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Landscape Fire Management Gap Analysis on the Level of Republika Srpska, Bosnia and Herzegovina



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РЕПУБЛИКА СРПСКА
МИНИСТАРСТВО ПОЉОПРИВРЕДЕ,
ШУМАРСТВА И ВОДОПРИВРЕДЕ

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TABLE OF CONTENTS

LIST OF INSTITUTIONS AND EXPERTS INVOLVED IN THE PREPARATION OF THE GAP ANALYSIS 4
LIST OF ACRONYMS 5
EXECUTIVE SUMMARY 6
INTRODUCTION 8
BACKGROUND 8
OBJECTIVES OF THE GAP ANALYSIS 9
SCOPE AND APPROACH 9

1. GAP IDENTIFICATION ON LANDSCAPE FIRE MANAGEMENT IN THE REPUBLIC OF SRPSKA 11
- **1.1.** PREVENTION 11
- **1.2.** PREPAREDNESS (READINESS/PRE-SUPPRESSIVE) 16
- **1.3.** SUPPRESSION 24
- **1.4.** POST FIRE MANAGEMENT 26

2. IMPLEMENTATION FRAMEWORK 30

3. MONITORING AND EVALUATION 39

LIST OF INSTITUTIONS AND EXPERTS INVOLVED IN THE PREPARATION OF THE GAP ANALYSIS

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
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
NGO CZZS
Public scientific research institution Institute for Protection and Ecology of the Republika Srpska
Inspectorate service of RS - Forestry inspection

LIST OF ACRONYMS

LFM	Landscape Fire Management
LF	Landscape Fire
MAFWM	Ministry of Agriculture, Forestry, and Water Management of Republic of Srpska
MIA	Ministry of Internal Affairs of Republic of Srpska
MSPCE	Ministry of Spatial Planning, Construction and Ecology
PEF	Public Enterprise of Forests
RACPRS	Republic Administration of Civil Protection of Republic of Srpska
RAGPLA	Republic Administration for Geodetic and Property-Legal Affairs
RHMI	The Republic Hydrometeorological Institute
RFMC	Regional Fire Monitoring Centre
RS	Republic of Srpska
SWOT Analysis	Strengths, Weaknesses, Opportunities and Threats Analysis

EXECUTIVE SUMMARY

This gap analysis provides a comprehensive evaluation of the Landscape Fire Management system in Republika Srpska, Bosnia and Herzegovina assessing its effectiveness. The primary objective is to identify key deficiencies, hereafter referred to as gaps, and propose actionable recommendations to bridge those gaps and enhance the country's LFM system's capacity to manage landscape fires. This aims to safeguard natural resources and local communities' livelihoods, and to integrate the landscape fire management among all of its relevant stakeholders. This gap analysis was developed through a participatory approach, facilitated by multiple workshops organized by the Landscape Fire Management in the Western Balkans (LFMWB) Programme. These workshops brought together participants from the national LFM networks of Republika Srpska, Bosnia and Herzegovina to collaboratively define, discuss and prioritize the identified gaps and measures for bridging them.

This gap analysis first identifies and defines the gaps, then offers brief explanation and context for each of the gaps. It then proposes a well-defined desired future state concerning the respective gaps. The desired state serves as a milestone and a reference for all intended improvements and actionable measures. To achieve this, the gap analysis document culminates in a detailed implementation framework table. This table acts similarly as a strategic action plan, listing each identified gap alongside proposed measures for bridging the gap, their period of implementation, the responsible institutions for undertaking or assisting in implementing the proposed measures, an approximation of a foreseen budget, and a priority level (urgency). The priorities in the implementation framework are colour-coded, meaning: Green (I) stands for the highest priority, Yellow (II) for moderate priority, and Blue (III) for lower priority measures.

The analysis reveals critical gaps across all four main phases (prevention, preparedness, suppression, and post-fire management) of the landscape fire management system in Republika Srpska, Bosnia and Herzegovina:

- Prevention: Prevention of Landscape Fire Management (LFM) is compromised by insufficient implementation of existing LFM-related legal regulations and fire protection plans. This deficiency is compounded by poor institutional and public engagement, specifically insufficient coordination between official institutions and other stakeholders in LFM and insufficient cooperation in knowledge exchange with other countries. Furthermore, planning and risk factors are undermined by insufficient public awareness of climate change impact on landscape fires, a lack of regulation over fragmented forest land ownership and unresolved property disputes, insufficient mapping of waste dump sites, and inadequate categorization and classification of land in cadastre records.
- Preparedness: Preparedness for Landscape Fire Management (LFM) is undermined by an absence of an early warning and detection system for landscape fires, coupled with the absence of professional firefighting teams within certain local government units. This operational deficiency is compounded by an insufficient number of trained human resources in LFM and underrepresentation of volunteerism in landscape firefighting. Planning and scientific foundations are also severely lacking, the lack of a landscape fire risk map, lack of official fuel classification for vegetation and fire behaviour assessment, insufficient country specific scientific research in LFM, and limited meteorological monitoring and forecasting infrastructure. Finally, practical issues like the lack of proper equipment in LF suppression units, inconsistent procedures and terminology of LF suppression, lack of knowledge on fire risks in agricultural lands among farmers, and insufficient production of deciduous seedlings in nurseries further compromise national readiness.
- Suppression: Suppression efforts are undermined by a severe lack of quality command training and practical command in managing large-scale fire incidents and coordination efforts. This operational

deficiency is compounded by a persistent lack of coordination mechanisms during firefighting operations, which prevents effective resource deployment. The capacity for proper tactical response is crippled by a lack of knowledge and expertise in coordinating helicopter units with ground units during fire suppression operations.

- Postfire Management: Effective postfire management is severely compromised by the absence of integrated post-fire management procedures and a corresponding absence of official standardized methodology and statistical forms for post-fire data collection and analysis. This lack of formal strategy results in the inadequate post-fire management of burnt areas and is further complicated by insufficient scientific research in post-fire management. Finally, there is a small percentage of officially detected fire causes and their inadequate enforcement, while the critical role of farmers in mitigation is insufficiently leveraged through their direct involvement in land use and agricultural practices.

The successful implementation of the proposed recommendations is envisioned over a five-year period and is contingent upon strong coordination among government agencies, academic institutions, and local communities (science-policy-practitioners interface). This holistic approach aims to address both immediate critical needs and facilitate long-term systematic improvements, thereby significantly bolstering Republika Srpska, Bosnia and Herzegovina's overall capacity to manage landscape fires effectively and sustainably.

The Landscape Fire Management (LFM) gap analysis report was fully validated and accepted by all participating stakeholders

INTRODUCTION

Background

This Gap Analysis Report is part of the critical output resulting from the comprehensive LFM Report for the Republic of Srpska based on concrete information obtained from official documents and reports and was developed through the active involvement of all identified LFM major stakeholders. These stakeholders attended the workshops of the LFM network during which a crucial analysis was performed to identify priority gaps in the current structure of landscape fire management.

The Gap Analysis Report followed up on workshops, meetings, and consultations. Therefore, it catalyses current dialogue by providing an all-rounded understanding of challenges and opportunities in the domain of landscape fire management. By carefully assessing the weaknesses, opportunities, and threats identified in the SWOT analysis for each of the phases—prevention, preparedness, suppression, and post-fire management—a clear and actionable plan of improvement is presented here.

This document consists of five chapters. After defining background, objectives, scope, and approach of the Gap Analysis, this document is structured into the following sections.

Gap identification in each of the four categories—prevention, preparedness, suppression, and post-fire management. The results from the SWOT analysis define gaps between the current and desirable state of fire management.

Gap description: Describing the root causes of the identified gap.

Desired state defined: This will be the best conditions or outcomes in each phase, usually opposite to the current deficiencies.

Implementation framework: A detailed framework (action plan) linked with the current situation and the identified gaps is being connected with the state desired to be achieved. Specifically, it will include the measures to be taken, entities responsible, possible time implementation frameworks, and cost assessments for filling these gaps effectively. The Implementation framework itself, as the last and key chapter of this document, includes plans and goals ordered by priority, that is, by the period of possible realization. Implementation framework is basically realistic and feasible, although this analysis is a dynamic process that needs to be adapted to new conditions over time.

Such a structured approach will ensure that the gap analysis not only identifies the areas that are critical for improvement but also provides a practical framework that will progress landscape fire management practices in the Republic of Srpska toward enhanced resilience to landscape fires and protection of the environment and local communities.

To mitigate the negative impacts of LFs in the WB, it is necessary to have inclusive, cross-boundary cooperation and knowledge exchange to strengthen the capacities for landscape fire management (LFM) in the region. All of these aspects are incorporated in the Landscape fire management in the Western Balkans Programme. The Landscape Fire Management in the Western Balkans (LFMWB) is a project financed by the Swiss Agency for Development and Cooperation – SDC and coordinated by Farmahem from Skopje, North Macedonia with backstopping support from Helvetas Swiss Intercooperation from Switzerland. The first phase is designed to be implemented in the period from 01.02.2022 until 31.12.2026.

