European Union
Civil Protection and
Humanitarian Aid

Wildfire Peer Review Assessment Framework

Wildfire Peer Review Assessment Framework
(Wildfire PRAF)

European Union
Civil Protection

Authors: Veronica Casartelli, Jaroslav Mysiak
Release date: May 29, 2023

Table of contents

Acknowledgments

Executive Summary

The Wildfire Peer Review Assessment Framework (Wildfire PRAF) is a tool designed to support comprehensive reviews of disaster risk management and civil protection systems, with a focus on the risk associated with large-scale *unplanned or uncontrolled fires affecting natural, cultural, industrial, and residential landscapes* (UNDRR, 2021).

It is based on the Peer Review Assessment Framework (PRAF) developed under the Union Civil Protection Mechanism (UCPM) Peer review programme 2020-2024. The Wildfire PRAF is meant to

guide sound reviews on wildfire risk management systems at the national and/or sub-national level in Member States, Participating States, enlargement and neighbourhood countries, under the EU's Civil Protection Mechanism legislation.

The Wildfire PRAF consists of seven thematic areas (represented by hexagons in the figure below), each containing six detailed topics (represented by wedges) for examining the practices of wildfire risk management in the host country or region. These thematic areas are vital for reviewing wildfire risk management capabilities.
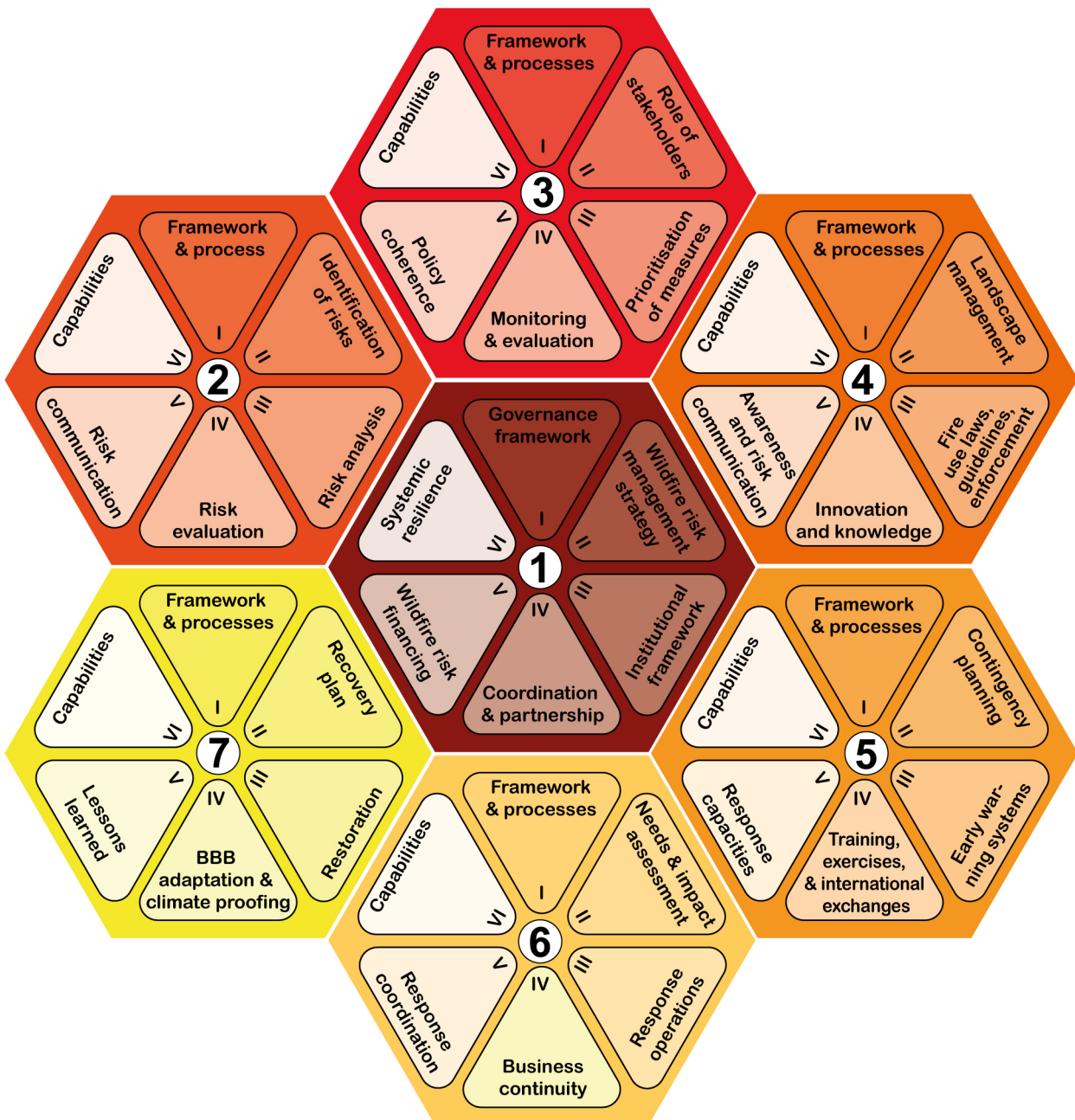
The analytical areas of the framework have been aligned with the policy requirements and terminology of the UCPM. In addition to the traditional ex-ante peer review areas, such as risk assessment, risk management planning, risk prevention and preparedness measures, the framework also includes emergency response, recovery, and lessons learned. This allows for ex-post reviews of emergency response and recovery processes from recent emergencies.

The host country or region can choose the peer review focus that best suits its needs. A comprehensive review covers all thematic areas, while a targeted review can zero in on specific aspects of wildfire risk management, such as risk governance, wildfire risk assessment, wildfire risk management planning, or any stage of the wildfire risk management cycle, from prevention and preparedness to emergency response and post-disaster recovery.
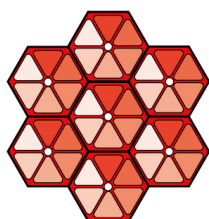
| Full/comprehensive peer review | Thematic review - risk assessment | Thematic review - risk management planning | Thematic review - prevention and preparedness measures | Thematic review - response and recovery |
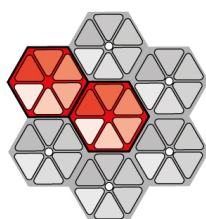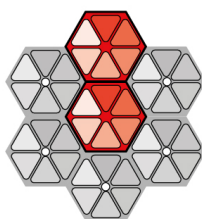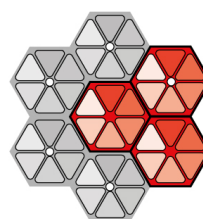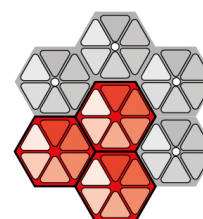
A comprehensive guide to the actors involved in and contributing to peer review, as well as the methods and tools used to collect information and evidence, the process of information collection, and the principles and rules of conduct during the assessment exercise are detailed in the document Peer review programme: Guidelines.

In brief, the peer review workflow adheres to the ISO 22392:2020 standard and expands upon it. This expansion focuses on several key aspects, including:

- the central role of the facilitator in drafting the peer review report and initial desk review, in a close collaboration with the peers,

- the use of fact-finding data collection methods, and formulation of initial hypotheses regarding the good practice examples and strengths/areas for improvements of the risk management practices – areas that are to be addressed during the peer review mission,

- additional supporting material produced to guide the peer reviews, such as the training kit and the peer review guidelines,

- suggestions for a voluntary self-assessment by the host country prior to the peer review mission and a follow up assessment after the review, on whether and how the recommendations have been considered by the host country/region.

The peer review workflow is structured in 12 steps, as per the figure below.

Plan the peer review

Objectives Benefits — 1
Analysis areas — 2
Stakeholders — 4
Reviewers — 5

Self-assessment — 3

Conduct the peer review

Draft report — 9
Review visit — 8
Desk review — 6

Surveys — 7

Assess the impact of the peer review

Impact assessment — 10
Final report — 11

Improve the process of the peer review

Process evaluation — 12
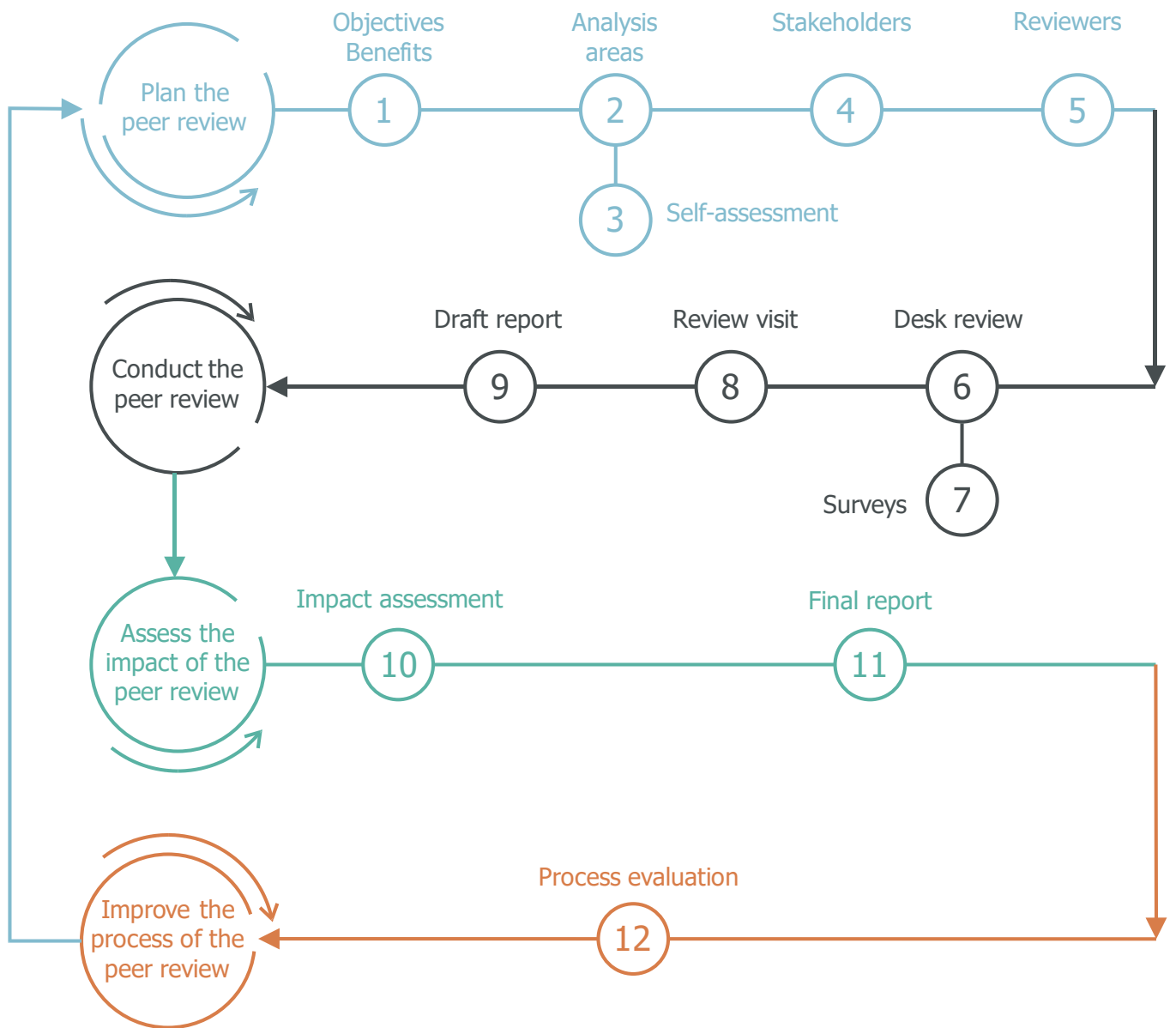
1 | Introduction

The Wildfire Peer Review Assessment Framework (Wildfire PRAF) is designed to facilitate thematic peer reviews of wildfire risk management systems within the framework of the Union Civil Protection Mechanism (UCPM). It focusses specifically on wildfires, defined as large-scale events with severe adverse impacts on human life, the environment, cultural heritage, infrastructures, assets, and economic activities.

Depending on the administrative organisation and responsibilities at various levels across the Member States and the UCPM Participating States, a wildfire peer review may be undertaken at the national and/or regional level[1].

The Wildfire PRAF provides independent experts, referred to as "peers", with a guide for evaluating wildfire risk management systems.

This document is based on the broader Peer Review Assessment Framework (PRAF[2]) developed under the UCPM Peer review programme 2020-2024. It is applicable to countries or regions

that have identified wildfires as an important risk, or that have experienced recent major wildfires.

The assessment framework has been developed with an additional purpose in mind: to serve as a self-assessment tool which offers countries and regions the opportunity to analyse their own system for wildfire disaster risk management.

UCPM peer reviews are carried out in partnership between the European Commission (DG ECHO) and the requesting country/region. Following the request for a peer review, DG ECHO selects a team of experts (the "peers") with the relevant experience from national civil protection authorities. For wildfire peer reviews, DG ECHO will also draw upon the expertise of teams such as the Spanish FAST (Forest Firefighting: assessment and advisory team).

An approximately one-week in-country mission is organised to collect relevant information and discuss the key topics under review. The review is completed upon the release of the final report including recommendations and good practices.

1.1 - UCPM Peer review of disaster risk management and civil protection systems

Peer review is a widely used method for evaluating policy performance and implementation. When applied to Disaster Risk Management (DRM), it provides countries and regions with an opportunity to assess their readiness to cope with natural and human-induced hazards, as well as related disasters. By identifying areas of improvement, peer reviews can contribute to strengthening risk management practices.

The UCPM, established by Decision 2013/1313/EU, has introduced peer reviews as a means for assessing and enhancing risk management capabilities[3], fostering knowledge exchange, and promoting the integration of risk prevention, preparedness, and response.

The European Commission's General Directorate for Civil Protection and Humanitarian Aid Operations (DG ECHO) manages and funds the UCPM peer review programme. Expert reviewers selected from UCPM Member and Participating States conduct independent analyses of each country's DRM practices. Since 2013,

sixteen countries have voluntarily participated in the peer review assessment. The most recent peer reviews have been conducted in Romania (2023) and in the Republic of Moldova (2023 – report is pending).

The current 2020-2024 peer review programme cycle has undergone procedural and technical updates, resulting in a significant improvement of the overall programme. The roles and responsibilities of all involved parties, as well as the different phases of the review process, have been reviewed and updated. The Peer Review Programme - Guidelines document describes the key elements that characterize the overall approach and process, including the principles that drive the process, the roles and responsibilities of the actors involved, the workflow to be followed, and the available tools.

The Peer Review Assessment Framework (PRAF) is presented as the technical guide underpinning the review analysis for assessing a country's risk management and civil protection system.

---

1   Requests for a peer review, including for a regional review, will only be considered by the Commission if submitted by the central/national civil protection authority.
2   Mysiak J, Casartelli V and Torresan S (2021). Union Civil Protection Mechanism - Peer Review Programme for disaster risk management: Assessment Framework.
3   The ability of a Member State or its regions to reduce, adapt to or mitigate risks, identified in its risk assessments to levels that are acceptable (Decision 1313/2013/EU).

These two documents, the Guidelines and the PRAF, are the key reference documents for conducting effective peer reviews on disaster risk management within the UCPM 2020-2024 programme cycle. They have resulted from sound research based on different inputs. These include the 2018-2019 programme cycle documentation and outcomes, recommendations from the Organisation for Economic Co-operation and Development (OECD)

to improve the UCPM peer reviews, the updated ISO 22392:2020 Guidelines for conducting peer reviews, the amended decision 1313/2013 on a Union Civil Protection Mechanism, and a series of interviews with key experts experienced in risk management capability assessment and peer reviews.

