientists were authors of these new species.

As regards the institutions we can conclude that 70 species were described by researches from the Institute of Biology (Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje), two from the Macedonian Natural History Museum (Skopje) and six by an independent researcher in arachnology. Nevertheless, 63 species of diatoms can be accounted to the diatomological team of the Institute of Biology.

Unfortunately, none of the species were described in the frames of projects that were nationally funded. About $^1/_3$ of the species were described from the materials collected for the purposed of (re)valorization studies in existing of proposed protected areas. Thus, most of the species were described from Shar Planina (projects implemented by Macedonian Ecological Society and State University of Tetovo), Bregalnica, Osogovo and Jablanica and Jablanica (projects implemented by Macedonian Ecological Society). Considerable number of species resulted from the research organized by the Biology Students' Research Society (Pelister, Kozhuf, Mariovo, Galichica, etc.).

Table 47 Overview of newly described species for science by taxonomic groups from the Republic of North Macedonia in the period 2014-2019

2014	15				1		2	1	1	**3**	3	1		**27**
2015	7			5		1	1			**1**	3			**18**
2016	34	1					1				1	1	1	**39**
2017	4			1	2		2				4			**13**
2018										**2**	1			**3**
2019	3		1								1		1	**6**
Total	**63**	**1**	**1**	**6**	**3**	**1**	**6**	**1**	**1**	**6**	**13**	**2**	**2**	**106**

The knowledge of biodiversity expressed through this indicator is increasing in the country in the last five years. National funding of scientific projects is completely missing and shows the necessity of establishment of national funding schemes for biodiversity research (MoEPP, Ministry of Education and Sciences).

The potential for description of new species is still very high which shows the necessity for continuation of biodiversity research. Having in mind the type localities of the new species the following areas should be targets for future research: Ohrid and Prespa lakes, Shar Planina, Jablanica, Kozhuf, Jakupica, etc.

The capacity of the scientific institutions in North Macedonia varies considerably. The leading institution is the Institute of Biology where the capacity for taxonomic research is evident.

8.19.5. Indicator: Citizen science – data collected by amateur naturalists

Authors: *Ksenija Putilin* (*MacedonianEcological Society)*

Indicator Name: Amateur Biodiversity Data (Civil Science)

Lead Agency: MacedonianEcological Society; Faculty of Natural Sciences-Insitute of Biology

Use and interpretation:

Key question(s) which indicator helps to answer

Citizen science is used in studies in which large numbers of volunteers help collect data, perform analysis or otherwise carry out research activities. Thus, citizen science can be used to answer many varied questions in accordance with the project that would apply it. Most commonly in the realm of biodiversity conservation volunteer citizens are tasked with observing all or specific species in certain locations. Generally, all citizen science data can be used to answer the question what is the capacity of the local population to understand biological diversity and the ability to identify species of animals and plants. Currently, there are no projects that rely on citizen science and it has been used only as an educational tool for school children (springalive.net) in North Macedonia.

Use of indicator

This indicator can be used to assess the interest in biological diversity among the citizens of North Macedonia as well as international contributors. It also assesses the level of knowledge of diversity of particular taxonomic groups and their popularity. It can also assist in the understanding of spread of and the overall frequency with which various species are spotted by amateur naturalists. We can further analyze how many species are regularly being spotted in certain locations and the seasonality of observations of the most commonly spotted species.

Scale of appropriate use

This indicator can be used at a national scale but most commonly it will be used in project scope.

Potential for aggregation:

This indicator is in a close relation with indicators related to increased levels of public awareness of biodiversity and citizens role in its protection as well as with indicators related to increased capacities of professionals and institutions which promote and conduct research of biodiversity.

Meaning of upward or downward trends („good or bad")

The positive trend (increase) of quantity and quality of amateur data will show increased interest and capacity of local and international amateur naturalists to identify species and to become involved with conservation efforts and/or biodiversity research.

Possible reasons for upward or downward trends:

The positive trend will be a result of increased intensity of environmental or biodiversity campaigns and training geared towards amateur naturalists. Since there is a current global trend in increased attention towards biodiversity conservation it is expected that this indicator will have a positive trend.

Implications for biodiversity management of change in the indicator:

Negative changes in the next few decades will probably show the decrease of interest in biodiversity conservation by the general public.

Units in which it is expressed:

Number of observations per year and number of observers per year

Description of source data:

There are several global and massive citizen science databases which can be easily accessed by citizens and validated by scientists. However, there are currently only three which we have interest in using: eBird by Cornell Lab of Ornithology, iNaturalist by California Academy of Sciences and Observation.org by Observation International, etc. All of these platforms can readily provide us with free data on trends in observations for North Macedonia.