Objectives of the Gap Analysis

This Gap Analysis is purposed to identify, in a structured way, the gaps existing between the current state of landscape fire management in the Republic of Srpska and the desirable state of LFM that ensures effective prevention, preparedness, suppression, and post-fire management. The identification of such gaps will, therefore, enable the document to offer actionable recommendations that would lead to improved practices in LFM, increased resilience of forests and landscapes, and reduced risks to communities that depend on them for their livelihood and socio-economic development.

This gap analysis is not only a diagnostic tool but also one that should catalyse progress in the field by addressing deficiencies, enhancing existing practices and leveraging opportunities for improvement.

The analysis aims to:

Improve the capacity of the Republic of Srpska for sustainable and efficient management of landscape fires.

Clearly outline a pathway for the integration of LFM practices into larger environmental, economic, and social development plans.

The recommendations contained in this document encourage coordination, inclusiveness, and feasibility of the proposed actions by all stakeholders, and serve to enhance compliance with international standards and best practices in LFM.

Data-based findings and recommendations presented in this report inform policy and decision-making.

This would eventually enable the gap analysis to facilitate long-term planning, allocation of resources, and implementation of measures to enhance the resilience of forests and landscapes to fire for the protection of the environment and the communities.

Scope and Approach

A Gap Analysis is a structured assessment that compares the current state of something (process, project, system, paper) to the desired future state, measuring actual against expected results and identifying the differences or 'gaps' between them. It helps to understand what needs to be done to reach the desired goals or outcomes and recommends actions to address suboptimal or missing strategies, processes, technologies, resources, or skills. Also, this is a valuable tool for making informed decisions and driving improvements in processes and projects. It helps organizations bridge the divide between their current and desired states. Gap analysis isn't merely about pinpointing out problems but finding ways to make things better.

In simpler terms, these gaps we identify aren't just holes to fill. They are opportunities waiting to be seized. They show us where we are now, where we want to be, and what stands in the way. By recognizing these gaps, we can pave the way for growth and improvement, creating a clearer path toward reaching our goals. In addition, this analysis provides a framework for cooperation on the creation of a strategic plan and a joint execution plan that is visible and aligned with all stakeholders.

This Gap Analysis was prepared in an inclusive and participatory manner to make sure that realities and needs of the Republic of Srpska are considered. The scope covers all the relevant stages of landscape fire management, such as prevention, preparedness, suppression, and post-fire management. Cross-cutting themes such as stakeholder involvement, institutional frameworks, capacity building, and resource allocation are also covered within the scope of the analysis.

The basis of the analysis was guided by the following key steps for this approach.

Stakeholder Consultation: Consultations and participation of all major LFM stakeholders provided opportunities for diverse views to be collated, findings validated as well as an assurance that inclusiveness has been catered through workshops, meetings, and consultations for in the analysis.

Workshops of the LFM Network on the level of Republika Srpska: A set of workshops were conducted to allow stakeholders to interact and discuss on a common platform. These workshops provided a venue for identifying the priority gaps in a systematic way and for brainstorming solutions.

SWOT Analysis: Detailed SWOT analysis for each phase of LFM—prevention, preparedness, suppression and post-fire management—was complete, which helped in the identification of weaknesses, opportunities, and threats, converting them into actionable insights.

Expert Support: The analysis also drew from consultants of high repute in the LFM, forestry and environmental protection. Their input ensures that the findings and recommendations presented are feasible and technically sound to meet global standards.

Data-Driven Approach: Founded on hard evidence derived from official records, reports and contributions, the findings and an action plan have been pegged on reliable and relevant data.

Action Planning: An in-depth Implementation Framework was then developed indicating specific measures to be taken over specific timeframes by specific responsible entities with estimated costs to effectively address identified gaps.

Finally, this comprehensive methodological framework, developed with continuous guidance and expert support from RFMC, ensures that the Gap Analysis provides not only a thorough assessment of the current system but also practical, implementable solutions or a practical guide for implementing necessary improvements in Republic of Srpska's landscape fire management. The scope and approach ensure comprehensiveness, realism, and adaptability to evolving conditions, thus forming the basis of a resilient and sustainable future for landscape fire management.

1. GAP IDENTIFICATION ON LANDSCAPE FIRE MANAGEMENT IN THE REPUBLIC OF SRPSKA

The following document constitutes a comprehensive gap analysis of the landscape fire management (LFM) system in the Republic of Srpska. With a sharp focus on four critical domains—prevention, preparedness, suppression, and post-fire management—this analysis aims to evaluate the efficacy and functionality of the existing landscape fire management framework within the country, fostering a more resilient and adaptive approach to landscape fire management, ensuring the protection of our environment, communities, and natural resources.

GAP analysis for each of the elements of the four categories (Prevention, Preparedness, Suppression, and Post-fire Management) was completed according to the following structure:

1. GAP formulation
2. Detailed description of the gap – explanation of root causes of the gap
3. Desired state – Desired state is an outcome or achieved objective in the period between 1 and 5 years. While the desired state defines WHAT needs to be achieved within a period 1-5 years, the Implementation plan proposes concrete measures/activities on HOW the desired state will be achieved

1.1 PREVENTION

Prevention is a key phase of landscape fire management and is of great importance for impeding occurrence of landscape fires. The practice of developed countries has shown that 1 EUR invested in prevention yields equal or greater results than 10 EUR invested in suppression.

In this part of the analysis, various measures are considered in order to prevent the occurrence of fires, which include:

- ✓ Legislation: Overview of existing laws and regulations related to fire prevention, enforcement mechanisms, effectiveness of fines for misdemeanours, etc.
- ✓ Education and awareness: Assessment of public understanding of landscape fires, awareness raising campaigns regarding climate change including knowledge exchange on national and regional level.
- ✓ Regulatory measures: Land use planning, land management, combustible material management, ways of using and managing forests, openness of the area, etc.

Table 1. *An overview of the identified weaknesses of the current prevention system*

Insufficient implementation of existing landscape fire management (LFM)-related legal regulations and fire protection plans
Insufficient coordination between official institutions and other stakeholders in landscape fire management (LFM)

Insufficient cooperation in knowledge exchange with other countries
Insufficient public awareness of climate change impact on landscape fires
Lack of regulation over fragmented forest land ownership and unresolved property disputes
Insufficient mapping of waste dump sites
Inadequate categorization and classification of land in cadastre records

Prevention phase analysis recommends enhancing regulations, bolstering educational campaigns, raising public awareness, effective spatial planning, and refining implementation mechanisms to prevent landscape fires in Republic of Srpska.

The following are the most significant gaps regarding prevention in the current fire protection system.

INSUFFICIENT IMPLEMENTATION OF EXISTING LANDSCAPE FIRE MANAGEMENT (LFM)-RELATED LEGAL REGULATIONS AND FIRE PROTECTION PLANS

Some local communities in the Republic of Srpska lack fire protection plans while others that have developed plans face challenges in securing adequate funding to fully implement measures from those plans.

The possible root causes for this gap can be traced to several factors. One primary issue is the lack of comprehensive fire protection plans in some local communities. For those communities that have developed fire protection plans, a key obstacle is the insufficient funding needed to fully implement the measures outlined in the plans. Limited financial resources hinder the ability to carry out necessary actions such as infrastructure improvements, training, or acquiring equipment for fire management.

Another cause is the lack of practical alignment of the plans. In some cases, fire protection plans are too ambitious or unrealistic for the specific needs and capabilities of the local communities. If the plans are not tailored to the local context—such as the available resources, infrastructure, and capacity—then they become difficult or impossible to implement effectively.

Additionally, insufficient support and guidance for communities that lack fire protection plans can prevent them from developing the necessary frameworks to manage fire risks. Even communities with existing plans may struggle with a lack of technical expertise or coordination between local authorities to ensure that the plans are properly developed, funded, and executed.

Lastly, inconsistent enforcement of legal regulations can also contribute to the gap. When there is no strong oversight or accountability for the implementation of fire protection measures, communities may not prioritize or follow through on the legal requirements set forth in the plans. This can lead to the underdevelopment or non-implementation of crucial fire management activities.

Desired State: Every local community has developed a realistic, tailored annual Fire Protection Plan, with regular improvements and updates. These plans have been fully implemented with adequate funding and support, aligned with local needs and capacities, ensuring effective fire management and enhanced resilience.

INSUFFICIENT COORDINATION BETWEEN OFFICIAL INSTITUTIONS AND OTHER STAKEHOLDERS IN LANDSCAPE FIRE MANAGEMENT (LFM)

The current gap in coordination stems from a deficiency in formal communication channels among representatives of different agencies, businesses, and local communities, which leads to fragmented efforts despite the existence of robust legal regulations. This lack of structured and consistent communication prevents efficient collaboration and information sharing, hindering the ability to address fire management needs effectively. Additionally, poor coordination between the public and private sectors can create gaps in the allocation of resources, planning, and implementation of fire management strategies. Institutional silos, where different sectors work in isolation, further exacerbate the problem, limiting the potential for cohesive and coordinated fire prevention and response efforts.