1.2 - Wildfire risk in EU and UCPM peer review on wildfire risk management capabilities

Wildfires remain one of the most prominent disaster risks in Europe and are increasing in intensity and geographic scope. The year 2022 was the second worst in Europe after 2017 in terms of burnt areas and number of fires since 2006. This is indicative of the significant attention paid to forest fires across the disaster risk management cycle under the Union Civil Protection Mechanism (UCPM).

Climate, environmental and socio-economic changes are underlying causes of wildfire risk that exacerbate the frequency and impacts of large-scale events across Europe. Areas with a usually low wildfire hazard are already experiencing an increased number of severe events, and the wildfire seasons are becoming longer. Oddly, wildfires are being recorded in winter, and this trend is expected to intensify, causing potential destructive impacts on human health, property, and ecosystem services across the EU.

In alignment with key global frameworks such as the Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR), the Paris Agreement on Climate Change, and the Sustainable Development Goals (SDGs), various European policies and regulations are in place to address the impacts of wildfires[4]. The European Green Deal has set an ambitious agenda for climate change adaptation, and the EU Strategy on Adaptation to Climate Change aims to foster faster, smarter, and more systemic adaptation. The EU Forest Strategy for 2030 aims to strengthen the resilience and adaptive capacity of woodland areas. The EU Biodiversity Strategy for 2030 also contributes to improving wildfire risk management, including several guidance documents and the Restoration Law proposal, presented by the Commission in 2022.

Along with these strategies and the revision of the UCPM, Europe's increased response capacities for coping with wildfires, and the

strong coordination mechanism spearheaded by the European Response Coordination Centre (ERCC), have proven to be crucial protective measures. However, the prospects of worsening wildfire risk highlight the critical importance of enhanced coordination and governance. Therefore, gaining a better understanding of the evolving drivers and patterns of wildfire risk, along with ever-better prevention and preparedness, is pivotal for protecting human lives, preserving the environment, and ensuring business continuity and critical entities' protection.

In the autumn of 2022, the European Commission launched the Wildfire Prevention Action Plan, building upon the lessons learned and the suggestions of various stakeholders. The Plan aims to strengthen wildfire prevention across the EU, improve the management of forests and landscapes, reduce the ignition of fires, and limit their impacts.

This plan fully utilizes the tools available under the UCPM, including the Union disaster resilience goals adopted in February 2023[5]. It complements the preparedness efforts under rescEU and builds on other important EU initiatives, such as the EU Forest Strategy. The Plan proposes ten actions organised around three topics: i) improved capacity to prevent wildfires, ii) improved knowledge on wildfires for increased prevention, and iii) increased financing of wildfire prevention actions.

Wildfire peer reviews are a strategic tool for strengthening resilience against wildfires at the European, national, and sub-national level. The primary objective is to exchange knowledge on wildfire risk management across and beyond Europe through independent analyses conducted by experts from different Member States and UCPM Participating States. The ultimate aim is to identify and

---

4   Most recently, the "Landscape Fire Governance Framework" has been launched during the 8th International Wildland Fire Conference (Porto, 16-19 May 2023), as an instrument for dealing with the growing occurrence of severe wildfires, through improved policies and governance.

5   Commission Recommendation of 8 February 2023 on Union disaster resilience goals 2023/C 56/01.

share good practices that are already in place, identify areas for improvement, and collect recommendations for enhancing wildfire risk management systems. In this context, developing an analytical framework focused on wildfire risk is of paramount importance for supporting effective, comprehensive and consistent peer reviews on this specific topic.

2 Thematic areas of the wildfire peer review

2.1 | Overview of the thematic areas of the wildfire peer review

The Wildfire Peer Review Assessment Framework (Wildfire PRAF) is based on the Peer Review Assessment Framework (PRAF) developed to provide technical support for comprehensive and thematic reviews of disaster risk management within the UCPM 2020-2024 programme cycle. The PRAF covers all stages of the disaster risk management cycle and is arranged into a modular structure that ensures an adequate level of flexibility and adaptability to the specific needs of each review. It identifies seven key topics on which the analysis should be based: (1) risk governance, (2) risk assessment, (3) risk management planning, (4) risk prevention, (5) risk preparedness, (6) emergency response, and (7) recovery and lessons learned (Figure 1).

To ensure consistency, the Wildfire PRAF is designed with the same overall structure, consisting of the same key areas, but is tailored to address wildfire risk: (1) governance of wildfire risk management, (2) wildfire risk assessment, (3) wildfire risk management planning,

Figure 1: Main thematic areas of analysis for UCPM peer reviews on disaster risk management and civil protection systems. Each hexagon is divided into 6 topics (wedges) further detailing the thematic area.

(4) wildfire prevention, (5) wildfire preparedness, (6) wildfire emergency response, and (7) recovery and lessons learned (as illustrated in Figure 2).

The proposed framing for analysing wildfire disaster risk management aligns with the requirements and terminology of the UCPM and covers all stages of the DRM cycle. Governance of wildfire risk management is the core element of the framework, making it a mandatory topic to be assessed in both the general and the thematic review process. Neglecting this area can compromise the effectiveness of the entire review process.

As illustrated in Figure 2, each area of analysis is further divided into six topics, represented as "wedges". Host countries/regions can define the purpose of the peer review in a more consistent way by selecting a combination of thematic areas and choosing to include or exclude certain topics within the selected areas.

Below is a brief overview of the "hexagon" areas of analysis and their content. The legislative, institutional and procedural framework is common to all areas and is therefore not repeated in the description of each hexagon.

- **Governance of wildfire risk management.** This section covers the overall governance of wildfire risk management at the national and/or sub-national level. The analysis focuses on the wildfire risk management strategy in place, the horizontal and vertical coordination and cooperation among key stakeholders involved in wildfire risk management, wildfire risk financing strategies in place, and systemic resilience.

- **Wildfire risk assessment:** This section covers risk assessment processes addressing wildfire risk at the national and/or sub-national level. The analysis focuses on the three

There are seven areas of analysis which the host country/region can choose from to specify the scope of the wildfire peer review.

Each area of analysis is made up of six topics (wedges) describing the thematic area of analysis in further detail.

The host country/region can choose the peer review focus that best addresses its needs. A comprehensive review covers all thematic areas, whereas targeted review can focus on risk assessment, risk management planning, or any of the risk management stages: prevention, preparedness, emergency response, and/or post-disaster recovery.

Figure 2: Main thematic areas of analysis for UCPM Wildfire peer reviews.

stages of the assessment process (wildfire risk identification, analysis, and evaluation). It also looks at the communication and sharing of results with key stakeholders and the general public.

- **Wildfire risk management planning.** This section covers the processes in place for planning wildfire risk management at the national and/or sub-national level, with the aim of managing and reducing wildfire risk. The analysis looks at the engagement of key stakeholders, the methods for identifying and prioritising wildfire risk management measures, the monitoring, evaluation and reporting processes in place, and the policy coherence with other key planning processes linked to wildfire risk.

- **Wildfire prevention.** This section covers important wildfire prevention measures aimed at reducing risks or mitigating

adverse consequences of a wildfire event for people, the environment, and property, including cultural heritage sites. The analysis focuses on the overall framework underlying the identification and implementation of preventive measures. It also examines the review of key landscape management measures, fire use laws, and guidelines in place, as well as their enforcement. Also included are the investigation of important innovation and knowledge services, and a special focus on risk awareness and communication processes.

- **Wildfire preparedness.** This section covers important wildfire preparedness measures aimed at establishing a state of readiness and capability of human and material means, structures, communities and organisations for ensuring an effective, rapid response to a wildfire event, achieved through advance action. The analysis focuses on the overall process supporting the identification and implementation

of preparedness actions. It also presents an analysis of key preparedness measures, identified as contingency planning processes, early warning systems in place, training, exercises and international exchanges, and development of response capacities.

- **Wildfire emergency response.** This section covers activities and processes related to the response phase of a wildfire event. The analysis focuses on process for assessing needs and impact, response operations, vertical and horizontal coordination processes.

- **Recovery and lessons learned.** This section covers important wildfire recovery and review processes implemented in the wake of a major wildfire event. It focuses on the post-disaster phase and addresses the implementation processes of recovery and restoration plans, the build-back-better adaptation and climate proofing processes, and the lessons learned procedures in place to identify good practices, areas for improvement and wildfire risk management measures needed to mitigate risk and strengthen resilience.

2.2 | Governance of wildfire risk management
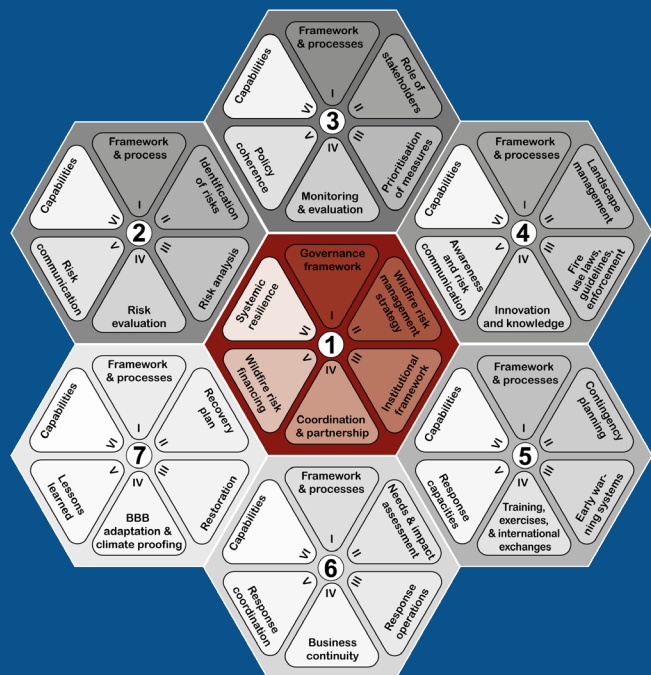
KEY MESSAGES

- An effective and efficient risk management system is built upon an **integrated approach** that prioritises the management of wildfire risk as a whole. This should be an overarching principle for strengthening resilience at both the national and sub-national level.

- It is paramount to establish **holistic and cross-sectoral governance frameworks** at the national and sub-national (including local) level, to effectively reduce the potential impacts of wildfire events. This requires the engagement and empowerment of the private sector, local communities, and academia, to ensure a **whole-society approach**.

- Effective **horizontal and vertical cooperation and coordination** among stakeholders dealing with wildfire risk management is key to the successful development and implementation of risk management policies. Wildfire governance frameworks must consider environmental, cultural, socio-economic, and political interactions.

- Research on the linkages between wildfire events and human activities is of paramount importance. **Close cooperation** between scientists, policymakers, local authorities, first responders, and civil society is needed to define appropriate wildfire risk management strategies.

- **The systematic alignment** of disaster risk reduction (DRR), climate change adaptation (CCA) and sustainable development (SDGs) efforts, in addressing wildfire risk ensures **policy coherence** while considering existing trade-offs in wildfire management, such as the trade-off between increase of biodiversity and fuel reduction.

2.2.1 - Governance framework

- A cross-sectoral, holistic approach should be applied in the legislative framework for wildfire risk management at the national and/or sub-national level, including local governance. It is essential to ensure the coherence and alignment of laws and regulations dealing with wildfire events management, the environment, sustainable forest management (public/private), biodiversity protection, the resilience of critical entities, sustainable agricultural practices and activities, land use, and urban planning.

- The governance framework for wildfire risk management at the national and sub-national levels should address all stages of the disaster risk management cycle (DRMC). Guidelines and technical documents should support the implementation of the governance framework at different territorial scales.

- The governance framework should also take into account the cross-border dimension of wildfire risk. Multi and bilateral agreement on wildfire risk management should be in place with neighbouring countries, if appropriate.

- Laws and regulations, as well as the governance structure for wildfire risk management, should be regularly updated after major wildfire events (see also chapter 2.8). Inefficient policies and approaches that could become risk drivers themselves should be adjusted and updated to take into account future environmental, climate and socio-economic scenarios (e.g. lack of woodland urban interface management, lack of appropriate forest management, abandonment of agricultural lands, etc.).

- The development process of the wildfire governance framework should ensure principles of transparency and democratic accountability.

- The wildfire governance framework should include penal laws on wildfire-related issues (e.g. aspects related to legal responsibility).

- The pivotal role of appropriate forest management and agriculture as primary tools for fuel management should be highlighted in the overall governance structure for wildfire risk management.

2.2.2 - Wildfire risk management strategy

- Wildfire risk is a complex issue that involves a variety of factors, including human, political, economic, and natural systems. It is crucial to develop a strategy for reducing wildfire risk at the national and sub-national levels that takes into account these complex interactions.

- The National Disaster Risk Reduction Strategy (NDRRS) should recognize the risk of wildfire and incorporate measures to mitigate it.

- The wildfire risk reduction strategy should fully consider current and projected climate risks[1], and align itself with the National Climate Change Adaptation Strategy and/or Plan and the National Sustainable Development Strategy (NSDS).

- Trade-offs in wildfire risk management should be considered and addressed in all strategies, in order to ensure that the most effective and efficient risk reduction measures are taken.

- Key stakeholders at the national and sub-national levels having a role in wildfire risk management, including the Ministry of Environment, the Ministry of Agriculture, the Ministry of Interior, the Ministry of Defence, Civil protection, landowners, NGOs, or academia should participate in drafting the wildfire risk reduction strategy to ensure broad-based support and effective implementation.

- Strategies at the sub-national level should be defined in line with the national wildfire strategy and adapted to the specific characteristics of the territory, taking into account environmental and socio-economic characteristics.

- Both a top-down and a bottom-up approach should be applied in defining wildfire risk reduction strategies at different territorial levels to ensure that the strategy is both comprehensive and locally relevant.

2.2.3 - Institutional framework

- The key authorities, institutions, businesses or landowners, and civil society or community-based organisations involved in wildfire risk management should be clearly defined, along with their specific roles and responsibilities linked to the sectors identified above.

- To prevent any major overlaps or gaps, it is important to ensure that there is no redundancy or confusion between relevant actors with a role in wildfire risk management.

- Roles and responsibilities at the sub-national levels must be clearly identified, and there should be no significant overlaps or gaps exist between key institutions involved in wildfire risk management.

- Risk ownership should be well-defined among key actors, who should understand and acknowledge their strategic role in preventing and managing wildfire risk.

- To ensure a holistic approach to wildfire risk management, stakeholders not specifically related to wildfires should be involved in supporting the risk management process. For example, the Ministry of Health and the Ministry of Education can provide support by disseminating information to communities about wildfire risk as related to health and including wildfire-related topics in school and university curricula.

2.2.4 - Coordination and partnership

- A clear coordination process should be established among the different stakeholders and sectors, including agriculture, the environment, the economy, etc. This process should involve a multi-hazard, comprehensive approach to understanding, reducing and addressing wildfire risks. Pivotal stakeholders in wildfire risk management, such as agriculture and forestry land management authorities, should be effectively engaged.

---

1   See also the Adaptation Support Tool - Assessing climate change risks and vulnerabilities.

- Horizontal coordination and cooperation should be ensured across key authorities and institutions dealing with wildfire risk management and reduction.

- Vertical coordination and cooperation should be ensured across key authorities and institutions dealing with wildfire risk management and reduction at different territorial levels.

- If the National Platform for Disaster Risk Reduction or other national forums exist, they should involve key authorities and institutions engaged in wildfire risk management.

- Cross-border coordination and cooperation mechanisms for wildfire prevention, preparedness and response should be in place with neighbouring countries.

- The coordination mechanism should include the participation of the public and private sectors as well as civil society organizations.

- Public-private partnerships should be established in the field of wildfire risk management and reduction. Any private sector stakeholder that may play a strategic role in wildfire risk management, such as the tourist sector (especially in the Mediterranean areas), should be actively engaged.

- Efforts should be underway to bridge the gap between the needs of policymakers and stakeholders and the production of scientific knowledge and tools, so that decision-making mechanisms can adopt innovations developed by fire science.

