Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

Ministarstvo poljoprivrede, šumarstva i vodoprivrede

Regional Fire Monitoring Center - RFMC

LANDSCAPE FIRE MANAGEMENT REPORT FOR MONTENEGRO



2023

ФАРМАХЕМ
PHARMACHEM

HELVETAS

List of institutions and experts engaged in the preparation of the LFM report

- Ministry of Agriculture, Forestry and Water Management
- Ministry of Spatial Planning, Urbanism and State Property
- Ministry of Public Administration
- Protection and Rescue Directorate of the Ministry of the Interior
- Institute of Hydrometeorology and Seismology
- Statistical Office – MONSTAT
- Administration for the Management of Forests and Hunting Grounds
- Cadastre and State Property Administration
- Administration of Montenegro – Biotechnical Faculty
- Association of Agricultural Producers of Montenegro
- Hunting Association of Montenegro
- NGO Green Home
- NGO Young environmentalists

Preparation and compilation of the report:
Srdjan Shashic, LFMWB Country Project staff in Podgorica

National supervisor of the process:
Srdjan Pejovic, LFMWB Country Focal Point, Ministry of Agriculture, Forestry and Water Management of Montenegro

Expert process support:
Prof. Dr. Nikola Nikolov, Regional expert for landscape fire management, Regional Fire Monitoring Center (RFMC)

Proofreader:
Elena Jankoska

The Landscape Fire Management Report for Montenegro is prepared within the Landscape Fire Management in the Western Balkans (LFMWB) Programme financed by the Swiss Agency for Development and Cooperation (SDC) and coordinated by Farmahem - Skopje with backstopping support of Helvetas Swiss Intercooperation. The process for preparation of this report was coordinated by the Ministry for Agriculture, Forestry and Water Economy of Serbia with the support of the Regional Fire Monitoring Center (RFMC) for the Southeast Europe/Caucasus Region as partners of the LFMWB Programme.

Table of Contents

List of institutions and experts engaged in the preparation of the LFM report 2
Table of Contents 3
Overview of figures, tables and maps 4
List of Abbreviations 6
Introduction 7

I LAND USE 9

II. DEMOGRAPHY 20

III. CLIMATE CHARACTERISTICS, CLIMATE CHANGE, CLIMATE CHANGE SCENARIOS AND NATIONALLY DETERMINED CONTRIBUTIONS (NDCs) 27

IV. EXISTING FIRE MANAGEMENT SYSTEM 36
- **a)** Main Stakeholders in the Existing System 36
- **b)** Organisational Setup of the System 37
- **c)** Legislation Regulating this Area 42

V. RECORDING FIRES 45

VI. LANDSCAPE FIRE RISK ASSESSMENT (risk of fires at landscape level + map) 51

VII. EXISTING PROJECTS 53
- **1.** Project on Capacity Building for Disaster Risk Reduction Through National Information System (NFFIS) and Eko-DRR 53
- **2.** Multi-country IPA programme relating to flood protection and forest fire risk management 53
- **3.** Building FIRE – SMART LANDCAPE in the Mediterranean region 54

VIII. IDENTIFICATION OF STRENGTHS AND WEAKNESSES IN THE LFM SYSTEM 55

IX. LFM GUIDELINES 60

References 69

Overview of figures, tables and maps

Graph 1.	*Utilised agricultural land*	10
Graph 2.	*Areas under forests and forestland areas*	11
Graph 3.	*Forest areas by ownership*	12
Graph 4.	*Proportions of the most important tree species in forests of Montenegro*	12
Map 1.	*Spatial distribution of forests and forestland areas by region*	13
Map 2.	*Forests and forestland cover by municipality*	14
Map 3.	*Spatial distribution of forests and forestland areas by ownership*	15
Table 1.	*Forests by use*	16
Map 4.	*Spatial distribution of national parks*	17
Table 2.	*Area of forests and forestland in the National Parks of Montenegro*	18
Table 3.	*Main demographic indicators, 2022*	20
Table 4.	*Number of inhabitants at the beginning, mid and at the end of 2022 by age groups*	21
Graph 5.	*Population by age at the beginning and at the end of 2022*	21
Table 5.	*Vital statistics indicators, 2022*	22
Graph 6.	*Birth rate and mortality rate by municipality, 2022*	23
Graph 7.	*Population migration within Montenegro by gender*	24
Graph 8.	*Population migration within Montenegro by age and gender, 2022*	24
Graph 9.	*Migration balance by region*	25
Graph 10.	*Population migration within Montenegro, 2012 – 2022*	25
Diagram 1.	*Data from the Institute of Hydrometeorology*	28
Map 5:	*Change (°C) in mean winter (DJF), summer (JJA) and annual (ANN) temperatures for periods 2011–2040, 2041–2070 and 2071–2100 compared to the period 1971–2000, according to the RCP8.5 scenario*	30
Map 6:	*Change (in %) in mean winter (DJF), summer (JJA) and annual (ANn) accumulated precipitation for the periods 2011–2040, 2041–2070 and 2071–2100 compared to the 1971–2000, according to the RCP8.5. scenario*	31
Map 7:	*Change in seasonal (winter – DJF and the period from November to April – N2A) amount of snow in %, for the periods 2011–2040, 2041–2070 and 2071–2100 compared to the period 1971–2000, according to the RCP8.5. climate change scenario*	32
Map 8:	*Change (%) in the number of days with precipitation higher than 20 mm in winter (DJF) and annual (ANN), and change (%) in the number of consecutive days without precipitation in the summer (JJA) and annual (ANN) for the periods 2011–2040, 2041–2070 and 2071–2100 compared to the period 1971–2000, according to the RCP8.5 scenario*	33
Map 9:	*Change (%) in the number of days with precipitation higher than 20 mm in winter (DJF) and annual (ANN), and the change (%) in the number of consecutive days without precipitation in the summer (JJA) and annual (ANN) for the periods 2011–2040, 2041–2070 and 2071–2100 compared to the period 1971–2000, according to the RCP8.5 scenario*	34
Diagram 2.	*Organisational setup of the Administration for Forest and Hunting Ground Management*	39

Diagram 3.	*PE National Parks of Montenegro*	40
Table 6.	*Number of fires per year*	45
Table 7.	*Number of fires per year*	45
Graph 11.	*Number of fires by year*	46
Table 8.	*Burnt area*	46
Graph 12.	*Burnt area*	47
Table 9.	*Burnt area (ha)*	47
Graph 13.	*Burnt area*	48
Table 10.	*Lost wood mass*	48
Graph 14.	*Lost timber in m^3*	49
Map 10.	*Burnt area from Landscape Fires in Montenegro (2008 to 2023)*	50
Annex 1.	*Organisational System Setup*	68

List of Abbreviations

CLC	CORINE Land Cover
EPA	Environment Protection Agency
FA	Forest Administration
GHG	Greenhouse gas
IHMS	Institute of Hydrometeorology and Seismology
IPCC	Intergovernmental Panel on Climate Change
LFM	Landscape fire management
LUC	Land use change
NDCs	Nationally Determined Contributions
NGO	Non-governmental organisations
PE	Public Enterprise
SPI	Standard Precipitation Index
WB	Western Balkans

Introduction

The countries of the Western Balkan (WB) region have gone through a period of societal, economic, and social transformation in the last three decades. A significant period as almost all the countries and some of the processes of change and transformation are still being developed. In this period, population migration within the countries is particularly pronounced, but the emigration outside of the region is also resolutely ongoing. In addition to these processes, unfortunately, the WB region has not been spared from the impacts of climate change either, causing numerous disasters and catastrophes, such as floods, landslides, periods of extremely high temperatures, etc. All this has had a negative impact on forest fire and landscape fire occurrence in the region resulting in large-scale forest fires, material damage, and, unfortunately, also cases of injuries and loss of human life in some instances.

Insufficiently defined forest fire protection systems (prevention, preparedness, suppression, and post-fire management) and inadequate coordination between the stakeholders on the landscape level within that system persist in all WB countries. This was influenced by the ever more frequent occurrence of fires that are not limited to forests but also burn on arable and agricultural areas, pastures, abandoned agricultural areas, and peri-urban landscapes. These types of fires (landscape-level fires) require both an appropriate approach and a concept for protection against them.

This was recognized by the **Swiss Agency for Development and Cooperation (SDC)** which supported the **Landscape Fire Management in Western Balkan (LFMWB) Programme**, coordinated by Farmahem – Skopje, North Macedonia, and Helvetas Swiss Intercooperation as a backstopper. This Programme, through its activities, aims *to increase the resilience of Western Balkans forests and landscapes against uncontrolled landscape fires to the benefit of the people who depend on these landscapes for their livelihoods and socioeconomic development*.

Following a landscape and participative approach, the LFMWB Programme contributes to establishing of the Landscape Fire Management (LFM) Network in Montenegro as a science-practice-policy mechanism where different stakeholders have the opportunity to discuss the current situation and propose future guidelines regarding landscape fires. Acting as Montenegro's sounding board, the LFM Network members were actively involved in a dynamic feedback process of preparation of the first Landscape Fire Management Report for Montenegro representing a comprehensive, authentic, and well-rounded document that elaborates the current situation in the country regarding fires on a landscape level. The process for preparation of this report was coordinated by the Ministry of Agriculture, Forestry and Water Management of Montenegro with the support of the Regional Fire Monitoring Center (RFMC) for the Southeast Europe/Caucasus Region as partners of the LFMWB Programme.

In 2023, the LFM Network members in Montenegro succeeded in developing a common understanding covering different areas of landscape fires through several workshops. All data elaborated in the report are provided and confirmed by official institutions of Montenegro, giving more legitimacy to the conclusions derived from the result analysis. This report gives an overview of land use, demography and migration, climate characteristics, climate change and nationally determined contribution, analysis of the existing fire system on landscape level, recording fires, landscape fire risk assessment, and existing initiatives. Additionally, this report includes findings of the LFM Network members in Montenegro who worked on developing a SWOT analysis elaborating the strengths, weaknesses, opportunities, and threats related to the LFM.

The last chapter of this report defines the LFM Guidelines developed by the LFM Network members, which will serve as a fundamental framework to steer future actions and strategies into landscape fire management governance in Montenegro. These Guidelines offer essential recommendations, laying a solid foundation for implementing the landscape fire management approach in all of its phases, especially

through stressing prevention and preparedness measures, all in one cohesive fire protection system.

The validation process of the Landscape Fire Management Report was ensured through continuous communication among the LFMWB Country Project Staff in Podgorica seconded by the Ministry of Agriculture, Forestry and Water Management of Montenegro as a drafting person of the report as well as the LFM Network members of Montenegro with expert support provided by the RFMC. Through ensuring an inclusive and participatory approach, this report has become a valuable resource for promoting and advancing LFM guidelines and principles in making Montenegro's forests and landscapes fire-resilient.

This report will serve as a fundamental document for planning measures and activities that will lead to the establishment of a more efficient landscape fire management system that will be able to successfully respond to the challenges resulting from socioeconomic, demographic, natural, and climate change.

LAND USE

Land use change (LUC), or the conversion of land from one use to another, is the factor that is not sufficiently studied in many countries and regions and that largely influences the occurrence of landscape fires. Land abandonment is the main cause of land use change, as human control over the land (for example, through agricultural activities and grazing) is reduced and the land is left to natural dynamics. As land has been abandoned, new shrubs and trees have taken over former forests, agricultural land and pastures that were abandoned by the local population who moved from rural regions to the cities. This process continues to this day and has dramatically changed rural landscapes. These trends are a critical factor when it comes to fires, as the invasion of tall grass, shrubs and forests results in the landscapes that are more flammable than in previous periods due to the natural sequence of land abandonment.

Montenegro is located in south-east Europe, on the Balkan Peninsula. It borders Croatia to the west (14 km of land border), Bosnia and Herzegovina to the north (225 km), Serbia and Kosovo1* to the north-east and Albania to the east (172 km) and is separated from Italy by the Adriatic Sea. It covers an area of 13.812 km^2.

The territory of Montenegro extends towards:

- North: 43° 32′ N, 18° 58′ E — slopes of the Kovač Mountain, near Moćevići
- South: 41° 52′ N, 19° 22′ E — near Ada Bojana, on the estuary of the Bojana River
- East: 42° 53′ N, 20° 21′ E — near the River Jablanica, east from Rožaje
- West: 42° 29′ N, 18° 26′ E — near the Village Sutorina, in the vicinity of Herceg Novi

Montenegro stretches from high peaks on the border with Serbia and Albania, from where it extends across:

- Bjelopavlićka Plain – fertile lowland along the Zeta River, stretching downstream to its confluence with Morača near Podgorica, while the plain merges into the highlands on the northern edge
- Zetska Plain – fertile lowland stretching from Podgorica in the north to the Skadar Lake

The most important rivers of Montenegro belong to the Adriatic and Black Sea basins:

- Morača and Bojana rivers belong to the Adriatic Basin
- Ibar, Lim, Piva and Tara belong to the Black Sea Basin

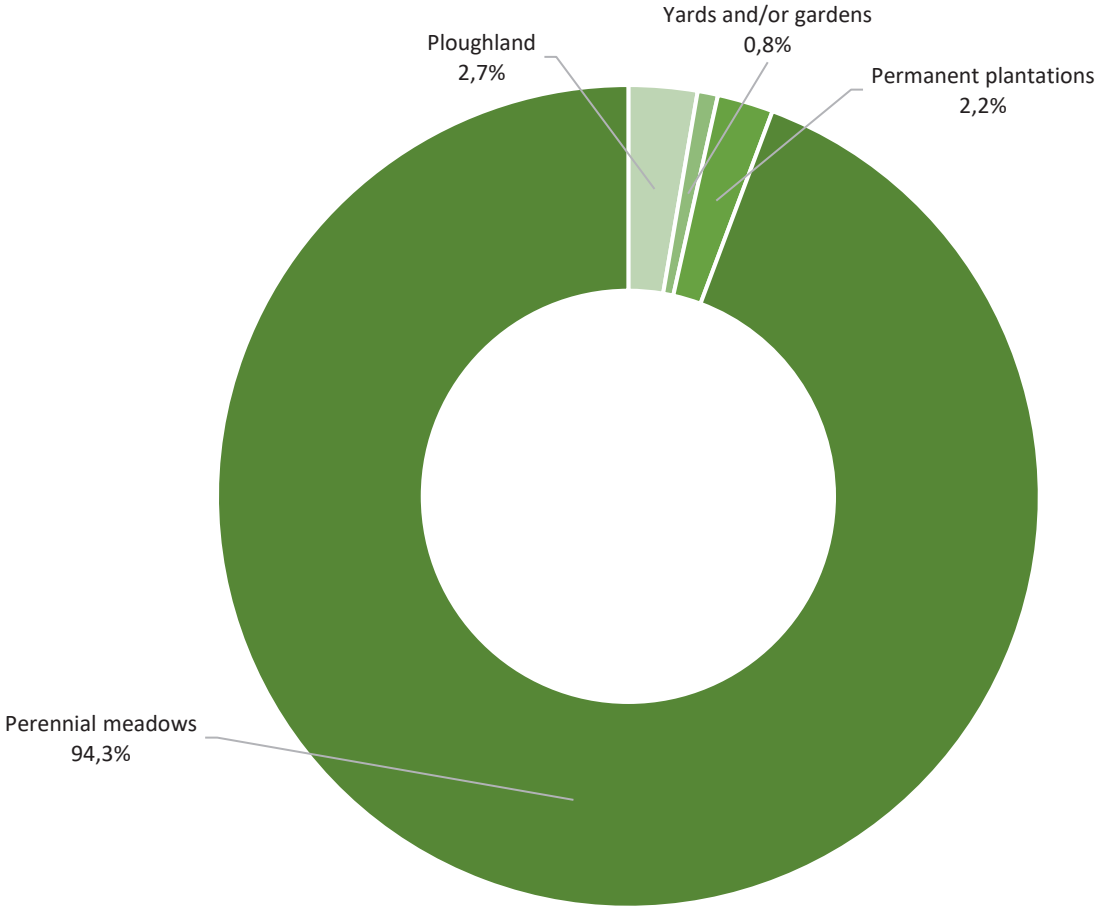
The Morača River with its tributaries Zeta, Mala Rijeka and Mrtvica on the one side and Ribnica and Cijevna on the other flows into the Skadar Lake. There are almost 400 km^2 of lakes in Montenegro. Skadar Lake is the largest with an area of 370 to 550 km^2, and 2/3 of its area belongs to Montenegro. The second largest lake is Pivsko Lake with 12 km^2, the only reservoir in Montenegro.

Taking the relief, climate and geology criteria into account, the territory of Montenegro can be divided into 5 (five) regions:

- Eastern region
- Northern region
- Central region
- Karst region
- Montenegrin coast: (Bešić M. Zarija, Geology of Montenegro 1975)

* This designation is applicable for whole document and is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

The region configuration determines land use. Eastern and northern regions focus on intensive livestock farming and extensive agriculture, the central region focus is on intensive arable farming, fruit growing, greenhouse production and extensive livestock farming, while the karst region and the southern region focus on olive growing and extensive agriculture and livestock farming in the coastal region. The utilised agricultural land in 2021 covered 255,564.4 ha, which corresponds to a decrease of 0.9% compared to 2020. The total utilised agricultural land is dominated by perennial meadows and pastures with a share of 94.3%, while ploughland accounts for 2.7%, permanent plantations for 2.2% and yards for 0.8%. Compared to 2020, the area of perennial meadows and pastures has decreased by 0.9%, ploughlands by 2.4%, permanent plantations by 0.2% and yards by 1.1%.



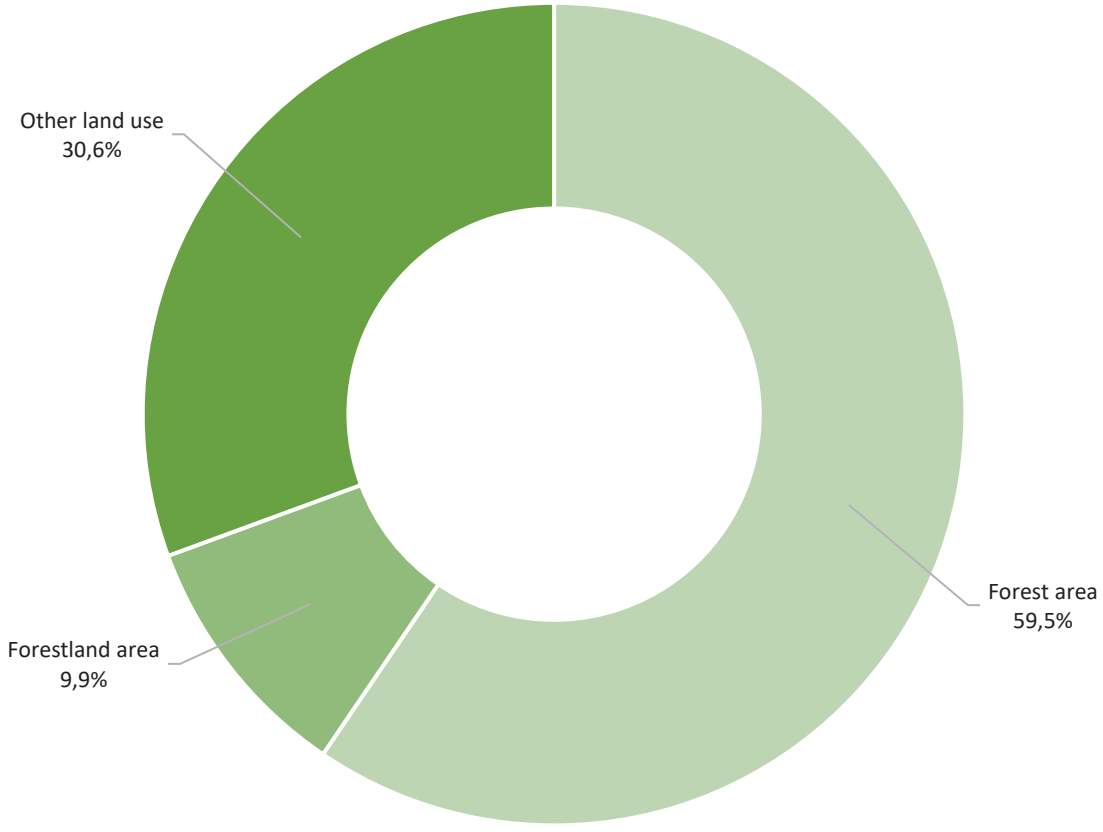
Graph 1. *Utilised agricultural land:* ***Source of data:*** *Statistical Office –* ***MONSTAT***

The data presented show slight changes in the structure of utilised areas in the period 2016 – 2021. The changes in the extent of agricultural land use that occurred showed a slight upward trend until 2020 (cumulative 0.9%) and were reversed in the following year 2021 with an even decline. Data for 2022 will be processed by the end of June 2023.

As far as agricultural land is concerned, the data is provided by the Cadastre and State Property Administration, where cadastral plots and title deeds form the basis for this census. Much of the data from

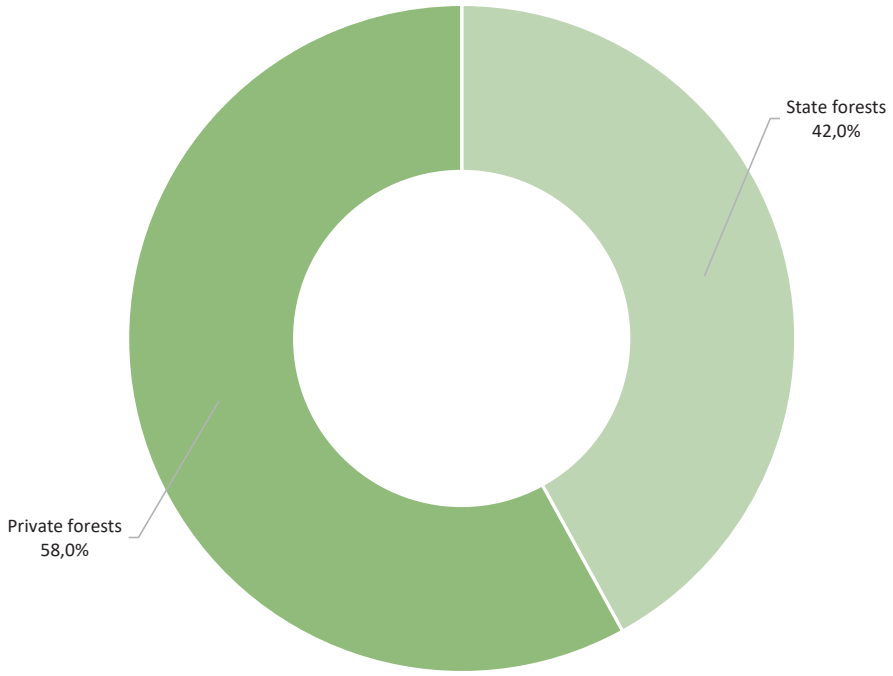
the Cadastre and State Property Administration can also be found in other agencies and state authorities, which leads to inadequate updating of data. Agriculture in Montenegro is a sector neglected by the economy and much agricultural land is not cultivated, regardless of ownership. State-owned agricultural land is mostly turned into industrial zones, and data on land use change is not updated. Privately-owned agricultural land is increasingly abandoned and overgrown, with land use changing, which is not updated in the database. This shows that digital availability of data is the only way for better data update so as to get a realistic picture of future land use.

