Management of Wildfire Risk in the EUROPEAN UNION

TAFF Technical Assistance Financing Facility for Disaster Prevention and Preparedness

Funded by the European Union

GFDRR

Administered by THE WORLD BANK
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Acknowledgement

This report forms part of technical assistance under the Technical Assistance Financing Facility (TAFF), financed by the European Commission— Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO)—and implemented by the World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR). Part of a set, this report is being delivered as part of Component 2 (cross-cutting/multi-country) activities funded by the TAFF budget allocated in 2024.

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The team is grateful for guidance and comments received from the DG ECHO B3 unit and other units of the European Commission.

Disclaimer

ACRONYMS

CAP	Common Agricultural Policy
CER	Critical Entities Resilience Directive
DG ECHO	Directorate-General for European Civil Protection and Humanitarian Aid Operations
DRM	Disaster Risk Management
EC	European Commission
EFFIS	European Forest Fire Information System
EMS	Emergency Management Service
EU	European Union
EUSF	EU Solidarity Fund
EWS	Early Warning System(s)
IWFRM	Integrated Wildfire Risk Management
NBS	Nature-Based Solution(s)
NMHS	National Meteorological and Hydrological Service
PRAF	Peer Review Assessment Framework
RRF	Resilience and Recovery Facility
TAFF	Technical Assistance Financing Facility
UCPM	Union Civil Protection Mechanism
WUI	Wildland-Urban Interface

KEY TERMS

Wildfire: Any unplanned or uncontrolled fire affecting natural, cultural, industrial, and residential landscapes (United Nations Office for Disaster Risk Reduction adapted from FAO). An unusual or extraordinary free-burning vegetation fire that poses significant risk to social, economic, or environmental values. It may be started maliciously, accidentally, or through natural means (United Nations Environment Programme).[1]

Forest fire: An unwanted fire burning forests and wildlands.[2]

Bush fire: The same meaning as wildfire but is the term used in Australia, New Zealand, and Africa. It is an unplanned fire in a vegetated area (as opposed to an urban area).[3]

Other types of fires:[4]

- **Accidental fire:** Fires resulting from unintentional human actions.
- **Arson fire:** Fires set intentionally and maliciously.
- **Controlled fire:** Fires that are managed for specific purposes, usually with precautions.
- **Uncontrolled fire:** Fires that are not managed or controlled, typically wildfires.
- **Natural fire:** Fires caused by natural events, such as lightning.
- **Prescribed fire/mild fire:** Intentionally set and controlled fires for land management.

Integrated wildfire risk management (IWFRM): The approach relies on coordinated use of resources, integrated policy frameworks, collaboration of stakeholders, society-wide engagement, and capacity development. This approach is gaining prominence given climate change impacts as well as the demand and need to address the wildfire challenge in an integrated and holistic manner.

Wildfire risk: Assessed by considering vulnerable areas where people, ecological, and socioeconomic values are exposed to fire danger.[5]

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

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.

Wildlands/wilderness areas: Areas governed by natural processes. They are composed of native habitats and species and are large enough for the effective ecological functioning of natural processes. They are unmodified or only slightly modified and without intrusive or extractive human activity, settlements, infrastructure, or visual disturbance.[6]

Wildland-urban interface (WUI): Areas where human development meets or intermingles with wildland vegetation. These areas often face heightened wildfire risk.[7]

Firebreak:[8] Man-made areas with a reduced fuel load that act as barriers to stop or slow down fire spread.

Early warning system (EWS): An integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication, and preparedness activities that enables individuals, communities, governments, and businesses, and others to take timely action to reduce disaster risks in advance of hazardous events. *Annotation: Multi-hazard EWSs address several hazards and/or impacts of similar or different type in contexts where hazardous events may occur alone, simultaneously, in a cascading manner, or cumulatively over time, taking into account the potential interrelated effects.*`

Nature-based solutions:[9] Solutions "inspired by, supported by, or copied from nature" and "simultaneously provide environmental, social, and economic benefits and helps to build resilience" by bringing

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[1] *Casartelli, V., and J. Mysiak. 2023. Union Civil Protection Mechanism - Peer Review Programme for Disaster Risk Management: Wildfire Peer Review Assessment Framework (Wildfire PRAF). Link.*

[2] *Tedim, Fantina, Gavriil Xanthopoulos, and Valerio Leone. 2015. "Forest Fires in Europe: Facts and Challenges." In Wildfire Hazards, Risks and Disasters, 77–99. Elsevier.*

[3] *Price, O. 2019. "Bushfires." In Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires, edited by S. Manzello. Springer, Cham. Link.*

[4] *Huidobro, G., L. Giessen, and S. L. Burns. 2024. "And It Burns, Burns, Burns, the Ring-of-Fire: Reviewing and Harmonizing Terminology on Wildfire Management and Policy." Environmental Science & Policy 157: 103776.*

[5] *Oom, D., D. de Rigo, H. Pfeiffer, A. Branco, D. Ferrari, R. Grecchi, T. Artés-Vivancos, T. Houston Durrant, R. Boca, P. Maianti, G. Libertá, J. San-Miguel-Ayanz, et al. 2022. Pan-European Wildfire Risk Assessment. doi:10.2760/9429, JRC130136. Link.*

[6] *Wild Europe. 2013. A Working Definition of European Wilderness and Wild Areas. Link.*

[7] *Silva, J. S., ed. 2010. Towards Integrated Fire Management: Outcomes of the European Project Fire Paradox. No. 23, pp. ix–229. Joensuu, Finland: European Forest Institute. Link.*

[8] *Casartelli and Mysiak 2023.*

[9] *Casartelli and Mysiak 2023.*

"more and more diverse nature and natural features and processes into cities, landscapes, and seascapes."

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.

Coping capacity: The ability of people, organizations, and systems, using available skills and resources, to manage adverse conditions, risks, or disasters.[10]

Resilience: The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including ensuring the preservation, restoration, or improvement of its essential basic structures and functions.[11]

'Build back better' (BBB) principle:[12] 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. *Annotation: The term 'societal' is not to be interpreted as a political system of any country.*

Damage: Total or partial destruction of physical assets existing in the affected area. Damage occurs during and after the disasters and is measured in physical units (that is, square meters of housing, kilometres of roads, and so on).[13]

Losses refer to indirectly quantifiable losses (declines in output or revenue, impact on wellbeing, disruptions to flow of goods and services in an economy), or additional operational costs associated with response and initial repairs.[14]

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.

Rehabilitation: The restoration of basic services and facilities for the functioning of a community or a society affected by a disaster.

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[10] *Casartelli and Mysiak 2023.*

[11] *World Bank and European Commission. 2021a. Investment in Disaster Risk Management in Europe Makes Economic Sense. Economics for Disaster Prevention and Preparedness. Link.*

[12] *Definition as per the NSDRR 2024–2035, GoR. Link.*

[13] *World Bank. 2021.*

[14] *Global Facility for Disaster Reduction and Recovery, website. Link.*

EXECUTIVE SUMMARY

Wildfires pose a significant and increasing risk across the European Union (EU). In 2023, wildfires burned over 500,000 ha of land, marking it as the fourth-largest area burned annually on record in the EU. In the same year, Greece experienced the largest wildfire ever recorded in Europe, burning 96,000 ha in the area of Alexandroupolis.[15] With change in the climate accelerating the frequency, intensity, and geographical spread of wildfire events throughout the EU,[16] as exemplified by forest fires coinciding with record droughts and heatwaves, it is important to investigate the risk trends and the existing capacity to manage wildfire risks.[17] Approximately 40 percent of the EU territory is covered by forests and other wooded land, necessitating a significant review of fire management practices in the EU.[18]

This report summarizes the results of a rapid review of wildfire risks, risk management capacity, investment needs, and recommended approaches in the EU, highlighting potential risk management priorities to inform policy dialogue and future research. Capacity considers risk governance, understanding of risk, risk reduction and mitigation, preparedness and early warning, risk preparedness and emergency response, recovery and post-disaster financing, and cross-cutting topics such as social resilience and the private sector. Each chapter reviews the current situation, key challenges, and opportunities for improvement. This review aims to provide an EU-wide perspective on wildfire risk, using EU Member States (MS) as examples, rather than an in-depth review of all EU Member States.

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[15] *JRC, European Commission. 2024b. Advance Report on Forest Fires in Europe, Middle East and North Africa 2023. Link.*

[16] *EC. 2024d. Climate Resilience Dialogue. Link.*

[17] *EEA. 2024c. Climate Change Impacts, Risks and Adaptation. Link.*

[18] *JRC, European Commission. 2024a. Cross-Border and Emerging Risks in Europe. Link.*

KEY MESSAGES

The following key messages can be highlighted based on the review of wildfire risks and risk management capacity in the EU:

1. **Wildfire risk is rising and becoming systemic across Europe.** Wildfire frequency, intensity, and spatial extent are rapidly increasing. Risk is driven by changes in the climate, land abandonment that creates fire-prone lands without surveillance, and the expansion of human settlement in the WUIs. These risks are no longer confined to traditional fire-prone regions, with many previously low-risk areas now increasingly affected.

2. **The Mediterranean remains the epicenter, but risk is expanding northward.** While Southern Europe continues to experience the most extreme wildfire events, Central and Northern Europe are now facing growing exposure due to warming temperatures and changing land use patterns.

3. **Europe's wildfire risk management capacity is outpaced by escalating threats.** The capacity to manage wildfire risk across the disaster risk management cycle is insufficient. Gaps in coordination, data, institutional mandates, and long-term planning limit the effectiveness of existing governance and response systems.

4. **Prevention and preparedness remain underfunded.** Despite increases in response funding, investment in proactive risk reduction such as fuel management, landscape-level interventions, and early warning systems lag. A rebalancing of funding priorities toward prevention and preparedness is essential.

5. **Better data and integrated risk analysis are critical.** Improved data collection, standardization, and probabilistic risk modeling that includes climate projections are necessary to inform decisions and guide investment across all phases of wildfire risk management.

6. **Cross-border and multilevel coordination must be strengthened.** Large-scale wildfires demand harmonized protocols, shared resources, and interoperable systems across EU Member States. Joint exercises, coordinated emergency planning, and knowledge exchange are vital for enhancing resilience.

7. **Community engagement and social resilience are essential.** Fostering a culture of preparedness, empowering communities, and promoting a 'living with fire' approach are key to reducing risk and enabling effective local response and recovery.

8. **Innovative and flexible financing mechanisms are needed.** Current funding mechanisms, while helpful, are often insufficient and lack flexibility. Exploring innovative financing, risk-based budgeting, and cross-border resource sharing and incentivizing private sector investment in resilience building can improve financial resilience to wildfires.

9. **A whole-of-society approach to risk governance is required.** Addressing wildfire risk effectively requires a holistic strategy that integrates governance, risk understanding, prevention, preparedness, response, recovery, and systemic resilience. This includes the role of civil society as well as private actors.

10. **Global lessons must inform European wildfire policy reform.** Experiences from wildfire-prone regions such as the western United States and Australia offer critical insights on land use planning, infrastructure hardening, social protection, and the limits of suppression. These lessons can be used to guide Europe's integrated wildfire risk management approach tailored to each Member State's context.

PRIORITIES GOING FORWARD

With the prevalence of wildfires in the EU, forward-looking approaches to wildfire risk management should be considered.

The following are suggested investment approaches to prioritize funding across prevention, preparedness, and response to protect people, ecosystems, and economies. Recommended investment types and examples are outlined in the final chapter of this note.

1. **Reform governance frameworks, adopting whole-of-government and cross-sectoral approaches.** Governance frameworks should be updated to reflect evolving wildfire risks, shifting beyond structural fire and forest conservation toward integrated risk management, balancing prevention, preparedness, and sustainable landscape practice. Clear arrangements or designated authorities—such as Portugal's Agency for the Integrated Management of Rural Fires—can improve coordination across different stakeholders. Cross-government and community collaboration, including support for local champions and volunteers, is critical for holistic wildfire resilience.

2. **Increase funding for wildfire prevention and preparedness.** Achieving balance between suppression and prevention funding is key. Investments should focus on fuel management, firebreaks, controlled burns, improved detection technologies, and technical training at all levels. Public awareness campaigns and consistent messaging are essential, alongside support for transboundary knowledge exchange. Tracking wildfire-related investments and their impacts is also vital for evidence-based policy making.

3. **Improve cross-border cooperation.** The EU could expand training, simulation exercises, and knowledge sharing among its Member States, particularly in areas such as risk analysis, prevention, early warning, and communications. Greater use of tools like Copernicus EMS and resource sharing during concurrent wildfire events can significantly strengthen collective EU response capacity.

4. **Promote nature-based solutions and sustainable land use practice.** Ecosystem-based approaches—such as reforestation with native species, sustainable land use, and controlled burning—offer long-term wildfire resilience and biodiversity benefits. These strategies should be integrated into land use planning, especially in WUI zones, guided by data and local context.

5. **Public-private partnerships and collaboration.** Financial incentives like tax breaks and subsidies can encourage private sector investment in fire resilience, including firebreaks, ensuring infrastructure is fire safe, and adopting fire-smart agricultural/forestry practices. Public-private collaboration expands the reach and sustainability of risk-reducing measures.

INTRODUCTION

This report is part of a series focusing on improving the understanding of the needs and priorities for disaster resilience investments in relation to two disaster risks: wildfires and earthquakes. The broader objective is to provide actionable insights and recommendations that can guide the European Union (EU) and its Member States in making informed, strategic investments to enhance resilience against wildfires and earthquakes.

This report focuses on wildfires and describes current risk trends, risk management capacity, investment needs, and recommended approaches relevant to an EU-wide understanding. This note is complemented by three country-specific case studies for Croatia, Cyprus, and Romania.

This report provides a rapid, high-level overview based on existing information and data gathered across EU Member States.[19] In addition, consultations with key national and EU organizations as well as researchers have been conducted to improve understanding of the key areas listed above. The note can serve to inform policy dialogue and future research, aiming to provide an EU-wide perspective.

The analysis is structured following the Union Civil Protection Mechanism (UCPM) Wildfire Peer Review Assessment Framework (PRAF).[20] This report also considers the integrated wildfire risk management (IWFRM) principles and includes the following elements:[21]

[19] *Overseas Countries and Territories are not considered.*
[20] *Casartelli and Mysiak 2023.*
[21] *Ibid.*

1. **Governance of wildfire risk management** focusing on the overall governance framework for wildfire risk management, including the strategies, institutional frameworks, coordination mechanisms, financing strategies, and systemic resilience related to wildfire risk at the national and subnational levels.

2. **Understanding wildfire risk management** examining the identification, analysis, evaluation, communication, and capacities associated with assessing the risk of wildfires.

3. **Wildfire risk prevention, risk reduction, and mitigation** reviewing wildfire prevention and exploring landscape management practices, innovation and knowledge services, and administrative capacities related to wildfire prevention.

4. **Early warning and public awareness** examining the processes and measures involved in preparing for wildfire events, covering contingency planning, early warning systems (EWSs), training and exercises, and the development of response capacities.

5. **Wildfire risk preparedness and emergency response** focusing on the activities and processes during the response phase of a wildfire event, including response operations, coordination among actors, international assistance, and need and impact assessments.

6. **Wildfire recovery, reconstruction, and post-disaster financing** covering the processes and actions taken after a wildfire event, including damage assessment, restoration efforts, recovery planning, and climate proofing for future disaster events.

7. **Cross-cutting topics:** social resilience and inclusion explores ways to address the disproportionate impact of disasters on vulnerable populations, with special focus on people with disabilities. Meanwhile, private sector covers relevant stakeholders' involvement in the context of earthquake risk management, including building owners and property managers, insurance companies, business owners, utility providers, construction and engineering firms, but also civil society organizations, and so on.

WILDFIRE RISK PROFILE AND RISK TRENDS

This chapter provides a short overview of risk trends for wildfires in the EU. It draws on available data and information and focuses on fire statistics, risk drivers, vegetation cover, forest fires, and wildland-urban interface fires. It also highlights less studied but growing wildfire risks such as peatland fires.

CURRENT STATUS

Wildfires originate from combining combustible vegetation with ignition sources such as lightning or human activity. They are influenced by a range of factors including vegetation type, structure, moisture content of the forest surface, topography, and wind speed and are a natural phenomenon. Other factors such as the nature of response (that is, time of detection and action), landscape management, and the capacities and vulnerabilities of communities play an important role in the occurrence, intensity and impacts of wildfires.

Across Europe, forests cover approximately 215 million ha and other wooded lands cover an additional 36 million ha, which amounts to over one-third of the continent's total land area.[22] Recent statistics find that woodland covers over 40 percent of the total area of the EU, followed by cropland (24.2 percent) and grassland as noted in Figure 1. Additional land cover types include shrubland, artificial land, and bare land. The heightened frequency and intensity of extreme wildfires may result in habitat destruction as well as air quality deterioration.[23] Northern Europe is characterized by a relatively wet and cold climate, and often features forests with species like Scots pine, leading to wildfires that are typically surface and ground fires.[24] In contrast, Southern Europe's Mediterranean climate, marked by hot, dry summers, results in vegetation that is highly flammable for extended periods, increasing the likelihood of more frequent and severe wildfires that are influenced by factors like drought and wind.

In recent years, Europe has experienced increased wildfires with larger fires and an extended fire season. Countries in Europe with the highest danger of wildfires are Spain, Portugal, Türkiye, Greece, and parts of central and southern Italy. Mediterranean France and the coastal regions of the Balkans are also susceptible to increased wildfire danger.[25] More European countries suffered from large forest fires in 2018 than ever before, and Sweden experienced the worst fire season in reporting history. In 2010 alone, wildfires were responsible for damaging half a million hectares of forests in Europe.

For most of 2023, Europe saw above-average fire danger with high levels of fire danger at the start of the summer in Northern Europe and later in the season in southwestern Europe. In 2023, the frequent occurrence of high temperatures and persistent drought conditions in Central Europe and the Mediterranean region led to critical fires in Portugal, Spain, Italy, and Greece. In Greece, the largest wildfire ever recorded in Europe burned approximately 96,000 ha of land in Alexandroupolis (see more in Box 1.).[26] Burned area (Figure 3) in 2023 is a way to measure the size and extent of the impact of wildfires. In 2023, a total of 500,000 ha of land was burned, which is the fourth largest on record in the EU.[27]

From March 2023 to February 2024, fires burned 8,400 km², or 840,000 ha, where more than half of the area was transitional woodland, forest, shrublands, grasslands, and agricultural lands. At least 44 people died as a direct result of wildfires in this period.[28] Countries in the Mediterranean Basin experienced mild to typical fire seasons affecting non-forest (open) vegetation types. In Southeast Europe, fire activity varied among countries but was mostly low by historical patterns, such as in Croatia, except for Greece as detailed below. North Macedonia had a typical fire year, and Bulgaria had the worst year in a decade, with fire activity extending into October in other countries. In Bosnia and Herzegovina, Serbia, and Montenegro, some 270 km² burned in the first two months of 2024.[29]

Persistent drought and high temperatures during late summer of 2023 led to a significant rise in the number of days with extreme fire danger. Figure 4 shows the extreme fire danger in Europe in 2023 relative to the average for the 1991–2020 period. These conditions are when critical fires, those above 10,000 ha, can develop. Furthermore, wildfires can increase soil erosion and landslides. Vegetation absorbs the rain and protects the ground from the direct impact of raindrops, preventing soil from being washed away during rainfall. When wildfires destroy the vegetation, burned areas become more susceptible to soil erosion. This was observed in Greece, where after the 2018 Attica wildfires, soil erosion rates increased fivefold compared to pre fire levels.[30] Another example of the impacts of changing weather patterns is included in Box 2.

[22] *De Rigo, D., G. Liberta, T. Durrant, T. Artes Vivancos, and J. San-Miguel-Ayanz. 2017. Forest Fire Danger Extremes in Europe under Climate Change: Variability and Uncertainty. Link.*

[23] *EC 2023d.*

[24] *Fernandez-Anez, N., Krasovskiy, A., Müller, M., Vacik, H., Baetens, J., Hukić, E., Kapovic Solomun, M., Atanassova, I., Glushkova, M., Bogunović, I. and Fajković, H., 2021. Current wildland fire patterns and challenges in Europe: A synthesis of national perspectives. Air, Soil and Water Research, 14, p.11786221211028185. Link.*

[25] *World Bank and European Commission 2021a.*

[26] *EC 2023d.*

[27] *Joint Research Centre, European Commission 2024.*

[28] *EC 2023d.*

[29] *Jones, M.W., et al. 2024. State of Wildfires 2023–2024. Link.*

[30] *OECD 2023a.*

Box 1. Greece wildfire in 2023

Greece's 2023 wildfire season marked the largest fire in recent European history and widespread evacuations, revealed critical gaps in firefighting capacity, and illustrated the escalating health, environmental, and economic impacts of extreme wildfires.

Greece experienced its second-worst fire season in terms of total area burned with 1,727 km² affected, despite recent efforts to strengthen firefighting mechanisms. The simultaneous spread of multiple fires stretched firefighting resources to their limits, with a notable focus on evacuations rather than fire suppression in several instances.[31] The 2023 fire season was notably more severe than typical years, with the total burned area significantly exceeding Greece's historical averages. From July to August 2023, Greece faced numerous large fires that overwhelmed firefighting capabilities. Key fires included those on the island of Rhodes and the massive Evros fire, which reached 838 km². The Evros fire became the largest on record in recent European history, significantly affecting both forested and agricultural areas. It also led to the death of 19 individuals who were trapped by the flames. These fires near populated areas necessitated large-scale evacuations, including about 20,000 tourists on Rhodes and multiple settlements around Mount Parnis in Attica. In addition, numerous evacuations took place in Alexandroupolis and surrounding villages. The Evros fire also caused a powerful explosion at an air force base. These fires caused significant damage to properties, infrastructure, and natural reserves, with significant impacts on biodiversity and local economies. The burned area was extensive and extended west through Macedonia and Thrace. Wildfires pose both direct and indirect threats to human health. The World Health Organization notes that wildfire smoke is hazardous, containing air pollutants such as $PM_{2.5}$, NO_2, ozone, aromatic hydrocarbons, and lead. These pollutants can cause respiratory system diseases and increase the risk of early death.[32]

Box 2. Slovenia wildfire risk trends

Slovenia's 2022 Karst wildfire highlighted the growing wildfire risk in drought-prone regions driven by rising temperatures and dry conditions and required extensive national and EU-supported response efforts.