- Effective engagement, collaboration and coordination with civil society organisations and local communities should be in place, particularly those living in areas prone to wildfire.

2.2.5 - Wildfire risk financing

- A financing strategy for wildfire risk based on an integrated, multi-hazard approach and cooperation across levels of government and with relevant stakeholders should be established, with the necessary resources and expertise to manage the financial impacts of severe and large-scale events.

- Mechanisms for estimating, accounting and disclosing contingent liabilities associated with losses to critical sectors in the context of national budgets should be established in relation to wildfires.

- Broad frameworks for assessing risk-related expenditures should be adopted, and expenses at the national and sub-national (including local) levels should be recorded.

- A financial system and regulatory framework that supports individuals, businesses, and sub-national governments in protecting themselves against the financial impacts of wildfires should be in place to effectively manage their financial impacts.

- Potential risks to public finances posed by wildfires should be evaluated to manage the impacts of disasters on public finances. An approach to managing those financial demands should be developed.

- The Nat Cat insurance system, if in place and effectively enforced, should cover the risk of wildfire.

- A cost-effective compensation system should be in place, embracing a mix of pre-funding mechanisms and clear and agreed public finance rules before a wildfire strikes. These should include market-based mechanisms that enable households and businesses to transfer financial risks to insurance and capital markets.

- Investments in proactive wildfire mitigation and prevention should be prioritized over reactive suppression, with a sufficient budget available for implementing prevention and preparedness measures, such as Early Warning Systems (EWSs).

- A variety of funding sources should be used at the national, sub-national and local levels. The EU funding instruments, such as the Resilience and Recovery Facility, Cohesion Policy Funds, Agriculture and Rural Development Fund, the LIFE programme, the Technical Support Instrument, the EU Mission on Adaptation to Climate Change, and UCPM funding programmes, should be fully exploited.

- The resources available within the different authorities/institutions for managing wildfire risk should be consistent

with their corresponding roles and responsibilities at different territorial levels.

2.2.6 - Systemic resilience

- A holistic, multi-risk, cross-sectoral approach is crucial for developing an effective wildfire governance framework that contributes to building systemic resilience in the country. The framework should identify and address interlinkages among key sectors, such as protection of critical entities, sustainable agriculture, and forestry management. This is illustrated by the variety of impacts related to the UN Sustainable Development Goals (Figure 3).

- The implementation of the Union Disaster Resilience Goals should be taken into account in building an effective wildfire risk governance system.

- The wildfire risk reduction strategy should work in tandem with the National Climate Change Adaptation Strategy and/or Plan, and the National Sustainable Development Strategy (NSDS). Amongst other things, this means that it should be reviewed on a regular basis, that adaptable 'no regret' solutions should be given preference, and that maladaptation should be avoided[2].

- Greening and sustainability of civil protection activities should be promoted in all phases of the risk management cycle, with the overriding objective of saving human lives, the environment and property, as well as employing the best available technologies for achieving these objectives.

Examples of good practices in wildfire risk governance at the European, national and/or sub-national level

- **Italy** has recently revised its governance framework on wildfires after the devastating 2021 wildfire season. The country has adopted new legislation, Law No.155/2021, with the primary objective of improving coordination, technological updating and increasing operational capacity in forecasting, prevention, and prompt intervention against forest fires. The legislation also aims to promote investments for a safer territory. As per the new legislation, a technical committee has been established, which includes all the administrations at both the national and local levels involved in the whole wildfire risk management cycle. The committee is responsible for preparing a national plan every three years to strengthen human, technological, aerial, and terrestrial resources for effective wildfire management.
- After the disastrous wildfires that occurred in 2017, **Portugal** took measures to implement institutional reforms aimed at improving an integrated management of wildfires. As part of these reforms, an integrated fire agency (Agência para a Gestão Integrada de Fogos rurais, AGIF) was established, which brought together conservation officials, the police, the armed forces, and private forestry firms to streamline both prevention and firefighting efforts. Additionally, a decree-law was passed in 2021 (Decree-Law No. 82 of October 13) that creates the Integrated Management System for Rural Fires (SGIFR), which is an integrated structure involving all entities in the area. AGIF ensures strategic coordination of the SGIFR. The National Plan for the Integrated Management of Rural Fires (PNGIFR), which was drafted by AGIF and approved through Council of Ministers Resolution No. 45-A/2020, also included Portugal's Strategy for rural fire management and rural fire protection.
- At the local level, the Forest Defence Groups (FDGs) in Catalonia, **Spain**, are a well-established institution comprising local communities involved in fire prevention, fire suppression and post-fire reforestation. The FDGs have also established new alliances with local actors to further enhance their efforts in combating wildfires.

---

2   See also Adaptation Support Tool - Choosing an assessment framework for adaptation options.

Impacts of wildfire on Sustainable Development Goals
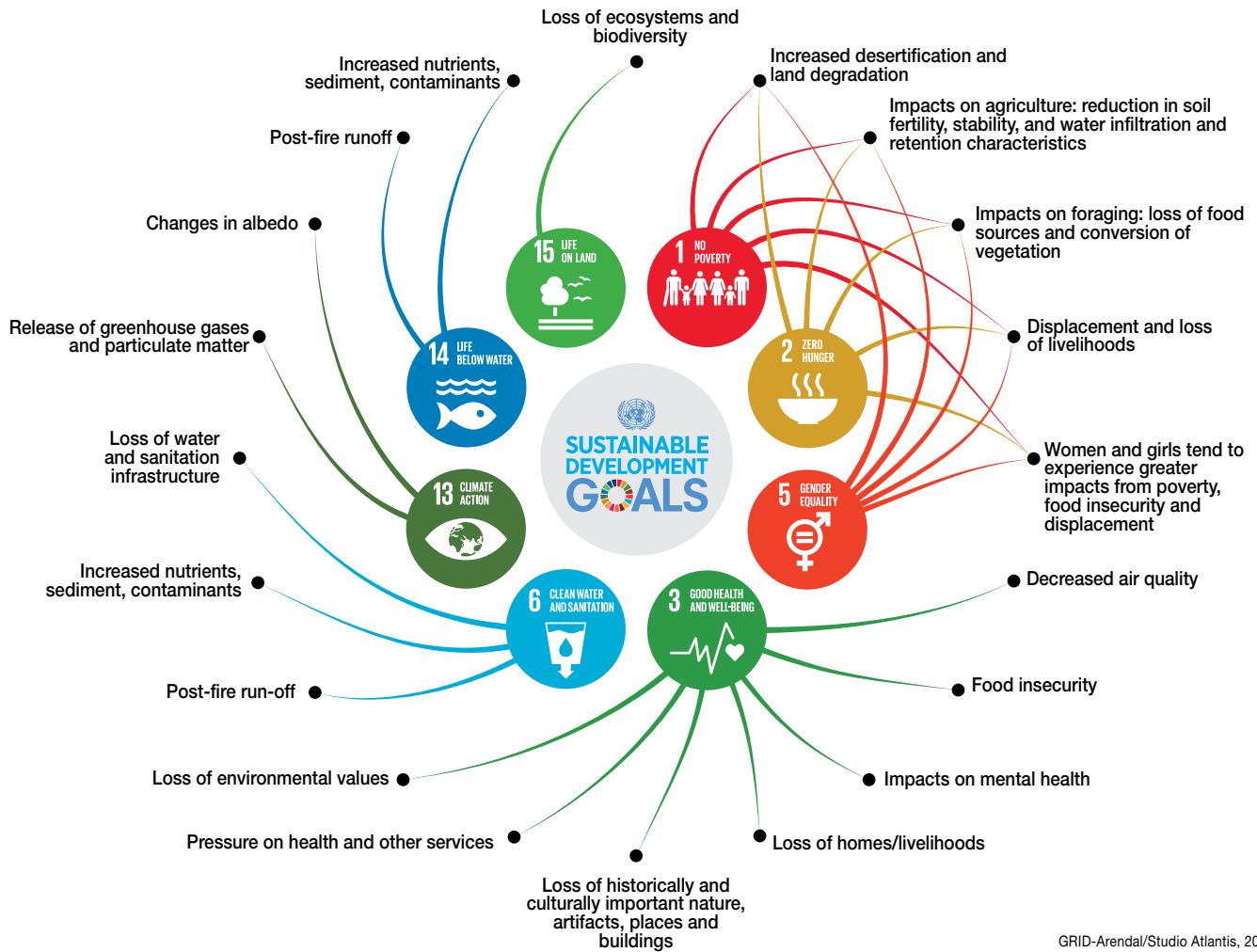
Figure 3. Impacts of wildfire on the United Nations Sustainable Development Goals (SDGs). The changing scale and intensity of wildfires may impact achievements across several of the SDGs that impact human health and well-being (Martin 2019).

2.3 | Wildfire risk assessment

KEY MESSAGES

- Wildfire risk assessments are essential for **all stages** of the wildfire Disaster Risk Management Cycle (DRMC) and serve as the foundation for developing appropriate and effective governance frameworks at different territorial levels.

- According to ISO 31000, the wildfire risk assessment process is structured in three main phases: **risk identification, risk analysis, and risk evaluation**. It is highly recommended to assess **the likely economic impacts** on societies, the environment, assets, and economic activities.

- Wildfire risk vary across Europe, and risk analysis and action thresholds should be adapted to **local conditions**. **Social, political, economic, and cultural factors** play a pivotal role in influencing risk assessment results.

- Special attention must be given to **vulnerable groups** during wildfire risk assessments, to ensure that no one is left behind.

- **Systematic recording and reporting** of wildfire events and related loss data are necessary for identifying and addressing the underlying causes of wildfires.

2.3.1 - Legislative framework and processes

- The legislative, procedural and institutional aspects governing the wildfire risk assessment process should be defined at the national and/or sub-national level.

- A single authority should be responsible for developing and/or coordinating wildfire risk assessment processes at the national and/or sub national level and across various sectors.

- A range of key authorities and stakeholders from different sectors should be involved in the wildfire risk assessment process. Roles and responsibilities should be clearly defined.

- Procedural or technical guidelines should be developed and used for conducting wildfire risk assessments at the national/sub-national level (including the local level). A common methodology should exist to ensure criterial consistency across risk assessments. Reference models, scenarios, methods, tools and the granularity of the results should be identified.

- The cross-border dimension of wildfire risk should be addressed in the risk assessment process, if relevant.

- A regular review of the wildfire risk assessments should be formally planned, and ad-hoc reviews should be conducted after major wildfire events take place.

- Risk assessments should take into account the observed and projected impacts of climate change on wildfire risks, in order to effectively support decision-making in all phases of the wildfire risk management cycle.

2.3.2 - Risk identification

Identification of wildfire hazard

- Historical records on the location, characteristics, and impacts of wildfires should contribute to risk identification.

- The fuel load and the type of fuel available to burn should be taken into consideration to identify wildfire risk. In addition, the horizontal and vertical structure of the fuels as well as their inter-connections should be used to assess the wildfire behaviour and the progression of the fire front. This data should be available in a GIS format, open to key actors involved in wildfire risk assessment and management.

- Both current climatic and terrain conditions (slope, elevation, local aspect) and future projections (climate, types of fuels, fuel load, urbanisation and land use changes) should be taken into account in the wildfire risk identification process.

Assessment of exposure and vulnerabilities

- The exposure of people and communities should be evaluated. The analysis should focus on, but not be limited to, the population at the wildland-urban interface (WUI).

- The exposure of ecosystem services, assets, critical entities, basic services, businesses and economies, and cultural heritage and landscapes should be assessed.

- The vulnerability of people and communities should be assessed. A special focus should be directed on the most vulnerable groups: women, children, the elderly, the disabled, the low-income population, and tourists/migrants/non-local people unaware of risk and not linguistically proficient.

- Both immediate and long-term physical (e.g. respiratory problems, increased cancer risk) and mental health effects on the affected population, such as firefighters and first responders, should be assessed and analysed.

- Vulnerabilities of the ecosystem services, the society, assets, critical entities, basic services, businesses and economies, and cultural heritage and landscapes should be assessed, also in monetary terms (ecological and socioeconomic "value").

Assessment of coping capacities: an evaluation should be carried out of the coping capacities of the wildfire risk management system in place in the area.

Collection and use of data

- An interoperable, digitized catalogue/repository of disaster loss data (DLD) related to wildfire events should exist at the national and/or subnational level, and should be interlinked with the broader all-hazard DLD system. A data model should be defined at the national and/or sub-national level.

- Standardised, homogeneous criteria on how to collect and share wildfires DLD should be defined in technical guidelines with the aim of ensuring consistency across data repositories accessible to various authorities at different territorial levels.

- Wildfire DLD and information collected should be aligned with Sendai indicators.

- Disaggregated data should be collected and included in the data repository/catalogue (e.g. gender, age).

- A GIS-cadastre of burnt areas should be implemented and regularly updated (e.g. on a yearly basis and/or after major wildfire events).

- The GIS platform should be open, and the interoperability of data should be guaranteed. Data and information uploaded should be in line with the INSPIRE Directive.

- The Risk Data Hub should be known and taken into consideration as a useful platform for sharing data and supporting risk assessments, if needed and feasible.

- Data collected should be reusable for defining and implementing other sectoral policies (e.g. land use planning) with the aim of developing "fire-smart" territories.

2.3.3 - Risk analysis

- The method used for wildfire risk analysis can be qualitative, semi-quantitative (risk matrix and indicator-based), or quantitative (deterministic and/or probabilistic). Future projections (climate, socio-economic, or related to types of fuels, fuel load, urbanisation ad land use changes) should be considered in the wildfire risk analysis process. The climate

projections and impact assessments should be based on best practices and available guidance and take into account the state-of-the-art science for vulnerability and risk analysis, and related methodologies in line with the most recent Intergovernmental Panel on Climate Change reports[1], scientific peer-reviewed publications and open source[2] or

---

1   Assessments Reports on Climate Change: Impacts, Adaptation and Vulnerability, published periodically by the Intergovernmental Panel on Climate Change (IPCC), the United Nations body for assessing the science related to climate change.

2   Such as Copernicus services managed by the European Commission.

paying models (ref. Commission Delegated Regulation EU 2021/2139 of 4 June 2021).

- The analysis should be conducted at an adequate spatial scale, so that the results can be considered for different purposes (civil protection/contingency planning, land use planning, disaster management, forest management, critical entities resilience).

- The analysis should address societal impacts/people, environmental impacts (ecological value), economic impacts (socioeconomic value), also in monetary terms.

- Seasonality should be considered in the wildfire risk analysis process.

- The types and availability of response capacities should be considered in the wildfire risk analysis process.

- Cascading effects (secondary/third effects) should be considered in the wildfire risk analysis process.

- The outcomes of wildfire risk analysis should be adequately aggregated and an assessment of uncertainties of the results should be carried out.

2.3.4 - Risk evaluation

- The results of the risk analysis should be evaluated to determine whether the wildfire risk is below a tolerable threshold.

- The criteria for identifying the threshold of tolerable wildfire risk should be defined in technical guidelines/official

documentation. The local disaster management capacities should be considered in defining the threshold.

- Multi-risk and cross-sectoral considerations should be taken into account in the risk evaluation process.

2.3.5 - Risk communication and the role of stakeholders

Stakeholders' engagement

- The national government should encourage and stimulate wildfire risk assessments at different scales and across different sectors.

- Key stakeholders from different sectors (public institutions, private sector, research and academia, civil society) should be involved in the risk assessment process. This engagement process should be defined within a suitable national multi-stakeholder' platform (e.g. the National Disaster Risk Reduction Platform or other national forums).

- A wide consultation process should be organised during the implementation of the risk assessment, engaging key stakeholders from different sectors (public institutions, the private sector, research and academia, and the civil society).

Communication and dissemination of risk assessment results

- Wildfire risk scenarios and maps should be publicly accessible and reusable in new studies. Risk assessment outcomes and information should be comprehensive and ready to use for operational purposes (such as land use, urban planning and contingency planning).

