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**LANDSCAPE FIRE
MANAGEMENT**

IN THE WESTERN BALKANS

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STRATEGY

FOR

ADAPTIVE LANDSCAPE MANAGEMENT

AND

LANDSCAPE FIRE MANAGEMENT IN REPUBLIKA SRPSKA, BOSNIA AND HERZEGOVINA



LIST OF INSTITUTIONS AND ORGANIZATIONS INVOLVED IN THE PROCESS OF DEVELOPING THE STRATEGY:

- ❖ Directorate for Civil Protection Republika Srpska
- ❖ Firefighters Association of Republika Srpska
- ❖ Institute of Statistics of Republika Srpska
- ❖ Ministry of Agriculture, Forestry and Water Management of Republika Srpska
- ❖ Ministry of Interior
- ❖ Ministry of Spatial Planning, Construction and Ecology
- ❖ Public Forestry Enterprise "Forests of Republika Srpska" a.d. Sokolac
- ❖ Republic Administration for Geodetic and Property-Legal Affairs
- ❖ Republic Hydrometeorological Service
- ❖ Republic Institute for Protection of Cultural, Historical and Natural Heritage of Republika Srpska
- ❖ University of Banja Luka, Faculty of Forestry

LIST OF EXPERTS AND INSTITUTIONS INCLUDED IN THE PREPARATION OF THE STRATEGY:

Preparation and compilation of the report:

Miroslav Rakita - LFMWB Country Project staff in Banja Luka

National supervisor of the process:

Slavko Stupar, Ministry of Agriculture, Forestry and Water Management of Republika Srpska

Expert process support:

Prof. Dr. Nikola Nikolov, Regional expert for landscape fire management, Regional Fire Monitoring Centre (RFMC), with the support of the RFMC Staff

Velian Jagev, Regional coordinator for Landscape Fire Management, Regional Fire Monitoring Centre (RFMC), and Jakob Kiprovski, Junior Associate for Landscape Fire Management, Regional Fire Monitoring Centre (RFMC)

Expert on process for preparation of LFM Strategy:

Aleksandar Karaev

Proofreader:

Elena Jankoska

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LIST OF ABBREVIATIONS

CLC	Corine Land Cover
EFI	European Forest Institute
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization of the UN
FSC	Forest Stewardship Council
GHG	Greenhouse gases
IPCC	Intergovernmental Panel on Climate Change
LFM	Landscape Fire Management
MAFWM RS	Ministry of Agriculture, Forestry and Water Management
MIA RS	Ministry of Internal Affairs
MPiK RS	Ministry of Education and Culture
MPUGiE RS	Ministry of Spatial Planning, Construction and Ecology
MSTDI RS	Ministry of Science, Technological Development and Innovation
MTC RS	Ministry of Transport and Communications
NDCS	Nationally Determined Contributions
NGO	Non- governmental organizations
PFE	Public Forestry Enterprise
RDCP	Directorate for Civilian Protection
RHMZ	Republic Hydrometeorological Institute
RUGIPP	Republic Administration for Geodetic and Property Legal Affairs
RZS	Republic Statistical Office
SPI	Standardized Precipitation Index
ŠPO	Forestry management base document
ŠDS	Forest wood assortments

1. INTRODUCTION

Landscape Fire Management (LFM) is an integrated approach to fire prevention, control and recovery that encompasses the entire ecosystem, social and economic activities, as well as the institutional and legal framework. Unlike traditional, sector-oriented approaches, LFM links forestry, agriculture, environmental protection, spatial management and security, emphasizing the role of landscapes in reducing fire risk and strengthening the resilience of communities to landscape fires. Its goal is to create a balanced system that allows for the prevention and reduction of the negative consequences of fires, while promoting sustainable rural development and preserving biodiversity.

Landscape fires pose an increasingly serious challenge to ecosystems, local communities and public institutions in the Republic of Srpska, especially in the context of climate change and increasingly frequent extreme weather events. Managing these risks requires a holistic and coordinated approach that combines science-based practices, strengthening institutional capacities, active community participation and an adapted legal and planning framework.

The many terms used for landscape fire carry a range of meanings that depend on the socio-cultural context, the nature of the land and vegetation involved, and the legal framework used. Fire is variously referred as forest fire, wildfires, landscape fire, or – using the more widely accepted term in the Western Balkans – “fire in open spaces”, etc. These are just a few of the many terms used by different agencies around the world. In Europe, where many countries suffer from fires on different types of land cover, the terminology currently in use in the European Forest Fire Information System (EFFIS) is “forest fire”; however, due to the spread of fires in non-forest areas of Europe, it encompasses and broadens the term from forest fire. The term “fire” is also used in the Global Fire Information System (GWIS), which aims to provide harmonized information on fire activity and impacts at a global level.

The principles promoted during the meetings of the LFM Network in Republic of Srpska, as well as those integrated into the “Landscape Fire Management Framework” adopted at the 8th International Conference on Forest Fires (Porto, 2023), form the basis of this strategy. Emphasis is placed on education, participation of all relevant stakeholders, improved communication and data exchange, and the development of institutional and technical capacities.

The purpose of developing the Strategy is to provide the basis for establishing a unified and functional landscape fire management system and its integration into Republic of Srpska. The Strategy indicates a legally defined process of development and coordination with stakeholders. The process of developing the Strategy, due to its comprehensiveness, included numerous steps, interest groups, information and data. During the development, in order to define strategic goals and measures, various methodologies were applied, such as classification, induction, deduction, analysis and synthesis, SWOT analysis, survey and interview.

The objectives defined in the strategy are realistic, achievable and result-oriented, making it feasible and effective. Protecting the landscape from fires is no longer just the responsibility of public services, but a shared social responsibility, involving individuals, households, businesses and civil society organizations.

This document lays the foundation for building a functional and inclusive landscape fire management system, focused on long-term sustainability, ecological stability and the well-being of all citizens of the Republic of Srpska.

Terminology:

There is no international consensus on the use of terms related to fire management, and the same terms are often used in different ways. It is, therefore, important to distinguish between key concepts.

Landscape Fire definition in terms of this strategy, is an overarching term for fires burning in vegetation of natural, cultural and urban-industrial landscapes (especially the peri-urban and rural residential areas). The closest term to landscape fire in our region is “fire on open space” which includes uncontrolled burning in forests, other wooded lands, agricultural lands, pastures and other areas with vegetation cover. “Controlled burning” refers to the deliberate and controlled use of fire for the purpose of fuel management.

Landscape Fire Management is a term that includes all measures of prevention, preparedness, suppression and post fire management of landscape fires. The term “Landscape Fire Management” encompasses all activities aimed at protecting forests and other vegetation from fire, as well as the use of fire as a tool in resource management. Finally, “Integrated Fire Management” is a more comprehensive approach that links different types of fire management.

Definition of LFM System: The term LFM system, for the needs of this strategy, includes the organization of all institutions (ministries, agencies, directorates etc.) and civil society organizations (NGOs, professional associations and other stakeholders) at the national level that participates (directly or indirectly) in creation or implementation of the measures for landscape fire prevention, preparedness and suppression as well as the sustainable use of fire in ecosystem/land management.

2. CURRENT STATE ANALYSIS

The purpose of the current state analysis, according to the methodology for developing strategic documents in the Republic of Srpska, is to collect relevant data in order to view the situation from different development perspectives (economic, social, environmental, institutional, etc.) and determine the comparative advantages and potential, i.e. problems and challenges of a certain area or sector. Therefore, the current state analysis includes the development characteristics, challenges and potentials in the field of landscape fire management.

When developing a current state analysis, it is assumed that the analysis is not an end in itself, but a means to arrive at the right questions that the strategic document will focus on and provide an answer to. Consequently, the current state analysis should provide the argumentation and a solid foundation for defining and developing the remaining elements of the strategic platform, and later for developing strategic goals, priorities and measures.

2.1 Overview of the landscape fire management system at the level of the Republic of Srpska

Landscape fire management represents a complex system of organization of institutions, professional bodies and societal actors at different levels, whose tasks are fire prevention, preparedness, suppression and the sustainable use of fire in ecosystems and land management. This system in the Republic of Srpska unifies the legislation and strategic documents of domestic origin with those of international obligations and recommendations, and activities also involve the public, academic community, nongovernmental organizations and the private sector. Strong intersectoral cooperation, knowledge exchange, and coordinated action are very important features of effective landscape fire management that can contribute to better resilience, protection of natural resources, and sustainable development.

2.1.1. International and domestic legislation

The term Landscape Fire Management System, for the purposes of this document, is considered to be the organization of all institutions (ministries, agencies, directorates, institutes, faculties, etc.) and civil society organizations (NGOs, professional associations and other stakeholders) at the level of the Republic of Srpska that participate (directly or indirectly) in the creation or implementation of fire prevention, preparedness and suppression measures, as well as the sustainable use of fire in the ecosystem/land management.

The strategy relies on domestic legislation and strategic planning documents: Spatial Plan of the Republic of Srpska (2013, 2015), Law on Forests (Official Gazette of the Republic of Srpska, No. 75/08, 60/13 and 70/20), Law on Protection and Rescue in Emergency Situations ("Official Gazette of the Republic of Srpska", No. 121/12), Law on Nature Protection (Official Gazette of the Republic of Srpska, No. 20/14), Law on National Parks of the Republic of Srpska, Law on Agricultural Land of the Republic of Srpska, Strategy and Action Plan for the Protection of Biological Diversity of BiH (2015-2020), Nature Protection Strategy of the Republic of Srpska (2011), Strategy for the Development of Agriculture and Rural Areas of the Republic of Srpska (2022), Forestry Development Strategy, etc.

This strategy is significantly influenced by the international environment with its legal documents. Some of these documents have the character of international conventions – multilateral agreements at the global or European level, and as such have the character of obligations. On the other hand, some legal

documents have the character of guidelines or recommendations (so-called “soft legislation”), while some are at the level of recommendations addressed to governments and are therefore not binding.

Also, the principles, recommendations and obligations arising from adopted international conventions, strategies, initiatives and plans, as well as ratified and signed international agreements and declarations, are observed:

- The UN's Global Sustainable Development Goals (SDGs)
- Ministerial Resolutions on the Protection of Forests in Europe MCPFE-process (Strasbourg, 1990; Helsinki, 1993; Lisbon, 1998; Vienna, 2003; Warsaw, 2007; Oslo, 2011; Madrid, 2015, Bratislava 2021)
- UN Framework Convention on Climate Change (1992)
- Directive on the conservation of natural habitats and of wild fauna and flora (1992)
- Convention on Biological Diversity (1993)
- FLEGT regulation (2003)
- UN Convention to Combat Desertification (1994)
- EU Forest Action Plan (2006)
- Bonn Challenge (2011)
- EU Timber Regulation (2013)
- New York Declaration on Forests (2014)
- 2030 Agenda for Sustainable Development (2015)
- Paris Agreement (2015)
- UN Strategic Plan for Forests 2017-2030. (2017)
- European Green Deal (2019)
- Ecological network of endangered species and habitats in the EU (Natura 2000)
- EU policy and regulations in the areas of forestry, environment and rural development
- UN Convention to Combat Drought and Desertification
- SDG Roadmap for the Forestry Sector (2019) and others.

All these documents create a very important legal, organizational and management framework, which should be incorporated into both the strategy and legislation related to the field of landscape fire management. Such an approach stems from the fact that the Republic of Srpska is part of Bosnia and Herzegovina, a state that is in the process of European integration and which, in the process of stabilization and accession to the European Union, has an obligation to base its strategic decisions on and harmonize them with valid international agreements, and to harmonize its legal regulations with European Union law.

2.1.2. LFM stakeholders in the Republic of Srpska

Identifying and analysing the impact of stakeholders on fire management is an important step in implementing sustainable strategies and plans in this area. As a general explanation, stakeholder participation in fire management requires the appropriate identification of individuals, institutions or organizations that can influence the goals of landscape fire management, playing an important role in the pre- and post-fire phases. Various actors, such as the government, public enterprises, local communities, academia, non-governmental organizations and the private sector, are important pillars of increasing the resilience of landscapes.

In the context of fire management, a stakeholder can be described as any entity that can influence and be affected by fire disaster management. According to UNIDSR, there are various actors that have an important role in the disaster management process, such as national and local governments, non-governmental organizations, academia, regional institutions, corporations, the media and, last but not least, local communities, especially those which are most vulnerable. Stakeholders experience or anticipate experiencing harm and benefits from the organization. The most recent definition describes a stakeholder as someone who has input into decision-making, as well as who benefits from the results of decisions made. Stake-

holders have two distinct approaches to fire management at the landscape level, noted as proactive and reactive approaches. Stakeholders respond proactively when they plan and implement activities before a fire occurs, such as prevention, preparedness, and enforcement of protection plans. These activities aim to effectively reduce the number of fires and, if one does occur, to reduce the harmful effects of fires. On the other hand, if the stakeholders' activities are related to responses and recovery of the landscape, they adopt a reactive approach. Although the attitude of stakeholders towards fire management is recognized by two distinct approaches, most studies conclude that stakeholders (actors) tend to solve problems arising from fires with a reactive approach (by forcing suppressive measures over preventive ones). Both national and local authorities in almost all Western Balkan countries are becoming more aware of the need to develop long-term, multi-stakeholder approaches to risk reduction.

However, as suggested by previous studies, local government units in Republic of Srpska lack sufficient knowledge about landscape fire risks and vulnerabilities of their communities, as well as appropriate disaster risk reduction measures and risk programmes at the local level, especially for smaller communities. In other words, disaster response capacities and planning at the municipal levels could be improved.

The stakeholders, or actors, of the current landscape fire management system in Republic of Srpska are the following:

- Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska

The Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska plays a key role in protecting forests in the region. Within its diverse competencies, the Department of Forestry, Hunting and Wood Processing is committed to protecting forests, including, inter alia, measures to prevent landscape fires. The Forestry and Hunting Department performs tasks related to the establishment and implementation of development policies in the field of forestry, management and control of forest and hunting resources, improvement and use of forests, implementation of forest protection measures, preparation of strategic documents, plans and programmes for the management and control of forests and forest land, monitoring the implementation of planning documents, keeping their register, ensuring the implementation of forest inventories on large areas, keeping records and forest cadastres, monitoring the health of forests, monitoring the expenditure of special-purpose funds for forests, professional coordination of tasks related to private forests and support measures for owners of privately owned forests, carrying out general regional forest development and hunting planning, providing information on the market situation for wood and other forest products, cooperation in applied research, implementation standards and knowledge transfer in forestry, promotion of interest groups in the process of planning and sustainable management of forest resources of all forms of ownership, etc. In addition to this sector, other sectors are important factors in this issue.

- Ministry of Spatial Planning, Construction and Ecology (MPUGE RS)

The Ministry of Spatial Planning, Construction and Ecology carries out administrative and professional tasks related to integrated spatial planning and development, development of the spatial information system, construction of facilities and improvement of construction, housing relations and communal activities, as well as integrated protection and improvement of the environment, protection and conservation of nature and waste management. In cooperation with other institutions and relevant stakeholders, it improves the legal and institutional framework while participating in the processes of European integration through projects and funding programmes in the field of spatial planning, construction and ecology.