The effects of rising temperatures and relative lack of precipitation have been visible over time in Slovenia, especially in the Alpine regions.[33] These trends caused the devastating fire in the Karst region in July 2022. This area is one of the most susceptible to drought and the general effects of dry and hot weather. Karst in western Slovenia is among the driest regions in the country and therefore has an increased risk of wildfire in the summer months. The Karst fire on July 17, 2022, was ignited in terrain that was hard to access and moved quickly towards the village of Temnica. More than a thousand firefighters from six regions were deployed in the response, along with the rescEU capacities that provided Croatian firefighting aircraft to help control the flames.[34]

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[31] *Ibid.*

[32] *Olsen, M. 2020. Western US Smoke from Fires Stretching across the Country. Link. Xu, Rongbin et al. 2020. Wildfires, Global Climate Change, and Human Health. Link.*

[33] *Pirc, G. 2022. Slovenia Social Briefing: The Excessive Temperatures, the Devastating Wildfire in the Slovenian Karst, and the Effects of Global Warming. Link.*

[34] *EC. n.d. Together, one Step Ahead of Wildfires: How Croatia's Firefighters Helped Slovenia Extinguish the Flames. Link.*

Figure 1. (Left) Breakdown of land cover in the EU (2018), percentage of total area

Source: Eurostat (lan_lcv_ovw)

Figure 2. (Right) Land cover of Europe (2018)

Source: Jakub Marian, Data: European Space Agency

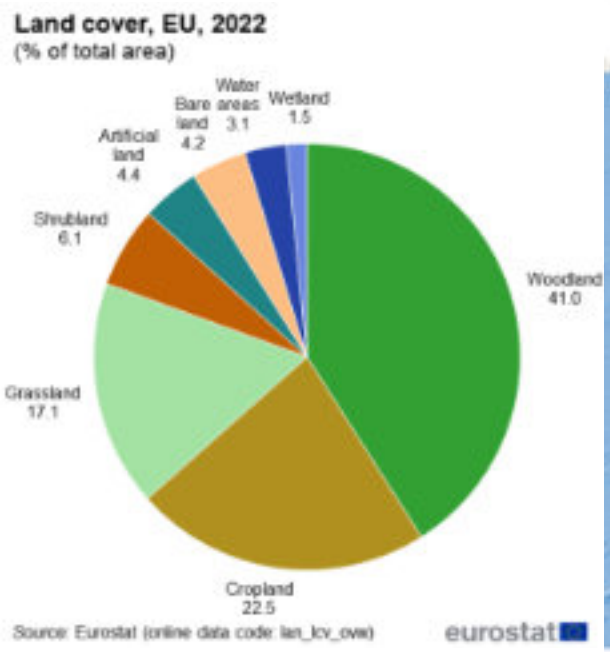
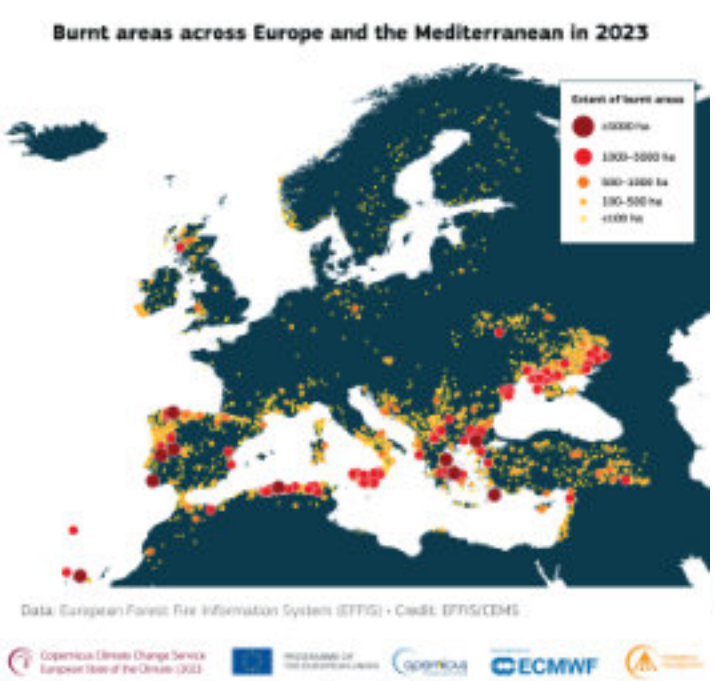


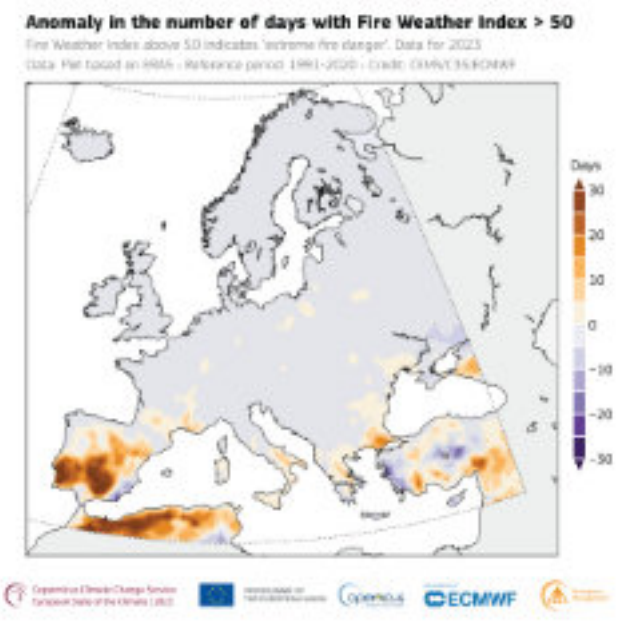
Figure 3. (Left) Burned area across Europe and the Mediterranean in 2023

Source: Copernicus, 2023. Link

Figure 4. (Right) Extreme Fire Danger in Europe 2023

Source: Copernicus, 2023; CEMS/C3S/ECMWF. Note: The map shows the anomaly in the number of days with a Fire Weather Index > 50. The Fire Weather Index above 50 indicates 'extreme fire danger'. Data are for 2023 and are based on the ERA5 Fire Weather Index. The reference period is from 1991 to 2020.





DRIVERS OF WILDFIRE RISK

Since 2020, Europe has seen unprecedented growth in wildfires. In 2022 alone, almost 900,000 ha of land was burned, with over 40 percent belonging to Natura 2000 sites recognized as protected biodiversity areas.[35] Wildfire risk in Europe will continue to evolve , where the season will increasingly be characterized by massive fires that cost lives and burn areas that take longer to fully recover. To exemplify, between 2007 and 2023, 16 percent of all requests for assistance through the UCPM were in response to wildfires.[36] Wildfire risk in the EU has expanded to areas previously not exposed to risk, moving well beyond the Mediterranean region. This causes great societal, environmental and economic losses across Europe. Between 2000 and 2017, wildfires are estimated to have caused €3 billion in direct economic losses (lost and damaged assets, crops, livestock, and so on) every year in the EU.[37] Estimated direct damage in 2023 for Member States includes €2 billion in Greece, €1 billion in Italy, and around €913 million in Spain.[38]

Socioeconomic drivers of wildfire risk include abandonment of the rural land and agricultural decline. Rural populations are critical for reducing fuel accumulation through agricultural practices such as grazing and pruning trees in forests for firewood and the creation of "mosaic" landscapes of agricultural crops that act as fuel breaks. With rural land abandonment, flammable vegetation encroaches and builds up, while at the same time there is a reduction in the number of people available on the ground to detect and respond to wildfires early on.[39] Rural depopulation trends are especially striking in the Mediterranean countries. In Portugal, for example, the rural population decreased from 5.7 million to 3.4 million between 1960 and 2021 (from 65 percent to 35 percent of the total population).[40] Such land abandonment reduces opportunities for sustainable land management that occurs organically through agriculture, cropland, and eco-service-related land management. When these opportunities are lost, more funding and resources are required for silviculture, silvo-pastoralism, and prescribed fires, but even still, these activities need to happen at a large enough scale to be effective for resilient landscapes. Without active or planned management strategies, these landscapes become hazardous for fire services to manage during seasonal wildfire seasons.

Settlement expansion in the WUI is another driver of wildfire risk. Increasing settlements in fire-prone landscapes heightens the likelihood of ignition and complicates suppression efforts. The risk arises not simply from human presence or absence but from the nature of human-ecosystem interactions and often the lack of regulated development. Strategic land use planning, such as buffer zones between natural and built environments, is critical in managing these interface areas to reduce fire hazard and vulnerability. While the expansion of human settlements into wildland areas and rural land abandonment may appear as opposing trends, they represent two distinct but interlinked wildfire risks. Abandoned rural land often experiences vegetation overgrowth and reduced local surveillance, creating conditions for larger and less detectable fires, while settlement expansion in the WUI can bring unique socio-ecological risks.

Ecosystem degradation is another driver for wildfire risk and makes many ecosystems more prone to fire.[41] For example, biodiversity loss, forest degradation and fragmentation due to excessive logging, overgrazing, and deforestation can reduce forest humidity and increase atmospheric temperatures which enhances the risk of extreme wildfires. Peatland drainage and associated drying can also enhance wildfire risk as dry peat is highly flammable, and wildfires in peatlands can burn underground and are thus difficult to extinguish (see Box 3). The introduction of non-native plant species, such as monocultures and flammable vegetation can also trigger wildfires.

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[35] *EC 2024d.*

[36] *World Bank. 2024. Financially Prepared - The Case for Pre-Positioned Finance in European Union Member States and Countries under EU Civil Protection Mechanism. Economics for Disaster Prevention and Preparedness. World Bank. Link.*

[37] *OECD 2023a.*

[38] *DISTRELEC. 2024. The Costs of European Wildfires 2023 Report. Link. Note: Source data from EFFIS.*

[39] *Moreira, F., Ascoli, D., Safford, H., Adams, M.A., Moreno, J.M., Pereira, J.M., Catry, F.X., Armesto, J., Bond, W., González, M.E. and Curt, T., (2020). Wildfire management in Mediterranean-type regions: paradigm change needed. Environmental Research Letters, 15(1), p.011001.*

[40] *OECD 2023a.*

[41] *OECD 2023a.*

Wildfires release large quantities of stored carbon from forests and peatlands, acting as a major emission source that can hamper mitigation efforts.[42] While the direct economic implication of lost value of stored carbon in climate finance and emissions accounting is a relevant dimension, there is a need to include carbon emissions in economic cost assessments to highlight the crucial need for integrating economic impacts into wildfire risk management with respect to countries meeting their Greenhouse Gas Emissions targets. More understanding and consideration are needed regarding trade-offs between carbon stores, potential revenue streams, and the economic value of carbon in fire mitigation efforts.

The growing expansion of human settlements and economic activities in wildland areas is another driver of wildfire risk. Globally, the expansion of the WUI, or areas where the built environment and wildland vegetation meet, increases the chances of fire ignition. This can occur due to uncontained campfires, controlled fires, faulty infrastructure, or engine-induced sparks. The extension of utilities and transportation systems into the WUI can create additional ignition sources. As urbanization progresses, power grid infrastructure is being moved into these areas. While modern urbanization employs technologically advanced methods, it often neglects strategies to protect against wildfires such as the establishment of space or the use of fire-resistant building materials. Poorly planned infrastructure can also increase wildfire risk. Regions that have not previously been affected by wildfires could be at high risk in the near future.

Europe has experienced increasing wildfire risks with larger fires and longer seasons driven by several factors, rural land abandonment, and expanding WUI. WUI development has increased the exposure of communities, assets, and economic activities to wildfires. The impacts of WUI development on wildfire activity are concerning as human expansion into the WUI is increasing. For example, the significant growth of WUI areas around Athens, Greece, between 1950 and 1980 has been associated with the high number of wildfires registered in the area.[43] WUI areas often consist of mixed environments, where infrastructure, forests, native and non-native vegetation coincide. In Mediterranean countries, peri-urban areas have significantly increased land abandonment and biomass accumulation, creating landscapes where wildfires can easily spread from fuel to human settlements.

In some areas, the expansion of forest cover can also be a driver of wildfire risk. For example, in Iceland, recent efforts to restore forest cover combined with global warming and reduced grazing have led to an increase in biomass and denser vegetation.[44] This, along with the growing number of summer homes, has heightened the risk of wildfires in Iceland and possibly in other Nordic countries where similar forest cover has been affected by changes in the climate and development patterns. Alongside the benefits of increasing plant cover, reforestation can also have counterproductive effects. Reforestation can increase the risk of fire spreading and thus accumulated carbon release back into the atmosphere, which can consequently affect and generate more fires in other areas.

The existing practice in wildfire management can also be a driver of wildfire risk, such as the overreliance on wildfire suppression in fire management which can amplify risk. While wildfire suppression is critical to contain the impacts of wildfires in fire-sensitive areas or where population and assets are exposed, suppressing every wildfire without accounting for the needs and characteristics of specific ecosystems can have negative impacts on their balance and increase future wildfire risk. In wildfire-adapted communities, for example, regular wildfire activity naturally contributes to containing the amount and continuity of vegetation. In these contexts, wildfire suppression can facilitate the excessive buildup of vegetation, which, during dry periods, can give rise to wildfires that are too large and too intense to contain.[45] This is known as the 'fire paradox' and is yet another driver of wildfire risk (see Figure 6).

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[42] *EC. 2024d. Climate Resilience Dialogue. Link.*

[43] *Salvati, L., and F. Ranalli. 2015. "'Land of Fires': Urban Growth, Economic Crisis, and Forest Fires in Attica, Greece." Geographical Research 53(1): 68–80.*

[44] *Fernandez-Anez et al. 2021.*

[45] *Williams, A. P., J. T. Abatzoglou, A. Gershunov, J. Guzman-Morales, D. A. Bishop, J. K. Balch, and D. P. Lettenmaier. 2019. "Observed Impacts of Anthropogenic Climate Change on Wildfire in California." Earth's Future 7(8): 892–910.*

Figure 5. The feedback loop between climate change and extreme wildfires

Source: Adapted from OECD 2023a.

Box 3. Peatland Fire Potential

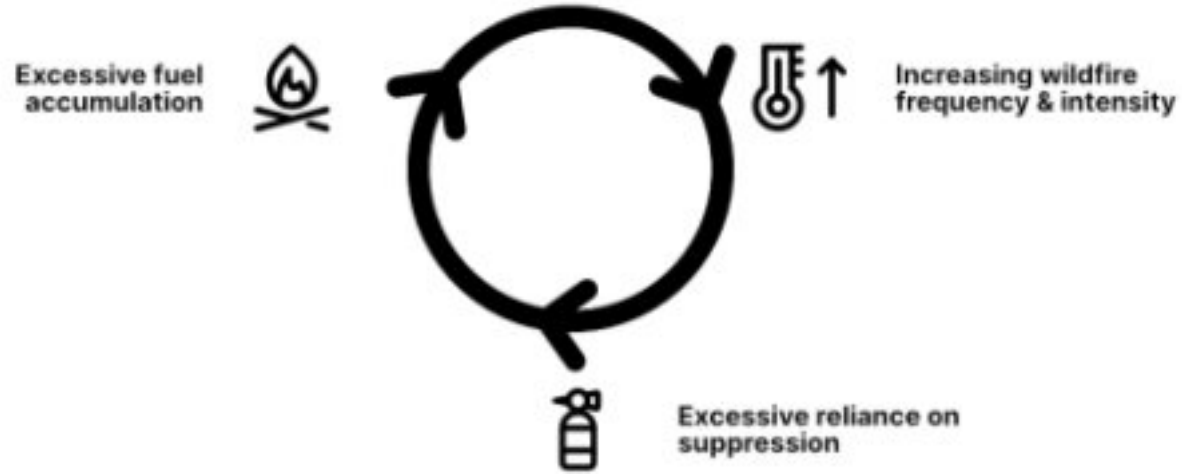
Peatland fires in Scandinavia threaten to accelerate permafrost thaw by removing insulating vegetation, leading to deeper heat penetration and long-term ecosystem damage. *This process releases stored carbon, creating a dangerous feedback loop that could push toward an irreversible tipping point.*

Peatland fires in Scandinavian countries pose a threat due to the region's vast area of combustible organic soils that store large amounts of carbon. Wildfires lead to increasing soil temperatures which result in permafrost thaw by removing the insulating cover of vegetation and organic matter and hampering tree cover recovery. These processes facilitate heat penetration deeper into the ground, contributing to reduced permafrost thickness and spatial extent. Increasingly extreme wildfires in boreal forests and peatlands accelerate permafrost thaw which enhances the positive feedback between permafrost reduction, carbon release and atmospheric warming, potentially leading to an irreversible tipping point.[46]

[46] *Miner, K. R., M. R. Turetsky, E. Malina, A. Bartsch, J. Tamminen, A. D. McGuire, A. Fix, C. Sweeney, C. D. Elder, and C. E. Miller. 2022. "Permafrost Carbon Emissions in a Changing Arctic." Nature Reviews Earth & Environment 3(1): 55–67.*

Figure 6. The fire paradox: The pitfalls of overreliance on wildfire suppression

Source: Adapted from OECD 2023a. WWF. 2020. Fires, Forests, and the Future: A Crisis Raging out of Control? Link



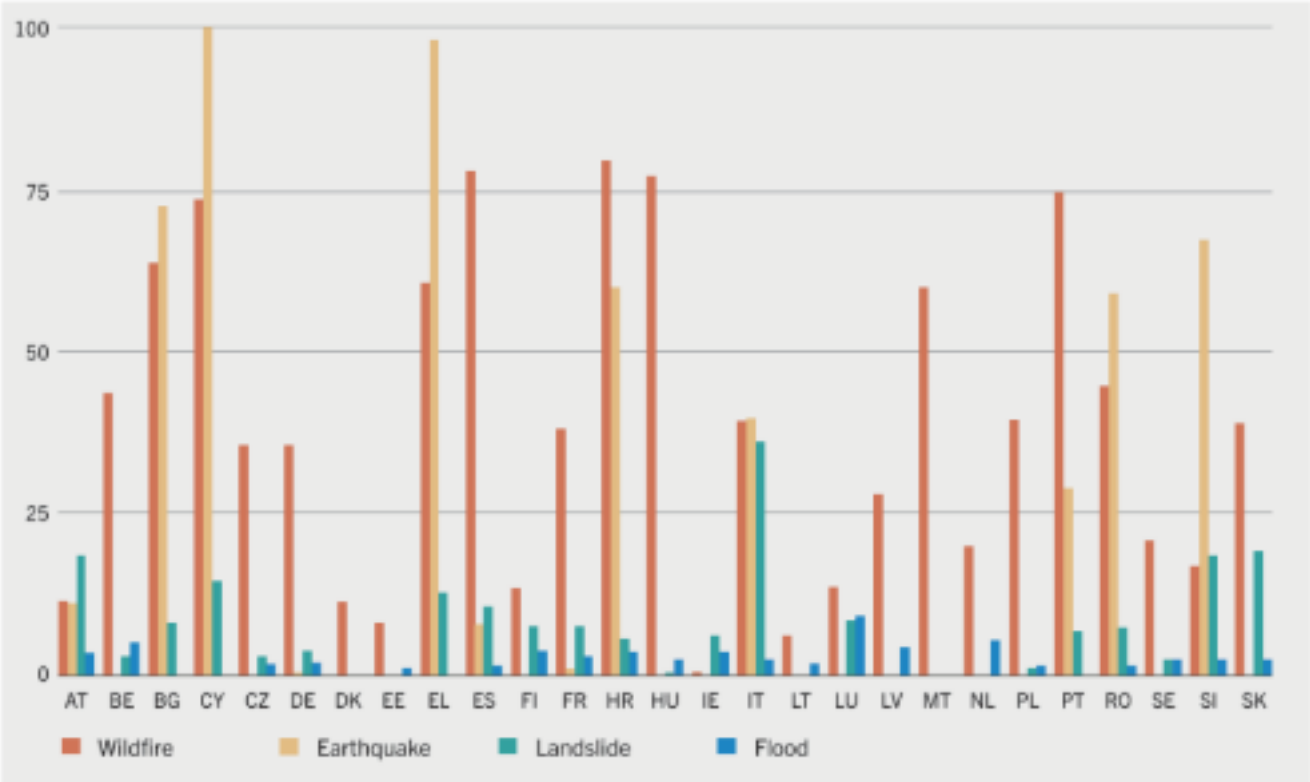
WILDFIRE ASSET EXPOSURE

Considering current risk across the EU (drawing on data from the Joint Research Centre [JRC]'s wildfire risk assessment[47]), and the location of various assets (available through OpenStreetMap), across the EU, there are over 52,000 emergency response-related assets including fire and police stations, schools, and hospitals located in wildfire hazard areas, with 17,000 in high hazard zones. Germany, France, Poland, Italy, and Spain alone have over 8,000 such assets exposed.[48] Greece, Italy, and Portugal, which are traditionally vulnerable to wildfires, have more than 80 percent of their emergency response infrastructure (education, health care, fire, police facilities) in high wildfire risk areas. Additionally, around half of the EU's Member States have more than 80 percent of the roads and 70 percent of power lines exposed to wildfire hazards, making critical infrastructure highly vulnerable to wildfire damage.[49] While it may make sense to have emergency response assets—such as fire stations—located in areas of high hazard, it is important to ensure that these assets are structurally as well as operationally safe. Currently, there is no comprehensive data or analysis that provides information on the current state of critical sectors in Europe considering their location, conditions, and current and future hazards.