- The public and relevant stakeholders involved in wildfire risk management, climate change adaptation, sustainable agriculture, land and forestry management, and sustainable development (but not contributing to the wildfire risk assessment process) should be informed of the results through different channels. The results should be communicated in an understandable way to each target audience.

- Uncertainties should be communicated along with the assessment findings.

2.3.6 - Administrative, financial and technical capacities

- The wildfire risk management system and the key stakeholders involved in implementing and disseminating the risk assessment process should possess adequate administrative skills.

- The wildfire risk management system and the key stakeholders involved in implementing and disseminating the risk assessment process should be adequately financed. EU/extra EU funding opportunities should be successfully exploited to support wildfire risk assessment activities.

- The wildfire risk management system and the key stakeholders involved in implementing and disseminating the risk assessment process should possess adequate technical skills.

- Sufficiently trained human resources should be available to support and carry out wildfire risk assessments at different territorial levels.

- A strategy to enhance technical skills on wildfire risk assessment, targeting specific sectors or public servants, should be in place. A training programme should be defined and implemented.

- ICT infrastructures to support wildfire risk assessments should be implemented and used at different territorial levels.

Examples of good practices on wildfire risk assessment at European, national and/or sub-national level

- To harmonise wildfire risk assessment at the pan-European scale, in line with a series of EU regulations, the **Joint Research Centre** of the EC has developed a pan-European wildfire risk assessment. The assessment is conceptualised as the combined impact of wildfire hazard on people, ecosystems, and goods exposed in vulnerable areas, accounting for the multiplicity of risk dimensions and sources of uncertainty. The process has involved the Expert Group on Forest Fires (EGFF), made up of fire management representatives from 43 countries in the region and part of the European Forest Fire Information System (EFFIS), established jointly by the EC and fire services from the EU Member States, other non-EU European countries, and Middle Eastern and North African countries.
- The project *Barcelona Fire Resilient Communities* (WUICOM-BCN) has developed a holistic analysis of fire risk at the WUI by detecting social, ecosystem and infrastructural vulnerabilities. The project has successfully fostered effective engagement, collaboration, and coordination between different actors, such as fire agency, local associations, communities and civil society organisations, and local governmental representatives. Following the risk assessment, this project develops specific strategies for the city, to increase resilience to fire in the most vulnerable areas by taking advantage of co-creation spaces with citizens and local agents.

Factors influencing wildfire outcomes and management actions
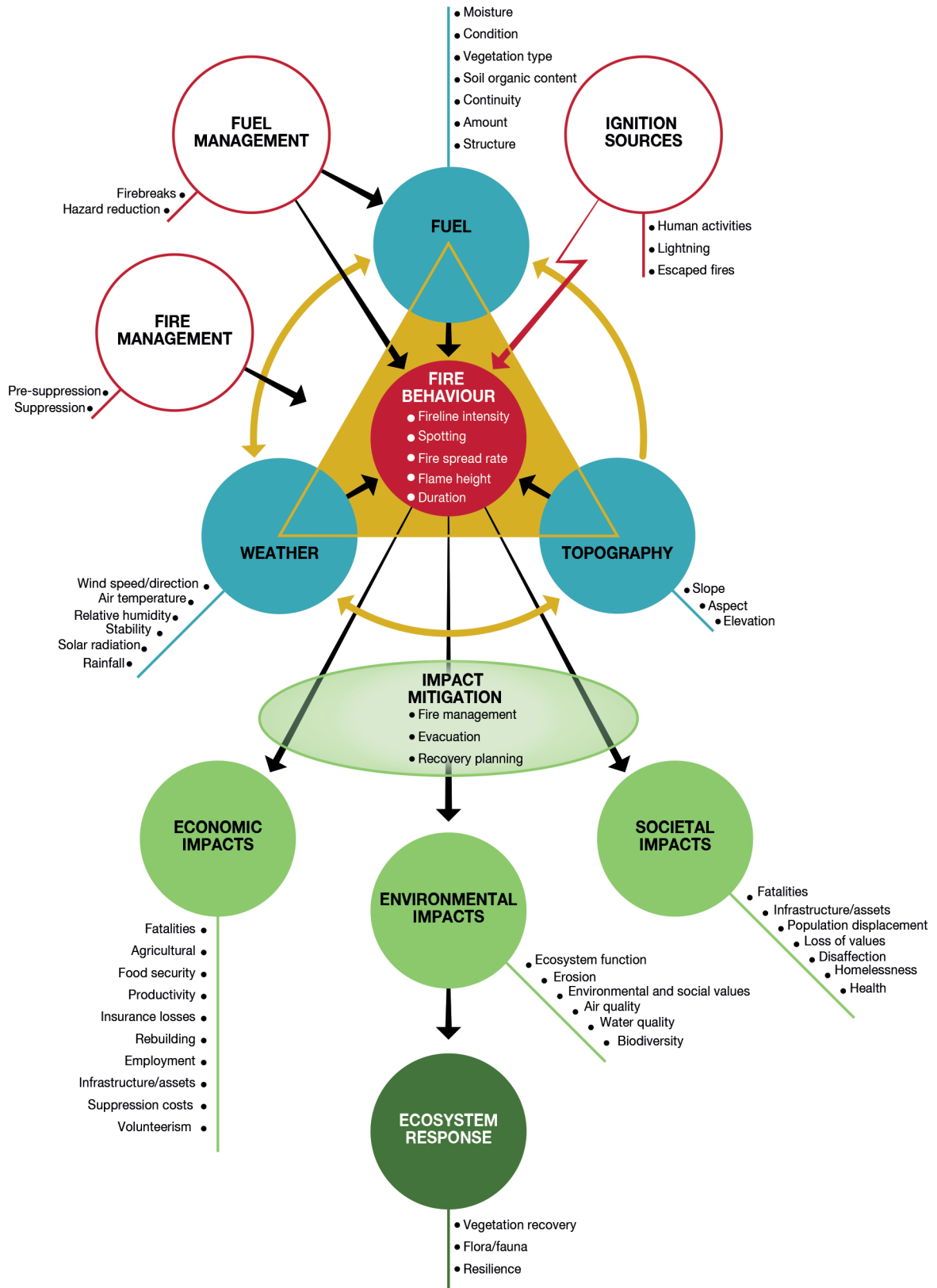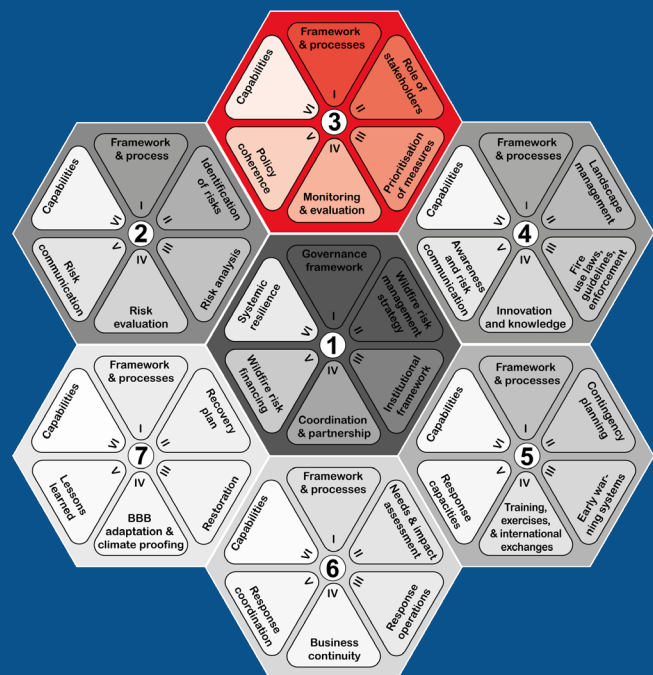

Illustration by Andrew Sullivan/CSIRO, 2021.

GRID-Arendal/Studio Atlantis, 2021

Figure 4: Factors influencing wildfire outcomes and management options (UNEP, 2022).

2.4 | Wildfire risk management planning

KEY MESSAGES

- Effective wildfire risk management plans should be **evidence-based** and built on the results of risk assessments conducted at different territorial levels. Clear **objectives and expected outcomes** should be stated and communicated at the beginning of the planning process.

- **Climate, environmental, and socio-economic changes,** as well as expected future modification in fire behaviour regimes, are critical elements in developing long-term wildfire risk management plans. Solutions that are adaptable to take into account climatic developments over time should be favoured, and maladaptation should be avoided. The development of innovative risk management plans should be supported by **new technologies and reliable models** that anticipate these changes.

- Successful, shared decision-making processes for wildfire risk management require a **multi-level approach** ranging from national agencies to firefighting teams in the field. Both **top-down** and **bottom-up** processes should underpin the development and implementation of wildfire risk management plans. Top-down guidelines should be informed by bottom-up reporting, and intermediate government levels should adapt national guidelines to their specific contexts.

2.4.1 - Legislative framework and processes

- A legislative framework underpinning wildfire risk management planning should exist at the national and/or sub-national level.

- A wildfire risk management/reduction plan should be in place at the national and/or sub-national level.

- Forestry laws should exist at the national and/or sub-national (including local) level and should be taken into consideration in the wildfire risk management/reduction plans. Forest management interventions, particularly the fire prevention interventions supported through the EU funds or through national funds (State aids) should be designed on the basis of these wildfire risk management/reduction plans.

- Forestry laws and other key sectoral laws, such as urban laws, should consider and include wildfire risk.

- Local wildfire risk management plans for WUI should be in place and follow national technical guidelines.

- Cross-border agreements on wildfire risk management should be in place and taken into consideration in the national and/or sub-national wildfire risk management plan, if relevant.

- A specific standard on implementing risk management planning should be defined and in place.

2.4.2 - Roles of stakeholders

- All key stakeholders having a role in wildfire risk management should participate in developing wildfire risk management/ reduction plans at different territorial levels to ensure horizontal and vertical cooperation.

- The key stakeholders should be fully aware of their roles and responsibilities, which should be clearly defined in the wildfire risk management plans at different territorial levels.

- A stakeholder mapping should be carried out on a regular basis at the national and sub-national level to identify both stakeholders having a role in wildfire risk management and those with the potential of exacerbating the risk if not adequately involved in wildfire risk management planning activities.

- A participatory approach should be in place and all key stakeholders should be actively involved in the drafting of wildfire risk management/reduction plans.

- The private sector and the citizens should be encouraged to participate in wildfire risk management planning.

- An extensive consultation process with relevant stakeholders (public institutions, landowners, the private sector, research and academia, and the civil society) should be in place and taken into account in the drafting process and before final approval of the plans.

- Local knowledge should be considered while drafting the plans.

- Rules and procedures should be in place for information and data sharing among key stakeholders.

- An information/communication flow across different public and private stakeholders and between different levels of administrations should be defined to ensure that key stakeholders are informed of the wildfire risk management planning process and can contribute to it.

2.4.3 - Prioritisation of measures

- Wildfire DRM/DRR measures should be identified at different scales and prioritised, applying a common methodology. Roles, responsibilities and a clear timeline for their implementation should be included in the plans.

- Plans should clearly indicate the time plan for implementing measures and the allocated funding.

- Measures should be prioritised on the basis of specific methodologies/criteria (e.g. Cost-Benefit Analyses, Cost-efficiency, Multi-Criteria Analyses).

- Win-win measures across different sectors and hazards should be identified and prioritised. A common methodology should be in place. Technical documents/guidelines should be available to underpin this process.

- The environmental and climate impact of measures should be taken into account in their prioritisation.

- Structural and non-structural measures for wildfire DRM/DRR should be identified and included in the plans at different territorial levels.

- Specific measures should be planned to protect infrastructures providing vital services, including critical entities and essential services. A list of critical entities should be compiled and regularly reviewed.

- Specific measures should be planned to protect cultural heritage and landscapes from wildfires. An effective coordination and collaboration with responsible authorities, along with specific protocols and standard operating procedures (SOPs), should be in place.

- Measures to protect against low probability-high impacts and simultaneous wildfire events should be identified, prioritised, and included in the plans.

- Climate change mitigation and adaptation considerations should be embedded in decision making, with prioritisation of adaptable solutions where feasible and avoidance of maladaptation. Measures should not adversely affect the adaptation efforts or the level of resilience to physical climate risks of other people, of nature, of cultural heritage, of assets and of other economic activities.

2.4.4 - Monitoring, evaluation and reporting

- A process should be in place to monitor and evaluate on a regular basis the effectiveness of the wildfire risk management plans and measures in place. An iterative process organised into planning cycles should be defined by law.

- Indicators to monitor and evaluate the effectiveness of the measures should be defined and can contribute to global indicators (e.g. Sendai indicators, SDGs).

- Roles and responsibilities in monitoring and evaluating the plans should be clearly defined by law.

- A reporting procedure should be in place at the national and/or sub-national level. Specific tools should be implemented and in place with this aim.

2.4.5 - Policy coherence

- A systematic alignment should exist among key planning documents:
  - » National Climate Adaptation Plan.
  - » National Disaster Risk Management Plan.
  - » National Sustainable Development Plan.
  - » Forest management plans or strategies, at various levels.
  - » National biodiversity, rural development, and nature conservation plan.

- Wildfires should directly influence the drafting of other key plans (see the list above). Procedures to ensures alignment with sectoral plans should be in place.

- Important sectors related to cross-cutting topics (such as tourism and urban planning) should take wildfire risk into account.

2.4.6 - Administrative, financial and technical capacities

- The wildfire risk management system and the key stakeholders involved in risk management planning at different territorial levels (including local) should possess adequate administrative skills.

- The wildfire risk management system and the key stakeholders involved in the risk management planning process at different territorial levels (including local) should be adequately financed. EU/extra EU funding opportunities should be successfully exploited to support the process.

- The wildfire risk management system and the key stakeholders involved in the risk management planning process at different territorial levels (including local) should possess adequate technical skills.

- Sufficient and trained human resources should be available to develop, monitor and evaluate wildfire risk management plans at different territorial levels.

- A strategy to build technical skills on wildfire risk management planning, targeting specific sectors or public servants should be in place. A training programme should be defined and implemented.

- ICT infrastructures to support wildfire risk management planning should be implemented and used at different territorial levels.

Examples of good practices on wildfire risk management planning at the European, national and/or sub-national level

- After the severe rural fires in 2017, a renewed approach to transform wildfire risk management was implemented in **Portugal**. The National Plan for Integrated Rural Fire Management was adopted in 2020, introducing an innovative risk governance model, clarifying the roles of various entities involved in wildfire risk management and identifying strategic objectives and measures to be implemented. The main goals set in the National Plan include the protection of human lives; a reduction in the percentage of fires with a burnt area over 500 ha; and the reduction of the burnt area accumulated in the period 2020-2030 to less than 600,000 ha. With a focus on prevention and with an ambitious vegetation management programme, the Plan promotes greater efficiency and effectiveness of the risk management measures. The Plan is supported by an Action Program, adopted in 2021, which implements its strategic guidelines and specific objectives, identifying 28 programs and 97 projects, for the period up to 2030. The strategic guidelines focus on the implementation of landscape reorganisation and certified forest management; on ensuring correct fuel management; on raising awareness among the population and establishing educational practices; on increasing the efficiency of the system and its results, as well as building the capacity of stakeholders.
- In 2022, the Spanish Government published the Strategic Guidelines for Wildland and Fire Management in **Spain**. The need for this document, approved by the Sectoral Conference of the Environment, was identified in the cross-cutting nature of wildland fires, the enhanced experience and responsibility of public administrations and the unsystematic approach in managing this risk in the country. Currently in Spain, wildfire risk management is addressed in different sectors through different plans: from a forestry approach in forestry plans by Autonomous Community or Municipalities, as well as in local action plans in the sphere of civil protection. The scope of the guidelines is thus to establish a common framework and common principles in wildfire management, along with clarifying the objectives and the roles of the main stakeholders involved in this field, so as to ensure policy coherence in wildfire risk management planning. The document identifies seven priority lines of action: managing the rural geography, reducing the risk of wildland fires, involving other sectoral policies, adapting wildland firefighting organisations to new scenarios, furthering knowledge, fostering the society's participation and incorporating technological improvements in prevention. For each priority objective, concrete actions in support of good wildland fire management are exemplified.