The competencies of the RS MPUGE are determined by the Law on Republic Administration. The RS MPUGE, inter alia, includes the following tasks:

- Integral protection and improvement of the environment and nature in general;
- Research, planning and management through environmental protection measures;

- Comprehensive protection of goods of general interest, natural resources, natural and cultural heritage, participation in the development and implementation of programme acts at the international and domestic level in the field of environmental protection;
 - Establishing and coordinating professional cooperation and exchange of experiences with international and domestic authorities and organizations and non-governmental organizations in the field of environmental protection;
 - Participation in the implementation of projects financed by international financial organizations in the field of environmental protection;
 - Drafting laws and by-laws within the competence of the Ministry;
 - Participation in the European integration processes through projects and funding programmes in the areas of spatial planning, construction and ecology.
- Ministry of Internal Affairs (MIA RS)

The Ministry of Internal Affairs, through its fire protection inspectors, examines the possible existence of a criminal offense in cases of landscape fires and conducts investigations to determine responsibility. In addition, in accordance with the Law on Fire Protection (Official Gazette of the Republic of Srpska 94/19, Article 19, paragraph 2), the Ministry provides opinions on spatial, urban and regulatory plans, as well as on their amendments and supplements. The Ministry of Internal Affairs also issues authorizations for the preparation of fire protection reports, thereby ensuring that regulations and protection standards are adequately applied in the planning and implementation of infrastructure projects, as well as in other areas susceptible to fire risk.

- Public Forestry Enterprise “Forests of the Republic of Srpska” a.d. Sokolac

Fire protection is an activity of special social interest. Each forest management within the PFE “Forests of the Republic of Srpska” has a special fire protection plan. The fire protection plan includes measures and activities that are undertaken to prevent the outbreak and spread of fire, its detection and extinguishing of fires and the rescue of people and material goods threatened by fire, as well as the obligations and tasks of the Company’s bodies. in this regard. The fire protection plan includes:

- Assessment of the degree of forest vulnerability
- Preventive measures for forest cultivation
- Organizational, material and personnel requirements for the implementation of the plan
- Necessary activities based on the assessment of the degree of forest vulnerability
- Plan of information and propaganda activities
- Staff training plan

The protection of forests and forest land is carried out in accordance with the situation on the ground, laws and by-laws, and according to the Programme of Measures and Activities for Forest Protection, the Plan for the Protection of Forests and Facilities from Fire, and the Operational Plans for Fire Protection.

The Public Forestry Enterprise “Forests of the Republic of Srpska” has received the prestigious FSC (FSC C013091) certificate for forest management. By definition, “FSC certification for forest management” means that forests and forest land are managed in accordance with strict environmental, social and economic standards.

According to the principles of the FSC standard, or the Forest Conservation Guide, high conservation value is defined as “Forests that provide protection against fire”. In principle, it is emphasized that these are forests that can represent a natural barrier to the spread of fire. Although there are no strictly separate

materials for this purpose, the principle of protection and the concept is known in practice and has been applied for many years. The VZV-4a principle defines forests that are important for water supply. In such stands, in addition to other protective functions they perform, there are also sources of drinking water, which are also used for water supply in the event of fire extinguishing. It is very important to mark these sources on the map and apply the protection prescribed by the FSC principles in practice.

The area managed by the Karst Management Centre is extremely specific and as such has a special management method. In the area of Trebinje, Ljubinje, Bileća and Berkovići, the area of forests and forest land is relatively large and amounts to 138,142 ha (forests owned by the Republic) and 35,152 ha (forests in private ownership). Of the total forest area and forest land, high forests occupy only about 3.5%, which is why more attention is paid to their protection. The largest area is occupied by bare and scrub forests, which occupy about 53% of the total area of state forests. Although dense scrublands may have little economic value, they represent the true wealth of the karst. Every bush in Herzegovina is of exceptional importance in purifying the air, binding the soil, preventing erosion and regulating the water regime.

The Public Enterprise “Forests of the Republic of Srpska” as a user of forests and forest land is organized into 26 forest management areas, which are managed by forest farms, one Research, Development and Project Centre (IRPC) and the Centre for the Production of Planting Material in Doboј, as well as the Centre for Karst Management based in Trebinje.

The 2009 Forest Law regulates policy and planning, forest and forest land management, forest protection, forest financing and valuation, forest and forest land cadastre, forestry information system, property and legal relations, as well as other issues of importance for forests and forest land with the aim of promoting sustainable use of forests and forest land and the development of forestry.

The Forest Management Principles establish the basic guidelines and objectives of forest management, measures for improving the condition of forests, preserving and strengthening general forest functions and protecting forests. It contains an overview of the condition of the forest, as well as the type and scope of work during the 10-year management period. The Forest Management Principles are a planning document with a validity period of ten years. Forest holdings are obliged to respect the plans and implementation of the Forest Management Principles and to adhere to the rules for managing forests and forest land prescribed by this planning document.

The Public Forestry Enterprise “Forests of the Republic of Srpska” plays an important role in the fight against forest fires, acting both preventively and directly in suppressing fires. As responsible managers of forests owned by the Republic of Srpska, they use natural forest management methods, such as selective logging, and more recently, afforestation with deciduous species, which contributes to reducing the risk of fires. In the field of prevention, the Public Forestry Enterprise “Forests of the Republic of Srpska” focuses on sustainable forest practices, ensuring the maintenance of healthy and well-managed forests.

In the event of a fire, the “Forests of the Republic of Srpska” are one of the main pillars in extinguishing it. Equipped with experienced firefighting teams and firefighting equipment, they are most often on the front line of fighting landscape fires. Their quick response, coordination with other agencies, and intimate knowledge of the terrain help in effectively containing and extinguishing fires.

By combining its expertise in sustainable forest management and its major role in fire suppression itself, “Forests of the Republic of Srpska” significantly contributes to minimizing the impact of fires in the Republic of Srpska.

- [Republic Civil Protection Administration of the Republic of Srpska](#)

The Republic Civil Protection Administration of Republic of Srpska plays an important role in combating wildfires. As a specialized government body, it is entrusted with coordinating and implementing emergency response measures to protect public safety and the environment during fires.

Through their proactive fire prevention efforts, effective emergency response measures, and collaborative approach, they play a key role in protecting human lives and the environment from the devastating effects of wildfires.

- Firefighters' Association of the Republic of Srpska

The Firefighters' Association of the Republic of Srpska is a social, non-governmental organization, which was established to achieve the common goals of professional fire departments, fire departments and business companies from the territory of the Republic of Srpska, in the implementation of fire protection goals and activities in accordance with the Law on Fire Protection and the Law on Protection and Rescue.

The Firefighters' Association of the Republic of Srpska has the status of a legal entity, as well as the status of an association of public interest for the Republic of Srpska.

- Republic Hydrometeorological Institute (RHMZ RS)

The Republic Hydrometeorological Institute is the competent institution responsible for a number of important functions related to monitoring the weather, climate and environment in this area. The Republic Hydrometeorological Institute of the Republic of Srpska is part of the Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska and is an administrative organization the Republic of Srpska, whose jurisdiction is regulated by the Law on Republic Administration. The Republic Hydrometeorological Institute of the Republic of Srpska performs professional tasks that, among other things, relate to:

- Establishment, maintenance and development of the meteorological and hydrometeorological observation, telecommunication and analytical-prognostic system of the Republic; systematic meteorological, climatological, agrometeorological and hydrological measurements and observations, implementation of monitoring of air quality, emissions into air and water;
- Establishing and maintaining a bank of observed and measured hydrological and meteorological data and data on air and water quality, permanent storage and publication of data;
- Monitoring, researching, analysing and forecasting the state and changes of air and water, and issuing hydrological and meteorological analyses, forecasts and warnings about the occurrence of atmospheric and hydrological disasters and catastrophes;
- Connecting the Republic with international hydrometeorological information systems, international data exchange and the implementation of other international obligations in the field of meteorology, hydrology and environmental protection.

The RS Meteorological and Hydrological Service consists of three sectors: the Meteorology Sector, the Hydrology and Environmental Protection Sector and the Seismology Sector. Within the Hydrology and Environmental Protection Sector, the Environmental Protection Department is responsible for establishing and managing air quality monitoring in the Republic of Srpska, monitoring air emissions, preparing an inventory of greenhouse gases, an inventory of unintentionally released long-lasting organic pollutants, an inventory of emissions according to UNECE/CLRTAP, establishing and maintaining the Register of Installations and Pollutants, establishing and maintaining an air quality information system and exchanging data with the European Environment Agency (EEA) and the European Information and Observation Network (EIONET).

- Republic Administration for Geodetic and Property Legal Affairs

The responsibilities of the Republic Administration for Geodetic and Property Legal Affairs cover a wide range of duties, including land surveying, land classification, property rights management, cadastre maintenance, and supervision of property-related legal affairs. Furthermore, it has a role in ensuring the effective implementation of land-related policies and regulations, as well as a role in property disputes in the territory of the Republic of Srpska.

- Statistical Office of the Republic of Srpska (RZS RS)

The RS Statistical Office is an administrative organization of the RS within the Ministry of Finance of the RS, whose competence is regulated by the Law on Republic Administration and the Law on Statistics of the Republic of Srpska. The mission of the Statistical Office is to provide reliable, high-quality, comprehensive, timely and internationally comparable statistical data, which meet the requirements of decision-makers, researchers and other domestic and international users, while simultaneously presenting the state and changes in the economic, demographic and social areas, environmental protection and natural resources.

The RS Statistical Office performs professional tasks related to the production of statistical data, as follows:

- Preparation, collection, storage, processing, analysis and distribution of statistical data based on a unified methodology and unified statistical standards;
 - Keeping, maintaining and developing administrative and statistical registers and building a statistical information and communication system, and
 - Database management.
- National parks of Republic of Srpska: Kozara National Park, Drina National Park, Sutjeska National Park

Republic of Srpska, a region known for its natural biodiversity, is home to three exceptional national parks: "Kozara", "Sutjeska" and "Drina". National parks are areas with a large number of diverse natural ecosystems, prominent landscape features and cultural heritage in which man lives in harmony with nature, intended to preserve existing natural values and resources, overall landscape, geological and biological diversity, as well as to meet scientific, educational, spiritual, aesthetic, cultural, tourist, health and recreational needs and other activities in accordance with the principles of nature protection and sustainable development. The total area of these three national parks is 26,275.20 hectares.

- Association of Agricultural Producers of the Republic of Srpska

Operating on more than one million hectares of agricultural land in Republic of Srpska, agricultural producers' associations serve as important pillars in the agricultural community in the region. With a broad network of livestock breeders and farmers, these associations lead initiatives to improve agricultural productivity, ensure sustainable land management, and promote modern agricultural techniques.

- Inspectorate of the Republic of Srpska

The Republic Administration for Inspection Affairs performs inspection, administrative and other professional tasks of inspection supervision over the applied regulations, which, among other things, relate to: phytosanitary area and area of primary plant production and agriculture; forestry, hunting; water, geology, spatial planning, urbanism, construction, ecology, geodetic; protection against fire, explosive substances, flammable liquids and gases, and giving consent to the appointment of inspectors of local self-government units and direct supervision over their work, as well as the drafting of legal regulations.

- Faculty of Forestry

The Faculty of Forestry of the University of Banja Luka is a higher education institution with a long tradition, good teaching and administrative staff. The faculty was established in difficult, wartime conditions, but it very successfully educates experts in the field of forestry. At the same time, the faculty provides the necessary knowledge for scientific research in various areas of modern forestry science.

The Faculty of Forestry in Banja Luka is included in the network of scientific and research centres, which were established under the auspices of the International Forestry Institute – EFI (European Forest Institute), based in Finland, with the aim of promoting projects in the field of forestry policy and economics.

- Republic Institute for the Protection of Cultural, Historical and Natural Heritage

In accordance with Article 57 of the Law on Republic Administration ("Official Gazette of the Republic of Srpska", No. 118/08), the Republic Institute for the Protection of Cultural, Historical and Natural Heritage performs administrative and other professional tasks related to: determining, recording, researching and evaluating real estate, movable property and parts of nature that enjoy prior protection, determining the properties of cultural, historical or natural heritage, declaring a property protected, maintaining a central register of protected properties, developing projects for the restoration, reconstruction and conservation of cultural, historical and natural heritage, granting consent to expert reports for reconstruction and restoration work on protected properties and their adaptation and revitalization, developing expert reports on the protection and use of properties in the process of developing spatial and urban plans, issuing approvals for the temporary export of protected goods abroad, issuing approvals for archaeological and other research, conditions for the use of protected goods, professional supervision over the work of protection organizations, publishing activities, publishing professional papers and publications, coordination and implementation of projects, professional training, cooperation with bodies and organizations in the field of protection and with users or owners of cultural, historical and natural goods for the purpose of their protection and other activities in accordance with the law. The Republic Institute for the Protection of Cultural, Historical and Natural Heritage is part of the Ministry of Education and Culture of the Republic of Srpska.

- Non-governmental organizations

The civil sector plays a key role in improving the state of the environment and nature. Various activities, such as environmental events, workshops, forums and seminars, demonstrate the significant participation of non-governmental organizations in national efforts to protect nature and the environment. Equally important is their role at the international level, through participation in events that have a special significance for these topics. The contribution of the non-governmental sector to nature protection is particularly noteworthy, with a focus on activities aimed at promoting and raising public awareness of nature protection from fires at the regional level, as well as the work of individual professional organizations to improve scientific databases and fire management.

The stakeholders at different levels, such as republican, regional and local, can make important differences in the outcome of fire management. Understanding, engaging and coordinating these actors at multiple levels – from government authorities and public enterprises to local communities, academia, NGOs and the private sector – is considered crucial for enhanced landscape resilience. While there is every encouragement for a proactive approach toward landscape fire management, present trends are more toward being reactive; thus, the need for awareness and capacity building, with long-term multi-stakeholder planning, becomes even more important.

2.1.3. Public awareness and education

Public awareness and education are important elements of this landscape-based fire management strategy. Awareness campaigns, stakeholder workshops, and educational materials empower individuals and communities to understand fire risks in their environment, adopt fire protection measures, and actively participate in creating more resilient landscapes. Educational programmes tailored to different target groups, such as private forest owners, farmers, students, schools, etc., increase fire preparedness and emphasize the importance of ecosystem vitality in fire management strategies.

Public awareness and education are fundamental for reducing fire risks and fostering resilient landscapes. Targeted educational programmes, campaigns and stakeholder workshops empower communities and individuals to adopt preventive measures and understand the ecological importance of landscape fire management. Strengthening engagement with younger generations, rural populations and professional

sectors will support sustainable workforce development and enhance the effectiveness of landscape fire management strategies.