Given the uncertainty about the actual state of forests of Montenegro and the collection of data on forests at national level based on empirical data from 1990 to 1998, which barely covers 50% of the forest resources, the Government and the Parliament of Montenegro identified the need for a **National Forest Inventory**, which was carried out in 2013. According to the results of the First National Forest Inventory (NFI), Montenegro is characterised by a high forest cover of 59.5% (826.782 ha). The forestland areas cover 9.9% (137 480 ha). Forests and forestland areas together make up 69.4% of the territory of Montenegro. The forest cover is 1.3 ha per capita.



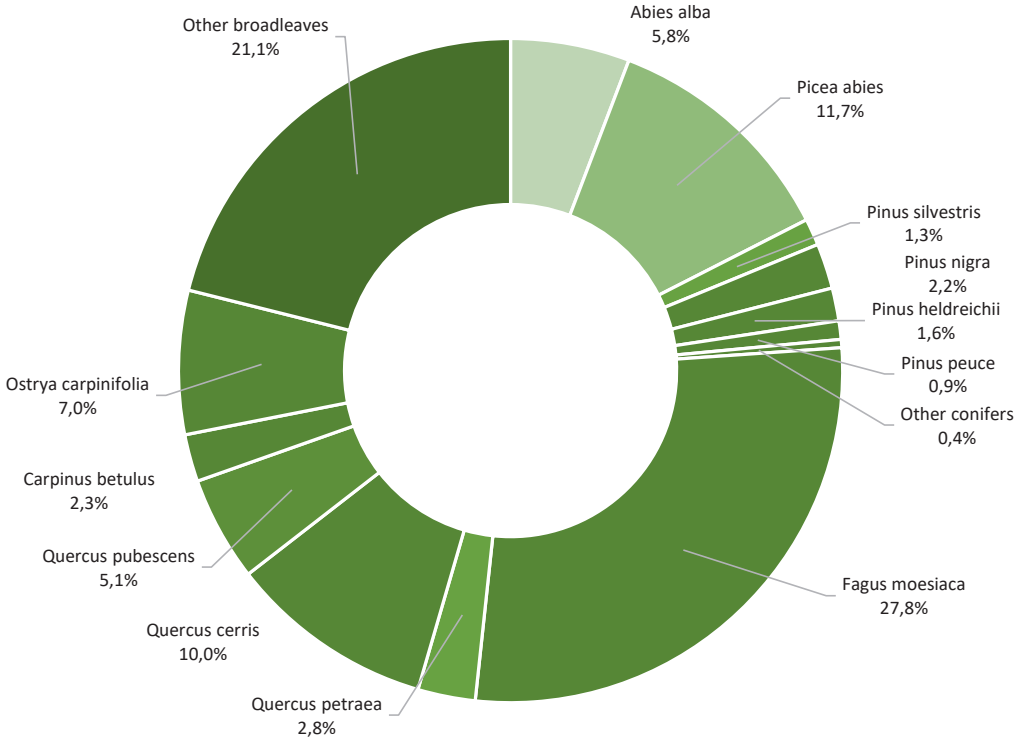
Graph 2. *Areas under forests and forestland areas:* ***Source of data:*** *First National Forest Inventory – NFI*

As far as forestland areas ownership is concerned, the situation is different, as private ownership dominates with 58.0% compared to 42% state ownership.



Graph 3. *Forest areas by ownership: Source of data: First National Forest Inventory – NFI*

The predominant tree species are beech, oak, spruce, fir, and pine, whereby the proportions of species per area are significantly different compared to the proportions of species by volume. A total of 12 coniferous species and 59 deciduous tree species are registered in Montenegro. The next graph shows the most important tree species by area.

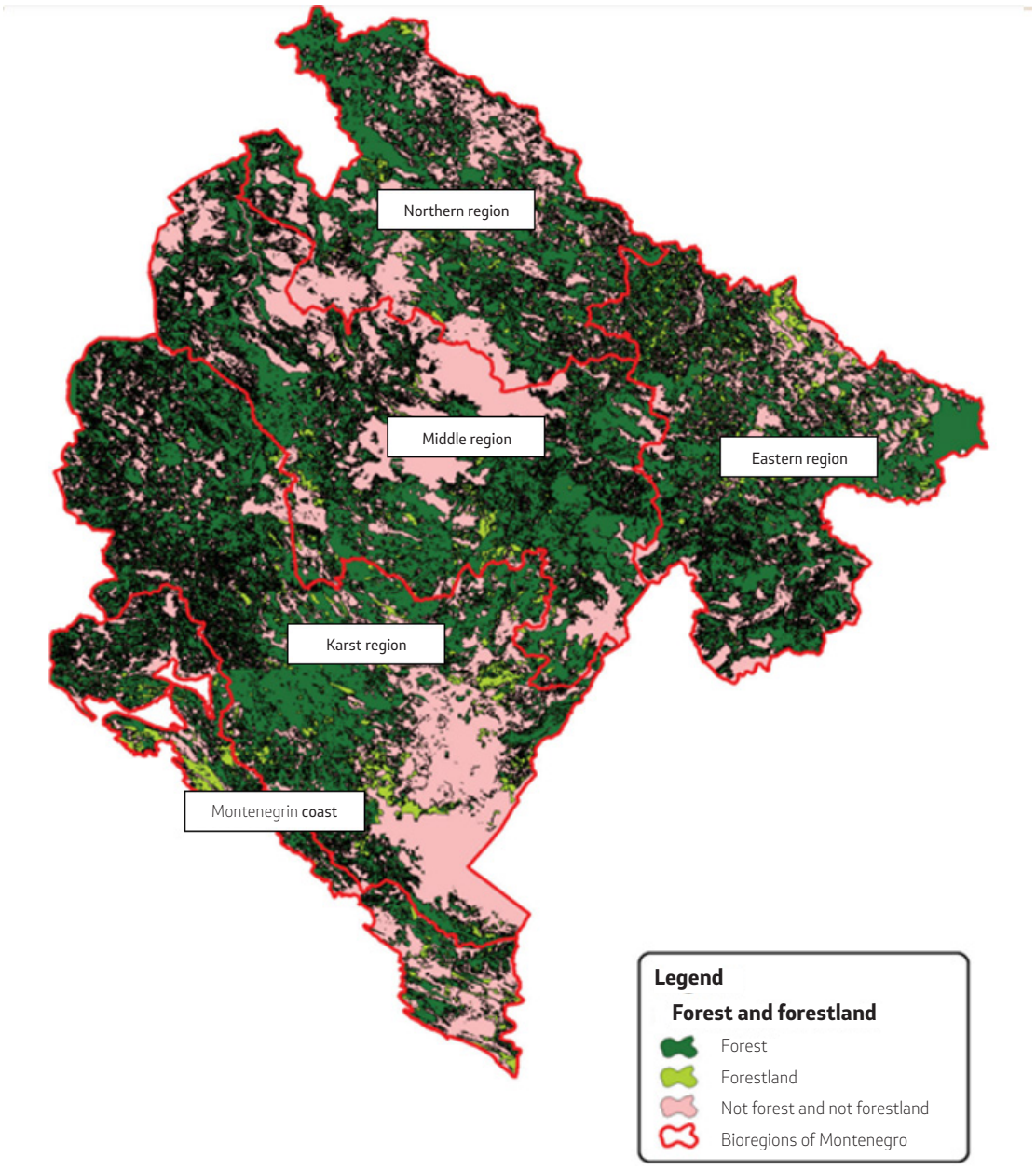


Graph 4. *Proportions of the most important tree species in forests of Montenegro**: Source of data:** First National Forest Inventory – NFI*

A considerable part of the forests and forestland areas was not accessible for the inventory since they were too steep and rocky and these areas were assessed using aerial photography and, to the degree feasible, by nearby inspection. Based on these assessments, the resulting data showed that 11.9% of forests and 8.4% of forestland areas were inaccessible. In order to assess the main attributes of all forest and forestland area, properties of inaccessible parts were estimated by making assumptions about the relationship between forest and forestland properties and accessible and inaccessible areas.

Forests and forestland areas and other characteristics of the growing stock vary considerably between municipalities. This depends on the affiliation of a municipality to one of the regions in Montenegro identified according to the relief, climate, and geology criteria.

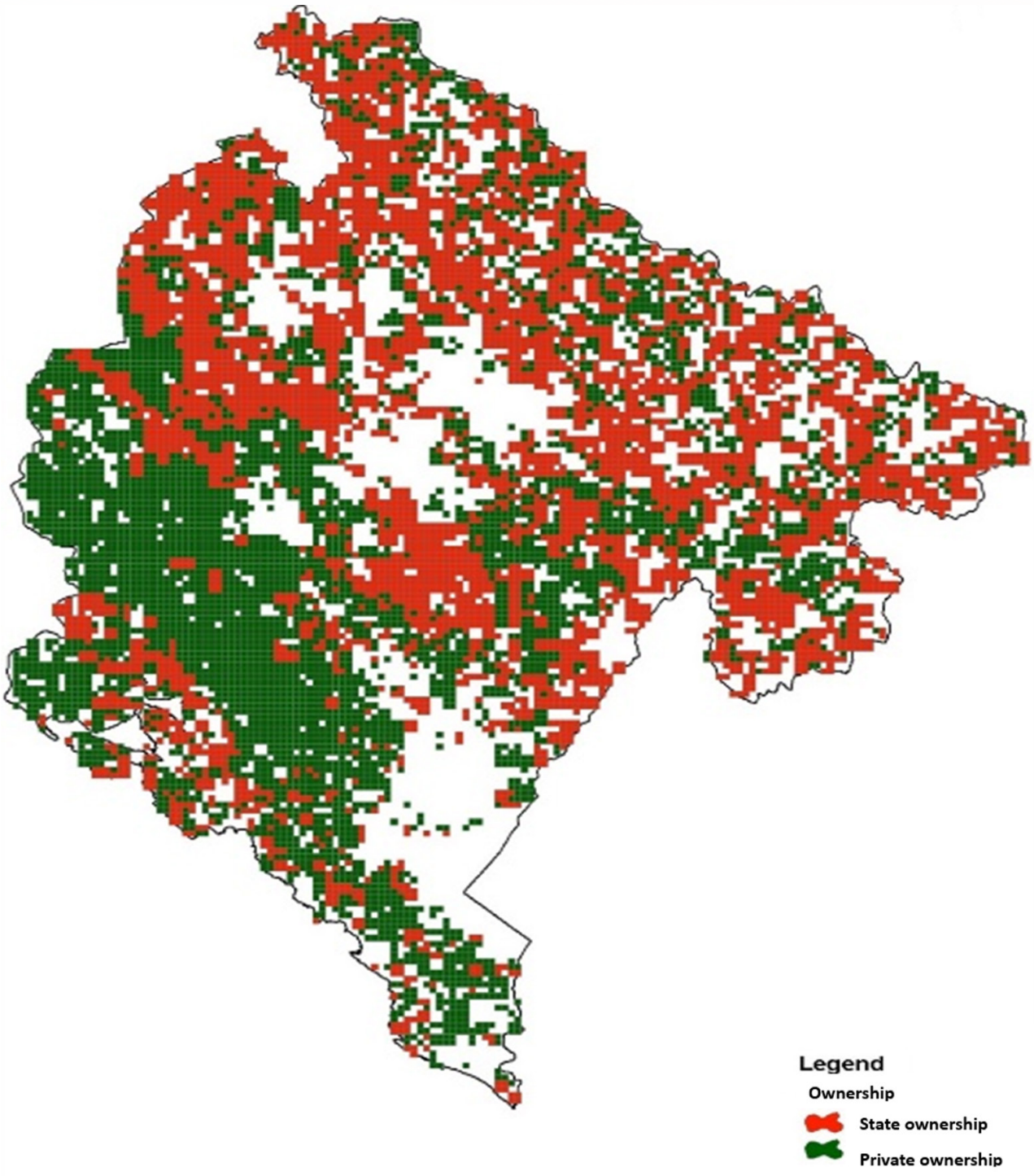
Based on the above, this Report will present the spatial distribution of forests and forestland areas by region, spatial distribution of forests and forestland areas by municipality and spatial distribution of forests and forestland areas by ownership.



Map 1. *Spatial distribution of forests and forestland areas by region:* ***Source of data:*** *First National Forest Inventory – NFI*



Map 2. *Forests and forestland cover by municipality:* ***Source of data:*** *First National Forest Inventory – NFI*



Map 3. *Spatial distribution of forests and forestland areas by ownership:* ***Source of data:*** *First National Forest Inventory – NFI*

Of the total area under forests, around 66.6% is accounted for by economic forests. Other forest areas show certain limitations in terms of utilisation, with protective forests being the most strongly represented. Forests in urban zone account for only 0.1%, indicating that their importance for air quality and space is not sufficiently recognised.

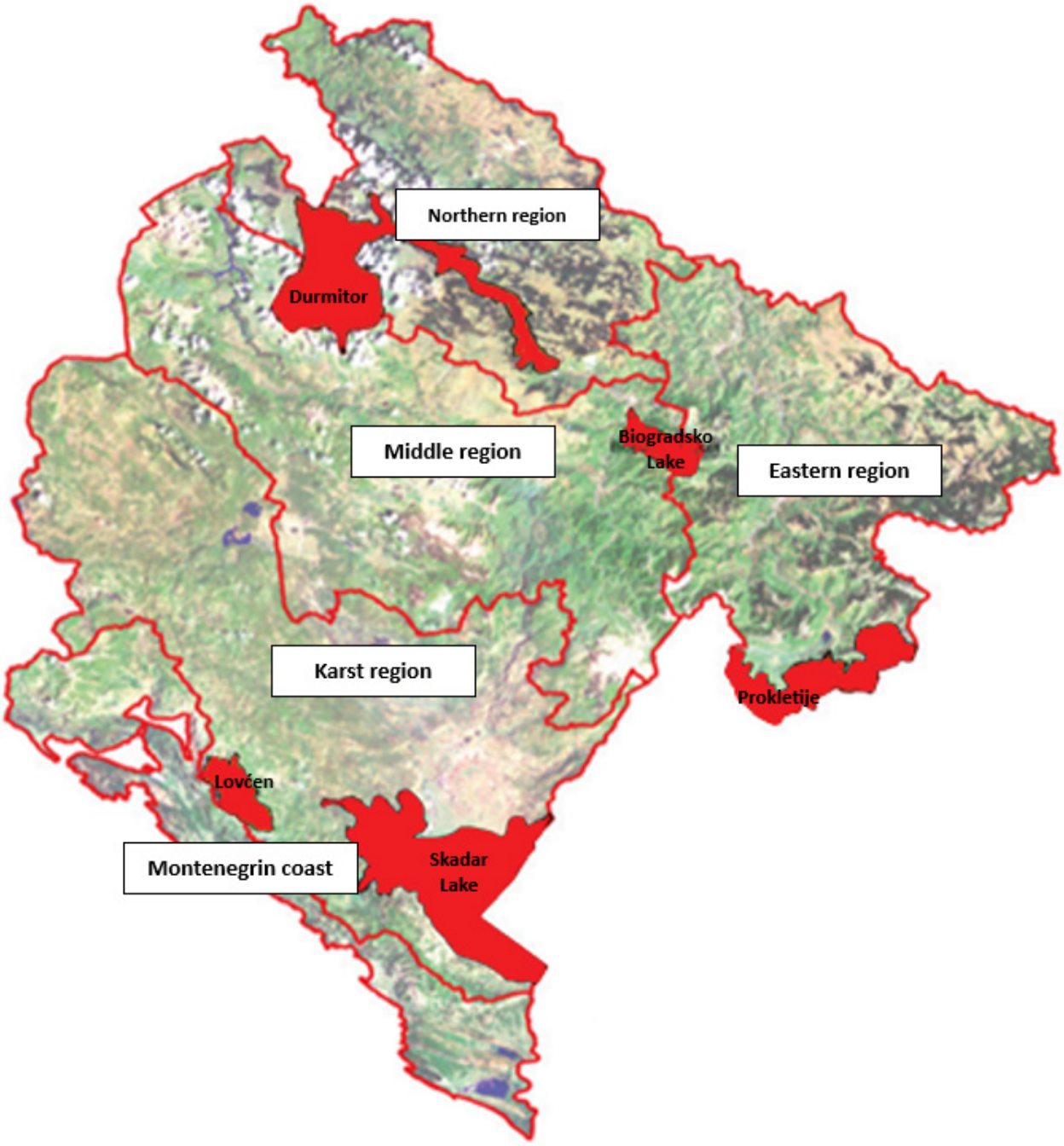
Land use	Area			
	Total ha	Forests ha	% of forests	% of TOT
1. Commercial forest	626,928.0	550,669.2	87.8	66.6
2. Protective forest	116,349.5	97,365.9	83.7	11.8
3. Forests for other purposes (include all purposes other than commercial or protective forests)	1,814.5	1,015.0	55.9	0.1
4. Forests for other purposes	13,400.2	6,711.4	50.1	0.8
5. Seed stand	592.2	592.2	100.0	0.1
6. National park	35,149.0	28,407.9	80.8	3.4
7. Forests in urban zone	1,493.9	1,188.3	79.5	0.1
8. Other protected natural resources and ecological networks (Emerald and Natura 2000)	64,628.3	55,158.0	85.3	6.7
9. No data	528,225.3	85,673.8	16.2	10.4
TOTAL	**1,388,580.9**	**826,781.6**	**59.5**	**100.0**

Table 1. *Forests by use:* ***Source of data:*** *National Forest Inventory – NFI*

In Montenegro, 13.41% of the territory of 185.269,69 ha is protected. The protected natural resources are:

1) Protected areas:
   - Strict nature reserve
   - National park
   - Special nature reserve
   - Nature park
   - Nature monument
   - Area of exceptional features
2) Area of ecological network

Nature parks and reserves are areas where climatic and other ecological factors have led to the development of a diverse and rich flora and fauna, where there is a differentiation between different altitudinal zones, ranging from river valleys and dense deciduous, mixed and coniferous forests in the lower and middle parts of the mountains massifs to rich mountain meadows and pastures, as well as rocky terrain and rock creeps on mountain peaks on the one hand and habitats that primarily serve to protect waters and wildlife on the other hand.



Map 4. *Spatial distribution of national parks:* ***Source of data:*** *National Forest Inventory – NFI*

Forests are the dominating land category in national parks, with the exception of the Skadar Lake NP. Forests in national parks are up to 76.2% state forests.

National park	National park	Forest			Forestland			Forest & forestland		
	Area (from GIS)	Area	% of total forest area in NPs	%of NP area	Area	% of total forestland area in NPs	%of NP area	Area	% of total f. & fl. area in NPs	%of NP area
	[ha]	[ha]			[ha]			[ha]		
1. Skadar Lake	43,283.7	4,328.9	10.1	10.0	1,805.4	22.4	4.2	6,134.3	12.1	14.2
2. Biogradska Gora	5,668.6	3,454.3	8.1	60.9	199.4	2.5	0.5	3,653.7	7.2	64.5
3. Lovcen	6,267.4	5,209.8	12.2	83.1	104.2	1.3	0.2	5,314.0	10.4	84.8
4. Dumitor	34,003.5	19,374.9	45.2	57.0	5,038.4	62.6	11.6	24,413.2	48.0	71.8
5. Prokletje	16,668.8	10,484.5	24.5	62.9	900.2	11.2	2.1	11,384.7	22.4	68.3
Total	**105,892.0**	**42,852.3**	**100.0**	**40.5**	**8,047.6**	**100.0**	**18.6**	**50,899.9**	**100.0**	**48.1**

Table 2. *Area of forests and forestland in the National Parks of Montenegro* ***Source of data:*** *National Forest Inventory – NFI*

National park forest properties, individually, are presented in **NFI subchapters** and are meant to serve as basic indications of forest and forestland properties considering the fact that the number of clusters and sample plots per national park is small. Since national parks still lack detailed level inventory, this information is primarily the basis for new, more detailed information that will be the subject of the second NFI.

The procedure for designating protected areas is regulated by Article 28 of the Law on Nature Protection and a requirement for the development of an expert study – **protection study**. This request is submitted by the Ministry, i.e. the competent body of the local self-government unit.

The protection study contains: description of natural, artificial and areal features of the protected asset, characteristics or values of the locality, existing resource state with assessment of their valorisation, spatial distribution and cartographic presentation of the most significant habitat and species (objectives of protection) distribution, assessment of the area state, central coordination of the protected area, opinion on placing natural asset under protection, proposal for classification of natural asset by importance, proposal for category and zone of protection (protection regimes), proposal for spatial border of protected areas with zone borders and protection regimes, cartographic presentation with marked borders of protected areas, i.e. with marked location based on the cadastral records, concept of protection, improvement, sustainable development, manner of managing such areas, proposal for protection measures and conditions, proposal for actions, activities and services that can be performed in specific zones and regimes of protection, proposal for actions, activities and services that cannot be performed in specific zones and regimes of protection, consequences of adoption of the act of declaration especially regarding ownership rights and economic activities, as well as provisional funds for implementation of the act of designation of protected natural resource and other elements of importance for placing natural resource under protection.

Management of nature parks or reserves has some shortcomings, as no management structures have been set up in this type of protected areas, which in practice means that local self-governments have taken on the obligations that they do not fulfil, as they do not have the necessary level of management plans and organisation.

The project **Establishing Emerald Network in Montenegro** was completed with a proposal for 32 Emerald sites, and the **Bern Convention on the Conservation of European Wildlife and Natural Habitats**, ratified by Montenegro, was the basis for the establishment of this ecological network. The Emerald sites were identified based on partial systematic research and literature data.

Montenegro has been conducting research for several years to establishing a NATURA 2000 network of protected areas. NATURA 2000 is a network of protected areas in the countries of the European Union, based on the Habitats and Birds Directive. The implementation of the project requires detailed field

research and mapping of species and habitats that are found on the territory of Montenegro and are of EU importance. The NATURA 2000 areas will be selected based on this research.

Extreme weather conditions resulting from climate change and trends in land use change have inevitably increased the vulnerability of rural areas to fire to the point where lives and property are continuously threatened each fire season. The LFM holistic approach to the problem of landscape fires ensures that rural development policy must be aligned with fire protection policy in order to manage the increasing amounts of fuels and that all legislation and main planning documents must be fully integrated with land use planning to prevent unfavourable impacts of poor and irrational land use.

The analysis of the above data lead to the conclusion that the trend towards a decrease in actively cultivated and used agricultural land is continuing. It is not possible to determine the extent and dynamics of this process due to the lack of quality and official data in the cadastre and the national statistical office. This prevents quality planning and landscape fire management linked to land use.

The cadastre for state property and real estate has data on the basis of title deeds. The obligations of the owners are to report possible land conversions to the cadastre, i.e. that all conversions that occur are reported and covered in the field. In other words, the Cadastre Administration disposes of the total area, but does not have accurate data on the structure of areas in the field. The planned census of agricultural holdings by the Statistical Authority - MONSTAT in 2024 will increase the accuracy of information. The accuracy of the information will be determined by a simple comparison of the existing data in the cadastral sheets and the new information that will be provided by the census in the percentage share of all types of agricultural land. The new census will only apply to private property, while state-owned will need to do the following:

- new forestry inventory
- list of state agricultural and industrial land

II. DEMOGRAPHY

Demography, i.e. the number of inhabitants, their spatial distribution, gender, age structure, occupations etc., provides a clear picture of the country's development potential, its main activities, the impact on the environment and its protection. The extent and quality of use of living space increases or decreases exponentially due to changes in population density, among other things. This process continues to this day and has dramatically altered rural landscapes. These trends are critical for fires, as the encroachment of tall grass, shrubs, and forests due to the natural sequence of land abandonment results in landscapes that are more flammable than in previous periods.