2.5 | Wildfire Prevention
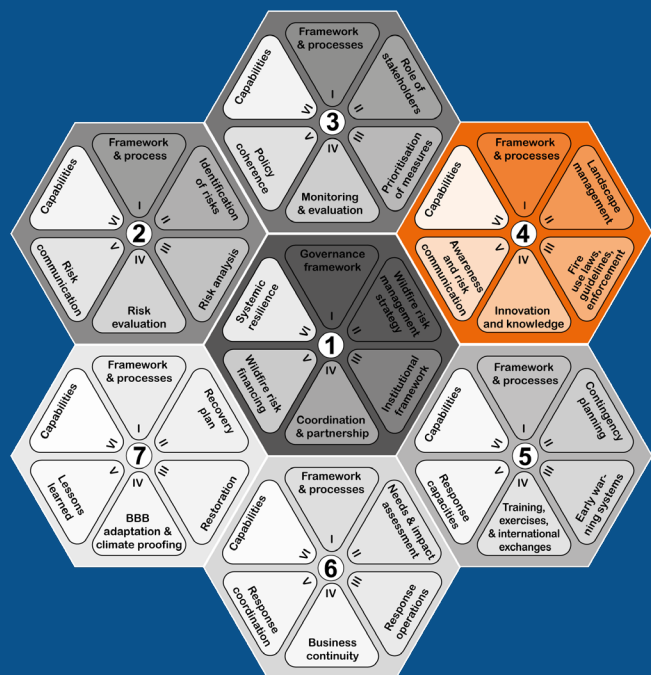
KEY MESSAGES

- The identification and implementation of appropriate prevention measures is dependent on a thorough understanding of the **underlying causes** of wildfires, as well as fire behaviour characteristics. This knowledge, coupled with the evaluation of the trade-offs that exist in forest management, sustainable agriculture, protection of biodiversity, and wildfire risk management, is essential. Effective coordination among key stakeholders and a cross-sectoral approach are also crucial for selecting prevention measures.

- **Long-term modifications** in wildland and vegetation adaptation patterns to climate changes require detailed analyses to ensure an understanding of current and future conditions. Maladaptation should be avoided, and where possible, adaptable solutions should be prioritised. **Adequate site information and reliable models** to anticipate changes in wildfire risk and mapping the suitability of the vegetation to climate change are crucial when selecting prevention measures.

- **Local communities and volunteers** play a significant role in identifying and implementing effective prevention measures tailored to site-specific conditions. The inclusion of **traditional fire knowledge** in prevention activities is highly recommended for effective risk reduction that protects landscapes and cultural values.

Some measures listed below could be prohibited in certain Countries at the national and/or subnational level and/or in certain time periods (e.g. prescribed fires). As for other hazards, *their applicability and effectiveness greatly depend on the specific context.*

2.5.1 - Legislative framework and processes

- Wildfire risk prevention should be addressed in a specific sectoral legislation.

- Guidelines and technical documents dealing with the implementation of wildfire prevention measures should be in place.

- Entities in charge of implementing wildfire risk prevention measures should be clearly identified, along with their roles and responsibilities.

- Procedures to ensure vertical and horizontal cooperation and coordination across national, sub-national, and local level authorities should be in place.

2.5.2 - Landscape management

Fuel management

- A strategy for wildfire landscape management should be promoted at the national and/or sub-national level.

- Strategies and techniques should be promoted for integrating the use of managed fires, management options for restricting the potential spread of fire, and long-term options that include an increase in the rotation and change of tree species.

- A strategy should be promoted for sustainably managing and monitoring fuel cover over time, and for reducing fire hazard/risk and helping to decrease intensity in the event of a large fire under extreme conditions.

- Prescribed fires, physical vegetation removal and chemical treatments as management tools to remove fuels and reduce the rate of spread of wildfires should be encouraged. SOPs and regulations on those tools should be in place.

- Nature Based Solutions, such as traditional grazing, forestry practices and crop mosaic should be encouraged.

- Techniques to break the vertical continuity and the horizontal continuity of fuel should be encouraged.

- Actions to reduce spot fire embers should be in place.

- Replacement of forest species with less fire-prone species should be encouraged, when feasible, to reduce fuel combustibility: use of less flammable species (e.g. deciduous species) and mixing of tree species (managing and planning at the local scale). Communities should be engaged in this process.

- Regional planning of better landscape vegetation pattern (forestry, agriculture), and for adapting to changing bioclimatic conditions and regime of the potential fire frequency and severity (planning for the future landscape) should be encouraged.

- The improvement of slope/mountain forests maintenance strategies by applying traditional and modern techniques should be encouraged.

- Sustainable agriculture and the prevention of land abandonment should be considered key measures for fuel management.

- The community should understand the concept and the importance of fuel management and should be actively engaged in reducing fuel load.

Creation and maintenance of firebreaks

- Systematic creation and maintenance of specific roads and tracks with associated fuel breaks in disaster-prone areas should be in place to break up the continuity of fuels, improve access for firefighters and provide shelter.

- Firebreak construction guidelines should be in place, taking into account land use and nature protection regulations, and

developed through a participatory approach. The multiple benefits of such measures should be considered.

- Fire break construction should be compatible with habitats and protected areas, and capable of enhancing rural development (e.g. trekking/cycling paths).

Land use planning

- Rural development policies and plans, land and forest plans should integrate measures to prevent wildfires.

- Land management and soil use strategies should address wildfire causes and integrate adequate planning and mitigation actions.

- Mosaics of diverse land uses should be used to reduce fuel continuity (inclusion of fire management planning in landscape planning).

- Land-use planning should be considered as a preventive measure and should regulate where to build in the landscape, distance from vegetation, and preservation of open space buffers (zoning), etc.

- Reduction/removal of fuel proximity to human settlements, infrastructures and high-value areas through clearing of vegetation around buildings and human infrastructures should be encouraged (e.g clean-up of fuels along roadsides to confine any fire that may be ignited to an isolated area).

- The construction of artificial water bodies should be recommended in highly wildfire prone areas, when feasible.

2.5.3 - Fire use laws, guidelines, and enforcement

- Building regulations/construction codes and guidelines (fire-resilient materials and design, smoke infiltration and water supply protection, backup energy, etc.) should be in place and effectively enforced.

- A programme/initiative to increase home ignition resistance should be implemented at different territorial levels.

- Legal obligation/guidelines for homeowners to maintain a standard defensible area around their homes should be in place in specific contexts of fire prone areas (to make these properties much easier to defend, while also protecting the surrounding fuels from accidental fires).

- The removal of ignitable fuel in limited zones to keep the area clear of fuels should be prescribed in specific contexts, especially around receptors that could themselves represent

a risk driver (such as private properties, critical entities, power stations and wind turbines).

- Along with the establishment of defensible spaces around structures and high-value assets, percolation plans aiming to reduce the potential impact of wildfires by removing fuel patches or increasing soil moisture should be recommended and implemented in order to reduce the risk of ignition and slow the spread of the fire.

- Regulations of individual prescribed fires and outdoor activities to prevent accidental fires should be in place and effectively enforced.

- An official forest fire season should be defined (if deemed appropriate according to the specific context).

- Activity restrictions, planning controls, alternatives for fire use should be defined and enforced. These measures should be linked to the forest fire season and/or the daily fire danger.

- Regulations to prevent accidental fires should be in place and effectively enforced.

2.5.4 - Innovation and knowledge services

- Innovation, knowledge, and climate services should be promoted at the national and/or sub-national level as tools to support wildfire prevention.

- The Copernicus programme should be made familiar to key stakeholders, and its tools/services should be used on a regular basis to support wildfire prevention activities (e.g., to support the assessment of fuel management needs and identify priority areas for interventions). Arrangements should be in place for using Copernicus products and activating Copernicus EMS for wildfire prevention activities.

- A climate service observatory should be set up to check for wildfires, and the services should be systematically evaluated for the benefits they provide to public and private users.

- Reliable models (tested at field-scale in real conditions) to anticipate changes in fire risk and to adapt measures and policies and develop innovative legislation in fire-prone regions should be operational.

- Fire behaviour and ecosystem behaviour models and tools should be in use.

- New tools for and approaches to wildfire risk management (e.g. remote sensing, satellites, drones, ground-based radar, new generation sensors, AI-based technologies, data processing) should be developed and used, and a validation process should be in place.

- The Risk Data Hub platform should be used, if needed and feasible (e.g. to support risk assessments).

2.5.5 - Awareness and risk communication

- A single competent authority should be in charge of risk communication.

- Detailed information about the causes of wildfires should be collected and shared with the aim of reducing risk through education and knowledge and raising fire consciousness among policy makers and the population.

- Targeted awareness campaigns to prepare communities for a wildfire event should be implemented at different territorial levels (national, sub-national, and local) through specific protocols and different channels.

- Awareness campaigns should be tailored to different target audiences (e.g. citizens, tourists, the disabled).

- Different topics related to wildfire risk should be addressed in awareness/communication campaigns (e.g. causes of fires, appropriate behaviour, role of forests and related fire risk). Integrated wildfire risk management should be addressed as a topic of paramount importance.

- Education on safety and health impacts due to smoke and emissions from fires (short-term and longer term) should be implemented. Awareness campaigns should be organised for

citizens with pre-existing health conditions, those operating in wildfire emergency response, and firefighters.

- Training programmes and rural campaigns for prescribed burning should be implemented on a regular basis.

- Campaigns and training programmes should be organized on a regular basis to improve communication between populations and rescue services. In addition, training programmes to educate the population on evacuation procedures and/or "stay-in-shelter" practices should be implemented on a regular basis.

- The public should be involved in different wildland-related projects to strengthen the awareness of the importance of wildland for people's life, especially in WUI areas.

- Campaigns should be in place to increase the awareness of decision-makers and the media about the complexity of fire risk and to avoid oversimplified messaging to the population.

- A new culture related to wildfires should be promoted in local communities, linked to such cultures of the past, aimed at heightening awareness of fire regimes.

- Education programmes on risk awareness should be implemented and wildfire risk awareness topic should be included in school curricula.

- A process of co-creating wildfire risk knowledge with the population should be promoted. Action should be taken against misinformation.

Examples of good practices in raising awareness activities for wildfire risk at the European, national and/or sub-national level

- The campaign Be Summer Ready is an initiative of the Government of **Ireland** to provide information to the general public on issues that may affect them during the summer. Among them, a dedicated section on wildfire is included, with information on the risks, as well as prevention and behavioural measures that can be taken to prevent them. The campaign information is accessible online and in a booklet. Additionally, the Department of Agriculture, Food and the Marine made available a document on fire management to inform the general public on wildfire prevention, which includes a practice code on prescribed burning.
- The **Italian** Civil Protection Department organises, in collaboration with the Regions and national and local voluntary associations, summer school camps *Anch'io sono la protezione civile* for young people between 10 and 16 years of age. The camps' objectives are to encourage the protection of forests and natural heritage sites, contribute to risk prevention, promote awareness of the tasks of the Civil Protection National Service, and make the youngest aware of the importance of the civil protection plans. In addition, the information awareness campaign Io non rischio will also soon be available for wildfire risks.
- As part of the research GOLIAT (Group of Tools for Fire Fighting and Land Use Planning) project, a large number of awareness-raising initiatives on the vegetation fire problem in **Corsica, France,** have been carried out for school children and public and local authorities. Some of these actions have included intervention and dedicated projects in schools, production of audio podcasts and radio broadcasts, drawing contests for primary and secondary schools, the provision of educational kits to teachers and students, permanent exhibits on wildfires, distribution of leaflets and calendars, organization of thematic events, newsletters to communities, town halls and associations.
- Following the devasting fires in 2017, the Safe Village, Safe People Programme has been established by the central government of **Portugal** via its Civil Protection Authority, and implemented with the support of municipal and civil parish councils. Among the project's goals are awareness-raising actions regarding dangerous behaviours and self-protection measures and the implementation of evacuation drills. Since 2018, almost 30 000 citizens have been involved in about 800 awareness actions.
- **Catalonia, Spain,** implements an awareness campaign directed to farmers on the importance of taking the necessary measures to avoid forest fires during grain harvests.

- Wildfire risk management responsible authorities should collaborate to raise awareness and build trust and consensus among the general public.

- Training courses should be implemented for the media, given their role in communication during emergencies.

2.5.6 - Administrative, financial and technical capacities

- The wildfire risk management system and the key stakeholders involved in implementing wildfire prevention measures at different territorial levels (including local ones) should possess adequate administrative skills.

- The wildfire risk management system and the key stakeholders involved in implementing wildfire prevention measures at different territorial levels (including local ones) should be adequately financed. EU/extra EU funding opportunities should be successfully exploited to support the process.

- The wildfire risk management system and the key stakeholders involved in implementing wildfire prevention measures at different territorial levels (including local ones)

should possess adequate technical skills.

- Sufficient, well-trained human resources should be available to implement wildfire prevention measures at different territorial levels.

- A strategy should be in place to perfect technical skills for implementing wildfire prevention measures, targeting specific sectors or public servants. A training programme should be defined and implemented.

- ICT infrastructures to support wildfire prevention measures should be implemented for use at different territorial levels.

Examples of good practices in wildfire prevention actions/measures at the European, national and/or sub-national level

- In **France**, the legislation on wildfire prevention provides rules for *débroussaillage or legal clearing of woodland undergrowth* (LCRs) in title III, book I of its forestry code. The LCRs consist in most cases of clearing undergrowth on private land located less than 200 m from woods or forests, as well as a 20 m strip on both road shoulders open to vehicular traffic and railway tracks. In most cases, these obligations are the responsibility of private owners or the managers of infrastructures. Mayors, under their policing powers, must ensure that obligations are respected on their territory and can impose fines if rules are ignored. In addition, mayors in the departments concerned are advised to draw up a communal plan to prioritise the areas to be cleared of undergrowth and indicate that communes can provide for collective undergrowth clearance, carried out by municipal services and 're-invoiced' to owners. Four years ago, 32 provinces were subject to LCRs, number which today have increased to 46, in the aftermath of the increased risk of wildfire.
- In **Corsica**, **France,** fuelbreaks called ZAL (Zone d'Appui à la Lutte) are used for fire prevention. ZALs have been set at a width of 100m, based on the technical judgment of experts. To date, Corsica has been equipped with 2150 ha of ZAL, created under the supervision of municipalities or communities of municipalities, in partnership with prevention and control services, and maintained by the Community of Corsica.
- The **Italian** Framework Law on forest fires L.353/2000 sets responsibilities for wildfire prevention and establishes the ignition of forest fires as a criminal activity, punishable by incarceration. Among its other provisions, the national law prohibits the construction of any civil settlement building or infrastructure on woodlands and pastures where a fire has taken place in the previous ten years.
- In **Catalonia**, **Spain,** the Fire Type Concept is used for strategic wildfire prevention. A handbook, the result of an ongoing cooperative effort between the Forest and Fire Service and stakeholders encourages the implementation of this concept in the form of strategic wildfire management areas (strategic points where fuels are reduced to support suppression operations in case of wildfires).

