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**LANDSCAPE FIRE
MANAGEMENT**

IN THE WESTERN BALKANS

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Landscape Fire Management Gap Analysis for the Republic of Serbia



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

Biological Society "Dr Sava Petrović"

Požega Volunteer Fire Department

Institute for Nature Conservation of the Autonomous Province of Vojvodina

Institute for Nature Conservation of Serbia

Institute of Lowland Forestry and Environment

Institute of Forestry

PE "Vojvodinašume"

PE "Srbijašume"

PE "Đerdap" National Park

PE Kopaonik National Park

PE Tara National Park

PE Fruška Gora National Park

Ministry of Environmental Protection

Ministry of Interior (Emergency Management Sector)

Young Farmers of Serbia

Faculty of Agriculture, University of Belgrade

Provincial Secretariat for Agriculture, Water Management and Forestry

Republic Geodetic Authority

Statistical Office of the Republic of Serbia

Republic Hydrometeorological Service of Serbia

Standing Conference of Towns and Municipalities

United States Forest Service

Association of Private Forest Owners "Tilva"

Agricultural Land Directorate, MAFWM

Forest Directorate, MAFWM

Forestry Ltd

Faculty of Forestry, University of Belgrade

LIST OF ACRONYMS

CSO	Civil Society Organization
EMS	Emergency Management Sector
FD	Forest Directorate
FMEs	Forest management enterprises
IT	Information Technology
LFM	Landscape Fire Management
LFMWB	Landscape Fire Management in the Western Balkans
LSGU	Local Self-Government Unit
MAFWM	Ministry of Agriculture, Forestry and Water Management
MESP	Ministry of Environmental Protection
Mol	Ministry of Interior
MME	Ministry of Mining and Energy
MCTI	Ministry of Construction, Transport and Infrastructure
MSTDI	Ministry of Science, Technological Development and Innovation
NGOs	Non-Governmental Organizations
NP	National Park
PE	Public Enterprise
PAM	Protected area managers
RGA	Republic Geodetic Authority
RHSS	Republic Hydrometeorological Service of Serbia
USFS	United States Forest Service
VFB	Voluntary fire brigades

EXECUTIVE SUMMARY

The gap analysis provides a comprehensive assessment of the landscape fire management (LFM) system in Serbia, aiming to evaluate its effectiveness. The primary objective of the analysis is to identify key gaps and propose concrete recommendations to overcome them in order to strengthen the capacities of the landscape fire management system, protect natural resources and the livelihoods of local communities, and enhance intersectoral cooperation among all relevant stakeholders.

This analysis was conducted through a participatory process, supported by a series of workshops organized within the framework of the **Landscape Fire Management in the Western Balkans (LFMWB) Programme**, as well as through continuous and constructive exchanges of opinions, comments, and suggestions provided by participants following the first workshop, thereby ensuring an inclusive and iterative document development process. The workshops brought together members of the national LFM network of Serbia with the objective of jointly defining, discussing, and prioritizing identified gaps and measures for addressing them.

The analysis first identifies and describes the gaps, providing brief contextual explanations for each, and subsequently defines the desired future state as a reference framework for planned interventions. The document concludes with an implementation table functioning as a strategic action plan, containing an overview of the proposed measures, implementation timelines, responsible institutions, estimated financial requirements, and priority levels.

The analysis highlights critical gaps across all four key phases of the LFM system in Serbia:

- **Prevention:** Prevention is constrained by insufficient implementation of existing fire protection regulations and plans, a low level of public awareness regarding fire risks, weak integration of LFM principles into spatial and land-use planning, as well as unresolved property ownership issues in rural and forest areas. In addition, the existing regulatory framework is not sufficiently aligned with contemporary fire prevention approaches, limiting the introduction of innovative fuel management measures and proactive risk management practices.
- **Preparedness:** Preparedness within the landscape fire management system in Serbia is limited by the absence of a unified early warning and fire detection system, an insufficient number of trained personnel at the local level, and uneven availability of professional and volunteer firefighting units. There is also a lack of systematic national-level fire risk and fuel maps, as well as stable channels for interinstitutional data exchange. Scientific and analytical support for operational planning remains limited.
- **Suppression:** Landscape fire suppression in Serbia is constrained by insufficient human and material capacities, particularly at the local level and in the most vulnerable areas. Uneven levels of equipment availability and training among firefighting units, limited access to specialized equipment for interventions in open landscapes, as well as an insufficient number of trained personnel and volunteer fire brigades in certain regions, affect the effectiveness of response operations. Although significant operational potential exists within the **Sector for Emergency Management**, further progress in fire management requires strengthening intersectoral operational coordination among fire and rescue units, public forestry enterprises, local self-governments, and other relevant stakeholders. It also requires improvement of the real-time exchange of spatial and situational information, as well as better integration of aerial assets and ground forces in complex interventions.
- **Post-fire management:** Post-fire management in Serbia is characterized by the absence of a standardized methodology for assessing fire damage and impacts, as well as a lack of clearly defined institutional responsibilities for planning and implementing recovery measures. Systematic monitoring of burned areas remains limited, while scientific research and analytical tools for tracking long-term fire effects are rarely used in decision-making processes. Post-fire interventions are most often implemented on an ad hoc basis, without integration into a broader risk management framework.

The implementation of the recommended measures is envisaged over a five-year period and requires strong coordination among state institutions, scientific organizations, and local communities. Such an integrated approach aims to simultaneously address urgent operational needs and enable long-term structural changes, thereby significantly enhancing Serbia's capacities for sustainable and effective landscape fire management.

BACKGROUND

This gap analysis was developed within the framework of the **Landscape Fire Management in the Western Balkans (LFMWB) Programme**, funded by the Swiss Agency for Development and Cooperation (SDC) and coordinated by Farmahem from Skopje, North Macedonia, with backstopping support from Helvetas Swiss Intercooperation, Switzerland. The first phase is designed to be implemented between 01.02.2022 and 31.12.2026, and represents a strategic regional initiative aimed at strengthening capacities for landscape fire management in the Western Balkan countries, in response to increasingly pronounced fire risks driven by climate and socio-economic changes.

The overall objective of the LFMWB Programme is to strengthen the resilience of forests and landscapes in the Western Balkans to landscape fires while supporting communities whose socio-economic development depends on these resources. The Programme is based on a participatory approach that promotes intersectoral cooperation, engagement of local communities, knowledge exchange, and increased public awareness of the importance of conserving natural resources. This objective is aligned with the strategic frameworks of the SDC, particularly in the areas of climate-resilient development and sustainable natural resource management.

The key outcomes of the Programme include:

- (1) strengthening regional cooperation through the establishment of a sustainable professional network and knowledge exchange among countries in the region;
- (2) enhancing capacities for integrated landscape fire management through the development of multidisciplinary approaches and intersectoral cooperation;
- (3) improving policies and strategic frameworks in the field of landscape fire management at the local, national, and regional levels.

This gap analysis represents a logical continuation of the **National LFM Report for Serbia** and serves as a strategic tool for assessing the current state of landscape fire management. While the National LFM Report provides a comprehensive overview of the current situation, this document focuses on identifying key institutional, policy, and operational gaps, as well as defining priorities for addressing them in order to strengthen the capacities of the fire management system.

OBJECTIVES OF THE GAP ANALYSIS

The primary objective of the gap analysis is to assess the current state of landscape fire management (LFM) practices in Serbia and identify the necessary improvements required to achieve the desired future fire management system. The analysis aims to address the increasingly complex fire risks intensified by climate change, land-use change, and rural depopulation, while bridging the gap between existing capacities and optimal fire management outcomes.

The specific objectives of the gap analysis are as follows:

- **Assess the current state of the fire management system**, including existing practices, policies, institutional frameworks, resources, and infrastructure.
- **Define the desired future state of fire management**, based on expert input and contributions from relevant stakeholders, serving as a reference framework for the further development of the system.
- **Identify the key differences between the current and desired states**, namely the structural, institutional, and operational gaps limiting the effectiveness of the system.
- **Develop applicable and realistic strategies to address identified gaps** through concrete measures, recommendations, and priorities for action.
- **Support the integration of fire management into broader national strategies** for climate change adaptation and disaster risk reduction.
- **Enhance collaboration and capacities of relevant stakeholders** through strengthened coordination mechanisms, knowledge exchange, and the development of intersectoral partnerships.

This document is designed as a practical roadmap for the gradual transition from the existing landscape fire management system towards a stronger, more integrated, and more effective fire management system in Serbia. By identifying key gaps and proposing realistic and feasible measures, aligned with the country's institutional and financial frameworks, the document provides decision-makers and relevant stakeholders with a clear and achievable direction for strengthening the system.