[47] *Oom et al. 2022.*
[48] *World Bank and European Commission 2024b.*
[49] *Ibid.*

Figure 7. Proportion of fire stations exposed to high levels of each assessed hazard

Source: World Bank and European Commission 2024.



Source: World Bank.

RISK MANAGEMENT CAPACITY

The following chapters provide an overview of key gaps and vulnerabilities in existing wildfire risk management systems relevant at the EU level, along with examples of successful strategies, investments, and approaches. It draws on publicly available information (such as national risk assessments, government reports, and studies) as well as information gathered during consultations.

GOVERNANCE OF WILDFIRE RISK MANAGEMENT

This chapter examines the governance structure for wildfire risk management at both the national and subnational levels. It analyzes existing strategic frameworks, interagency coordination mechanisms, and systemic resilience measures. Particular attention is given to the relationships and responsibilities among key stakeholders involved in wildfire management.

CURRENT ARRANGEMENTS

The EU has been strengthening its wildfire governance framework focused on both prevention and response.[50] Key to these efforts is the EU Forest Strategy for 2030, which provides the foundation for enhancing resilience and fire prevention in forests. It is a flagship initiative of the European Green Deal, building upon the EU Biodiversity Strategy for 2023.[51] The EU Forest Strategy encourages sustainable forest management, ecosystem restoration, and IWFRM.[52] It specifically advocates for better management of vegetation, the reduction of fuel accumulation, and controlled burns as preventive measures.[53] In 2023, EU proposed a new Soil Monitoring Law, which provides a framework and guidance toward protecting and restoring soils, ensuring use in a sustainable manner.

The EU Strategy on Adaptation to Climate Change, adopted in 2021, emphasizes the need for systemic adaptation to rising wildfire risks.[54] This strategy calls for faster, smarter adaptation approaches to mitigate wildfire impacts and recognizes the critical role of nature and nature-based solution(s) (NBS) in disaster resilience, including those related to wildfire risk adaptation measures. The EU Climate Law includes objectives on adaptation relevant to wildfire risk management.[55] It writes into law the goals within the European Green Deal for climate neutrality by 2050 and the reduction of greenhouse gas (GHG) emissions by at least 55 percent by 2030. The first EU Climate Risk Assessment provides baseline risks in Europe on which EU Member States can build their national assessments. In addition, the Nature Restoration Law seeks to build up Europe's wildfire resilience and strategic autonomy by preventing forest fire disasters while restoring forest ecosystems.[56]

Recent amendments to Directive 2011/85/EU highlight the need for integrating climate-related fiscal risks into national budgetary frameworks. Member States are now required to collect and publish information on disaster and climate-related contingent liabilities, including fiscal costs of past events, to improve budgetary planning and resilience to disaster-related shocks.[57] In addition, the 2023 Critical Entities Resilience Directive (CER) requires Member States to identify the critical entities for 11 sectors that are crucial for the maintenance of vital societal functions, economic activities, public health and safety, and the environment.[58] This will change risk management at both national and EU levels, requiring each Member States to appoint a competent authority to undertake directive implementation by 2025.

The UCPM also plays a central role in wildfire governance. Established in 2013, the UCPM strengthens coordination across EU Member States during wildfire events and facilitates cross-border firefighting support through resources like the rescEU fleet of firefighting planes and helicopters, while also providing a training program for disaster

[50] *EC. 2023b. Sendai Framework for Disaster Risk Reduction, Midterm Review. Link.*
[51] *EC. 2024f. Fighting the Flames: EU-Funded Projects Protecting Forests from Fire Destruction. Link.*
[52] *EC 2024c.*
[53] *EC. 2021c. Forest Fires. Link.*
[54] *EC. n.d. EU Adaptation Strategy. Link.*
[55] *EC. 2021a. European Climate Law (europa.eu) OJ L 243, 9.7.2021, p. 1. Link.*
[56] *European Union. 2024a. Regulation of the European Parliament and to the Council of 24 June 2024 on Nature Restoration. Link.*
[57] *Directive 2011/85/EU. Link.*
[58] *EC. 2023e. Enhancing EU resilience: A step forward to identify critical entities for key sectors. Link.*

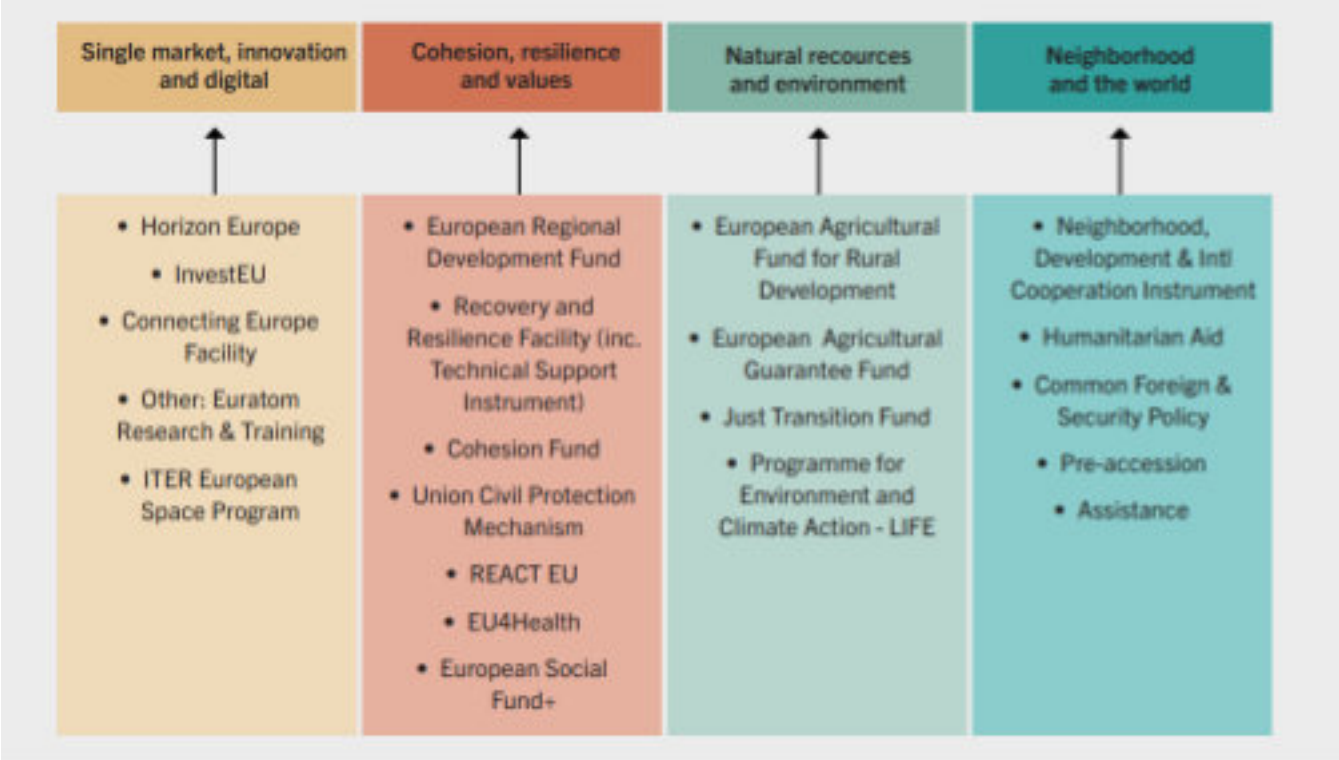
management actors from EU Member States and participating states.[59] These training programs are offered through the UCPM's Knowledge Network and help to increase capacity for wildfire management while improving knowledge for wildfire prevention and awareness (see Prevention section for more information). In addition, it manages the Early Warning and Information Systems and the Emergency Response Coordination Centre that liaises with national authorities from the EU Member States to exchange information on wildfire risk and preparedness.[60] Article 6 of the UCPM Decision is the legislative framework for Member States and participating states, outlining a prevention strategy for disaster resilience by integrating climate risks into national disaster risk assessments. Article 6 also requires countries to report on cross-border risks and low-probability risks with high impacts, which are relevant to many countries facing wildfire threats.[61]

Several EU funding mechanisms support the implementation of these various strategies and policies related to disaster risk management (DRM) (including wildfire risk management), adaptation, and recovery efforts. These include Horizon Europe under the European Green Deal, the EU Solidarity Fund (EUSF), the European Fund for Rural Development, EU Cohesion Policy, and the Recovery and Resiliency Facility (Figure 8), with examples included in another section of this report.[62]

[59] *European Union. 2024g. UCPM Training and Exercises Programme Page. Link.*
[60] *EC 2023d.*
[61] *EC 2024c.*
[62] *Ibid.*

Figure 8. Examples of funding instruments under multi-annual financial framework 2021–2027

Source: World Bank.



KEY CHALLENGES

Despite the existing EU-wide governance structure and member state/participating state guidelines, several challenges hinder wildfire management across the EU. Key limitations are described below.

Coordination and institutional fragmentation: A major challenge is the lack of coordination between national authorities and different levels of government concerning landscape management and zoning, prevention, and response.[63] For example, in Portugal, a program called *Condomínio de Aldeia* promotes active land management through community engagement. However, low monitoring and enforcement, along with the lack of official land registries and unclear forest ownership, can limit the effectiveness of these measures, highlighting the lack of coordination between state and local land management.[64] In another example, communal land ownership in the northwestern part of Spain has experienced several large-scale fires.[65] Property fragmentation in the region is a considerable obstacle to sustainable and profitable management of forest and rangelands and leads to challenges in overall land and resource management as well as wildfire management. Property fragmentation in this context refers to land divided into many small, individually owned parcels which can make coordinated land and wildfire management challenging. The lack of unified governance and local coordination and planning can exacerbate the risks and impacts of wildfires. Furthermore, EU-level forest policies that conflict with Member States priorities can pose a significant challenge in terms of effective forest and fire management. For example, Sweden's national legislation prohibits funding that can affect forestry competitiveness, which may limit intervention opportunities.

Recent reviews conducted on wildfire management in Greece (UCPM)[66] and Portugal (Organisation for Economic Co-operation and Development [OECD]) highlight some lack of clarity on roles and institutional overlaps between forest services and fire services, which hinders wildfire suppression efforts within the risk preparedness and emergency response phase of wildfire risk management.[67] For example, in Greece, until recently, there was no institutional collaboration mechanism between the Forest Service, which is responsible for wildfire prevention and the preparation of forest maps, and the Fire Service, which is the main entity responsible for wildfire suppression. This hampered a coordinated approach to wildfire management.[68] Until recent planning changes to integrated forest management in Portugal, the preparedness for wildfires was found to be uncoordinated after investigations into governance structures took place following the devastating fires of 2017.[69] Fire response crews were arranged into three levels of hierarchy at the national, district, and municipal levels. However, this was not reflected in other areas of wildfire management, such as planning and prevention, and therefore did not harmonize risk reduction and prepositioning of resources before suppression activities (response) taking place.

Another challenge lies in integrating wildfire risk into sectoral policy areas, including agriculture, infrastructure, land use planning, and adaptation strategies, including NBS.[70] Infrastructure resilience to wildfires is stymied due to the lack of government regulations, with wildfire prevention measures often being implemented by infrastructure operators on a voluntary basis.[71] Furthermore, wildfire prevention is often treated as a secondary concern compared to firefighting efforts, leading to underinvestment in long-term preventive measures.[72] Countries such as Greece and Portugal have made strides toward this goal, but many EU Member States still lack a comprehensive national wildfire management policy that can guide management strategies such as FireSmart policies.[73] For example, Portugal's Climate Change Adaptation

[63] *OECD 2023a.*

[64] *Nature Conservancy and Aspen Institute. 2023. Roadmap for Wildfire Resilience: Solutions for Paradigm Shift. Link.*

[65] *Marey-Perez, M., X. Loureiro, E. J. Corbelle-Rico, and C. Fernández-Filgueira. 2021. "Different Strategies for Resilience to Wildfires: The Experience of Collective Land Ownership in Galicia (Northwest Spain)." Sustainability 13 (9): 4761. Link.*

[66] *Arbinolo et al. 2024.*

[67] *OECD. 2024. Taming Wildfires in the Context of Climate Change: The Case of Greece. Link.*

[68] *OECD 2024.*

[69] *AGIF. 2020. 20–30 National Plan for Integrated Rural Fire Management. Link.*

[70] *Casartelli and Mysiak 2023.*

[71] *OECD 2023a.*

[72] *OECD 2023a.*

[73] *OECD 2023a.*

Action Plan sets the ambitious goal of having 50 percent of its transportation infrastructure companies develop an adaptation or contingency plan for extreme events by 2030.[74]

There are financial limitations with respect to post-disaster financing. While funding is available through EU mechanisms such as Horizon Europe, the EUSF, the European Fund for Rural Development, the Recovery and Resiliency Facility, the Cohesion Fund, and the European Agricultural Fund for Rural Development, Member States often struggle with sufficient financing for prevention efforts. Countries with high wildfire risk, like Greece, have found it challenging to balance the immediate costs of wildfire suppression with long-term investment in risk reduction. While the EUSF covers damage from disasters in Europe to some extent, the trend in increased economic damage as a result of disasters in Europe suggests that further reinforcement of financial instruments and arrangements at the EU and its Member States levels should be considered. Additionally, financial mechanisms for recovery and rebuilding such as the EUSF have been criticized for not providing adequate support to smaller scale but frequent disasters. For example, access to funding takes time, with applications taking 8–10 weeks and disbursement taking an average of 56 weeks, which can be challenging for financial needs following smaller, frequent disasters.[75] In addition, the EUSF is not typically used to support Member States following wildfires, in part due to the low amount of eligible direct damage costs for EUSF funding.[76] Furthermore, unlike civil protection services, the land- and forest-based sector often struggles to access and spend funding for wildfire prevention effectively. Fire prevention funding processes tend to lack clarity, and stakeholders do not have the expertise to obtain and manage these resources.

There is a gap with respect to peer-to-peer learning, training, and technical knowledge exchanges between countries with medium- to high- wildfire risk and those with newer or growing wildfire risks.[77] Wildfires are typically common in Southern Europe; however, changes in the climate has expanded wildfire risk to regions in Central and Northern Europe. As seen in 2022, major wildfires affected countries like Czechia, Hungary, Germany, and Slovenia in addition to Mediterranean climates that are affected seasonally by large fires.[78] This requires adjusted governance frameworks, additional coordination and cooperation with fire services, cross-border mechanisms, and prevention strategies as fire conditions rise throughout the EU. Several countries' governance related to management of 'structural' (buildings) fire and forest conservation is not yet adapted to existing and expected wildfire risks. Some of these gaps exist due to a lack of formal acknowledgment in wildfire risk governance. For example, Iceland's legislative framework does not yet formally recognize wildfires as a distinct natural hazard, which limits the ability of some actors—such as the national meteorological agency—to provide relevant services.[79]

Comprehensive building codes for wildfire resilience in WUI areas are limited. The EU emphasizes IWFRM, improving prevention, preparedness, and response capacity; yet at this point, prescriptive building codes in WUI areas, which exist in Canada and the United States, are lacking.[80] Where there are WUI regulations or other fire preventive legal requirements at the national or subnational level, it is found that these are open to interpretation based on the municipality, creating unequal implementation of measures. There are, however, good examples of building code regulations and guidelines.

- *For example, Greece* provides minimum standards for retrofitting housing and other built assets, which are mandatory for properties located within 300 meters of forested areas, woodlands, and grasslands as well as for properties in urban and suburban green areas.[81] Notably for the WUI, Greece has required structural protection measures and established a mandatory three-tier fire protection zone around houses, regulates the use of different types of vegetation around properties, and prohibits the storage of flammable materials in the vicinity of the property (Figure 9).

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[74] *Government of Portugal. 2019. National Plan for Climate Change.*

[75] *World Bank 2024.*

[76] *Ibid.*

[77] *Müller, M. M., L. Vilà-Vilardell, H. Vacik, C. Mayer, S. Mayr, P. Carrega, Y. Duche, S. Lahaye, F. Böttcher, and H. Maier. 2020. Forest Fires in the Alps: State of Knowledge, Future Challenges and Options for an Integrated Fire Management. EUSALP Action Group 8. Link.*

[78] *EC 2024e.*

[79] *World Bank (forthcoming). Towards intertied approach to wildfire risk management in Iceland (title tentative).*

[80] *EC. n.d. Civil Protection-Performance. Link.*

[81] *OECD 2024.*

- *Portugal* also has building codes and standards to strengthen building assets in wildfire-prone areas. This includes the requirement of nonflammable building materials for new and existing buildings and the creation of defensive measures such as fire barriers and building maintenance.[82] There is also a specific requirement for rural settlements within 50 meters of forested lands to have buffer zones around built assets. Existing buildings in exposed WUI areas must be integrated into fuel management programs, and new construction should be constrained to areas with less fire risk. However, despite existing regulations, enforcement is hindered by the socioeconomic context and land ownership structure in the country.[83]

- *Spain* set up mandatory regulations for high wildfire risk areas which can include WUI and recommended regulations for lower risk areas. Fuel reduced strips must be developed around WUI areas, with a 30 meters width or at least 8 times the vegetation height. The area must be free of dead vegetation and crown trees cleared. A one-lane road must be at least 3 meters in width, and a two-lane road at least 5 meters wide with a space of 5 meters for turning and 5 meters of height without obstacles. There is also a requirement for an area slope of no higher than 12 percent (with some special exceptions) and provision of areas for turning each 200 m^2. WUI areas must also have a hydrant system installed.[84]

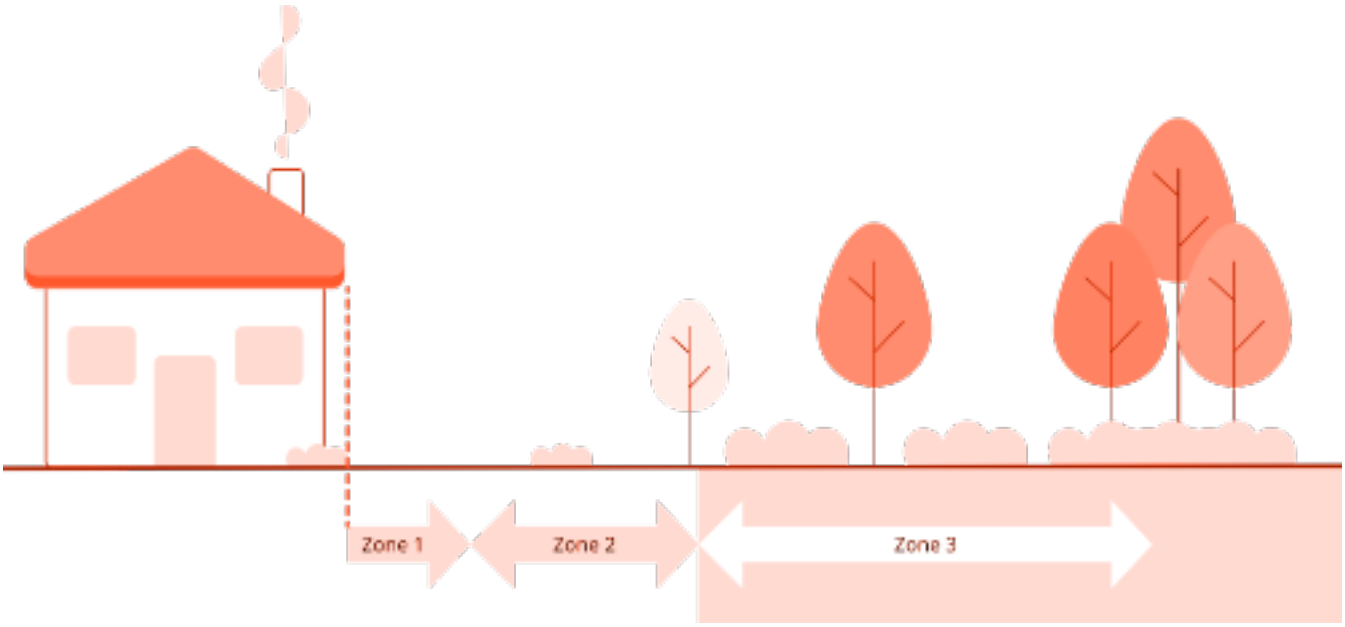
[82] *OECD. 2023b. Taming wildfires in the Context Of Climate Change: The Case of Portugal. Link.*

[83] *Canadas, M. J., M. Leal, F. Soares, A. Novais, P. F. Ribeiro, L. Schmidt, A. Delicado, F. Moreira, R. Bergonse, S. Oliveira, and P. M. Madeira. 2023. "Wildfire Mitigation and Adaptation: Two Locally Independent Actions Supported by Different Policy Domains." Land Use Policy 124: 106444. Link.*

[84] *E. Pastor at al. 2019 Wildland–Urban Interface Fires in Spain: Summary of the Policy Framework and Recommendations for Improvement Link*

Figure 9. Three-tier buffer zone requirements around residential properties

Source: Adapted from Hellenic Republic. 2019. Regulation 55904/2019. Cited in OECD 2024.



Informal buildings and settlements tend to increase wildfire risk due to their noncompliance with safety standards established by land zoning and building regulations.[85] For example, the use of flammable building materials and lack of escape routes were identified as two key causes of the high death toll of the Mati wildfire.[86] Despite the observed negative impacts, some cases of informal buildings in Greece have been granted development rights retrospectively after they have been built. Since 2021, Greece has made significant efforts to address these challenges through the development of land use regulations.

Similar to informal settlements are campsites and caravan parks, where typical associated activities can initiate devastating fires in European communities.[87] Wildfire prevention guidelines are developed through organizations like the European Confederation of Professional Firefighters (CFPA). These guidelines emphasize maintaining proper spacing between sites, designating fire pit areas with nonflammable surfaces, and ensuring accessible emergency water sources, among others. However, enforcement and specifics often vary by country and region and are influenced by local wildfire risks and fire bans. For example, during high-risk periods, additional restrictions on open fires or smoking may apply.