Calculation procedure: The databases provide the data
Most effective forms of presentation: Histograms, line trends, etc.
Limits to usefulness and accuracy: Since all three chosen platforms require validation of observations the number of observations will be useful and accurate. However, number of observers can be inaccurate since there is no limit to how many accounts a person i.e. a single observer can have.
Updating the indicator: The indicator should be followed annually, but the results should be compared in 5-years periods.
Closely related indicators - Capacity building - Number of professionals - Number of published articles using citizen science data
Additional information and comments Once citizen science data is used in research project in North Macedonia there may be more insight into how this indicator is tracked and what units need to be calculated.

8.19.5.1. Assessment of the indicator

The analyses of major biodiversity databases populated by citizen science and verified by scientists shows that even though there are currently no projects using citizen science (nor have there been such in the last 5 years) there is certain data. While some of these data bases provide straightforward insight into the number of observations, species, identifications and observers per year, most provide only some of those numbers. We have selected to look at three databases as these three are the ones most likely to be put in use in the coming years. Those databases are eBird, iNaturalist and Observation.org. The data from two of them has been collected by using just a general free account (eBird and iNaturalist) as that would be the most likely way to track this indicator in the coming years, while for observation.org Macedonian Ecological Society gathered information as the national administrator i.e. the data is not generally available.

eBird is a very popular North American product used globally. It is especially popular among avid birdwatchers and it is limited to ornithological data. This database needs to be monitored even if it is not being used in a specific research in our country because of the sheer amounts of data it provides. It is currently the largest global biodiversity-related citizen science project with over 100 million bird observations and hundreds of thousands of users. This database is managed by the Cornell Lab of Ornithology. Data that could be collected through eBird are: bird distribution, abundance, habitat use, and trends.

There are currently 266 species of birds recorded for the Republic of North Macedonia on eBird. It seems that numbers observers in the last 5 years have been rising steadily.

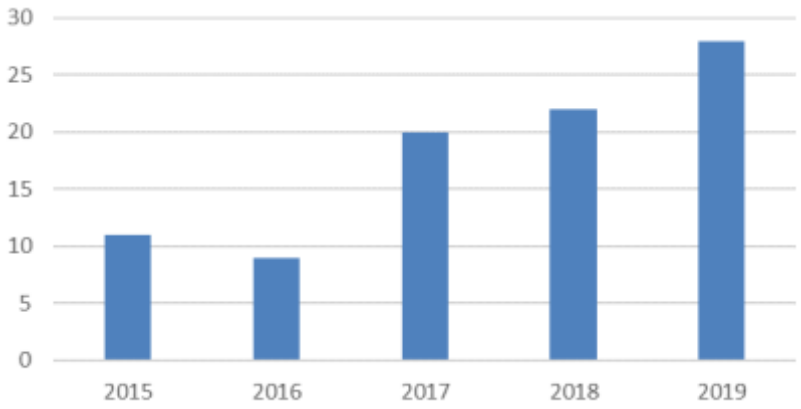


Figure 138 eBird - Number of observers annually 2015-2019

Unfortunately, we cannot analyze the provenance of the observers i.e. we cannot judge simply on profile names who is a local observer and who is an international observer. It is, though, probably mostly international observers. *eBird* does not provide the number of observations annually per country for free on its website. Hence we cannot include this number in the indictor for now. *iNatualist* is one of the world's most popular biodiversity databases because of its app which while collecting data also provides help in identifying species. It has over 750.000 users (both citizens and scientists who verify data). iNaturalist is a joint initiative by the California Academy of Sciences and the National Geographic Society. The databases collects data on all taxonomic groups. There are currently 2433 observations of 1023 species for North Macedonia to date. The numbers of observers are rising.

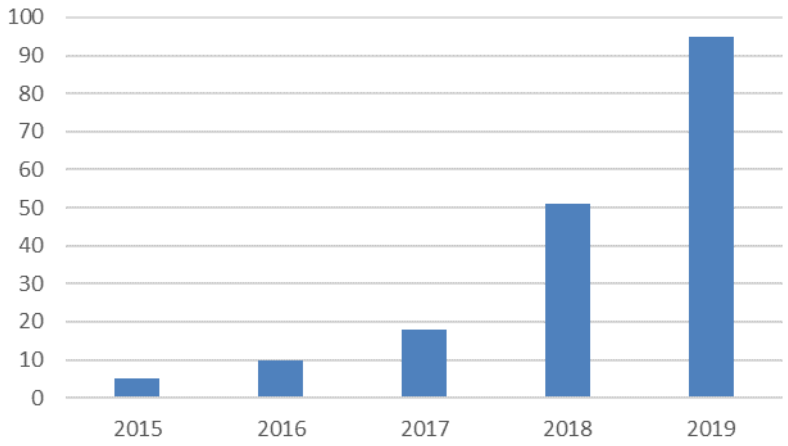


Figure 139 iNFigure 139aturalist -Number of observers annually (2015-2019)