Desired state: Proper coordination and communication have been established between institutions (and sectors) and other stakeholders. Formal communication channels have been put in place, facilitating consistent information sharing and coordination. These mechanisms have ensured cohesive efforts across both the public and private sectors, resulting in more effective landscape fire management (LFM).

INSUFFICIENT COOPERATION IN KNOWLEDGE EXCHANGE WITH OTHER COUNTRIES

There is insufficient collaboration with other countries in the exchange of expertise and best practices, despite having regional partnerships. The effectiveness of these collaborations is limited due to several factors.

One key issue is the lack of effective communication at the operational level, which hinders the flow of information and expertise between countries. Also, infrequent working meetings and a lack of proactive engagement from relevant stakeholders limit the opportunities for exchanging knowledge, leading to missed opportunities for sharing best practices and learning from successful fire management strategies. Despite having regional partnerships, these challenges prevent the establishment of strong, ongoing collaborations that could enhance fire management efforts across borders.

Other possible causes include institutional barriers, such as differing priorities or policies between countries, which can lead to reluctance or difficulty in sharing information. Cultural and language differences also play a role in hindering collaboration, making it harder for experts to communicate and understand one another's practices and experiences. Furthermore, the absence of structured frameworks or agreements for cross-border collaboration on fire management creates uncertainty about roles and responsibilities, further diminishing the effectiveness of knowledge exchange. Limited funding and resources for international collaboration efforts also restrict opportunities for engagement, particularly in countries with fewer resources dedicated to such initiatives. Lastly, a lack of mutual trust between countries or agencies can create barriers to sharing sensitive information or adopting foreign practices, which further weakens the effectiveness of international partnerships.

Desired State: International cooperation and knowledge exchange mechanisms have been strengthened, promoting mutual learning, ensuring know-how transfer, and joint capacity-building initiatives in landscape fire management.

INSUFFICIENT PUBLIC AWARENESS OF CLIMATE CHANGE IMPACT ON LANDSCAPE FIRES

Lack of awareness among the public regarding the connection between climate change and increased landscape fire risk result in inadequate behaviour and reaction of the general public to landscape fire prevention, and risk reduction.

One primary cause is the lack of targeted educational campaigns that effectively communicate the link between climate change and increased fire risks. Without clear, accessible information, the public may not fully understand how climate change is contributing to more frequent and severe landscape fires.

Another cause is the limited media coverage of climate change's role in fire behaviour, which results in a public knowledge gap. While climate change is often discussed in scientific and policy circles, it may not be adequately covered in mainstream media or communicated in a way that resonates with the general population.

Inadequate integration of climate change in fire management education is another contributing factor. Lastly, cultural and societal factors may play a role as some communities might not perceive climate change as an immediate threat, particularly if they have not experienced the direct impacts. This disconnect can result in a lack of urgency to address the issue and a failure to recognize the need for public awareness campaigns focusing on the link between climate change and fire risks.

Desired State: A well-informed public that clearly understands the link between climate change and the increased risk of landscape fires. This has empowered individuals and communities to adopt practices that lead toward climate resilience, support policy measures, and contribute to collective efforts in landscape fire prevention and mitigation.

LACK OF REGULATION OVER FRAGMENTED FOREST LAND OWNERSHIP AND UNRESOLVED PROPERTY DISPUTES

Many forests are owned by numerous private individuals, leading to fragmented management and unresolved property issues. Also, relatively large areas of forests have been usurped, i.e. the property issue has not been resolved.

One significant cause for this gap is the unresolved disputes over legal property rights, which complicate the ability to establish clear ownership and responsibilities for forest management. These disputes prevent effective land use planning and hinder the implementation of fire prevention or management measures. Another cause is the fragmentation of forest land ownership, with private forest parcels often being as small as 0.5 hectares. This small-scale ownership makes it difficult to manage forests effectively as landowners may lack the resources or incentive to engage in coordinated management practices, including fire risk reduction.

Additionally, there is no regulation for the management of private forests, leaving many owners without clear guidelines or legal requirements for forest care, fire prevention, or sustainable land use. Without a regulatory framework, individual landowners are left to manage their properties in isolation, which often leads to inconsistent fire preparedness and vulnerability to fire spread, especially when private forests border agricultural land. Fires in private forests can easily spread to adjacent agricultural lands, exacerbating the damage and impacting surrounding communities.

Moreover, lack of cooperation between private landowners may further hinder collective fire prevention efforts, as there is little coordination or collaboration to create shared strategies for fire risk management. Finally, insufficient institutional support for private forest owners in terms of technical advice, resources, or financial incentives can prevent effective forest management, leaving large areas of land inadequately prepared for fire prevention or mitigation.

Desired State: A well-regulated system has been established where private forest ownership has been clearly defined, and legal disputes have been resolved. This enhances forest management and strengthens fire prevention efforts.

LACK OF COMPREHENSIVE WASTE DUMP MAPPING

Numerous illegal waste dumps exist and there is no centralized map of these sites. Also, some local communities do not have an organized waste collection system.

The primary cause is the lack of centralized data collection and coordination among relevant authorities, leading to incomplete or fragmented information on waste dump sites. Without a systematic approach to mapping, waste disposal sites are often not tracked, making it difficult to assess their environmental impact or plan for cleanup and remediation efforts. Additionally, limited funding and resources dedicated to waste management and environmental monitoring may prevent the development and maintenance of a comprehensive waste dump database. Inadequate regulation or enforcement can also play a role, as improper waste disposal may not be properly documented or monitored, especially in informal or illegal waste sites. Lastly, lack of public awareness or involvement in waste disposal practices can lead to undocumented waste dumping, further complicating the mapping process.

Desired State: A centralized database has been created that accurately maps all waste dump sites, ensuring effective monitoring and management of waste disposal. This has contributed to reducing the risk of fire outbreaks at wild waste dump sites and has enabled efficient cleanup, remediation efforts and improved environmental protection.

LACK OF PROPER REGULATION AND MEASURES FOR MANAGEMENT OF ABANDONED LAND

Large areas of land do not belong to the categories listed in the cadastre. The situation on the ground and in the cadastre do not match in many situations (many forests are listed as meadows, for example, and vice versa).

The root causes of this gap are primarily linked to outdated and inaccurate cadastre records, which fail to reflect the current land use and classification. Many areas, such as forests listed as meadows or vice versa, are not correctly categorized, leading to discrepancies between the actual land use and what is recorded in official documents. This misalignment could be due to historical land use changes, where land that was once forested may have been converted to pasture over time, but the cadastre records have not been updated to reflect these changes.

Additionally, there is a lack of proper land survey and monitoring systems, which prevents accurate and timely updates to cadastre records. Limited coordination between land management authorities and other relevant agencies further exacerbate the issue, as land classifications are not consistently reviewed or corrected. Finally, insufficient resources or technical capacity in cadastre offices may hinder the ability to regularly update and maintain accurate land records.

Desired State: An improved, accurate and up-to-date cadastre system, reflecting the true classification and land use of all areas. This ensures alignment between official records and the actual situation on the ground, improving land classification schemes for better land use planning and fire risk management.

1.2 PREPAREDNESS (Readiness/Pre-suppressive)

This chapter focuses on the readiness of stakeholders to respond effectively to landscape fires and includes:

- ✓ Training and capacities: Assessment of training programmes for firefighters, forest workers, volunteers, and other persons participating in suppression as well as the availability of equipment and resources.
- ✓ Planning and Coordination: Assessing the effectiveness of emergency response plans, coordination mechanisms between agencies and organizations, and the integration of early detection and warning technology.

Table 2. *An overview of the identified weaknesses of the current preparedness (readiness/pre-suppressive phase)*

Absence of an early warning and detection system for landscape fires
Absence of professional firefighting teams within certain local government units
Insufficient number of trained human resources in LFM
Inconsistent procedures and terminology of LF suppression compared to the internationally adopted standards
Lack of proper equipment in LF suppression units
Underrepresentation of volunteerism in landscape firefighting
Insufficient country specific scientific research in landscape fire management
Lack of official fuel classification for vegetation and fire behaviour assessment
Absence of a landscape fire risk map on the territory of Republic of Srpska
Limited Meteorological Monitoring and Forecasting Infrastructure
Lack of knowledge on fire risks in agricultural lands among farmers
Insufficient production of deciduous seedlings in nurseries

These are the most significant gaps in the current preparedness (readiness) system.

ABSENCE OF AN EARLY WARNING AND DETECTION SYSTEM FOR LANDSCAPE FIRES

Currently there is no centralized system in place in Republic of Srpska for early warning and detection system for landscape fires at entity level.

The root causes of this gap can be traced to several factors. One major cause is the insufficient investment in technology and infrastructure, which prevents the establishment of an effective fire detection system. Another contributing factor is the lack of integration between existing monitoring systems. In many regions, fire monitoring efforts are fragmented, with no centralized system for coordinating data from various sources, such as weather stations, fire watch towers, or local reports. Limited capacity and training for personnel involved in fire monitoring also hinders the development of an efficient early warning system. Additionally, lack of political will or institutional prioritization prevent the establishment of a cohesive and proactive fire detection network, leaving communities and landscapes vulnerable to unmonitored fire outbreaks. Lastly, insufficient collaboration and communication between agencies, local authorities, and the private sector lead to gaps in fire detection efforts, delaying response times.