KEY OPPORTUNITIES

The following opportunities have been identified which could improve wildfire risk governance in the EU. These are in line with the findings of the European Parliament's review of lessons learned from the 2022 wildfire season (see Box 5). Further details for specific elements are included in the individual chapters.

STRENGTHENING INTEGRATED WILDFIRE RISK MANAGEMENT

There is an opportunity to enhance the integration of wildfire risk into broader DRM and adaptation policies and strategies. IWFRM is an approach that relies on the coordinated use of resources, integrated policy frameworks, collaboration of stakeholders, society-wide engagement, and capacity development. The EU Climate Law and the European Green Deal emphasize resilience, providing a legal foundation for stronger DRM. These legal frameworks can be leveraged to incorporate wildfire risk reduction into all relevant sectors, including energy, infrastructure, and agriculture, and can support comprehensive wildfire governance.[88] Cross-sectoral collaboration between forestry, agriculture, civil protection/DRM, territorial/spatial, environmental, and water agencies is critical. For example, IWFRM that combines sustainable forest management with DRM strategies can have successful outcomes for wildfire risk reduction and ecological balancing.[89] A recent initiative is the development of the IWFRM Strategy for the EU, which seeks to address stakeholders involved in management of wildfire risk across Europe. As of May 2025, a draft version of the EU-wide IWFRM strategy has been published and proposes IWFRM approaches through governance, innovative measures, data, and modelling across Europe.[90] The EU can also improve on a shared definition of the Forest Policy that can be agreed upon by various Directorate-Generals (DGs) to help establish a coherent framework for integrated forest and wildfire management. Strategic and national plans, both binding and as guidelines, should include UN Sustainable Development Goals as well as the Union Disaster Resilience Goals when building an effective wildfire risk governance system.[91] Furthermore, countries can adopt IWFRM/FireSmart governance that empowers local communities by shifting the focus from suppression to prevention and increasing the awareness and preparedness of populations while relying on science-based forest fire management and risk informed decision-making.[92] An example of a country reforming its governance is included in

[85] *OECD 2023a.*

[86] *OECD 2024.*

[87] *Confederation of Fire Protection Associations Europe (CFPA-Europe) CFPA Europe. 2022. Fire safety in Camping Sites. CFPA-E Guideline No 20:2022. Link.*

[88] *Casartelli and Mysiak, 2023.*

[89] *Forest Europe. n.d. Policy Brief: Reducing Wildfire Risk in Europe through Sustainable Forest Management. Link.*

[90] *Berchtold (née Bach), C. 2025. "An Integrated Wildfire Risk Management Strategy for the EU: developing resilient landscapes and safer communities". Zenodo. Link.*

[91] *Casartelli and Mysiak, 2023.*

[92] *EC. 2018. Forest Fires: Sparking FireSmart policies in EU. Link.*

Box 4. EU-funded projects, such as Firelogue, can support harmonized governance and coherent cross-sectoral actions by sharing knowledge among policy makers, practitioners, and scientists.[93] Finally, the EU should fund, sustain, and promote reviews and peer reviews of wildfire governance frameworks to identify specific gaps and opportunities.

To address gaps related to the governance of wildfire risk reduction, several countries have developed agencies and mechanisms to promote policy alignment, collaboration, coordination, and knowledge exchange across all relevant stakeholders. This is an especially important legal backdrop for IWFRM that requires both horizontal and vertical policy cohesion.[94] These agencies can clarify roles and responsibilities throughout the wildfire management cycle, establish clear lines of communication, develop standard operating procedures and protocols, and formalize cooperation across sectors. This enables empowerment of all government agencies and levels, especially important for local governance, which can be more efficient in responding to fires at the WUI.[95] For example, use of the recently updated United Nations FAO guidelines to manage extreme wildfires can be an important and collective tool for improved IWFRM.[96] This can also improve transboundary cooperation and coordination for wildfire risk management.

[93] *European Union. Firelogue. Link.*
[94] *OECD 2023a.*
[95] *OECD 2023a.*
[96] *FAO of the UN. 2024. FAO Launches Updated Guidelines to Tackle Extreme Wildfires. Link.*

Box 4. Example of reforming wildfire governance approach

Following the devastating 2017 wildfires, Portugal reformed its wildfire governance by creating AGIF, an integrated agency coordinating prevention and response across sectors. *These reforms were supported by new legislation and a national strategy that have strengthened the country's institutional approach to rural fire management.*

After the wildfires in 2017, Portugal implemented institutional reforms to improve IWFRM. An integrated fire agency *(Agencia para a Gestão Integrada de Fogos Rurais*, AGIF) was created, which brought together 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 that creates the Integrated Management System for Rural Fires (SGIFR), which is legislation 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 the Council of Ministers, also included Portugal's strategy for rural fire management and rural fire protection.

See: Agencia para a Gestão Integrada de Fogos Rurais (AGIF) website, Link; and AGIF. 2020. National Plan for Integrated Wildland Fire Management. Link.

CROSS-BORDER COOPERATION AND KNOWLEDGE SHARING

There are opportunities to strengthen cross-border cooperation, particularly through the UCPM legal mechanisms. The UCPM has been effective in pooling resources for rapid response. EU Member States can enhance cooperation by participating in joint training, simulation exercises, and exchanging best practices on wildfire risk management across the different phases and elements of IWFRM (that is, not just the response phase). Portugal's National Plan for IWFRM provides clear guidelines on roles and responsibilities across government levels and offers a model for other EU Member States and UCPM participating states to follow.[97] Furthermore, teams of experts through the wildfire peer-review faculty of the UCPM can be made available to countries. To date, a UCPM PRAF has been conducted specifically for wildfires in Greece, Italy, and will be done in Brandenburg, Germany. In addition, knowledge transfer should be facilitated between countries with high wildfire risk and those with newer or growing wildfire risks, such as through transnational training and continuing research on wildfire risks.[98]

ENGAGEMENT WITH PRIVATE SECTOR AND LOCAL COMMUNITIES/ GOVERNMENTS

Enhancing collaboration with private landowners and communities in fire-prone areas can significantly reduce wildfire risks. This is important in countries like Portugal and Greece, but also others, where a substantial portion of forested land is privately owned. Encouraging active forest management through legal allowances that enable the state to carry out fuel management activities in forestlands where the owner is unknown or where owners fail to carry out requested fuel management efforts can reduce fire risk. This policy, known as 'forced tenancy', exists in Portugal, along with the Bolsa de Terras program that encourages public and private lands to be made available for lease or sale to facilitate their active management via agriculture, forestry, and silvopastoral activities.[99] A whole-of-community approach is needed in successful wildfire risk management, backed by enabling legislation, especially in areas of WUI. For example, in France, it is mandated for homeowners to cut vegetation within 50 meters of their property in areas designated as being at high risk of wildfire.[100] Empowering local communities to manage wildfire risks is critical for timely action, especially in response phases, as well as clarifying roles and responsibilities. Furthermore, facilitators or brokers at the community and sector levels could assist forest ministries, landowners, and other stakeholders in navigating funding processes and securing resources for fire prevention. For example, Spain's use of communal land ownership models has demonstrated how collective stewardship can enhance landscape management and resilience to wildfires. Research and development and innovation in the construction sector regarding improved fire-resistant design should also be undertaken with efforts to disseminate knowledge, backed by funding and ordinances.

FOCUS ON CRITICAL INFRASTRUCTURE

Due to the growing vulnerability of critical infrastructure, including energy, transport, water, and communication networks, it is important to implement preventive measures. These include fuel breaks, buffer zones, and vegetation management along with building flammability reduction for these assets. For example, Portugal's largest generator and provider of energy, *Energias de Portugal*, has developed its own wildfire risk reduction plan which includes interventions on fuel management, asset management, wildfire monitoring, and awareness-raising activities.[101] Non-binding recommendations on wildfire risk reduction also exist around some infrastructure assets in Portugal. For example, the National Communications Authority has issued a series of recommendations for the protection of electronic communications from wildfire risk. However, it is found that lower-voltage energy providers in dense networks have fewer wildfire preventive measures and actions than high-voltage providers. There is an opportunity for EU Member States and participating states to improve infrastructure resilience through the EU CER which provides important resources for assessing and improving the resilience of critical entities in Europe, whether they are publicly or privately owned[102]

[97] *OECD 2023b.*
[98] *Müller et al. 2020.*
[99] *OECD 2023a, 2023b.*
[100] *EC 2024e.*
[101] *OECD 2023b.*
[102] *European Environment Agency. 2024b. European Climate Risk Assessment. Link.*

WILDFIRE-RISK INFORMED LAND USE

Land use zoning informed by wildfire risk assessments has been used to reduce human and asset exposure to wildfire risk and should be applied in more EU and UCPM participating states. In France, for example, wildfire risk prevention plans regulate development in fire-prone areas. Furthermore, France bans development in areas where property protection is impossible and only allows it where exposure and vulnerability can be reduced through specific wildfire risk reduction measures. Additionally, building codes and standards for the development, upgrade, and maintenance of assets are important in particularly high wildfire risk areas. Legislation mandating structural protection measures and fireproofing in building design, including the use of nonflammable materials, has been successful in both Greece and Portugal. However, regulation and enforcement capacities for both zoning and building development must also be created, appropriately funded, and bolstered, especially in cases of informal developments due to housing shortages or tourist-activity purposes in the WUI.[103] EU Member States and UCPM participating states should employ the campsite and caravan guidance created by the European CFPA, and governments should provide the legislative backing, monitoring, and enforcement to ensure informal settlements inhabited temporarily or permanently are properly planned for through implementing safety measures like fuel breaks and fire breaks.[104]

In conclusion, a holistic, multi-risk, cross-sectoral approach is critical for developing an effective wildfire governance framework that contributes to building systemic resilience in EU Member States and UCPM participating states. The framework should identify and address linkages among key sectors, such as infrastructure, agriculture, and forestry, and also assess economic pressures that may lead to increased wildfire risk such as informal building in WUI areas. Finally, understanding all funding sources available to countries to prevent and respond to wildfires is critical and should be used at the national, subnational, and local levels. These can include EU funding instruments like the Resilience and Recovery Facility (RRF), Cohesion Policy Funds, Agriculture and Rural Development Fund, LIFE programme, and the Technical Support Instrument, the EU mission on Adaptation to Climate Change, and UCPM funding programs.[105]

[103] *OECD 2023a.*
[104] *CFPA Europe 2022.*
[105] *Casartelli and Mysiak 2023.*

Box 5. Lessons learned from the 2022 European Wildfire Season – Governance

- There is a need for better coordination among various funding mechanisms and stakeholders involved in IWFRM. This includes coordination within the Cohesion Policy framework, across different DGs of the European Commission, and with other relevant EU instruments like the Common Agricultural Policy (CAP) and the EU Forest Strategy.

- A centralized platform such as the Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO)'s Knowledge Network Platform should be established to provide comprehensive information about funding schemes and best practices. This would facilitate access to funding and promote a unified approach to wildfire risk management across the EU.

- DG ECHO should be adequately funded and resourced to effectively implement wildfire-related initiatives, including those focused on governance, prevention, and risk awareness.

- An EU-coordinated wildfire expertise team should be established to assess Cohesion Policy fund investments and ensure national agencies have access to wildfire expertise. This would help ensure that funding is allocated effectively and strategically based on wildfire risk.

- Enhanced cross-border intervention protocols and simplified chains of command are needed. Protocol revisions in Slovenia simplified cooperation between field operations and military forces, creating a direct channel to integrate emergency systems effectively.

- Tailored guidance should be provided to countries newly prone to wildfires to ensure they adopt effective strategies and learn from the experience of more fire-prone nations.

- The Dadia National Park fire in Greece highlighted the importance of dynamic and adaptable management plans and collaborative efforts of local authorities, conservation groups, and volunteers.

- The Germany-Czechia fire demonstrated the need for unified approaches to transboundary fire management.

Sources: Pronto et al. 2023. Forest Fires of Summer 2022 - Lessons to Draw from the Cohesion Policy Response. European Parliament, Policy Department for Structural and Cohesion Policies, Brussels. Link; European Commission, Joint Research Centre, M. Almeida, M. Soviev, J. San-Miguel, T. Durrant, D. Oom, A. Branco, et al. 2024. Report on the Large Wildfires of 2022 in Europe. Publications Office of the European Union, Luxembourg. Link, JRC138859.

UNDERSTANDING WILDFIRE RISK AND USE OF RISK DATA

This chapter examines current understanding of wildfire risks in the EU, particularly forest fires, which is informed by various sources of data and analysis, research and innovation, national risk assessments, and other risk evaluations. Wildfire risk is understood as the combination of fire hazard (for example, the frequency of wildfires occurrence, dry vegetation, extreme weather events), exposure (for example, the number of people exposed, the value of assets and ecosystems exposed), and vulnerability (for example, the susceptibility of assets to damage, depending on factors like building materials, land use, and preparedness level). It reviews how assessment results are communicated to stakeholders and the public.

CURRENT ARRANGEMENTS

The EU has facilitated knowledge sharing and created frameworks that enable countries to access and understand wildfire risks comprehensively. The EU has created tools and platforms for understanding risk in efforts to support EU Member States and participating states and their wildfire risk management. Wildfire risk information is categorized into three key types to clarify its uses and further explained in the following section:

- **Fire Danger Forecasts**: These forecasts, such as those provided by the European Forest Fire Information System (EFFIS) focus on fire weather and climate conditions, predicting days or weeks in advance. The primary use is for early warning and preparedness. This type of information is well developed in Europe.

- **Real-time Fire Spread Modeling and Insights**: Systems like Copernicus EMS provide real-time insights into fire spread and other crucial information. These are vital for operational support and response efforts. This type of information is growing in Europe, and an example is that of Portugal's national electricity and gas transmission system operator, Rede Electrica Nacional (REN), which has developed a network of multi-sensorial monitoring systems for automatic wildfire detection. This system includes a Decision Support System (DSS) that simulates fire spread and alerts where and when it will impact electric or gas infrastructures.[106]

- **Long-term Wildfire Risk Assessment**: These assessments that are conducted annually or over decades incorporate climate projections and are used for long-term planning, adaptation, and risk reduction strategies. This type of information is the least developed among EU Member States.

EFFIS is a key tool for assessing and monitoring wildfire risks.[107] It provides a hub for data and information on forest fires in Europe and is managed by the Joint Research Centre (JRC) as a component of the Copernicus Emergency Management Services (EMS). EFFIS provides near-real-time data on fire activity, fuel loads, and weather conditions across Europe. It also provides historical information on forest fires and forest fire regimes in Europe, the Middle East, and North Africa. Such information is critical for Member States and participating states to plan, prevent, prepare, and respond to wildfire risk through its application in early warning. EFFIS is also used to promote cross-border cooperation by providing a pan-European overview of wildfire activity.[108] The Global Wildfire Information System (GWIS), an initiative from GEO and Copernicus, is another tool which unites existing data at global and national levels.[109]

The Risk Data Hub (RDH) developed by the JRC is another key platform for understanding disaster risks, including wildfires. It hosts and provides access to various geospatial data through its ATLAS, including hazard, exposure, and vulnerability. While risk calculation is still under development, the RDH aims to improve transparency and accessibility of data for a better understanding of wildfire risk across the EU. The JRC also collects data from Member States in developing the risk assessments. However, many countries are several years

[106] *Renewables Grid Initiative. N.d. Decision Support System – Increasing Infrastructure Resilience to Wildfires. Link.*
[107] *EC. 2018. Copernicus Emergency Management System - European Forest Fire Information System. Link.*
[108] *Oom et al. 2022.*
[109] *Global Wildfire Information System (GWIS) Link*

behind in having the necessary data to create a comprehensive risk assessment. Wildfire management is often regionalized within countries which makes harmonization efforts difficult and slow. The most comprehensive and standardized data comes from EFFIS.

The Copernicus EMS provides a mapping component to mainly civil protection authorities and humanitarian aid agencies with maps based on satellite imagery. It is also implemented by the JRC.[110] Mapping is based on satellite imagery and can be combined with other data sources such as digital feature sets in a Geographic Information System (GIS) to support geospatial analysis and in situ observations, and to provide assistance in decision-making processes for emergency managers. Data used from the Copernicus EMS can be used for all phases/aspects of emergency management from prevention, early warning and risk preparedness, prediction, disaster risk reduction, emergency response, and recovery. The JRC works with DG ECHO to understand analytical forecasts during fire seasons in Europe to assist in operational decision support and strategic asset deployment.

The European Climate Adaptation Platform, Climate-ADAPT, is a partnership between the European Commission and the European Environmental Agency. Climate-ADAPT is maintained by the European Environmental Agency with the support of the European Topic Centre on Climate Change Impacts, Vulnerability, and Adaptation. It includes expected climate change information in Europe, along with current and future vulnerability of regions and sectors. It also provides adaptation case studies and potential adaptation options at the EU, national, and transnational levels.[111] The EU Climate Risk Assessment has provided baseline risks in Europe on which member countries can build their national assessments. Furthermore, the EU JRC manages a Risk Data Hub, a multi-hazard Geo-portal that hosts, curates, and disseminates data, tools, and methodologies for risk assessment. It aims to map loss and damage from natural disasters primarily through a GIS web platform and is intended to improve access and sharing of curated European-wide risk data, tools, and methodologies for fostering DRM-related actions.[112]

Other EU-funded operational projects for wildfire protection include the SAFERS project, which is a wildfire emergency management system using Copernicus information. It uses crowdsourced da-ta from social media and other apps that can be used by citizens and first responders to provide situational, in-field information.[113] FIRE-RES is another project designed to promote the implementation of more holistic fire management approaches by integrating research, technology, civil protection, policy, and governance spheres related to wildfires.[114] FirEUrisk develops, evaluates, and disseminates a science-based integrated fire management strategy that expands wildfire risk assessments, produces measures to reduce current fire risk conditions, and promotes adaptation strategies considering socioeconomic changes and future climates.[115] Firelogue created a diverse network at EU level of different stakeholders, from scientists to civil society, to create integrated solutions for fire management.[116] Finally, the TREEADS project focuses on the forests at risk of wildfire and brings together research institutes and companies from 14 EU countries and Taiwan. The project uses AI-based techniques to help fire prevention, suppression, and preparedness.[117] The IWFRM Strategy for the EU also mentions as a proposal the establishment of a European Technical Working Group on data-driven Decision Support Systems (DSS) focused on AI and Machine Learning. This working group can research, adapt, and scale the most recent developments and provide suggestions for data curation and harmonization.[118]

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[110] *Programme of the European Union. 2024. Copernicus. Link.*
[111] *European Union. n.d. Climate-ADAPT. Link.*
[112] *EC. n.d. DRMKC- Risk Data Hub. Link.*
[113] *SAFERS. n.d. Structured Approaches for Forest Fire Emergencies in Resilient Societies. Link.*
[114] *Fire-Res. n.d. Fire-res. Link.*
[115] *FirEUrisk. n.d. Dissecting Risk to Prevent Extreme Wildfires: A Unified European Response to an Increasing Hazard. Link.*
[116] *Firelogue Link.*
[117] *TREAADS. n.d. TREEADS. Link.*
[118] *Berchtold (née Bach), C. 2025.*

Box 6. Example of efforts to improve understanding of wildfire risk – Greece

Greece is advancing wildfire risk assessment through national and subnational hazard mapping and vulnerability analysis under different climate scenarios. *Efforts like the LIFE AdaptinGR project also support public awareness campaigns that enhance preparedness and resilience.*

The production of wildfire hazard projection and mapping efforts at the national and subnational levels under different emission scenarios, as well as the in-depth assessment of exposure and vulnerability in selected areas, are examples of wildfire risk assessments undertaken in Greece. The country has also taken steps to improve public awareness of wildfire risk through the launch of various awareness-raising campaigns and guidelines. The LIFE AdaptinGR project plays a significant role in both wildfire risk assessment and awareness raising going forward.[126]

National efforts toward improved understanding of wildfire risk. In Portugal, there are efforts under way to develop a national wildfire risk map as the absence of such a tool was identified as a key challenge to effective wildfire management.[119] Another example is in the Attica region of Greece, where a comprehensive wildfire risk assessment was undertaken that considered hazard, vulnerability, and exposure in selected high-risk areas, with projections available at the neighborhood level (see Box 6).[120] European efforts like FirEUrisk and the JRC Pan-European Wildfire Risk Assessment (EWRA) provide methodologies for understanding wildfire risk, often resulting in a fire risk index.[121] However, these indices can have limitations for specific uses such as insurance and sector prioritization, and the economic value of nature is difficult to fully quantify in loss calculations.

Given the importance of including projections into risk data and risk assessment efforts, the Portuguese Environmental Agency is working on updating the downscaled projections of climate-induced wildfire risk and providing guidance on how best to integrate these into risk maps, planning tools, and ultimately the land-use planning process.[122] In recent years, Italy made progress by implementing integrated wildfire management, shifting focus from response to other phases of tackling wildfire risk. The final output has focused on creating and building communities that are resilient to wildfire disturbance.

KEY CHALLENGES

Methodologies for risk identification and risk analysis vary across countries and by type of risk and there are no widely accepted wildfire risk assessment frameworks. Only a handful of countries mention temporal horizons for risk scenarios, which limits the understanding of how and to what degree important drivers such as climate change are being taken into account for wildfire hazards.[123] A review of existing, current, and available national risk assessments that include wildfire risk analyses indicates that the quality of data and analysis for many EU countries varies greatly. Few countries have strong scenario-based assessments along with integration of projections, while most countries have moderate to low wildfire data and risk analysis and have weak alignment with DG ECHO's wildfire peer review assessment program recommendations.[124] Probabilistic wildfire modeling for risk assessments, including current and future scenarios, is a good practice yet requires technological infrastructure, advanced analytical tools, and specialized expertise. As a result, it remains an example of best practice for an advanced risk assessment that is challenging for many countries to adopt and is relatively rare in national risk assessments.[125] This also relates to challenges of capacity for authorities mandated to conduct national risk assessments. Many public officials, planners, forest managers, or civil protection staff who are involved in developing the National Risk Assessments (NRAs) or incorporating the findings into current plans and processes find difficulty in doing so adequately due to capacity limitations.