2.1.4. Research related to LFM

Research and innovation are key drivers for achieving the strategic goals of landscape fire management (LFM) in the Republic of Srpska. While climate change is increasing the frequency and intensity of fires, there is still limited local research capacity to comprehensively address fire behaviour, ecosystem impacts, and socio-economic factors. Strengthening national research capacities is therefore essential to support preventive measures, fire suppression strategies, and adaptive landscape management.

Several institutions in the Republic of Srpska can lead or support such research. Key actors include the University of Banja Luka and East Sarajevo (Faculty of Forestry, Faculty of Science, Faculty of agriculture), the Republic Hydrometeorological Service, the Public Enterprise “Šume Republike Srpske,” and research institutes such as the Institute for Protection and Ecology in Banja Luka. Non-governmental organizations and think-tanks active in environmental protection, rural development or landscape fire management (e.g., local environmental NGOs, regional initiatives such as RFMC) can provide additional expertise, facilitate stakeholder engagement and promote the transfer of knowledge from global best practices to the local context. Collaborative networks with universities, research institutions, and regional LFM actors enable access to advanced methodologies, data, and innovation.

The integration of research results into practical LFM is critical. Scientific findings should inform all four main phases of fire management: prevention (e.g., identifying fire-prone landscapes and promoting adaptive land-use practices), preparedness (e.g., designing risk maps and early warning systems), suppression (e.g., guiding fire suppression tactics and resource allocation), and post fire management (e.g., informing ecological restoration and post-fire monitoring). Research can also underpin risk assessments, landscape vulnerability analyses, and the development of evidence-based policies and action plans, ensuring that LFM strategies are both context-specific and scientifically grounded.

Investing in local research not only strengthens capacity to manage wildfires but also enhances ecosystem resilience, supports climate adaptation, and fosters sustainable management of forest and agricultural landscapes. Public engagement, stakeholder workshops, and regional collaborations are critical for translating research findings into actionable strategies and ensuring long-term societal benefits.

2.1.5. Intersectoral cooperation

Intersectoral cooperation is a continuous process that, in addition to time, requires significant investments of human and material resources. It should be emphasized that there is no universal model of intersectoral cooperation, and that cooperation in the case of landscape fire management must fully respect the specificities of the given problem and area, while also reflecting the needs of all relevant stakeholders.

In the context of a fire management strategy, intersectoral cooperation implies active coordination between institutions responsible for forestry, agriculture, water management, environmental protection, civil protection, scientific institutions, non-governmental organizations and local communities. This includes joint planning, data exchange and the integration of different sectoral policies, with the aim of creating synergy in prevention, preparedness and response to fires. The involvement of scientific and research institutions, NGOs and economic entities operating in rural areas is particularly important for knowledge transfer, innovation uptake and community-based activities.

To ensure that cooperation is translated into practice, several concrete coordination mechanisms will be established:

- A formal coordination body at the entity level (e.g., an intersectoral LFM Coordination Committee) responsible for strategic oversight, annual planning and review of intersectoral activities.

- Operational coordination mechanisms, such as joint field inspections, multi-agency response protocols and regular inter-agency meetings before and during the fire season.
- Shared data and planning platforms, including a central GIS-based information system integrating forestry, agriculture, hydrology, meteorology and fire incident data to support joint risk assessments and operational decision-making.
- Funding and programmatic instruments, such as co-financed prevention projects, coordinated grant schemes for rural communities and integrated training programmes supported by multiple sectors.
- Local engagement mechanisms, including municipal-level coordination groups, community fire management committees and participatory planning workshops with residents, volunteer firefighters and local businesses.

Only through this type of structured and operationalized cooperation is it possible to build a functional and resilient landscape fire management system that contributes simultaneously to safety, sustainable development and climate change adaptation.

2.2 Landscape fire management and the environment.

2.2.1 The protective role of landscapes

“A landscape is an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors.” (European Landscape Convention).

From an environmental protection aspect, the basic feature of the situation in the Republic of Srpska includes a comparatively high level of threat for all elements of the environment, which involves negative tendencies in natural resource management. Landscape Fire Management is an approach that connects the prevention, control, and rehabilitation of landscape fire in an integral way, including the whole ecosystem with all social and economic activities, as well as the institutional and legal framework. In contrast with the traditional, sector-oriented approaches, LFM connects forestry, agriculture, environmental protection, spatial planning, local communities and security, accentuating the role of the landscape in the reduction of fire risk and strengthening the resilience of communities to landscape fires.

The structure, composition and visual configuration of the landscape itself are some of the most determining elements of landscape fire risk. Large areas of abandoned agricultural land, overgrown vegetation and unmanaged shrublands create continuous fuel carpets that enable rapid fire spread. Similarly, large areas of single-species coniferous monocultures – especially on dry, shallow soils – represent landscapes with high fuel loads, low moisture retention and elevated flammability. Fragmented ownership and lack of land management accelerate the build-up of combustible biomass.

Addressing these risks involves the creation of fire-resilient landscape mosaics. Such landscapes integrate ecological diversity with controlled land use and planned spatial arrangements designed to break fuel continuity, thereby reducing the possibility of large, intense fires. Examples of good practice include:

- Increasing the share of broadleaved forests, with species of high moisture content and lower flammability, such as beech, oak, or hornbeam, to act as natural fire buffers between conifer stands or shrublands.
- Conversion of pure stands of conifers to mixtures, with the progressive introduction of broadleaf species at regeneration to reduce fuel flammability and enhance ecological stability.

- To maintain the land in an active agricultural use by providing incentives for grazing, mowing, and cultivation, preventing the accumulation of dry biomass and reducing the spread of fire across open lands.
- Create landscape discontinuities like fuel breaks, managed forest edges, silvopastoral areas, orchards, or vineyard strips that act as barriers to fires and slow their advance to allow safer suppression operations.
- Restoring traditionally managed landscapes, including pastures and extensively used rural areas that have historically maintained lower fuel loads and provided natural fire mitigation features.
- Applying strategic vegetation management around settlements, infrastructure corridors, and cultural heritage sites to guarantee a defensive space which will safeguard vulnerable assets.

Integrate landscape planning into the spatial plan and the forest management plan by considering fire risk reduction and preserving landscape functions related to resilience in future land uses. By shaping landscapes in this manner – diverse, discontinuous, and actively managed – significant landscape fire hazard reduction can be accomplished; ecological integrity can be supported; and communities and ecosystems can be better positioned to deal with the challenges posed by climate change.

2.2.2 Biodiversity conservation

The territory of Republic of Srpska (as part of Bosnia and Herzegovina) is treated in international and domestic literature as a geographical area with the highest level of biological diversity in Europe. Based on literature references on previous vegetation research, over 250 different plant communities have been described in the territory of Bosnia and Herzegovina – more precisely 252 ecosystems (United Nations Economic Commission for Europe) (UNECE 2018). According to USAID report (2020) for everything about very important biotopes from European and global perspectives conservation, but their status is unknown, because there is no monitoring system. In accordance with the Habitats Directive (Directive 92/43/EC), the area of Europe is divided into 11 biogeographic regions. According to this classification, due to its geographical position, the Republic of Srpska (BiH) is located in three biogeographic regions: continental (northern part), alpine (central part in the northwest-southeast direction) and Mediterranean (southern part). However, a major deficiency in today's knowledge of the ecosystem diversity of the Republic of Srpska is the lack of an ecosystem map (vegetation map).

The richness of habitat diversity in the territory of the Republic of Srpska has been confirmed by data from the CORINE land cover (CLC), as well as typification and analyses of habitat diversity. Data indicate that, within the territory of the Republic of Srpska, 28 classes can be identified (compared to 31 in Bosnia and Herzegovina) out of the 44 classes defined at the third level of the CORINE Land Cover Nomenclature across Europe. Analysis has established that 61.07% of the territory of Bosnia and Herzegovina is covered with forests and other natural vegetation, while 36.70% consists of agricultural land. Artificial surfaces account for 1.48%, water surfaces for 0.66%, and wetlands for 0.10%.

According to preliminary data published on the "Nature Protection of the Republic of Srpska" website (Faculty of Forestry, University of Banja Luka, 2011), 191,287 records have been documented, covering 3,697 higher plant species and subspecies (as of May 29, 2024). In their study, Stupar et al. (2021) registered 3,692 plant taxa in the territory of the Republic of Srpska, of which 131 taxa are mentioned for the first time in this area. The fauna is also characterized by a high level of biological diversity. Unlike plant species, many animal species have been recorded at the level of BiH without a clearly defined range of movement or occurrence, which makes knowledge about animal diversity in the Republic of Srpska very scarce.

In accordance with the current legislation, the protected area of the Republic of Srpska amounts to 73,038 hectares, which is 2.96% of the territory. This percentage is far below the European average. Currently, 34 areas are protected: two strict nature reserves (Ia), three national parks, 17 natural monuments, three protected habitats, six nature parks and three resource management areas. Two categories (II – national parks and V – protected areas) occupy the largest areas under protection, while the other categories (I – strict nature reserve, III – natural monument, IV – protected habitat and VI – area for sustainable use of natural resources) occupy a smaller area.

The Republic of Srpska has 3 protected areas based on international agreements and conventions. One is a Ramsar site (Bardača Wetland Reserve), the second is a UNESCO natural resource of world importance (Janj Rainforest), while the third area is on the UNESCO Tentative List.

The Spatial Plan of the Republic of Srpska until 2025 and the Nature Protection Strategy of the Republic of Srpska (2011) define the operational objectives and the concept of development of the conservation and protection of biological diversity, areas of characteristic flora and fauna and areas of protected natural assets. According to the Habitats Directive (92/43/EEC of 21 May 1992), the Republic of Srpska is located in three biogeographic regions: continental (northern part), alpine (central, Dinaric part) and Mediterranean (southern part). Phytocoenoses at the level of BiH are classified into 66 classes, however, it is not clear how many of them are present in the Republic of Srpska. Also, there is no classification of habitats of lower categories that could be used in practice. Species diversity has been estimated or inventoried at the level of the entire Republic of Srpska, and it remains unknown how many species are related to forest ecosystems. The autochthonous vascular flora of the Republic of Srpska numbers around 3,700 species and subspecies. The number of mosses has been estimated at 565 species, algae at 2,000 species, while the diversity of fungi is potentially very high. Zoological diversity has been estimated at: 119 species of fish, 20 species of amphibians, 38 species of reptiles, 326 species of birds, 85 species of mammals, while various groups of invertebrates are extremely diverse (Report of BiH to the UN Convention on Biological Diversity, 2010).

The territory of the Republic of Srpska contains primary gene centres for a large number of endemic and endemic-relict species, among which the Pančić spruce (*Picea omorika* Pančić/Purk) should be highlighted. The forest resources of the Republic of Srpska abound in numerous ecotypes, varieties, forms and other forms of polymorphism, which are significant factors for the preservation of species adaptability (Isajev and Tucović, 1997; Isajev et al. 1997; Mataruga, et al. 2000; 2005).

According to the Spatial Plan of the Republic of Srpska by 2025, operational objectives and concepts for the development and protection of biological diversity, areas of characteristic flora and fauna, and the protection and preservation of protected natural assets have been defined. The Regulation on Strictly Protected and Protected Wild Species strictly protects 292 (597) species of vascular plants, 7 (11) species of fungi, 1 leech, 4 species of snails, 4 species of crustaceans, 13 (6) species of insects, 31 (20) species of fish, 9 (4) species of amphibians, 10 (9) species of reptiles, 314 (28) species of birds and 42 (24) species of mammals.

Forests as the largest centre of biodiversity

Forests are biologically very diverse and among the richest of all terrestrial ecosystems. They are not only important habitats for many plant and animal species; they also have key abiotic functions. For example, forests act as a crucial climate change buffer. Forests are a significant factor in the water cycle in the atmosphere. They regulate the water regime by increasing infiltration, reducing runoff and protecting against floods, thereby influencing the quantity of water, which is of crucial importance for the supply of watercourses in mountainous areas. Forest ecosystems are the best natural biofilters, playing a crucial role in protecting and improving water quality.

The forests of Republic of Srpska represent the largest centre of biodiversity, but they are under great pressure due to the increasing demand for forest timber, construction land and other resources. These factors lead to the degradation of forest ecosystems, which threatens their ability to support biodiversity.

Forestry status:

- The planning and management of the RS forests is not aligned with its multipurpose (ecological, economic and social) functions.
- The state of the forest fund in terms of the structure of areas, stocks and growth is not in line with the natural potential of the forest ecosystem.
- The available potential of the forest ecosystem is not used purposefully and efficiently.
- Optimal biological balance, openness to communications, and sustainable use of the forest ecosystem for the purpose of environmental protection have not been established.
- There is no global system for monitoring and evaluation of the state of forest protection from plant and other diseases, nor for assessing the impact of climate change.
- The system for educating forestry personnel and conducting scientific research has not been developed in line with the needs of forestry's functioning and sustainable development.
- The financing system in forestry is not in line with the needs of sustainable development of this multipurpose activity.
- In state forests, the share of noble broadleaf and fruit trees has decreased by 6%, and the volume growth is lower by as much as 63%, which negatively affects the overall forest growth.
- There is no habitat classification or habitat type map, which makes it difficult to monitor and manage forest ecosystems.
- Although there is a list of vascular flora, an inventory of plant and animal species has not been conducted, nor is there an inventory of the genetic variability of woody species.
- Species or habitat monitoring is not conducted, and invasive species and their presence in forest ecosystems are not sufficiently researched, which means that there are no management plans for these species.
- There is a lack of programmes that would link the state of biodiversity to climate change, as well as strategies for adapting to and mitigating the impacts of climate change on species and ecosystems.
- The ecological network has not been fully established, nor have forest areas that could be part of that network been identified.
- There is a lack of knowledge about rare, endemic, protected and endangered species and habitats in forest ecosystems.
- Although individual forest management companies have proposed certain areas as forests of high conservation value, they have not been formally legally declared, and the distribution is uneven, with over 90% of areas having a protective character.
- Openness to forest roads is significantly below the European average (below 10 m/ha)
- The karst area is often exposed to fires and has only been successfully afforested in places, and due to the difficult conditions for afforestation, large areas have been left to overgrow with indigenous vegetation.
- In addition, in recent years, there have been increasing incidences of certain types of harmful insects, which significantly reduce the vitality of forests. These phenomena, combined with increas-

ingly frequent droughts, further reduce the ability of forests to naturally regenerate, causing stress, which reduces their resistance to disasters, including fires.

These challenges require urgent measures to protect and restore forest ecosystems to ensure the long-term conservation of biodiversity in the Republic of Srpska.