2.6 | Wildfire Preparedness
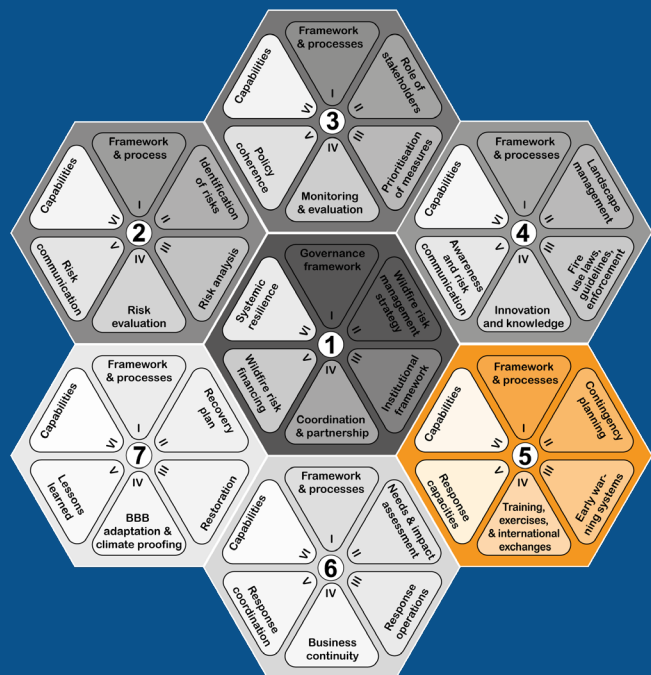
KEY MESSAGES

- Prevention and preparedness are both of paramount importance as **ex-ante activities** for reducing wildfire impacts. In addition to developing wildfire risk management plans, other sectoral plans and frameworks, such as urban plans and regulations, should consider and integrate preparedness measures, requirements and operational needs.

- Risk management systems and tools should be **reinforced and adapted** to deal with extreme wildfire events that have the potential to cause severe impacts on human health, the environment, assets, cultural heritage and landscapes, and economic activities.

- Countries with limited experience should benefit from exchanging with more experienced ones. Recent prepositioning of teams across the EU (e.g., Greece 2022) has proven very successful in **exchanging knowledge** on different operational scenarios and good practices.

- To ensure proper preparation for wildfire events, firefighters should be provided with sufficient and appropriate **equipment and tools** for their safety.

- **Local communities, civil society and traditional knowledge** can play a pivotal role in increasing coping capacity, and therefore their engagement should be supported and facilitated.

2.6.1 - Legislative framework and processes

- Wildfire risk preparedness should be addressed in a specific sectoral legislation.

- Guidelines and technical documents dealing with the implementation of risk preparedness measures should be in place.

- Entities in charge of implementing measures for wildfire risk preparedness should be clearly identified, along with their roles and responsibilities.

- Procedures for ensuring vertical and horizontal cooperation and coordination across national, sub-national, and local level authorities should be in place.

2.6.2 - Contingency planning

- Regulations and guidelines dealing with the development and implementation of contingency plans at different territorial levels (national, sub-national, and local) should exist and be effectively enforced. Wildfire contingency plans should be regularly revised and, if necessary, updated after major wildfire emergencies. Procedures and/or guidelines dealing with methods to review, update and evaluate contingency plans should be in place.

- The representative in charge of the civil protection contingency plan (in many cases belonging to the local administration) should have a clear understanding of their roles and responsibilities.

- Specific contingency plans for WUI, and strategic sites and sectors should be drafted. Guidelines on how to draft them should be in place.

- Wildfire contingency plans should be aligned with risk assessments, land use plans and forest management plans.

- Wildfire contingency plans should include single and/or multi-risk scenario(s), response procedures, and communication flow. Risk scenarios should be defined on the basis of both historical events and future projections. Specific procedures for safeguarding wildland fauna and cultural heritage sites and landscapes should be included in the plans. In addition,

agreements with water companies (public/private) should be in place and SOPs should be part of the plans.

- Wildfire contingency plans should be linked to the wildfire early warning systems (EWSs) and should include activation procedures linked, among others, to warnings/alerts and information from patrol teams.

- All key stakeholders should be involved in the designing of contingency plans, including local communities and academia. A consultation process should be in place in the drafting stage.

- Wildfire contingency plans should be publicly available, and the population and key institutions should be well-informed of them. Communication and dissemination activities should be promoted.

- Wildfire contingency plans at the national level should set procedures for UCPM activation or other forms of international mutual assistance (existence of thresholds and decision-making processes for moving the responsibility upwards, including up to UCPM activation).

- Evacuation, stay and defend, and/or shelter-in-place procedures should be clearly defined in wildfire contingency plans, and the population should be well-informed of them.

2.6.3 - Early warning systems

- An EWS for wildfires should be operational at the national and/or sub-national level and should cover detection, monitoring, and forecasting phases.

- Laws, regulations, and guidelines dealing with wildfire EWSs should be in place.

- EFFIS and Copernicus EMS should be integrated in the process.

- A Fire danger rating system should be defined and used to support the drafting of warning/alert messages.

- Reliable models for forecasting activities should be in use and forecast messages should be clear, understandable, and disseminated in a timely fashion.

- New generation sensors and different types of technologies should be used for the monitoring phase. Coverage of the territory should be adequate.

- Data/information from patrolling should be integrated into the EWS. In addition, citizens should be able to report wildfire events in real time (e.g., using social media apps).

- The wildfire EWS should be linked to the hydro-meteorological service. Weather monitoring and forecasting should be integrated into the wildfire EWS. Impact-based EWS are encouraged.

- Early warning communication systems should be defined by using an inclusive, community-based approach. Specific social-cultural needs and the needs of the most fragile groups should be addressed.

- Early warning data and information should be shared with key stakeholders across different sectors.

- Warnings/alerts should be disseminated through different channels to reach the "last mile" in a timely fashion (e.g. app, sms, cell-broadcasting, websites, mails, social media).

- A cell-broadcasting system, if in place, should be used and be well calibrated for wildfire events. The population should also be well-informed of them.

- In case of cross-border wildfire events, information/data/warnings/alerts should be shared with the neighbouring country or countries.

2.6.4 - Training, exercises, and international exchanges

Training

- National curricula should exist for different types of training focused on wildfire management.

- Different institutions/teams should participate in joint training to enhance interoperability and cooperation (e.g. armed forces, civil protection, fire brigades, forest services, forest owners, volunteers).

- The private sector, in particular owners and operators of infrastructures or systems that provide essential services should be trained and participate in joint training programmes.

- New tools, such as virtual reality simulations, should be used to train operational staff.

- Theoretical and practical training of firefighters on the use of fuel breaks during forest fires should be in place to optimize the actions of firefighters on the ground.

- Wildfire experts and teams/modules should participate in the UCPM training programme.

Exercises

- A comprehensive exercise program on wildfire risk should be in place. Exercises should be implemented at different scales: international, cross-border, national, regional, and local. Interoperability of training standards should be guaranteed.

- The exercises should be based on risk scenarios, including real ones related to recent fires. Interoperability of teams should be tested and evaluated during the exercises.

- Different types of exercises should be organised on a regular basis: full-scale (FSX), table-top (TTX), command-post (CPX).

- Exercises should involve key stakeholders/institutions having a role in wildfire risk management at different territorial scales. Coordination and collaboration among different institutions/agencies should be tested and evaluated during exercises.

- Population, community volunteers and civil society organisations, as well as the private sector (in particular owners and operators of infrastructures or systems that provide essential services), should be involved in exercises.

- A debriefing phase (lessons learned process) should be conducted on a regular basis after exercises.

- Personnel and teams/modules should participate in UCPM exercises (e.g. EU ModEx).

Exchange programmes

- Exchange programmes among local authorities/communities and among different organisations/institutions (such as forestry agencies and firefighters) should be implemented on a regular basis.

- Firefighting/rescue teams should be encouraged to participate in exchange for initiatives by experts at the national, sub-national and international level. The UCPM exchange for experts programme should be publicized and exploited for international exchanges focused on wildfire risk.

2.6.5 - Response capacities

- Adequate firefighting aerial and terrestrial means and teams should be continuously available at different territorial levels. They should be well distributed over the territory, especially during the wildfire season, and able to reach the most vulnerable areas in a timely manner. Urban and wildland wildfire fighting capacities should be implemented.

- An adequate number of trained volunteers should be available to carry out and/or support firefighting activities.

- A sufficient pool of firefighters should be available for wildfire response activities.

- Good coordination and collaboration between rescue teams and the private sector (in particular owners and operators of essential services) should be in place.

- Adequate equipment should be available for firefighting/rescue teams, in particular in relation to Personal Protecting Equipment (PPE) and safety equipment in vehicles.

- Maps of water bodies for terrestrial and aerial firefighting activities should be available along with approach maps identifying the types of aircraft to be used on the specific water body. During wildfire season mobile water tanks should be dislocated in strategic points near vulnerable/disaster prone areas.

- Initiatives to adapt response capacities to new/future climate/environmental conditions should be planned and/or ongoing (e.g. initiatives to deal with increasing water scarcity).

- UCPM modules for wildfire operations should be implemented, if appropriate (such as GFFF, GFFF-V, HCP).

- Seasonal fire risk assessments, based on seasonal and mid-term meteorological forecasts should be used at the operational level to support the assessment of response capabilities needed before the fire season begins.

- Response capacities should be planned and be available to manage the potential cascading effects of wildfires (such as pollution).

2.6.6 - Administrative, financial and technical capacities

- The wildfire risk management system and the key stakeholders involved in implementing wildfire preparedness measures at different territorial levels (including local) should possess adequate administrative skills.

- The wildfire risk management system and the key stakeholders involved in implementing wildfire preparedness measures at different territorial levels (including local) should be adequately financed. EU/extra EU funding opportunities should be successfully exploited to support the process.

- The wildfire risk management system and the key stakeholders involved in in implementing wildfire preparedness measures at different territorial levels (including local) should possess adequate adequate technical skills.

- Sufficient well-trained human resources should be available to implement wildfire preparedness measures at different territorial levels.

- A strategy should be in place to enhance the technical skills of specific sectors or public servants in implementing wildfire preparedness measures. A training programme should be defined and implemented.

- ICT infrastructures to support the implementation of wildfire preparedness measures should be put in place and used at different territorial levels.

Examples of good practices in wildfire preparedness actions/measures at the European, national and/or sub-national level

- rescEU has established a new European reserve of resources (the '**rescEU** reserve'). It includes notably a fleet of firefighting planes and helicopters, in addition to medical evacuation planes, and a stockpile of medical items and field hospitals. The rescEU reserve also includes mobile shelters for those displaced. rescEU is 100% EU-financed, including costs for purchase, operation and maintenance.

- Since 2003, **Croatia** has used video surveillance to prevent forest fires. The initiative was launched and developed over the years through an EU scientific research project called HOLISTIC. The system now counts dozens of cameras set up in strategic locations, which automatically detect smoke and fires within a radius of 10 km. The cameras are connected to two operational centres in Zagreb and Split, which through image processing systems and fire propagation prediction software, enable the coordination centre to quickly organize, disperse troops and geo-reference fires.

- In **Catalonia**, **Spain**, the Alpha Plan is an operating procedure established by the Corps of Rural Agents to define the actions of fire surveillance and prevention personnel, in the face of forest fire danger situations that may occur. This is connected to the regional emergency plan for wildfires (INFOCAT), which establishes the regulation of risk activities according to the level of wildfire risk that is updated on a daily basis in the Alpha Map. Information is proactively disseminated through different channels, even by SMS to local civil protection officers in case of high risk.

- During the summer period, the **Italian** National Civil Protection Department (ICDP) encourages the implementation of twinnings between regions to fight forest fires more effectively. This measure would ensure the widest availability of resources to extinguish forest fires, as, for example, regions in northern Italy being ready to support the southern regions, which face a greater risk of wildfires. In addition, during the summer of 2022 a specific steering committee made up of ICPD, fire brigades, Carabinieri Forestali and regional delegations was established to support such inter-regional twinning activities. It is also responsible for coordinating the wildfire campaign, for maximising the effects of fire patrolling through the coordination of resources, and for preventing a range of other related issues. The Prime Minister annually signs operational recommendations declaring the period of the wildfire campaign and providing general instructions for all the entities -at the national and the local level- involved in wildfire management. In advance of the summer season, the ICPD organises an annual plenary meeting with all the public stakeholders involved in wildfire management (various ministries, fire brigades, Carabinieri, national government air fleet operators, Regions, national association of municipalities, and volunteer representation) for the purpose of sharing information about the system readiness, best practices, and discussing the main challenges in wildfire management.

- In **Portugal**, the rural fire risk index, computed by the Meteorological Service of Portugal and based on weather forecasts and information on the vegetation, is used as an early warning system at the district and municipal level. In addition, the national network of watch towers (managed by the National Guard) and integrated forest video surveillance systems is efficient and allows for early detection of rural fires.

- **Ireland** provides fire warnings and operates a fire Danger Rating as part of its forest fire awareness system, operated jointly by the Department of Agriculture, food and the Marine and Met Eireann, the national Weather Service. Warnings are issued with a classification of wildfire risk.

- **Slovenia** has developed an automated daily forest fire-risk forecast system using the Canadian Meteorological Fire Hazard Indicator and different meteorological models to provide fire hazard forecasts three days in advance. The system has a free web application that can be used by different stakeholders to assess fire risk and support fire management and planning during a fire.

- **Spain** has set up a Forest Fire-fighting Assessment and Advisory team (FAST) module within the UCPM, a national and self-sufficient assessment and advisory capacity supporting the requesting country on a range of aspects related to prevention and preparedness on wildfires. The number of experts and areas of expertise is decided on the basis of the request, with the purpose of supporting the affected country. FAST's support can come usefully into play in evaluating forest fire risk assessment and awareness campaigns; in assessing training systems for forest firefighters on the basis of competences and different roles within the country's emergency management system; in providing expertise in managing areas at the wildland-urban interface; in collecting data and recommendations for developing forest fire databases and information systems; and any other issues related to prevention and preparedness in dealing with forest fires.

2.7 | Response
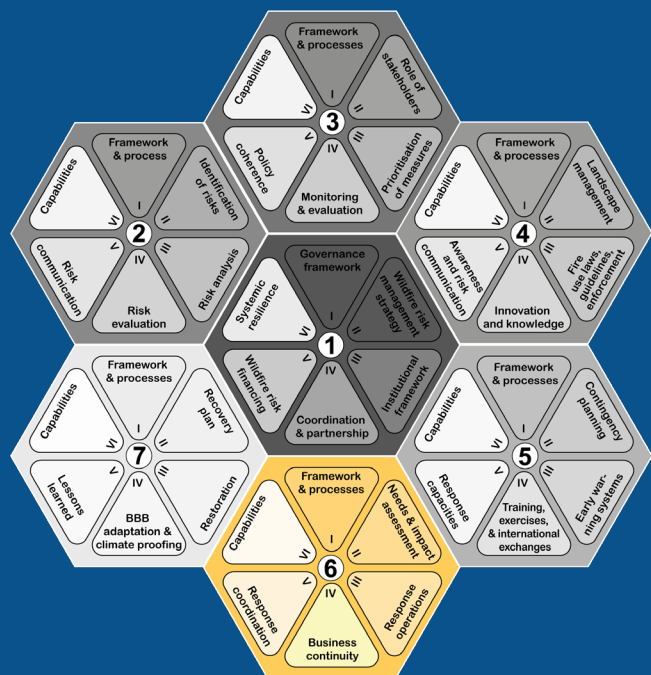
KEY MESSAGES

- **Timely, gradual and adequate** response operations can effectively reduce the potential adverse impacts of wildfires. However, the initial attack is of paramount importance in dealing with severe and large-scale events.

- Good vertical and horizontal **coordination** of response activities, along with a clear definition of roles and responsibilities, are key factors for effective and efficient response operations.

- A **well-defined command and control chain and communication flow**, known to all key actors involved in response activities, are necessary at different territorial levels.

- **Decision support systems, data, and tools** are crucial for informing and guiding response operations to take timely and appropriate actions. The ongoing **collection** of wildfire data during the response phase is essential to guarantee a better understanding of the evolving risk and adapt risk management systems to new scenarios.

2.7.1 - Legislative framework and processes

- Wildfire response operations approach and procedures should be addressed in specific legislations/guidelines.

- Guidelines and technical documents should be in place to deal with response operation procedures, communication flow, and the command-and-control chain.

- Entities in charge of the implementation of wildfire emergency response operations should be clearly identified, along with their roles and responsibilities.