For these reasons, the LFM approach to landscape fire management treats the demographic picture of the state as one of the most important elements influencing land use. The purpose of population assessment is to obtain data necessary for analysing the natural population trends of Montenegro and municipalities, birth rates, fertility, and other indicators. The population assessment is carried out based on basic demographic indicators whose function is to describe natural population trends through rates, indices, and other indicators.

- According to the population assessments:
- Montenegro had 617.213 inhabitants in the middle of 2022
- the number of children (0 to 17 years of age) in Montenegro was 132. 606 or 21.5% of the total number of inhabitants in the middle of 2022
- the working age population or the population between 15 and 64 years of age accounts for 65.9% of the total number of inhabitants, which is 406.741 inhabitants
- the population of 65+ years of age accounts for 16.2% of the total population, which is 99.951 inhabitants
- based on birth rate per 1,000 inhabitants in Montenegro, the number of inhabitants decreased by 0.1 per inhabitant
- in 2022, 5.3 marriages per 1,000 inhabitants were entered into, constituting the nuptiality rate, while the divorce rate was 1.1
- the migration rate in Montenegro is 11.3, which means that 11 persons per 1,000 inhabitants have changed their place of residence within Montenegro
- life expectancy at birth in 2022 was 76.2 years. (Statistical Office – MONSTAT)

Birth rate	11.4	Infant mortality rate	3.6	Life expectancy – Total	76.2
Mortality rate	11.5	Mortality rate for children below 5 years of age	4.4	Life expectancy – men	73.7
Population growth rate	-0.1	Vital index of live births per 100 deceased	99.3	Life expectancy – women	78.8
Nuptiality rate	5.3	Live births masculinity rates	106.5	Total fertility rate	1.8
Divorce rate	1.1	Masculinity rate of the deceased	107.4	Migration rate	11.3

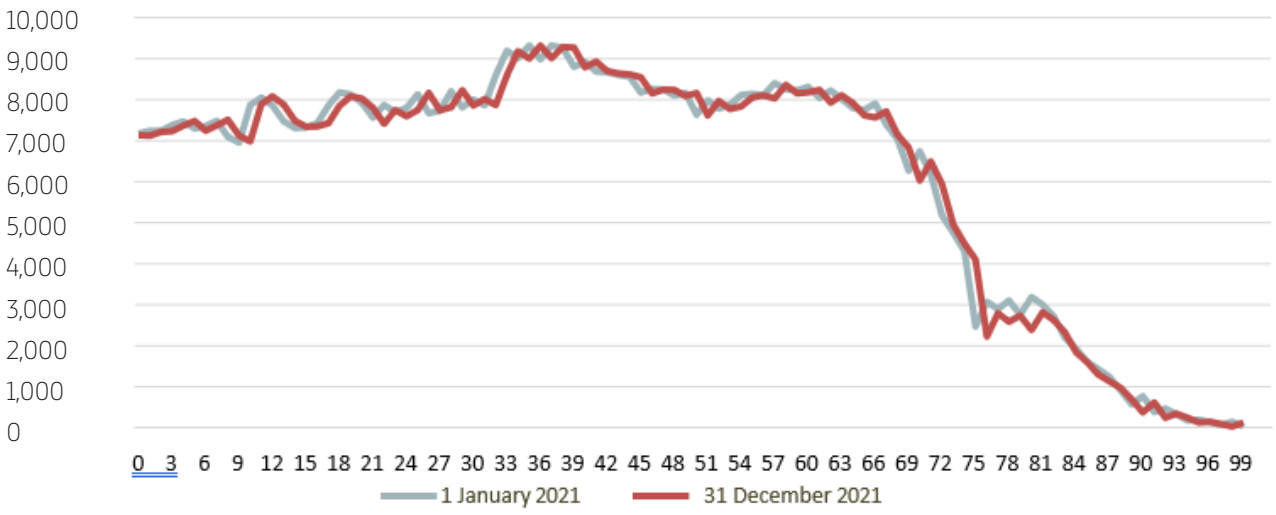
Table 3. *Main demographic indicators, 2022:* ***Source of data:*** *Statistical Office - MONSTAT*

POPULATION ASSESSMENT

The number of inhabitants at the last census is used as the basis for assessing the number of inhabitants. This number is corrected in accordance with the **vital statistics** results, i.e. population growth and migration trends.

	1 January 2022			Mid-2022			31 December 2022		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
Total	617,683	305,174	312,509	617,213	304,958	312,255	616,695	304,691	312,004
0-14	110,803	57,639	53,164	110,521	57,456	53,065	110,230	57,265	52,965
15-64	408,032	204,782	203,250	406,741	204,175	201,881	405,248	203,547	201,881
65+	98,848	42,753	56,095	99,951	43,327	56,624	101,037	43,879	57,158
0-17	132,855	69,142	63,713	132,606	69,020	63,586	132,348	68,889	63,459
18+	484,828	236,032	248,796	484,607	236,032	248,796	484,347	235,8022	248,545

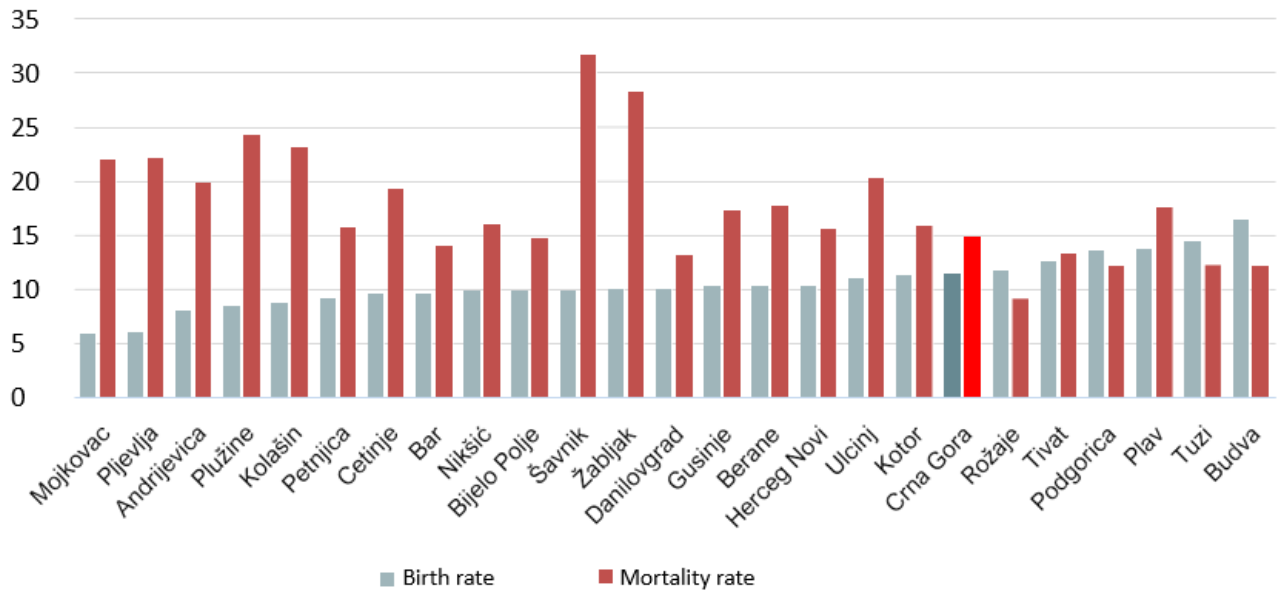
Table 4. *Number of inhabitants at the beginning, mid and at the end of 2022 by age groups:* ***Source of data:*** *Statistical Office -* ***MONSTAT***



Graph 5. *Population by age at the beginning and at the end of 2022:* ***Source of data:*** *Statistical Office –* ***MONSTAT***

	Population growth rate	Birth rate	Mortality rate
MONTENEGRO	-3.4	11.4	14.8
Andrijevica	-11.8	7.9	19.8
Bar	-4.5	9.5	14.0
Berane	-7.4	10.3	17.7
Bijelo Polje	-4.9	9.8	14.7
Budva	4.2	16.4	12.2
Cetinje	-9.7	9.5	19.2
Danilovgrad	-3.1	10.1	13.1
Gusinje	-7.0	10.3	17.3
Herceg Novi	-5.2	10.3	15.5
Kolašin	-14.4	8.6	23.0
Kotor	-4.6	11.3	15.9
Mojkovac	-16.2	5.8	22.0
Nikšić	-6.2	9.8	16.0
Petnjica	-6.6	9.1	15.7
Plav	-3.8	13.7	17.5
Pljevlja	-16.1	6.0	22.1
Plužine	-15.7	8.5	24.1
Podgorica	1.4	13.5	12.1
Rožaje	2.5	11.6	9.1
Šavnik	-21.8	9.8	31.6
Tivat	-0.7	12.5	13.2
Tuzi	2.3	14.4	12.2
Ulcinj	-9.1	11.1	20.2
Žabljak	-18.1	10.0	28.1

Table 5. *Vital statistics indicators, 2022:* ***Source of data:*** *Statistical Office -* ***MONSTAT***



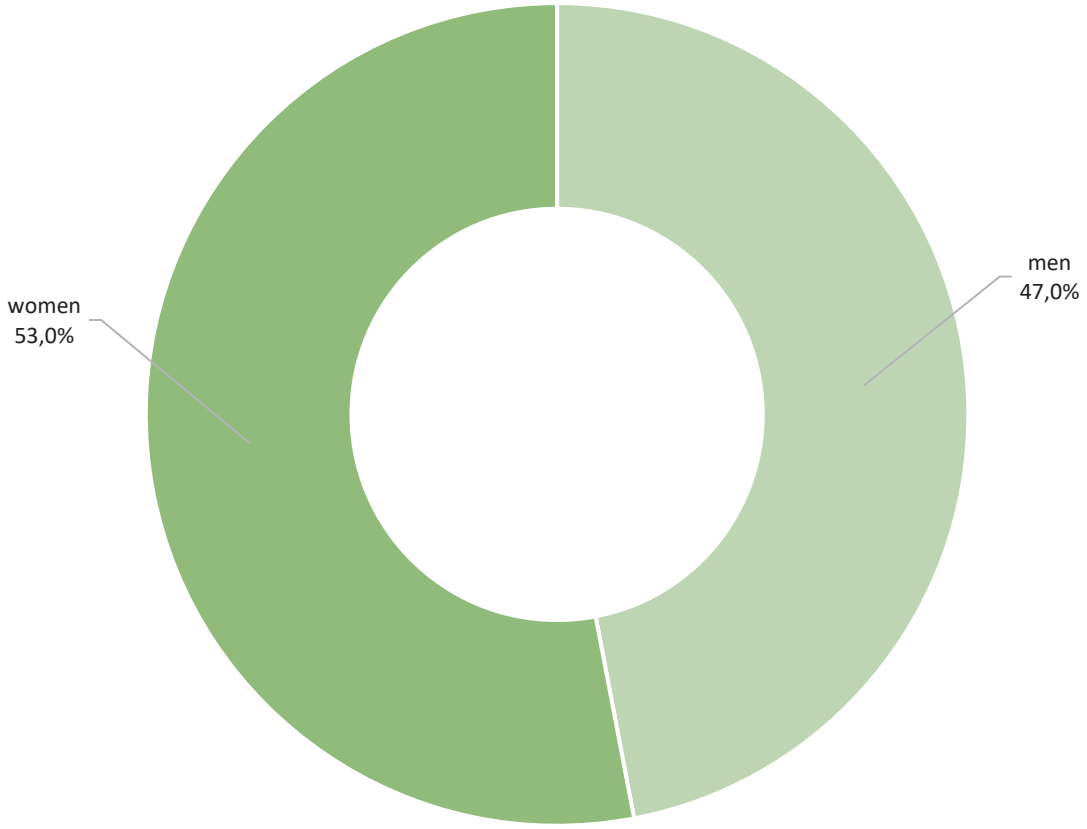
Graph 6. *Birth rate and mortality rate by municipality, 2022:* ***Source of data:*** *Statistical Office –* ***MONSTAT***

A negative population growth rate of – 3.4 was recorded at the level of Montenegro. Only the municipality of Rožaje has a positive population growth rate. The northern region is much more vulnerable to negative population growth, which is due to the migration of the population to the central and southern regions caused by unfavourable social and economic conditions.

Migrations within Montenegro

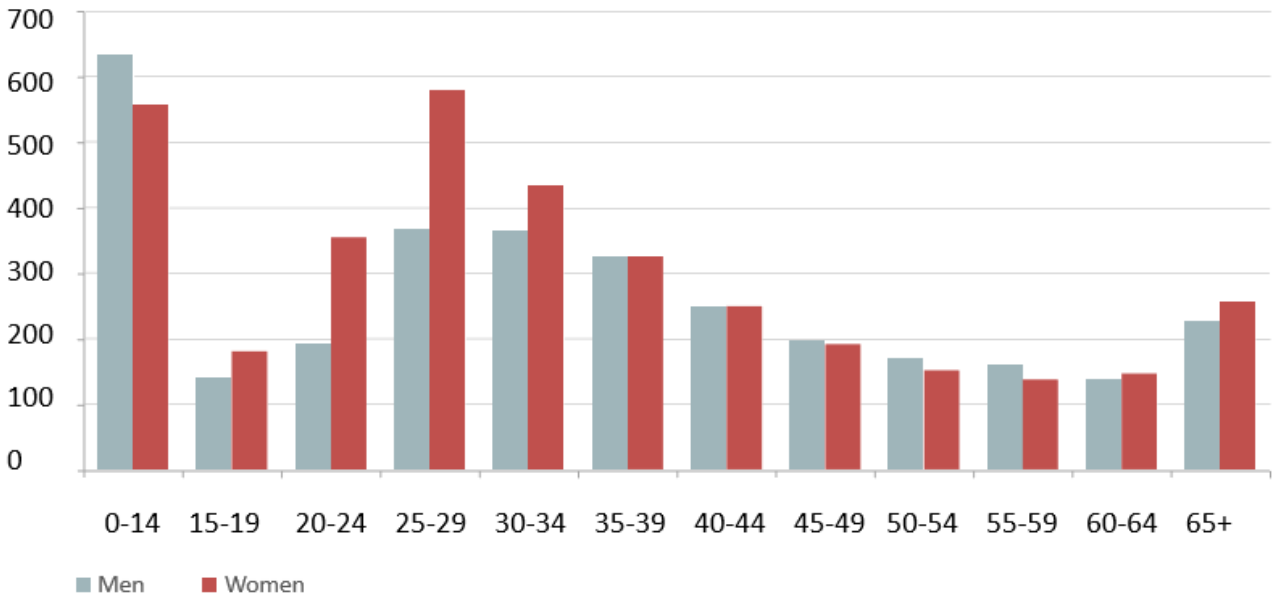
The purpose of internal migration statistics is to collect data required for analysing the spatial population movement. These data are used in the statistics to calculate the estimated number of inhabitants and to determine the net migration, which shows the changes in the number of inhabitants by municipality in Montenegro. Net internal migration is equal to zero, which means that there are no changes in the total population of Montenegro when a person changes their place of residence within the state borders. (Statistical Office – MONSTAT)

The reasons for the migration of the population lie the large disparity of the conditions of life in the north region of the country, compared to the central and southern regions. The long transition period of the state resulted in the closure of a large number of state-owned companies, which led to an enormous increase in unemployment. Agriculture, as one of the most important economic branches of the country, was not a sphere of interest for such a large number of the population who lost their jobs and incomes. In addition, the Strategy for the Development of Agriculture and Rural Areas is not implemented to such an extent and in a sustainable way, which should be the motive for staying in rural areas.



Graph 7. *Population migration within Montenegro by gender:* ***Source of data:*** *Statistical Office –* ***MONSTAT***

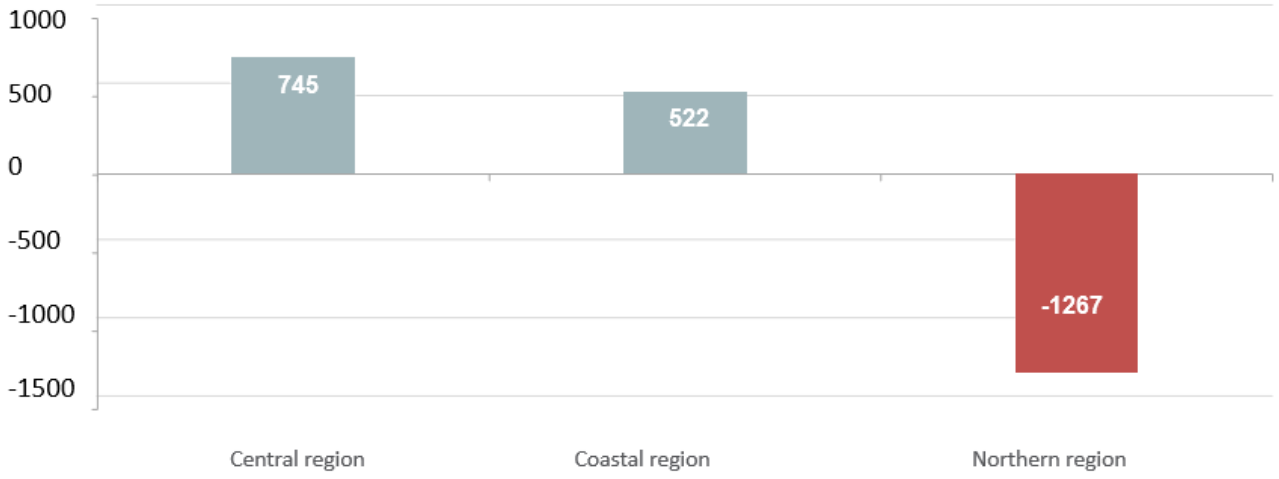
The total number of residents who moved within Montenegro in 2021 is 6,723. Most of these residents are women, 53% or 3,556, while men make up 47% of the total number, namely 3,167 residents.



Graph 8. *Population migration within Montenegro by age and gender, 2022:* ***Source of data:*** *Statistical Office –* ***MONSTAT***

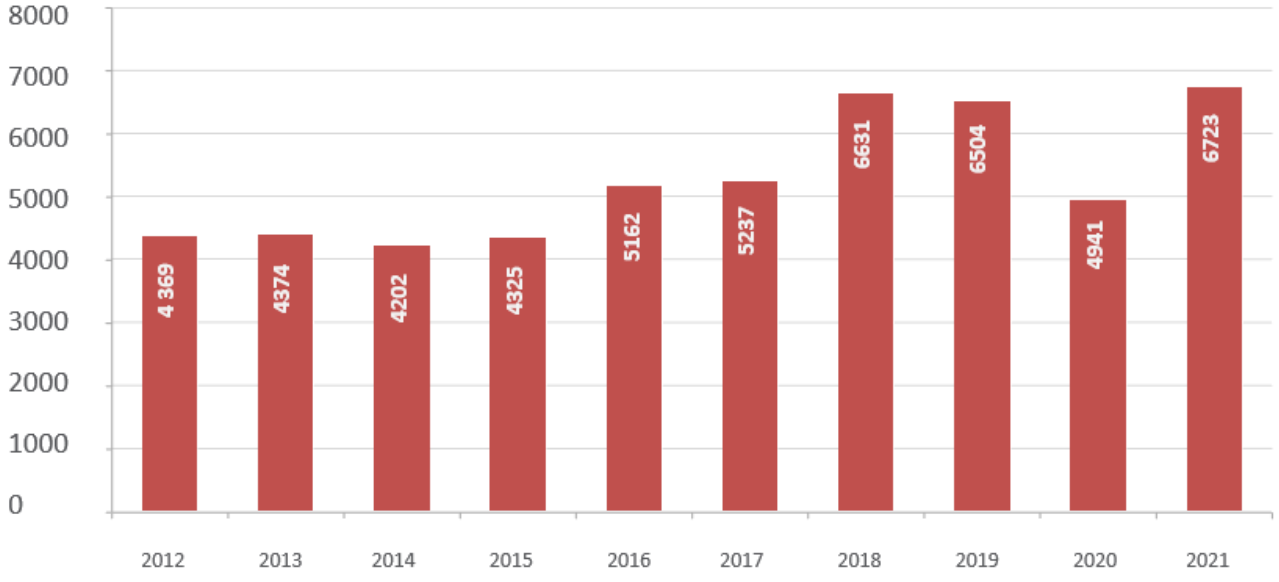
The migration pattern by age and gender shows that women aged 15 to 34 and aged 60+ age move more frequently than men of the same age, and the largest difference compared to men is in the age group between 25 and 29 years and amounts to 211. As far as the change of residence is concerned, there is no difference between men and women in the age group of 35 to 39 years.

In 2022, a positive migration balance was recorded in 11 municipalities, mainly in Bijelo Polje.



Graph 9. *Migration balance by region:* ***Source of data:*** *Statistical Office –* ***MONSTAT***

In addition to population movements, internal migration also shows the actual situation in individual regions. The trend of population leaving the north is largely due to social and economic factors. Hance, this region, as the least economically developed region, shows a negative migration balance, which amounts to 1,267 people in absolute figures. There is a positive migration balance in the central and coastal regions, which indicates a much more favourable economic situation.



Graph 10. *Population migration within Montenegro, 2012 – 2022:* ***Source of data:*** *Statistical Office –* ***MONSTAT***

There is a clear upward trend in the number of citizens who changed their place of residence within Montenegro in the period 2012 – 2022. 2020 is an exception, being first year of the COVID 19 pandemic strict epidemiological measures.

Demographic change is considered to be the main cause for land use change, although there are other interacting factors, especially in developing countries. The relationship between land use extent and population density could be well modelled using the logistic regression model. The dynamics of land use in Montenegro increases or decreases exponentially depending on how the population density changes. Furthermore, there is no **hollow village** phenomenon in Montenegro, where the degree of land use increases in areas with negative population density due to economic growth and technological progress. In general, the relative change in land use is proportional to the change in population density.

At this point, it should be noted that it is difficult to analyse population migration between villages and towns as the main problem is the Law on Territorial Organisation and the ability of local self-governments to make independent decisions on the designation of towns. Villages and arable land near towns are still cultivated to a small extent, so there are no positive trends between towns and villages. Larger towns in Montenegro declare agricultural state-owned land as **industrial zones** through administrative decisions, whereby the land is no longer used for agriculture.

Migration of the population, as a social phenomenon, causes the emergence of disproportionate economic development of the state as a whole. Internal migration in Montenegro, viewed through the scope of the LFM approach, causes the following negative effect:

- reduces the volume of agricultural work/development;
- the livestock fund is being reduced, consequently grazing as well;
- increases the area of abandoned/neglected agricultural land in all categories;
- by increasing abandoned areas, neglected management and reduced grazing, the amount of fuel material increases.
- uncontrolled occurrence of fires in abandoned pastures and meadows
- reduces the natural resilience of ecosystems at landscape level

III. CLIMATE CHARACTERISTICS, CLIMATE CHANGE, CLIMATE CHANGE SCENARIOS AND NATIONALLY DETERMINED CONTRIBUTIONS (NDCs)

CLIMATE

Climate is one of the factors that influence the social and economic development of society and some economic sectors (agriculture, tourism, energy etc.). Its influence is decisive for the health of the population. It also influences the modelling of natural vegetation, as well as the selection and development of man-made green areas. Among other things, the flammability and development of fires depend on the climate.