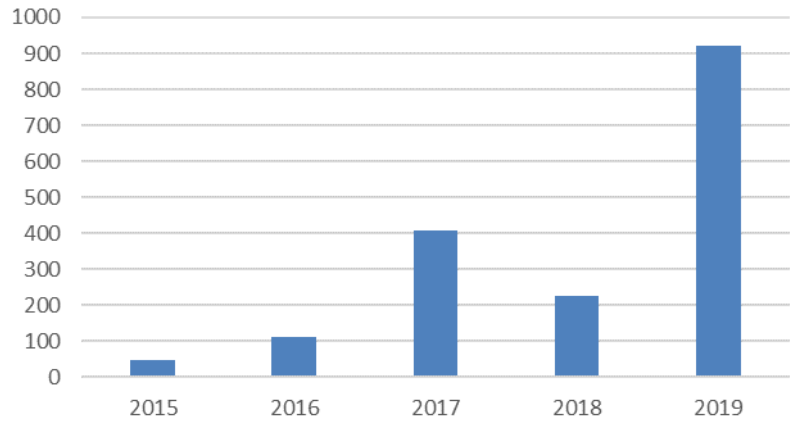


Figure 140 iNaturalist - Number of observations annually 2015 -2019

Since we have had no targeted campaign to use this database in North Macedonia we have way of explaining why there is a dip in the number of observations for 2018.

Observation.org is database of the Observation.org citizen science organization collecting and presenting international plant, animal and other nature observations. Observations are collected by thousands amateur and professional nature lovers. Data quality is ensured by validation by a team of international taxonomic specialists. This database has an automatic recognition system which assists the identification of species. The database consists of over 100.000.000 observations in 2018. This is the only database that has a localized app for North Macedonia. The number of observers seems to have a generally rising trend.

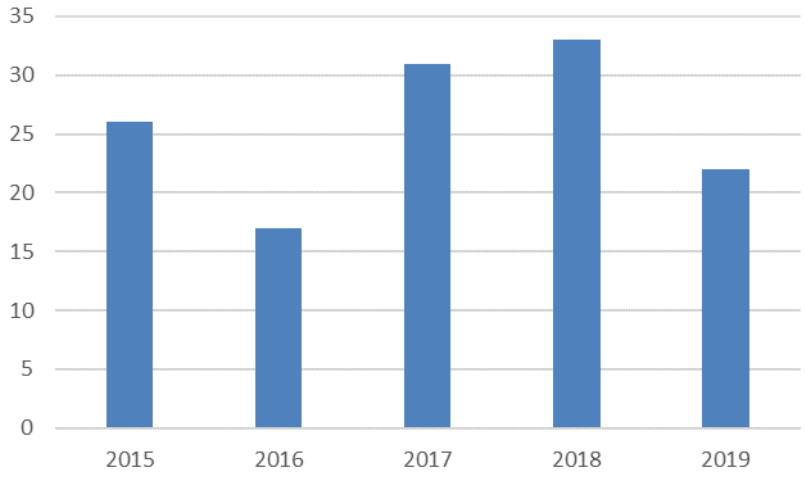


Figure 141 Observation.org - Number of observers annually 2015 - 2019

Numbers of observations per year are available to us as administrators of the database and it seems to have a generally decreasing trend.

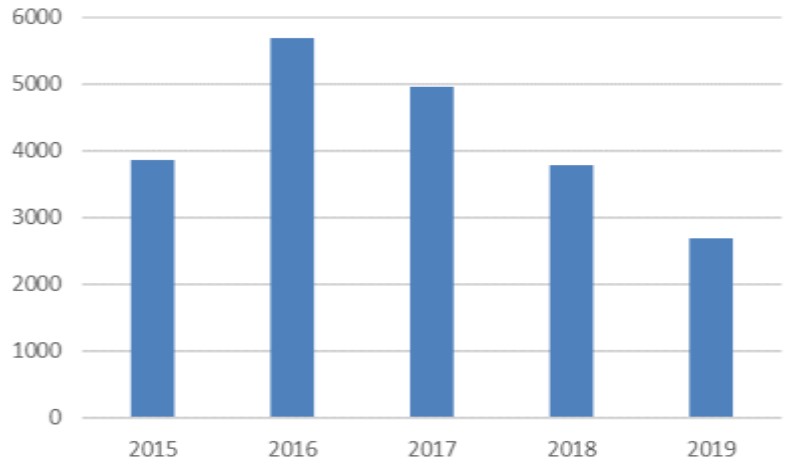


Figure 142 Observation.org - Number of observations annually 2015-2019

The numbers from all three databases for now can serve as a baseline and should be monitored annually. Once citizen science is included in a project/research in North Macedonia the numbers will lead to conclusions and provide more insight.

8.20. **National target 19:** Preserve and promote traditional knowledge, innovations and practices for conservation and sustainable use of natural resources

In the present stage, no national indicators were developed. However, it is necessary do elaborate at least one national indicator that will present the trends od utilization of biodiversity in traditional medicine.