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[119] *OECD 2023b.*

[120] *OECD 2024.*

[121] *ECHO. 2024. Wildfire Peer Review report Greece Link.*

[122] *OECD 2023a.*

[123] *EC 2024c.*

[124] *Casartelli and Mysiak 2023.*

[125] *Fiorucci, P., U. Pernice, G. Meschi, A. Trucchia, and E. Ponte. 2024. Technical Guidelines for Forest Fire Risk Assessment: An Output of the Programme "EU Support to Flood Prevention and Forest Fires Risk Management in the Western Balkans and Turkey – IPA Floods and Fires." Link.*

[126] *OECD. 2024.*

One of the major gaps in understanding wildfire risk across the EU is the lack of integration between wildfire risk assessments and long-term projections.[127] Extreme wildfires are predicted to increase by 14 percent by 2030 and 50 percent by 2100.[128] Climate change has altered temperatures, precipitation, lightning and wind patterns, the occurrence of heat and drought extremes, and vegetation cover. These changes are projected to continue under future changes in the climate, which will affect fuel conditions and ignition likelihood. Therefore, it is important to consider the impacts of future changes in the climate within wildfire hazard models.[129] While research on how different scenarios affect weather indices in Southern Europe has advanced, more efforts are needed to better reflect the latest scientific understandings on links between changes in the climate and future wildfire activity in risk assessments.[130]

Several challenges remain in reporting and data collection for wildfires in Europe. Although EFFIS requires EU Member States to provide updates on fire emergency and response-related information, there is no legal mandate for countries to provide consistent information on fatalities, building losses, insurance against fire damage, or prescribed or mild fires. This creates difficulty in understanding baseline losses and resilience.[131] Furthermore, only a few countries cover the complex interactions between 'natural' and 'man-made' disaster risks by taking complex, compound, and cascading effects into account in their risk assessments. This is relevant for wildfires in understanding how human-caused ignitions may occur and how cascading impacts, such as wildfire-induced landslides, can be a possibility in estimating and anticipating risk.[132] Additionally, a major challenge is the reluctance of critical entities to share sensitive data on incidents and vulnerabilities in reference to the CER as well as member state resilience and emergency planning.

A further limitation is the prevalent use of risk indices such as those from the JRC study and FireRiskEU in place of more direct decision metrics. Focusing on indices rather than quantifiable measures of losses such as causalities, evacuations, damage to property and infrastructure can hinder effective advocacy, planning, and decision-making processes. Additionally, current economic evaluations of wildfire damage significantly underestimate the true cost of losses. This underestimation stems from inadequate inclusion of natural capital losses and the long-term economic consequences of wildfires. Additionally, there is limited research and understanding of human-caused ignitions which are the majority of ignition types in Europe. The lack of robust data and modelling that includes human factors can hinder effective risk reduction strategies. Finally, the absence of standardized nomenclature and models for wildfire vulnerability represents a major obstacle. Unlike established frameworks for other hazards such as GEM for earthquakes, the lack of a common language and modeling approach for wildfires can impede comprehensive understanding of wildfire risk and subsequently reduce effective opportunities for wildfire mitigation strategies.

While the increased availability of geospatial data over time has helped to better understand, model, and map wildfire hazards, drivers, and behavior over time, hazard assessment alone is not sufficient to provide a comprehensive assessment of wildfire risk. Exposure and vulnerability are also necessary for understanding risk and must be integrated with spatial hazard information. In many cases, embedding socioeconomic information in wildfire risk assessments remains a challenge and is not developed systematically by most countries.[133] Limitations in the availability and quality of historic wildfire records, as well as inconsistencies within and across datasets, can reduce the predictive capacity of wildfire models. For example, each country can have its own way of describing wildfire data, which are gathered from different sources, making comparisons difficult.[134] Data availability and quality such as fuel cover as well as knowledge gaps on the complex interactions of wildfire drivers such as fire-vegetation and fire-weather feedback limit the comprehensiveness of risk models.[135] Furthermore, the erosion risks following wildfires are not compre-

[127] *OECD 2023a.*
[128] *Held, A., L. Pronto. n.d. Reducing Wildfire Risk in Europe through Sustainable Management. Policy Brief. Forest Europe. Link.*
[129] *IPCC. 2020. Special Report on Climate Change and Land. Link.*
[130] *EC 2024c.*
[131] *Firelogue, Fire-Res, Treeds, Silvanus. n.d. Green Deal Wildfire Risk Management Targets.*
[132] *EC 2024c.*
[133] *OECD 2023a.*
[134] *Firelogue, Fire-Res, Treeds, Silvanus, n.d.*
[135] *OECD 2023a.*

hensively understood. While this phenomenon may be a lower risk in Northern Europe, degraded soils in Mediterranean regions face higher erosion risks, especially when combined with intense rainfall, and must be appropriately modeled and understood. Erosion following wildfires, as well as ash deposits, can lead to water contamination, which is a significant concern in many European regions. Severe fires can increase this contamination risk and must be appropriately planned for in management plans for fire risk reduction. FirEUrisk is now expanding information on erosion risk and water contamination following fires.

Modeling and mapping wildfire risk at the subnational level is a challenge given resource and capacity constraints as well as data gaps, such as the lack of disaggregated or appropriately downscaled data. Additional challenges include the lack of use of more technically advanced models for wildfire projections as well as the level of uncertainty in existing projections.[136] Despite increasing impacts from wildfires, there is currently no publicly available probabilistic risk model for wildfires in Europe, although several are currently under development with multiple providers.[137] Sophisticated models for wildfire hazards require high-resolution, up-to-date spatial information, such as on available fuel and weather conditions, which can be resource intensive.[138] Probabilistic models that do exist at an academic level fail to account for Europe's fragmented landscapes and diverse fuel types. Many existing models are calibrated for North American or Australian conditions, which limits their predictive capacity in European contexts.

KEY OPPORTUNITIES

Opportunities to improve the understanding of risk for wildfires include integrating projections, adopting multi-hazard risk assessments, and improving data collection, dissemination, and harmonization. These are in line with the findings of the review of the European Parliament of lessons learned from the 2022 wildfire season summarized in Box 7.

Improving data collection, dissemination, and harmonization: Risk Data Hub and other Climate-ADAPT initiatives should continue to be supported and expanded upon for robust historical and future data in European regions. Such platforms can improve understanding of wildfire risks by providing access to detailed loss data and enabling improved decision-making for prioritized adaptation and risk reduction.[139] Additionally, the Pan-European Wildfire Risk Assessment developed under EFFIS offers a useful framework that can be downscaled to national and subnational levels to provide more tailored risk assessments. Additionally, AI is currently used in classification for burned area detection and in the future can potentially include dynamic and structural risk assessments with higher resolution, even down to the community level. There are also opportunities to use AI to replicate conditions from past fires to simulate fire behavior and typology in real time. Considerations by JRC for the future of wildfire risk is to include dynamic and structural risk assessments with higher resolution, potentially down to the community level. Furthermore, these platforms can serve as peer-to-peer learning networks for countries undertaking fire risk analysis and assessments as well as technical expertise. FirEUrisk is also improving data on European landscapes to enhance modeling and knowledge on comprehensive wildfire risk in the EU[140]. Additionally, PESETA V could serve as an opportunity for improving wildfire risk projections in broader climate contexts. Furthermore, ministries can work directly with planners to obtain data needed for various directives and resilience planning, especially in relation to critical entities.

Undertaking multi-hazard risk assessments: Multi-hazard and cascading hazard assessments are critical for understanding comprehensive wildfire risk as ignition types for wildfires can vary in type and location. Cascading and secondary hazards such as wildfire-induced landslides and floods are also essential for preparedness. These should include, but not be limited to, erosion risks, water contamination risks, and air quality contamination action plans post-fire.

Integrating climate projections: Including long-term projections into national and EU-wide wildfire risk assessments is important in understanding

[136] *OECD 2023a.*
[137] *World Bank 2024.*
[138] *OECD 2023a.*
[139] *EC 2024e.*
[140] *Fire-Res. 2022. FirEUrisk and FIRE-RES: Sharing Knowledge on How to Map Fuel Availability at the European Level. Link.*

growing wildfire risk. Successful examples of such information can be seen in Greece, which has included future projections into models and tools, including different emissions pathways (LIFE AdaptinGR project). These maps are scaled at the national and subnational levels and include in-depth assessments of exposure and vulnerability in selected areas.[141]

Box 7. Lessons learned from the 2022 fires in Europe: Understanding wildfire risk

The 2022 Spanish fires highlighted the importance of historical forest management data in identifying areas with lower post-fire severity, aiding more effective wildfire response and planning.

The Spanish fires underscored the significance of historical forest management data. Knowing where areas have better-maintained historical data and therefore have lower post-fire severity improves forest fire management.

Sources: European Commission et al. 2024; Pronto et al. 2023.

[141] *OECD 2024.*

WILDFIRE RISK PREVENTION, REDUCTION, AND MITIGATION

This chapter examines preventive measures designed to reduce wildfire risks and mitigate the negative consequences for people, the environment, property, and cultural heritage. It analyzes the framework for implementing preventive measures, including landscape management practices, fire use regulations and enforcement, innovation and knowledge services, and risk communication strategies.

CURRENT ARRANGEMENTS

Wildfire risk prevention, reduction, and mitigation strategies at the EU level are supported by several policies, frameworks, and funding mechanisms. The following describes wildfire risk reduction focusing on structural and nonstructural measures, NBS, ecosystem-based approaches, and innovation in services. Figure 10 shows how preventive measures can include structural or physical measures that manage fuel loads and continuity, including fuel breaks, buffer zones, prescribed fires, ecosystem protection, restoration, and adaptive management.[142]

POLICY ARRANGEMENTS FOR RISK PREVENTION, RISK REDUCTION, AND MITIGATION

The EU Forest Strategy for 2030 emphasizes sustainable forest management, including reducing fuel loads through controlled burns and vegetation management. It aims to move from simple fire suppression to effective prevention of wildfires and is part of the European Green Deal and builds upon the EU Biodiversity Strategy for 2030. The Forest Strategy focuses on the following: strategic forest monitoring, reporting and data collection, developing a research and innovation agenda on forestry knowledge, and implementing an inclusive EU forest governance framework. The Sendai Framework for Disaster Risk Reduction also has a critical role in guiding wildfire prevention and mitigation within EU plans. Sendai Framework for Disaster Risk Reduction urges signatory countries[143] EFFIS is a central platform for gathering and disseminating information on wildfires in Europe and plays an important role in shaping policies and practices for risk reduction[144]

Furthermore, the European Commission's Wildfire Prevention Action Plan was developed after the 2022 wildfire season to better manage forests and landscapes and their ignition potential (Table 1**).** It also complements preparedness efforts under rescEU and will build on other EU initiatives, such as the EU Forest Strategy. The 10 action items are organized into three themes: (1) improved capacity to prevent wildfires, (2) improved knowledge of wildfires for prevention, and (3) increased financing for wildfire prevention actions. The plan will be taken forward through dialogue and cooperation with Member States with a clear legal base and proposed deliverables. The actions are listed in Table 1.

The EU also supports and complements prevention efforts by focusing on areas where a joint European approach is more effective than separate national actions, for example, in cases of cross-border coordination. These can include risk assessments to identify disaster risks across the EU to encourage wildfire resilience. As both national and regional authorities near the location of risk can support wildfire prevention, preparedness, and response activities, the EU is able to co-finance and coordinate further support when needed.[145]

At the EU level, funding for wildfire prevention has increased due to a new body of EU policies on climate change and risk prevention. For example, since 2020, the Agriculture Fund has allocated a larger percentage of funding to EU territories prone to wildfires. The RRF for

[142] *OECD 2023a.*
[143] *EC. 2023c. EU Reaffirms Support at Sendai Framework for Disaster Risk Reduction Midterm Review. Link.*
[144] *EC. European Forest Fire Information System (EFFIS). Link.*
[145] *EC 2023d.*

Figure 10. Reducing the risk of extreme wildfires through prevention measures

Source: OECD 2023a.

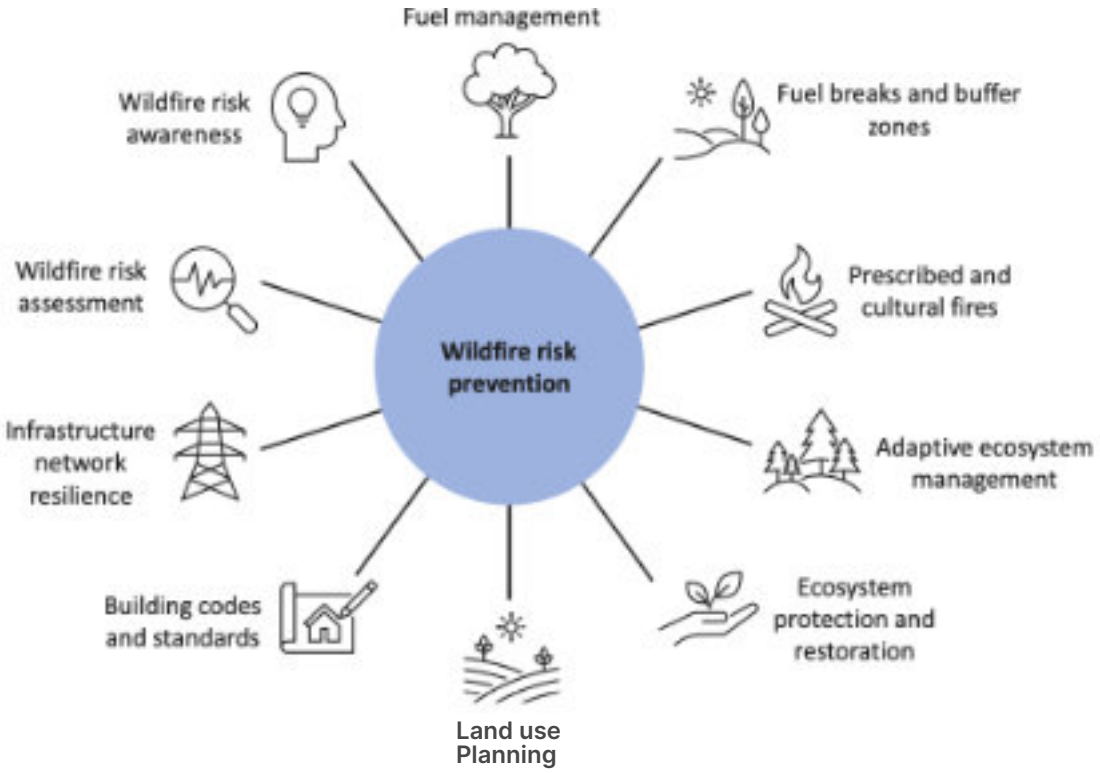

Table 1. Wildfire Action Plan 2022, European Commission

Source: European Commission. 2022. Overview of the Wildfire Prevention Action Plan. Link

Improved capacity to prevent wildfires	Strengthen capacity building through targeted peer reviews on wildfire prevention and preparedness.
	Develop disaster scenarios including wildfires and develop specific wildfire prevention disaster resilience goals.
	Create a good practice guide on wildfire prevention, with national civil protection and forest management experts building on other EU policies and existing guidance and recommendations.
	Share good practices on raising wildfire risk awareness to enhance prevention, followed by development of a good practice guide on disaster risk awareness, public information, and education to further enhance citizen protection, preparedness, and prevention
	Develop new wildfire risk awareness and communication actions at the EU level.
	Launch a dialogue process with MS on wildfire disaster prevention with recurrent UCPM activations for wildfires.
Improved knowledge on wildfires for increased prevention	Model the economic and geographic impact of predicted future wildfires to better understand and plan for the future financial needs for response and prevention.
	Improve the assessment and mapping of wildfire risk, taking a multi-hazard approach and climate scenarios into account, and encourage improved collection of data on past disaster events
Increased financing of wildfire prevention actions	Encourage the use of UCPM prevention and preparedness funding instruments for national, cross-border, or pan-European projects to support wildfire prevention and improve the uptake of good practices
	Encourage further use of EU funds for investing in wildfire prevention and analyze the current uptake of EU funds for DRM.

funding forestry-related risks, including wildfires, has also increased.[146] EU-funded projects that support wildfire prevention include the TREEADS project, which focuses on forests at risk of wildfire. The project brings together research institutes and companies from 14 EU countries and Taiwan and is using AI-based techniques to help fire prevention, suppression, and preparedness to support integrated wildfire management.[147] Another is the FIRE-RES project, which is designed to promote the implementation of a more holistic fire management approach through innovative technological and socio-ecological-economic solutions. It integrates research, technology, civil protection, policy, and governance spheres related to wildfires to develop knowledge on sustainable fire management models.[148]

Fuel treatment is increasingly recognized by Member States as an important measure for wildfire prevention, including in areas adjacent to critical infrastructure. The EU-funded FirEUrisk project has developed a Framework for Reduction of Operation-based Ignitions, which supports the identification and prioritization of vulnerable areas for fuel treatment along linear and point infrastructures such as electricity networks. The framework is intended for operational use by infrastructure operators in coordination with local authorities to guide vegetation management activities as part of broader prevention strategies. In several Member States, discussions are also taking place around the cost and resource implications of implementing targeted treatments in high-risk zones.

MEMBER STATES' PRACTICES FOR RISK REDUCTION, PREVENTION, AND MITIGATION OF WILDFIRES

Structural measures such as firebreaks, fuel management, and building regulations are critical for the protection of communities from wildfires. For example, Portugal's National Plan for Integrated Wildland Fire Management underscores the need for a comprehensive approach to wildfire risk reduction which includes both structural measures, such as creating protection zones, and nonstructural measures such as community awareness and preparedness programs.[149] In addition, after the devastating fires of 2017 in Portugal, the country has boosted public funding available for wildfire prevention. This has brought prevention and suppression funding to near parity. In 2017, only 20 percent of wildfire management funding was allocated to prevention. By 2021, that amount had increased to 46 percent of public funds from a greater overall budget earmarked for prevention.[150] Another example of structural measures is that taken by the Spanish National Forest Law, which establishes that when high or extreme fire risk is foreseeable in a certain territorial area, communities must apply bans and restrictions, including the use of machinery and equipment whose operation could cause a fire.[151]

Some countries have also scaled up efforts to ensure adaptive management of forests to reduce landscape flammability by employing NBS and ecosystem-based approaches. The EC defines NBS as solutions that are "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."[152] Examples of NBS include traditional grazing, forestry practices, and crop mosaics (see Box 8).

[146] *OECD 2023b.*

[147] *EC. 2024d. A Holistic Fire Management Ecosystem for Prevention, Detection, and Restoration of Environmental Disasters. Link.*

[148] *EC. 2024g. Innovative Technologies and Socio-Ecological-Economic Solutions for Fire Resilient Territories in Europe. Link.*

[149] *AGIF 2020.*

[150] *OECD 2023b.*

[151] *Arbinolo et al. 2024.*

[152] *Casartelli and Mysiak 2023.*

Box 8. Examples of Nature-based solutions and ecosystem-based approaches for fire risk reduction

European countries are adopting diverse, locally tailored wildfire prevention strategies – from Portugal's promotion of native species and fuel mosaics to Spain's use of recycled water for green firebreaks and grazing-based fuel management. Programs in Türkiye, Italy, and the UK emphasize strategic zoning, community engagement, and forest planning to reduce landscape flammability and enhance wildfire resilience.

Portugal: The extent of eucalyptus forests, which are highly flammable, grew over the previous two decades. To address this issue, the country developed a financial scheme to promote the planting of native species on private lands to reduce landscape flammability. The use of strategic networks of fuel breaks and alternating and differing land covers, known as fuel mosaic areas, has significantly reduced landscape flammability and supported emergency response operations.[153]

Türkiye: Establish fire-stopping zones and separation zones based on different types of areas, for example, fire-stopping zones in young and fire-sensitive forests, separation zones between settlements and forest areas, or between agricultural land and forested areas.[154]

Italy: The ABCD program is an innovative fire prevention program through strategic fuel management involving private owners and citizens which is also a good example of IWFRM.[155]

Spain: The RAPCA program directed by the General Directorate of Management of the Natural Environment, is a payment reward scheme for shepherds who engage in biomass control and fuel break maintenance; dry vegetation and fuel management by grazing animals in wildfire-prone areas.[156] Additionally, Spain's 'Ramats de Foc' (Fire Flocks) project enhances wildfire prevention by employing targeted livestock grazing in strategic forest areas to manage vegetation and reduce fuel loads.

Spain: About 80,000 cubic meters of annual recycled water from the urban wastewater treatment plant is available in the Riba-Roja de Túria municipality in Spain to improve the ability to cope with forest fires. This recycled water is used to make transitional 'green belts' around the urban area ("green firebreaks") to act as firebreaks and prevent the advancement of fire in the urban-forest interface area.[157] The recycled water is also used for response and is part of the GUARDIAN project aimed at increasing the Spanish municipalities' resilience against the risk of forest fires through the implementation of green urban actions.[158]

United Kingdom: The practice Guide "Building wildfire resilience into forest management planning" supports UK Forestry Standards by setting out good case planning and practice. The guidance helps to reduce both the likelihood of wildfires occurring and the severity of damage and impact on people and the environment. It is focused on forests and woodlands in the UK and promotes appropriate fire prevention regimes that can be used in operational phases, such as in fire suppression, so that they benefit from proper design of forest management planning. The guide highlights the importance of prevention to reduce the impact of wildfire and improve response and recovery.