2.2.2.1 Other factors that threaten biodiversity

One of the immediate effects of fires is the loss of plant species. Many plant species in our country have adapted to specific environmental conditions and may not be resilient enough to survive frequent fires. Loss of vegetation can lead to erosion and soil degradation, making it difficult for the land to recover. In addition, invasive species can take advantage of the disturbed environment, outcompeting native species, further altering the ecosystem. Fires have a significant impact on wildlife. Many animals are unable to escape rapidly spreading fires, leading to population declines. Those that survive may find their habitat altered or destroyed, forcing them to migrate or face increased competition for limited resources. For example, birds may lose nesting sites, while mammals and reptiles may struggle to find food and shelter. This disturbance can lead to changes in species composition and abundance, which can lead to the loss of key species that play a crucial role in ecosystem functioning.

Aggravating circumstances and problems in the area of biodiversity conservation, which negatively affect progress in this area, are:

- an insufficiently developed system of organized data collection and monitoring of the spatial and temporal organization of the overall biological and landscape diversity, as well as their heterogeneity in terms of scientific and professional level,
- insufficient human and technical capacity of competent institutions to implement existing laws and international conventions in the field of biodiversity management, and
- unsatisfactory implementation of measures and identified methodologies for the development of an effective system for the protection of biological and landscape diversity.

Waste and illegal landfills

The state of waste management in the Republic of Srpska, especially the large number of illegal landfills and unsecured waste sites, poses a significant risk in the context of landscape fire management. Improperly disposed municipal and organic waste creates a high accumulation of combustible material, which increases the likelihood of fire occurrence and rapid spread, especially in peripheral and rural areas. This applies not only to the waste itself but also to its proximity to forests, agricultural areas and settlements, which poses a direct risk to the safety of people, property and infrastructure. In the past period, a higher number of fires at landfills, as well as fires that spread from illegal landfills, have been recorded.

In the LFM context, waste management is seen as one of the preventive mechanisms for reducing fire risk. Regionalization of landfills, improvement of sanitation capacities and systematic involvement of municipal companies in separate waste collection and treatment contribute to the creation of safer and less fire-vulnerable areas. Reducing the number of illegal landfills directly affects the reduction of fuel material available for uncontrolled fire spread and enables easier implementation of LFM measures such as the formation of firebreaks, maintenance of access roads and controlled management of areas.

This way, the integration of waste management into the LFM strategy represents a preventive instrument that not only protects the environment and human health, but also strengthens the resilience of communities to fire risks. The successful implementation of these activities depends on the coordination of relevant institutions, local governments and municipal enterprises, as well as on the establishment of financially sustainable regional waste management systems. Systemic waste management and the

remediation of illegal landfills should be integrated into the LFM as a preventive measure, as it directly reduces combustible materials in rural and peri-urban areas, supports the formation of safe and resilient landscapes and enables the effective implementation of preventive and operational fire management measures.

Mine-hazardous areas

Mined areas pose a significant risk in the context of landscape fire management because they prevent access for firefighters, making timely intervention and fire control difficult. Unplanned spread of fire in these territories can lead to the detonation of explosive devices, which further endangers human lives, infrastructure and the environment. In addition to the direct danger, mined areas often remain neglected and without maintenance, which increases the accumulation of combustible material and therefore susceptibility to the outbreak and spread of fires. Mine-hazardous areas in Republic of Srpska cover 194.76 km², which represents 20.12% of the total hazardous area in BiH.¹ These territories, as well as 2,429 registered hazardous micro locations and 507 endangered communities, represent a serious barrier to the implementation of landscape fire management measures and an integrated LFM approach. Access to the terrain in these areas is limited or impossible, which prevents preventive activities such as the formation of fire belts and maintenance of access roads. In the context of fire, mine-hazardous areas are treated as constraints that directly affect the spatial and operational effectiveness of fire risk management. In addition, the presence of UXO increases the risk to people conducting interventions, making an integrated approach that combines mine action and fire management necessary. Mine-hazardous areas represent a significant limitation to the effective implementation of LFM measures, but their inclusion in strategic planning, in coordination with mine action activities, enables safe fire risk management and the gradual return of these areas to sustainable and safe use.

2.3 LFM and climate change

Climate and its influence play an important role in fire risk. Many authors (Pyne et al. 1996, Flannigan and Wotton 2001, M. Flannigan et al. 2009, Živanović 2010, Allen CD et al. 2010, Xystrakis et al. 2013) suggest that fire occurrence depends on climate and fuel moisture content. Martin et al. (2001) believe that fire is closely related to climate. The greatest fire risk occurs during the warm months, when air temperatures are high and the moisture content in the air and fuel is low (Živanović 2014).

Analyses show that there is a change in the frequency, intensity, spatial distribution and/or duration of weather and climate extreme events, primarily climate and hydrometeorological events such as: heat waves, droughts, intense precipitation events, fires, storm surges and tropical cyclones (Intergovernmental Panel on Climate Change 2013; Hao et al. 2018).

The climate of the Republic of Srpska is determined by basic climatic factors – geographical location, geological base, relief, proximity to the Mediterranean and vegetation cover. In addition to these basic factors, meteorological factors also play a significant role, which significantly affect the climate of the Republic of Srpska. Within the general circulation of the atmosphere over the Balkans, and therefore over the Republic of Srpska, there is a frequent change of polar and tropical air masses, in the winter and the influx of cold Arctic air. It takes place under the direct influence of synoptic systems, cold and warm fronts, cyclones from the Atlantic, from the Mediterranean and Adriatic Seas and anticyclones in the summer, most often from the Azores, and from central Europe and Siberia in the winter.

Based on an analysis of meteorological data for the 1961–2014 period, the average annual air temperature has shown a continuous increase across the territory Republic of Srpska, which is especially expressed

¹ Mine Action Strategy of BiH 2009–2019

in the last 30 years and that in continental part. Increase temperatures air on annual level is moving everything from 0.4 °C to 1.0 °C, while growth temperatures during vegetation period amounts up to 1.2 °C. Of the ten warmest years in the 1961-2015 period, nine years were recorded after 2000. A large part of the territory of the Republic of Srpska is characterized by a slight increase in annual precipitation and a disturbed pluviometric regime, that is, the annual distribution precipitation. Because of increased intensity of precipitation and the significant share of heavy rainfall in total precipitation, the risk of flooding has risen, especially in northeast part Republic. In preparing the fourth national report (Fourth National Communication, FNC) in accordance with the UN Framework Convention on Climate Change, a projection of the future climate for Bosnia and Herzegovina was made, based on different scenarios.

The considered scenarios of future concentrations are the RCP2.6, RCP4.5, RCP6.0 and RCP8.5 scenarios defined in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). According to global climate models (by 2035), the RCP2.6 model is projected to maintain the current increase in temperature of +1.3 °C; the RCP4.5 model to increase +2.4 °C; the RCP6.0 model to increase +2.9 °C, while for the RCP8.5 climate scenario, which represents the most extreme climate scenario, the expected change in the average daily temperature is 4.8 °C, with a range of 4 to 6 °C compared to the reference 1986-2005 period. Changes in total annual precipitation compared to the reference period show that for all four scenarios, changes from -5 to +5% are possible, and more pronounced differences can be expected under the RCP 8.5 scenario in the second half of the 21st century (-4 to -15%). According to current climate change trends, in areas with a "Mediterranean type" climate, a decrease in rainfall of about 17% is expected. Increased heavy rainfall causes greater erosion and flooding, and in areas with lower rainfall, a greater risk of drought and fire is expected. A significant drop in groundwater levels in the northern part of the Republic will affect the spatial distribution of lowland forests. As a result of climate change, woody species are expected to migrate towards the north and south poles and to higher altitudes, and some of the more sensitive species may disappear. Species with narrow ecological niches may be displaced to the edges of their habitats, causing other species to become more dominant.

Even though in more than 95% of cases, fire in the Republic of Srpska is brought on by humans, the accentuation of climate change – through longer and stronger droughts – is raising the level of fire danger indices in conditions whereby even small ignitions develop into a landscape-scale fire. In such a context, it's increasingly necessary that LFM to focus its attention on reducing the likelihood of ignition through behavioural prevention, while adapting the landscape to more frequent and severe droughts.

Areas of eastern Herzegovina and mined forest lands are the most susceptible. Within these zones, long-term summer droughts drastically lower vegetation moisture, so that natural and abandoned rural landscapes alike become highly flammable. In areas with mines, vegetation management or fuel-reduction interventions cannot be carried out; hence, standard LFM measures are not applicable, increasing the importance of remote sensing monitoring, fire-smart planning, and early-warning systems that compensate for limited on-ground access.

The most severe impacts of fire are manifested in mountainous areas with higher altitudes and in Mediterranean and sub-Mediterranean zones, where steep topography, dry winds, and dense conifer vegetation can rapidly spread fires and impede suppression operations. For LFM, this underlines the need to develop landscape discontinuities, diversify forest composition, and include topographic fire modelling into planning processes with the aim of identifying priority areas where prevention and preparedness effort should be focused.

Insect outbreaks are also becoming more frequent, as populations of bark beetles and other pests respond sensitively to warmer and drier conditions. These disturbances serve as early indicators of declining ecosystem resilience. Moreover, insect-damaged stands accumulate dead and dry biomass, significantly increasing the fuel load. For LFM, such disturbances require tighter integration of forest health monitoring, sanitation felling, and prioritization of high-risk stands in prevention programmes.

Extreme weather events, such as heatwaves, strong winds, dry lightning or prolonged drought, further degrade forest stability, reduce timber quality and complicate operational work. These conditions also increase the risk of ignition and intensify the spread of fires. Within LFM, this requires adaptive management through flexible operational planning, climate-responsive silviculture and enhancing fire suppression capacity that reflects the new intensity of climate-driven extremes.

Drought as a meteorological phenomenon develops slowly, covers wider areas and leaves far-reaching consequences for the population, economy and landscapes. It used to be mainly associated with climate types and areas that traditionally have very little precipitation. In the last 50 years, drought has become increasingly common in temperate latitudes of Europe. In industrially developed countries, drought has a different character of consequences, which relate more to the socio-economic aspects of life. The more frequent occurrence of drought in the last decade is seen as a sign and consequence of climate change. Climate projections for the next 10 to 30 years indicate that the problem of drought will be even more pronounced. Republic of Srpska has not been spared from this. Severe droughts have socio-economic consequences, so the population that lives from agriculture is endangered, the economy is affected (agriculture and hydropower), the environment, and rivers dry up, leading to a shortage of drinking and technical water.

The application of adaptive landscape management can significantly reduce and mitigate the negative consequences of these impacts. Climate change has a positive impact on the economy when forest productivity increases in areas with sufficient rainfall (spruce forest belt), which would result in faster growth rates and migration of more productive species to these habitats. However, forest productivity is expected to decline in the coming period, and floods, storms and fires will cause significant financial damage to forestry. Climate change affects: fragmentation of forest habitats, range of tree species, shifting boundaries of forest types, frequency of damage from biotic and abiotic factors, change in tree phenophases, reduction of forest functions, decline in quality, increase in the number and intensity of forest fires, which has major biological, ecological, social and economic consequences for forestry.

Fire is a natural ecological process and an important anthropogenic tool that significantly impacts ecosystems, water supplies, carbon budgets, and society as a whole (Abatzoglou et al. 2019). Globally, fires are a major source of carbon from the terrestrial biosphere to the atmosphere (Ward et al. 2018). They occur in seasonal cycles and with significant interannual variability (Ward et al. 2018). Global biomass burning is a source of approximately 2.5 Pg C to the atmosphere per year, making fires a major component of the terrestrial carbon budget and an important contributor to atmospheric greenhouse gases and aerosols with associated climate impacts (Ward et al. 2018).

The increase in the extent of burned areas has been well documented in some parts of the world over the past half century, indicating a significant impact of changing climate conditions and increased temperatures on fire activity when other factors, such as biomass abundance, are not limiting. Increases in the frequency and severity of fires have been observed in many parts of the world over the past half century (Abatzoglou et al. 2019). The results of their modelling, which aimed to identify where and when anthropogenic climate change causes weather-driven fires to exceed natural variability, show that this is already happening in a significant part of the world, including much of southern Europe and the Amazon, with this area expanding as global warming continues throughout the 21st century. These findings indicate a significant increase in fire potential in regions where vegetation abundance and burning are not limiting, highlighting the urgency of adapting to changes in disturbances and increasing fire hazards. An anthropogenically induced increase in days with extreme values of the Fire Weather Index (FWI) was found in 22% of the global land area burned by 2019, including much of the Mediterranean and Amazonia (Abatzoglou et al. 2019).

Flannigan et al. (2013) using three general circulation models and three emission scenarios to calculate the Cumulative Severity Rating (CSR), showed a significant increase in fire risk and an extension of the fire season in a global context. The increases were most pronounced in the Northern Hemisphere at the

end of the 21st century, with the CSR increasing more than threefold compared to the reference period (1971–2000), and the fire season in higher latitudes is projected to extend by more than 20 days per year. Similar trends have been identified in the Mediterranean region, southern Africa, the Amazon and South America (Abatzoglou et al., 2019), indicating a clear link between climate change and increased fire risk. These findings should be interpreted in the context of the IPCC scenarios, as they show that at 2 °C warming above pre-industrial levels, the occurrence of intensified fires covers half the area as at 3 °C warming. This clearly signals that any increase in global temperatures directly affects the intensity and duration of the fire season. In light of these projections, existing conventional fire management approaches, which mainly rely on reactive interventions, may be insufficient for future conditions. Translated to the national level, the Republic of Srpska and the wider Western Balkans region are no exception. The increase in the length of the fire season and intensity requires the development of national fire risk assessment systems and the adaptation of LFM strategies to local conditions. The Cumulative Severity Score (CSR), as a tool that integrates climate and meteorological variables, can serve as a basis for creating national and regional risk maps and prioritizing preventive measures.

The results of global CSR analyses and IPCC scenarios indicate serious implications for future fire seasons – they will be more intense, longer and potentially larger in area. This highlights the need to transform fire management towards an integrated approach (Integrated Landscape Fire Management, LFM), with a focus on prevention, planning, adaptation and preparedness, tailored to the specificities of local landscapes and communities. Adopting an LFM approach allows us to manage future fire risks systematically, reduce potential damage and increase the resilience of ecological and social systems.

One region where significant changes in fire activity are expected is the Mediterranean region. The observed trend towards warmer and drier conditions (decreasing precipitation and increasing drought frequency) across the Mediterranean is projected to continue in the coming decades, likely leading to an increased risk of large-scale fires due to climate change (Turco et al. 2018; Ruffault et al. 2020). Projections show that fire frequency could increase by 14% by the end of the century (2071–2100) under the RCP4.5 scenario, and by 30% under the RCP8.5 scenario (Ruffault et al. 2020). The results of Amatulli et al. (2013) showed that in the European part of the Mediterranean, significant increases in the total burned area of 66% to as much as 140% can be expected at the end of the 21st century, according to different climate change scenarios. Turco et al. (2018) estimate that in the Mediterranean region of Europe, with the realization of global warming scenarios of 1.5 °C, 2 °C and 3 °C (taking into account possible modifications of the climate-fire relationship in changed climate conditions due to changes in productivity), the burned area will increase significantly. The higher the degree of warming, the greater the increase in the burned area, which will range from about 40% to about 100% according to all scenarios. The research results showed that significant benefits would be achieved if the warming of the climate system were limited to well below 2 °C.