Montenegro is located in the central part of the northern hemisphere temperature zone (41°52' and 43°32' north latitude and 18°26' and 19°22' east longitude) and its climate is moderately warm. However, in addition to the latitude, the climate of Montenegro is also determined by large bodies of water (Skadar Lake, the Adriatic Sea and the proximity to the Mediterranean Sea), the height and orientation of the coastal mountains and the relief. Consequently, there are large differences between the coastal climate and the high mountain region climate with numerous local climate transitional forms in a small area. Against this background, the prevailing climate types can be categorised as maritime, continental, and mountainous. Weather conditions and climate in Montenegro are strongly influenced by the Genoa low, the Adriatic cyclone, the Islandic Depression, the Black Sea Depression, the Asor Anticyclone, the Siberian Anticyclone, the Central European Anticyclone, the cold frontal system from the north – the Arctic Cold Front and the warm tropical front from the south.

Dominant climate types are:

- Maritime
- Continental
- Mountainous

The main climate types in continental and mountain regions are mutually modified and are very often intertwined in a single area, so that certain climate subtypes lie within the main climate type. For example, the maritime climate type penetrates deep into the continental region and modifies the classic continental and mountainous climate. A consequence of this modification may be that the continental climate type is modified by the mountainous climate type, or that the continental climate type is modified by the maritime climate type, and even that the mountainous climate type is modified by the maritime type.

Six (6) climate regions with distinctive climate types, but without clearly defined boundaries, can be identified on the territory of Montenegro.

The main climate regions are:

- Coastal – with long and warm summers and mild winters with high precipitation
- Zetsko – Bjelopavlićka Plain – with long, warm, and dry summers and high temperatures with warm nights, mild winters with high precipitation and temperatures lower than in the coastal region
- Mountainous hinterland of the Adriatic – the area with the highest precipitation in Europe, Krivošije in the mountains above the Bay of Kotor; in this area, on the steep slopes of Orjen in the place of Crkvice (940 m.a.s.l.), the average annual precipitation is about 5,000 mm (highest precipitation in Europe) and almost 7,000 mm in record years, with pronounced precipitation of an orographic nature
- Continental region in the north of the country with an average altitude of up to around 700 m – areas with the lowest annual precipitation, which is evenly distributed throughout the year
- Continental areas with an altitude of around 1,000 m – summers in the mountainous regions in the north of the Republic are short and humid, winters are long and cold, with frequent frosts and low temperatures that drop rapidly with altitude
- Mountain regions with an altitude of over 1,500 m – snow-forest climate with long and cold winters and areas where the snow cover remains all year round

The prevailing winds in Montenegro are north-northeast and south winds. As periodic winds during the day, the best-known local winds are Bora on the coast, a summertime wind from the sea (during the day), and the wind from the mainland (at night).

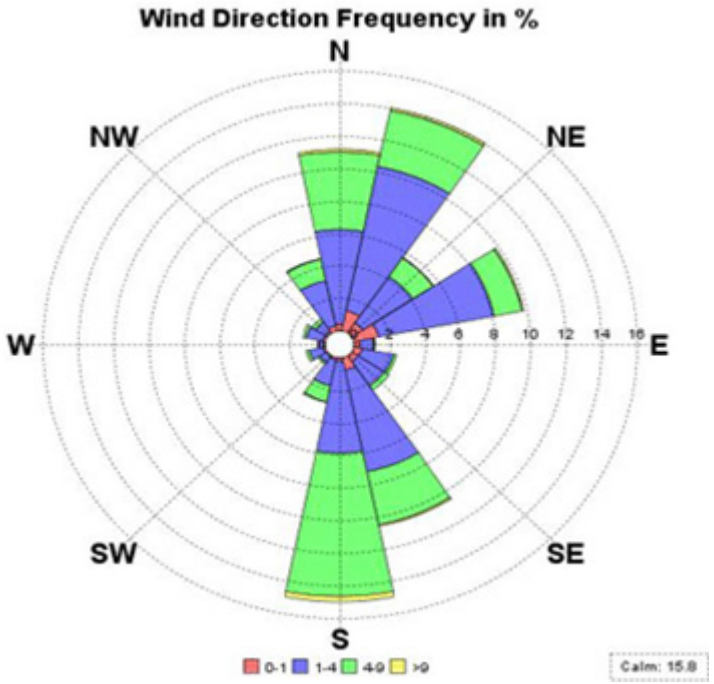


Diagram 1. *Data from the Institute of Hydrometeorology*

Large bodies of water, the height and orientation of coastal mountains and the relief have a local and regional influence on the climate, creating large differences between the climate of the coast and the climate of the high mountainous region in a small area, with numerous transitional forms of the local climate. The mean annual air temperature ranges between 4.6 °C in the Žabljak area at the altitude of 1,450 m and 15.8 °C on the coast. The average annual precipitation ranges from 800 mm in the far north to around 5,000 mm in the far southwest. The average annual number of days with precipitation is 115 to 130, while in the north of Montenegro this number is 172. November is the month with the highest precipitation, while July is the driest month. The snow cover forms at altitudes above 400 m and reaches a height of over 50 cm in an average of 10 days (in Kolašin) to 76 days (in Žabljak). In the mountainous regions, it snows much more frequently in spring than in autumn.

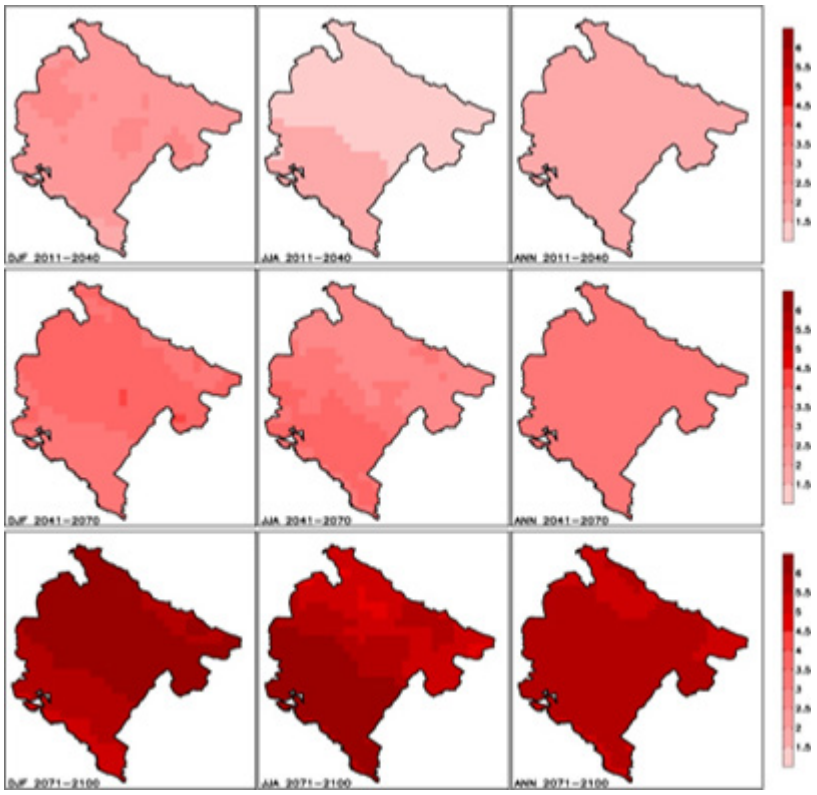
CLIMATE CHANGE

Montenegro joined the UNFCCC as a non-Annex I member in October 2006, the Kyoto Protocol on 27 June 2007 and ratified the Paris Agreement on 20 December 2017. It submitted its INDC in December 2017 and revised NDC in June 2021. Montenegro has submitted three NDCs to the UNFCCC, in 2010, 2015 and 2020, while the fourth NDC is in preparation. According to the Third National Communication, the situation of climate change, which has a significant impact on the occurrence and intensity of forest fires, is as follows.

Projections of Mean Annual and Seasonal Temperatures

The results of climate projections show an increase in annual temperature of 1.5 °C to 2°C by 2040 across the country. The temperature rise is expected to be between 2 °C and 2.5°C in the winter months of December-January-February (DJF) and around 2°C on average in the summer months of June – July – August (JJA). For the period 2041 – 2070, the deviation in the annual mean temperature is between 2.5°C and 3°C. The projected warming during the winter and summer seasons is the same on average, with a significant increase in the north during the winter season and in the south during the summer season. For the period 2071 – 2100, the deviation of the mean annual temperature in most areas is about 5.5°C. According to the projections, the temperature increase is expected to be more than 6°C in winter in the northern mountainous regions and more than 6°C in summer in the southern coastal region and at lower altitudes. Institute of Hydrometeorology and Seismology.

It is expected that the predicted increase in temperature in the summer months will lead to a decrease in the total snow accumulation and the number of days with snowfall on the territory of Montenegro.

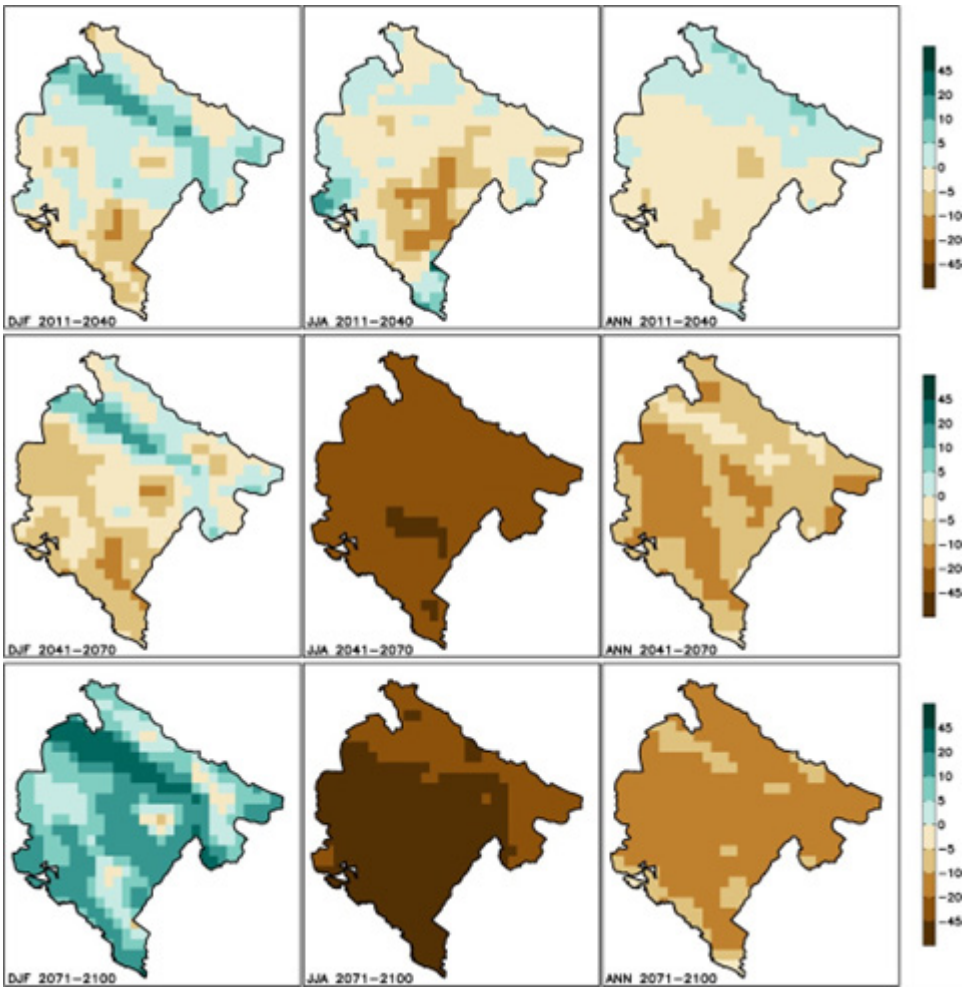


Map 5: *Change (°C) in mean winter (DJF), summer (JJA) and annual (ANN) temperatures for periods 2011–2040, 2041–2070 and 2071–2100 compared to the period 1971–2000, according to the RCP8.5 scenario:* ***Data from the Institute of Hydrometeorology: Author: V. Đurđević***

Mean Annual and Seasonal Precipitation

The results of the climate projections indicate a decrease in precipitation, especially in the summer months, and an increase in the winter months in some regions of the country. An increase in precipitation of up to 5% is expected for the north of the country for the period 2011 – 2040, while a decrease in precipitation of up to 5% is expected for the south of the country. An increase in precipitation of up to 5% is expected for the DJF season, with the changes being somewhat more pronounced in the north, while somewhat lower precipitation is expected for the JJA season, especially in the southeastern regions. For the period 2041 – 2070, a decrease in mean annual precipitation of up to 20% is expected across the country. The change during the summer season is similar to the previous period, while the summer season is characterised by a decrease in precipitation of up to 45%. Institute of Hydrometeorology and Seismology.

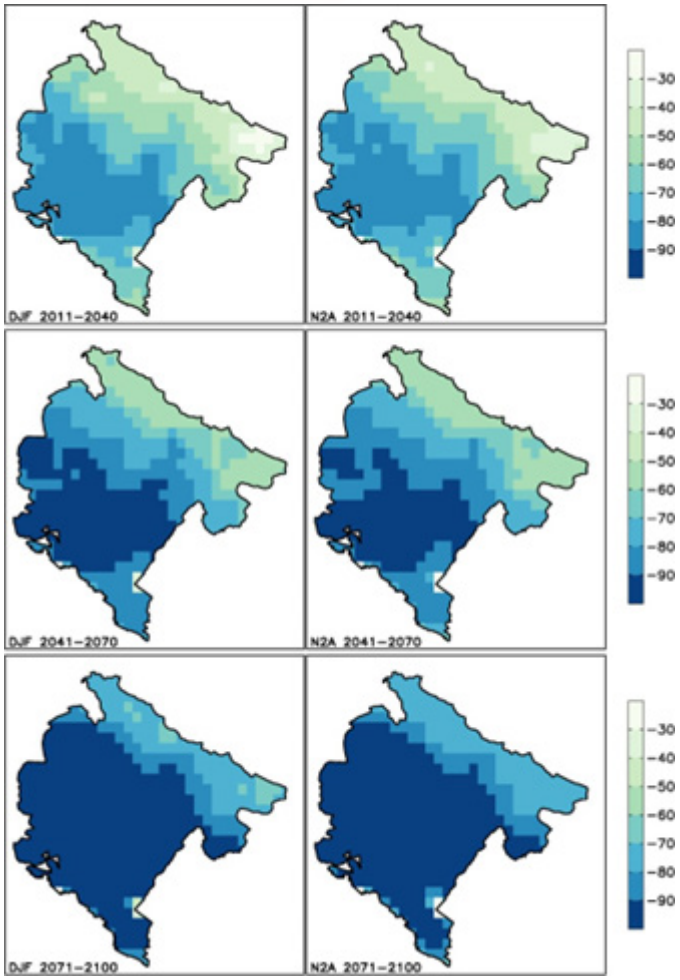
For the period 2071 – 2100, a decrease in mean annual precipitation of up to 20% is expected in most parts of the country. It can be expected that precipitation in the summer season will increase by an average of around 20%, while a significant decrease of up to 45% will be recorded in the summer season.



Map 6: *Change (in %) in mean winter (DJF), summer (JJA) and annual (ANn) accumulated precipitation for the periods 2011–2040, 2041–2070 and 2071–2100 compared to the 1971–2000, according to the RCP8.5. scenario:* ***Data taken from the Institute of Hydrometeorology: Author: V. Đurđević***

As far as snow is concerned, the climate projections show a total decrease in snowfall in the following periods:

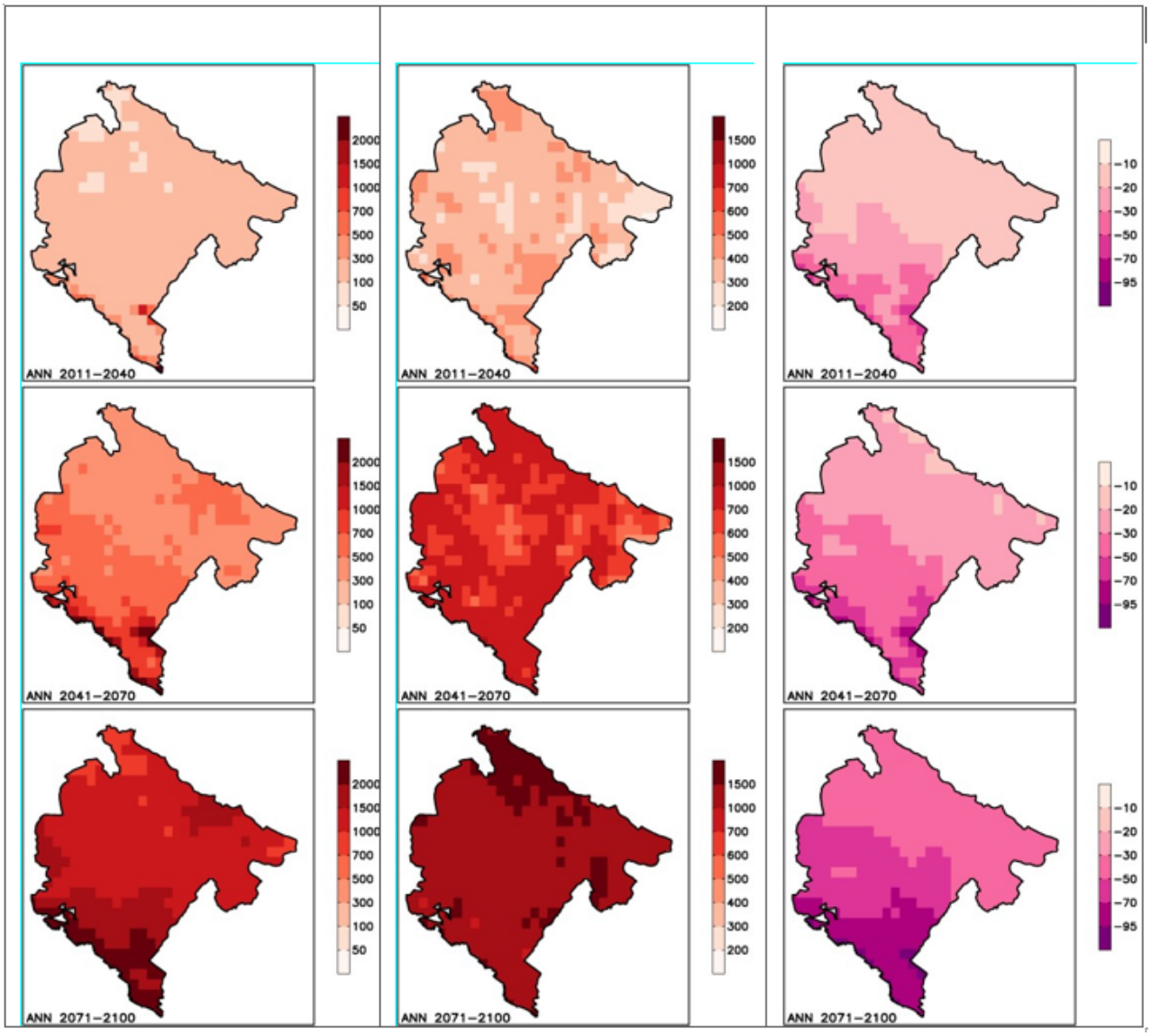
- For the current period, i.e. 2011 – 2040, the annual snowfall deviation for both seasons compared to the reference period ranges from -30% in the north to -80% in the central parts of the country. The number of days with snow is expected to decrease by the same percentage (30%, 80%).
- For the period 2041 – 2070, the expected changes in snowfall range from -50% in the north to more than -90% in the central parts of the country. At the same time, the number of snow days is expected to decrease from 50% to more than 70%.
- In the period 2071 – 2100, a change in the amount of snow of more than – 90% can be expected for almost the entire territory, except the far north. The number of days with snowfall is expected to decrease by more than 70% compared to the reference period.



Map 7: *Change in seasonal (winter – DJF and the period from November to April – N2A) amount of snow in %, for the periods 2011–2040, 2041–2070 and 2071–2100 compared to the period 1971–2000, according to the RCP8.5. climate change scenario:* ***Data taken from the Institute of Hydrometeorology: Author: V. Đurđević***

The weather conditions and climate in Montenegro are under the strong influence of the Genoa low, the Adriatic Cyclone, the Islandic Depression, the Black Sea Depression, the Asor Anticyclone, the Siberian Anticyclone, the Central European Anticyclone, the cold frontal system from the north – the Arctic Cold Frond and the tropical warm front from the south. The number of summer and tropical days will continue to increase, as will the number of days with tropical nights. Heat waves will become more frequent and longer, the number of frost days will decrease, and the vegetation period will lengthen.

In the period 2011 – 2040, the number of summer and tropical days is expected to change practically evenly over the entire area and to increase by up to 100%, i.e. the number of these days is expected to double compared to the reference period 1971 – 2000. The number of days with tropical nights is expected to increase by around 50% in most of the territory, while this change could be as much as 100% in the southeast of the country. Institute of Hydrometeorology and Seismology.



Map 8: *Change (%) in the number of days with precipitation higher than 20 mm in winter (DJF) and annual (ANN), and change (%) in the number of consecutive days without precipitation in the summer (JJA) and annual (ANN) for the periods 2011–2040, 2041–2070 and 2071–2100 compared to the period 1971–2000, according to the RCP8.5 scenario.* ***Data taken from the Institute of Hydrometeorology: Author: V. Đurđević***

In the period 2041 – 2070, a change in the number of summer and tropical days is expected to be more pronounced in the northern, mountainous part of the country, where up to 200% more summer days and up to 500% more tropical days is expected compared to the reference period 1971 – 2000. The number of days with tropical nights is expected to increase by around 50% in the north and by around 200% in the southeast.

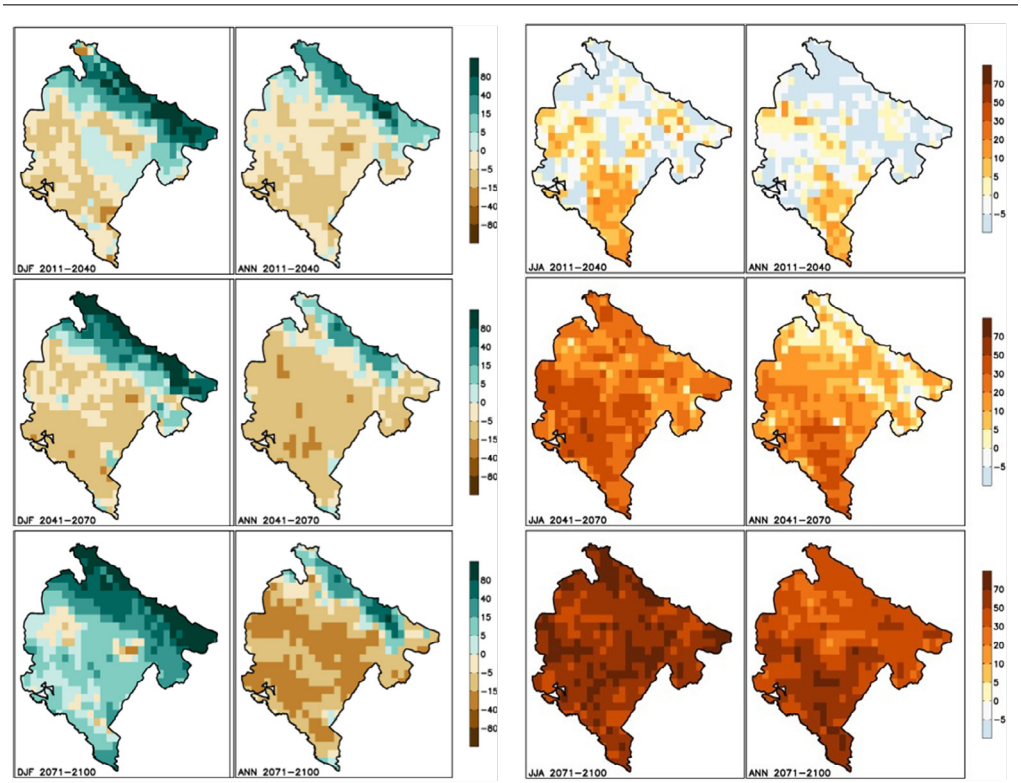
The number of tropical nights is expected to be up to 15 times higher in the north and up to three times higher the southeast compared to the reference period.