SCOPE AND APPROACH

In preparing this gap analysis on landscape fire management, a focused, systematic, and participatory approach was applied to ensure that the analysis is comprehensive, accurate, and aligned with the priorities of relevant stakeholders. The scope of the analysis encompasses an assessment of the current state of LFM practices, policies, institutional frameworks, available resources, and infrastructure in Serbia, as well as the identification of necessary steps toward achieving the desired future fire management system.

The gap analysis represents the outcome of a collaborative and consultative process involving key stakeholders within the landscape fire management system. Their insights, practical experiences, and expert opinions were integrated throughout all phases of the document development process, ensuring that the analysis reflects the actual situation on the ground and the institutional challenges identified.

The methodological approach included the following key steps:

- **Consultation with relevant stakeholders**

Consultations were conducted with competent national and local institutions, fire management services, public enterprises, research institutions, and other relevant organizations. These consultations enabled the collection of key insights into existing practices, challenges, and priorities in the field of fire management in Serbia.

- **Meetings and workshops of the national LFM network**

Workshops and meetings of the national LFM network were organized, bringing together experts and practitioners from various sectors (forestry, fire protection, risk management, nature conservation, local self-governments, etc.). During these sessions, key system gaps were identified through structured discussions and SWOT analysis covering all phases of LFM.

- **Expert and technical support**

The analysis was further supported through expert and technical input from specialists in fire management, forestry, environmental protection, and climate change adaptation, ensuring that the proposed measures are realistic, applicable, and aligned with contemporary approaches in the field.

- **Data collection and analysis**

Relevant data from national sources, official statistics, existing reports, and sectoral analyses were used to identify trends, spatial specificities, and structural challenges within the fire management system.

This methodological framework ensured that the gap analysis functions not only as a diagnostic document but also as a practical tool for joint planning, priority setting, and the development of realistic and feasible measures for strengthening the landscape fire management system in Serbia. The document also serves as a foundation for further intersectoral cooperation and the continuous improvement of policies and practices in this field.

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

This document constitutes a comprehensive gap analysis of the landscape fire management (LFM) system in the Republic of Serbia. With a clear focus on four key domains—**prevention, preparedness, suppression, and post-fire management**—the analysis aims to assess the effectiveness and functionality of the existing landscape fire management system in the country, with the ultimate objective of strengthening system resilience and adaptability, as well as protecting the environment, communities, and natural resources.

The gap analysis of the landscape fire management system for each element within the four categories (**prevention, preparedness, suppression, and post-fire management**) was conducted in accordance with the following structure:

1. **Gap formulation**
2. **Detailed description of the gap** – explanation of the root causes of the identified gap
3. **Desired state** – the desired state represents an outcome or achieved objective within a period of **1 to 5 years**. While the desired state defines **what** needs to be achieved within that period, the **Implementation Plan** proposes concrete measures and activities describing **how** the desired state can be achieved.

1.1. PREVENTION

Prevention represents a key phase of landscape fire management and plays a crucial role in reducing the likelihood of fire occurrence and mitigating its impacts before it escalates. Through the implementation of preventive measures, such as vegetation and fuel management, infrastructure maintenance, and the enforcement of fire protection measures, the risk of uncontrolled fires can be significantly reduced. Such a proactive approach not only protects ecosystems, property, and human lives, but also reduces long-term costs and the burden on resources associated with fire suppression and post-fire recovery.

Experiences from developed countries demonstrate that investments in prevention yield substantially greater benefits compared to reactive interventions. Therefore, strengthening preventive mechanisms represents one of the most cost-effective and sustainable approaches to landscape fire risk management.

Although the fire management system in Serbia is based on a relatively well-developed legislative and strategic framework, key challenges relate to the consistent implementation of existing regulations, institutional oversight, and continuous monitoring of their effectiveness in practice. In addition, the existing regulatory framework is not sufficiently aligned with modern approaches to fire prevention, limiting the systematic introduction of innovative active risk management measures.

Within this phase of the analysis, the following key areas were examined:

- **Legislative and regulatory framework:** Review of existing laws, by-laws, and strategic documents in the field of fire prevention, mechanisms for their implementation and oversight, as well as the

extent to which landscape fire management principles are integrated into spatial planning and sectoral policies.

- **Institutional and governance capacities:** Analysis of institutional responsibilities, cross-sectoral cooperation, available human resources, and organizational mechanisms in the field of fire prevention.
- **Education and awareness raising:** Assessment of the public awareness level regarding landscape fire risks, the existence of systematic awareness-raising programmes, and knowledge-sharing mechanisms at the national and regional levels.

Following the identification of strengths and weaknesses, the following gaps in the prevention phase of the landscape fire management system in Serbia were identified:

Insufficiently developed regulatory framework for landscape fire management
Insufficiently developed institutional framework and capacities
Insufficient intersectoral coordination
Insufficient integration of LFM into formal education and training programmes
Insufficient public awareness of landscape fires
Unresolved property rights issues and outdated cadastral records
Inadequate management of privately owned land
Abandonment of traditional livestock farming
Insufficient integration of fire risk management into the maintenance system of energy infrastructure

GAP 1: INSUFFICIENTLY DEVELOPED REGULATORY FRAMEWORK FOR LANDSCAPE FIRE MANAGEMENT

Current state: The existing regulatory framework for landscape fire management formally encompasses laws, by-laws, and planning documents; however, these are not fully harmonized nor functionally interconnected. As a result, a gap exists between prescribed regulatory solutions and their practical implementation, hindering the consistent application of measures across all phases of fire management — from prevention and preparedness, through response, to post-fire recovery.

Current regulations do not sufficiently and clearly define several key areas related to fuel management and the use of fire in open landscapes. Prescribed burning is not recognized as a professionally managed preventive measure with clearly defined conditions, responsibilities, and implementation procedures. At the same time, although the burning of agricultural residues is legally prohibited, this practice remains widespread, indicating challenges in the consistent implementation of regulations, monitoring, and enforcement of violations.

The regulatory framework does not clearly distinguish between different forms of fire use, leading to a situation in which all burning activities are often treated in practice as a single and predominantly negative phenomenon. This prevents the institutional adoption of prescribed burning as a legitimate preventive measure, while simultaneously creating space for unregulated and risky practices.

An additional gap relates to the inadequate regulatory recognition of the management of abandoned land overgrown with combustible vegetation. Existing regulations do not clearly define obligations and

response mechanisms in such cases, increasing fire risk, particularly under conditions of fragmented land ownership.

The penalty framework in the field of fire protection and agricultural practices is not sufficiently preventive. Sanctions for risky activities are often not proportionate to the actual level of risk, thereby reducing their deterrent effect.

The existing licensing system in the field of fire protection does not reflect the multidisciplinary nature of landscape fire management. Relevant areas of expertise are not adequately covered, limiting the implementation of modern LFM approaches.

Desired state: A clear, harmonized, and functional regulatory framework for landscape fire management is established, enabling the consistent implementation of regulations across all phases of the LFM system.

GAP 2: INSUFFICIENTLY DEVELOPED INSTITUTIONAL FRAMEWORK AND CAPACITIES

Current state: The institutional framework for landscape fire management is characterized by insufficiently clear roles, responsibilities, and chains of accountability across different levels of governance. The lack of standardized operational procedures results in inconsistent implementation and hampers coordination among institutions.

Vertical and horizontal cooperation among sectors — including forestry, local self-government units, fire and rescue services, and other competent authorities — remains limited. This leads to overlaps in certain areas of activity and institutional gaps in others, particularly in prevention and fuel management.

The implementation of existing fire protection plans is inconsistent, indicating weaknesses in enforcement and oversight mechanisms. Inspection services operate with limited human, technical, and financial capacities. An insufficient number of field inspections, administrative burden, and a lack of specialized expertise further reduce the effectiveness of the oversight system.

Coordination among different inspection authorities remains insufficiently developed, particularly on land under mixed ownership, creating legal and operational uncertainty. Limited availability of equipment, vehicles, and digital tools further reduces the capacity of institutions to respond effectively and implement preventive measures.

Desired state: A functional institutional system for landscape fire management is established, with clearly defined responsibilities and adequate capacities to ensure the consistent implementation of regulations across all phases of the LFM system.

GAP 3: INSUFFICIENT INTERSECTORAL COORDINATION

Current state: In the Republic of Serbia, there is no formally established and functional intersectoral network that systematically connects stakeholders from the fields of forestry, agriculture, environmental protection, emergency management, local self-government units, public utility companies, research institutions, and civil society in joint efforts aimed at the prevention of landscape fires. Existing forms of cooperation are largely ad hoc in nature, typically initiated as needed or within the framework of individual projects, without sustained systemic support, clearly defined coordination mechanisms, or standardized cooperation protocols.