- Procedures should be in place to ensure vertical and horizontal cooperation and coordination on the field across national, sub-national, and local level authorities.

- Multi-lateral and bilateral cross-border assistance agreements should be in place, if appropriate.

- Decision-making processes and procedures for upscaling the response coordination and management responsibility, including up to UCPM activation, should be in place.

2.7.2 - Needs and impact assessment

- Procedures should be in place to conduct needs and impact assessments during a wildfire event.

- The SOPs focused on needs and impact assessment should be regularly updated and an evaluation process should be in place.

- Entities in charge of conducting needs assessment should be identified, and their roles and responsibilities should be

clearly defined by law.

- Training for conducting targeted needs assessment in the aftermath of a wildfire event should be implemented on a regular basis at different territorial levels. A list of trained experts should be available.

- Needs assessment procedures focused on ecosystem, wildlife and livestock, and cultural heritage should be in place.

2.7.3 - Response operations

- Evacuation procedures, including logistical support, and/or shelter-in-place procedures for the population should be in place, and the operations should be well coordinated across different sectors and territorial levels.

- Evacuation procedures for livestock and wildlife should be in place, and the operations should be well coordinated across different sectors and territorial levels.

- Suppression operations should be safe, adequate (ensuring a rapid initial attack), appropriate (ensuring a right resource mix), and effective (maximising containment and control).

- Adequate aerial and terrestrial means should be gradually activated to ensure effective containment and suppression operations.

- Containment and suppression operations should be supported by the hydro-meteorological service (providing updates and short-/medium-term weather forecasts).

- New generation sensors and technologies should be in use during containment and suppression operations to ensure effectiveness of the response activities and team safety.

- Decision support systems and tools (shared at different territorial levels) should be used to guide containment and suppression operations. The command-and-control chain should take into account the evolution of a fire.

- During containment and rescue operations, teams should be adequately provided with sufficient PPE.

- Containment and suppression techniques should be tailored to the specific context.

- New tools using social media should be used and validated to detect/monitor wildfires and to support response operations (when feasible).

- Decision support tools should be operational, and access should be guaranteed at different territorial levels.

2.7.4 - Business continuity

- Procedures and measures should be in place to restore the operation of essential services and continuity of business operations.

- Procedures and measures should be in place to protect and restore in a timely manner infrastructures or systems that provide essential services.

2.7.5 - Response coordination

- The overall coordination of response operations should be adequate and efficient. The political level should be fully engaged to facilitate coordination and trust in the population.

- Coordination and cooperation should be ensured at different territorial levels and across different entities and sectors, for an effective response action.

- Armed forces, civil protection, fire brigades, forest services, volunteers, local authorities, police, and farmers should cooperate efficiently during wildfire emergencies. Clear and agreed operational responsibilities and procedures should be in place.

- The private sector (especially owners and operators of infrastructures or systems that provide essential services) and important civil society organisations should be involved in response activities and informed on situation updates.

- Procedures should be in place to activate (and scale up) the level needed for response operations (from local to sub-national to national and international).

- An efficient communication flow should be ensured during response activities across different territorial levels and different sectors, including the population.

- A command-and-control chain/management and operational command methodology (hierarchical or mission-oriented structure) should be in place and made familiar to key entities involved in response activities.

- New technologies and decision support tools should be used in coordinating response activities.

- Host Nation Support procedures should be in place and effectively implemented.

- Procedures should be in place to manage cascading effects (such as pollution and related procedures to deal with the contamination of surface water) and an effective coordination among responsible authorities to deal with them.

2.7.6 - Administrative, financial and technical capacities

- The wildfire risk management system and the key stakeholders involved in response operations at different territorial levels (including local) should possess adequate administrative skills.

- The wildfire risk management system and the key stakeholders involved in response operations at different territorial levels (including local) should be adequately financed. EU/extra EU funding opportunities should be successfully exploited to support the process.

- The wildfire risk management system and the key stakeholders involved in in response operations at different territorial levels (including local) should possess adequate technical skills.

- Sufficient, well-trained human resources for response operations should be available at different territorial levels.

- A strategy should be in place to build technical skills on response operations, targeting specific sectors or public servants. A training programme should be defined and implemented.

- ICT infrastructures to support response operations should be implemented and used at different territorial levels.

Examples of good practices in wildfire response actions/measures at the European, national and/or sub-national level

- In **Türkiye**, effective wildfire early response is evidenced by the diminished average time from detection to intervention, from 40 minutes in 2003 to 14 in 2018. These results are to be attributed to sufficient rescue capacity of 42 helicopters available for the initial attack, and to an effective fire protection network, besides extensive road networks, and the use of fuel breaks, water impoundments and silvicultural practices in much of the country.
- A specific mutual assistance agreement in case of forest fires in border areas is in place between **Spain** and **Portugal** (additional protocol signed on November 8, 2003). The agreement allows operational teams of these two countries to act in unison within 15km from the border of each before a formal request of assistance is issued, in order to prevent fires from spreading across borders.

2.8 | Recovery and lessons learned
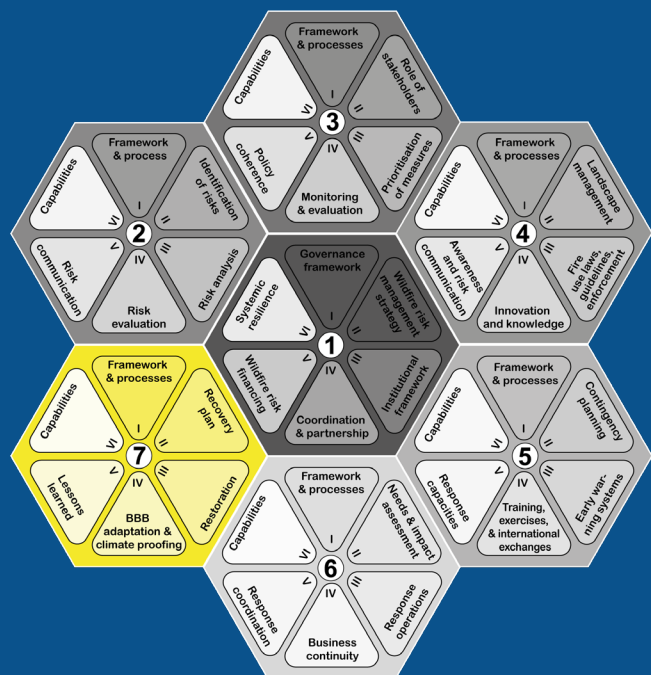
KEY MESSAGES

- The principles of "**Building back better**" and "**Building back more resilient landscapes**" should guide actions to increase resilience against future wildfire events, not only in the affected areas but also in other vulnerable regions. **Traditional fire knowledge** and practices should be integrated into recovery and restoration plans to inform effective solutions.

- Post-wildfire rehabilitation plans should include **landscape and ecosystem conservation and restoration actions.** These plans should be pre-established and implemented immediately after the disaster, as well as during the fire response efforts, if necessary and feasible.

- A crucial step in the aftermath of a wildfire is to conduct systematic assessments of **damages and losses** to evaluate impacts on affected populations, ecosystem services, assets, and economies. These assessments can help build knowledge, inform stakeholders, identify potential multi-risk cascading effects, and support risk management actions.

- To identify good practices and weaknesses to overcome, it is necessary to collect, in a systematic manner, **lessons learned** from various territorial levels. An appointed authority should manage the process, and key outcomes should be communicated among key actors involved in wildfire risk management.

- Governments and communities should actively **learn from each other's experiences** by sharing data, information and analyses to improve wildfire risk management. **Scientific knowledge production** should be incorporated into the lessons learned process to enhance the effectiveness of wildfire risk management strategies.

2.8.1 - Legislative framework and processes

- Post-disaster recovery and reconstruction regulations should be in place.

- A holistic multi-risk approach should be considered in post-disaster recovery and reconstruction regulations.

- A post-fire forensic investigation (on triggering causes) should be in place and regulated by law.

- Regulations on post-wildfire data collection should be in place. Post-fire data should be collected following EU regulations.

- A post-fire forensic investigation system should be in place with the primary purpose of identifying the causes of the fire.

2.8.2 - Recovery plan

- Post-disaster recovery procedures (e.g. community welfare assistance, environmental repair) should be in place at different territorial levels.

- Secondary effects of wildfires should be taken into account (e.g. flash-floods, landslides, water pollution).

- Procedures to establish priority recovery actions and goals should be defined, in particular in relation to critical entities and essential services.

- Recovery strategies and plans should be linked to the post-disaster needs assessment.

- A clear process should be defined and in place for the design, drafting and adoption of the recovery plan.

- A coordination mechanism across sectors and territorial governance levels should be guaranteed in the drafting of recovery plans.

- Procedures should be in place to monitor and evaluate the recovery plan and corrective instruments in place to revise the plan in case of underperformance.

- The human mobility consequences in terms of evacuations, displacement and possible loss of livelihoods should be important parts of the wildfire recovery plan.

2.8.3 - Restoration

- Economic, social, and environmental/ecosystem restoration measures should be defined, along with funds and timing needed for their implementation.

- Post-disaster actions should be in place to support physical and mental health (i.e. psychological assistance) for both rescuers and the population at large. Psychological support and training may focus on improving awareness and preparedness of more vulnerable citizens (e.g. those with pre-existing health conditions and those previously exposed to smoke pollution from fires).

- Long-term recovery assistance plans should be in place for community aid (e.g. finance, emergency housing), environment and fire regime restoration, and cultural heritage restoration.

- Instruments for financial recovery assistance should be available at the national and/or sub-national level, and appropriate insurance schemes should exist to facilitate the recovery (see Chapter 2.2.5).

2.8.4 - Build-back better adaptation and climate proofing

- The Build-Back-Better (BBB) and recover-better principles should be considered, and the application of those principles should contribute to reducing wildfire risk.

- DRR and climate adaptation principles should be taken into account in the reconstruction phase.

- Key stakeholders, including the private sector, academia and the civil society should be cooperatively engaged in the reconstruction phase. Community-based, traditional, and contemporary fire management practices should be considered and included in the reconstruction plans.

- Reconstruction in the aftermath of a fire event should minimise the risk of re-establishing an interface between buildings, human infrastructures and flammable vegetation fuels.

- Activities to support post-fire recovery of vegetation should consider the opportuneness of species changes as an alternative to restoring pre-fire vegetation. This option should complement the species traditionally found in an area with other species better adapted to climate change conditions.

- The opportuneness of planning for a future, less fire-prone landscape should be considered and implemented (e.g. more resilient distribution of vegetation types).

2.8.5 - Lessons learned

- A procedural framework for a review process in the aftermath of major wildfires should be in place to identify good/best practices and areas for systemic improvement. Roles and responsibilities in the lessons learned process should be clearly defined.

- The lessons learned should be identified and taken into account to update the legislative framework, guidelines, SOPs, and wildfire risk management plans.

- A plan should be drafted and formally approved with a timeline and financial needs to implement the recommendations gained through the lessons learned process. Roles and responsibilities should be clearly defined.

- All key stakeholders having a role in wildfire risk management (all stages of DRMC) should be engaged in the lessons learned process.

- Lessons learned from past wildfire events should inform training programmes to improve community preparedness and enable a social learning process.

- An inventory of "bad practices" should be also implemented, along with the one on good practices.

2.8.6 - Administrative, financial and technical capacities

- The wildfire risk management system and the key stakeholders involved in implementing the recovery and lessons learned processes at different territorial levels (including local ones) should possess adequate administrative skills.

- The wildfire risk management system and the key stakeholders involved in implementing the recovery and lessons learned processes at different territorial levels (including local) should be adequately financed. EU/extra EU funding opportunities should be successfully exploited to support the process.

- The insurance regime in place (private, public or public-private) should encourage prevention measures and building back better recovery that take climate change adaptation and proofing into account, as well as just resilience.

- The wildfire risk management system and the key stakeholders involved in in the recovery and lessons learned processes at different territorial levels (including local) should possess adequate technical skills.

- Sufficient, well-trained human resources should be available to implement the recovery and lessons learned processes at different territorial levels.

- A strategy should be in place to build technical skills on wildfire recovery and lessons learned processes, targeting specific sectors or public servants. A training programme should be defined and implemented.

- ICT infrastructures to support the implementation of wildfire recovery and lessons learned processes should be put in place and used at different territorial levels.

Examples of good practices in wildfire response actions/measures at the European, national and/or sub-national level

- Since the 2017 fire season, and following the proposals shared during the debriefing in November 2017, an interinstitutional technical board has been established by the **Italian** Civil Protection Department. The purpose of the technical board is to monitor the forest fire-fighting sector and propose operational solutions for issues that have emerged during the lesson learned process.
- A lessons Learned Process has been applied in **Ireland** in the aftermath of severe 2017 and 2018 fire seasons, and improvements in fire responses, communications and operational readiness have been identified following these processes.

Annexes

Annex 1 - Further readings

The documents listed in this Annex were consulted and provided inspiration while drafting of the Wildfire PRAF, however, no specific references were included in the text.

A. Camia, G. Libertá, and J. San-Miguel-Ayanz, 'Modeling the impacts of climate change on forest fire danger in Europe Sectorial results of the PESETA II Project', Luxembourg, 2017. doi: 10.2760/768481.

A. Ganteaume et al, 'Wildfire Risk Management in Europe: A Comparative Study of Policies and Practices', 2021.

C. del Rocio Montiel-Molina, J. Pablo Argañaraz, M. P. Thompson, A. Dowdy, and L. Purcell, 'Noise, Blazes and Mismatches - Frontiers 2022: Emerging Issues of Environmental Concern', 2022. Available: https://globalforestwatch.org/topics/fires

C. Eberle and O. H. Roa, 'Mediterranean wildfires', 2021.

Commission Delegated Regulation (EU) 2021/2139 of 4 June 2021 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32021R2139.

D. A. Martin, 'Linking fire and the United Nations Sustainable Development Goals', *Science of The Total Environment*, Volume 662, pp. 547-558, 2019. Available: https://doi.org/10.1016/j.scitotenv.2018.12.393

DRMKC, 'Recommendations for National Risk Assessment for Disaster Risk Management in EU', Publications Office of the European Union, Luxembourg, 2019. ISBN 978-92-79-98366-5, doi:10.2760/084707 (online), JRC114650.

DRMKC, 'Recommendations for national risk assessment for disaster risk management in EU: where science and policy meet', Version 1, Publications Office of the European Union, Luxembourg, 2021. ISBN 978-92-76-30256-8, doi:10.2760/80545, JRC123585. EPRS and A. Caprile, 'New EU Forest strategy for 2030', 2022. Available: europarl.europa.eu/thinktank

European Commission, 'EU Biodiversity Strategy for 2030 - Bringing nature back into our lives [COM(2020) 380 final]', 2020. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0380

European Commission, 'European Union Disaster Resilience Goals: Acting together to deal with future emergencies', 2023. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2023%3A61%3AFIN&qid=1675958089171

European Commission, 'Forest Fires - Sparking Firesmart Policies in the EU', 2018. [Online]. Available: https://op.europa.eu/en/publication-detail/-/publication/0b74e77d-f389-11e8-9982-01aa75ed71a1/language-en

European Commission, 'Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change {SEC(2021) 89 final} - {SWD(2021) 25 final} - {SWD(2021) 26 final}', 2021. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:82:FIN

European Commission, 'Guidelines on Biodiversity-Friendly Afforestation, Reforestation and Tree Planting', Commission Staff Working Document SWD(2023) 61 final, 2023. Available: https://ec.europa.eu/transparency/documents-register/detail?ref=SWD(2023)61&lang=en

European Commission, 'New EU Forest Strategy for 2030 {SWD(2021)651final}-{SWD(2021)652final}', 2021.

European Commission, 'Risk Assessment and Mapping Guidelines for Disaster Management', *Commission Staff Working Paper SEC(2010) 1626 final*, European Commission, pp. 1–43, 2010. Available: http://ec.europa.eu/echo/civil_protection/civil/prevention_risk_assessment.htm

European Commission, 'The European Green Deal [COM(2019) 640 final]', 2019.