The main feature of the change in the number of days with daily precipitation above 20 mm is that an increase is expected in the far north region of the country, with maximum values of over 80% in all three future periods, during almost all seasons and also at annual level. In the period 2011 – 2040, the number of days with precipitation in summer will develop positively in the west, northwest and southeast of the country and negatively in the east and part of the coast. For the periods 2041 – 2070 and 2071 – 2100,

the changes in summer will be negative in almost the entire territory, with a maximum value of – 80%. On the other hand, in the winter season in the period 2071 – 2100, a change in the number of days with daily precipitation of more than 20 mm will be positive for almost the entire territory and will be + 20% in most parts.

At the same time, in all seasons and for all three future periods, there is a positive change in the daily amount of precipitation on days with a value above 20 mm. This change indicates that, on average, a decrease in the number of days with precipitation above 20 mm can be expected and, on the other hand, a higher intensity, i.e. the precipitation amounts on these days can be higher than in the reference period.

The intensification of precipitation is most pronounced in winter and in autumn for the period 2071 – 2100, where the expected maximum change will be 30%. The greatest change is expected for the summer season and for the period 2071 – 2100 in the southeast of the country, with values of over 60% compared to the reference period 1971 – 2000.



Map 9: *Change (%) in the number of days with precipitation higher than 20 mm in winter (DJF) and annual (ANN), and the change (%) in the number of consecutive days without precipitation in the summer (JJA) and annual (ANN) for the periods 2011–2040, 2041–2070 and 2071–2100 compared to the period 1971–2000, according to the RCP8.5 scenario.* ***Data taken from the Institute of Hydrometeorology: Author: V. Đurđević***

Based on the selected scenario, an increase in the average number of episodes with five-day precipitation above 60 mm is expected in northern Montenegro in all three future periods analysed, with the local maximum being 40% higher than in the reference period 1971 – 2000. In the rest of the country, this change is negative, and its maximum is around – 40% for the period 2071 – 2100. On the other hand, the average change in the amount of precipitation per five-day precipitation episode above 60 mm will be positive in most of the country for all three periods, and its maximum of 20% occurs in the period 2071 – 2100 in the coastal areas. Therefore, in case of the RCP8.5 scenario, a decrease in the number of episodes can be expected when the total five-day precipitation exceeds 60 mm while the amount

during individual episodes can be expected to increase in most areas of the country over the course of the century. Although the number of these episodes will be lower, the cumulative amount of precipitation during individual episodes will be higher on average.

In the period 2011 – 2040, the change in the average number of consecutive days without precipitation in the north of the country is around – 5%, both in summer and over the course of the year. A positive change with a maximum value of around 30% is expected in the southeastern part of the country and is slightly higher for the summer season compared to the annual value.

In the two remaining periods analysed, an increase in the number of consecutive days without precipitation is expected throughout Montenegro. For the period 2071 – 2100, a stronger change is expected, ranging from 30% to more than 70% in the summer season. A drastic increase in the number of consecutive days without rain by the end of the century clearly shows there will be intense droughts in the future, which will lead to a higher risk of droughts and very favourable conditions for the occurrence of forest fires.

The DNI states that climate change is expected to have a negative impact on the distribution of the main tree species in Montenegro, mainly spruce, fir and white pine, over larger areas, mainly in the far east of Montenegro, but also in the northwest part of the country. According to the forecasts, beech will retain most of its current area, with the exception of some neighbouring habitats on the coast and in the Polimlje region.

NATIONALLY DETERMINED CONTRIBUTIONS – NDCs

On 11 October 2017, the Parliament of Montenegro adopted the **Law on Ratification of the Paris Agreement.** Montenegro thus became a party to the Paris Agreement and committed to contributing to the global reduction of greenhouse gas (GHG) emissions. Montenegro committed to reduce GHG emissions by at least 1.572 kt CO2eq to 3.667 kt CO2eq or less. The contribution of Montenegro to international efforts to tackle climate change, expressed through the **Intended Nationally Determined Contribution (INDC)** to reduce GHG emissions, is stated as a reduction of at least 30% by 2030 compared to the base year 1990.

With the submission of the Third National Communication (TNC), Montenegro has once again fulfilled its international commitments under the UNFCCC. This Report contains the results of new GHG inventories for 2016 and 2017, a recalculation of previous time series since 1990 and a general description of the measures that Montenegro has formulated, defined, and implemented for the purpose of planning the reduction of GHG emissions. This Report includes strategies, plans and measures to mitigate climate change, recognises the importance of forests in mitigating climate change and presents the country's plans to increase forest cover and improve forest management. The NDC's focus on improved forest management can directly contribute to the prevention of forest fires by reducing the risk of drouths and other climate change related factors.

Montenegro is particularly exposed and vulnerable to climate hazards such as droughts, forests fires and heat waves. Some of these phenomena are direct consequences of climate change, i.e. increases in air temperature, changes in precipitation, frequent droughts, storms and generally extreme atmospheric conditions. Climate projections show that these climate extremes in the future will become more frequent and pronounced. Unsustainable forest management practices have led to a deterioration in the state of forest ecosystems, as forests have become more susceptible to climate change. Climate change is not only affected by climate change, the processes of development and growth, but usually there are cumulative effects that can last throughout the lifetime of the tree. Climate change, as one of the main drivers of environmental change in forests, creates the need to revise existing forest management methods and re-evaluate the methods of planting and cultivation used. Adaptation measures in the forestry sector should focus on promoting sustainable forest management and strengthening information systems and monitoring.

IV. EXISTING FIRE MANAGEMENT SYSTEM

a) Main Stakeholders in the Existing System

For the purpose of this Report, the term **Landscape Fire Management System** means the organisation of all institutions and civil society organisation at national level that are directly or indirectly involved in the creation or implementation of prevention, preparedness and fire prevention measures and the sustainable use of fires in ecosystem / land management.

Article 3 of the Law on Protection and Rescue (Official Gazette of Montenegro 13/07, 32/11, 54/16, 146/21 and 3/23) provides that protection and rescue shall be conducted by state bodies, state administration authorities, local self-government units - municipalities, business organisation, entrepreneurs, and other legal and natural persons.

Within the meaning of this law, state authorities, state administration authorities, municipal bodies, business organisations, entrepreneurs and natural persons mean entities that are obliged to plan, organise and implement preventive and operational activities and measures for protection and rescue and thus for protection and rescue from fires.

List of state authorities

- Ministry of the Interior
- Ministry of Agriculture, Forestry and Water Management
- Ministry of Defence
- Ministry of Health
- Ministry of Labour and Social Welfare
- Ministry of Foreign Affairs
- Ministry of Finance
- Ministry of Transport and Maritime Affairs
- Ministry of Energy and Mining
- Ministry of Spatial Planning, Urbanism and State Property
- Ministry of Tourism, Ecology, Sustainable Development and Development of the North
- Ministry of Culture and Media

List of state administration bodies

- Institute of Hydrometeorology and Seismology
- Environment Protection Agency
- Centre for Ecotoxicological Research

- Institute for Public Health
- Armed Forces of Montenegro
- Police Directorate
- Customs Administration
- Water Administration
- Administration for Forest and Hunding Ground Management
- Administration for Food Safety, Veterinary and Phytosanitary Affairs
- Traffic Directorate
- Local self-government bodies

List of business organisations

- Economic operators
- Other legal entities and entrepreneurs forming the protection and rescue action units

(Source of data: Protection and Rescue Law)

Identifying and analysing the impacts of participants in landscape fire management are important steps in the implementation of sustainable strategies and plans in this area. As a general explanation, stakeholder involvement in landscape fire management requires proper identification of individuals, institutions or organisation that can influence the ultimate objectives of landscape fire management by playing a key role in pre- and post-fire phases.

b) Organisational Setup of the System

Ministry of the Interior

Fire protection and rescue in forests and in landscapes is carried out in accordance with the Law on Protection and Rescue and in accordance with the Fire Protection and Rescue Plans drawn up at 3 (three) levels – national, municipal, and operational. To date, twenty municipal protection and rescue plans and more than 350 operational protection and rescue plans have been prepared.

The Regulation amending the Decree on Organisation and Manner of Work of State Administration, published in the Official Gazette of the Republic of Montenegro 78/2004 provides that the Ministry of the Interior is responsible for risk management, protection and rescue management in emergencies and managing the consequences of emergencies. In this sense, the Protection and Rescue Directorate has been established within the Ministry of the Interior, which is divided into 7 (seven) departments and 7 (seven) regional units, depending on their area of work and competence, covering a wide range of protection and rescue activities, from preventive, operational to rehabilitation measures and activities.

This means:

- A standardised management of protection and rescue activities in the event of natural, technical-technological, and other hazards
- Monitoring and analysis of the situation in the field of protection and rescue, proposing measures to improve the situation and steering the development of the protection and rescue system

- Coordinating the work of all institutions, from state to local levels and individuals
- Managing a single database of operational forces, means, and equipment
- Organising and conducting exercises for participants in protection and rescue measures
- Carrying out preventive, operational and consequence management measures
- Implementation of protection and rescue measures
- Notification and alerting for implementation of protection and rescue measures
- Training of citizens
- Professional development and training of members of the operational units
- Equipping the operational units
- Monitoring the functioning and equipment of units within the local self-government units for the purpose of system integrity maintenance
- Establishing international cooperation
- Cooperation with companies and scientific institutions for development of protection and rescue technologies and equipment.

Normative regulation through amendments to the Protection and Rescue Law established three levels of protection and rescue management and coordination:

- Protection and Rescue Coordination Team manages and coordinates protection and rescue on the territory of Montenegro
- Operational Protection and Rescue Headquarter coordinates operations of participants in protection and rescue measures
- Municipal Protection and Rescue Team manages and coordinates protection and rescue on the territory of municipalities

Operational units involved in fire protection and rescue are:

- Municipal protection and rescue services
- Civil protection units
- Voluntary protection and rescue units
- Protection and rescue units of companies and other legal entities
- Units for extinguishing fires from the air (the aircraft and helicopter unit is an integral part of the Department) and specialised units

Forestry Sector (Organisation, Resources and Position in the System)

Article 49 of the Protection and Rescue Law sets out the obligations to draw up operational protection and rescue plans, recognising, among other things, the obligation of the forestry sector to draw up these plans. The Ministry of Agriculture, Forestry and Water Management comprises the Directorate of Forestry, Hunting and Wood Industry with the Department of Forestry, Hunting, Wood Industry and the Department for Monitoring Forestry and Hunting. State activities and expert activities in the field of forest policy, forest conservation, improvement and exploitation of forests and game, protection of forests and ecosystems are carries out through the Administration for Forest and Hunting Ground Management.

The Administration for Forest and Hunting Ground Management is organisationally divided into 3 (three) sectors:

- Sector for Forest and Hunting Ground Management,
- Sector for Legal Affairs,
- Sector for Finance, Accounting and Public Procurement.

The Sector for Forest and Hunting Ground Management comprises the Forest Planning Department, the Department for Cultivation and Protection of Forests, the Department for Utilisation of Forests and Secondary Forest Products, the Department for Nature Conservation and Management of Special-Purpose Hunting Grounds and the Department for Forest Information System. All sector activities are carried out by regional units that coincide with the municipal territory in which they are located. An exception is the Kotor regional unit, which has its local offices in Bar, Budva, Herceg Novi and Cetinje.

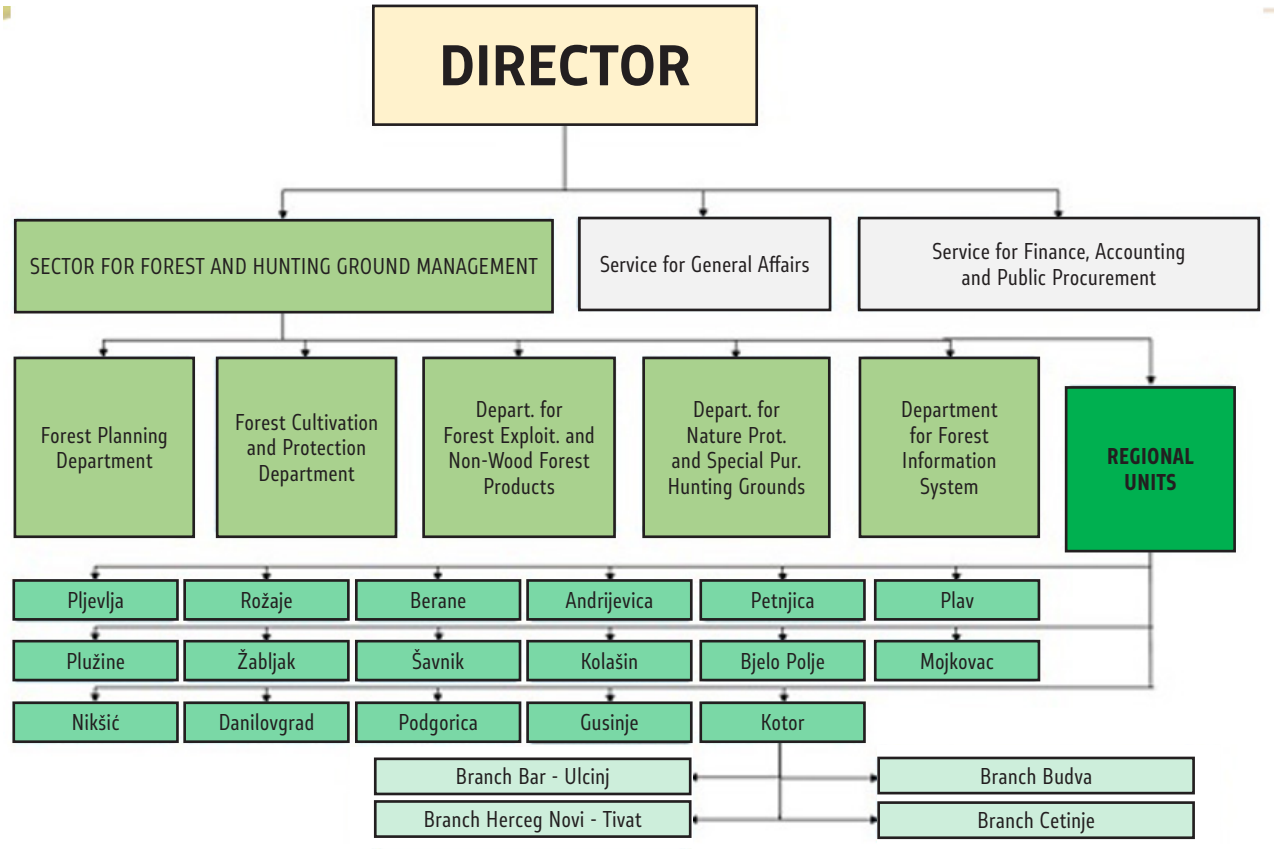


Diagram 2. *Organisational setup of the Administration for Forest and Hunting Ground Management:* ***Source of data:*** *website of the Administration for Forest and Hunting Ground Management*

The Administration for Forest and Special Purpose Hunting Ground Management adopts forest fire protection plans for forests of all types of ownership, which include operational maps in the event of forest fires and is passively and actively responsible for the detection and timely reporting of forest fires. The threat of forest fires is defined in the Forest Management Plan and an appropriate management method is determined for these forests. One of these is the treatment of state-owned forests, while the situation is different for privately-owned forests. Problems in the implementation of forest protection measures also arise from the fragmentation of areas and the large number of owners, unresolved ownership and legal relationships with forest owners and outdated cadastral data, the inability to communicate with forest owners, as they are obliged by regulations to protect their property.

Another part of the forestry sector is the Public Enterprise National Parks of Montenegro, which, with its particularly beautiful landscapes and important and rare natural phenomena, form an ecological and geographic unit protected by a special law. Montenegro has 5 (five) national parks covering 7.7% of the total territory of the country.

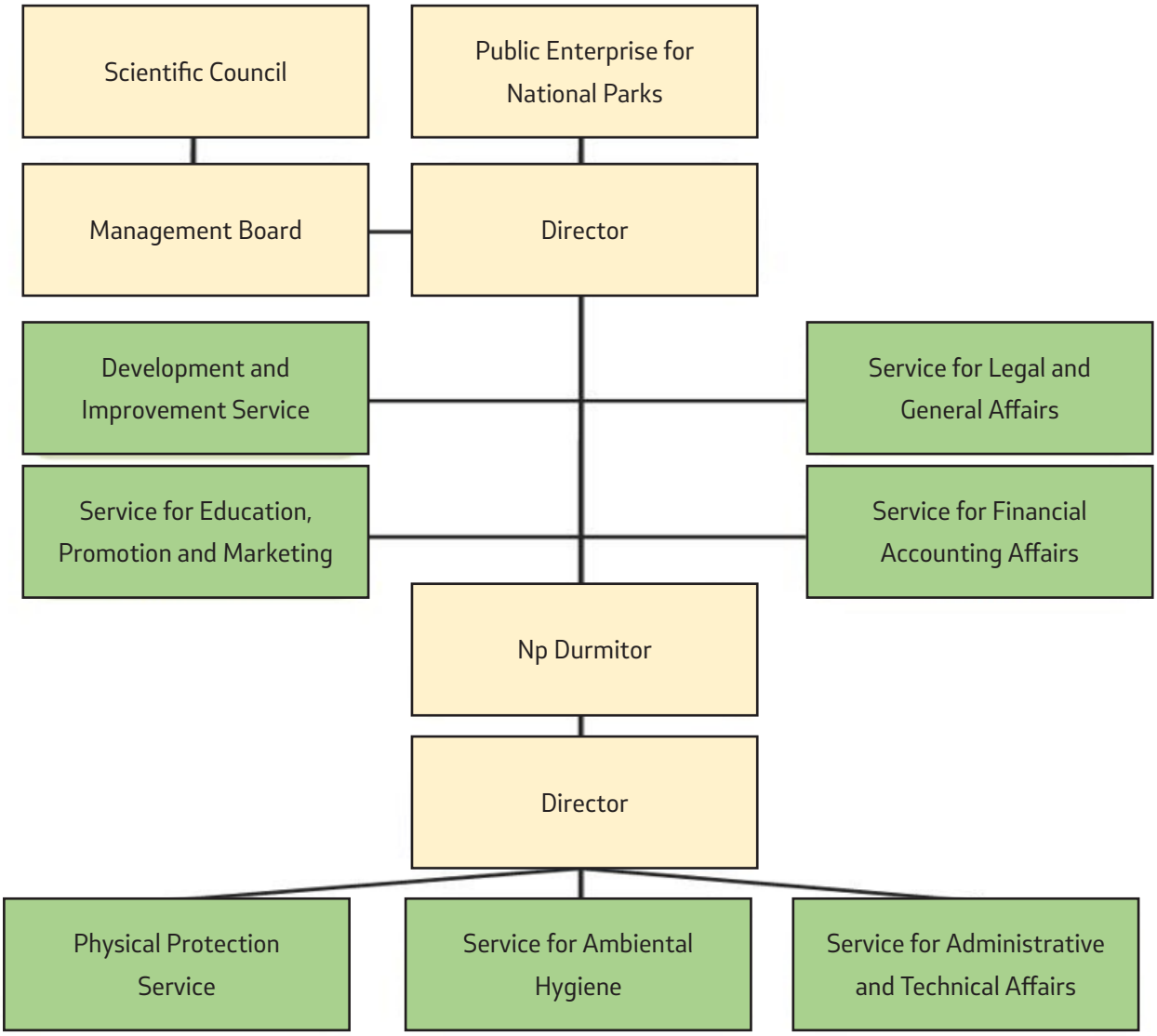


Diagram 3. *PE National Parks of Montenegro:* ***Source of data:*** *website of the PE National Parks of Montenegro*

Article 66 of the Law on Nature Protection defines the content of the management plan and provides that the management plan for a protected area shall consist of the following:

- Measures of protection, conservation, improvement, and use of protected natural resource
- Development guidelines, guidelines and priorities for protection and preservation of protected natural resource, respecting the needs of the local population
- Manner of protection measures implementation; use and management of protected natural resource
- Long-term protection and sustainable development objectives
- Analysis and assessment of the conditions for meeting the protection objectives

- Presentation of natural resources and users of protected natural resource
- Priority activities for the conservation, maintenance and monitoring of natural and other values and environmental segments
- Assessment of the protected natural resource state
- Guidelines for the scientific research
- Planned activities for sustainable use of natural resources, development and spatial planning
- Spatial identification of planned purposes and regime of land use
- Activities for promotion and valorisation of protected natural resource
- Ways of cooperation and partnership with local population, property owners and users
- Dynamics and subjects to the Management Plan implementation and implementation assessment method
- Funds for the Management Plan implementation
- Other elements of importance for natural resource management

Institute of Hydrometeorology and Seismology (IHMS)

The Institute of Hydrometeorology and Seismology is a state administration body responsible for numerous tasks in the fields of meteorology, climatology, hydrology, hydrography, oceanography, and seismology. The Institute establishes, develops, and ensure the operation of the methodological and hydrological observation and forecasting system on the entire territory of Montenegro. The Institute is responsible for establishment, quality functioning and improvement of the early warning system, i.e. the system for early warning of possible meteorological and hydrological natural disasters. The effiective functioning of the meteorological and hydrological network on the territory of Montenegro and the emergency notification of competent authorities about possible occurrence of major meteorological disasters ensures that the protection system is prepared to respond quickly and appropriately in an immediate and rigorous manner. The Institute is also a contact institution for the Intergovernmental Panel on Climate Change (IPCC) and the World Meteorological Organisation (WMO).

Environment Protection Agency (EPA)

The Agency performs professional and related administrative tasks in the field of environmental protection in order to ensure the protection and improvement of the environment in Montenegro as the main principle of sustainable development through transparent and responsible implementation of environmental laws, regulations and policies. The Agency is responsible for providing reliable and timely information on the state of the environment in Montenegro to the public, national and international bodies and organisations. With the establishment of the Environment Protection Agency, the conditions for implementation of EU environmental goals and standards have been created. The Agency's mission is to actively improve the environmental status of Montenegro in a professional manner in the service of nature, health, and economic interests of present and future generations, with a vision that Montenegro will be a country where life is in harmony with nature.

Cadastre and State Property Administration

The Cadastre and State Property Administration is a state institution that carries out unique management of state property and ensure the purposeful use of state property and land. The competence of the Cadastre and State Property Administration covers a wide range of tasks, and as an important area for the use of spatial data required for implementation of the Landscape Fire Management Project, the tasks related to the following should be pointed out:

- Initiating the regulation of property and legal relations for real estate and managing administrative proceedings in the field of property and legal relations and the cadastre of property, as well as ensuring implementation and enforcement of legal and property-related regulations in Montenegro
- Development of standards for geodetic works in the field of surveying, development of cadastre of immovable property and underground installations
- Planning, designing, analysing, and evaluating the accuracy of works related to surveying, cadastre of immovable property and cartographic works
- Photometric aerial surveys and other geodetic surveys
- Design, maintenance and development of the Geographic Information System (GIS)
- Keeping a register of house, streets, and square numbers
- Keeping a register of spatial units
- Cadastral classification and land classification
- Keeping a register of state property
- Other tasks related to the development and maintenance of spatial data

For the purpose of using and exchanging spatial data, the Cadastre and State Property Administration has enabled access to the data via a web service.