The absence of a formalized intersectoral network results in stakeholders operating primarily within their own sectoral mandates, with limited exchange of data, information, experience, and resources. There is no joint or coordinated approach to the planning and implementation of preventive activities, such as aware-

ness-raising and educational campaigns, work with local communities, fuel management, training, or the development of pilot initiatives. As a result, the efforts of different stakeholders remain fragmented, leading to duplication of activities in certain areas, while significant gaps persist in the fire prevention system.

The main causes of this situation include the absence of standardized communication channels and protocols, resulting in inconsistent, insufficient, or delayed information exchange among sectors. Underdeveloped coordination mechanisms, unclear roles and responsibilities, and limited intersectoral communication practices contribute to confusion and operational inefficiencies. Additionally, institutional and cultural barriers, including differing priorities, approaches, and organizational cultures among stakeholders, hinder the establishment of stable and continuous cooperation.

Although certain relevant legal and strategic frameworks exist, the lack of formal and consistent communication channels among institutional representatives, the private sector, and local communities limits their effective implementation in practice. Insufficient coordination between the public and private sectors further creates gaps in planning, resource allocation, and the implementation of landscape fire management measures. Institutional “silos”, in which different sectors operate in isolation from one another, further reduce the potential for a coherent, integrated, and effective approach to landscape fire prevention and response.

Desired state: A functional and sustainable intersectoral network is established, enabling effective coordination, regular information exchange, and harmonized action among all relevant stakeholders involved in landscape fire management.

GAP 4: INSUFFICIENT INTEGRATION OF LFM INTO FORMAL EDUCATION AND TRAINING

Current state: Within the existing formal education system in the Republic of Serbia (primary, secondary, and higher education), as well as in continuous professional development programmes, landscape fire management is not systematically integrated as a cross-sectoral and interdisciplinary topic. Educational programmes are largely focused on conventional fire protection, with insufficient attention given to the specific characteristics and complexity of landscape fires, fuel management, risk-based prevention, the use of spatial and climate data, and the relationship between fires and climate change.

Professionals in the sectors of forestry, agriculture, environmental protection, emergency management, and spatial planning rarely have opportunities during formal education to acquire systematic knowledge and competencies in landscape fire management in line with the LFM approach. Existing training programmes that are occasionally organized are mostly fragmented, short-term, and focused on specific operational aspects, lacking a unified concept, standards, and long-term programme design based on international practices.

Educational programmes are largely theoretical, with very limited opportunities for practical instruction, fieldwork, internships, or direct engagement with institutions and organizations involved in landscape fire management. Students and training participants rarely have opportunities to gain practical experience in prevention, planning, monitoring, and response, significantly limiting the applicability of acquired knowledge in real-world conditions.

In addition, teaching staff in educational institutions generally lack specialized knowledge and experience in landscape fire management, which hinders the effective integration of LFM topics into curricula. The absence of systematic support for the professional development of teachers and lecturers in this field further widens the gap between contemporary fire management concepts and existing educational practice.

The education system is also predominantly organized within individual disciplines, without a sufficiently developed interdisciplinary approach to link ecology, geography, meteorology, spatial sciences, public policy, and risk management within a unified LFM framework. Such disciplinary fragmentation limits understanding of the complex and interconnected nature of landscape fires.

At the same time, there is no systematically developed cooperation between educational institutions and relevant services and organizations involved in fire management, such as forestry services, emergency management services, public enterprises, and protected areas. The lack of institutionalized partnerships between academia and practice limits knowledge transfer, experience exchange, and the involvement of students and young professionals in real fire risk management processes.

As a consequence, knowledge and capacities in the field of landscape fire management develop unevenly, depending on individual initiatives, projects, or personal interests, without systemic support and long-term sustainability within the education system.

Desired state: An integrated education and training system is established, ensuring the development of competencies for the application of the LFM approach in landscape fire management.

GAP 5: INSUFFICIENTLY DEVELOPED PUBLIC AWARENESS AND UNDERSTANDING OF LANDSCAPE FIRE RISKS

Current state: In the Republic of Serbia, there is a low level of public awareness and understanding of the relationship between climate change and the increased risk of landscape fires, resulting in inadequate behaviour and insufficient public engagement in prevention and risk reduction. Most of the population does not perceive climate change as a direct or immediate factor affecting the frequency and intensity of fires, nor do they recognize their role in preventive activities.

One of the key causes of this situation is the lack of targeted and continuous information and awareness-raising campaigns that would communicate, in a clear and accessible manner, the link between climate change, human activities, and fire risk. Existing activities are sporadic, project-based, and implemented without a unified national communication strategy.

Although, for example, the emergency management sector conducts annual awareness campaigns focused on fire prevention, these activities are mainly limited to the distribution of posters and notices concerning bans on open burning and applicable penalties. Such an approach has limited outreach and does not lead to significant or lasting behavioural change among the population.

In practice, the existing communication model is predominantly punitive, focused on prohibitions and sanctions, and lacks sufficiently developed mechanisms to encourage risk awareness and the adoption of safer alternatives. This structure of preventive activities indicates the limited effectiveness of current campaigns in raising meaningful awareness and promoting behavioural change, particularly in rural areas and among socially vulnerable groups.

An additional challenge is the limited media coverage of landscape fires in the context of climate change and risk management. Although climate change is discussed within professional and policy circles, it is rarely translated into messages tailored to the general public that could influence behavioural change and strengthen a culture of prevention.

The insufficient integration of climate change topics and the LFM approach into educational programmes and public communication channels further deepens the knowledge gap. As citizens and local communities have a limited understanding of the long-term environmental, economic, and safety impacts of fires, preparedness remains low while the risk of human-induced fires remains high.

Another challenge is the marginalization of landscape fires in the media space. Reporting is predominantly reactive and focused on extreme events and consequences, with a strong emphasis on sensationalist (“click-bait”) approaches that favour short-term public attention rather than continuous, analytical, and educational reporting.

Regular, evidence-based, and targeted media reporting treating landscape fires as a persistent social and environmental risk — rather than solely as occasional emergency events — remains lacking.

At the same time, local self-government units and institutions often do not recognize LFM as a priority topic within broader development and land management policies. The absence of clear institutional support for public campaigns and educational activities results in a fragmented approach, uneven levels of awareness, and varying levels of preparedness across regions.

There is no unified, nationally coordinated awareness-raising campaign on landscape fires and the LFM approach, supported by standardized messages, materials, and communication tools. Consequently, levels of knowledge and risk perception vary significantly, directly affecting the effectiveness of preventive measures and community resilience to fires.

Desired state: A high level of public awareness regarding the relationship between climate change and landscape fire risk is established, alongside the active participation of citizens and communities in prevention and the implementation of the LFM approach.

GAP 6: UNRESOLVED PROPERTY RIGHTS ISSUES AND OUTDATED CADASTRAL RECORDS

Current state: In a significant number of areas across the Republic of Serbia, unresolved property rights issues and outdated cadastral land records are found, failing to reflect actual conditions on the ground. Significant areas of land are not assigned to clearly defined categories within the cadastre, and in many cases, there are discrepancies between actual land use and official records (for example, areas registered in the cadastre as meadows are, in practice, overgrown with forest vegetation).

The underlying causes of this situation are linked to outdated and insufficiently accurate cadastral data, which have not been regularly updated to reflect long-term land-use changes and natural vegetation succession processes. Numerous areas that once had an agricultural purpose have gradually been abandoned and overgrown with natural vegetation, while retaining their original classification in cadastral records.

In addition, unresolved property rights issues — including unclear ownership rights, unresolved inheritance matters, and loss of documentation — contribute to legal uncertainty and complicate the identification of responsible landowners and land users. This mismatch between the legal and actual situation significantly limits opportunities to plan and implement preventive measures, fuel management, securing access for interventions, and implementing post-fire recovery measures.

The lack of adequate field monitoring systems and coordination among institutions responsible for land management further slows the updating of records and deepens the gap between official data and actual on-the-ground conditions, representing a significant obstacle to effective landscape fire management.

Desired state: An up-to-date and reliable system of land records and property rights is established, enabling the clear determination of ownership, responsibilities, and accountability for the implementation of landscape fire management measures.

GAP 7: INADEQUATE MANAGEMENT OF PRIVATELY OWNED LAND

Current state: Privately owned forest land in Serbia accounts for a significant share of the country's forest land area (over 50%); however, it is often managed in an insufficiently planned and unsustainable manner. Forest owners frequently lack the financial resources, technical equipment, and professional support necessary to implement land maintenance measures, landscape fire prevention activities, and fuel management practices. A large number of parcels are small, fragmented, and frequently characterized by unresolved ownership status, further complicating coordinated land management.