Extreme weather and climate events, such as fires, heat waves, and droughts, are often the result of a combination of physical processes interacting at different spatial and temporal scales, and are shaped by physical drivers and social forces (Raymond et al. 2020; Zscheischler et al. 2018).

This combination of processes leading to a significant impact is called a “complex event” (Zscheischler et al. 2018). These hazards can occur simultaneously (simultaneous or complex events) or sequentially, i.e. one hazard following another (cascading events). Thus, we define complex hazards as two or more extreme events occurring simultaneously, i.e. on the same day and in the same region, and cascading events as two or more extreme events (as individual and/or as complex hazards) occurring successively or cumulatively over time, without being interrupted by a zero-hazard day (Sutanto et al. 2020).

2.4 Landscape fire management and socio-economic aspects

2.4.1 LFM's contribution to rural development, poverty reduction, and the well-being of local communities

The application of the principles of adaptive fire management in rural areas of the Republic of Srpska is an important instrument for supporting sustainable development and strengthening the resilience of local communities. Reducing the risk of fires in agricultural and forest areas allows the preservation of the main sources of income of the population, while at the same time encouraging the development of new economic activities such as rural tourism, collection and marketing of non-timber forest products, and improvement of livestock farming.

By integrating local communities in the planning and implementation of LFM measures, social cohesion, self-confidence and the capacity of the population to cope with crisis situations are strengthened. In this way, LFM becomes not only an instrument of fire protection, but also an incentive for economic empowerment, poverty reduction and improvement of the quality of life in rural areas.

The key question of this chapter is what will reducing the number and intensity of landscape fires mean for people in this area. In addition to preserving natural wealth, landscape diversity, genetic resources, and drinking water, protection will enable the involvement of the local community in the sustainable use of the natural potential of the landscape with the aim of reducing poverty and improving the well-being of local communities.

2.4.1.1 Rural development

Rural development is one of the key aspects of the LFM strategy, as rural areas are the most exposed to the risk of fires. These areas are characterized by a combination of demographic and economic challenges – depopulation, aging and shrinking populations, as well as inadequate land use – fragmentation, neglect, inappropriate land use – which results in accumulation of fuel material and greater susceptibility to fire. At the same time, rural areas have significant potential for sustainable development through tourism, production of non-timber forest products, strengthening agriculture and preserving landscapes with a protective role. By integrating the LFM approach into rural development strategies, it is possible to simultaneously improve fire safety, contribute to the climate resilience of the landscape and stimulate the economic and social vitality of local communities.

The official definition of the FAO (Food and Agriculture Organization of the United Nations) contains an approach according to which a rural area should meet two criteria. According to the first criterion, rural areas are generally characterized by low population density, which is related to the way in which land is used. The second criterion emphasizes the structure of income from work of the rural population as an important determinant. According to the FAO, the inhabitants of rural areas earn a greater part or all of their income from activities related to the production of primary products.² The second criterion is somewhat more important for developing countries, but is losing its importance over time. The reason for this is the process of reorientation of the rural population from traditional agricultural activities to activities in the service sector.

The fragmentation of cadastral parcels in the Republic of Srpska represents one of the structural obstacles to effective fire risk management, as well as other land use planning measures. Insufficiently large and scattered parcels make it difficult to build and maintain fire-fighting infrastructure (belts, access roads, drainage and irrigation systems) and in practice make it impossible to systematically apply protection

² Atchoarena, D., Gasperini, L., 2003, Education for rural development: Towards new policy responses, Rome, p. 37-38

measures. In addition to the fragmentation, relatively large areas are subject to various forms of usurpation and unresolved property and legal status, which prevents any meaningful management of this space or its use according to the cadastre.

Land consolidation in this sense appears as a prerequisite for the application of the LFM principle at the local level. It enables the consolidation of plots and the creation of functional units on which it is possible to implement preventive measures (e.g. mechanized cultivation, fire belts, controlled use of fire) at lower costs and greater efficiency. Responsibility for implementing land consolidation is shared between the relevant institutions (Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska, Directorate for Geodetic and Property-Legal Affairs), local governments and the land owners themselves. Without their cooperation, it is not possible to build a sustainable fire management system on the ground. Problems arising from the current situation include: increased intervention costs, poorer accessibility of land to fire departments, lack of space for the construction of protective infrastructure and insufficient involvement of owners in preventive activities.

The implementation of this procedure would lead to better land use, better spatial planning and more efficient implementation of infrastructure projects, improved accessibility of agricultural areas and the construction of a new network of field roads, which would directly affect the reduction of fire risk.

One of the characteristics of the landscape in the Republic of Srpska is the large share of uncultivated agricultural land, which not only does not contribute to overall economic and social development, but as such represents a significant risk for the occurrence and spread of fires due to the accumulation of combustible material. In the LFM context, this phenomenon indicates the need for a systemic approach that includes: fire prevention through appropriate land use, improvement of agrotechnical practices and controlled use of fire in accordance with regulations and professional supervision (in the future, after the adoption of legal regulations). Uncultivated areas, if left unmanaged, increase the exposure and vulnerability not only of agricultural resources but also of neighbouring forests, settlements and infrastructure. On the other hand, integrating this land into production and protection systems creates opportunities for the economic empowerment of local communities, reducing fire risk and preserving natural resources. LFM in this context implies the responsibility of landowners, local governments and relevant institutions to establish incentive mechanisms for the cultivation or maintenance of uncultivated plots, as well as cooperation with agricultural cooperatives and associations that can take an active role in the management of these spaces. Thus, LFM principles reduce fire risk, strengthen the resilience of rural areas and encourage sustainable development, while at the same time reducing the social and economic damage that fires can cause.

Such lands are mainly located on the border with forests and woodlands, and it is precisely their burning that causes a large number of fires in landscape. Increasing the use of agricultural land should be achieved by combining legal norms and incentive measures. Agricultural land should be used in accordance with its purpose, as regulated by the Basic Law on the Protection and Development of Agricultural Land in the Republic of Srpska. According to the Law on Agricultural Land of the Republic of Srpska, "the owner of agricultural land is obliged to regularly cultivate the land and use it in a manner that best suits its natural fertility and existing economic and agrotechnical conditions". The same law provides that "The owner of agricultural land, if he does not use it for more than one year, is obliged to enable its use by leasing it or in another way". Based on the previous two articles of the aforementioned law, in the long term, the goal should be to cultivate all arable land, that is, to utilize all agricultural land. The first step in realizing this goal is to establish and maintain up-to-date records of agricultural land according to its purpose (agricultural land cadastre) and method of use. According to the Law on Real Estate Tax, cultivated agricultural land is exempt from paying real estate tax, which means that tax should be paid on uncultivated land. By consistently applying this article of the law, owners of agricultural land who do not cultivate the land they own (most often heirs) are taxed and thus encouraged to rent it out. By establishing adequate databases and digital platforms for mediation in the rental of agricultural land (at the local and republican levels),

the area of land under lease can be increased. Ultimately, multi-year leases will in some cases lead to a permanent change of ownership (purchase and sale) of agricultural land. Another way of returning agricultural land to its function is the purchase of agricultural land by the state or local community and leasing or resale. This measure should first be implemented on a pilot basis during the period of validity of this strategy, and it can be linked to the cross-cutting objective of reducing poverty among the rural population and increasing care for the elderly. The counterpart to the consolidation of agricultural land is the prevention of its further fragmentation. In this context, the amendment of the Law on Inheritance, which would prohibit the splitting of plots during the transfer of ownership rights, is constantly mentioned. The transposition of good practices of developed countries into domestic legislation should still be sought, but experience to date indicates that tradition still dominates over rationality.

2.4.1.2 *Poverty reduction*

In accordance with the UN Millennium Development Goals, poverty is a multidimensional phenomenon that, in addition to insufficient income to meet basic living needs, also includes aspects related to human rights such as the inability to find employment, inadequate housing conditions, failure to realize the right to a healthy environment and natural resources, primarily to clean water and air, and inadequate access to social protection, health, educational and communal services, etc.

2.4.1.3 *Benefits of local communities*

Unplanned use of abandoned private forests, as well as frequent fires and the damage they cause, pose a significant risk to local communities and their economic stability. Within the LFM approach, this challenge can be overcome by developing partnerships with private forest owners, through joint forest management mechanisms and the implementation of measures that contribute to reducing fire risk.

Of particular importance are non-timber forest products, which directly impact the rural economy and represent an important source of income, especially for socially vulnerable groups of the population. The collection and processing of these resources, if carried out in a sustainable manner, can reduce pressure on forests, contribute to reducing fire risk and ensure better integration of local communities into the LFM system.

The additional income from forestry work for members of smallholder farms contributes to their socio-economic survival. The dual employment status – agriculture combined with forestry activities – makes these communities more resilient to risks, including fires.

The development of agroforestry in rural areas is one of the key directions of the LFM approach, as it simultaneously enables the creation of new jobs, diversification of income and strengthening of capacities for fire risk reduction. This way, integrated management of forest and agricultural resources becomes a tool for economic development, social stability and fire prevention.

2.4.1.4 *Tourism*

Tourism is one of the fastest growing economic sectors in the Republic of Srpska. The number of tourist arrivals in the 2010-2019 period increased by 69%, the number of overnight stays increased by 68%, and the increase in the number of arrivals and overnight stays of foreign tourists is faster than that of domestic tourists. The number of tourist arrivals in mountain areas is about 15% of the total number of arrivals, and the number of overnight stays is about 17% of the total number of overnight stays. Preserved natural areas are extremely suitable for active and passive recreation and enable the development of ecotourism, rural, recreational-adventure, health tourism, etc. At the same time, the preservation of natural areas is also a prerequisite for the development of tourism, as an economic sector, but also for the development of rural areas. Protecting areas from fires protects their true value and enables the development of the aforementioned sector.

Hunting tourism within the tourism industry represents the strongest connection with natural areas. Agricultural and forest areas constitute integral habitats for game, and of the total hunting area, on average, about 45% is covered by forest. The basis for the development of hunting tourism is the condition of game (species, quality and abundance) and the existence of hunting facilities and infrastructure in forest areas (hunting lodges, pheasant farms, check-ins, wintering grounds for game, shelters and feeding grounds for game, etc.). The backbone for the development of hunting tourism is made up of hunting associations (60 associations) and hunters (about 21,800 hunters). Hunting tourism is based on hunter-tourists who come from abroad and shoot game, with the assistance of employees of registered hunting associations.

Tourism is primarily developed in areas and regions that have appropriate landscape characteristics of importance for the development of tourism. Recently, there has been a significant development of the tourism sector with an emphasis on winter tourism. Given the poor tourism infrastructure, this problem is directly related to the pressures on natural landscapes because it often happens that the capacity of the number of visitors exceeds the capacity of the ecosystem, and especially the infrastructure equipment. The problem of illegal and uncoordinated construction in forest and naturally valuable areas has been observed. Tourism would have to define its long-term interest, in which the natural and cultural heritage will be valorised as a potential for the development and improvement of the region, but it must be in accordance with the capacity and in harmony with the natural landscapes.

Rural tourism is associated with staying in rural areas, the dominant environment of which in the Republic of Srpska is forests. Forest roads in rural areas represent the main infrastructure for communication between tourists and the population.

Eco-tourism in natural environments is best expressed in protected areas of nature, within which forests are of the greatest importance. The main motive of eco-tourists for visiting natural areas is the beauty of the landscape, the hydro potential of forest areas, the uniqueness of flora and fauna, which is particularly diverse in forest ecosystems. The natural basis of ecotourism in the Republic of Srpska, in addition to its distinct biodiversity and landscape, is made up of 53,533.58 ha of protected areas. Recreational, adventure and health tourism are enabled by forests and forest watercourses or lakes.

In summary, LFM contributes directly to socio-economic stability by protecting rural livelihoods, reducing losses in agriculture and forestry, safeguarding tourism-dependent areas and supporting employment through prevention, restoration and community-based fire management activities. Effective prevention and sustainable landscape management therefore represent not only environmental priorities but also long-term economic investments that strengthen resilience and reduce future costs. These intertwined ecological and economic benefits form a solid foundation for the analysis of advantages and disadvantages that follows.

3. ANALYSIS OF ADVANTAGES AND DISADVANTAGES

The following chapter deals with a specific analysis of the strengths and weaknesses, or advantages and disadvantages, of the land fire management (LFM) system that have been identified through a comprehensive analysis. By exploring the strengths and weaknesses of the system, this research aims to provide an understanding of its current state and potential opportunities for improvement. Through a thorough examination of the strengths and weaknesses, we aim to gain clear insights that will inform strategic decision-making and guide the improvement of the LFM system for more effective land fire management and more resilient landscapes.

3.1. Prevention

Preventive fire protection reduces the risk of fire outbreaks, which can reduce total fire damage to one-tenth of the current situation (Stipančev D., Hrastnik B., 2004).³

The forests of the Republic of Srpska are not sufficiently permeable to enable quick access to the fire site, and forest management companies and private forest owners are not well enough equipped to spot and detect fires early, or to quickly access and extinguish them.

In order to prevent damage to the environment and society as a whole, it is necessary to build a modern fire protection system that would minimize harmful effects. This system must provide a fire hazard assessment on the basis of which it is possible to deploy human and material resources necessary for rapid and efficient fire extinguishing from areas with lower risk to areas with higher risk. When areas of increased fire hazard are identified in this way, intensification of surveillance will enable early detection of the resulting fire, which results in a reduction in the areas affected by the fire due to faster intervention by firefighters.

Forest roads are infrastructure facilities that are designed and constructed with spatial and structural characteristics determined by the shape of the terrain, the purpose of the forest, habitat and potential of forest ecosystems. The network of forest roads affects the reduction of the occurrence and spread of large-scale fires (Lugo A.E. Gucinski H. 2000). The importance of forest roads in fire protection is great because they enable prevention but also help in direct suppression. Preventive protection involves not only preventing the occurrence of fires, but also eliminating the conditions for their occurrence (Ratkins M. et al, 2006). It is also carried out through constant monitoring of endangered forest areas, while direct protection consists of creating the conditions for timely extinguishing of fires (Stipančev D., Hrastnik B., 2004). The impact of the forest road network density on initial fires is great because the greater road network density results in faster fire detection and formation of a defensive line to prevent the spread of fires (Larjavaara M., 2005.)

³ For example, the impact of the forest road network density on initial fires is significant, as the higher road network density results in faster fire detection and formation of a defensive line to prevent the spread of fire (Larjavaara M., 2005). On the other hand, there are negative effects of the openness of the space to roads, which are reflected in a greater flow of people (campers, hikers, picnickers, etc.) which ultimately increases the risk of fires (Chuvieco E., Congalón RG, 1989), so there is a significant correlation between the frequency of fires and the density of the forest road network (Arienti CM, et al, 2009).