Desired State: A comprehensive early warning and fire information system has been implemented, providing reliable information on landscape fires. This enables the responsible authorities to efficiently manage landscape fires and inform the public about potential risks.

IMPROPER DISTRIBUTION OF FIRE FIGHTING TEAMS ACROSS THE COUNTRY

Certain areas within local government jurisdictions do not have dedicated fire department units. This absence poses significant risks to public safety and property.

One key cause is insufficient funding and resources, which prevents local governments to establish and maintain dedicated firefighting teams. Without adequate budget allocations, local authorities may be unable to hire, train, and equip professional firefighters.

Also, insufficient organizational capacity or planning at the local government level may hinder the development of a professional firefighting force. Some units may lack the knowledge, experience, or administrative capacity to establish and manage professional fire services effectively.

Furthermore, geographical or demographic factors may play a role, especially in rural or remote areas where population density is low, making the demand for a full-time professional firefighting team less evident. In such areas, volunteer firefighting units may be relied upon, even if they are not always sufficient to address large-scale fires.

Finally, lack of collaboration between local and national authorities can lead to fragmented or inconsistent fire response systems, where smaller or less resourced local governments may struggle to develop and maintain professional firefighting teams.

Desired State: All local government units across the country have well-established, professional firefighting teams that are adequately funded, trained and equipped to respond to fire emergencies effectively. Adequate funding has been allocated, qualified personnel have been recruited and trained, and modern firefighting equipment has been procured.

LACK OF TRAINED HUMAN RESOURCES IN LFM

Having a sufficient number of trained human resources in landscape fire management (LFM) is crucial because they possess the specialized knowledge and skills necessary to manage complex, large-scale fires in diverse environments. Currently, there is no centralized facility specialized for the training of landscape fire-fighters (professional firefighters, volunteers, forestry service, emergency service, municipality etc.). Firefighters in Republic of Srpska are primarily trained to address urban fires, focusing on structures, buildings, and more localized fire scenarios. This training does not adequately prepare them for the unique challenges of landscape fire management (LFM), which requires specialized skills to handle large-scale fires in natural environments, involving complex terrain, diverse vegetation, and unpredictable fire behaviour.

The root causes of this gap include a focus on training for urban fire extinguishing rather than for landscape fire management, leaving a significant shortage of personnel skilled in managing fires in larger, more complex environments.

Another cause could be a lack of awareness or prioritization of landscape fire management as a distinct field, leading to insufficient investment in training personnel for these specific needs. Additionally, there may be logistical and financial barriers that prevent firefighters from accessing specialized LFM training, such as limited resources or funding for training programmes. The shortage of qualified instructors or experts in the field also hinders the expansion of appropriate training opportunities.

Desired State: A specialized landscape fire-fighting training centre has been established, providing standardized and specialized training programmes for landscape fire-fighters across multiple sectors. This ensures their readiness and effectiveness in responding to fire emergencies.

INCONSISTENT PROCEDURES AND TERMINOLOGY OF LF SUPPRESSION COMPARED TO THE INTERNATIONALLY ADOPTED STANDARDS

Procedures and terminology related to landscape firefighting are not standardized and aligned with those of internationally adopted, which makes cooperation during LF suppression difficult.

One of the key issues is the absence of standardized procedures and terminology for landscape fire suppression, which leads to inconsistencies in how fire management is approached at national and local levels. These discrepancies make coordination and cooperation during firefighting efforts, especially across borders, more challenging, as different agencies or countries may use different methods, terms, or systems to describe fire-related activities.

Another contributing factor is the lack of awareness or adherence to international best practices. Firefighting agencies may not be familiar with or trained in internationally recognized standards, either due to resource constraints or insufficient emphasis on global fire management guidelines. This lack of alignment limits the ability to adopt proven and effective methods used worldwide.

Furthermore, institutional and organizational fragmentation may play a role, with fire management responsibilities spread across various entities that operate under different frameworks or policies.

Additionally, cultural factors or national policies could influence resistance to adopting international standards. In some cases, local traditions or long-standing practices in fire management may not align with global practices, leading to reluctance or slow adoption of standardized procedures.

Finally, insufficient funding or technical resources may prevent the necessary training, system upgrades, or procedural changes that would bring fire suppression efforts in line with international standards.

Desired State: Procedures and terminology have been harmonized with those of international standards, facilitating smooth cooperation and the effective exchange of assistance during landscape fire incidents.

LACK OF PROPER EQUIPMENT IN LF SUPPRESSION UNITS

Most LF suppression units are equipped with outdated or inadequate equipment, hampering their effectiveness in fire suppression.

Main cause for this gap is insufficient funding and budget allocations, which can prevent firefighting units from acquiring or maintaining the necessary equipment. Local or national governments may prioritize other needs, leaving fire suppression units under-resourced.

Another contributing factor is the inefficient procurement processes, where outdated or bureaucratic procedures delay the purchase of essential equipment. These delays leave firefighting units without the tools they need, especially during high-risk seasons.

Additionally, the lack of strategic planning or needs for assessment of fire management lead to purchasing of wrong equipment, or a failure to recognize emerging needs for new technologies, such as advanced firefighting vehicles, drones, or protective gear.

Lastly, inadequate training on equipment use is also a contributing factor. Even if firefighting units have the proper equipment, lack of training or familiarity with the tools can prevent effective use during fire suppression operations.

Desired State: All landscape fire suppression units have been equipped with proper equipment and technology, including fire vehicles, personal protective gear, communication devices, and firefighting tools. This has enhanced operational capabilities, safety standards and response efficiency during fire incidents.

UNDERREPRESENTATION OF VOLUNTEERISM IN LFM SYSTEM

Volunteer firefighting is not sufficiently integrated into the overall firefighting system leading to limited manpower and resources during emergency response. One of the issues is the lack of sufficient integration of volunteer firefighting into the broader firefighting system, resulting in limited manpower and resources during critical fire response efforts. Volunteers are not adequately recognized or supported, leaving them feeling undervalued.

A significant contributing factor is the lack of motivation or incentives for individuals to join volunteer firefighting teams. Without tangible rewards, such as financial compensation, time off, or public recognition, people may not feel motivated to participate. For example, in Slovenia, volunteers receive extra paid days off, an incentive that helps attract more individuals to participate in firefighting efforts, but similar incentives are lacking in the Republic of Srpska.

Limited promotion and awareness of the importance of volunteer firefighting in Republic of Srpska contributes to this gap, as the benefits and opportunities of volunteering are not widely communicated to the public. Furthermore, the lack of structured support systems, including proper training and resources for volunteers, may deter potential volunteers who feel unprepared or unsupported in their roles. Finally, insufficient institutional recognition of volunteers' contributions results in a lack of sustained engagement and long-term commitment.

Desired State: Participation and engagement of volunteer firefighters have increased through recruitment drives and training programmes.

INSUFFICIENT SCIENTIFIC RESEARCH IN LANDSCAPE FIRE MANAGEMENT

There is a lack of comprehensive country-specific scientific research, which hinders the development of evidence-based landscape fire management.

The root cause for this gap can be attributed to the lack of funding dedicated to scientific research in landscape fire management. Without adequate financial support, there is little incentive or ability to conduct in-depth, country-specific studies to understand local fire behaviour, ecosystem responses, and effective management strategies.

Another root cause is the limited institutional capacity. Research institutions or government bodies lack the necessary resources, expertise, or technical infrastructure to carry out specialized studies on landscape fire management, leading to a reliance on generalized, global studies that may not be applicable to local conditions.

Additionally, insufficient collaboration between research, policy, and fire management practitioners hinder the development of country-specific research. If there is a disconnect between researchers, policymakers, and the firefighting community, it becomes difficult to prioritize and focus on locally relevant issues and solutions in fire management.

There may also be a lack of data collection and monitoring systems. Without reliable data on landscape fires, their causes, and their impact on ecosystems and communities, conducting meaningful scientific research becomes challenging.

Political or institutional inertia might also contribute to the gap. Fire management may not be seen as a priority in some regions, which leads to a lack of political will or institutional support for research initiatives in landscape fire management. This lack of prioritization can result in the underdevelopment of scientific research specific to the country's fire management needs.

Desired State: A well-established, scientific research framework for landscape fire management has been put in place, supported by adequate funding, resources, and institutional capacity.

ABSENCE OF AN OFFICIAL WILDLAND FUEL CLASSIFICATION

Currently, there is no standardized methodology in place to categorize vegetation types and fuel characteristics based on scientific criteria. This hinders accurate assessment and prediction of fire behaviour across different regions.

The possible root causes for this gap can be traced to the lack of a standardized methodology for categorizing vegetation types and fuel characteristics, which prevents the accurate assessment and prediction of fire behaviour. While sufficient data may exist, failure to process and utilize this data is a significant barrier, with unclear reasons for the lack of action. This may stem from insufficient institutional coordination, where no clear ownership or responsibility for processing and classifying the data exists, resulting in delays or inaction.