Oversight of privately owned land is limited due to insufficient capacities of inspection services, resulting in inadequate monitoring of compliance with legal obligations and preventive measures. In practice, the system often relies on reactive interventions following the emergence of risks or fires, rather than on systematic monitoring and support for landowners.

The lack of financial incentives, advisory services, and organized training contributes to low levels of knowledge and awareness among landowners regarding the importance of preventive land management. As a consequence, privately owned land — particularly forests, agricultural land, meadows, and pastures — often accumulates significant vegetation fuel loads (e.g., deadwood, unmanaged vegetation, and degraded areas), increasing landscape fire risk and complicating response efforts.

Desired state: A functional privately owned land management system is established, ensuring the active participation of landowners and the effective integration of privately owned land into the landscape fire management system.

GAP 8: ABANDONMENT OF TRADITIONAL LIVESTOCK FARMING

Current state: Traditional grazing practices in rural areas of Serbia represent one of the most effective natural mechanisms for reducing vegetation fuel loads, particularly grasses, low vegetation, and degraded shrublands, which significantly contribute to landscape fire risk. However, this role of livestock farming is neither systematically recognized nor institutionally integrated into fire risk management policies and instruments within the LFM system.

Over recent decades, a continuous decline in livestock numbers and active livestock farms has been recorded, driven by rural depopulation, the limited economic viability of traditional production systems, restricted access to grazing land, and insufficient infrastructure (access roads, watering points, and fencing). The existing agricultural incentive system is not linked to fire prevention objectives, nor does it recognize grazing as a functional landscape-level fuel management tool.

A particularly pronounced gap exists in protected natural areas that are not predominantly forested, such as pastures, grasslands, salt marshes, steppe and semi-natural habitats, as well as mosaic cultural landscapes. In such areas, the accumulation of dry biomass represents one of the primary drivers of landscape fire risk.

At the same time, there is no systematic integration among the agriculture, forestry, and nature conservation sectors in planning and coordination of grazing as a preventive measure. Formal cooperation models, operational guidelines, and institutional mechanisms recognizing livestock farmers as relevant actors within the fire prevention system remain lacking. This is particularly problematic in protected areas outside forest ecosystems, where land managers often lack adequate tools for active fuel management and a clearly defined framework for cooperation with local livestock farmers as partners in reducing landscape fire risk.

Desired state: Traditional grazing is integrated into the fuel management system as a preventive LFM measure.

GAP 9: INSUFFICIENT INTEGRATION OF FIRE RISK MANAGEMENT INTO THE MAINTENANCE SYSTEM OF ENERGY INFRASTRUCTURE

Current state: Fire risk management in the context of energy infrastructure maintenance in the Republic of Serbia represents an important area with potential for further improvement through stronger inter-sectoral integration. Vegetation management within the protection corridors of power lines and other energy infrastructure is carried out in accordance with various technical and safety standards; however, in practice, it is not always systematically linked to landscape fire risk management principles. There is room to improve the coordination among the energy, forestry, local self-government, and emergency management sectors to better align preventive activities and contribute to reducing fire risk along energy corridors.

Desired state: Fire risk management is integrated into the energy infrastructure maintenance system through intersectoral cooperation and the application of LFM principles in vegetation management and protection corridors.

1.2. PREPAREDNESS (READINESS/ PRE-SUPPRESSION)

Preparedness within the landscape fire management system refers to the readiness of all relevant stakeholders to respond to the occurrence of fires in a timely, coordinated, and effective manner. It encompasses a set of planning, organizational, and capacity-building measures that enable effective suppression operations, reduce fire impacts, and protect human lives, property, and the environment.

As a **pre-suppression phase within the LFM approach**, preparedness primarily includes:

- development and strengthening of human capacities through training and education;
- ensuring adequate technical equipment and resources;
- planning and coordination of activities among competent institutions, organizations, and local communities.

Particular importance is also attached to the engagement of local communities and voluntary structures in preparedness activities, as a key element of system resilience at the local level.

Although the Republic of Serbia has institutional and legislative frameworks for emergency response, as well as organizational units within the system of the Ministry of Interior and local self-governments, the preparedness system for landscape fires continues to face a number of challenges. Limited human resources, insufficient specialized capacities related to landscape fires, uneven levels of equipment and operational readiness, and an underdeveloped and insufficiently active network of volunteer fire associations affect the overall effectiveness of the system and its ability to respond to growing risks.

In this context, the following section identifies key gaps in the area of preparedness, relating to training and capacity development, planning and coordination, as well as the involvement of communities and voluntary structures in the landscape fire management system.

Insufficiently developed and integrated national landscape fire information system
Limited human resources and professional capacities for operational landscape fire response
Insufficiently developed technical and infrastructure capacities for preparedness and response
Insufficiently developed early detection and warning system with limited territorial coverage
Insufficient implementation of the legal requirements for local planning and a lack of harmonized protocols
Lack of regular intersectoral training and joint operational exercises

GAP 1: INSUFFICIENTLY DEVELOPED AND INTEGRATED NATIONAL LANDSCAPE FIRE INFORMATION SYSTEM

Current state: Serbia does not have a unified national information platform that integrates data on fire risk, early detection, fire history, infrastructure, meteorological parameters, and spatial analyses. Data are collected and stored across different institutions, often in incompatible formats, without common standards or effective data exchange mechanisms, which significantly hampers systematic risk assessment, preventive planning, and operational decision-making.

Although relevant scientific research on fire risk assessment has been conducted in certain parts of Serbia (e.g., modelling and prediction of forest fire occurrence probability at the Faculty of Forestry, University of Belgrade), these results have not been integrated into a unified national system, nor translated into operational tools for planning and decision-making. Risk assessments exist in a fragmented manner, limited to specific regions or projects, without national synthesis or spatial consistency.

As a result, Serbia lacks an operationally usable national spatial landscape fire risk map that could provide a clear overview of high-, medium-, and low-risk zones, and there is no systematic prioritization of areas for preventive action and resource allocation. Consequently, fire management largely relies on a reactive approach, without strategic, risk-informed spatial planning.

In practice, for most landscape fires, dynamic fire parameters—such as wind speed and direction, fire spread direction, fire intensity, and fire behaviour—are neither systematically collected nor stored. Historical records are predominantly descriptive in nature (e.g., village, hamlet, or locality names), without precise geospatial references, which severely limits the application of advanced analytical and predictive models, particularly at the local level.

In addition, consolidated and regularly updated spatial data on critical infrastructure are often unavailable at the local level. This includes water abstraction points and water sources (including hydrant networks), road and access infrastructure, power lines, and other elements relevant to fire response. These data are not systematically organized into unified databases, are not regularly updated, and are not integrated into operational planning and analytical tools.

Although the Republic of Serbia has established a **Disaster Risk Register**—an interactive digital database covering hazards such as earthquakes, floods, and forest fires—this system currently serves primarily an informational and analytical purpose, and it is not fully integrated into operational landscape fire management processes. Data from the register are not directly linked to preparedness, planning, or field-level decision-making systems, nor are they systematically used as a basis for development of standardized spatial risk maps.

An additional limitation relates to the regulatory framework governing the licensing of experts responsible for risk assessments and spatial analyses. The current framework is largely oriented toward technical disciplines and conventional fire protection (primarily structural fires), while insufficiently recognizing the

multidisciplinary nature of landscape fires and the need to involve expertise from forestry, ecology, geography, meteorology, and spatial planning.

As a result, existing systems and tools do not function as integrated operational support for the LFM system, but rather as fragmented sources of information with limited links to practical risk management, preventive planning, and coordinated response.

Desired state: An integrated and regularly updated national information system, including spatial risk maps, is established to enable data sharing and evidence-based decision-making in landscape fire management in line with the LFM approach.

GAP 2: LIMITED HUMAN RESOURCES AND PROFESSIONAL CAPACITIES FOR OPERATIONAL FIRE RESPONSE

Current state: The number of trained and specialized personnel for monitoring, risk assessment, and operational response to landscape fires in Serbia is insufficient, given the size of the territory and the growing intensity of fire risk. This particularly applies to personnel possessing knowledge and skills specific to landscape fire management, including the integration of spatial data, fire behaviour assessment, and real-time multi-agency coordination.

The shortage of qualified professionals is a consequence of insufficient systemic investment in education and training, limited opportunities for continuous professional development, and the absence of clearly defined professional profiles in the field of LFM. Existing training programmes are predominantly focused on conventional fire protection, with insufficient emphasis on the specific characteristics of landscape fires and intersectoral approaches.

A particular challenge is the underdeveloped network of professional and volunteer fire service structures, both in terms of the number of active personnel and their geographical distribution, and the level of training. In certain rural and mountainous areas, where fire risk is highest, human resource capacities for rapid response are particularly limited, further increasing vulnerability of these areas.