Preventive advantages and weaknesses

ADVANTAGES	WEAKNESSES
• Well-organized existing systems and legislative framework, which provide the basis for effective fire management. • Existence of statistical data. • Effective implementation of selective forest management practices (selective logging system). • Favourable climate and vegetation suitable for fire prevention. • An abundance of qualified human resources and a high level of expertise in this field. • Increasing use of deciduous tree seedlings in reforestation. • Active campaigns to raise public awareness about fire prevention measures. • Existence of relatively good accessibility via communication infrastructure (motorways, regional roads, forest roads).	• Incomplete implementation of existing laws. • Insufficiently regulated prevention measures and jurisdiction. • Inadequate methodology for data collection. • Overlapping responsibilities between institutions leading to inefficiency. • Excessive participation of coniferous species in afforestation. • Poor communication between agencies that hinders effective cooperation. • Inadequate implementation of sanctions for fire starters. • Lack of learning from past incidents, leading to repeated mistakes. • Financial constraints that prevent the implementation of modern technological solutions. • Abundance of neglected and uncultivated land, increasing the risk of fire. • Depopulation of rural areas. • Extensive agricultural activities. • Tendency to abandon traditional land uses such as grazing. • Forcing more repressive measures compared to preventive measures. • Increasing frequency and intensity of forest fires due to climate change. • Political instability. • The human factor, which is difficult to control and manage. • Mines and other hazardous materials left over from the wars of the 1990s. • Favouring investors who influence decisions on regulatory spatial planning. • Continued urban sprawl and land development leading to increased interaction between urban areas and forests, increasing the risk of fires. • Relatively large areas under conifer monocultures.

As for other preventive measures in the field of forestry, a great advantage of the current system is the commendable long-standing practice of using forest management systems such as selective logging in the Republic of Srpska, which significantly contributes to reducing the risk of catastrophic forest fires by

increasing the resilience of the landscape (forests) to this harmful phenomenon. The application of this traditional method of forest management shows the commitment of institutions in preserving its natural ecosystems and mitigating the potential impact of landscape fires on its valuable forest resources. Continuing sustainable forest management practices can improve forest resilience and reduce forest vulnerability to catastrophic fires.

By emphasizing a holistic approach to land use management, which takes into account the coexistence of uncultivated land, agricultural land, and forests, Republic of Srpska can better protect its natural heritage and protect its citizens from the harmful effects of landscape fires. Sustainable land management practices and proactive fire management strategies are the cornerstones of building fire-resilient ecosystems and fostering a safer environment for all.

3.2. Preparedness

Within the fire suppression paradigm, much work needs to be done before the fire itself breaks out. Planning is key to developing a good fire suppression strategy, and some decisions need to be made in advance, including procurement of materials, hiring personnel, and allocation of resources to locations, and even decisions about where those resources will be based.

All fire departments in the Republic of Srpska are professionally trained to fight landscape fires, especially those that regularly have a large number of fires in their area. In the event of a large-scale fire, firefighters would in most cases not be able to adequately respond with the available human resources and material capacities, and would be forced to seek international assistance. Fire trucks in most fire departments (in more than 70% of cases) are often 20 or even 30 years old. In addition to age, the problem in most fire departments is the insufficient number of fire trucks. The fire departments of Banja Luka, Bijeljina, East Sarajevo, Gradiška, Prijedor and Doboj have acquired one to three fire trucks and other firefighting equipment in the last 7 years, which has significantly contributed to the greater efficiency of the fire department in extinguishing fires and other interventions.

A number of local communities have not formed professional fire departments or voluntary fire companies; a certain number of fire departments do not have the minimum number of firefighters prescribed by the Fire Protection Law. Most municipalities do not have a fire protection plan, which represents a major shortcoming of the current system.

Fire preparedness

ADVANTAGES	WEAKNESSES
• A dense hydrological network that facilitates firefighting operations. • An abundance of qualified human resources and a high level of expertise in this field. • Presence of fire departments in almost all local communities • Cooperation with international fire agencies to exchange knowledge and resources. • Integrating community fire prevention initiatives for improved preparedness and resilience.	• Practices that hinder rapid and effective fire management. • Limited openness of space. • Lack of early warning and fire detection systems. • Lack of a map for fire risk assessments of the Republic of Srpska (also available only for forest land). • High costs of road construction and maintenance, especially in demanding terrain. • Insufficient number of weather stations

3.3. Fire suppression

ADVANTAGES	WEAKNESSES
• Rich experience: Fire departments in Republic of Srpska have extensive experience in fighting landscape fires, which allows them to respond effectively to emergency situations. • Terrain knowledge: Firefighters are familiar with local terrain and specifics, which allows for faster response and more efficient management of firefighting situations. • Involvement of "Šume RS", which actively participates in firefighting activities with contributing its resources and expertise. • The existence of a helicopter service for rapid reaction and reconnaissance (RS).	• Outdated equipment: Fire departments have outdated equipment, which may be less effective in modern firefighting scenarios. • Insufficient number of firefighters: There is a shortage of human resources, which can hinder rapid and effective response to emergencies. • Limited funding: Insufficient funding can hinder the implementation of necessary upgrades and training programmes, affecting overall firefighting capabilities.

When fire prevention fails, the fire extinguishing process begins. The first step in this process is to immediately identify the source of the fire. The success of fire extinguishing depends on the speed of detection and suppression before it gets out of control. If the reaction comes too late, the consequences can be extreme, with a high likelihood of very large fires spreading across vast areas in a short period of time (Rodrigues et al., 2019).

The role of fire suppression is to control – and ultimately extinguish – destructive fires that are identified (Martell 1982). Decisions about how to extinguish a fire are largely influenced by how the fire grows and develops, depending on weather conditions, terrain characteristics or fuel type, conditions and other attributes. However, these decisions are also influenced by the resources available and where they are located. Thus, fire suppression management includes decisions not only related to directly acting on a fire after it has broken out, but also to the deployment of all available resources before the fire starts.

Martell (1982) divided the fire suppression process into four phases: resource acquisition and strategic deployment, resource mobilization, initial attack (IA) deployment, and extended attack (EA) management. The first phase includes all the long-term decisions that need to be made before a fire occurs, which will strongly influence other factors. The second phase, which refers to resource mobilization, deals with how the acquired resources are distributed among the locations where the resources will be deployed. This distribution can be made at the beginning of the fire season, but can change depending on the occurrence of the fire (Chov et al. 2019).

Initial attack (IA) is an aggressive firefighting strategy that aims to get resources to the scene as quickly as possible. It focuses on allocating available resources, deciding which strategies to use, and how to implement them to prevent the fire from getting out of control. If the initial attack fails, an extended attack is required. Extended attack (EA) consists of two key phases: containment and control. Containment involves the creation of control lines that are expected to contain the fire. Control involves establishing a control line around the fire, all fire points, and any other interior areas that need to be protected, as well as cooling any hot spots that may pose a threat to the established control line. This fire suppression scheme includes decisions that correspond to the disaster preparedness phase (long-term decisions in acquiring and deploying resources to bases) and others that correspond to the response phase (resource mobilization, initial attack, and sustained attack). The inherent interdependence of these phases makes it

almost impossible to develop a specific plan exclusively for one of them. In this sense, operation research can provide integrated tools that helps decision makers determine alternatives. In order to develop an appropriate fire suppression strategy, a significant amount of information is needed. The lack of quality information could be a major limitation to the development of an OR model.

Thomson et al. (2011) review several scientific papers that criticize the lack of robust information on fire response and suppression resource performance; they suggest that real-time monitoring and analysis is a first step towards improving performance. In order to predict and manage fire suppression as quickly and efficiently as possible, it is necessary to predict its behaviour, due to its uncertain nature. In this regard, simulation models of fire growth are a good tool for prediction.

3.4. Post-fire management

Post-fire management plays an important role in addressing the consequences of landscape fires in Republic of Srpska. While fire suppression is essential, rehabilitation and restoration of fire-affected areas are equally important in efforts to restore ecosystems, minimize erosion, and reduce the risk of future fires. This chapter explores the various components of post-fire management in the region, including rehabilitation techniques, monitoring strategies, and community engagement to foster a more resilient and safer environment.

ADVANTAGES	WEAKNESSES
• The existence of large capacities for the production of planting material in the fire management system enables the efficient rehabilitation of burned areas, enabling timely and effective restoration. • Previous experience in implementing post-fire measures can be used for future planning and some subsequent interventions. • Advances in post-fire vegetation restoration technologies greatly facilitate this process. • Partnerships with local communities and donor organizations can provide additional resources and support for implementing post-fire measures.	• Lack of learning from previous fires, leading to repetition of mistakes. • The high costs associated with post-fire rehabilitation efforts can strain budgets and resources, affecting the effectiveness of restoration activities. • Limited funding and competing priorities in resource allocation can limit the scope of post-fire recovery initiatives, potentially hindering long-term ecosystem rehabilitation.

Post -fire management in Republic of Srpska is of paramount importance in building resilience to the damaging effects of landscape fires. By adopting a comprehensive approach that includes native vegetation restoration, monitoring, community engagement, and adaptation strategies, the region can better protect its landscapes and communities from future landscape fires. Integrating effective post-fire management practices not only aids in ecological recovery, but also fosters a proactive culture of fire protection, mitigating the risk of future landscape fires. With joint efforts and continued commitment, Republic of Srpska can create a more sustainable and fire-resilient environment for generations to come.

4. VISION, GOALS, PRIORITIES AND TASKS

A vision is a clear statement that describes the long-term goal that a state/entity wants to achieve through its Land Fire Management (LFM) Strategy. The vision provides a sense of purpose and goal, guiding decision-making and inspiring actions in the development of the LFM strategy.

This vision is realized through the definition of main goals, priorities and key activities, through strong community engagement and cooperation of all institutions and agencies in order to achieve the optimal level of prevention, but also preparedness and response to fire situations.

The vision of the Republika Srpska Landscape Fire Management Strategy is to create more resilient landscapes in which fires will be the exception and their negative impacts will be minimized.

The main objectives set in the preparation of this document represent key tasks and measures that will support and enable the realization of the stated vision. The defined objectives are specific, measurable and directed towards achieving the desired future state. The three main objectives are: establishing better cooperation, building stronger institutional capacities, and improving the current planning and legal framework.

1. Establishing better cooperation between institutions
2. Building stronger institutional capacities
3. Improving planning and legal framework

For each of the defined main goals, priorities have been formulated as key fields and directions of action.

1. Establishing better cooperation between institutions

Priority 1.1: Formation of inter-institutional coordination bodies

Priority 1.2: Development of common operational protocols and procedures

Priority 1.3: Improvement of communication and information exchange

2. Building stronger institutional capacities

Priority 2.1: Training and professional development of officials

Priority 2.2: Strengthening technical and logistical capacities

Priority 2.3: Improvement of internal management systems

3. Improving planning and legal framework

Priority 3.1: Analysis and revision of existing laws and bylaws

Priority 3.2: Integration of fire management into spatial and development plans

Priority 3.3: Development of new policies for prevention of landscape fires and implementation of adaptive landscape management

Table 1. General objectives, priorities and indicators

General goal	Priority	Indicator
1. Establishing better cooperation between institutions	Priority 1.1: Formation of inter-institutional coordination bodies	Number of established coordination bodies at the republic and local level
		Frequency of meetings (number of meetings per year)
		Percentage of institutions actively participating in the work of the body
	Priority 1.2: Development of common operational protocols and procedures	Number of adopted joint response protocols
		Percentage of institutions applying common procedures
		Reduction in response time during incidents (in minutes)
	Priority 1.3: Improvement of communication and information exchange	Established IT platform or communication channel for information exchange
		Number of operational reports exchanged between institutions
		Level of satisfaction of institutions with cooperation (measured through a survey)
2. Building stronger institutional capacities	Priority 2.1: Training and professional development of officials	Number of trainings and workshops organized annually
		Number of trained persons in the field of fire prevention and response
		Percentage of participants who successfully completed the training
	Priority 2.2: Strengthening technical and logistical capacities	Number of vehicles, equipment or tools purchased
		Percentage of institutions with adequate equipment for interventions
		Time required for first response in emergency situations
	Priority 2.3: Improvement of internal management systems	Number of improved internal procedures/plans
		Level of utilization of the budget allocated for risk management
		Number of internal simulations or exercises per year
3. Improving planning and legal framework	Priority 3.1: Analysis and revision of existing laws and bylaws	Number of regulations analysed
		Number of proposed amendments or new laws
		Degree of compliance with EU standards (measured by expert assessment)
	Priority 3.2: Integration of fire management into spatial and development plans	Number of plans that include a fire management component
		Percentage of municipalities with adopted fire risk plans
		Share of budget planned for prevention and protection
	Priority 3.3: Development of new policies for prevention of landscape fires and implementation of adaptive landscape management	Adopted policy or strategy for reducing fire risk
		Number of institutions that have implemented adaptive landscape management measures
		Reduction in the number of fires in areas with the implementation of preventive measures (annual comparison)

5. LINKING THE NATIONAL LFM STRATEGY TO THE REGIONAL AND INTERNATIONAL CONTEXT

5.1 Regional cooperation

Regional cooperation in the field of Landscape fire management is a key element of an effective and sustainable approach to protecting lives, property and natural resources. For Republic of Srpska, active participation in regional initiatives enables the sharing of knowledge, resources and best practices with neighbouring countries. This helps to strengthen emergency response capabilities, coordinate firefighting operations, and prevent and minimize fire damage. Through cooperation at the regional level, Republic of Srpska can more effectively respond to the challenges arising from climate change, drought and other factors that contribute to increasing fire risk. In addition, joint efforts in the field of training, equipment and harmonization of procedures contribute to more effective crisis management and provide greater security for citizens.

In the Western Balkans, the Regional Network for Landscape Fire Management (LFM) plays a central role in fostering regional synergies and facilitating cross-border cooperation and knowledge exchange.

The network members are the Regional Fire Monitoring Centre (RFMC), Country Focal Points (CFP) representing Country Partner Institutions (CPIs) in the Western Balkans and Country Project Staff (CPS), supported by the Global Fire Monitoring Centre (GFMC) in Germany. Within this network, the RFMC has a coordinating role and acts as a hub for knowledge collection and exchange. This network is committed to driving change and increasing landscape resilience in the region. The collective vision focuses on LFM and fire prevention that extends beyond national borders, fostering landscape resilience and unity in addressing regional LFM challenges. The aim is to enhance cross-border cooperation by establishing a long-term regional network that will contribute to knowledge exchange and cooperation in the field of LFM.

In the Western Balkans, the LFM regional network represents not only the region's commitment to preserving the value of its natural resources, but also its commitment to preserving the landscape and ensuring a more sustainable future for all. Through this cooperation, network members create opportunities to work at republican, regional and international levels, actively participating in various LFM projects and initiatives. The network is a testament to the importance of cooperation and a shared vision of resilience and unity regarding LFM. Therefore, investing in regional cooperation in the field of landscape fire management is a vital component of the Republic of Srpska's strategy to preserve the safety and sustainability of its territory.