Another root cause is the lack of technical expertise or capacity in relevant institutions to develop and implement a scientific fuel classification system.

Limited funding and resources could also contribute to the gap, as processing and classifying fuel data require financial support for both human resources and technical tools.

Lastly, fragmented data collection systems or inadequate data-sharing mechanisms between agencies and institutions hamper the process of compiling and utilizing the available data, leading to missed opportunities for comprehensive fuel classification and more accurate fire behaviour predictions.

Desired State: A fuel classification methodology based on scientific criteria has been established, enabling consistent categorization of vegetation types and fuel characteristics. This official fuel classification system enhances fire preparedness, response, and overall landscape fire management.

ABSENCE OF A LANDSCAPE FIRE RISK MAP ON THE TERRITORY OF REPUBLIC OF SRPSKA

There is no comprehensive fire risk map that indicates levels of fire risk and sensitivity, making it impossible to effectively plan for training, equipment procurement, resource allocation, and other critical aspects.

One possible root cause could be the lack of a foundational fuel map, which is necessary to assess the fuel types and characteristics that contribute to fire risk. Without a comprehensive fuel map, it is impossible to accurately determine areas of high fire risk. Another cause is the insufficient data collection and analysis, as available data on vegetation, weather, and fire history may not be systematically gathered or processed to create an effective risk map.

Lack of technical expertise or capacity to develop and implement a landscape fire risk map is a contributing factor. Developing such maps requires specialized knowledge in remote sensing, fire modelling, and GIS technologies, which may not be readily available.

Limited funding and resources for fire risk mapping could also be a barrier, as these projects often require substantial financial investment in both equipment and personnel. Finally, lack of institutional coordination between relevant agencies, such as environmental and firefighting authorities, hinders the creation of a unified map, as responsibilities for fire risk mapping may not be clearly defined or prioritized.

Desired State: A comprehensive landscape fire risk map has been developed and implemented, identifying high-risk areas to effectively plan and prioritize landscape fire risk reduction measures and overall proper management.

LIMITED METEOROLOGICAL MONITORING AND FORECASTING INFRASTRUCTURE

Insufficient coverage of meteorological stations across Republic of Srpska results in gaps in weather monitoring for landscape fires conditions.

Primary cause is the insufficient investment in meteorological infrastructure, particularly in the establishment and maintenance of real-time weather monitoring systems and local weather stations.

Another factor is the over-reliance on external satellite forecasts, such as those from European sources, which may not provide the level of precision required for local, micro-level weather conditions. These

forecasts are often generalized and do not capture specific, real-time variations that could be critical for fire risk management.

Additionally, there is a lack of density and coverage of meteorological stations, particularly in remote or rural areas. Inadequate station placement limits the ability to gather accurate, high-quality data at a micro level, making it difficult to assess localized weather patterns that influence fire behaviour.

Furthermore, lack of coordination and integration between meteorological agencies, fire management bodies, and other relevant institutions may result in fragmented efforts, leading to inefficiencies in weather monitoring and forecasting. Finally, insufficient technical expertise or training for personnel responsible for operating weather stations or interpreting meteorological data further affects negatively the development of an effective weather monitoring system.

Desired State: A comprehensive, real-time meteorological monitoring and forecasting system with an extensive network of high-quality meteorological stations, particularly at the micro-level, has become fully operational, providing accurate and localized weather data. This system enables timely alerts, fire danger ratings, and proactive measures to prevent and mitigate fire incidents.

LACK OF KNOWLEDGE ON FIRE RISKS IN AGRICULTURAL LANDS AMONG FARMERS

Farmers play a critical role in landscape fire management due to their direct involvement in land use and agricultural practices, which can either contribute to or help mitigate fire risks. Unfortunately, they lack education regarding the detrimental effects of burning agricultural residues on their farmland. The absence of training and awareness about the consequences of burning crop residues leads to adverse impacts on the quality and fertility of their agricultural land.

Possessing knowledge of landscape fire management among farmers is essential for promoting fire-safe practices, reducing fire hazards, and fostering community-wide resilience against wildfires. Farmers are often the first to observe changes in vegetation, weather conditions, or early signs of fire, and with the right knowledge, they can take proactive steps to prevent or control fires on their properties.

Educating farmers on fire risk factors—such as how dry conditions, the type of crops grown, and the management of crop residues can increase fire risks—helps them implement preventive measures like creating firebreaks, proper disposal of waste, and safe burning practices.

Farmers do not have access to formal education or training programmes that specifically address landscape fire management. Since these programmes are not offered by agricultural extension services or local agricultural organizations, farmers remain unaware of the risks and best practices related to fire management. Extension services, which traditionally serve as a bridge between farmers and scientific knowledge, are underdeveloped or lacking in rural areas. These services do not include fire management as part of their offerings, so farmers do not receive critical information about fire risks, prevention strategies, and fire-safe land management practices.

Agricultural advisors or experts do not have the necessary training or capacity to advise farmers on landscape fire management effectively. The extension workers are not equipped with the knowledge or resources to provide fire-specific guidance, which leads to an increase of the knowledge gap.

Farmers often prioritize immediate agricultural needs (e.g., crop production, market demands) over long-term fire risk management. Without an understanding of the long-term benefits of fire prevention, such as reduced loss of crops and land, farmers do not view fire management as essential to their operations.

Most of the farmers rely on traditional methods of land clearing, burning, and crop management that may inadvertently increase fire risks. Since these traditional practices have been passed down for generations, farmers are not open enough to modern fire management techniques, nor do they see the need for change. They are accustomed to using fire for land clearing and pest control, and resist adopting new fire management practices, especially when they perceive these methods as unfamiliar, costly, or disruptive to their existing ways of farming.

Desired state: A well-informed, proactive farming community possesses the knowledge, tools, and resources needed to manage fire risks effectively. This has led to safer, more sustainable agricultural practices, reduced fire-related losses and stronger community involvement in fire management efforts.

INSUFFICIENT PRODUCTION OF DECIDUOUS SEEDLINGS IN NURSERIES

Significant portions of forested areas consist of conifer monocultures, which are susceptible to fires and ecologically unstable. This monoculture practice, driven by economic factors, has led to forests that lack biodiversity, resilience and are more prone to catastrophic fire events. The existing production of containerized deciduous seedlings is not sufficient to meet the needs of afforestation. According to the Master Plan for Afforestation of the Republic of Srpska, this has been less than 10% lately. Also, seedlings should be grown to be as mature as possible before planting, as they are more resistant to stress during planting and record better results, even though they are initially more expensive to produce. The production of planting material is in line with the needs and habitat potentials.

Following the production plan:

Initial values: Three million seedlings (spruce (Picea abies) 41%; white pine (Pinus sylvestris) 16%; black pine (Pinus niger) 25%; other 18%)

Target values: Five million seedlings (beech (Fagus sylvatica) 14%; fir (Abies alba) 11%; oak (Quercus petreaea) 11%; spruce (Picea abies) 9%; white pine (Pinus sylvestris) 3%; black pine (Pinus niger) 11%)

The root causes for this gap can be attributed to the tradition and preference for cheaper, non-deciduous plant varieties, which have historically been more popular due to their lower production costs and faster growth rates. This preference has led nurseries to focus on non-deciduous species, often at the expense of deciduous varieties, which may require more time and resources to grow.

Additionally, the lack of knowledge or training on the benefits and importance of deciduous species in landscape management also contributes to this gap.

Insufficient financial incentives or support for producing deciduous seedlings may also play a role.

Furthermore, climate and environmental factors could impact the ability to grow deciduous seedlings, particularly if the local conditions are not conducive to their cultivation or if nurseries lack the appropriate infrastructure for growing a wider variety of species. Finally, lack of market demand or consumer awareness about the benefits of deciduous plants may also discourage nurseries from investing in their production.

Desired State: A well-balanced nursery production system prioritizes the cultivation of a diverse range of plant species, including a sufficient supply of deciduous seedlings. Nurseries are equipped with the knowledge, resources, and incentives to produce high-quality deciduous plants, meeting ecological, environmental, and market demands.

1.3 SUPPRESSION

Suppression, or the phase of localization and fire extinguishing, is a process where the focus is primarily on extinguishing the fire and reducing its harmful impact. This includes deploying ground and aerial resources in order to control and suppress LF and also provide assistance to affected communities. Coordinated and prompt reactions are the main precondition for effective LF control and suppression.

Table 3. *An overview of the identified weaknesses of the current suppression system*

Lack of quality command training and practical command in managing large-scale fire incidents and coordination efforts.
Lack of coordination mechanisms during firefighting operations
Lack of knowledge and expertise in coordinating helicopter units with ground units during fire suppression operations.

Taking this into consideration here are the defined gaps:

SHORTAGE OF A SPECIALIZED COMMAND PERSONNEL FOR LANDSCAPE FIRE SUPPRESSION

The current situation is marked by a deficiency in command personnel specifically trained to combat potential large-scale fires across vast areas. This shortage hampers the ability to effectively coordinate and manage firefighting efforts in the event of significant fire outbreaks.