Desired state: Sufficient and adequately trained human capacities are in place for monitoring, risk assessment, and timely response during the preparedness phase of the landscape fire management system.

GAP 3: INSUFFICIENTLY DEVELOPED TECHNICAL AND INFRASTRUCTURE CAPACITIES FOR PREPAREDNESS AND RESPONSE (FOREST ROADS, FIREBREAKS, WATER ACCESS POINTS, ETC.)

Current state: Existing fire protection and forest infrastructure in Serbia—including forest roads, firebreaks, water abstraction points, and other technical elements—is, in many cases, in poor condition, insufficiently maintained, or entirely non-functional. Due to erosion, overgrown sections, and a lack of regular mechanical maintenance, many forest roads are not accessible year-round while firebreaks in numerous areas are absent, overgrown, or insufficiently wide to effectively slow or stop fire spread.

A particular challenge is the lack of functional water access points and reliable access to water in high-risk areas, which significantly constrains operational firefighting activities and prolongs intervention times. In many cases, existing water resources are not technically equipped for fire protection purposes or are inadequately maintained and marked.

Infrastructure maintenance is further constrained by unclear responsibilities and fragmented mandates among different land managers (public enterprises, local self-governments, and private landowners), as

well as limited financial resources allocated for these purposes. In some areas, infrastructure established through externally funded projects has never been systematically integrated into regular maintenance plans, resulting in its gradual deterioration.

As a consequence of these limitations, access to affected areas during fire events is often delayed or completely obstructed, response times are prolonged, and the effectiveness of interventions is significantly reduced. In certain high-risk areas, due to the lack of road and water infrastructure, some locations remain practically inaccessible to firefighting and forestry services, directly increasing the likelihood of large and/or uncontrolled fires.

Desired situation: A functional and sustainable fire protection and forest infrastructure system is established, ensuring effective terrain access and operational support for landscape fire response.

GAP 4: INSUFFICIENTLY DEVELOPED EARLY DETECTION AND WARNING SYSTEM WITH LIMITED TERRITORIAL COVERAGE

Current state: The early detection and warning system for landscape fires in Serbia remains insufficiently developed, technologically limited, and unevenly distributed across the territory. Modern tools such as automated cameras, sensors, satellite systems, and software for smoke and thermal anomaly detection are deployed only in specific areas and on a limited scale. Significant parts of the territory—particularly rural areas, protected natural areas, and privately owned forests—remain without adequate and continuous monitoring coverage.

Early detection systems rely on outdated or insufficient technological equipment, with limited territorial coverage of modern sensors, cameras, and automated detection software. Integrated technical systems enabling rapid data and information exchange among relevant services are largely lacking, further slowing decision-making and field-level coordination.

Although modern satellite-based fire detection services (e.g., OroraTech, European Forest Fire Information System, and Copernicus Programme) are increasingly available and represent an important resource for strengthening preparedness, their use has not been institutionalized within the Ministry of Interior and other competent authorities. Rather than being embedded in formal procedures, these tools are used only occasionally and primarily through individual initiatives or project-based activities. This insufficient systemic integration reduces the potential for early warning and rapid response to landscape fires.

Existing detection mechanisms continue to rely heavily on human observation, including lookout towers, field patrols, and telephone reports from citizens. Such practices significantly delay fire identification and increase the likelihood of incidents being detected only once fires have already developed and become difficult to control.

Integrated information platforms capable of linking and processing data from multiple sources—such as cameras, satellite imagery, meteorological stations, field services, volunteers, and citizens—are lacking. In addition, clear and harmonized protocols for assessing, verifying, and forwarding reports to relevant institutions have not been established, further constraining timely decision-making and coordinated response.

Desired state: An integrated and functional early detection and warning system is established, enabling the timely detection of fires and rapid response across the entire territory of Serbia.

GAP 5: INSUFFICIENT IMPLEMENTATION OF THE LEGAL REQUIREMENTS FOR LOCAL PLANNING AND A LACK OF HARMONIZED PROTOCOLS

Current state: At the local level, a relatively small number of local self-government units have developed and adopted municipal or city-level Fire Protection Plans with the involvement of licensed experts and relevant organizations. As a result, the existing national regulatory framework does not adequately cover all levels of governance, nor does it ensure the consistent implementation of planning documents in practice.

At the same time, there is a lack of clearly harmonized and standardized operational protocols and procedures defining the roles, responsibilities, and sequence of actions of different actors during landscape fire response. Different institutions and sectors continue to apply their own internal procedures, resulting in inconsistent practices, differing interpretations of mandates, delays in decision-making, and limited intersectoral coordination during emergencies.

A particular challenge is the absence of specialized fire protection plans and operational maps for highly sensitive protected areas, especially those without a predominantly forest character. Although these areas often include specific natural values, sensitive habitats, limited accessibility, and elevated fire risk, in most cases they are not covered by tailored response plans, nor are detailed operational maps available to enable intervention services to act rapidly, safely, and in an environmentally responsible manner.

In practice, interventions in such areas frequently rely on general planning documents and ad hoc decision-making, without predefined information on habitat types, access routes, available water resources, zones of special protection, and potential operational constraints. This further increases risks to people, nature, and property.

Desired state: Unified and intersectorally harmonized protocols and operational plans are established to enable effective coordination and response to landscape fires.

GAP 6: LACK OF REGULAR INTERSECTORAL TRAINING AND JOINT OPERATIONAL EXERCISES

Current state: Training activities and field exercises involving different institutions are conducted infrequently, are not systematically planned, and do not include all relevant stakeholders. There is no continuous training programme aimed at strengthening operational skills, tactical alignment, and joint response capacities under real-life conditions. As a result, interventions are often characterized by insufficiently synchronized actions and limited coordination among responding services.

Desired state: An institutionalized system of regular intersectoral training and joint operational exercises is established, enhancing coordination and operational preparedness for landscape fire response.

1.3. SUPPRESSION

The suppression phase within the landscape fire management system encompasses direct measures and tactical actions aimed at fire containment and suppression, to reduce adverse impacts on people, property, ecosystems, and infrastructure. Despite all preventive and preparedness efforts, landscape fires will inevitably occur, making effective suppression a key component of the overall LFM system.

Fire suppression involves acting upon one or more elements of the “fire triangle” — heat, oxygen, and fuel — through the application of different tactical approaches and resources, depending on the type of fire, field conditions, and available capacities. This includes the deployment of ground and aerial resources, the use of machinery, hand tools, water, foam, and other suppression means, as well as the protection of affected populations and critical infrastructure.

A coordinated, timely, and safe response represents a fundamental prerequisite for successful fire suppression. The suppression phase is also a critical point at which the actual effectiveness of the preceding phases—prevention and preparedness—is demonstrated. The quality of planning, the level of training of human resources, the availability of infrastructure, and the effectiveness of early detection systems directly influence the speed and efficiency of interventions, as well as the safety of firefighting and rescue units and other services operating in the field.

The following section identifies the key gaps in the suppression phase of landscape fire management in the Republic of Serbia.

Limited human resources and professional capacities for landscape fire management

Insufficient technical and operational capacities for landscape fire response

Insufficiently developed intersectoral operational coordination during fire suppression

GAP 1: LIMITED HUMAN RESOURCES AND PROFESSIONAL CAPACITIES FOR LANDSCAPE FIRE MANAGEMENT

Current state: At present, firefighting and rescue units in Serbia undergo basic training that includes landscape fire suppression, ensuring that all personnel are familiar with the fundamentals of interventions in such conditions. The topic is further addressed through case-based learning, incident analyses, professional gatherings, and seminars.

However, there is no dedicated specialist training programme focused exclusively on landscape fire management. Differences in the level of knowledge and operational experience among units primarily result from variations in practical experience and the operational environments in which units operate.

Given the specific characteristics of fires in natural landscapes—including the large spatial scale, difficult terrain, diverse vegetation types, and complex fire behaviour—the need to further strengthen the practical knowledge and specialized competencies in this field remains a significant aspect of capacity development.

An additional challenge relates to the limited operational readiness and uneven capacities of volunteer fire brigades (VFBs), many of which are unable to effectively participate in landscape fire interventions due to insufficient equipment, training, or institutional support. Although VFBs formally exist within the system, their actual operational role is often unclear or limited to a symbolic level.

At the same time, there is no unified, up-to-date, and functional database of VFBs and civil society organizations as potential actors in landscape fire suppression. The absence of systematized data on their number, location, capacities, equipment, and level of training further complicates their integration into the operational system and planning for deployment during emergencies.