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[153] *OECD 2023b.*
[154] *World Bank and European Commission 2024.*
[155] *Ibid.*
[156] *Ibid.*
[157] *European Union. 2024c. Building Fire Resilience Using Recycled Water in Riba-Roja de Túria, Spain. Link.*
[158] *European Union. n.d. Guardian: Green Urban Actions for Resilient Fire Defense of the Interface Area. Link.*

Funding for NBS at the EU level includes the CAP, which provides funding for farmers to implement a variety of practices, including those for environmental protection.[159] The RAPCA program mentioned above is one that could be considered a type of NBS that is potentially eligible for CAP funding. The LIFE Programme funds environmental and action projects, including forest monitoring, information systems, and preventing forest fires.[160] The Cohesion Fund could support EU Member State**s** with investments related to the environment and climate change, as well as the European Regional Development Fund, which invests in a variety of areas including adaptation**.**[161] The European Agricultural Fund for Rural Development (EAFRD) may emphasize and direct the use of adapted and resilient agricultural measures in fire prone areas. The Interreg Programmes fund cross-border cooperation projects, some of which may include NBS for wildfire risk reduction, as they allow for multi-level participation.[162]

KEY CHALLENGES

While there is recognition of the need to invest in wildfire risk prevention, the increase in available funding has mostly been used to strengthen emergency response capacities. In many countries prone to wildfires, institutional frameworks and incentives remain heavily predisposed to emergency response, and countries struggle to develop more prevention-oriented strategies and to obtain related funding.[163] Spending on wildfire suppression remains up to six times higher than funds allocated for prevention. This structural funding imbalance has been exacerbated by frequent 'fire borrowing', which is the diversion of funds earmarked for wildfire prevention to fund emergency response and recovery. This furthers the gap between funding for prevention and suppression.

There are challenges in scaling up and monitoring adaptive forest management and green/NBS.[164] The potential and success of NBS are highly location-based and dependent on physical constraints and the severity of scenarios. Widespread implementation of NBS is therefore limited due to high management costs, lack of knowledge, undervaluation of nature, and a low level of consideration of species shifts in current conservation policies.[165] Furthermore, NBS are complicated by fragmented land ownership, including small private forest owners, communal forests, and state lands. This fragmentation results in a lack of consensus on fire prevention strategies, with many stakeholders viewing NBS as economically unviable for forestry enterprises. In addition, many rural communities feel unsupported in wildfire management, lacking resources and guidance. Such disconnectedness undermines the local capacity to prepare and respond effectively to fire risks and proactively manage landscapes. There are significant gaps in the data available for NBS projects in the EU, which makes it difficult to draw definitive conclusions about the scale of investment and the specific funding mechanisms used.[166] In addition, prescribed burning as a land management solution is hindered by a lack of trained personnel, regulatory barriers, and insufficient public support. Amenability to prescribed or mild burns depends highly on national priorities and cultural sensitivity, and in some regions, this tool is seen as disruptive to ecosystems rather than beneficial for creating resilient landscapes. An evaluation of where mild burning is appropriate as a tool for fuel management is important for seasonal fire prevention. For example, in land and forest areas of Northern Europe, mild burning may truly be disruptive to ecosystems and therefore, prescribed burns should not be an overgeneralized tool.

KEY OPPORTUNITIES

Increased prioritization of funding for wildfire prevention measures is needed to achieve parity with response funding. This can include investment in structural and nonstructural prevention and risk reduction measures and can include near-term and future-term climate impacts of wildfires in EU countries. The European Green Deal has allocated over €60 million to projects focused on wildfire risk

[159] *European Union. 2020. Land-Based Wildfire Prevention. Link.*
[160] *EC. n.d. LIFE Programme. Link.*
[161] *Pronto et al. 2023.*
[162] *European Union. 2017. Ideas for Interreg post-2020: Cross-Border Programmes. Link.*
[163] *OECD 2023a.*
[164] *OECD 2023a.*

management.[167] These include the FIRE-RES, FirEUrisk, and SILVANUS projects, which are piloting innovative technologies like big data, AI, and remote sensing to improve early detection and preventive actions. Furthermore, Firelogue is a platform for cross-border and interdisciplinary exchange that will help preventive and response measures. Other projects include Wildland-Urban Interface Fire Touristic Infrastructure Protection Solutions, TREEADS, and ResAilience on agriculture, forestry, and agro-forestry. Implementing and scaling up these efforts across EU Member States presents an opportunity for more data-driven and efficient wildfire prevention systems. Wildfire risk management targets and the ways to achieve them are complex and engaged processes that may not be viable given contextual factors of culture, governance, and legal systems. For example, prescribed burns for wildfire risk reduction require multi-stakeholder discussions and the appropriate policy and legal structure to implement.[168]

Strengthening the tracking and analysis of wildfire-related expenditures presents a key opportunity to align financial decision-making with risk reduction goals. A recent World Bank-led survey presented at the 49th meeting of the Expert Group on Forest Fires in December 2024 found that most EU Member States cannot readily determine how much they spend on wildfire management or evaluate the impact of that spending.[169] These limitations stem from fragmented institutional responsibilities, inaccessible or inconsistent data, and varying definitions of budget categories, making it difficult to assess whether current investments are achieving intended outcomes. Therefore, better tracking and follow-up of funding for wildfire mitigation can improve overall financial effectiveness for wildfire risk management.

Promoting ecosystem and nature-based solutions (NBS) with multi-level application can reduce wildfire risk and have significant co-benefits. FireSmart initiatives that focus on forest management, such as thinning and planting native species, can enhance resilience to wildfires while also supporting biodiversity.[170] For example, the pilot scheme of payment-for-ecosystem-services sets out reward mechanisms to encourage the plantation of native species on private rural lands to reduce landscape flammability.[171] This type of program can be scaled and adapted at various national and subnational levels. Another solution is 'close-to-nature' (CNF) forest enterprises, as seen in some Alpine regions in Europe, which promote natural regeneration and species diversity that create microclimates that can delay forest fire severity.[172] Such an approach also supports sustainable forest practices that can balance economic and resilience objectives.

Fire regulations often differ in nature-protected areas and natural heritage sites compared to the rest of the territory, which can include limitations on suppression methods or specific rules for activities within these zones, as seen in national parks in Germany.[173] The need for specific fire management guidelines tailored to the conservation goals of these areas is also recognized. Further, post-fire effects should also be considered for land management, including altered energy and water exchanges and the need for climate-smart reforestation prioritizing native species. Further, changing drainage practices to facilitate sustainable restoration can improve soil moisture and can therefore reduce wildfire risks. Rewilding efforts and conservation efforts in the EU, such as the REWET project, should not only be considered for wetland restoration and GHG reductions but also for the capacity to improve drainage and reduce wildfire risks.[174]

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[165] *European Environment Agency. 2023. Scaling Nature-Based Solutions for Climate Resilience and Nature Restoration, EEA Briefing No 21/2023. Link.*

[166] *European Investment Bank and European Commission. 2023. Investing in Nature Based Solutions. Link.*

[167] *Firelogue, Fire-Res, Treeds, Silvanus, n.d.*

[168] *Firelogue, Fire-Res, Treeds, Silvanus, n.d.*

[169] *EC. 2024h. 49th meeting of the Expert Group on Forest Fires. Link.*

[170] *EC 2018.*

[171] *EC. 2021b. Communication from the Commission to European parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: New EU Forest Strategy for 2030. Link.*

[172] *Blattert, C., S. Mutterer, T. Thrippleton, J. Diaci, G. Fidej, L.G. Bont, and J. Schweier. 2024. "Managing European Alpine forests with Close-to-Nature Forestry to Improve Climate Change Mitigation and Multifunctionality." Ecological Indicators 165: 112154.*

[173] *Pronto et al. 2023. Research for REGI Committee – Forest Fires of Summer 2022, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels. Link.*

[174] *European Union. n.d. How We Recover Wetlands to Reduce CO_2. Link.*

Figure 11. Public Investments in prevention and suppression in France, Greece, and Spain

Source: OECD (2023). Taming Wildfires in the Context of Climate Change. OECD Publishing. Adapted from WWF. (2019). The Mediterranean Burns. World Wildlife Fund (WWF). Link. Notes: Information on Spain is based on data from the Spanish Official School of Forestry Engineers and refers to the period 2008-2017. It includes state and regional investment, as regional governments share competences in forest management. Information on France is based on data from the National Institute of Geographic and Forest Information and refers to the period 2009-2018. Information on Greece is based on WWF estimation.

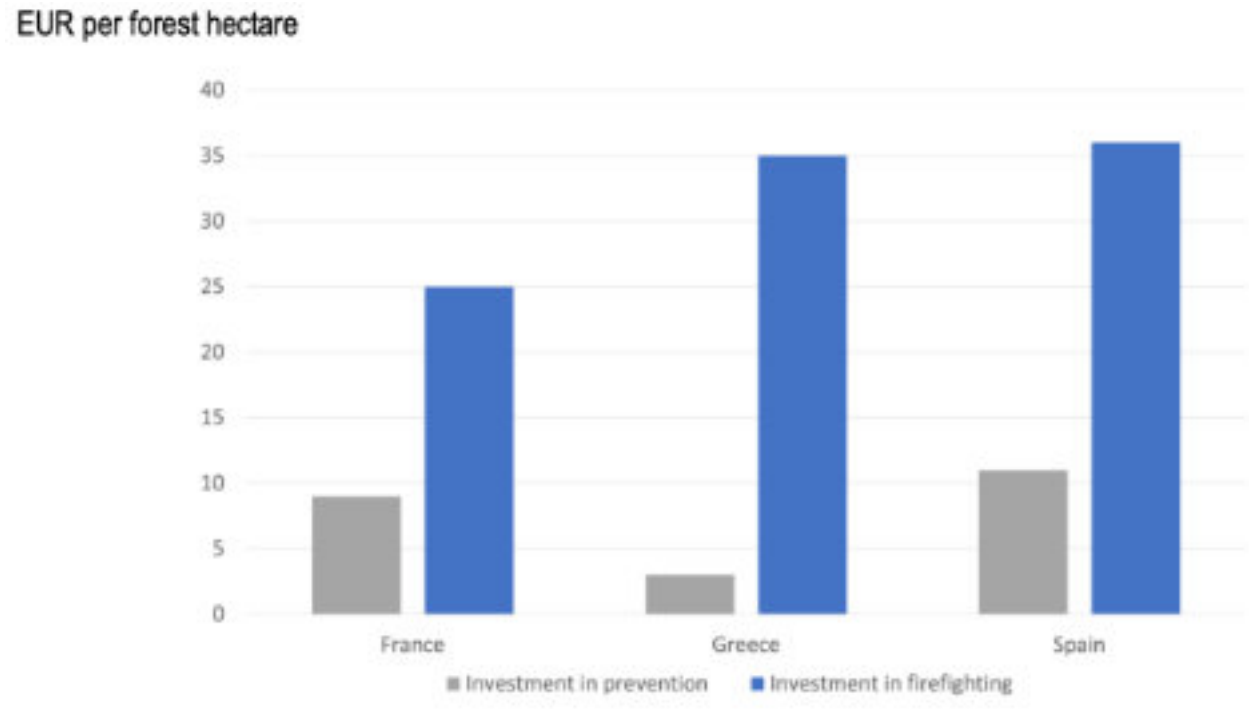
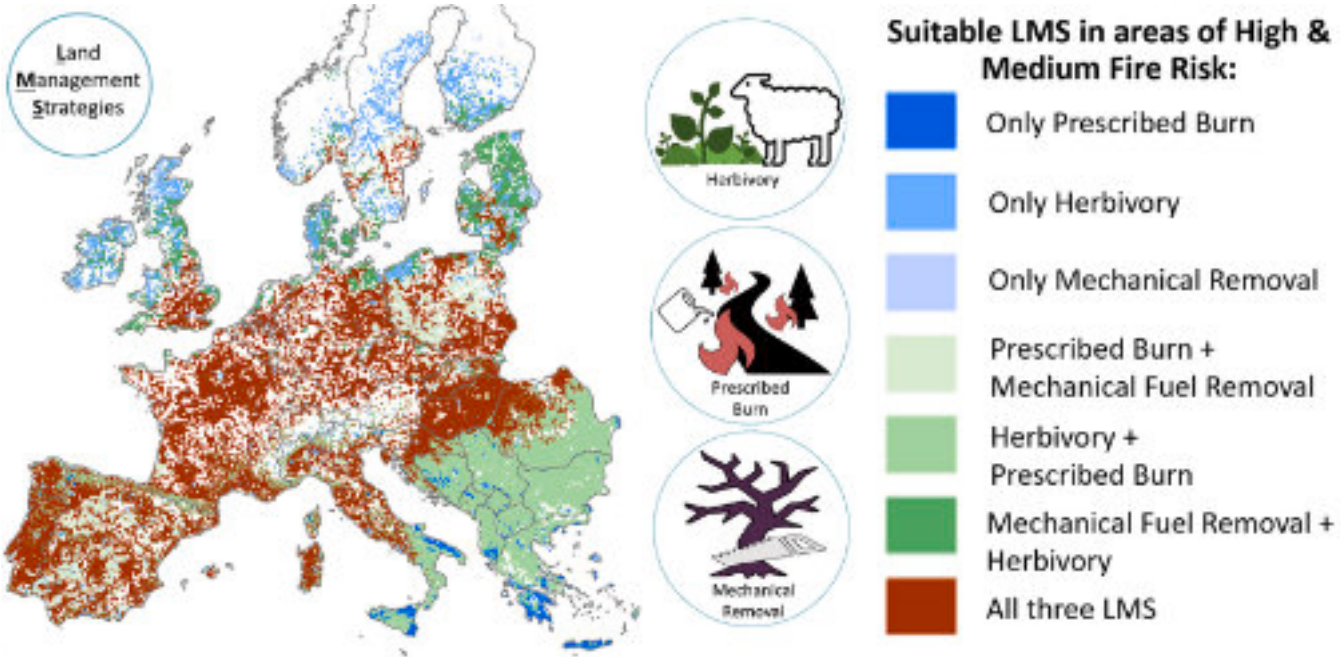


Figure 12. Suitable Land Management Strategies in areas of high and medium fire risk

Source: Neidermeier, A. N., C. Zagaria, V. Pampanoni, T. A. P. West, and P. H. Verburg. 2023. "Mapping Opportunities for the Use of Land Management Strategies to Address Fire Risk in Europe." Journal of Environmental Management 346: 118941. Link.



Given the underutilization of prescribed fires as a land management strategy, more resources and knowledge sharing in appropriate settings in Europe can bolster preventive forest and fire management. Targeted public awareness campaigns could foster greater acceptance of prescribed burns as a tool for fire management. An example of such resources is FirEUrisk, which provides information on land management strategies that reduce fire risk and provides information on the mapped suitability in the EU, as shown in Figure 12. Empowering communities by providing resources and funding to encourage community-led initiatives for fire-resilient landscapes can strengthen overall mitigation.

Countries should continue leveraging climate services such as data from EFFIS and Copernicus to understand and mitigate wildfire risk. This is especially true for cross-border regions where the EU-level assets can support cross-national activities for wildfire prevention and coordination. Where these tools are not readily applied, efforts and investments should be made to ensure that the data from these platforms are embedded into preventive planning. Furthermore, the EU's CAP could be reformed such that it is utilized to promote fire-resilient agricultural practices. It could do so by more directly funding NBS in agricultural landscapes for wildfire risk reduction.[175] Box 9 includes lessons learned from 2022 European wildfires to increase Cohesion Policy funding impact on wildfire risk prevention, risk reduction, and mitigation and to enhance integrated wildfire management, funding accessibility and impact, and risk reduction across Europe.

[175] *European Investment Bank and European Commission 2023.*

Box 9. Lessons learned from the 2022 European fires: Wildfire risk prevention, risk reduction, and mitigation

- Climate-smart sustainable forest management plays a crucial role in wildfire risk reduction. This involves practices that support a forest's microclimate, reduce fuel loads, and promote forest health and diversity.
- Investing in wildfire prevention is highly cost-effective. Estimates suggest that every €1 invested in prevention can save €4–€7 in response and recovery costs.
- Prescribed burning is a valuable tool for wildfire risk reduction and nature preservation. More countries should legalize and encourage the use of prescribed burning while ensuring access to training for safe and effective implementation.
- Bulgarian fires revealed that road maintenance in forest zones must be part of risk reduction planning; in Portugal, fuel management zones around communities proved effective in protecting settlements from devastating fires.
- Ministries and agencies need access to wildfire expertise to effectively use funding for wildfire risk management. A lack of expertise often leads to funding being used for less impactful short-term solutions rather than more sustainable and holistic approaches.
- Databases on past and current wildfire-related initiatives need improvement to enhance traceability and analysis. This would allow for a better understanding of the effectiveness of different funding schemes and programs.
- A more balanced approach to wildfire management is needed, with increased investment in prevention, community engagement, and landscape resilience measures in addition to traditional suppression efforts.
- The impact of Cohesion Policies on nature preservation is difficult to quantify and likely insufficient given the increasing trend of wildfires in protected areas. This suggests that more investment in proactive measures like fuel management and prescribed burning (where contextually appropriate) is necessary to protect vulnerable ecosystems.
- Clear and detailed guidelines for prescribed fire use need to be developed, considering environmental impact, safety precautions, and ecological benefits.

Sources: Pronto et al. 2023; European Commission et al. 2024.

EARLY WARNING AND PUBLIC AWARENESS

This chapter examines measures for establishing early warning systems (EWS) and public awareness for wildfire events. It analyzes processes for identifying and implementing early warning and public awareness actions, including contingency planning, EWSs, training and exercises, international exchanges, and response capacity development. Public awareness measures include those protective actions that the public can take in the context of early warning and alerts and the educational activities that support these actions.

CURRENT ARRANGEMENTS

Wildfire early warning, and public awareness in the EU refer to measures taken before a wildfire occurs to ensure the ability to respond effectively, including establishing necessary response capacities. Early warning and awareness include elements like fire danger rating systems and also early warning protocols made more effective with public awareness campaigns. A fire danger rating system assesses the potential for fire occurrence and spread based on environmental conditions, while early warning for fire provides real-time alerts to the public and authorities about imminent fire threats. The EU funded SILVANUS project includes a citizen engagement course aimed at empowering the public and integrating civil protection agencies and firefighters in education efforts.[176]

A number of specialized European meteorological bodies exist that support wildfire early warning, both directly and through the National Meteorological and Hydrological Services (NMHSs). EUMETNET (European Meteorological Network) is a network of 31 European NMHSs which exists to provide a framework to organize co-operative programmes between members in meteorology, especially in relation to weather observation, data processing and forecasting products. EUMETNET coordinates the pan-European "Meteoalarm" warnings website, which includes warnings for wildfires among the hazards encompassed. ECMWF (the European Centre for Medium-Range Weather Forecasts) is a collaborative European organization providing computer-based weather forecast guidance for weeks, months and seasons ahead. ECMWF produces a daily "Fire Activity Analysis" map as part of the Copernicus Atmosphere Monitoring Service (CAMS). EUMETSAT is the European operational satellite agency for monitoring weather, climate and the environment from space on behalf of its 30 member states. An example of the value of EUMETSAT in practice was in Portugal, when citizens on mobile phones received pinged messages with a warning of extreme fire risk, as the country braced for another brutal heatwave. Early warning messaging based on data provided by EUMETSAT can show the outbreak and evolution of wildfire.

Programs like Copernicus and EUMETSAT play an important role in early warning and public knowledge dissemination on fire risk. They provide earth observation data for wildfire monitoring, which are consistent both in time and space across Europe. Information including active fires and burned area from EFFIS is also used to support the management of forest fire risk in Europe and neighboring countries by providing updated and reliable information on active fires and burned areas. This system is supported by the EU's Emergency Response Coordination Centre, which operates 24/7 to monitor risks and coordinate response actions in collaboration with national Emergency Management Services.[177]

DIREKTION is an EU-funded initiative aimed at enhancing the capacity of fire and rescue services across Europe. It does so by fostering innovation and promoting cutting-edge solutions to recognized operational needs to reduce wildfire risks.[178] A currently ongoing EU-funded program is FIREPRIME under the UCPM Knowledge Network. FIREPRIME is a European Program for Wildfire-Prepared Communities and aims to establish an EU-wide program promoting fire resilience in WUI areas through awareness and preparedness. It

[176] *Silvanus. N.d. Citizen Engagement Course. Link.*
[177] *EC. 2023f. Emergency Response Coordination Centre (ERCC). Link.*
[178] *DIREKTION. n.d. Disaster Resilience Knowledge Network. Link.*

develops toolkits with a smartphone application, guidelines, and educational materials with the goal of enhancing wildfire resilience at the household, community, and infrastructure levels. FIREPRIME is currently being tested in Barcelona, Spain; Tyrol, Austria; and Gothenburg, Sweden.[179]

The European Forestry Institute (EFI) under the project Waldbrand-Klima-Resilienz (WKR) published Training Materials for Suppression Techniques. Training modules are specifically adapted for the German context, but can easily have a much wider application, and are divided into five parts: fire behavior, fire weather, vegetation firefighting – operational tactics, vegetation fire – mop-up operations and tools and equipment. The training aims to consolidate international good practices including reducing wildfire risk in a variety of contexts. Materials are primarily designed for users in the response phase, with land and forest managers as a secondary audience. A key objective is to develop and present modern graphics to address the global shortage of high-quality graphical material for basic wildfire management and suppression training. The training modules have been widely used across Germany and much of the training content and graphics have been incorporated into Germany's first national training framework for wildfire training and tactics. Based on this version, Belgium will translate and adapt the available German modules and possibly develop others using the same authors and graphic design. The Netherlands is also in the process of incorporating various components into a new national training framework that is currently being developed. Further planning and possible adaptations are being discussed in Czechia, Slovenia, Luxembourg, Poland, and Iceland.