European Commission, Directorate-General for Environment, Nuijten, D., Onida, M., Lelouvier, R., 'Land-based wildfire prevention: principles and experiences on managing landscapes, forests and woodlands for safety and resilience in Europe', Nuijten, D. (editor), Onida, M. (editor), Lelouvier, R. (editor), Publications Office of the European Union, 2021. Available: https://data.europa.eu/doi/10.2779/695867

European Commission and World Bank, 'Economics for Disaster Prevention and Preparedness - Investment in Disaster Risk Management in Europe Makes Economic Sense (Background Report)', 2021. Available: worldbank.org

European Commission and World Bank, 'Economics for Disaster Prevention and Preparedness - Investment in Disaster Risk Management in Europe Makes Economic Sense (Summary Report)', 2021. Available: worldbank.org
European Parliament, 'European Parliament Resolution of 15 September 2022 on the consequences of drought, fire, and other extreme weather phenomena: increasing the EU's efforts to fight climate change (2022/2829 [RSP])', 2023.

European Parliament and The Council of the European Union, 'Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030', 2022.

European Science & Technology Advisory Group, 'Contribution to the development of the next European Union Forest Strategy – Synthetic statement', UNDRR, Brussels, 2021.

European Science & Technology Advisory Group, 'Evolving Risk of Wildfires in Europe - The changing nature of wildfire risk calls for a shift in policy focus from suppression to prevention', UNDRR, Brussels, 2020.

F. M. Cardoso Castro Rego, J. M. Moreno Rodríguez, V. R. Vallejo Caldaza, and G. Xanthopoulos, 'FOREST FIRES - Sparking firesmart policies in the EU', Brussels, 2018. doi: 10.2777/248004.

H. Costa, D. de Rigo, G. Liberta , T. Houston Durrant, and J. San-Miguel-Ayanz, 'European wildfire danger and vulnerability in a changing climate: towards integrating risk dimensions: JRC PESETA IV project: Task 9 - forest fires.', Luxembourg, 2020.

IBC, 'Wildfires in Latin America: A preliminary analysis, messages and resources for RC/UNCT', 2021.

J. Goldammer, I. Mitsopoulos, G. Mallinis, and M. Woolf, 'Words into Action Guidelines: National Disaster Risk Assessment Hazard Specific Risk Assessment 6. Wildfire Hazard and Risk Assessment', 2017. Available: fire.uni-freiburg.de/media/bulletin_news.htm

J.L. Rossi, D. Morvan, A. Simeoni, T. Marcelli, F.-J. Chatelon, 'Fuelbreaks: a part of wildfire prevention', in *Global Assessment Report of Disaster Risk Reduction*, UNDRR, 2019, Geneva, 2019. Available: undrr.org/publication/fuelbreaks-part-wildfire-prevention.

J. Mysiak, V. Casartelli, and S. Torresan, 'Union Civil Protection Mechanism - Peer Review Programme for disaster risk management: Assessment Framework', 2021.
J. San-Miguel-Ayanz et al., 'Forest Fires in Europe, Middle East and North Africa', Luxembourg, 2021.

Joint Research Centre of the European Commission, 'Forest fires in Portugal in 2017', *Science for Disaster Risk Management 2020: acting today, protecting tomorrow*, Publications Office of the European Union, Luxembourg, 2020. ISBN 978-92-76-18182-8, doi:10.2760/571085, JRC114026

Joint Research Centre of the European Commission, 'Wildfire Risk in the EU: Science for Prevention, Preparedness, and Response', 2018.

JRC, 'Pan-European wildfire risk assessment', Ispra, 2022. doi: 10.2760/437309.

K. A. Porter, C. R. Scawthorn, D. Sandink, and National Research Council Canada, 'An impact analysis for the National Guide for Wildland-Urban Interface Fires', Institute for Catastrophic Loss Reduction, 2021.

M. A. Moritz et al, 'Assessing Wildfire Exposure in the European Union', 2020.

OECD, 'Disaster Risk Assessment and Risk Financing – A G20 / OECD Methodological Framework', 2012.

OECD, 'National Risk Assessments: A Cross Country Perspective', 2018. Available: oecd.org/gov/national-risk-assessments-9789264287532-en.htm

OECD, 'Recommendation on Disaster Risk Financing Strategies', 2017. Available: https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0436

OECD, 'Recommendation on Governance of Critical Risks', 2014. Available: https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0405

OECD, 'Taming Wildfires in the Context of Climate Change', 2023. Available: www.oecd-ilibrary.org/sites/dd00c367-en/index.html?itemId=/content/publication/dd00c367-en

Ş. Altıok, A. Sarkar, and D. Thogmartin, 'The Next Frontier in Fighting Wildfires: FireAId Pilot and Scaling', Geneva, 2023.
UNDRR, 'Words into Action Guidelines: National Disaster Risk Assessment Hazard Specific Risk Assessment 6. Wildfire Hazard and Risk Assessment', 2017. Available: fire.uni-freiburg.de/media/bulletin_news.htm

UNDRR, 'Hazard Definition & Classification Review', Geneva, Switzerland, 2020.

UNEP, 'A rapid response assessment - Spreading like wildfire: The rising threat of extraordinary landscape fires', 2022. [Online]. Available: https://www.unep.org/resources/report/spreading-wildfire-rising-threat-extraordinary-landscape-fires
UNFCCC, 'Paris Agreement', 2015.

Union Civil Protection Mechanism (UCPM), 'Wildfire prevention action plan – Looking for good practices on wildfire risk awareness in Europe', 2022.

Project websites consulted

Firelogue, Cross-sector dialogue for Wildfire Risk Management. Available: https://firelogue.eu/

FIRE-RES, Innovative technologies & socio-ecological-economic solutions for fire resilient territories in Europe. Available: https://fire-res.eu/

FireSmart Project, Nature-based solutions for preventive fire management and sustainable supply of ecosystem services. Available: https://firesmartproject.wordpress.com/

FirEUrisk, Dissecting risk to prevent extreme wildfires. Available: https://fireurisk.eu/

Goliat, Groupement d'Outils pour la Lutte Incendie et l'Aménagement du Territorie. Available: https://goliat.universita.corsica/?lang=en

Silvanus, Integrated Technological and Information Platform for Wildfire Management. Available: https://silvanus-project.eu/

Treeads, A Holistic Fire Management Ecosystem for Prevention, Detection and Restoration of Environmental Disasters. Available: https://treeads-project.eu/

Wildland-Urban-Interface Fire Touristic Infrastructures Protection Solutions –WUITIPS. Available: https://wuitips.org/

Annex 2 - Terminology

The following definitions are included for the sole purpose of providing a common language within this document.

Build Back Better: The use of the recovery, rehabilitation and reconstruction phases after a disaster to increase the resilience of nations and communities through integrating disaster risk reduction measures into the restoration of physical infrastructure and societal systems, and into the revitalization of livelihoods, economies and the environment. (Source: UNDRR, 2017)

Building code: a set of ordinances or regulations and associated standards intended to regulate aspects of the design, construction, materials, alteration and occupancy of structures which are necessary to ensure human safety and welfare, including resistance to collapse and damage. (Source: UNDRR, 2017)

Coping capacity: the ability of people, organizations, and systems, using available skills and resources, to manage adverse conditions, risk or disasters. The capacity to cope requires continuing awareness, resources, and good management, both in normal times as well as during disasters or adverse conditions. Coping capacities contribute to the reduction of disaster risks. (Source: UNDRR, 2017)

Climate change adaptation: the process of adjustment to actual and expected climate change and its impacts. (Source: EC, 2020)

Contingency planning: a management process that analyses disaster risks and establishes arrangements in advance to enable timely, effective and appropriate responses. (Source: UNDRR, 2017) Critical infrastructure: an asset, a facility, equipment, a network or a system, or a part of an asset, a facility, equipment, a network or a system, which is necessary for the provision of an essential service. (EC, 2022)

Disaster loss database: a set of systematically collected records about disaster occurrence, damages, losses and impacts, compliant with the Sendai Framework for Disaster Risk Reduction 2015-2030 monitoring minimum requirements. (Source: UNDRR, 2017)

Disaster risk reduction: aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development. (Source: UNDRR, 2017)

Early Warning System: an integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enables individuals, communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events. (Source: UNDRR, 2017)

Exposure: The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas. (Source: UNDRR, 2017)

Essential service: a service which is crucial for the maintenance of vital societal functions, economic activities, public health and safety, or the environment. (EC, 2022)

Firebreak: man-made areas with a reduced fuel load that act as barriers to stop or slow down fire spread (Rossi, Jean-Louis et al., 2019).

Host nation support: all actions undertaken in the preparedness phase and the disaster response management by a Participating State, receiving or sending assistance, or the Commission, in order to remove as much as possible any foreseeable obstacle to international assistance so as to ensure that disaster response operations proceed smoothly. It also includes the support that Participating States can provide to facilitate international assistance transiting through their territory by land, sea or air. (Source: EC, 2012)

Integrated fire management: the integration of science and wildfire risk management approaches with socio-economic elements at multiple levels for the planning and implementation of a balanced approach to managing fires. This approach places greater emphasis on addressing underlying causes and seeking long-term, sustainable solutions that incorporate five essential elements. (Source: FAO, 2011)

National Platform for Disaster Risk Reduction: a generic term for national mechanisms for coordination and policy guidance on disaster risk reduction that are multisectoral and interdisciplinary in nature, with public, private and civil society participation involving all concerned entities within a country. (Source: UNDRR, 2017)

Nature Based Solutions: Solutions inspired by, supported by or copied from nature" and "simultaneously provide environmental, social and economic benefits and helps to build resilience" by bringing "more and more diverse, nature and natural features and processes into cities, landscapes and seascapes. (Source: EC, 2015)

Preparedness: a state of readiness and capability of human and material means, structures, communities and organisations enabling them to ensure an effective rapid response to a disaster, obtained as a result of action taken in advance. (Source, Decision 1313/2013/EU)

Prevention: any action aimed at reducing risks or mitigating adverse consequences of a disaster for people, the environment and property, including cultural heritage. (Source: Decision 1313/2013/ UE)

Reconstruction: the medium- and long-term rebuilding and sustainable restoration of resilient critical infrastructures, services, housing, facilities and livelihoods required for the full functioning of a community or a society affected by a disaster, aligning with the principles of sustainable development and "build back better", to avoid or reduce future disaster risk. (Source: UNDRR, 2017)

Rehabilitation: the restoration of basic services and facilities for the functioning of a community or a society affected by a disaster. (Source: UNDRR, 2017)

Resilience: the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management. (Source: UNDRR, 2017)

Risk transfer (tool): an approach to risk management that involves the transfer of financial responsibility for some or all of the risk and any costs associated with the materialisation of that risk (e.g. through a financial instrument such as property insurance contract). (Source: OECD, 2017)

Tolerable risk: the extent to which a disaster risk is deemed tolerable depends on existing social, economic, political, cultural, technical and environmental conditions. In engineering terms, acceptable risk is also used to assess and define the structural and non-structural measures that are needed in order to reduce possible harm to people, property, services and systems to a chosen tolerated level, according to codes or "accepted practice" which are based on known probabilities of hazards and other factors. (Source: UNDRR, 2017)

Underlying risk drivers: processes or conditions, often development-related, that influence the level of disaster risk by increasing levels of exposure and vulnerability or reducing capacity. (Source: UNDRR, 2017)

Vulnerability: The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards. (Source: UNDRR, 2017)

Wildfire (UNDRR): any unplanned or uncontrolled fire affecting natural, cultural, industrial, and residential landscapes (UNDRR 2021, adapted from FAO 2010). An unusual or extraordinary free-burning vegetation fire that poses significant risk to social, economic, or environmental values. It may be started maliciously, accidently, or through natural means (UNEP, 2022).

Wildland Urban Interface: the communities located within or adjacent to areas that could be affected by wildfires potentially posing a threat to life and property (Forest Service, USDA, 2019).

Annex 3 - Acronym table

BBB: Build Back Better

CCA: Climate Change Adaptation

Copernicus EMS: Copernicus Emergency Management Service

CPX: Command Post Exercise

DFMC: Dead Fuel Moisture Content (DFMC

DG ECHO: Directorate-General for European Civil Protection and Humanitarian Aid Operations

DLD: Disaster Loss Data

DRM: Disaster Risk management

DRMC: Disaster Risk Management Cycle

DRMKC: Disaster Risk Management Knowledge Center

DRMP: Disaster Risk Management Plan

DRR: Disaster Risk Reduction

EC: European Commission

EEA: European Environment Agency

EFFIS: European Forest Fires Information System

EGFF: Expert Group on Forest Fires

ERCC: Emergency response Operations Center

E-STAG: European Science and Technology Group

EU: European Union

EU ModEx: EU Modules Exercise

EWS: Early Warning System

FSX: Full Scale Exercise

GFFF: Ground Forest Fire Fighting

GFFF-V: Ground Forest Fire Fighting using Vehicles

HCP: High-Capacity Pumping

ICT: Information and Communication Technologies

IFM: Integrated Fire Management

JRC: Joint Research Centre

Nat Cat insurance: Natural Catastrophes insurance

NCCAS: National Climate Change Adaptation Strategy

NDRRP: National Disaster Risk Reduction Platform

NDRRS: National Disaster Risk Reduction strategy

NSDS: National Sustainable Development Strategy

OECD: Organization for Economic Cooperation and Development

PPE: Personal Protecting Equipment

SDGs: Sustainable Development Goals

SFDRR: Sendai Framework for Disaster Risk Reduction

SOP: Standard Operating Procedure

TTX: Table Top Exercise

UCPM: Union Civil Protection Mechanism

UNDRR: United Nation Office for Disaster Risk Reduction

WB: World Bank

WUI: Wildland Urban Interface

Annex 4 - List of experts consulted

Laurent Alfonso (FR) - Ministère de l'Intérieur, French civil protection.

Nestor Alfonzo Santamaria (LU) - OECD, Organisation for Economic Co-operation and Development.

Marta Arbinolo (FR) - OECD, Organisation for Economic Co-operation and Development.

George Eftychidis (EL) – Satways.

Carolina Gallo (IT) - FAO, Food and Agriculture Organization.

Lenka Hejzlarova (CZ) - General Directorate of the Fire Rescue Service of the Czech Republic.

Alexander Held (DE) - EFI, European Forest Institute.

Gökhan Kaya (TR) - OGM, General Directorate of Forestry.

Carlos Mendes (PT) - ANEPC, Autoridade Nacional de Emergência e Proteção Civil.

Dario Negro (IT) - Presidenza del Consiglio dei Ministri, Italian civil protection.

Ciaran Nugent (IE) - Department of Agriculture, Food and the Marine.

Tiago Oliveira (PT) - AGIF, Agency for Integrated Management of Rural Fire.

Elsa Pastor Ferrer (ES) - Universitat Politècnica de Catalunya – BarcelonaTech.

Eduard Plana Bach (ES) - CTFC, Forest Science and Technology Centre of Catalonia.

Jean-Louis Rossi (FR) - University of Corsica. *(not attending the workshop, but sent feedback on the draft)*

Leif Sandahl (SE) - MSB, Myndigheten för samhällsskydd och beredskap – Swedish civil protection.

Jordi Vendrell Flotats (ES) - Pau Costa Foundation.

Domingos Viegas (PT) - University of Coimbra.

European Commission: **Cristina Brailescu**, **Maria Brattemark**, **Juan Galvan Montero**, **Guillermo Griem, Artur Malantowicz**, **Judith Sorensen**, and **Gaetano Vivo** (DG ECHO); **Duarte Oom** (JRC); **Peter Loeffler** (DG CLIMA); **Nicolas Faivre** (REA - Research Executive Agency).

Expert workshop at the Commission's premises on 02nd March 2023, group photo.