The root causes of this gap include the long-standing orientation of the system toward urban and structural fire suppression, limited financial and logistical resources for specialized training, the shortage of national LFM trainers and experts, as well as the absence of a systematic approach to the development and registration of volunteer capacities. Positive examples exist, such as training programmes implemented by the United States Forest Service between 2023 and 2026 in cooperation with the Ministry of Interior; however, these initiatives have not yet acquired a permanent systemic character nor have they been integrated into the national training and capacity development system.

Desired state: A sufficient number of trained and operationally available human capacities, including professional and volunteer firefighting units, are ensured and effectively integrated into the landscape fire response system.

GAP 2: INSUFFICIENT TECHNICAL AND OPERATIONAL CAPACITIES FOR LANDSCAPE FIRE RESPONSE

Current state: In certain regions, particularly rural, mountainous, and remote areas, there is a significant lack of basic and specialized firefighting equipment, directly affecting operational capacities and the effectiveness of interventions. Firefighting units in these areas often lack sufficient numbers of fire engines, water tankers, hoses, pumps, personal protective equipment, and other key resources required for responding to landscape fires.

The availability of equipment varies significantly across regions, with resources concentrated in urban areas or better-funded regions, while high-risk areas often remain inadequately equipped. In some cases, equipment is outdated and insufficiently maintained, while replacement is delayed due to limited budgets and competition with other priorities. As a result, interventions in less-equipped regions often depend on the deployment of resources from other parts of the country, leading to delayed response and increased risk of fire spread and greater damage.

In addition to equipment, the availability of operational maps and adequate GIS support remains a significant challenge. Operational fire suppression maps are prescribed and include graphical and textual components containing information relevant for planning and implementing interventions. Responsibility for their preparation and updating lies with the head of the competent firefighting and rescue unit responsible for the territory concerned. However, such maps are not developed and maintained for all firefighting and rescue units and their respective areas of responsibility. Where maps are available, their level of detail, updating, and practical use may also vary depending on local capacities, changes in field conditions, and the operational workload of units.

Beyond the availability of operational maps, firefighting units do not always have readily accessible and up-to-date GIS-based information that could support operational planning and intervention management, including the locations of water access points, access roads and terrain accessibility, topography, vegetation and fuel types, infrastructure and other assets at risk, and relevant meteorological information. The limited availability and integration of such spatial information can reduce situational awareness and make it more difficult to rapidly assess conditions and deploy human and technical resources effectively. Strengthening the availability, regular updating, digital accessibility, and practical use of operational maps and GIS-based information would therefore improve planning and decision-making during landscape fire interventions.

This gap significantly reduces situational awareness in the field, delays tactical decision-making, and may lead to inadequate deployment of human and technical resources. Operational teams frequently rely on local knowledge of individuals or incomplete and outdated maps, increasing risks to the safety of personnel and equipment. Underlying causes include insufficiently developed GIS support, the absence of standards for the content and structure of operational maps, limited availability of digital tools, and insufficient capacities of local self-governments to develop and maintain such spatial datasets.

Desired state: Adequate material, technical, and information capacities are ensured to enable rapid and effective response to landscape fires.

GAP 3: INSUFFICIENTLY DEVELOPED INTERSECTORAL OPERATIONAL COORDINATION DURING FIRE SUPPRESSION

Current state: During fire interventions, operational command and coordination remain a complex area requiring continuous improvement, particularly in the context of large or spatially extensive fires. Communication continues to rely significantly on existing radio systems and mobile telephony, which may be limited in mountainous and rural areas, indicating the need for further development of integrated and

more reliable communication solutions. There is a need for clearer definition of command structures, as well as for strengthening standardized procedures and decision-support tools for complex operational situations.

Particular attention should be given to further regulating and institutionally strengthening procedures related to the involvement of relevant actors beyond the Sector for Emergency Management, such as public forest enterprises, protected area managers, meteorological services, local self-governments, and volunteer fire brigades (VFBs). Although these actors already make important contributions in practice, their engagement is not always formalized through predefined roles, responsibilities, and mechanisms for integration into a unified command system, highlighting the need for greater systematization and a clearer procedural framework.

Although various analytical tools and data sources are available and can support fire management, their integration into operational command and intersectoral coordination processes is not yet fully developed. There remains considerable scope to strengthen mechanisms for the exchange of relevant information and to establish stable communication channels that could support shared situational awareness and coordinated decision-making during interventions.

Desired state: An integrated operational command and decision-support system is established, with clear command structures, reliable communication, and the effective involvement of all relevant actors in landscape fire response.

1.4. POST-FIRE MANAGEMENT

Post-fire management represents the final phase of landscape fire management, while at the same time constituting the initial phase of recovery and restoration of affected landscapes. Landscape fires can cause significant adverse impacts on soil, water resources, biodiversity, and local communities, including increased erosion, land degradation, water pollution, habitat loss, reduced ecosystem productivity, and damage to infrastructure. The extent and severity of these impacts depend on multiple factors, including fire intensity and duration, vegetation type, climatic conditions, terrain characteristics, and the time interval between the fire event and the first significant rainfall.

To mitigate the short- and long-term impacts of fires, it is essential to implement systematic measures for damage assessment, rehabilitation, and restoration. Timely assessment of risks related to surface runoff and sediment transport is particularly important, as these may lead to secondary impacts such as landslides, flooding, and further degradation of soils and watercourses. Effective post-fire management requires an integrated approach encompassing damage and condition assessment, risk reduction, ecosystem restoration, and support for the recovery of local communities and economies.

The analysis indicates that post-fire activities in Serbia remain insufficiently systematized and inadequately supported by resources. Gaps in damage assessment methodologies, limited human and technical capacities, outdated restoration approaches, administrative barriers, and unresolved property ownership issues significantly slow down and reduce the effectiveness of recovery efforts. Establishing a modern, integrated, and well-coordinated post-fire management system—based on standardized procedures, modern technologies, and sustainable planning—is essential for ecosystem restoration, reduction of long-term risks, and the overall resilience of landscapes.

The assessment of the existing post-fire management system has identified a number of challenges and gaps affecting the ability of society to ensure timely, systematic, and resilient recovery of fire-affected areas. The following section presents the key gaps in post-fire management, highlighting priority areas for improvement aimed at strengthening the resilience of landscapes and communities in Serbia.

Lack of a standardized methodology for post-fire impact and damage assessment
Insufficient capacities for post-fire rehabilitation and restoration
Insufficiently developed scientific research in the field of post-fire management

GAP 1: LACK OF A STANDARDIZED METHODOLOGY FOR POST-FIRE IMPACT AND DAMAGE ASSESSMENT

Current state: Following fire events, there is no adopted and nationally harmonized methodology for assessing post-fire environmental impacts, resulting in inconsistent practices and differing approaches to damage assessment. As a consequence, standard criteria and procedures for identifying affected ecosystems, assessing erosion risks, determining the degree of soil degradation, and prioritizing rehabilitation measures are lacking.

In addition to physical and geomorphological parameters, current practice lacks a systematic assessment of post-fire impacts on biodiversity, ecosystem structure, and ecosystem functions. Standardized criteria do not exist for assessing fire impacts on different habitat types, populations of sensitive and protected species, vegetation recovery dynamics, or aquatic ecosystems that may be indirectly affected by fire and erosion. In the absence of biological indicators and clearly defined recovery parameters, assessments are often based solely on visual observations or short-term effects, without sufficient understanding of long-term ecosystem impacts.

This results in delays in planning, incomplete analyses, and inadequate selection of restoration measures. Furthermore, the absence of a harmonized methodology complicates the integration of post-fire data into planning documents and prevents systematic monitoring.

In addition, there are no clearly defined and standardized procedures for the systematic assessment of ecological, material, and infrastructure damage following fires, including damage to agricultural land, forest infrastructure, roads, energy and water management infrastructure as well as public and private property. Such assessments are carried out on an ad hoc basis through different sectoral systems, without a unified methodology and without linkage to environmental impact assessments.

Desired state: A national methodology for the standardized assessment of ecological, material, and infrastructure damage following landscape fires is established and systematically applied.

GAP 2: INSUFFICIENT CAPACITIES FOR POST-FIRE REHABILITATION AND RESTORATION

Current state: There is a significant shortage of trained personnel, appropriate machinery, technical equipment, planting material, and financial resources necessary for effective post-fire interventions. Rehabilitation and restoration efforts are often delayed due to limited resources, increasing the risk of erosion, landslides, the spread of invasive species, and other adverse impacts on ecosystems and local communities.

As a consequence of limited capacities and insufficient investment, post-fire activities continue to rely heavily on traditional and outdated approaches that do not align with contemporary technological trends and standards. Modern tools and techniques for condition assessment and recovery monitoring—such as drones, geographic information systems (GIS), remote sensing, erosion modelling, and digital monitoring systems—remain insufficiently available and applied. This reduces precision during planning interventions, weakens progress monitoring, and limits the efficient use of available resources.