The data available relates to cadastral data, address registers, spatial units, orthophotos and 1:25,000 topographic maps.

Statistical Office of Montenegro (MONSTAT)

The Statistical Office performs tasks related to the organisation and implementation of official statistics, collection of data from administrative sources and derivation of statistics from combined data sources; collection, processing, statistical analysis, and publication of official statistics; establishment, development, maintenance, updating and use of statistical registers for statistical purposes only. The aim of MONSTAT is to provide reliable, timely and internationally comparable statistical data that meet the requirements of decision-makers, researchers, and other national and international users, while at the same time presenting the situation and changes in the economic, demographic, social, environmental, and natural resource sectors.

With the passing of the Protection and Rescue Law, the rights and obligations of all those involved in the protection and rescue process are clearly specified. Beside the large number of institutions and companies involved, this system is burdened by a lack of personnel and equipment, which is a result of numerous factors. The greatest threat to the stability of this system is the brain-drain and departure of employees of all profiles.

Addressing these shortcomings and strengthening cross-sectoral cooperation between all stakeholders is crucial to increasing the efficiency of landscape fire prevention, both at national and regional level.

c) Legislation Regulating this Area

The assessment of fire risk management capabilities on landscape fires in terms of administrative capacities, is based on the analysis of the legislative and strategic framework, the determination of professional qualifications and readiness for education, as well as the review and assessment of coordination in decision-making, the review of available capacities, as well as the involvement of stakeholders in the process of fire management on landscape fires. In this context, it is necessary to determine the scope and quality of existing legislation on the basis of which tasks, responsibilities and mechanisms of institutional coordination in the area of protection and rescue are defined.

The purpose of this approach is to determine the extent to which sectoral laws are harmonized and identify areas for enhancing legislation, with the ultimate goal of fostering the adoption of more effective development policies and strategies.

Protection and Rescue Law
(Official Gazette of Montenegro 13/07, 32/11, 54/16, 146/21 and 3/23)

Protection and rescue include a set of measures and actions taken to detect and prevent the hazard of natural disasters, fires, technical and technological accidents, chemical, biological, nuclear and radiological contaminations, consequences of wartime destruction and terrorism, epidemics, epizootic and epiphytotic diseases and other disasters that can threaten or jeopardise the population, material goods and the environment.

Article 36 of this Law sets out that the Government shall adopt the protection and rescue strategy, while Article 37 sets out that the Ministry of the Interior shall propose the protection and rescue strategy. To this end, the Strategy for Disaster Risk Reduction (SDRR) with a Dynamic Plan of Activities for the Implementation of the Strategy for the period 2018 – 2023 was adopted on 21 December 2017.

Disaster risk reduction includes comprehensive professional implementation of activities to analyse the causes of disasters, appropriate land and environmental management, reduction of exposure to hazards and vulnerability of people and property, and improvement of overall disaster preparedness.

Main objectives of this Strategy (2018 - 2023) are:

- Raise awareness of citizens and encourage institutions to implement activities in the field of disaster risk reduction
- Build natural and other disasters risk management capacity
- Integrate disaster risk reduction in policies, programmes, and plans
- Create safe and disaster resilient communities

The Dynamic Plan of Activities (DPA) is an integral part of the Strategy for Disaster Risk Reduction in Montenegro for the period 2018 – 2023. It is actually an operational document whose implementation will improve the situation in the field of disaster risk reduction, positively influence the integration of risk reduction policies, programmes and plans, further strengthen and increase early warning capacity, create more disaster resilient communities and prevent new risks in Montenegro.

Law on Nature Protection
(Official Gazette of Montenegro 054/16 and 018/19)

The Law on Nature Protection regulates the protection and conservation of biological, geological and landscape diversity as components of the environment. One of the nature protection measures laid down in the Law is the mitigation of harmful consequences of activities in nature, including forest fires.

Law on the Environment Protection
(Official Gazette of Montenegro 52/2016, 73/2019)

The law on the Environment Protection regulates an integral system of environmental protection that ensures the exercise of the human right to live in the environment and a balance between economic development and the environment in Montenegro. As a general legal document, it does not specifically address forest or landscape fires, but this issue is included in the environmental protection concept.

Law on Spatial Planning and Construction of Structures
(Official Gazette of Montenegro 64/2017, 44/2018, 63/2018, 11/2019 - corr. and 82/2020)

This Law regulates the spatial planning system, the manner, and conditions for building construction, the legalisation of illegal structures and other matters relevant to spatial planning and building construction. The objectives of this Law include uniform and regionally balances spatial development, rational and efficient use of spatial potentials and resources, protection of natural resources, development and

preservation of landscape identity and uniqueness, harmonisation of human actions and activities while protecting integral spatial and environmental values, protection against natural disasters, all in accordance with the needs of the society, the environment, the economy and spatial capacity.

Planning governed by this Law is based on an integral approach, spatial sustainability, harmonisation of planning documents with international treaties, declarations and conventions, prevention, or mitigation of climate change impacts in accordance with which climate change mitigation and climate change adaptation measures are planned.

Forest Law
(Official Gazette of Montenegro 74/20 and 47/2015)

This Law regulates the cultivation, protection, conservation and improvement of forests, the planning, manner, and conditions for utilisation of forests, construction and maintenance of forest roads, monitoring of forests and other matters relevant to forests, forestland and forestry. This Law also applies to the protection, conservation, and utilisation of forest trees outside forests and forestland. Forests and forestland as resources of general interests are specially protected by:

- Permanent conservation and improvement of forests and forestland and their functions
- Sustainable and multifunctional forest management
- Conservation and improvement of biological and landscape diversity of forests, as well as the quality of their environment

National Fire Protection and Rescue Plan

The National Fire Protection and Rescue Plan provides a detailed overview of the responsibilities and duties of the various actors in the field of protection and rescue at national and local level and provides for specific measures and activities to be carried out to implement the necessary protection and rescue measures in the preventive, operational and rehabilitation phases, which will advance the level and quality of response of protection and rescue system in Montenegro.

The National Plan is prepared based on the Fire Risk Assessment Study which is an integral part of the Fire Protection and Rescue Plan.

The documents included in this Plan are as follows:

- Protection and rescue measures
- Operational units (human and material resources)
- State authorities, state administration bodies, administration bodies and local self-government units (human and material resources)
- Mobilisation, management and coordination of fire extinguishing actions
- Cross-municipal and international cooperation
- Informing citizens and the public
- Manner of maintaining order and safety in interventions
- Plan implementation funds

NOTE - ANNEX 1: Organisational setup of the system, page

V. RECORDING FIRES

Recording fires is one of the most important activities in the process of forest fire and landscape fire management. Monitoring certain statistical parameters of forest fires contributes to an improved, organised, and cross-sectoral approach to fighting this type of disaster. The purpose of recording fires is also to identify the causes of fires to improve the fire management system and base it on accurate and detailed records.

Considering the existing fire management system in Montenegro, records come from 3 (three) levels:

- Ministry of the Interior – Protection and Rescue Directorate, as the coordinator of the protection and rescue process
- Administration for Forest and Hunting Ground Management
- Statistical Office of Montenegro – **MONSTAT**

The practice so far has shown that the most common causes of fires are the following, and the order is empirical:

- Intentional burning of meadows on perimeters or inside forest complexes at the time of cleaning meadows and pastures
- Burning of meadows with ground vegetation, shrubs, and individual trees
- Unlawful use of land
- Picknickers in inadequately secured excursion areas in forest complexes

The above shows the importance of recording forest fires, and the overview of forest fire records is presented as a comparison of the data from the institutions mentioned above, i.e. to see how intensive the cooperation in the process of landscape fire management is. The observed period is 2010 – 2020.

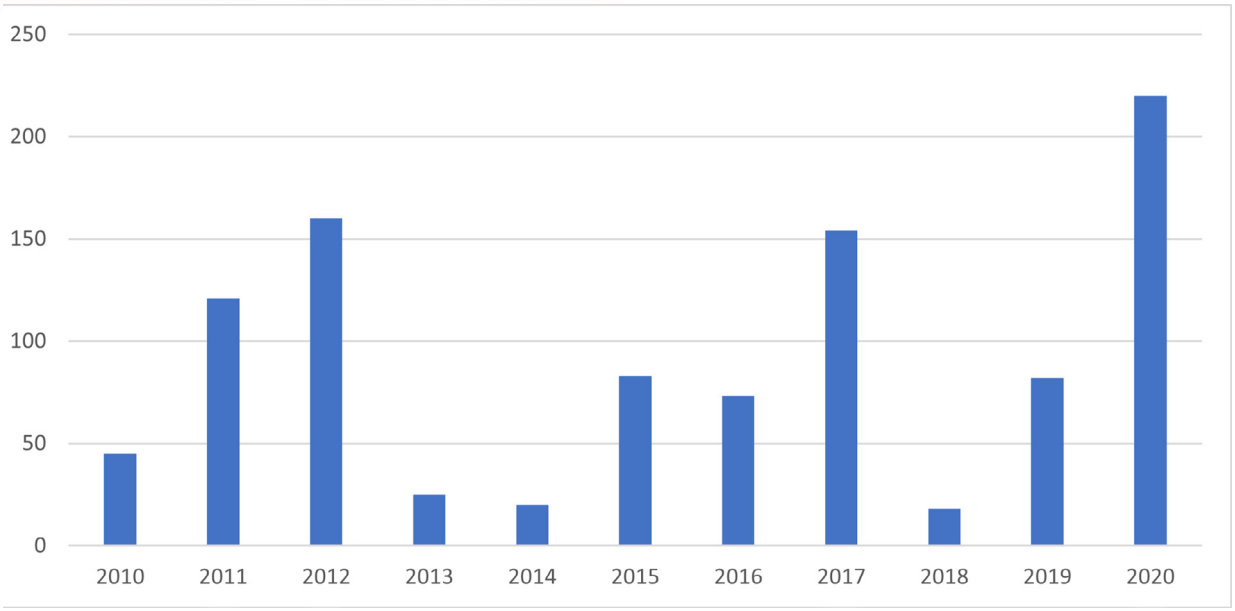
The first indicator will be the **number of fires** per year in order to analyse the consistency and traceability of data.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	No/ year
Number of fires	45	121	160	25	20	83	73	154	18	82	220	1001	91

Table 6. *Number of fires per year:* ***Source of data:*** *Administration for Forest and Hunting Ground Management*

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	Annual average
Number of fires	45	121	160	25	20	83	73	154	18	82	220	1001	91

Table 7. *Number of fires per year:* ***Source of data:*** *MoI – Disaster Risk Assessment of Montenegro*



Graph 11. *Number of fires by year:* ***Source of data:*** *Administration for Forest and Hunting Ground Management;* ***Source of data:*** *MoI – Disaster Risk Assessment of Montenegro*

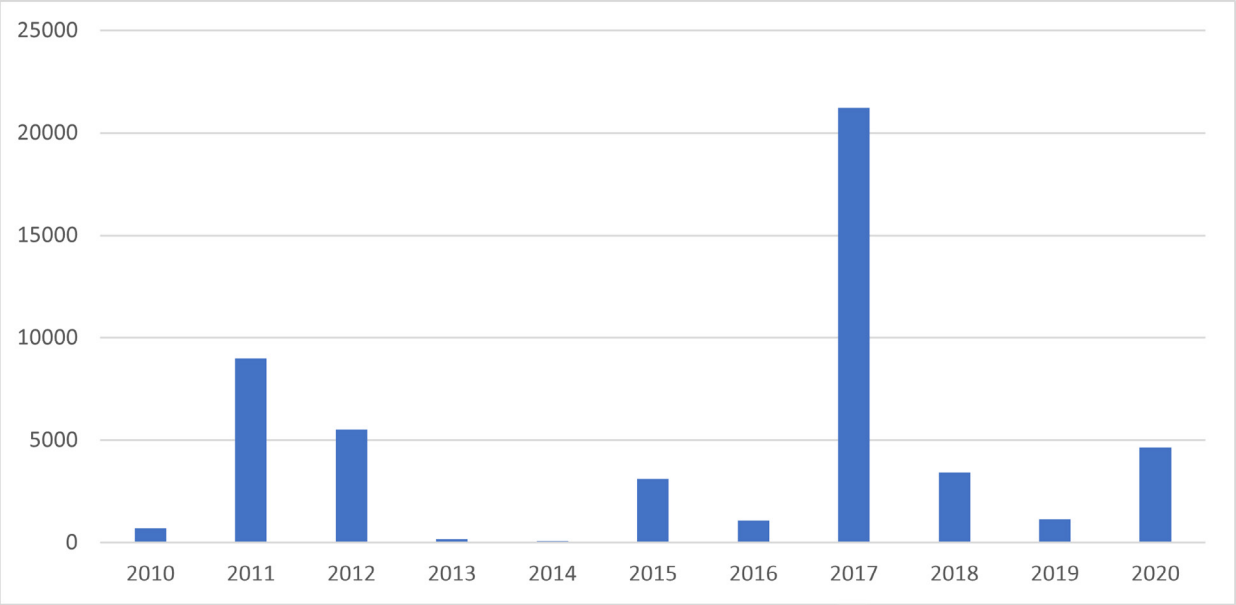
The Statistical Office does not have records of the number of fires, therefore the parameter for comparison will be the area burnt. This shows that the data of the Administration for Forest and Hunting Ground Management are identical to the data from the Ministry of the Interior – Protection and Rescue Directorate.

At this point, it should be noted that the Ministry of the Interior – Protection and Rescue Directorate and MONSTAT carry out analyses for the period of 10 years, while the Administration for Forest and Hunting Ground Management collects annual data for the following parameters:

- Number of fires
- Burnt area
- Lost timber

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	Annual average
Area	695	9,009	5,539	171	62	3,124	1,100	21,216	3,417	1,163	4,644	50,140	4,558

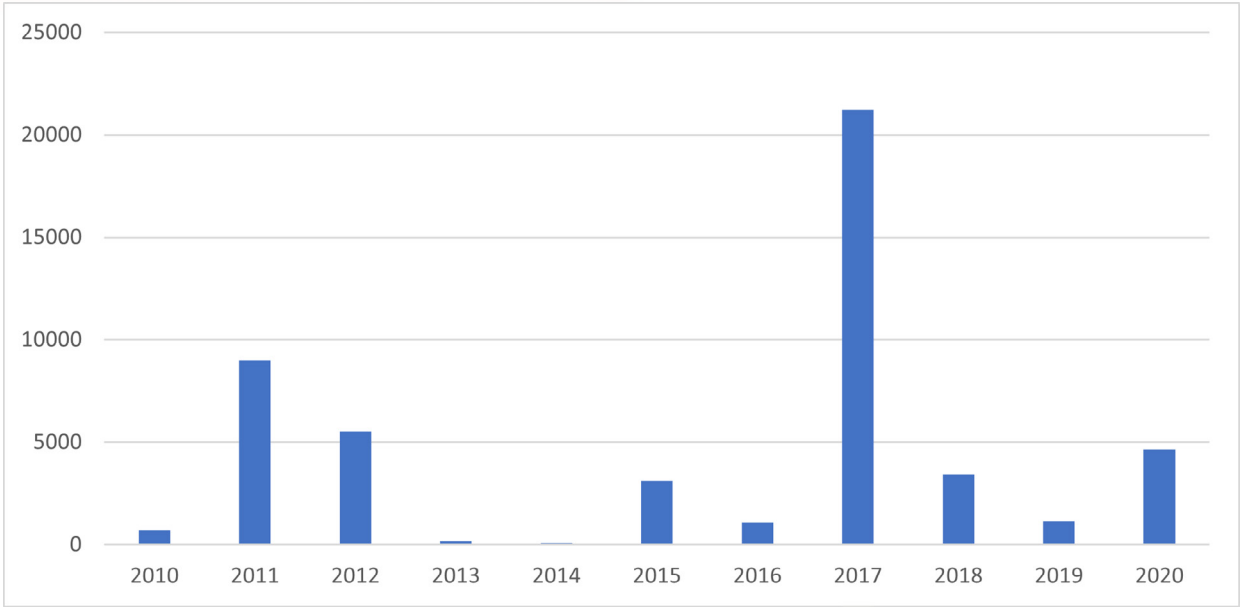
Table 8. *Burnt area :* ***Source of data:*** *Administration for Forest and Hunting Ground Management*



Graph 12. *Burnt area:* ***Source of data:*** *Administration for Forest and Hunting Ground Management*

Year	Conifers (ha)	Broadleaves (ha)	Total (ha)
2010	676	19	695
2011	6,566	2,443	9,009
2012	5,272	267	5,539
2013	30	142	171
2014	/	62	62
2015	158	2,966	3,124
2016	36	1,064	1,100
2017	1,903	19,313	21,126
2018	/	3,417	3,417
2019	41	1,129	1,170
2020	3,738	906	4,644
Total:	18,420	31,728	50,148
Average:	1,674	2,884	4,558

Table 9. *Burnt area (ha):* ***Source of data:*** *Statistical Office –* ***MONSTAT***



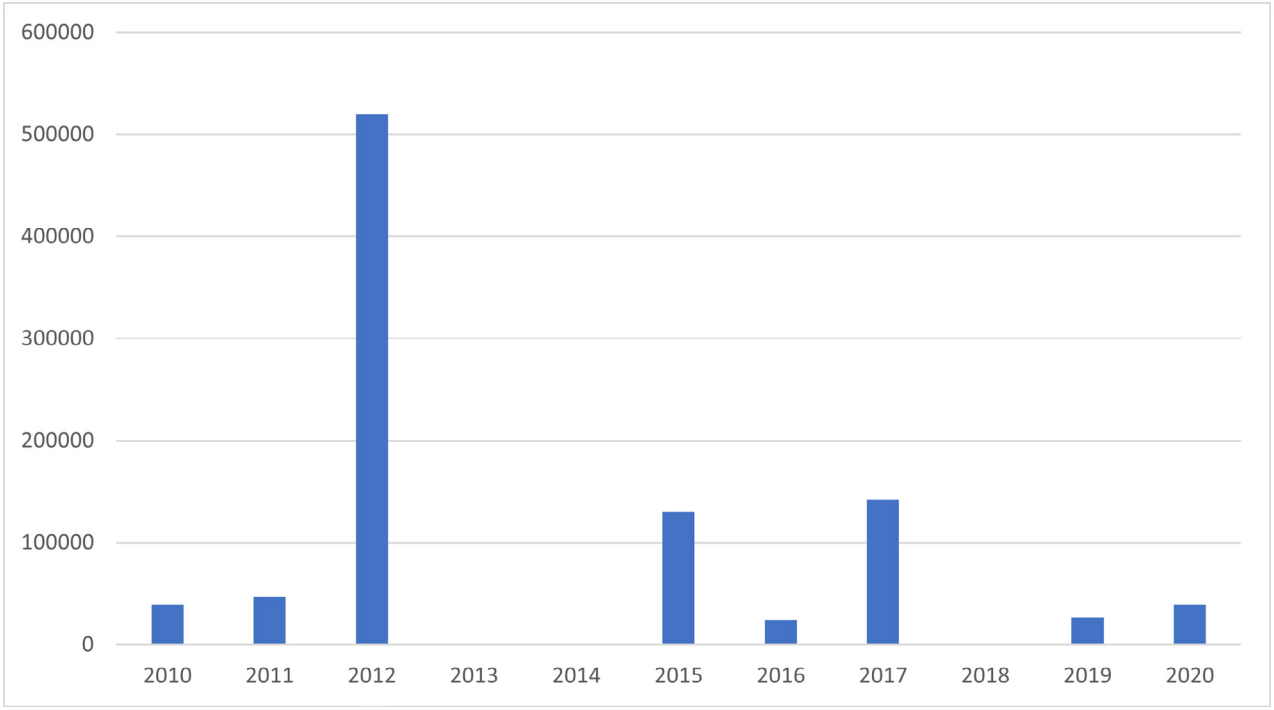
Graph 13. *Burnt area:* ***Source of data:*** *Statistical Office –* ***MONSTAT***

This analysis shows the proportion of conifer and broadleaved stands in the burnt area. A shortcoming of this type of analysis is that records do not show the structure by cultivation types of stands, which leads to a lack of information for the future period to decide on the selection of cultivation measures in forestry. Another shortcoming of the analysis is that there is no overview of the structure of areas under forests and other land in the burnt areas, which leads to an unrealistic perception of the landscape.

As far as lost timber as a fire parameter is concerned, the Administration for Forest and Hunting Ground Management has relatively precise data on the volumes based on the National Forest Inventory and planning documents for managed forests. The data for unmanaged forests is estimated based on the National Inventory. Privately-owned and inaccessible forests fall under this category of forests.

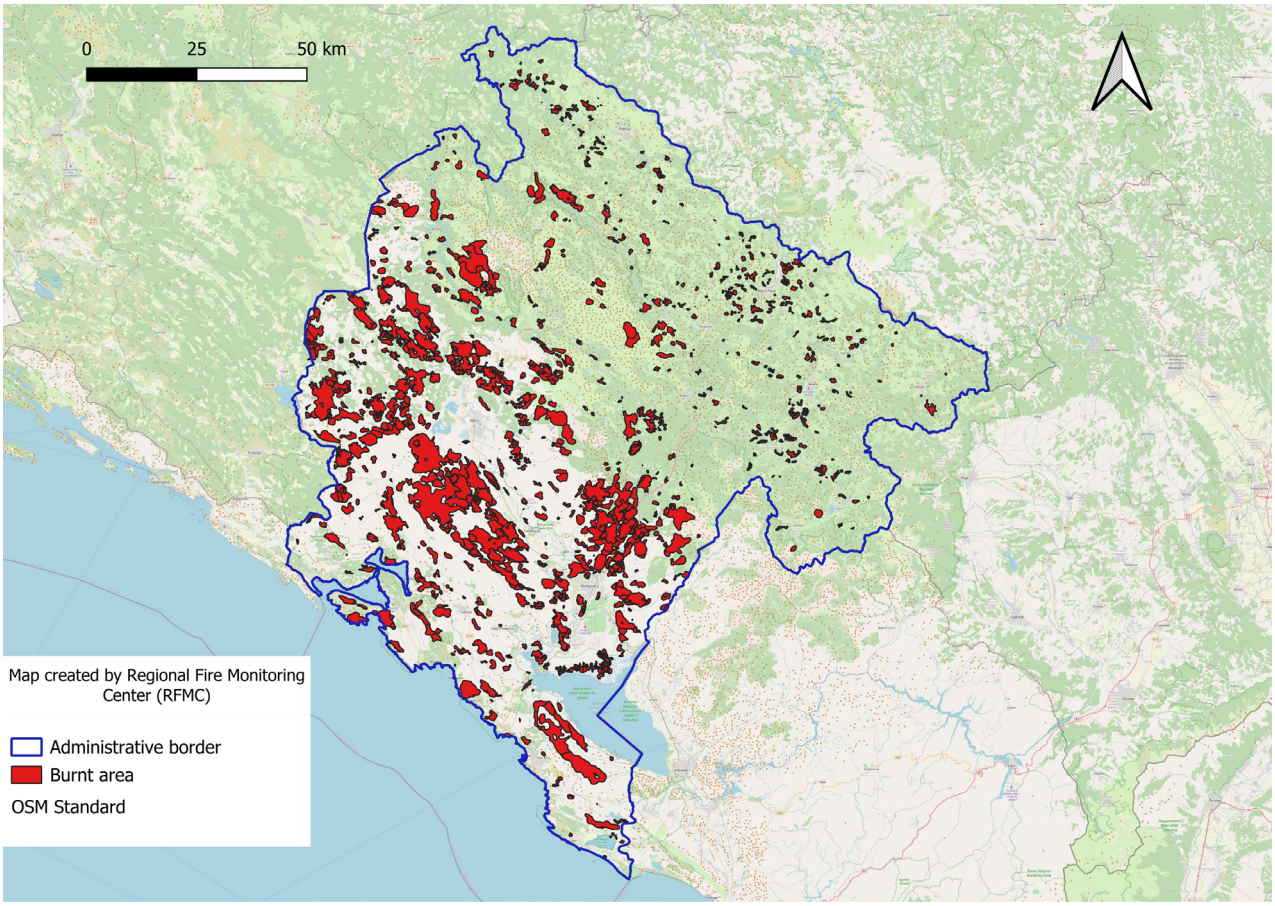
Year	Wood volume (m^3)	Total
2010	39,111	39,111
2011	47,216	47,216
2012	519,455	519,455
2013	290	290
2014	30	30
2015	130,586	130,586
2016	24,334	24,334
2017	142,629	142,629
2018	132	132
2019	26,737	26,737
2020	39,017	39,017

Table 10. *Lost wood mass:* ***Source of data:*** *Administration for Forest and Hunting Ground Management*



Graph 14. *Lost timber in m³:* ***Source of data:*** *Administration for Forest and Hunting Ground Management*

The chapter explains that fire history records can inform science and the public about the landscape management now and in the future, in a time of rapid change. It is based on an understanding of the phenomenon of fires and its effects as it leaves open options for discussing current issues such as the impact of climate change and other aspects of global change on fires, the status of combustible material, a map of burnt areas and environmental impacts of fires. Fires are often the drivers of change. This is important as the chapter provides important insights into what makes ecosystems resilient and how to manage them adequately. Therefore, the effects of fire on landscapes are linked to landscape management in forests, grasslands, shrubs, and other vegetation types across the country.