A survey to assess the awareness of EU citizens about various disaster risks that could affect them, and their preparedness to face these scenarios, has been conducted by the EC. It finds that of those surveyed, 6 percent of Europeans have experienced wildfires or forest fires.[180] Wildfires are the most frequently mentioned disaster risk in four countries, these being Greece, Cyprus, Portugal, and Spain. Lastly, additional EU funding instruments and initiatives can support improved awareness and overall resilience through the Knowledge for Action in Prevention and Preparedness (KAPP) initiative, along with the Technical Assistance for Disaster Risk Management (Track 1) and the Technical Assistance Financing Facility.[181]

KEY CHALLENGES

Technical limitations to current EWS are considered a key challenge for preparedness. Although Copernicus provides satellite data for fire information, the temporal resolution of some data can lag behind wildfire spread. Some satellites – typically those in the geostationary orbit altitude of 36,000 km - offer frequent updates but lack the detailed spatial resolution needed, while high-resolution satellites, which circle the earth in much lower altitude orbits, provide detailed images but with less frequency.[182] This creates challenges in real-time monitoring that can delay rapid decision-making for early warning and preparedness actions.

Funding for preparedness, early warning, and awareness is still secondary to traditional civil protection investments for emergency response. Preparedness and prevention activities are not prioritized among high-level decision-makers within civil protection agencies due to the lack of political visibility of non-tangible investments in preparedness actions (such as training) versus response investments (such as rescue equipment).[183]

While many countries have national-level contingency plans, these plans often lack integration with subnational plans.[184] Subnational plans often do not utilize risk assessments or integrate land use and forest management plans. Many lack periodic review following significant wildfire events. Finally, there is a lack of clarity on roles and responsibilities within these contingency plans, particularly at the local level.

EWSs have been uneven at the national and subnational levels throughout the EU. While Mediterranean countries like Greece and Portugal have implemented EWSs through text messages warning of imminent fires, these are not seen in other countries with existing and developing wildfire risk.[185]

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[179] *European Union. 2024d. FIREPRIME. Link.*
[180] *EC. 2024b. Disaster Risk Awareness and Preparedness of the EU Population. Link.*
[181] *European Union. N.d. Civil Protection Funding Disaster Management. Link.*
[182] *OECD 2023a.*
[183] *World Bank and European Commission. 2021b. Understanding the Needs of Civil Protection Agencies and Opportunities for Scaling Up Disaster Risk Management Investments - Technical Report. Link.*
[184] *Fernandez-Anez et al. 2021.*
[185] *OECD 2023a.*

Inconsistent messaging reduces the effectiveness of public alerting for wildfires. Issues with public warning systems have led to inconsistent or delayed communication. For example, in Greece, multiple entities are responsible for public alerting, but there is no overarching coordination strategy. During the 2018 Mati fires, people near the coast had limited time available between the moment of awareness of the threat and the ultimate appropriate moment of decision-making for reaction, resulting in causalities.[186] In addition, thresholds for issuing alerts need revision to prevent the public from being overwhelmed by frequent or redundant messages, which affect the public's ability to understand and their willingness to act during emergencies.[187]

Health emergency capacity for many countries is limited with respect to burn casualties and burn units.[188] Burn care is centralized in highly specialized burn centers in Europe, which have limited capacity and may be overwhelmed by a sudden surge due to wildfire-related casualties. Countries may also vary in the detail of their planning for burn mass casualty response.[189] In Belgium, for example, while a specific plan for burn disasters exists, there is no pediatric burn disaster plan. Also, national tracking systems are deficient, and there is a lack of coordination between burn and non-burn hospitals.[190]

KEY OPPORTUNITIES

Improving the application of the EFFIS system to preparedness measures with appropriate temporal and spatial qualities can support early warning efforts at the national and subnational levels. Currently, there are several technical limitations in the balance of quality/clarity versus speed of information obtained from satellites to detect and prepare for wildfires. In addition, improved daily information on fire emissions and ground-based air quality monitoring can be bolstered to support preparedness and early actions with respect to the air quality of regions.[191] Newer EU projects such as FIRE-RES and TREEADS use AI in their wildfire management strategies and can be incorporated into EFFIS to bolster the system's effectiveness. FIRE-RES provides holistic fire management for Europe, while TREEADS supports improved forest management with a focus on protection and regeneration.

Countries should develop a specific risk communications plan for wildfire risk that is targeted to particular groups, especially vulnerable populations such as the elderly. Targeted campaigns to farmers, industry owners, forest and land managers, tourists, and local communities ensure that awareness for fire reduction and emergency actions are tailored to specific stakeholders. For example, Portugal's 'Portugal Chama' and 'Safe Communities Portugal' campaigns inform citizens and tourists of wildfire risks that exist seasonally.[192] Better signage and awareness raising is required with due consideration for both locals and tourists (multilingual) that relay information on reducing ignition as well as informing campsites and caravan parks on how to minimize and prevent wildfire risk through safe camping. A 'living with wildfires' campaign can help communities understand how to navigate the rising onset of wildfires and reduce panic if and when preventive measures like mild burning are employed and when emergency response and evacuation are required.

Increasing funding at the EU level dedicated to awareness, early warning, and preparedness can support countries' needs to build localized knowledge of, and preparedness for, wildfires. This can assist in allocating resources to preparedness versus emergency response; something that is desirable but often difficult to obtain due to preferences for highly visible emergency response

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[186] *Lekkas, E., Carydis, P., Lagouvardos, K., Mavroulis, S., Diakakis, M., Andreadakis, E., Gogou, M.E., Spyrou, N.I., Athanassiou, M., Kapourani, E., Arianoutsou, M., Vassilakis, M., Parcharidis, P., Kotsi, E., Speis, P.D., Delakouridis, J., Milios, D., Kotroni, V., Giannaros, T., Dafis, S., Kargiannidis, A. & Papagiannaki, K. (2018) The July 2018 Attica (Central Greece) Wildfires – Scientific Report (Version 1.0). Newsletter of Environmental, Disaster, and Crisis Management Strategies, 8. Athens: National and Kapodistrian University of Athens, Faculty of Geology and Geoenvironment, Department of Dynamic Tectonic Applied Geology.*

[187] *Arbinolo et al. 2024.*

[188] *EC 2020.*

[189] *Almeland, S. K., E. Depoortere, S. Jennes, F. Sjöberg, J. A. Lozano-Basanta, S. Zanatta, C. Alexandru, et al. 2022. "Burn Mass Casualty Incidents in Europe: A European Response Plan within the European Union Civil Protection Mechanism." Burns 48 (8): 1794–1804. Link.*

[190] *Al-Shamsi, M., M. Moitinho de Almeida, L. Nyanchoka, D. Guha-Sapir, and S. Jennes. 2019. "Assessment of the Capacity and Capability of Burn Centers to Respond to Burn Disasters in Belgium: A Mixed-Method Study." Journal of Burn Care & Research 40(6): 869–877. Link.*

[191] *Firelogue, Fire-Res, Treeds, Silvanus, n.d.*

[192] *Republic of Portugal. n.d. Portugal Chama. Link.*

investments. This should also include health emergency planning for burn victims within Member States with thorough development of a burn casualty national preparedness plan, including improved communication and planning at the EU level for timely deployment of UCPM medical teams.[193] Awareness campaigns must address various societal perceptions on wildfires and should tailor messaging based on the audience. For example, some communities and people respond better to positive messaging versus others to negative messaging, and such combinations can better address diverse audience needs to promote action.

Highlighting best practices for awareness - such as Portugal's Safe Village Safe People program (Aldeia Segura, Pessoas Seguras), which combines early warning and evacuation simulations for communities - to other communities cross-nationally can be beneficial for overall preparedness. Scaling up such grassroots programs across the EU would help empower local stakeholders to mitigate wildfire risks. Resources to implement similar initiatives in other EU regions, especially those countries experiencing new or enhanced wildfire risks due to changes in the climate, will raise public understanding and community engagement in wildfire preparedness. The Wildfire Risk Awareness and Communication publication by the UCPM is one such resource that provides actionable insight to emulate initiatives like Safe Village Safe People.[194] Croatia has also enhanced public awareness through brochures on managing personal risks, which discuss critical gaps in early warning and risk communication, aiming to improve community readiness for the 11 highest disaster risks identified.[195] Box 10 includes several existing examples for improved practice for preparedness, early warning, and awareness, Box 11 includes information on Fire Danger Rating systems in the EU, and Box 12 includes lessons learned from the 2022 European fires.

[193] *EC 2020.*

[194] *Plana, E., M. Serra, S. Nebot, A. Smeenk, P. Macri, J. Vendrell, L. Pronto, G. Canaleta, J. Gomes, and L. Alfonso. 2024. Wildfire Risk Awareness and Communication: Analysis of Good Practices. Union Civil Protection Knowledge Network. Link.*

[195] *EC/Union Civil Protection Knowledge Network. 2024. Success stories: prevention and preparedness projects supported by the Union Civil Protection Mechanism. Link.*

Box 10. Examples for early warning and public awareness[196]

European countries are implementing a range of wildfire preparedness initiatives combining public education, early warning systems, and youth engagement. *Examples include Ireland's 'Be Summer Ready' campaign and fire danger ratings, Italy's youth summer camps, Portugal's 'Safe Village, Safe People' drills and 'CeaseFire' app, and France's school-based programs in Corsica. Additionally, targeted efforts in Catalonia engage farmers in fire prevention, while Slovenia offers a free, app-based forecasting system to support risk assessment and planning.*

- **The "Be Summer Ready" campaign by the Government of Ireland** provides information to the general public on issues that may affect them during the summer, including wildfires. It provides information on the risks as well as prevention and behavioral measures that can be taken to prevent them. The campaign information is accessible online and in a booklet.[197] Ireland also 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 Éireann, the National Weather Service. Warnings are issued with a classification of wildfire risk.

- **The Italian Civil Protection Department,** in collaboration with regional and local voluntary associations, organizes summer school camps called *Anch'io sono la protezione civile* for young people between 10 and 16 years of age.[198] The objectives of these camps are to encourage the protection of forests and natural heritage sites and contribute to awareness and risk prevention. An awareness program which includes a focus on wildfire risks called *Io no rischio* is also implemented.

- **In Corsica, France**, a number of awareness projects have been initiated on the vegetation fire problem. These are presented to school children and local authorities and include actions such as interventions 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, and circulation of newsletters to communities, town halls, and associations.[199]

- **The Safe Village, Safe People Programme** in Portugal has been developed by the central government and is implemented with the support of municipal and civil parish councils. One of the project's goals is to enhance awareness regarding dangerous behaviors and self-protection measures and the implementation of evacuation drills. Local warning mechanisms have been established, and 12,000 citizens have taken part in over 400 drills.[200] Portugal's 'CeaseFire' app is another awareness-raising example that integrates real-time meteorological data and fire danger indices to inform and raise awareness both for the public and for professionals in fire service and management.[201]

- **In Catalonia, Spain**, an awareness project works with farmers on the importance of taking necessary measures to avoid forest fires during grain harvests. [202]

- **Slovenia** has an automated daily forest fire risk forecast system using the Canadian Meteorological Fire Hazard Indicator underpinned by different meteorological models to provide fire hazard forecasts three days in advance. The system has a free web-based app that can be used by different stakeholders to assess fire risk and to support fire management and planning.[203]

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[196] *Casartelli and Mysiak 2023.*
[197] *Government of Ireland. 2022. Be Summer Ready. Link.*
[198] *Government of Italy. 2019. School Camps. Link.*
[199] *Goliat. n.d. Section 5: Communication. Link.*
[200] *European Union. 2024e. Safe Village, Safe People: Working with the Local Community. Link.*
[201] *EUMETSAT. 2024. Ceasefire. Link.*
[202] *Generalitat de Catalunya. n.d. Department of Interior Link.*
[203] *UNDRR. 2020. Evolving Risk of Wildfires in Europe - Thematic paper by the European Science & Technology Advisory Group. Link.*

Box 11.Examples of Fire Danger Rating Systems in EU Member States

Many EU Member States utilize fire danger rating systems to assess the potential for wildfires. However, the implementation and effectiveness of fire danger rating systems vary significantly across the region. *The following are examples of various fire danger rating systems in countries with wildfire risk in the EU.*

The most commonly used information at higher scales are the EFFIS and the CEMS. These tools support the Member States in understanding how the EU assesses fire danger. CEMS also supports national fire risk danger assessment.

Developed fire danger ratings are in place in Mediterranean countries including Portugal (IPMA), Spain (AEMET), France (Vigilance), Italy (Aqua UPC), Greece (Greece Civil Protection), and Germany (Deutscher Wetterdienst). Many of these countries have integrated the respective systems into institutional and public warning mechanisms, including SMS alerts, mobile apps (e.g., Italy's FireAware), legal fire-use restrictions, and public awareness campaigns. For instance, Spain's regional authorities (e.g. Catalonia) and France's "France Alert" system issue real-time fire warnings while Greece has implemented a system that issues SMS alerts on high fire danger days. The nationwide alerting in Greece ensures that the public receives immediate information regarding fire danger, evacuation orders, or fire bans. Several countries including Sweden, Finland, and Norway, are developing their fire danger alerting systems and have increased efforts to include the introduction of mobile app alerts and seasonal campaigns. Many EU Member states are also increasing awareness of fire risk in protected natural areas where specialized education efforts target visitors before and during fire seasons.

Box 12. Lessons learned from the 2022 European fires: Wildfire preparedness, early warning, and awareness

- Investing in training and capacity building for firefighters is essential. This includes specialized training for wildfire management and standardized operational frameworks for international cooperation.
- Tailored guidance should be provided to countries newly prone to wildfires to ensure that they adopt effective strategies and learn from the experiences of more fire-prone nations.
- Public awareness and community engagement are critical for wildfire risk reduction. Educational campaigns should be implemented to promote responsible behavior and reduce human-caused ignitions.
- Italian preparedness, which includes the use of infrared maps and drones, can support early detection and serve as an asset for reclamation operations and can be considered for other preparedness operations. The Karst fire in Slovenia showcased the need to include cascading risks in fire management protocols, such as improving access to water sources and to secondary roads.

Sources: EC et al. 2024; Pronto et al. 2023.


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WILDFIRE RISK PREPAREDNESS AND EMERGENCY RESPONSE

This chapter examines response activities during wildfire events, focusing on needs assessment, impact evaluation, response operations, and coordination processes across agencies and jurisdictional levels. Preparedness includes capacity and training as well as situational awareness during wildfire emergencies.

CURRENT ARRANGEMENTS

Preparedness at the European level is primarily coordinated through the UCPM, which enables EU Member States to respond collectively to wildfire emergencies. Central to the UCPM mechanisms is rescEU, established in 2019, which provides a pool of firefighting resources, including planes and helicopters that can be deployed quickly when states are overwhelmed by wildfire emergencies.[204] This mechanism has been essential during peak fire seasons to reduce the burden on individual countries managing large wildfires. As an element of the Union Civil Protection Pool, the European Medical Corps aims to strengthen the EU's capacity to respond to emergencies with health consequences beyond the coping capacities of affected countries within and outside the EU.[205] The UCPM facilitates medical evacuation (MEDEVAC) and deploys Burn Assessment Teams to non-specialized hospitals for triage and patient evaluation.[206]

The UCPM also coordinates cross-border disaster response and is central to EU-wide wildfire risk preparedness and response. In addition, the UCPM manages the Early Warning and Information Systems and the ERCC, which liaises with national authorities from the EU Member States to exchange information on wildfire risk and preparedness throughout the wildfire season and coordinate firefighting response in MS.[207] Part of the UCPM is the rescEU initiative to provide a reserve of resources, including firefighting planes, helicopters, and prepositioned personnel to support countries facing severe wildfires. RescEU has expanded significantly to strengthen Europe's capacity to deal with extreme wildfires. In 2022, the rescEU operation was strengthened with a €170 million funding envelope to enhance firefighting capacity throughout Europe. This reserve has been critical during severe wildfire seasons to assist countries like Greece and others. The UCPM can also co-finance the transport of assistance to the affected area as well as operational costs.[208]

Additional preparedness support is provided through specialized EU-supported response teams coordinated via operational platforms like FoRisk.[209] These teams are deployed across Member States and assist with post-storm or wildfire events. For example, a team has been deployed twice to Ireland to support recovery following a major storm event, which offers lessons on surge deployment and knowledge sharing between EU Member States.

EFFIS and Copernicus EMS are also essential for monitoring and forecasting wildfire events. EFFIS provides near-real-time data on fire activity and geo-locates all the news related to forest fires that are published on the internet in any of the European languages (current situation viewer). This supports decision-making and resource allocation for wildfire response and emergency situations.[210]

Essential operational support to wildfire response is provided through the NMHSs. Their predictions of wind speed and direction, precipitation, temperature, humidity, and so on help predict wildfire behavior and allow responders to deploy their resources strategically.

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[204] *EC 2023d.*

[205] *EC. 2020. Commission Staff Working Document: Preparing for mass burn casualty incidents. Link.*

[206] *Leclerc, T., F. Sjöberg, S. Jennes, J. R. Martinez-Mendez, C. H. Van der Vlies, A. Battistutta, J. A. Lozano-Basanta, N. Moiemen, and S. K. Almeland. 2023. "European Burns Association Guidelines for the Management of Burn Mass Casualty Incidents within a European Response Plan." Burns 49 (2): 275–303. Link.*

[207] *EC 2023d.*

[208] *Ibid.*

[209] *FoRisk. 2025. Pan-European Forest Risk Facility. Link.*

[210] *EC, European Forest Fire Information System, Link.*

The work of the NMHSs is underpinned by the three European-level specialist meteorological organizations: EUMETSAT, ECMWF, and EUMETNET.

For the summer of 2024, the EU boosted risk preparedness to combat the wildfire season. As Europe prepared for the approaching wildfire season, the EU took significant steps to bolster firefighting efforts and safeguard communities by pre-positioning firefighters and assembling a fleet of firefighting aircraft. EU has put together 556 firefighters from 12 countries that were strategically prepositioned across key locations in Europe, such as in France, Greece, Portugal, and Spain. They were standing ready to support local fire brigades, when the scale of a wildfire overwhelms the response capabilities of a country. In addition, there was a dedicated rescEU fleet of firefighting aircraft, consisting of 28 airplanes and 4 helicopters stationed in 10 Member States. €600 million in EU funds has also been allocated to acquire additional firefighting aircraft. The extra funding is intended to purchase 12 new firefighting planes in the future, which will be distributed among six EU Member States, as well as several helicopters. Further, several EU countries, particularly in the Mediterranean region, have established training programs for the use of tactical fires like backburning as an essential wildfire suppression tool, and there are EU-level past efforts like the EuroFire project that have developed training materials to support the development of these skills across Member States. Portugal stands out as having specific requirements for prescribed fire training and certification for fire specialists involved in wildfire analysis and suppression fire use.[211]

Volunteerism and community-based groups active in wildfire emergencies are also critical for readiness and response. Volunteer firefighters are especially a crucial component of wildfire response in many European countries. International Search and Rescue is facilitated by the UCPM to assist specialized teams to conduct search and rescue operations following disaster scenarios, and depending on the MS, these teams are comprised of both professional and voluntary members. In both Portugal and Greece, volunteer civil protection groups and firefighters demonstrate their invaluable service, particularly in rural areas. In Sweden, organized volunteer groups consisting of voluntary resource groups, farmers, Mountain Rescue, Home Guard, and Red Cross supported the wildfire response efforts in 2018.[212] Additionally, Mountain Rescue services in Italy called *Corpo Nazionale Soccorso Alpino e Speleologico* also consist of volunteer professionals and are crucial for Alpine search and rescue activities.

KEY CHALLENGES

Due to the increasingly severe and frequent wildfires that are exacerbated by prolonged drought and extreme heat, the resource intensiveness of wildfire risk preparedness and emergency response is generally challenging as wildfire risk grows throughout the EU. For example, during the 2018 extreme wildfire season in Greece, the outbreak of multiple wildfires at the same time created a bottleneck for the deployment of firefighting resources and contributed to an unprecedented wildfire death toll in Mati.[213] Extreme wildfire seasons strain emergency response resources and limit their ability to contain impacts. During the 2017 wildfires in the Iberian Peninsula in Southwestern Europe, the rate of fire spread exceeded the available firefighting capacity by three to nine times. Fragmented wildfire governance across EU Member States can lead to inconsistent levels of readiness and response.[214]

There is a lack of impact evaluation and systematic records of past or future projected economic losses and damages from wildfires at national or international levels.[215] Existing estimates of economic impacts are difficult to compare due to differences in impact assessment methodologies and varying wildfire regimes. In addition, limited attention has been given in economic literature to soil erosion impacts, water supply, and regulation following wildfire events.[216]

There is a need for better incentives and regulatory frameworks to attract and retain volunteerism for wildfire disaster response, and specific training on wildfire management could be further implemented.[217] Volunteers have cited a lack of appreciation and inadequate frameworks for resource provision that hinder recruitment and retention of volunteer

[211] *Silva, J.S. ed., 2010. Towards integrated fire management: outcomes of the European project fire paradox (No. 23, pp. ix+-229). Joensuu, Finland: European Forest Institute.*

[212] *Kvarnlöf, L., and K. Eriksson. 2024. "Filling the Void: Rural Disaster Volunteerism during the Swedish Wildfires of 2018." International Journal of Disaster Risk Reduction 105: 104393. Link.*

[213] *OECD 2023a.*

[214] *OECD 2024.*

[215] *OECD 2023a.*

fire response and emergency response members.[218] In Sweden, it was found that there were coordination issues with volunteer farmers' organizations and professional services as well as burnout due to prolonged or large-scale disasters which can strain volunteers.[219]

Finally, there is a lack of standardization of training and certification for fire services throughout Europe. This becomes more evident when firefighters are deployed to varying nations or supporting cross-regional or cross-boundary fires and have differing perspectives on how to manage fires, which is not conducive to effective emergency management.