A particular gap relates to the limited capacity for implementing biologically and ecologically grounded post-fire measures. In practice, specialists in biology, ecology, and nature conservation are often insufficiently involved in assessing priority areas for rehabilitation, selecting appropriate restoration measures, and monitoring natural ecosystem recovery. As a result, rehabilitation activities are frequently implemented without sufficient understanding of ecological processes and the specific characteristics of local habitats, increasing the risk of inappropriate restoration, the introduction of unsuitable planting material, and disruption of the natural structure and function of ecosystems—particularly in protected areas and sites of high biological value.

These limited capacities stem from long-term underinvestment in the post-fire management segment, prioritization of short-term interventions over long-term restoration, limited technical equipment, insufficient production of high-quality native planting material, and inadequate institutional capacity-building for organizations responsible for rehabilitation and monitoring.

Desired state: Adequate human, technical, and financial capacities are ensured for the timely and science-based implementation of post-fire rehabilitation and ecosystem restoration.

GAP 3: INSUFFICIENTLY DEVELOPED SCIENTIFIC RESEARCH IN THE FIELD OF POST-FIRE MANAGEMENT

Current state: Serbia faces a significant lack of systematic and long-term scientific research in the field of post-fire management and the assessment of long-term fire impacts on ecosystems, communities, and infrastructure. Existing research is fragmented, predominantly project-based, and time-limited, lacking continuity and clear integration into national fire management and nature protection policies.

One of the key constraints is insufficient and unstable funding for scientific research in this field. Research activities rely heavily on international projects and donor funding, resulting in dependence on external financial sources and insufficient alignment of research priorities with national needs. Such an approach limits the development of a sustainable, long-term, and nationally driven scientific framework for post-fire management.

An additional challenge is the limited number of domestic experts and specialized workforce in the fields of post-fire ecology, ecosystem rehabilitation, and fire impact assessment. Targeted education programmes, professional development opportunities, and research infrastructure needed to strengthen the scientific knowledge base and foster innovation in this field remain insufficiently developed.

Existing legal and institutional frameworks predominantly address fire damage through the lens of timber value and material losses, while ecological damage, biodiversity loss, ecosystem degradation, and the loss of ecosystem services remain insufficiently recognized and are not systematically assessed. There is no legal requirement for the preparation of comprehensive, science-based reports on ecological damage following fires, nor is fire impact assessment consistently integrated into existing environmental impact assessment mechanisms.

Limited cooperation between research institutions, competent ministries, public enterprises, protected area managers, and fire management services further constrains the development of relevant research. In the absence of institutional coordination and systematic knowledge exchange, scientific findings are rarely used as a basis for decision-making in post-fire rehabilitation and restoration practice.

Desired state: An institutionally supported and sustainably funded system of scientific research in the field of landscape fire management and post-fire restoration is established.

2. IMPLEMENTATION FRAMEWORK

2.1. Prevention

NO.	IDENTIFIED GAP	SUB NO.	MEASURE	IMPLEMENTATION PERIOD	COMPETENT INSTITUTION(S)	ESTIMATED BUDGET	PRIORITY
1.1.	Insufficiently developed regulatory framework for landscape fire management	1.1.1	Conduct an analysis of the existing regulatory framework for landscape fire management with the aim of identifying areas for improvement	Up to 1 year	MAFWM, Mol - EMS, MESP, MME, MCTI, CSO	5,000.00	I
		1.1.2	Integrate prescribed burning as a fuel management measure into the regulatory framework, including the establishment of criteria for its safe and environmentally sound implementation	Up to 5 years	MAFWM, Mol - EMS, MESP, scientific institutions	7,000.00	I
		1.1.3	Amend the Law on Fire Protection to introduce "landscape fire" as a distinct category and regulate the landscape fire management system through secondary legislation	Up to 5 years	Mol - EMS, MAFWM, MESP and scientific research institutions	7,000.00	I
		1.1.4	Introduce regulatory mechanisms for the management of abandoned and neglected land	Up to 5 years	MAFWM, MCTI, RGA, LSGU	10,000.00	II
		1.1.5	Amend the Rulebook on Professional Examinations and Licensing Requirements for the Preparation of Fire Protection Plans and Projects, including the expansion of the range of authorized experts	Up to 5 years	Mol – EMS, MAFWM, MSTDI, RHSS	7,000.00	II
		1.1.6	Review and strengthen the penalty framework for activities associated with an increased risk of fire ignition	Up to 5 years	Mol – EMS, MAFWM and relevant institutions	5,000.00	II
		1.1.7	Amend and supplement regulations governing the preparation, issuance, and dissemination of meteorological information relevant to landscape fire risk management before, during, and after fire events	Up to 5 years	RHSS	5,000.00	I

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1.2.	Insufficiently developed institutional framework and capacities	1.2.1	Strengthen inspection oversight through increased staffing, training, and technical equipment to improve control of landscape fire risks	Up to 5 years	MAFWM, Mol - EMS, MESP, LSGU	100,000.00	I
		1.2.2	Develop continuous training programmes for professionals in forestry, agriculture, and risk management to support the implementation of preventive measures	3-5 years	MAFWM, Mol – EMS, scientific research institutions, CSOs	80,000.00	II
		1.2.3	Research and pilot alternative practices for crop residue management to prevent landscape fires	3-5 years	MAFWM, MESP, Mol – EMS, scientific research institutions, LSGU, CSOs	80,000.00	II
1.3.	Insufficient intersectoral coordination	1.3.1	Institutionalize and further strengthen the LFM network as a permanent interinstitutional mechanism for coordination, information exchange, and monitoring of activities related to landscape fire management	Up to 3 years	All relevant institutions	30,000.00	I
1.4.	Insufficient integration of LFM into education and training	1.4.1	Integrate LFM principles into primary, secondary, and higher education curricula and educational programmes, including activities delivered by civil society organizations and volunteer fire brigades (VFBs)	Up to 5 years	MSTDI, MAFWM, Mol – EMS, NGOs and VFBs	90,000.00	II
1.5.	Insufficient public awareness of landscape fires	1.5.1	Develop and implement a national awareness-raising campaign on landscape fires and the LFM approach	Up to 1 year	Mol, MAFWM, MESP, RHSS, CSOs, media	100,000.00	I
		1.5.2	Develop and implement educational programmes for local communities and rural populations, with a particular focus on farmers and alternatives to crop residue burning	Up to 5 years	MAFWM, LSGU, Mol – EMS, CSOs	70,000.00	II
		1.5.3	Organize training for media professionals and journalists, and develop guidelines for media reporting on fire risks and climate change	1-3 years	Mol – EMS, MESP, MAFWM and media associations	15,000.00	II

1.6.	Unresolved property rights issues and outdated cadastral records	1.6.1	Conduct an assessment of cadastral records in areas with increased landscape fire risk	Up to 5 years	RGa, MAFWM and LSGU	15,000.00	II
		1.6.2	Update cadastral data and align records with actual land use conditions	Up to 5 years	MCTI, RGa, MAFWM and LSGU	150,000.00	II
1.7.	Inadequate management of privately owned land	1.7.1	Strengthen advisory and technical support for private forest owners in landscape fire prevention	Up to 5 years	MAFWM, FMEs and NPs, LSGU	70,000.00	II
		1.7.2	Introduce incentives for agricultural land maintenance and biomass management to reduce landscape fire risk	Up to 5 years	MAFWM	800,000.00	II
		1.7.3	Promote the organization of private forest owners through information-sharing, advisory support, and joint fuel management initiatives	Up to 5 years	MAFWM, FMEs and NPs	70,000.00	III
1.8.	Abandonment of traditional grazing and overgrowth of meadows and pastures, increasing landscape fire risk	1.8.1	Develop support programmes for livestock farmers in areas with increased landscape fire risk	Up to 5 years	MAFWM, FMEs, LSGU	300,000.00	II
1.9.	Insufficient integration of landscape fire risk management in energy infrastructure corridors	1.9.1	Develop standards and guidelines for vegetation management in energy infrastructure corridors	Up to 5 years	MME, MAFWM and energy enterprises	25,000.00	II