One of the major causes for this gap is the lack of experience in commanding larger firefighting units or managing large-scale fires, which leaves personnel unprepared for complex, wide-ranging fire events.

In addition, there may be insufficient training programmes focused on the specialized skills needed for large-scale fire suppression. Another factor is the limited career development pathways for fire management personnel, which may result in a lack of qualified candidates rising to command positions.

Finally, organizational fragmentation within firefighting agencies may also hinder the development of specialized command personnel. If fire management systems are decentralized or there is insufficient communication between agencies, it can limit the ability to train and deploy effective commanders for large-scale fires.

Desired state: Well-trained command staff capable of effectively managing large-scale landscape fires.

INADEQUATE COORDINATION MECHANISMS DURING FIREFIGHTING OPERATIONS

Coordination among firefighters (All involved stakeholders with their forces), forest management units, police, civil protection and relevant stakeholders is inadequate, leading to inefficient and suboptimal utilization of resources. That means that the engaged resources (human and equipment) don't yield the desired result.

The possible causes for inadequate coordination mechanisms during firefighting operations can be traced to several factors. One key issue is the lack of clear roles and responsibilities within the coordination centre.

Second contributing factor is the insufficient communication infrastructure or technological limitations within the coordination centre. If communication tools are outdated or unreliable, or if there is a lack of integration between different communication systems used by various agencies, it becomes difficult to ensure seamless collaboration during firefighting operations.

Limited training and preparedness for joint operations also contribute to poor coordination. Firefighters and other emergency responders are not adequately trained in inter-agency collaboration, leading to inefficiencies during high-pressure situations. This is compounded by the lack of regular joint exercises or simulations to practice coordination, which can leave gaps in operational effectiveness during real incidents.

Additionally, institutional barriers such as bureaucratic delays, lack of trust between agencies, or competition for resources can lead to disjointed efforts during fire operations.

Lastly, the lack of standardized procedures or protocols for multi-agency coordination can create confusion. Without clear, well-established frameworks for collaboration, each agency may operate based on its own procedures, making it harder to align efforts and achieve a coordinated firefighting response.

Desired State: A unified incident command system and communication protocols have been established, facilitating coordination and information-sharing during firefighting operations, especially during the use of aerial suppression services. This has enabled swift and effective deployment of personnel, equipment, resources and aerial means, optimizing the collective response to fires and minimizing burnt area and damage levels.

INADEQUATE COORDINATION BETWEEN GROUND TO AIR FORCES DURING FIRE SUPPRESSION OPERATIONS

There is a lack of, or insufficient, knowledge and expertise in coordinating helicopter units with ground units during wildfire suppression operations. This gap leads to inefficiencies in communication, delays in response, and reduced effectiveness in extinguishing fires.

Primary cause for this gap is the lack of qualified personnel on the ground who are trained to manage the complex procedures involved in helicopter operations, such as determining suitable landing sites, assessing wind conditions, and calculating fuel needs. These tasks require specialized knowledge to ensure the safety and efficiency of aerial operations.

Another contributing factor is the absence of standardized procedures or guidelines for coordinating air-ground operations, which can lead to confusion and delays during firefighting efforts. In some cases, there may be limited training programmes for both helicopter crew members and ground personnel, preventing them from fully understanding how to work together effectively in fire suppression efforts. Furthermore,

insufficient integration between helicopter units and ground teams may result in a lack of communication and coordination, making it difficult to synchronize efforts during critical moments. While Serbia may have solved this challenge with more effective coordination, other regions may face a lack of institutional support, resources, or focus on improving these critical operational links.

Finally, the lack of regular joint exercises or simulations involving both helicopter and ground units hampers the development of smooth, efficient coordination.

Desired State: Fire suppression operations are well-coordinated, with aerial suppression units and ground teams working seamlessly together. Qualified personnel on the ground are trained to manage aerial fire suppression procedures. Standardized protocols, regular joint training exercises and effective communication systems ensure safe, efficient and synchronized air-to-ground operations, optimizing the effectiveness of fire suppression efforts.

1.4 POST FIRE MANAGEMENT

Post-fire management is both the final phase of landscape fire management and the initial step in restoring landscapes.

Landscape fires can significantly increase soil erosion and harm water quality by washing away fire-related pollutants into rivers. The extent of this damage depends on factors like how severe the fire is, the type of vegetation, the characteristics of the burned area (such as climate, soil, and terrain), and how much time passes between the fire and the next rainfall. To reduce the impact of fires on soil and water, rehabilitation efforts are necessary. Predicting how much runoff and sediment will occur after a fire is crucial for managing risks and planning effective restoration measures for soil and water.

Current post-fire restoration and recovery efforts lack smart and holistic approaches, impeding efficient and resilient rehabilitation of fire-affected landscapes. Inadequate coordination, limited data integration, and resource constraints hinder prioritising and implementing effective restoration strategies, resulting in prolonged ecosystem recovery, increased susceptibility to future fires or related risks deriving from fire events, and diminished socio-economic well-being.

Table 4. *An overview of the identified weaknesses of the current post-fire management system*

Absence of Integrated Post-Fire Management Procedures
Absence of Official Standardized Methodology and Statistical Forms for Post-Fire Data Collection and Analysis
Insufficient Scientific Research in Post-Fire Management
Inadequate Post-Fire Management of Burnt Areas
A Small Percentage of Officially Detected Fire Causes and Their Inadequate Enforcement

Farmers play a critical role in landscape fire management due to their direct involvement in land use and agricultural practices, which can either contribute to or help mitigate fire risks.

ABSENCE OF INTEGRATED POST-FIRE MANAGEMENT PROCEDURES

Currently, there is a lack of a cohesive and integrated set of procedures for post-fire management across various jurisdictions and landscapes. Post-fire management involves a range of critical activities related to

ecological restoration, erosion control, infrastructure protection and community recovery. However, these efforts are often fragmented, inconsistent or reactive rather than proactive. This fragmented approach can lead to inefficiencies, delays in recovery efforts, and suboptimal effects in terms of ecosystem resilience and community well-being. Lessons learned are often not documented or implemented, leading to a cycle of repeated errors and vulnerabilities in LFM practices.

One key issue is the lack of coordinated efforts between agencies involved in post-fire management, such as firefighting, environmental protection, forestry, and local governments.

This is followed by an insufficient planning and preparedness for post-fire recovery, where the focus is primarily on fire suppression during the incident, but the long-term recovery and rehabilitation of the affected areas are not adequately addressed in advance. This lack of foresight can delay recovery processes and result in ineffective management of land restoration, community support, and ecosystem rehabilitation.

Additionally, limited funding and resources dedicated to post-fire management may hinder the development and implementation of integrated procedures. In many cases, the immediate costs of firefighting efforts take priority over long-term recovery planning, leaving post-fire management underfunded or unsupported.

Inadequate data collection and monitoring systems may also contribute to the gap. Without proper systems in place to assess the damage and monitor recovery progress, it is difficult to create a coordinated and informed post-fire management plan.

Desired State: Integrated Post-Fire Management procedures have been established, leading to a model for assessing fire damage. This model includes standardized protocols for assessing fire impacts, coordinating multi-agency responses, prioritizing restoration activities based on ecological and community needs and monitoring long-term recovery progress.

ABSENCE OF AN OFFICIAL STANDARDIZED METHODOLOGY AND STATISTICAL FORMS FOR POST-FIRE DATA COLLECTION AND ANALYSIS

Currently there is no standardized methodology for collecting and analysing comprehensive post-fire data, including ecological, social and economic impacts. This lack of a unified approach hinders a thorough assessment of fire impacts and makes it difficult for informed decision-making in fire management practices. Also, there is a need for standardized statistical forms to facilitate consistent data collection across institutions responsible for fire data, such as protected area managers, Forestry management units, the Ministry of Internal Affairs, firefighters, and civil protection agencies.

The possible root cause for this gap is the lack of coordination between agencies involved in fire management and post-fire recovery, resulting in inconsistent data collection methods. Different agencies may use their own formats or procedures, making it difficult to integrate and analyse post-fire data effectively.

Second factor is the absence of formal guidelines or regulations that mandate standardized methodologies for data collection and analysis following fires. Without clear directives or policies from governmental or regulatory bodies, agencies may not prioritize or implement consistent approaches to post-fire data gathering.

Additionally, there are limited resources or capacity to develop and implement a standardized methodology. Data collection and analysis require specialized tools, trained personnel, and financial resources, which

may not be readily available or prioritized in many regions, especially after a fire event when resources are already stretched.

Inadequate training or knowledge in the field of post-fire data collection also contributes to this gap. If personnel involved in fire management or recovery efforts are not familiar with proper data collection methods, the quality and consistency of the data may suffer.

Finally, political or institutional barriers hinders the development of standardized forms and methodologies. If post-fire recovery is not seen as a priority, or if agencies work in isolation with competing interests, there may be little incentive or capacity to establish a unified system for data collection and analysis.

Desired State: A unified data collection methodology has been developed and implemented, including standardized statistical forms for post-fire assessments. This methodology enables systematic monitoring, analysis and reporting of fire incidents across different institutions. By establishing uniform statistical forms, it provides valuable insights into fire patterns, trends, impacts and the effectiveness of fire management strategies.