Map 10. *Burnt area from Landscape Fires in Montenegro (2008 to 2023)* ***Source of data:*** *Regional Fire Monitoring Center*

This map was created based on data provided by the European Forest Fire Information System – EFFIS (https://effis.jrc.ec.europa.eu) of the EC JRC and prepared by the Regional Fire Monitoring Centre (RFMC) in Skopje. In addition to the image representation of the map above, for the period of 2008 to 2023, the digital/interactive map offers the following information (and more):

- Date and geo-referenced location
- Timeframe: beginning and end of fire
- Comparison of fires in the same location but different time periods
- Total burnt area (per fire or overall) expressed in hectares (ha)
- Structure of the burnt area: land use and vegetation type, expressed in percentage (%) of the total burnt area

VI. LANDSCAPE FIRE RISK ASSESSMENT (risk of fires at landscape level + map)

Risk assessment is designed to support landscape fire risk mitigation activities, prevention, preparedness and recovery phases. The risk map contains levels of fire risk and fire sensitivity, negative impact on population, property and the environment, transport infrastructure, response and evacuation capacities, as well as proposed preventive measures to reduce risks. The purpose of risk assessment is to create a technical basis for further risk management activities, i.e. decision-making on preventive measures and preparedness of operational services. These assessments shall take into account:

- a simple risk assessment that takes into account the likelihood of a particular undesirable fire scenario and the consequences of that scenario
- a comprehensive risk assessment that considers all likely undesirable fire scenarios and their consequences

Within the framework of these assessments, we distinguish:

- short-term risk assessment relating to fire ignition and fire-related behavior under the influence of rapidly evolving factors closely related to climatic conditions or type of vegetation (fuel): these risk assessments through effective operational indices based on weather conditions and fuel type, allow organizing activities of pre-suppression, fire detection and control, as well as updating decisions regarding changes in the level of fire risk.
- a medium-term risk assessment relating to the ignition of fires and spread under the influence of structural factors with slow changes over time: as such includes fire hazard and vulnerability and considers the likelihood of fire occurring with humans as the cause and potential damage associated with fire intensity and vulnerability.

At a time of increasingly pronounced climate change, landscape fires pose a key threat to forest ecosystems and represent a global environmental and economic problem. Landscape fires are an increasingly common risk, most often associated with summer dry periods and directly conditioned by extreme meteorological conditions, as well as human factor. The analysis of climate projections for Montenegro shows that there can be an increase in mean annual and extreme temperatures, which can cause more frequent and longer heat waves, with more warm days and nights, with fewer cold days and nights. All this leads to an increase in the frequency of a number of different extreme weather conditions, among others, droughts and landscape fires.

In Montenegro, there is a disaster risk assessment, even for landscape fires. But, At this moment, there is no comprehensive map for forest and landscape fire risk assessment. This absence of a detailed fire risk assessment poses a significant challenge in effectively managing and mitigating fire-related hazards across the region. Creating a fire hazard map would provide valuable insight into the spatial distribution of fire risks, identifying high-risk areas that require urgent attention and resources. By including a variety of factors such as vegetation types, weather patterns, historical fire data and human activities, the map could offer a comprehensive understanding of the potential threats posed by fires in different regions.

For the development of such a risk map, it is necessary to involve the entire professional, university public, all relevant participants, in order to unify the profession, data and resources, which ensures that the future risk map will contain the latest and most relevant information. Such a map would serve as a key fire management planning tool, thus enabling authorities to allocate firefighting resources strategically and implement targeted preventive measures. In addition, it would help raise public awareness of fire risks, encourage responsible behavior and promote community engagement in fire prevention efforts.

One way to create such a map could be to cooperate with other projects such as the Project on Capacity Building for Disaster Risk Reduction Through National Information System (NFFIS) and Eko-DRR, which is being implemented in Montenegro and funded by the Government of Japan.

As a conclusion, it can be said that the absence of a detailed fire hazard map for the entire territory of Montenegro poses a significant challenge in the effective management of fire-related risks. The urgent need for such a map highlights the importance of joint efforts among different stakeholders in developing a comprehensive tool that will help protect the region from the danger of major fires. In addition, such a map is necessary in order to exchange knowledge, experience and new technologies at regional and international level

VII. EXISTING PROJECTS

This chapter looks at existing and ongoing projects and the initiatives that form the basis of our national efforts to mitigate the devastating effects of landscape fires. The existing project are the result of the cooperation and dedicated work of Government agencies, local communities, and various stakeholders. These efforts are designed to respond to the various challenges that landscape fires pose, including prevention, preparedness, response, and recovery.

Ongoing project

1. Project on Capacity Building for Disaster Risk Reduction Through National Information System (NFFIS) and Eko-DRR

Donor: Japanese Government (Japan International Cooperation Agency)

Implementing agency: Government of Montenegro, Ministry of the Interior – Protection and Rescue Directorate (PRD)

Associated partners: Institute of Meteorology and Seismology (IMS) and the Directorate for Climate Change (DCC)

Project duration: 03 March 2021 – 28 February 2026

Project purpose: Build capacity of Government officials to prevent and mitigate forest fires and other natural disasters by establishing NFFIS and Eko-DRR. The combination of satellite and meteorological data with topographic maps makes it possible to monitor the places where fires are most likely to occur, how easily the fire spreads and how dry the area is.

2. Multi-country IPA programme relating to flood protection and forest fire risk management

Donor: European Union (EU)

Implementing agencies: Civil Protection Department of the Republic of Italy (DPC) – lead partner, Administration for Civil Protection and Disaster Relief of the Republic of Slovenia (URSZR), Swedish Civil Contingencies Agency (MSB), General Inspectorate for Emergency Situations of the Ministry of the Interior of Romania (IGSU), Firefighting and Rescue Brigade of the Moravski-Sleski region (FRB-MSR), APELL National Disaster Management Centre from Romania and Italian research foundation for monitoring the environment (CIMA Research Foundation). The beneficiary countries are Albania, Bosnia and Herzegovina, Kosovo*, Montenegro, North Macedonia, Serbia, and Tukey.

In Montenegro, the Protection and Rescue Directorate is in charge of the project implementation. The project activities within component 2 (forest fires) involve the Ministry of Agriculture, Forestry and Water Management, the Administration for Forest and Hunting Ground Management, the PE National Parks of Montenegro and the Institute for Hydrometeorology and Seismology.

Project duration: 15 November 2020 - 14 April 2024

The programme comprises two components:

Component 1 (floods): improve legal and institutional framework related to the EU Floods Directive (EUFD) and institutional cooperation between all stakeholders involved in the EUFD implementation

Component 2 (forest fires): improve prevention, preparedness, and capacities to respond to forest fires at national, regional and EU levels.

The IPA FF programme is an important continuation of previous EU-funded initiatives aimed at building capacities to prevent disaster risks and preparedness in the region and in Montenegro.

Activities include workshops, training, exercises, exchange of experts, establishment, equipping and training under civil protection modules for extinguishing fires from the land and awareness raising campaigns.

3. Building FIRE – SMART LANDCAPE in the Mediterranean region

Project title: MediterRE3 – Restoring Resilience of Mediterranean Landscapes to Reduce GHG Emissions from Wildfires

Donor: European Climate Initiative (EUKI) 2021

Implementing agencies: Project Coordinator - Institute Oikos (Italy);

Local Coordinators: Mediterranean Agronomic Institute of Chania (Greece), Luberon Lure UNESCO Biosphere Reserve (France) and NGO Green Home (Montenegro)

Project duration: September 2021 - December 2023

Project purpose: Reduce greenhouse gas emissions caused by fires by switching from firefighting to prevention and promoting a fire-resilient landscape.

Guidelines for the restoration of forest landscapes through intelligent fire management planning in the Mediterranean have been developed to provide competent authorities with methods to reduce the risk of forest fires through integrated forest fires management.

Regarding the areas covered by the project, a Baseline Study of Landscape Resilience to Fires was conducted for the NP Prokletije and PP Komovi. This Baseline Study refers to ecological and socio-economic characteristics, policy framework and management, current management practices and stakeholders. The assessment of vulnerability, strengths, opportunities, and entry points for action through interaction with local focus groups.

In addition, a Landscape Action Plan will be drawn up as part of the project, which will form the basis for the preventing forest fires in the areas mentioned.

The information obtained will be disseminated internationally via the MedForVal network.

VIII. IDENTIFICATION OF STRENGTHS AND WEAKNESSES IN THE LFM SYSTEM

The analysis of strengths and weaknesses in the field of landscape fires risk reduction determines the situation in this field in a highly quality manner as the analysis clearly shows the vision, mission and strategic directions of developments in the field of disaster risk reduction. It focuses on the essence and the purpose of planned activities and measures to be implemented. Achieving more efficient landscape fire management requires cooperation between Government agencies, local communities, and environment protection organisations. Together they can design and implement comprehensive fire prevention and preparedness plans, including involvement of communities, awareness raising campaigns, and capacity building initiatives. Through holistic approach to land use management, where uncultivated land and forests are perceived at the same level, Montenegro can better protect its natural heritage and its citizens from harmful impacts of landscape fires and open space fires.

Montenegro has set itself a goal of implementing the **SENDAI FRAMEWORK** for disaster risk reduction measures by 2030, initiated in 2015. This requires amendments to the existing legal framework that cover the entire disaster management cycle. In addition, cooperation at international and regional level needs to be improved and the technical and technological capacities of the early warning system need to be expanded. It is necessary to improve the level of scientific research and cooperation with local and international experts and no less important option is the appropriate use of experience and databases on disasters that have occurred naturally or under human influence, with the aim of defining more successful policies in this field.

PREVENTION

Over many years of practice, Montenegro has introduced a nature-friendly forest management system that rejuvenates forests through selective and regenerative felling, which has significantly contributed to reducing the risk of devastating forest fires. These traditional forest management practices demonstrate a commitment to preserving ecosystems and mitigating the potential impact of large-scale fires on valuable forest resources. The openness of forests and forest land has been at an enviable level, creating a good forest fire defence line. Montenegro has been applying the **concession system** since 2008, where harvesting and transport of timber are carried out by concessionaires and these are the only activities of concessionaires in the system, with other activities of simple forest reproduction not being carried

out. In addition, the NFI found that a considerable part of the forest and forestland areas are beyond reach because they are steep and inaccessible, which significantly reduces the openness of forests of Montenegro. The conclusion is that the existing management system does not ensure the necessary openness of forest complexes, that concessionaires are not sufficiently equipped for monitoring and early warning or for rapid access and extinguishing of fires. The density of the forest road network has a strong impact on the forests as a higher density of the road network enables faster detection of fires and the creation of a line of defence to prevent the spread of fires by land. The road network is a designed infrastructure whose spatial and structural solution depend on the terrain shape, the forest purpose, the habitats and the occasional possibility of forests.

Preventing damage to forests and society as a whole requires the development of a modern fire protection system that would minimise the harmful effects. This system must provide a fire risk forecast on the basis of which it is possible to extinguish fires quickly and efficiently. By identifying areas of increased fire risk in this way, more intensive monitoring increases the chances of early detection of fires, leading to a reduction in the areas affected by fires as firefighters – rescuers – can intervene more quickly.

STRENGHTS	WEAKNESSES
Good legal, strategic, and institutional framework	Insufficient implementation and law enforcement
Planning regulations at all three levels in accordance with the **Protection and Rescue Law** in place	No law on fires
Institutional and administrative capacity in place	Incompatibility of sectoral laws with the Protection and Rescue Law
Bodies for coordination in the field of disaster risk reduction put in place	Insufficient occupational and technical-technological training
Management by selective and regenerative felling applied	Existence of large areas under conifer monocultures
NFIS – early warning system	Discontinuity of political decisions
Cross-curricular area of education in the field of disaster risk reduction introduced in cooperation with the Ministry of Education	Unsatisfactory penal policy
Cross-sectoral and international cooperation in place	A lot of abandoned and uncultivated land
International projects and international funding	Uncontrolled urban expansion and creation of unclear boundaries between urban areas and forests
	Improper data collection methodology

READINESS/PRE-SUPPRESSION

As landscape fires occur frequently, their intensity is increasing, and the area affected is growing. Readiness of society and institutions for a better and more appropriate response in this situation is extremely important.

STRENGTHS	WEAKNESSES
Coordination of work of all institutions from the state level down to the local level and individuals is in place	Financial limitations in the implementation of modern technologies
A relatively favourable staffing structure of operational protection and rescue units	Lack of fire risk maps with all required and available data
Operational protection and rescue headquarter is in place	Insufficient openness of forests and forest complexes
The Coordination Protection and Rescue Team and municipal protection and rescue teams are in place	Planning deficiencies in designing fuel breaks and firebreaks
All operational protection and rescue units are in place in accordance with the Protection and Rescue Law, apart from civil protection units	A high percentage of inaccessible forests and forestland and poor maintenance of road infrastructure
Cooperation with international organisations and agencies which work on protection and rescue and disaster risk reduction with a view to exchanging knowledge and resources	Inadequate radio system for functioning of professional services
Cooperation with NATO and EU Member States	Unplanned procurement and inadequate maintenance of equipment and material-technical assets and personal and collective equipment is not in line with the standards prescribed by the EU
	Lack of adequate management methods for flammable materials

FIREFIGHTING

When fire prevention is unsuccessful, the process of firefighting begins. It should be noted that the task of firefighting is to control and eventually extinguish and put out fires that have been detected by detection systems. The decision on how to extinguish a fire will depend on how the fire grows and develops depending on weather conditions, terrain characteristics or fuel type and conditions. However, the decision is also influenced by the available resources and their location. Therefore, firefighting management includes not only the decision on the immediate response to fires after they have started, but also the decision on the organisation of all available resources before they start.

The fire containment process is divided into four phases:

- Collecting resources and strategic deployment
- Mobilisation of resources
- Initial attack (IA)
- Extended attack (EA) management

The first phase comprises all long-term decision that need to be made before a fire breaks out and which largely affects the other phases. The second phase, which concerns the distribution of resources, deals with the way in which all available resources are distributed to the bases. This distribution can be made at the beginning of the firefighting season but can be changed depending on the frequency of fires.

Initial attack (IA) is an aggressive type of firefighting in which the first resources arrive. It focuses on organising the distributed resources, deciding on the strategies to be used and implementing them. If the initial attack is not successful, an extended attack is required. The extended attack (EA) comprises two key phases: containment and control.

Containment requires creation of control lines to prevent the spread of fire. Control involves completing the control line around the fire, any on-site fire and any other interior areas to be saved, and cooling any hot spot that could pose a threat to the established control line. This scheme of firefighting requires decisions that correspond to the disaster preparedness phase (long-term decisions in the procurement and distribution of resources between bases) and others that correspond to the response phase (mobilisation of resources, initial attack, and extended attack).

The aircraft and helicopter unit of the Protection and Rescue Directorate of the Ministry of the Interior plays an important role in fighting landscape fires as it plays a key role in the rapid containment of initial epidemics and in carrying out important aerial observations. With their ability to quickly transport water and fire retardants to inaccessible areas, firefighting aircrafts are a vital force on the front line of the battle against the rapid spread of flames.

The aerial observation capability provides invaluable support in identifying potential fire hot spots and determining the most efficient containment strategies, significantly improving the efficiency and effectiveness of firefighting efforts on site.

STRENGTHS	WEAKNESSES
Coordination at all levels in line with the Protection and Rescue Law	Lack of IT equipment for persons who manage firefighting actions
Good knowledge of terrain by municipal protection and rescue services	Insufficient openness of forests and forest complexes
Good cooperation with local communities and the population	Poor maintenance of road infrastructure
There is already a certain level of training of protection and rescue services and other operational units	Lack of firefighting equipment
	Drafting of the new law on volunteers or amendments to the existing law

POST-FIRE MANAGEMENT

Although fire containment is key, rehabilitation and regeneration of affected areas are equally important for ecosystem recovery, minimising erosion and reducing the risk of future fires. Post-fire management includes restoration techniques, monitoring strategies and community involvement.

Montenegro has prepared 3 (three) forest restoration plans, none of which adequately covered the burnt areas. The reason for this is the concession system for the use of the forests, as the concessionaires were not interested in clearing the burnt areas due to lack of economic interest, justifying this with the poor quality of the wood, which is not fully justified and correct.

The implementation of the restoration plan comprises two key phases: the first phase foresees the harvesting of burnt trees and their removal from the burnt area, while the second implementation phase foresees either the afforestation of the burnt areas that were not subject to natural regeneration by parent tree species or another measure. Since most of the burnt wood remained unused, i.e. was not removed from the burnt area, it is proposed to re-introduce the auction procedure for the burnt wood, with the

initial prices being set in accordance with the rules for the re-introduced procedure for the auction sale of state property. Fires can destroy a layer of soil that contains organic matter and is particularly susceptible to run-off in karst areas, which can lead to a change in the physical and chemical properties of the soil that affects fertility. Together with expected climate change, which will lead to a shift in certain vegetation zones (forest types), both in terms of latitude and altitude, increased drying out of trees due to stress and attacks of pest infestation and plant diseases, a reduction in yields and more difficult natural regeneration, it will be necessary to find other solutions for the second phase of restoration of burnt areas.

Restoration and rehabilitation of ecosystems requires rehabilitation techniques that initiate the natural regeneration of vegetation and prevent the spread of invasive species. Soil stabilisation, seeding and erosion control play a key role in initiating the process of restoration and maintaining ecological balance. The procedures for rehabilitating burnt areas are laid down in the Forest Law. There is currently no secondary legislation, but the adoption of the new Forest Law will provide for the adoption of a rulebook in this area.

STRENGHTS	WEAKNESSES
Regulations and planning documents for post-fire management are already in place	Inadequate quality of the existing regulations and planning documents
Staff is in place in institutions	Lack of implementation of the existing regulations and measures contained in planning documents
	Insufficient training of the existing staff

IX. LFM GUIDELINES

Forest fires, landscape fires that occur as a result of inadequate management of forests and forest land, improper practices of land use, excessive land use change, increase in abandoned areas in Montenegro have become an increasing threat to communities and natural and cultural landscapes. Unsustainable forest management practices have led to a deterioration in the state of forest ecosystems, as forests have become more susceptible to climate change. . Climate projections show that these climate extremes in the future will become more frequent and pronounced. This increases the negative impact on natural and cultural landscapes, including ecosystems, human health and, generally, the safety of the community. Increasingly frequent and prolonged droughts lead to large fires that are often uncontrollable and result in ecosystem degradation with subsequent secondary damage such as loss of the top soil layer, flooding, erosion and landslides, which in turn leads to a loss of stability, biodiversity and productivity of the natural and cultural landscape.

Because of all of the above, there was a need to form a national LFM network, in order to approach the problem of fire management with a holistic approach. The national LFM network collaborates with a wide range of involved institutions and experts to find a different approach to landscape fires, based on a maximum engagement of prevention through institutional, legal and innovative frameworks. Consequently, the national LFM guidelines are being developed to identify the key actions to define national landscape fire management policies, that should be defined in broad consultations with the national LFM network (serving as a science-practice-policy interface). National guidelines are the result of the participatory process of the LFM network, where the workshops, through the work of working groups, defined comprehensive guidelines for landscape fire management in order to reduce the escalation of the severity and frequency of fires, problems associated with fires, damage and negative impacts on people and the environment, to the least possible extent.

The guidelines identified through the work of the national LFM network are fully compliant with the following conclusions of the SWOT analysis:

CLIMATE CHANGE ADAPTIVE MEASURES OF KEY SECTORS BY INCLUDING LFM PRINCIPLES

Climate change is one of the main drivers of environmental change. It creates the need to revise existing forest management methods and re-evaluate the methods of planting and cultivation used. Adaptive measures for all sectors affected by climate change must be aimed at promoting sustainable management and strengthening information and monitoring systems.

Possible adaptation measures in the forestry sector include planning and capacity-building measures. All measures that should be implemented in forestry can be divided into three groups, namely:

- **policy and institutional strengthening measures**

  These measures imply strengthening the landscape fire management through measures of prevention and preparedness. The LFM approach implies holistic and through review landscape management at local, national and regional level. In this sense, it is necessary to establish cross-sectoral monitoring of the state of forest ecosystems with a database for each sector, in order to obtain quality information for planning, as well as for the implementation of adaptive measures. This

way of communication and cooperation between relevant institutions has a positive impact on the effect of landscape fire management. As an institutional measure, the need for the formation of a National Bodie for climate change, vulnerability and adaptiveness.

- **strengthening scientific research and capacity building measures**

  These measures are viewed in capacity building in sustainable forestry through continuous learning and training, Identification of species and provenance of forest trees that are genetically best adapted to the influence of climate change and are of economic significance, and support for cooperation for research and inter-institutional and international agencies.

  The possible measures of adaptation in the agricultural sector include measures of planning and capacity building, while the second type of measures has a more technological and informational character. Within this sector, adaptive measures can be divided into:

- **strategic and Institutional strengthening**

  These measures include the development of a comprehensive plan drought response/adaptation with an emphasis on existing measures for control of the drought. It is very important to establish a national network of reporters in the context of agrometeorological observations, which they would report on the state of soil moisture and the state of agricultural crops. Finally, it is necessary to strengthen the cooperation between scientists, bringers decisions and stakeholders.