2.2. Preparedness

NO.	IDENTIFIED GAP	SUB NO.	MEASURE	IMPLEMEN- TATION PERIOD	COMPETENT INSTITU- TION(S)	ESTIMATED BUDGET	PRIORITY
2.1.	Insufficiently developed and integrated national information system for landscape fires	2.1.1	Establishment of a standardized system for the collection, exchange, and updating of landscape fire data among relevant institutions	Up to 1 year	Mol – EMS, MAFWM, RGA and LSGU	120,000.00	I
		2.1.2	Development of landscape fire risk maps based on the integration of geospatial, climatic, and historical data	Up to 5 years	MAFWM, Mol – EMS, RHSS, RGA and scientific research institutions	300,000.00	II
		2.1.3	Establishment of a national information platform for landscape fire management, integrating spatial, meteorological, and operational data	Up to 5 years	Mol – EMS, MAFWM, RHSS, RGA and scientific research institutions	500,000.00	III
	Insufficient human resources and professional capacities for operational response to landscape fires	2.2.1	Establishment of an LFM Centre for training and continuous professional development in landscape fire management / in the field of landscape fire management	3-5 years	Mol – EMS, MAFWM, RHSS, MESP	1,000,000.00	I
		2.2.2	Strengthening the capacities of professional and voluntary fire brigades in rural and high-risk areas	3-5 years	Mol – EMS, VFBs, LSGU, CSOs	350,000.00	I
2.3.	Insufficiently developed technical and infrastructural capacities for preparedness and response (forest roads, firebreaks, water supply points, etc.)	2.3.1	Assessment and inventory of existing technical, infrastructural, and operational capacities at the local level for landscape fire preparedness and response, including mobilization resources	2 years	Mol – EMS, MAFWM, VFBs, FMEs, PAM, LSGU	100,000.00	I
		2.3.2	Development of a plan for strengthening and improving technical and infrastructural capacities for preparedness and response, based on the assessment results	Up to 3 years	Mol – EMS, MAFWM, VFBs, FMEs, PAM, LSGU	25,000.00	II

2.4.	Insufficiently developed and territorially limited system for early detection and warning of landscape fires	2.4.1	Development and expansion of the national early landscape fire detection system through cameras, sensors, satellite systems, and automated data analysis tools	Up to 5 years	Mol – EMS, MAFWM, MESP, RHSS, Army, VFBs, LSGU, MCTI, RGA, PAM	1,000,000.00	I
2.5.	Insufficient implementation of the legal obligation to develop local plans and unharmonized protocols	2.5.1	Mapping of local self-government units in terms of the existence and up-to-datedness of landscape fire protection plans	Up to 1 year	Mol – EMS, LSGU, VFBs	10,000.00	I
		2.5.2	Improvement of standardized operational procedures and protocols for landscape fire response	Up to 1 year	Mol – EMS, LSGU, VFBs, CSOs	25,000.00	I
2.6.	Lack of regular intersectoral training and joint operational exercises	2.6.1	Organization of regular joint field-based operational exercises for landscape fire response, involving all relevant stakeholders at the national and local levels	Up to 5 years	Mol – EMS and all other relevant institutions	150,000.00	II

2.3. Suppression

NO.	IDENTIFIED GAP	SUB NO.	MEASURE	IMPLEMENTATION PERIOD	COMPETENT INSTITUTION(S)	ESTIMATED BUDGET	PRIORITY
3.1.	Insufficient human resources and professional capacities for landscape fire suppression	3.1.1	Updating the national database on voluntary fire brigades and other organizations that may be engaged in landscape fire suppression	Up to 1 year	Mol, LSGU, VFBs, CSOs	15,000.00	I
		3.1.2	Increasing the number of trained and operational personnel for landscape fire suppression in professional and voluntary fire brigades, in line with risk assessment	Up to 5 years	Mol, VFBs, LSGU	300,000.00	I
		3.1.3	Enhancement of the landscape fire suppression training system (LFM) for professional firefighting and rescue units, voluntary fire brigades, and other relevant stakeholders	Up to 5 years	Mol – EMS, MAFWM and VFBs	150,000.00	I
3.2.	Insufficient technical and operational capacities for landscape fire response	3.2.1	Development of a national needs assessment for equipment and resources for landscape fire suppression, based on risk analysis, operational requirements, and the findings of Measure 2.3.1.	Up to 1 year	Mol, LSGU, VFBs	30,000.00	I
		3.2.2	Procurement and strategic deployment of specialized vehicles, technical equipment, and personal protective equipment for landscape fire suppression in high-risk areas	Up to 5 years	Mol, LSGU, VFBs	1,500,000.00	I
3.3.	Insufficiently developed intersectoral operational management during landscape fire suppression	3.3.1	Enhancement of the operational management and command system during landscape fires, with clearly defined roles of all relevant institutions	Up to 5 years	Mol – EMS and all other relevant institutions	25,000.00	I
		3.3.2	Improvement of operational procedures for intersectoral coordination in landscape fire suppression	Up to 5 years	Mol – EMS, MAFWM, RHSS, Army, LSGU and VFBs	20,000.00	I

2.4. Post-Fire Management

NO.	IDENTIFIED GAP	SUB NO.	MEASURE	IMPLEMENTATION PERIOD	COMPETENT INSTITUTION(S)	ESTIMATED BUDGET	PRIORITY
4.1	Lack of a standardized methodology for the assessment of post-fire impacts and damages	4.1.1	Development and adoption of a national methodology for the assessment of post-fire impacts on the environment, biodiversity, infrastructure, and material assets	Up to 1 year	MAFWM, MESP, MoI – EMS, RHSS, RGA, scientific research institutions, CSOs	25,000.00	I
4.2	Insufficient capacities for post-fire rehabilitation and restoration	4.2.1	Establishment of multidisciplinary expert teams for the assessment, planning, and implementation of effective and timely post-fire rehabilitation and restoration of burned areas	Up to 1 year	MAFWM, MESP, MoI – EMS, FMEs, PAM, LSGU, scientific research institutions, CSOs	80,000.00	I
		4.2.2	Enhancement of technical capacities for the assessment and monitoring of post-fire rehabilitation (GIS, drones, remote sensing)	Up to 5 years	MAFWM, MoI – EMS, RGA, RHSS, FMEs, LSGU, scientific research institutions, CSOs	250,000.00	II
4.3	Insufficiently developed scientific research in the field of post-fire management	4.3.1	Establishment of a dedicated financial fund to support scientific and professional institutions in researching post-fire management and the restoration of burned areas	Up to 1 year	MSTDI, Ministry of Finance, MAFWM and MESP	500,000.00	III

*The budget estimate is indicative and based on an approximate assessment, without a detailed financial analysis having been conducted.

** Priority description

I	II	III
High priority	Moderate priority	Low priority

3. MONITORING AND EVALUATION

The monitoring and evaluation framework provides a structured approach for following up on the implementation of the recommendations identified through the Landscape Fire Management Gap Analysis for the Republic of Serbia. It will help assess progress in addressing the identified legal, institutional and policy gaps, identify challenges, and determine where further action or support may be required.

As the Country Partner Institution (CPI) for the project, the Forestry Directorate under the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia will coordinate the follow-up and monitoring of the recommendations. Implementation of individual measures will remain the responsibility of the competent institutions, in accordance with their respective mandates. The monitoring process should therefore involve relevant national and local institutions and other stakeholders working in the areas of forestry, fire protection, civil protection, environmental protection, nature conservation, agriculture and landscape management.

3.1. Frequency of monitoring

Progress should be reviewed twice a year, preferably through one meeting held before the main fire season and one held after it.

The pre-season review should focus on preparedness, prevention measures and the status of planned activities. The post-season review should assess progress, challenges and lessons learned from the fire season, and identify any measures that may need to be adjusted or given further support.

3.2. Evaluation framework

The evaluation should assess both the implementation of the recommendations and their contribution to improved landscape fire management in Serbia. The assessment should consider:

Implementation progress – whether planned measures have been initiated or completed, and whether activities are progressing according to agreed timelines.

Effectiveness – whether the measures are contributing to improved prevention and preparedness, stronger institutional coordination, and increased capacity for landscape fire management.

Sustainability – whether the measures and improvements are being integrated into existing policies, procedures and institutional practices, and can be maintained over the longer term.

The evaluation should be participatory and involve relevant public institutions, local self-government units, forestry and environmental authorities, fire and rescue and civil protection services, research and educational institutions, and other relevant stakeholders.

3.3. Key indicators and continuous improvement

The monitoring process should use a practical set of indicators linked to the recommendations and, where applicable, to a future implementation or action plan. Indicators should cover implementation progress, institutional capacity and coordination, prevention and preparedness, and improvements in landscape resilience.

Findings from the monitoring exercises should be used to identify delays, emerging challenges and areas requiring additional support. The recommendations should be reviewed and updated periodically, where necessary, to reflect changes in legislation, institutional arrangements, climate, and landscape fire risks, and lessons learned from fire seasons.

In this way, the Gap Analysis will provide a basis for continuous improvement of landscape fire management in Serbia, with progress regularly reviewed and the proposed measures adapted to changing needs and circumstances