INSUFFICIENT SCIENTIFIC RESEARCH IN POST-FIRE MANAGEMENT

There is a lack of scientific research regarding post-fire management and the long-term effects of fires on ecosystems, communities and infrastructure.

The most crucial barrier that causes this gap is the lack of funding. Since international projects are often the main source of funding for such research, this can lead to reliance on external support, which may not always align with national priorities or result in sustainable long-term research efforts.

Another cause is the lack of local experts or a specialized workforce in the field of post-fire management. With limited expertise and training programmes in this area, it becomes difficult to build a strong foundation for scientific research and innovation in post-fire recovery and management.

Additionally, insufficient institutional support for post-fire research contributes to the gap. If research is not prioritized or integrated into national fire management strategies, there may be a lack of organizational backing, coordination, and infrastructure to support scientific initiatives.

Limited collaboration between research institutions, government agencies, and fire management authorities is another barrier that affects the development of post-fire management studies. Without a unified effort and exchange of knowledge, the research may lack relevance or fail to address the most pressing challenges in post-fire recovery.

Desired State: Well-supported scientific research framework for post-fire management, with adequate funding, local expertise and institutional backing is established.

INADEQUATE POST-FIRE MANAGEMENT OF BURNT AREAS

Post-fire management efforts in burned areas are often delayed or inadequate, prolonging ecological recovery and exacerbating environmental degradation. There is an excessive use of conifer seedlings in afforestation and rehabilitation of burnt areas, due to their excessive and unplanned production in nurseries.

One significant cause is the delayed response to post-fire recovery, where firefighting efforts are prioritized over rehabilitation, causing prolonged ecological recovery and exacerbating environmental degradation. The lack of timely intervention in assessing and restoring burnt areas leads to diminished biodiversity and increased erosion, as well as hindered recovery of essential ecosystems.

Another contributing factor is the excessive use of conifer seedlings in the afforestation and rehabilitation of burnt areas. This results from unplanned and excessive production of conifer seedlings in nurseries, which leads to monocultures being planted instead of a more ecologically diverse mix of species. Such monocultures can increase fire risks and reduce the resilience of ecosystems in the long term.

Additionally, lack of a coordinated, comprehensive recovery strategy is a significant root cause. Often, post-fire management lacks integration between fire management, ecological restoration, and land-use planning, resulting in fragmented or ineffective restoration efforts. Insufficient funding and resources dedicated to post-fire rehabilitation can further hinder recovery, as there may be a shortage of materials, expertise, or long-term support to restore the affected ecosystems.

Finally, poor monitoring and data collection delays the assessment of damage and recovery progress, leading to ineffective management strategies.

Desired State: Timely and proper rehabilitation measures have been implemented in burned areas, including vegetation regeneration, erosion control and habitat restoration. These measures have expedited ecosystem recovery, mitigated soil erosion and water quality impacts and supported the regeneration of biodiversity and ecosystem services in fire-affected landscapes.

INSUFFICIENT FIRE CAUSE INVESTIGATION AND ACCOUNTABILITY FOR OFFENDERS

The causes and initiators of fires are not adequately identified and sanctions for offenders are not effective. In the past period, the perpetrator of a fire was discovered in only 16% of cases.

The possible root causes for this gap can be attributed to several factors. One major issue is the lack of expertise and specialized training for investigating the causes of landscape fires. Without a dedicated team of forensic experts, it is difficult to effectively gather, analyse, and present evidence in fire investigations. Additionally, inadequate legal frameworks and laws around fire-related offenses make it challenging to prove the causes of fires in a legal context, limiting the effectiveness of investigations and subsequent enforcement actions.

Another cause are the low penalties for those found responsible for causing fires. When the penalties are insufficient or not properly enforced, there is little deterrent for individuals or groups who may negligently or intentionally start fires, contributing to the recurrence of such incidents. Furthermore, the lack of public awareness and negative promotion of those punished for fire-related offenses reduces the perceived severity of the consequences, failing to act as a deterrent for potential offenders.

Finally, limited funding and resources for developing and maintaining a forensic service prevents the establishment of a dedicated team for LF investigations. This includes the lack of proper tools, technologies, and personnel required to carry out thorough investigations into the causes of landscape fires.

Desired State: Investigation and understanding of fire causes have been enhanced, coupled with strict enforcement of penalties to deter arson and negligence. A specialized forensic service dedicated to investigating the causes of landscape fires has been established, staffed with trained experts, supported by clear legal frameworks and effective enforcement mechanisms. This has resulted in over 70% of arson cases being solved.

2. IMPLEMENTATION FRAMEWORK

To prepare an effective implementation framework that addresses the identified gaps in the current fire management and protection system on the level of Republic of Srpska, Bosnia and Herzegovina, it is crucial to have a comprehensive understanding of the various factors, challenges, and complexities involved in the landscape fire management. This understanding must include the overall landscape fire situation and provide effective solutions. The implementation framework, as shown in Table 5. below, aims to achieve this through actions regarding the identified gaps, suggesting precise measures, identifying the responsible parties, specifying the implementation period and estimating the presumed costs of implementation. Emphasis is placed on the multifaceted approach of LFM that integrates efforts on prevention, preparedness, suppression, and post-fire management.

The framework is carefully tailored to address specific gaps in the current fire management/protection system, with a clear delineation of the responsibilities of the key stakeholders and the allocation of resources to ensure effective implementation. Furthermore, this framework puts emphasis on the importance of collaboration between government agencies, emergency services, communities and all key stakeholders listed here:

List of major stakeholders in terms of Landscape Fire Management in Republic of Srpska:

- ✓ Association of Municipalities and Cities of the Republic of Srpska
- ✓ Associations of Agricultural Producers of the Republic of Srpska
- ✓ Directorate for Civil Protection Republic of Srpska
- ✓ Firefighters Association of the Republic of Srpska
- ✓ Industrial Plantations
- ✓ Institute of Statistics Republic of Srpska
- ✓ Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska
- ✓ Ministry of Interior
- ✓ Ministry of Spatial Planning, Construction and Ecology
- ✓ National Park „Kozara', National park „Sutjeska' and National Park „Drina'
- ✓ NGOs
- ✓ Public Forestry Enterprise 'Forests of the Republic of Srpska' a.d.
- ✓ Republic Administration for Geodetic and Property-Legal Affairs
- ✓ Republic Administration for Inspection Affairs
- ✓ Republic Hydrometeorological Service
- ✓ Republic Institute for the Protection of Cultural, Historical and Natural Heritage of the Republic of Srpska
- ✓ University of Banja Luka, Faculty of Agriculture
- ✓ University of Banja Luka, Faculty of Forestry

By fostering a culture of shared responsibility and collective action, Republic of Srpska can and must improve its landscape fire management and build fire-resilient landscapes in response to ever-increasing factors that create favourable conditions for fire occurrence which are at present already manifested and are expected to increase in the years to come. This framework aims to address identified gaps to enhance the country's resilience to landscape fires, reduce their impact on the ecosystems and communities and promote sustainable land management and spatial planning practices concerning fires. Finally, the

framework aims to serve as a roadmap for the improvement of landscape fire management by utilizing the existing fire protection system in its entirety and transforming it into an improved, more refined system by implementing the landscape fire management principles and approach, effectively addressing the identified shortcomings. This can only be achieved through joint efforts of all stakeholders for a safer, more resilient landscape and environment for current and future generations and their livelihoods.

Note on prioritization of the measures in the action plan table:

The action plan table prioritizes all measures at three levels as follows.

Green colour: Measures marked in green represent Priority I. These are the most urgent and critical measures that should be attended to.

Orange colour: Measures marked in orange represent Priority II. These measures are important but follow after Priority I measures have been initiated or completed.

Blue colour: Measures marked in blue represent Priority III. These are of the lowest priority, which can be implemented later or after the higher-priority measures have already been addressed.

Important clarification: The prioritization does not refer to the timeline for implementation but rather to the importance and logical order of measures. Priority I measures are those that must be finished first to enable or support the implementation of other measures of the action plan.