- **technical measure**

  Within these measures it would be necessary to establishment of a network of agrometeorological cells and their corresponding sensors (for temperature and moisture of the soil, leaf moisture, the length of the sun, etc.) Expansion of the scope of agrometeorological user-friendly information such as what are satellite data and the results of numerical models. It is also necessary to build/upgrade the system for watering and draining water to provides access to water in the dry periods. One of the most important measures would be the implementation of a simulation model yields (plant – time) and models for anticipation of plant diseases in operational agrometeorological work. There is also a need for the introduction of new varieties of agricultural crops which are more resistant to a warm climate and frequent the occurrence of extreme events. For the envisaged measures, it is necessary to provide and increase scientific research work, improve information and intensify capacity building. In the end, it would be necessary to systematically collect existing organic carbon in the soil. and other soil fertility parameters and creating an integrated database. The impacts of climate change on water resources are diverse and permeate a number of sectors, which include: water for human consumption, agriculture and industry, water that is not for consumption, such as wastewater treatment, electricity production from hydroelectric power plants, transport and recreation, but also a range of water-related services provided by natural ecosystems, such as habitat conservation and type, and flood control. A large number of people live in urban areas, given the vulnerability of urban areas and the enormous pressure on space in the basins of the source, there is a real fear that climate change will further complicate. Reduction of annual amount snow, an increase in the frequency of heat waves, prolongation of the vegetation period and all more consecutive days without precipitation will affect the availability of water in springs and its quality. Recognized measures of adaptation of water and water resources are measures of strategic and institutional strengthening.

- **Strategic and Institutional strengthening:**
  - an integrated approach to water management resources and systems and strengthening intersectoral planning and activities.
  - harmonization of relevant legislation
  - improve coordination between the Government, the Agency for Nature and Environment Protection and the Institute of Hydrometeorology and Seismology

- monitoring surface waters and implement the spatial plan
- define clear and effective protocols for compliance with established sanitary zones protection and conditions for all areas.

- **Technical measures:**
  - strengthen the network of hydro-meteorological stations for monitoring and generating climate data.
  - build new and upgrade existing plumbing and the infrastructure of the system, increasing the capacity for water storage
  - exploring the potential of groundwater in Montenegro using GIS mapping of hydrogeological boundaries groundwater that is used to supply water according to the climate change scenario.
- **Information measures and the capacity building**
  - strengthen research and management capacities for assessing the occurrence of negative impacts and risks of the negative impacts of climate change and adaptation the sweet water systems
  - raise awareness of the structure of the connection between the karst the system and the system of precipitation that is needed as a factor that allows the strengthening of conservation measures and improving groundwater vulnerability assessment.
  - upgrade the water information system with consideration of options for implementing a better software information system for water/cadaster

STRENGTHENED PREVENTIVE MEASURES IN FORESTRY PRACTICES BY USING LFM APPROACH

This type of measures has a wide spectrum of action and in operational sense. From the aspect of managing forests and forest ecosystems, and in particular forests in the karst area, it is necessary to promote tree species that are naturally present or suitable for habitat, increasing species richness in forests and promote mixed forest communities, encouragement of a mixed forest stand, particular attention should be given to the preservation of selected stands of beech, silver fir, and spruce (stands of various ages), maintain and increase genetic variation within tree species promote natural forest regeneration, avoid clear cutting. In addition, the Forest Law should discourage the deliberate burning of forests for the purpose of repurposing forests and forest land. Furthermore, in order to strengthen these measures, it is necessary to adopt the bylaws on measures and activities for the protection of forests from fire. Within the framework of strengthening preventive measures, it is necessary to have modern and efficient monitoring of forest fires.

One of the measures to be taken is the development of a methodology for assessing forest fire damage.

INTRODUCING THE LFM CONCEPT IN AFFORESTATION AND POST-FIRE MANAGEMENT

Post-fire management includes restoration techniques, monitoring strategies and community involvement. The forest restoration plan includes two phases, namely:

a) felling of burnt wood mass, and,

b) afforestation of burned areas that have not undergone natural regeneration

The introduction of the LFM concept in afforestation involves the following measures:

- promoting indigenous tree types in afforestation
- promoting afforestation, landscaping and protection of forests
- production of seedlings
- promote forest cultivation practices that focus on individual trees

Given the growing trend of deserting pasture surfaces, it is necessary to promote the sustainable use of mountain ousters pastures and support for sustainable use manure. For the envisaged measures, it is necessary to provide and increase scientific research work, improve information and intensify capacity building. We need to understand how climate change affect the area and which regions are best for certain breeds and types of livestock. Therefore, it is necessary to ensure adequate conditions for the production of forage in the new climate conditions and use new technology.

When it comes to water and water resources, the potential impacts of climate change are reflected in increasing temperatures, reducing rainfall and heavy rainfall. As a result of the increase in temperature, water consumption increases and water quality decreases, and in ecosystems, due to the increase in water temperature and air, the productivity of habitats decreases. A decrease in precipitation causes a decrease in water quality, a decrease in the required amounts for irrigation and a decrease in the surface level of groundwater. In ecosystems with reduced rainfall, sediment transfer increases, which reduces water quality. The occurrence of heavy rainfall increases the maximum swelling of water, increases the volume of floods, increases erosion and transfer of sediments, as well as adverse effects on health. spilling rivers and lakes in urban, suburban and rural areas

Possible adaptation measures in the water sector, include measures planning and capacity building, technologically/information-oriented.

- **Technical measures:**
  - strengthen the network of hydro-meteorological stations for monitoring and generating climate data.
  - build new and upgrade existing plumbing and the infrastructure of the system, increasing the capacity for water storage
  - exploring the potential of groundwater in Montenegro using GIS mapping of hydrogeological boundaries groundwater that is used to supply water according to the climate change scenario.
- **Information measures and the capacity building**
  - strengthen research and management capacities for assessing the occurrence of negative impacts and risks of the negative impacts of climate change and adaptation the sweet water systems
  - raise awareness of the structure of the connection between the karst the system and the system of precipitation that is needed as a factor that allows the strengthening of conservation measures and improving groundwater vulnerability assessment.
  - upgrade the water information system with consideration of options for implementing a better software information system for water/cadaster.

PROMOTING THE IDEA OF INDEPENDENCE OF THE PROTECTION AND RESCUE DIRECTORATE (PRD)

Promoting the idea of independence of the Directorate for Protection and Rescue is based on the opinion that this would be a good solution to increase the efficiency of the existing system. According to the current organization, PRD represents a part of the Ministry of Internal Affairs with a large number of obligations, whose realization depends on the budget that MIA receives from the budget of the Government of Montenegro**.** Such an organizational system and a way of financing, a rigid system of public procurement has resulted in insufficient dynamics of the realization of obligations that PRD has under the law. In addition, the independent PRD would have a larger number of professionals, organize trainings and trainings, participate more intensively in the education of stakeholders and the population, which would contribute to the efficiency of the protection and rescue system.

INITIATING A HIGHER DEGREE OF DRAFTING OF PLANNING DOCUMENTS

Protection and rescue in the existing system is carried out on the basis of protection and rescue plans, which include: national plans, municipal plans and plans of companies and other legal entities and entrepreneurs. The new law significantly expanded the number of entities that have the obligation to draw up entrepreneurial plans. Protection and rescue plans are made on the basis of risk assessment studies, the content of which is prescribed by law and, with the obligation of mutual harmonization, allows for better production and easier exchange of data at all three levels of planning. It is necessary to involve private forest owners, organization of food producers, association of olive growers in the process of comprehensive planning

ESTABLISHING CIVIL PROTECTION UNITS, SPECIALIST UNITS AND PROMOTING VOLUNTARISM

Civil Protection is part of a unique protection and rescue system and consists of units and teams of civil protection, protective and rescue equipment and assets. Civil protection is intended to function as a system for mass support to civilian structures in the event of disasters. Despite the established norms and realistically established needs, due to the lack of stable and continuous financing, this resource has not been put into use. From all of the above, it is clear what is the main task in order for the formation of civil protection to be successfully implemented.

Specialist units consist of citizens who voluntarily carry out protection and rescue activities, and are organized into rescue societies, Red Cross organizations, mountain rescue services, speleological societies, diving societies, scout organizations, amateur radio clubs, etc. They are obliged to participate in emergency situations at the Ministry of Internal Affairs, whereby contracts on engagement are signed with them, with precise mutual rights and obligations, but it is necessary to step up activities on defining specialist units with which, in the coming period, sign contracts as a preventive activity.

For the purpose of organized voluntary participation of citizens in protection and rescue, as well as propagation of protection and rescue, companies, entrepreneurs and other legal entities can organize voluntary units. This resource, although clearly defined by law, is not sufficiently recognized in the wider community. Activities on the promotion of voluntarism should be aimed at not generally greater education

of the population, on raising social awareness of the need to create voluntary units, i.e. how important it is to develop and strengthen human and material capacities of voluntary units.

ESTABLISHING CLEAR PROCEDURES FOR EXCHANGING INFORMATION BETWEEN INSTITUTIONS

The Regulation on Amendments to the Regulation on the Organization and Mode of Operation of the State Administration established that mia is responsible for risk management, emergency protection and rescue management and remediation of consequences in emergency situations. This implies that the management and coordination are under the jurisdiction of mia. This implies that the management and coordination are under the jurisdiction of mia. Key competent entities should improve their own organization, as well as cooperation, knowledge exchange and information flow, in order for the process of managing landscape fires to proceed smoothly and efficiently.

ESTABLISHING TYPOLOGY OF COMBUSTIBLE MATERIAL (FUEL CHARACTERISATION CLASSIFICATION)

Within the framework of fire protection, it is necessary to make a typology – classification of wildland fuels according to which different types of vegetation are classified before their flammability and contribution to fire behaviou. This standardised classification system helps forest managers assess fuel conditions, predict fire behavior and prioritise fuel management efforts for maximum efficiency. The final stage of typology would be the creation of a fuel map in the country providing valuable spatial information on fuel types, distribution and abundance, enabling better planning and decision-making in landscape fire management. By mapping fuel characteristics at national level, stakeholders can identify high-risk areas, target fuel management interventions and allocate resources more effectively to mitigate fire hazards and protect vulnerable landscapes and communities. For the development of such a map, it is necessary to update data on areas by forests and forest land (National Inventory) and structural inventory of agricultural land.

SETTING UP A UNIQUE DATABASE AND DATA DIGITALISATION

A unique database is one of the most important activities in the process of managing landscape fires, because monitoring certain statistical parameters of forest fires contributes to an improved, organized and cross-sectoral approach to combating this type of disaster. In the existing system, many data are found in various agencies and there is no adequate up-to-dateness of them. Adopting a uniform and standardized data collection method ensures consistency and accuracy in the collection of information related to landscape fire management In the existing system, we have a unique database in the field of meteorology, while data on surfaces under fire and the height of fire damage are very questionable. The data on the area are based on insufficiently updated data by land owners, especially in the part of land conversion due to reduced agricultural production, abandonment of agricultural land, migration of population, etc., and these data need to be revised by the new Forestry Inventory and inventory of agricultural land. It emphasizes the availability of data in digital form, as the use of new technologies, including digitalization and best practices, increases the efficiency and effectiveness of landscape fire management efforts. The use of innovative tools such as remote sensing, geographic information systems (GIS) and predictive modelling increases the ability to detect, monitor and respond to fires, leading to more proactive and targeted interventions to mitigate fire risk.

INTRODUCING A SCHOOL SUBJECT ON FIRES INTO THE EDUCATIONAL SYSTEM

Within the context of increasing social awareness regarding the importance of enhancing knowledge and embracing new technologies and trending approaches in landscape fire management, the question arises about introducing a school subject dedicated to fires and fire-related issues (pyrology, climate change, air pollution, fire-ecology, etc.) into the educational system. Previously, a cross-curricular area of education in disaster risk reduction was introduced in collaboration with the Ministry of Education, yielding promising yet insufficient results. Hence, it is imperative to further discuss whether this subject should be optional or mandatory, at what age it should be integrated into the curriculums and many other specifics that need to be deliberated.

The present state of fire risk management and institutional arrangements falls short in combating the escalating trend of the fire problem. Existing planning and strategies must incorporate elements of distinctiveness and cohesion, prioritizing prevention and preparedness. This approach not only bolsters environmental resilience but also strengthens societal well-being and economic stability and livelihoods, aligning with the core principles of the LFM programme. This requires a multisectoral approach to risk management, a dialogue with participants, socio-economic approach through innovation in rural areas, stronger fire-related actions in the local communities, all of which leads to the creation of fire-resilient ecosystems, landscapes and communities.

Solving these problems and adopting priority measures to be taken is neither effective nor economically justified if there is no widest possible cooperation. The application of knowledge under the Western Balkans LFM programme creates the conditions for the joint adoption of strategies and policies, capacity building, improvement and knowledge sharing, all aimed at reducing the negative impact of landscape fires on the environment.

IMPROVEMENT OF LEGISLATION

The general guideline for this area is to maximally improve all legal solutions, in order to reduce the risk of the fires. It is necessary to revise national policies and strategies, because in this way it contributes to sustainable landscape management, involvement of the community and key actors in the development process, and most importantly, contributes to encouraging the integration of this program as a key part of climate change adaptation and mitigation strategies, it's one of the basic LFM principles. This means that improving legislation in each lfm sector also involves improving and aligning with other sectors to avoid collisions of responsibilities and obligations across different sectors levels.

INSPECTION SUPERVISION

Improvement and harmonization of laws by sector implies proper implementation, which would be controlled by the state inspection. The main competent entities need to constantly improve and develop their own organizations in terms of forest fire risk management, in order to better implement the law, implement obligations and improve mutual cooperation. It is necessary to initiate the development of plans for protection and rescue from some entities that have not made these plans so far. Within the framework of spatial planning documentation to provide measures to reduce the risk of fire, and primarily to implement controlled spatial and urban development.

MANAGEMENT AND COORDINATION

The Ministry of Internal Affairs is responsible for risk management, protection and rescue management in emergency situations and emergency remediation. The normative regulation established three levels of management and coordination through protection and rescue. The normative regulation established three levels of management and coordination through protection and rescue. Management in the protection and rescue system has been further improved by the legislative framework that provides for the establishment of a protection and rescue team in companies and other legal entities. Also, through the law, the need to use the early announcement system was recognized, through the competent institution of the Republic Hydrometeorological Institute. Through the planning documentation of all participants in the process of protection and rescue, data on human and material resources is obtained. Measures that would improve such a system of management and coordination include the following:

- **Intensive analysis of the situation in the field of protection and rescue**

  The purpose of the analysis is to propose measures to improve the situation and direct the development of the protection and rescue system.

- **Formation of a national training center**

  This measure provides for a sufficient number of national training instructors in the field of protection and rescue. Such a center would provide a sufficient number of quality trainings, their continuity, which would increase the level of training and preparedness of members of the protection services.

- **Intensive control of the stakeholder's basic planning documentation**

  In order to monitor the situation in the field of protection and rescue, it is necessary to regularly update the number of human resources, the condition and the amount of equipment, in order to make recommendations for improving the situation.

- **Additional funding measures for the prevention and preparedness phases**

  Such a measure aims to intensify the processes of education of citizens, public propaganda of the importance of protection and rescue, professional training of members of operational units, further improvement of equipment of members of operational units.

EARLY WARNING SYSTEM

In Montenegro, there is an early warning system that primarily deals with potential natural disasters of meteorological and hydrological origin. The Institute of Hydrometeorology and Seismology of Montenegro, which manages this system, uses EFFIS (European Forest Fire Information System) to monitor information about forest fires. EFFIS is a European forest fire information system supported by forest protection services in the European Union and neighbouring countries. It also provides the European Commission and the European Parliament with up-to-date and reliable information on fires in Europe. In addition, EFFIS may include fires that are intentionally caused for vegetation management purposes1. Within this guideline, the following adaptive measures are envisaged:

- **Development of a strategic plan and guidelines.**

  There is no strategic plan, guidelines and procedures for early intervention services in Montenegro. There is also a lack of standards for the personnel who work to provide these services. These are key prerequisites for the establishment of an efficient national early intervention system

- **Increase the capacity to collect data.**

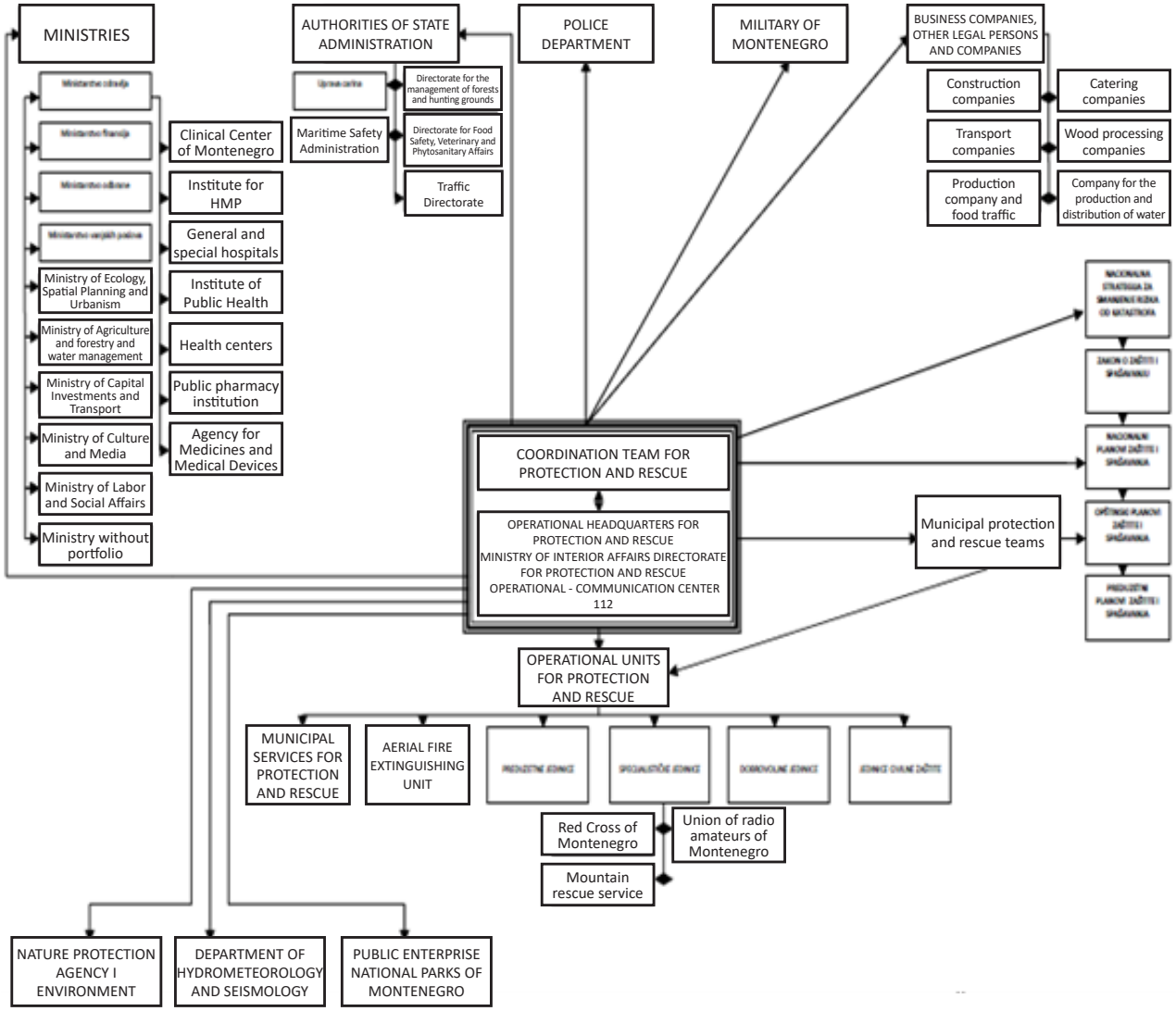
  in order to improve the early information system and timely warning of potential natural disasters, it is necessary to increase the capacity to collect data on weather and seismic conditions

- **Strengthening the professional capacity of institutions**

  This measure includes guidelines for improving the rescue protection system in line with good EU practice models.

- **Regional and international cooperation**

  Intensifying all forms of cooperation at the regional and international level through the exchange of knowledge and experience, through joint initiatives, programs and projects.



Annex 1. *Organisational System Setup:* ***Source of data****: Strategy for Disaster Risk Reduction with the Dynamic Plan of Activities for Implementation of the Strategy for the Period 2018 – 2023*

References

- A., Ishizaka, P. Nemery, (2013). Multi-criteria decision analysis: methods and software, New York: John Wiley & Sons Ltd.
- *Statistical Office – MONSTAT*: Census of population (2011), Census of Agriculture (2010), Statistical Yearbook 2021, Statistical Yearbook 2022
- Bešić M. Zarija (1975) "Geologija Crne Gore". Titograd: Društvo
- Ćurić M., Živanović S. (2013): Dependence between Deficit and Surplus of Precipitation and Forest Fires, Disaster Advances
- D.Stipaničev, B.Hrastnik, R.Vujčić, (2007). Holistic Approach to Forest Fire Protection in Split and Dalmatia County of Croatia, Wildfire 2007 Int. Conference, Sevilla, Spain.
- Goldammer, J.G. (2000): Global transitions of fire and fire management: Retrospectives and perspectives. In: Moser, W.K. and Moser, C.F.(eds.) Fire and Forest Ecology: Innovative Silviculture and Vegetation Management 1-9. Proc. Ann. Tall Timbers Fire Ecol. Conf. 21. Tall Timbers Research Station, Tallahassee, Florida.
- IPCC (2013). Climate Change (2013): The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.
- Mersudin Avdibegović, Gerard Buttoud, Bruno Marić, Margaret Shannon (Editors): "**Assessing Forest Governance in a Context of Change**", IUFRO Proceedings of abstracts, Faculty of Forestry University of Sarajevo, 2012.
- Mersudin Avdibegović, Sead Vojniković, Faruk Bogunić, Saša Kunovac, Alma Hajrudinović, Mirza Dautbašić, Amila Brajić, Besim Balić, Sabina Delić, Senka Mutabdžija, Bruno Marić, Dženan Bećirović: "**Razvoj regulatornih instrumenata šumarske politike – izdvajanje šuma visoke zaštitne vrijednosti (HCVF) na području Š.P.P. "Igmansko**", Šumarski fakultet Univerziteta u Sarajevu, 2013.
- Dževada Sokolović, Muhamed Bajrić: "**Otvaranje šuma**" – Univerzitetski udžbenik; Šumarski fakultet Univerziteta u Sarajevu 2013.
- Sead Vojniković: "**Zaštićena šumska područja u Bosni i Hercegovini**", Šumarski fakultet Univerziteta u Sarajevu 2017.
- Spasovski, M. (1995). Osnovne odlike demografskog razvitka Bosne I Hercegovine od 1918. do 1991. godine. Bosna i Hercegovina od srednjeg veka do novijeg vremena. Zabornik radova. Knj. 12. Istorijski institute SANU. Beograd.
- Institute of Hydrometeorology and Seismology : **Montenegro's first national report on climate change: Montenegro's second national report on climate change: Montenegro's third national report on climate change**
- MONTENEGRO, GOVERNMENT OF MONTENEGRO, MINISTRY OF INTERIOR, Protection and Rescue Directorate of the Ministry of the Interior : **" Montenegro's disaster risk assessment "**
- MINISTRY AGRICULTURE, FOREST AND WATER MANAGEMENT
- **The first national inventory of forests of Montenegro**