5.2. International cooperation

One of the most important international actors that has made a significant contribution to the field of fire prevention so far is the Japan International Cooperation Agency (JICA). Through its project "National Forest Fire Prevention, Control and Management System" (NFFIS) in Bosnia and Herzegovina, JICA

has focused its efforts on building capacity for forest fire prevention and rapid response. This project includes training local experts, procurement of equipment and development of effective monitoring and early warning systems, which is a significant improvement in the field of fire management in the region.

In addition to JICA, organizations such as FAO, UNDP, and USAID play a significant role in international cooperation, contributing to strengthening capacities for forest fire prevention, management, and recovery through various programmes and projects. These actors promote integrated approaches, technical assistance, and financing, thereby improving regional and international coordination in this area.

The Global Fire Monitoring Centre (GFMC), based in Freiburg at the Max Planck Institute for Chemistry and the University of Freiburg, plays a concrete role in international cooperation on fire management. GFMC operates as a global information hub, maintaining an open portal for documenting and monitoring vegetation fires, including early warning systems and remote sensing data. Through the Global Wildland Fire Network, GFMC coordinates with 14 regional fire networks and supports the establishment of regional centres, which together help countries improve their capacity for integrated landscape fire management. In addition, GFMC serves as secretariat for key mechanisms like the International Wildfire Preparedness Mechanism (IWPM) and the International Fire Aviation Working Group, offering technical policy advice and facilitating coordinated responses to large-scale fire emergencies. This collaboration provides valuable support to national governments and international organizations, helping to develop strategies and build resilience against increasing fire risks.

Also, grants from international organizations represent a quality solution for securing external financing, as well as for strengthening human and other capacities. Particular attention should be paid to funds aimed at environmental protection, reducing the impact of climate change, etc., where these sources of funding can particularly help in achieving the goals of the Paris Agreement and the European Energy Community, as well as in the areas of rural development and preventing land degradation. Potential for additional financial resources can be found in the EU Horizon programmes, IPA funds, as well as the ERASMUS+ programme. In addition, there are programmes from international organizations such as:

- German Corporation for International Cooperation (GIZ),
- United States Agency for International Development (USAID),
- The Swedish Development Cooperation Agency (SIDA),
- United Nations Development Programme (UNDP),
- The Food and Agriculture Organization of the World (FAO),
- World Bank (WB).

In addition to these programmes, funds such as the Global Environment Facility (GEF), the Green Development Facility (GGF), the Climate Investment Facility (CIF), the Green Climate Fund (GCF), the Sustainable Development Fund (SDGF) and the Special Climate Change Fund (SCCF) are also important, and are realistically available for activities related to landscape protection within the framework of the green economy, rural development, nature protection, land degradation, environmental protection and sustainable energy sources. The banking sector can also contribute to such activities through specialized “green” credit lines (Green Credit Lines, GCL). In this context, in addition to commercial banks, the European Investment Bank (EIB), the European Bank for Reconstruction and Development (EBRD) and other international financial institutions play an important role, as highlighted in the Economic and Investment Plan for the Western Balkans. Also, the Western Balkans Investment Framework (WBIF), together with the private sector platform, as well as instruments for entrepreneurship and innovation development, plays an important role in the effective implementation of the green and digital transition packages.

5.3. Vertical coordination of the LFM strategy

Coordination and cooperation are of great importance for the successful implementation of the LFM strategy, as they allow different actors to act in synergy and achieve common goals. For effective fire management, it is necessary that the LFM principles are integrated into a number of strategic documents at the entity and regional levels. This subsection analyses the key strategic documents that should contain the LFM principles, ensuring that different institutions and sectoral policies are coordinated in their efforts to prevent and manage fires.

Managing the risks of landscape fires must be recognized as a common “touching” area for all public sectors that implement public policies and influence the use of nature and natural resources. Landscape fires cover different types of land cover and cause damage to all categories of land, not only forests, and therefore require mutual cooperation and coordination of activities. Measures to strengthen capacity for fire prevention should be appropriately recognized and integrated into all public policies, and special attention should be paid to the so-called accompanying (soft) measures that influence the awareness of users of natural resources, primarily forests, and provide information on how to act when staying in areas susceptible to fires.

The establishment of mechanisms for mutual institutional cooperation with precisely defined procedures enables more effective and efficient management of fire risks. The effectiveness of quick and clear action is especially evident when a fire occurs that requires a quick response and reaction. It is clear that the complexity of the organizational structure and administrative levels make effective action difficult, but cooperation and communication between all actors in different areas must be constantly strengthened and directed towards increasing mutual trust and capacity to deal with risks.

List of strategic documents that should contain LFM principles:

- Spatial Plan of the Republic of Srpska
- Forestry Development Strategy
- Nature Protection Strategy
- Strategy for the Development of Agriculture and Rural Areas of the Republic of Srpska
- Basis for the protection, use and development of agricultural land in the Republic of Srpska as a component of the land use planning process
- Vulnerability assessment of the Republic of Srpska
- Karst Area Management Programme
- Forestry management principles for all forestry areas
- National Waste Management Plan
- Program for the alignment of the legislation of the Republic of Srpska with the *acquis communautaire* of the European Union in the field of environmental protection
- Waste Management Strategy for the 2017 – 2026 period

Several national documents already support elements relevant to Landscape Fire Management, especially those focused on climate change, biodiversity, DRR, rural development and land use. However, LFM is a relatively new concept and many of these documents were developed before the term existed, which means that full understanding and systematic application of LFM principles can only be expected in future strategic cycles. Even so, strategies such as the Climate Change Adaptation Strategy, the Biodiversity Strategy, the Vulnerability Assessment and sectoral forestry and agriculture policies contain measures closely linked to fire prevention and sustainable landscape management. At the international level,

frameworks such as the EU Civil Protection Mechanism, DPPISEE, the Global Fire Hub, and UNECE/FAO networks offer guidance, training and cooperation platforms that complement national efforts. Together, these instruments create a practical foundation for further developing and integrating LFM and help ensure that future policies gradually adopt a more comprehensive and coordinated approach to landscape fire management.

6. TRANSFORMING LFM STRATEGY INTO ACTIONS

6.1 Strategic planning

The successful implementation of a fire management strategy depends on its ability to be effectively translated into concrete actions on the ground. Strategic planning is a key step in this process, as it provides a framework for implementing defined objectives and measures. It links long-term visions with short-term action plans, ensuring that resources, capacities and responsibilities are clearly allocated and directed towards reducing fire risk. This chapter explores how key elements of an LFM strategy can be integrated into everyday practice and how, through coherent strategic planning, we can achieve sustainable results in fire prevention and management.

Fire risk reduction measures should be based on information that reveals and elaborates on the complexity and interconnectedness of fire drivers of a social, ecological, economic and political nature. Precisely for this reason, the strategic planning process must be based on a systematic risk analysis, mapping of endangered areas, as well as an assessment of the capacity of institutions and local communities to respond to fires. Integrating spatial data, climate projections and socio-economic analyses allows for the identification of priority areas of action and the definition of measures that have the greatest effect in reducing the overall risk.

Strategic planning within the LFM also implies a clear hierarchy of actions – from preventive activities, such as maintaining agricultural and forest land, educating the population and implementing legal measures, to intervention activities that include the rapid mobilization of firefighting units, the use of modern equipment and technologies for detecting and extinguishing fires. The integration of local communities into this process is particularly important, as they form the first line of defence against fires and possess specific knowledge about the characteristics of the landscape.

To ensure the long-term sustainability of measures, it is essential that strategic planning includes monitoring and evaluation mechanisms, which allow for regular assessment of the effectiveness of the implemented actions and their adaptation in line with new challenges, such as climate change, land use changes and demographic trends. This way, the LFM strategy becomes a dynamic instrument that not only responds to existing risks, but also builds the resilience of communities and ecosystems to future challenges.

7. LFM ACTION PLAN

The preparation of an effective action plan for Landscape Fire Management in Republic of Srpska requires a comprehensive understanding of the various challenges, as well as previously identified gaps that contribute to the negative effects of landscape fires at the level of Republic of Srpska, and a strategic approach to addressing them. Previous analyses have identified the strengths and weaknesses of the current system. Despite the presence of qualified firefighting personnel and effective cooperation with neighbouring countries in the field of firefighting, the system faces several critical shortcomings. These shortcomings were highlighted through a comprehensive LFM GAP analysis, which examined in detail the existing framework for Landscape Fire Management in Republic of Srpska.

The LFM GAP analysis identified various shortcomings in the current fire management system, ranging from limited resources and infrastructure vulnerabilities to insufficient community preparedness and inadequate post-fire recovery efforts. Specifically, challenges such as lack of resources, low awareness of the issue, insufficient communication, and inadequate land management were identified as areas requiring urgent attention and intervention.

In response to these identified gaps, this action plan has been developed, which aims to describe a series of measures and activities to improve fire management. By addressing the gaps identified in the GAP analysis, this action plan seeks to strengthen the country's resilience to forest fires, minimize their impact on ecosystems and communities, and encourage sustainable land management practices.

In the very structure of the action plan, emphasis is placed on a multifaceted approach that integrates efforts in prevention, preparedness, suppression, and ultimately rehabilitation of burned areas. Each component of the action plan is carefully tailored to address specific gaps in the fire management system, with clear delineation of responsibilities and allocation of resources to ensure effective implementation. Furthermore, this Action Plan emphasizes the importance of cooperation between government agencies, emergency services, communities, and stakeholders at all levels. By fostering a culture of shared responsibility and collective action, Republic of Srpska can and must better respond to landscape fire management and build resilience to growing fire hazards.

One of the key elements of the strategy is a proposal to harmonize the existing legal framework with the legislation in this area in the EU, which is the basis for further steps in the Republic of Srpska. The second chapter of this strategy provides a detailed analysis of domestic legislation and international regulations.

One of the basic assumptions for the successful implementation of the strategy, i.e. the measures from the action plan, is the active participation and mutual cooperation of all participants in the decision-making and management process, competent authorities and institutions at the republican and municipal levels and the wider social community. The success of the implementation of the planned measures is directly correlated with the level of joint and synchronized action of the participants in the implementation process: scientific research institutions, educational institutions of universities, professional and business associations. Civil society organizations in general also play an important role in the implementation of the strategy, given their role in monitoring and controlling the exercise of power, but also in acting as active participants in the exercise of power.

This action plan serves as a roadmap for improvement and refinement of fire management. By leveraging the strengths of the existing system and addressing identified gaps, it is possible to work together towards a safer, more resilient future for all citizens and the environment. Through proactive measures and strategic interventions outlined in this plan, Republic of Srpska can strengthen its capacity to mitigate, respond to, and recover from fires, ensuring the well-being and prosperity of current and future generations.

Table 2. Action plan

Measures/activities	Implementation period	Competent institution	Partners
Objective 1. Establishing better cooperation between institutions			
Organizing expert workshops on Landscape Fire Management	Continuously	MAFWM RS	PFE, MGİE RS, local communities, firefighters' association, RDCP
Conclude and implement intersectoral memoranda on data exchange	1 year	MAFWM RS, MIA RS, MPUGİE RS, RUGİPP	Scientific research institutions
Organize specialized training for Host Nation Support (HNS) personnel in cases of receiving and accepting assistance from abroad	5 years	RDCP	Firefighters' association
Objective 2. Strengthened capacities of institutions and organizations in the implementation of prevention and preparedness measures			
Implementing media campaigns to raise awareness about the risks and consequences of fires	1 year	MAFWM RS	RDCP, Firefighters' Union
Training of personnel for coordinating the use of helicopters in landscape fire management	5 years	RDCP, MIA RS	Firefighters' association, PFEH
Holding workshops for the preparation and writing of projects in the field of landscape fire protection	1 year	MAFWM RS	Everyone
Organizing study visits to exchange knowledge and achieve better cooperation in landscape fire management with countries in the region	1 year	MAFWM RS	RDCP, PFEH
Procurement of modern equipment and protective equipment for firefighters and forestry workers for efficient fire extinguishing and prevention.	Continuously	Government of the Republic of Srpska	Local communities
Establishing a fire forecast and monitoring system (FWI index)	1 year	MAFWM RS, RHMZ	RDCP
Maintenance and improvement of meteorological stations for monitoring fire risk conditions	continuously	RHMZ	
Establishing a more efficient system for statistical monitoring of landscape fires at the regional level	5 years	RDCP	Institute for Statistics
Specialized training for firefighters and forestry workers in extinguishing landscape fire	1 year	RDCP	Firefighters' association, PEF
Training of personnel in the use of advanced technologies for reconnaissance and coordination (drones, GIS, critical ICS infrastructure, simulation of fire behaviour, prediction of fire occurrence, etc.)	1 year	RDCP	Firefighters' association, PFE
Introduction and application of early fire warning and reporting technology in the most vulnerable places	5 years	PFE	RDCP
Implementation of an integrated information system for landscape fire data management	5 years	MAFWM RS	PEF, SS RS
Increasing accessibility to forest areas by building and maintaining roads	5 years	PFE	Ministry of Agriculture and Rural Development of the RS

Measures/activities	Implementation period	Competent institution	Partners
Establishing a VR (virtual reality) and AR training centre	1 year	Institute for Protection and Ecology of the Republic of Srpska	Ministry of Scientific and Technological Development of the Republic of Srpska
Development of specific landscape fire protection plans and fire risk maps for the most vulnerable areas	1 year	Institute for Protection and Ecology of the Republic of Srpska	NGO, PEF
Equipping relevant institutes and faculties with modern equipment, software tools and access to data in order to improve research and support decision-makers.	5 years	MSTDI RS	MAFWM RS
Establishing a system for monitoring forest degradation and creating maps of micro locations sensitive to climate impacts for the purpose of fire prevention.	5 years	MAFWM RS	PEF
Objective 3. Improving current planning and legal framework and creating conditions for consistent implementation			
Amendments to the Criminal Code of the Republic of Srpska in order to tighten sanctions for arson	1 year	MIA RS	Inspectorate of the RS
Development and adoption of a unified methodology for assessing fire damage, including ecosystem services	1 year	MAFWM RS	PEF, Forestry Faculty
Development and adoption of the rulebook on the forest compensation price list	1 year	MAFWM RS	PEF
Development and adoption of regulations on controlled burning	1 year	MIA RS	MAFWM RS
Development and adoption of a methodology for habitat classification	5 years	MPUGiE RS	MAFWM RS, Forestry Faculty
Development and adoption of regulations on the content of fire protection plans	1 year	MAFWM RS	Inspectorate of the RS
Improvement of legislation on the use of advanced landscape fire management technologies	1 year	MIA RS	MAFWM RS
Implement educational programmes about LFM through school and preschool programmes with the aim of acquiring knowledge, skills and habits necessary for improving and strengthening positive attitudes and behaviours	Continuously	MPiK RS	Firefighters' association
Incorporation of Landscape Fire Management (LFM) principles into the Spatial Plan of the Republic of Srpska	5 years	MPUGiE RS	Everyone
Accelerate the process of mass real estate listing (real estate cadastre)	5 years	RUGIPP	Government of Republic of Srpska
Intensification of inspection supervision in the field of landscape fire protection	Continuously	Inspectorate of the RS, MIA RS	