Table 5. *Action plan*

N.	GAP Identified	Sub. number	Measure	Period of implementation	Responsible institution/s	Foreseen Budget	Priority
1			PREVENTION				
1.1	Insufficient implementation of existing landscape fire management (LFM)-related legal regulations and Fire Protection Plans	1.1.1.	Analysis of the current inspection services	Up to 1 year	Inspectorate of Republic of Srpska, Supreme Audit Office of Republic of Srpska	50,000.00 BAM	I
		1.1.2.	Developing fire protection plans	Up to 1 year	Local communities	150,000.00 BAM	I
		1.1.3.	Provide training and resources to relevant authorities for effective enforcement measures as per fire protection plans	Up to 1 year	All relevant institutions	80,000.00 BAM	I

1.2	Insufficient coordination between official institutions and other stakeholders in landscape fire management (LFM)	1.2.1.	Establishing inter-agency task forces or committees to facilitate collaboration through regular meetings, workshops, and communication channels	Up to 5 years	All relevant institutions	50,000.00 BAM	II
1.3	Insufficient cooperation in knowledge exchange with other countries	1.3.1.	Organisation of at least two international workshops annually	Up to 1 year	All relevant institutions	20,000.00 BAM	II
		1.3.2.	Establishing bilateral and multilateral agreements for LFM and cooperation	Up to 1 year	All relevant institutions		II
1.4	Insufficient public awareness of climate change impact on landscape fires	1.4.1.	Developing an official plan for landscape fires and climate change info campaign	Up to 1 year	MAFWM and media agencies	10,000.00 BAM	I
		1.4.2.	Creating focused educational campaigns, media outreach, public engagement activities and community discussion forums in accordance with the plan (1.4.1)	Up to 1 year	MAFWM and media agencies	20,000.00 BAM	I
		1.4.3.	Incorporate climate change and LF into school curricula	Up to 5 years	Ministry of Education and Culture		II

1.5	Lack of regulation over fragmented forest land ownership and unresolved property disputes	1.5.1.	Forming of an arbitration centre for solving unresolved property and legal disputes	Up to 5 years	RAGPLA	400,000.00 BAM	III
		1.5.2.	Adoption of laws and regulations for the proceedings of land consolidation and re-parcelling	Up to 5 years	RAGPLA	800,000.00 BAM	II
		1.5.3.	Establishment of cadastre for most LF-vulnerable areas whilst ensuring public data transparency	Up to 5 years	RAGPLA		II
1.6	Lack of comprehensive waste dump mapping	1.6.1.	Development of a comprehensive database of waste dump locations	Up to 1 year	MIA, PEF	90,000.00 BAM	I
1.7	Lack of proper regulation and measures for the management of abandoned land			Up to 5 years	MAFWM	/	I
		1.7.1.	Adoption of proper legislature for land abandonment concerning jurisdiction and management				

N.	GAP Identified	Sub. number	Measure	Period of implementation	Responsible institution/s	Foreseen Budget	Priority
2.			PREPAREDNESS				
2.1	Absence of an early warning and detection system for landscape fires	2.1.1.	Implementing fire information systems such as EFFIS or NFFIS (adapted to local/national conditions and needs)	Up to 5 years	RACPRS, PEF, MAFAWM	4,000,000.00 BAM	I
		2.1.2.	Implementation of a national LF early detection system	Up to 5 years	RACPRS, PEF, Firefighters Union	10,000,000.00 BAM	II
2.2	Absence of professional firefighting teams within certain local government units Improper distribution of firefighting teams across the country	2.2.1.	Analysis of the current distribution of professional firefighting units	Up to 5 years	RACPRS, Firefighters Union	60,000.00 BAM	II
		2.2.2	Establishment of a system for adequate distribution of firefighting units			6,000,000.00 BAM	
2.3	Lack of trained human resources for LFM	2.3.1.	Preparation of a detailed plan for a national LFM centre	Up to 5 years	RACPRS, PEF, Firefighters Union	50,000.00 BAM	I
		2.3.2.	Establishment of a national LFM training centre			3,000,000.00 BAM	
2.4	Inconsistent procedures and terminology of LF suppression compared to the internationally adopted standards	2.4.1.	Alignment of national procedures and terminology with EU guidelines where applicable	Up to 5 years	All relevant institutions		II

2.5	Lack of proper equipment in LF suppression units	2.5.1.	Conducting analysis of the current state of LF suppression equipment	Up to 5 years	RACPRS, PEF, Firefighters Union	60,000.00 BAM	II
		2.5.2	Procurement of adequate LF suppression equipment, vehicles and tools in accordance with the analysis (2.5.1)			10,000,000.00 BAM	
2.6	Underrep-resentation of volunteerism in the LFM system	2.6.1.	Organisation of public campaign for the significance of volunteerism in LFM system	Up to 5 years	RACPRS, Firefighters Union	200,000.00 BAM	II
		2.6.2.	Developing a permanent financial programme for the proper functioning of LFM volunteerism	Up to 1 year	Government, RACPRS, Firefighters Union	/	II
2.7	Insufficient scientific research in landscape fire management	2.7.2.	Provide funding for research grants and academic partnerships focused on landscape fire management	Up to 1 year	MAFWM, Forestry Faculty	200,000.00 BAM	II
2.8	Absence of an official wildland fuel classification	2.8.1.	Adopting a national fuel classification	Up to 5 years	MAFWM, Forestry Faculty	150,000.00 BAM	I

2.9	Absence of a LF risk map on the territory of the Republic of Srpska	2.9.1.	Creation of LF risk map	Up to 1 year	MAFWM, Forestry Faculty	1,000,000.00 BAM	I
2.10	Limited meteorological monitoring and forecasting infrastructure	2.10.1.	Upgrade the network of meteorological stations to improve data coverage and accuracy	Up to 1 year	RHMI	800,000.00 BAM	II
2.11	Lack of knowledge on fire risks in agricultural lands among farmers	2.11.1.	Development of training programmes on fire risks in agricultural lands for farmers	Up to 5 years	MAFWM	30,000.00 BAM	II
2.12	Insufficient production of deciduous seedlings in nurseries	2.12.1.	Construction of deciduous seedling production lines within the framework of the Centre for Seed Production and Nursery	Up to 5 years	PEF and MAFWM	500,000.00 BAM	II

N.	GAP Identified	Sub. number	Measure	Period of implementation	Responsible institution/s	Foreseen Budget	Priority
3.			SUPPRESSION				
3.1	Shortage of specialized command personnel for landscape fire suppression	3.1.1.	Conducting training for command staff	Up to 5 years	RACPRS, PEF., Firefighters Union	150,000.00 BAM	II
3.2	Inadequate coordination mechanisms during firefighting operations	3.2.1.	Development and adaptation of standardized incident management procedures based on the nationally recognized frameworks such as the Incident Command System (ICS)	Up to 5 years	RACPRS	150,000.00 BAM	I
3.3.	Inadequate coordination between ground-to-air forces during fire suppression operations	3.3.1.	Organizing specialized training program and joint simulation exercise for helicopter units and ground firefighting teams. These sessions should focus on improving communication protocols, operational coordination and understanding the roles and responsibilities of each unit in fire suppression scenarios.	Up to 1 year	RACPRS, Helicopter Service of RS, Firefighters Union	50,000.00 BAM	II

N.	GAP Identified	Sub. number	Measure	Period of implementation	Responsible institution/s	Foreseen Budget	Priority
4.			POST FIRE MANAGEMENT				
4.1	Absence of integrated post-fire management procedures	4.1.1.	Development and publishing of an official standardized methodology for post-fire management procedures	Up to 1 year	Forestry faculty	30,000.00 BAM	I
4.2	Absence of an official standardized methodology and statistical forms for post-fire data collection and analysis	4.2.1.	Development of unified data collection methodology	Up to 1 year	MAFWM	8,000.00 BAM	I
4.3	Insufficient scientific research in post-fire management	4.3.1.	Establishing special financial fund for support of scientific and professional institutions for research related to the management of burnt areas	Up to 1 year	Forestry faculty	2,000,000.00 BAM	III
4.4	Inadequate post-fire management of burnt areas	4.4.1. 4.4.2.	Implementation of a long-term programme to monitor soil, vegetation, and biodiversity conditions in burned areas Implementation of pilot projects for post-fire management in burnt areas that differ ecologically and in burn intensity	Up to 5 years	MAFWM, PEF, Forestry faculty	1,500,000.00 BAM 1,500,000.00 BAM	II
4.5	A small percentage of officially detected fire causes and their inadequate enforcement	4.5.1.	Establishment of special units for LF investigation within the frame of Ministry of Internal Affairs	Up to 5 years	MIA	1,000,000.00 BAM	II

3. MONITORING AND EVALUATION

The Landscape Fire Management Gap Analysis for the Republic of Srpska, Bosnia and Herzegovina, will be monitored and evaluated by the Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska as the appointed Country Partner Institution. This will ensure the measures proposed in the document are appropriately implemented and the progress over time.

The monitoring process will involve the following:

Frequency of Meetings: Biannual meetings, that is, two meetings a year will be held to review the progress of the implementation process. This will provide an avenue for the discussion of key performance indicators, analysis of challenges, and identification of areas needing adjustment or further support.

Evaluation Framework: An outcome evaluation framework shall be developed to measure the impact of the interventions taken. Indicators on LF prevention, landscape resilience, and the strengthening of institutional capacities regarding fire management shall be monitored and assessed.

Stakeholder Involvement: The monitoring process will involve various stakeholders, including representatives from local government, forestry and environmental agencies, research and educational institutions. This participatory approach will ensure a comprehensive evaluation process.

Continuous Improvement: The measures taken under the gap analysis will, on the strength of the above monitoring and evaluation activities, be reviewed and updated periodically to retain relevance to emerging challenges. This means that the Landscape Fire Management Gap Analysis will be followed through and adapted for the needs of the Republic of Srpska, furthering sustainable management of fires and landscapes, by entrusting the process of monitoring to the Ministry of Agriculture, Forestry and Water Management.