8. LFM MONITORING PLAN

Table 3. Monitoring plan

Measures/ activities	Baseline	Direct result	Monitoring indicators	
Objective 1. Establishing better cooperation between institutions				
Organization of expert workshops on landscape fire management	So far, not organized or very rarely	Improved knowledge of participants in the field of fire management	Number of workshops held	1
			Number of trained participants from relevant institutions	50
			Number of educational manuals prepared and distributed	1
Conclusion and implementation of intersectoral memoranda on data exchange	Insufficient number of signed data exchange memoranda	Signed memoranda, established protocols or data exchange mechanisms, increased institutional cooperation in the field of fire	Number and type of institutions covered by the agreements	20
			Number of signed memoranda	10
			Number of applications in practice	8
Organization of specialized training for Host Nation Support (HNS) personnel	So far, there have been no trainings organized for HNS nor any plans/ scenarios prepared for host nation support	Improved understanding of procedures for receiving international aid	Number of trainings held	1
			Number of trained HNS officers	70
		Prepared plans or scenarios for host country support	Number of scenarios or plans created	1
Training of personnel for coordinating the use of helicopters in fire management	There is no trained personnel outside the Helicopters Directorate of the RS Ministry of Internal Affairs	Increased number of trained personnel capable of coordinating air support	Number of trained air coordination personnel	70
			Number of practical simulations or exercises in cooperation with aviation services	1

Measures/ activities	Baseline	Direct result	Monitoring indicators	
Holding workshops for the preparation and writing of projects in the field of landscape protection	Limited	Increased capacity of local stakeholders to attract funding	Number of workshops held	2
			Number of participants	50
		Prepared project drafts/concept notes	Number of project drafts prepared	5
Organization of study visits to exchange knowledge and experiences on fire management with countries in the region	Low number of exchange knowledge visits; weak contacts in the region	Study visits carried out	Number of study visits carried out	2
		Established contacts and initiatives for regional cooperation	Number of participants in study visits	20
			Number of documented examples of good practices	2
Objective 2. Strengthened capacities of institutions and organizations in the implementation of prevention and preparedness measures				
Implementing media campaigns to raise awareness of risks and consequences of fires	100 at the local level, municipalities, PFEs but 0 at the entity level	Implemented campaigns	Number of implemented media campaigns (TV, radio, internet, print)	1 for every municipality
		Increased public awareness of risks and preventive measures	Audience reach (estimated number of citizens who saw/heard the message)	500000
Training of local residents in fire-prone areas	Low capacity of local population for prevention and rapid response	Increased local community capacity for prevention and rapid response	Number of trainings implemented in risk areas	1/every municipality
			Number of trained citizens/households	50/municipality
Educating school children about the importance of fire	Low awareness among children about the importance of prevention and responsible behaviour. No designed and implemented educational content	Designed and implemented teaching/educational content	Number of schools involved in the programme	All
		Increased awareness among children about the importance of prevention and responsible behaviour	Number of educational hours	1 every year
Conducting mandatory field training on landscape fires for students	Not implemented	Established field teaching programmes at faculties	Number of students who underwent practical training	100
		Increased capacity of future experts in the field of fire protection and management	Number of faculties with field teaching; number of students	4

Measures/ activities	Baseline	Direct result	Monitoring indicators	
Procurement of modern equipment and protective equipment for firefighters and forestry workers for efficient fire extinguishing and prevention	Various/ unknown	Equipped units Increased operational capability in firefighting and worker safety	Types and quantities of equipment purchased	At least 100 personal protect eq.
Establishing a fire forecast and monitoring system	No system established	A functional fire forecasting and monitoring system has been developed Improved early detection and response in critical situations	Number of trained operators managing the system Number of trainings for operators	6 6
Maintenance and improvement of meteorological stations for fire weather index	No FWI assessment is performed	Functional weather stations Continuous collection and distribution of data on weather conditions relevant to fires Real-time data availability to institutions and the public	Number of improved and functional meteorological stations Data update frequency	50 24/7
Establishment of a Statistical Landscape Fire Monitoring System	The number of fires and the burned area are monitored, but they are not monitored by cause, or by location, and they are not monitored in agricultural land, but only in forests	Developed and functional fire recording and analysis system Developed database with parameters including location, cause, extent and damage Generating regular statistical reports for planning and reporting purposes	Number of data entered Number of reports per year	10 1

Measures/ activities	Baseline	Direct result	Monitoring indicators	
Specialized training for firefighters and forestry workers in landscape fire suppression	No training provided. Weak capacities for effective firefighting on LF	Conducted training modules focused on field firefighting techniques and safety Increased capacity for effective intervention in real-world conditions	Number of trained professional and volunteer firefighters and forest workers Number of trainings	1200 + 2000 10
Training personnel in the use of advanced technologies for reconnaissance and coordination (drones, GIS, critical ICS infrastructure)	Foreseen in the plan, but not implemented	Operational use of technology in planning, detection and interventions Improved spatial analysis and real-time coordination	Number of trained operators and planners to work with drones, GIS systems and IKS platforms	1 per l.c.
Establishment of an early fire detection system	Not existent	Reduced time from occurrence to fire reporting	Number of installed sensors, cameras or other detection equipment	50 min
Implementation of an integral information system for fire data management	Not existent	A central information system for data entry, processing and sharing has been established Integration of data from various institutions (forestry, central government, fire departments) Availability of updated and high-quality data for decision-making and crisis management	Number of institutions connected to the system	5
Increasing accessibility to forest areas by building and maintaining truck roads	9.6km/1000 hectares	Truck roads built or reconstructed in forest areas (in km) Improved access to critical intervention zones Reduced response time for fire and forestry services	Number of km of roads built/reconstructed Number of zones with improved access Average response time	15km/1000 hectares 5 at least Reduced by 20%

Measures/ activities	Baseline	Direct result	Monitoring indicators	
Establishing a VR (virtual reality) and AR training centre	Not existent	Established and equipped VR/AR training centre	Number of service members trained through new technologies	100
		Developed educational content and simulations for fires in natural environments	Number of training modules	1
Development of specific fire protection plans for the most vulnerable areas	There are no specific protection plans	Protection plans developed for priority risk zones	Number of plans	1 for every PRZ
		Defined locations, risk scenarios and intervention measures		
		Compliance with spatial and sectoral plans		
Equipping relevant institutes and faculties with modern equipment, software tools and access to data in order to improve research and support decision-makers	Various/ Unknown	Equipment and software for research and analysis of fires and climate impacts purchased	Number of institutions capable of providing support to public policies	1
		Increased number of expert analyses and research reports		
Establishing a system for monitoring forest degradation and creating maps of micro locations sensitive to climate impacts for the purpose of preventive action	There is only a forest health monitoring system	A system for continuous monitoring of forest health has been established.	Number of mapped micro locations	10
		Maps of critical micro locations threatened by climate change have been created	Number of reports on the state of forests	1
Objective 3. Improving current planning and legal framework and creating conditions for consistent implementation				

Measures/ activities	Baseline	Direct result	Monitoring indicators	
Amendments to the Criminal Code of the Republic of Srpska in order to tighten sanctions for arson	Relatively low fines	Adopted amendments to the Criminal Code defining stricter sanctions for criminal offenses related to arson	Number of adopted legal amendments	1
			Number of processed cases	100+
			Reduced number of fires caused by human factors	50%
		Clearly prescribed penalties and legal consequences for arson		
Development and adoption of a unified methodology for assessing fire damage, including ecosystem services	There is no unified methodology for assessing fire damage	Increased legal certainty and basis for preventive action		
		Developed and officially adopted methodology for assessing fire damage	Number of estimates based on the methodology	10
		Integrated components of environmental, economic and social damage assessment	Number of applications in planning	10
		Applying the methodology in practice		
Development and adoption of the rulebook on the forest compensation price list	There is no official rulebook	Adopted regulation determining the values of forest resources in the event of damage	Rulebook developed and adopted	1
		Consistent application of compensation measures enabled		
		Improved legal basis for compensation for environmental and economic damage		

Measures/ activities	Baseline	Direct result	Monitoring indicators	
Development and adoption of regulations on controlled burning	There is no regulation on controlled burning	Adopted normative framework regulating conditions, procedures and responsibilities for controlled burning Reduced risk of uncontrolled fires Increased legal certainty for agricultural and forestry activities	Rulebook developed and adopted	1
Development and adoption of a methodology for habitat classification	There is no adopted methodology	Developed and applied methodology for typification and classification of natural habitats Maps of classified habitats developed as a basis for protection planning and risk management Support for alignment with EU standards (e.g. Natura 2000)	Developed and adopted methodology	1
Development and adoption of regulations on the content of fire protection plans	There is no regulation	Adopted regulation defining the mandatory content, structure and technical elements of fire protection plans Ensured uniform implementation of planning at the level of municipalities, institutions and enterprises Increased transparency and efficiency in preventive action	Number of adopted regulations	1

Measures/ activities	Baseline	Direct result	Monitoring indicators	
Improving legislation for the use of advanced fire management technologies	Improvement needed	Adopted amendments or supplements to regulations that enable the formal use of drones, GIS, and sensor systems	Number of regulations improved	2
		Clearly defined responsibilities and standards for the use of advanced technologies	Number of projects using advanced technologies	5
Incorporation of Landscape Fire Management (LFM) principles into the Spatial Plan of the Republic of Srpska	The current FPP lacks recognized principles for managing open fires	The Spatial Plan of the Republic of Srpska with integrated elements of fire risk management has been developed and adopted	Number of integrated fire protection measures	1
		Critical zones identified and mapped		
		Compliance with natural resource management plans and climate policies		
Accelerating the process of mass real estate listing (real estate cadastre)	Currently in progress Funds secured	Increased scope of cadastrally processed areas and accelerated registration of real estate	Number of newly processed cadastral units	10
		Reduced legal uncertainty regarding land ownership		
		Enabled faster access to information important for fire interventions		
Intensification of inspection supervision in the field of fire protection	No extraordinary controls, only regular ones	Increased number of inspections and controlled facilities	Number of inspection controls	1 ex-traordinary inspection per year
		Improved law enforcement and increased level of compliance with regulations	Number of administrative measures and misdemeanour orders issued	Annually + other inspectors

9. A FRAMED FINANCIAL PLAN FOR IMPLEMENTING THE STRATEGY

Table 4 Financial plan

Measures/activities	Budget (KM)	Sources of funding		Notes
		Budget of the competent institution %	Other sources (Name of potential sources) %	
Objective 1. Establishing better cooperation between institutions				
Organizing expert workshops on landscape fire management	10,000	100%	0%	
Conclusion and implementation of intersectoral memoranda on data exchange	5,000	100%	0%	
Organizing specialized training for Host Nation Support (HNS) personnel	80,000	50%	50%	EU funds
Training of personnel for coordinating the use of helicopters in fire management	50,000	100%	0%	
Holding workshops for the preparation and writing of projects in the field of landscape protection	25,000	50%	50%	
Organizing study visits to exchange knowledge and experiences on fire management with countries in the region	100,000	20%	80%	(LFM Programme, others)
Objective 2. Strengthened capacities of institutions and organizations in the implementation of prevention and preparedness measures				
Implementing media campaigns to raise awareness about the risks and consequences of fires	50,000	20%	80%	
Training of local residents in fire-prone areas	10,000	40%	60%	
Educating school children about the importance of fire	100,000	50%	50%	
Conducting mandatory field training on landscape fires for students	10,000	10%	90%	

Measures/activities	Budget (KM)	Sources of funding		Notes
		Budget of the competent institution %	Other sources (Name of potential sources) %	
Procurement of modern equipment and protective equipment for firefighters and forestry workers for efficient fire extinguishing and prevention.	2,000,000	50%	50%	Grants from other international donations
Establishing a fire forecast and monitoring system	1,000,000	20%	80%	EU funds
Maintenance and improvement of meteorological stations for monitoring fire risk conditions	800,000`	30%	70%	
Establishing a system for statistical fire monitoring	40,000	90%	10%	
Specialized training for firefighters and forestry workers in extinguishing landscape fires	500km/day	100%	0%	
Training personnel in the use of advanced technologies for reconnaissance and coordination (drones, GIS, critical ICS infrastructure)	100,000	50%	50%	
Introduction and application of technology for early fire detection in the most vulnerable areas	500,000	50%	50%	
Implementation of an integrated information system for fire data management	40,000	100%	0%	
Increasing accessibility to forest areas by building and maintaining truck roads	50,000,000	20%	80%	Loans from international and development institutions
Establishing a VR (virtual reality) and AR training centre	500,000	20%	80%	
Development of specific fire protection plans for the most vulnerable areas	500,000	10%	90%	
Equipping relevant institutes and faculties with modern equipment, software tools and access to data in order to improve research and support decision-makers.	60,000	20%	80%	

Measures/activities	Budget (KM)	Sources of funding		Notes
		Budget of the competent institution %	Other sources (Name of potential sources) %	
Establishing a system for monitoring forest degradation and creating maps of micro locations sensitive to climate impacts for the purpose of preventive action.	300,000	30%	70%	
Objective 3. Improving current planning and legal legislation and creating conditions for consistent implementation				
Amendments to the Criminal Code of the Republic of Srpska in order to tighten sanctions for arson	5,000	100%	0%	
Development and adoption of a unified methodology for assessing fire damage, including ecosystem services	20,000	50%	50%	
Development and adoption of the rulebook on the forest compensation price list	40,000	100%	0%	
Development and adoption of regulations on controlled burning	5,000	50%	50%	
Development and adoption of a methodology for habitat classification	60,000	100%	0%	
Development and adoption of regulations on the content of fire protection plans	5,000	50%	50%	
Improving legislation for the use of advanced fire management technologies	5,000	50%	50%	
Consistent implementation of Article 6, paragraph 5 of the Fire Protection Law	5,000	50%	50%	
Incorporation of Landscape Fire Management (LFM) principles into the Spatial Plan of the Republic of Srpska	50,000	50%	50%	
Accelerating the process of mass real estate listing (real estate cadastre)	10,000,000 ⁴	100%	0%	These funds have already been secured; the process is ongoing.
Intensification of inspection supervision in the field of fire protection	50,000	100%	0%	

⁴ These funds have already been secured; the process is ongoing.

Table 5. Sources of funding

OVERVIEW BY SOURCE (amounts in KM and percentages)		
Budget of the Republic of Srpska / local self-government units	Funds provided on the basis of PPP (public-private partnership)	EU pre-accession and other funds
KM	KM	KM
10%	10%	30%
Grants from other international donations	Loans from international and development institutions	Other sources
KM	KM	KM
20%	20%	10%