KEY OPPORTUNITIES

Ensuring that the UCPM's rescEU operation is maintained and strengthened with a better understanding of near-term wildfire risk and prepositioning in Europe is essential to support the capacity to respond. This is also useful for countries that are facing new risks to wildfire and will require coordination with the rescEU facility as climate risks exacerbates wildfire scale and frequency across the EU.

Institutionalizing and formalizing volunteer response support in the case of wildfire emergencies is an important way to mobilize community resources and tap into local knowledge of machinery and equipment for combating wildfires. In addition, supporting rural organizations that are key in wildfire response both in Member States and transnationally with training and compensation can ensure the maintenance of volunteers during and beyond wildfire seasons. Inter-agency collaboration and regional coordination centers can support the leveraging of emergency resources, such as Mountain Rescue, Coast Guard, and other groups with helicopters, which can significantly improve wildfire response. Finally, uniform certification and training of fire service and emergency personnel can improve interoperability among them.

Using innovation such as AI, big data, and additional remote sensing capabilities can enhance wildfire monitoring and prediction. By integrating such technologies into Copernicus tools like EFFIS, the EU can improve its real-time situational awareness to optimize resource allocation for wildfire risk preparedness and emergency response. It can also improve the prediction of wildfire behavior to optimize prepositioning in countries with seasonal risk as well as countries facing new wildfire threats. Box 13 provides examples of innovative approaches to enhance risk preparedness and emergency response.

Funding and expanding more peer reviews through the UCPM Peer Review Programme will offer additional and useful insights into assessing current risk preparedness and emergency response situations in Member States to locate gaps and improve wildfire management systems, in and across countries.[220] The UCPM Peer Reviews support not only risk preparedness and emergency response but all parts of the wildfire disaster cycle. Box 14 includes lessons learned in 2022 both to increase Cohesion Policy funding impact on wildfire readiness and response and to enhance integrated wildfire management, funding accessibility and impact, and risk reduction across Europe.

All significant wildfire incidents should be followed by a "lessons learned" workshop. This workshop should engage front-line responders, local authorities, national meteorological services, representatives of affected utilities and infrastructure, and community representatives. The workshop should focus on recording the lessons learned from the wildfire incident (what worked well, what can be improved etc.); the outcomes should be documented and shared widely.

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[216] *Chuvieco, E., M. Yebra, S. Martino, K. Thonicke, M. Gómez-Giménez, J. San-Miguel, D. Oom, R. Velea, F. Mouillot, J. R. Molina, and A. I. Miranda. 2023. "Towards an Integrated Approach to Wildfire Risk Assessment: When, Where, What and How the Landscapes May Burn." Fire 6 (5): 215.*

[217] *OECD 2024.*

[218] *Freise, M., and A. Walter. 2024. "Motivations and Expectations of German Volunteer Firefighters." Journal of Civil Society: 1–19. Link.*

[219] *Kvarnlöf and Eriksson 2024.*

[220] *European Union 2024f.*

Box 13. Examples for risk preparedness and emergency response in the EU

Croatia, Spain, Czechia, and Italy have developed proactive wildfire surveillance and coordination systems to enhance early detection and response. *Croatia uses video surveillance and predictive software, Catalonia's Alpha Plan regulates risk activities and informs local officials via SMS, and Italy strengthens interregional cooperation through twinning, coordinated patrolling, and annual stakeholder meetings.*

- Since 2003, **Croatia** has used video surveillance to prevent forest fires through the EU-scientific research project called HOLISTIC (Adriatic Holistic Forest Fire Protection). Image processing systems and fire propagation prediction software enable the coordination centers to respond quickly by dispersing troops and geo-referencing fires.

- In **Catalonia, Spain**, the Alpha Plan provides surveillance and prevention personnel and establishes the regulation of risk activities according to the level of wildfire risk which is updated daily. This information is proactively disseminated through different channels, including SMS, to local civil protection officers in case of high risk.

- In the summer period in **Italy**, the Italian National Civil Protection Department implements twinning between regions to fight forest fires more effectively, supported by a specific steering committee. This group is also responsible for coordinating the wildfire campaign to maximize the effectiveness of fire patrolling through the coordination of resources. In advance of the summer season, the Italian National Civil Protection Department organizes an annual plenary meeting with all public stakeholders involved in wildfire to share information about system risk preparedness and best practices and to discuss the main challenges in wildfire management. [221]

- **Czechia** has created a Wildfire Early detection System (WEDS) which is a DG ECHO funded initiative to conduct national analysis of detection technologies, pilot studies, and policy development to integrate advanced early warning capabilities into national wildfire risk management strategies.

Box 14. Lessons learned from the 2022 European fires: Wildfire Risk Preparedness and Response

- Aggressive initial attack on new fires has proven to be an effective strategy in France. This method should be maintained and expanded with a focus on the rapid deployment of both local and national resources.

- Modernization and capacity building for fire response are needed, including specialized equipment and multi-tiered approaches leveraging local, regional, and national resources.

- A common operational framework for wildfire modules within the European Emergency Response Capacity needs to be established. This would help overcome barriers to international cooperation caused by varying operating standards and ensure responder preparedness.

- Good practice training and wildfire response capacity development are urgently needed for both professional and volunteer firefighters to ensure safe and effective operations.

Source: Pronto et al. 2023.

[221] *OECD 2023a.*

WILDFIRE RECOVERY, RECONSTRUCTION, AND POST-DISASTER FINANCING

This chapter focuses on post-fire recovery, encompassing all the rehabilitation, restoration, and reconstruction interventions that take place after a wildfire, including short-term efforts to stabilize emergencies and long-term interventions aimed at the recovery of ecosystems and socioeconomic assets and systems.[222]

CURRENT ARRANGEMENTS

The EUSF is one of the instruments for financial support following major disasters in the EU. It provides financial aid to Member States to restore infrastructure, assist in disaster relief efforts, and address immediate recovery needs. National funds for disaster recovery are usually complemented by those made available by the EUSF. For example, Greece has received approximately €118 million between 2002 and 2017 to complement its national resources for disaster recovery.[223] Measures eligible for funding by the EUSF include the following:

- Restoration to working order of infrastructure facilities providing energy, drinking water, wastewater disposal, telecommunications, transport, health care and education.
- Provision of temporary accommodation and funding of rescue services to meet the needs of the population affected.
- The consolidation of preventive infrastructure and protection of cultural heritage sites.
- The cleaning up of disaster-stricken areas, including natural zones.
- Rapid assistance, including medical aid, to the population affected by a major public health emergency and the protection of the population from the risk of being affected.[224]

The EU RRF was initially introduced as part of the COVID-19 recovery plan and provides financial resources that support wildfire recovery. For example, Greece has integrated the Anti-Nero program within its RRF framework to enhance forest restoration and wildfire management. In addition, the RRF can contribute to enhancing infrastructure and reducing future disaster risks through infrastructure investment and green transitioning.[225]

The Cohesion Fund provides support to EU Member States to strengthen the economic, social, and territorial cohesion of the EU and supports investments in the field of environment and transport infrastructure.[226] During the 2014–2020 funding cycle, three countries used funds for wildfire risk reduction and fire management: Poland, Portugal, and Hungary.[227] The 2021–2027 funding cycle states more clearly the investments that can be made in wildfire risk management, which could help countries identify how and when they use funds for wildfires.

Insurance coverage for asset recovery and reconstruction in the context of wildfire risk varies significantly across and within countries. In some countries, such as Greece, wildfire insurance coverage is part of basic property insurance, while in others it remains largely unavailable in many parts of the country. The share of wildfire losses that are insured remains relatively low across many EU countries. In Greece, only around 15 percent of dwellings and 230,000 commercial properties have insurance coverage against wildfires.

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[222] *OECD 2023a.*

[223] *OECD 2024.*

[224] *World Bank 2024.*

[225] *EC. 2024a. Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions: Strengthening the EU through Ambitious Reforms and Investments. Link.*

[226] *EC. n.d. Cohesion Fund. Link.*

[227] *Pronto et al. 2023.*

Similarly, in Portugal, the share of wildfire losses covered by insurance was around 10 percent in 2021. Lack of wildfire insurance leaves a financial burden on governments and affected communities. In many cases, the low uptake of insurance coverage for wildfire risk is also linked to the low levels of insurance availability or affordability.[228] For most EU countries, property insurance policies often cover damage caused by wildfires as this is included under traditional fire policies. Wildfire insurance coverage for homeowners is mandatory either by law or through mortgage requirements by banks. Nevertheless, insurance penetration is low for agricultural sites and forests.[229] In addition, there is no commercial model for wildfire insurance in Europe. This leads to insurers not offering wildfire insurance commercially and highlights the confusion between fire insurance and wildfire insurance for properties. However, Solvency II is considering the inclusion of wildfire, coastal flood, and drought as new perils to be covered under the standard formula used by the European Insurance and Occupational Pensions Authority (EIOPA), which is a positive step for the potential availability of wildfire commercial insurance.[230]

Ecological restoration is an important aspect of wildfire recovery which focuses on rehabilitating landscapes and ecosystems by restoring natural processes. This includes reforestation, habitat restoration, managing invasive species, and removing dead biomass. Some fire affected areas need emergency stabilization which is then followed by years of rehabilitation and restoration treatment. In Algarve, Portugal, the restoration of native cork oak belts has reduced landscape flammability and enhanced ecosystem resilience. Similarly, Greece has advanced its post-fire recovery framework by developing the Greek Biodiversity Restoration Hub to improve recovery through expert support and coordinated efforts.[231] In some MS, the government provides financial assistance to help cover the costs of wildfires that exceed the capacity of insurance policies. One example is the *Consorcio de Compensacion de Seguros* in Spain or the publicly owned *Caisse Centrale de Reassurance* in France.

KEY CHALLENGES

Following the fire phase, several challenges remain in the development of more resilient built landscapes, typically due to pressures to 'quickly return to normal' after a wildfire. In such a mindset to regain normalcy, fire-resilient land use and building regulations fail to be considered. For example, in the aftermath of the Mati wildfire in Greece, local groups opposed the widening of the local street network, even though the narrow streets and absent escape routes in the WUI contributed to the high death tolls.[232] Furthermore, there are often difficulties in environmental recovery after fire where in some cases human intervention can delay ecosystem recovery and must be considered in post-fire recovery planning.

Settlement relocation as a policy option for individuals and mostly informal settlements near the WUI also fails post-disaster due to the socioeconomic implications of such decisions. Even with existing post-fire recovery plans that recognize the importance of enhancing resilience through post-fire interventions, implemented measures have been found to maintain or even increase wildfire risk levels, especially in the WUI. For example, the Special Urban Plan developed to guide recovery efforts after the 2018 extreme wildfires in Attica revoked the legal status of 'forested area' from some of the burned areas, which formally recognized them as agricultural lands and thus legitimized new and previously existing developments. These decisions are often influenced by local pressure groups such as associations representing developers and local property owners.[233]

The lack of adequate information, capacity, and resources hampers effective ecological restoration, particularly on private lands where recovery is the landowner's responsibility. Without appropriate planning, ecological recovery can be unmanaged or poorly executed which increases the long-term risk of wildfires. In other areas, opportunistic post-fire land grabbing poses another major challenge to effective and fire-resilient restoration.[234]

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[228] *OECD 2023a.*
[229] *World Bank 2024.*
[230] *European Union. 2024b. EIOPA Consults on Natural Catastrophe Risk Reassessments in the Standard Formula. Link.*
[231] *OECD 2023a.*
[232] *Ibid.*
[233] *OECD 2024.*
[234] *OECD 2023a.*

In addition, the EUSF mechanism has a disbursement process to member countries that takes time. Applications typically take 8 to 10 weeks and disbursements an average of 56 weeks. Also, since 2002, the most common application to the EUSF is for floods, which account for nearly half of the total applications. Most of the funding has gone to earthquakes which have received half of the financing under the EUSF.[235] The EUSF has been found to not typically support EU Member States following wildfires, in part due to the low amount of eligible direct damage costs for EUSF funding.[236] Furthermore, additional consideration should be given to the alignment between the eligibility conditions for the EUSF operations and the guiding practices of DRM and post-disaster reconstruction. Consequently, many countries tend to rely on reprogramming cohesion funds to address disaster costs, as the EUSF is not designed to be a primary source of funding.[237] This reprogramming often involves reallocating resources from other areas to address immediate needs, which may result in underutilization of funds for their original purpose. Additionally, economic recovery focused on returning to vulnerable, pre-disaster states and locations cannot be a long-term, sustainable investment and needs to be addressed in the 2021–2027 EUSF framework. The current structure of post-disaster financing mechanisms, including the EUSF, does not sufficiently incentivize preventive actions, which continues the cycle of recovering back to status quo rather than reducing wildfire risk over time.[238]

Analysis by the European Court of Auditors highlights that funding for adaptation and resilience under the RRF is inconsistently tracked across EU Member States, with limited mechanisms in place to monitor whether climate-tagged spending results in measurable improvements in disaster resilience.[239] This creates a missed opportunity to systematically channel investments into wildfire prevention and preparedness efforts. The ECA recommends more clearly defined targets, robust monitoring systems, and transparency mechanisms to ensure EU resilience funding is effectively translated into long term risk reduction.

The lack of a fully probabilistic disaster risk model for wildfires in Europe (at the time of writing this note) contributes to the scarcity of wildfire insurance, particularly for large-scale events.[240] Without reliable probabilistic models, insurers struggle to accurately assess the probability of wildfires of different magnitudes occurring in specific locations and quantify potential losses which makes it difficult to price premiums appropriately. The absence of these models leads to a market perception that wildfire is not a significant financial risk, unlike other hazards such as floods and earthquakes which have well-established probabilistic models. Consequently, insurance companies may be hesitant to offer comprehensive and affordable wildfire insurance, particularly in high-risk areas.

KEY OPPORTUNITIES

The budgets of the UCPM and the EUSF have both been exhausted in recent years due to demand consistently overwhelming funding capacity, and therefore, an increase in these funds for post-disaster resources is necessary. These instruments have been an important source of finance for disaster damages in EU Member States and UCPM participating states. While the funding is to complement national budgets, the budget allocation to both remains insufficient.[241] Additionally, ensuring that the funds are not applied for resettlement in vulnerable areas without appropriate risk reduction measures must be embedded in the legal language of funding frameworks. Frameworks can include contingencies to retain a portion of the investment for risk reduction and mitigation efforts, along with needed recovery and reconstruction investments. Commercial insurance for wildfires with clarity between what constitutes a fire versus a wildfire and appropriate coverage is also needed in Europe. Mandatory catastrophic insurance for commercial businesses, such as in Italy's new Budget Law (Law No. 213), is a promising step for national insurance requirements; however, it leaves open many questions regarding the assessment and management of risks, determining appropriate premiums, and accessibility and impact on small and medium enterprises. Leveraging insurance mechanisms to

[235] *World Bank 2024.*
[236] *Ibid.*
[237] *Pronto et al. 2023.*
[238] *World Bank, TAFF C2_Task 1, Under Development.*
[239] *European Court of Auditors. 2024. Newsletter No. 1/2024 – Resilience to climate-related disasters. Link.*
[240] *World Bank 2024.*
[241] *World Bank 2024.*

promote NBS for risk reduction can, for example, include underwriting policies that incentivize ecological forest management practices. These can include controlled burns, thinning, and grazing to reduce fuel loads while conserving biodiversity. Insurers could support NBS by shifting investment portfolios toward nature-positive projects and withdrawing coverage for activities detrimental to ecosystem resilience.[242]

Improving the data to inform decision-making on disaster risk finance at the EU level is essential to have reliable data and analytics. Health costs associated with wildfire, extreme heat, and drought, as well as hospital admissions associated with these events, are not captured and therefore cannot fully represent the total cost and needs post-fire. Streamlining the EUSF funding process and leveraging digital tools and data platforms to conduct damage assessments could reduce the time it takes to release financial assistance. For example, remote sensing technologies, including satellite imagery and drones, can support decision-making and provide the necessary inputs for prioritizing recovery efforts and allocating resources effectively.[243] In addition, adopting performance-based mechanisms can allow the EU to reward Member States for proactive efforts in wildfire risk reduction and strengthen financial resilience. Furthermore, public-private partnerships can also support long-term recovery efforts by financing forest restoration, building infrastructure, and improving risk management systems.[244] Improved data through a more sophisticated probabilistic fire model for Europe could also support appropriate pricing for premiums, especially in areas of high wildfire risk. Targeted policy interventions are needed to incentivize insurance uptake, especially in high-risk areas such as wildfire-prone regions throughout the EU.[245] There also needs to be improved consumer trust in insurance products, which can be specified in awareness campaigns.[246]

Furthermore, there is a growing recognition that insurance incentives can support wildfire resilience for critical infrastructure. Infrastructure operators who proactively implement fire protection protocols could be rewarded with reductions in insurance premiums. As more infrastructure is privatized and insured independently, the insurance market can become a key driver of resilience by incentivizing risk reducing behaviors through premium discounts or differentiated pricing structures. In addition, community-based insurance models where entire communities collectively negotiate coverage can offer an opportunity to enhance local resilience and broaden access to affordable insurance, which is especially relevant in high wildfire risk areas.

Finally, ensuring post-disaster planning and policies are developed before disaster occurrence, as well as their enforcement post-fire, is essential for ecological restoration and resilience as well as asset management through 'building back better'. Using zoning tools and funding targeted restoration projects across wildfire-prone regions in Europe could significantly enhance community resilience, particularly in rural and WUI regions. This can include post-disaster forest and land rehabilitation plans and post-disaster air quality plans and actions for community health, among others. For example, the Spanish Strategic Health and Environmental Plan has added wildfire smoke in its latest version, and the European Climate and Health Observatory is showing data on direct wildfire fatalities. Such planning and data gathering improve recovery and building back better options.[247]

In recognition that the EUSF budget has been exhausted in recent years, EU Member States should pursue more comprehensive disaster risk financing strategies that adopt a risk layering approach. As is evident, EU Member States often rely on the EUSF to partially fund their recovery after earthquakes. While the EUSF is not intended to fully fund disaster recovery, the current budget allocation across both regional and national instruments has been insufficient,[248] and earthquake insurance penetration has been low. A disaster risk financing strategy can embrace a variety of instruments aimed at, and capable of, achieving different outcomes through risk layering (Figure 13 being a schematic representation). Each of these instruments can efficiently handle only a certain type of

[242] *Firelogue, J. Linnerooth-Bayer. 2024. Firelogue-Naturance Insurance Working Group.*

[243] *GEM. 2018. Improving Post-Disaster Damage Data Collection to Inform Decision Making. Link.*

[244] *OECD 2023a.*

[245] *EC. 2021d. Improvement of Insurance Conduct Supervision in Greece. Link.*

[246] *DLA Piper. 2024. Italian Budget Law on Mandatory Insurance against Catastrophic Events Raises Several Questions. Link.*

[247] *Plana, E., M. Serra, A. Smeenk, A. Regos-Sanz, C. Berchtold, M. Huertas, L. Fuentes, A. Trasobares, J. N. Vinders, C. Colaço, and J. A. Bonet. 2024. Framing Coherence Across EU Policies Towards Integrated Wildfire Risk Management and Nature-Based Solutions.*

[248] *World Bank. 2024. Link.*

risk, depending on its frequency, intensity, and impacts. The use of budgetary instruments is, for instance, more suitable for high-frequency, low-severity events in EU Member States. The use of risk transfer market-based instruments is more suitable for high-risk events that occur less frequently. Box 15 includes lessons learned in 2022 to increase EU cohesion policy funding impact on wildfire recovery and reconstruction and to enhance integrated wildfire management, funding accessibility and impact, and risk reduction across Europe.

Figure 13. Disaster risk layering approach: No single instrument can address all risks

SOURCE: WORLD BANK.

Box 15. Lessons learned from the 2022 European fires: Wildfire recovery and reconstruction

- Post-fire recovery efforts should not simply restore areas to their pre-fire state but should consider long-term resilience and adaptation to future wildfire risks. This involves incorporating factors like species ecology, forest dynamics, climate change, and local community needs.
- Funding mechanisms should be aligned with the 'build back better' principle to promote sustainable recovery and reduce vulnerability to future disasters.
- Post-fire recovery efforts should focus on building back better to enhance resilience to future wildfires. This includes incorporating principles of 'building back better' into funding schemes like the EUSF.

Sources: EC et al. 2024; Pronto et al. 2023.

CROSS-CUTTING TOPIC: SOCIAL RESILIENCE AND INCLUSION

This chapter explores the social dimensions of wildfire resilience, focusing on the inclusion of vulnerable populations and community-driven approaches to wildfire risk management. It examines social equity, community engagement, and targeted support for at-risk groups to enhance adaptive capacity and foster long-term wildfire resilience.

GENERAL

IWRFM in Europe integrates various policies aimed at mitigating the impacts of wildfires on vulnerable populations and enhancing social resilience. Social justice aspects that arise in wildfire risk management can relate to land use restrictions that relocate people and their homes from wildfire-prone areas, putting fewer lives at risk. However, these require careful consideration of who these populations are, whether they have a voice or influence in the matter, whether they will be compensated for relocation, and at whose expense, among other factors.[249] Lower income is often correlated with higher vulnerability because people with fewer financial resources may also be less mobile, may have fewer resources to support evacuating or taking preparedness actions, and will have fewer resources to devote to recovery. Lower income also correlates with less political influence, which can, in turn, mean less investment in preparedness and risk reduction, weaker services, and lower capacity in local government and civil protection. Age can be a vulnerability factor as older people tend to be physically weaker and thus less mobile, which affects their ability to evacuate and move to safer locations. Age can also be an issue when it comes to technology—older people may be less tech savvy and thus may have access to fewer resources of information, especially as related to EWS.[250]

Psychological impacts of extreme wildfires can also be significant. High rates of post-traumatic stress disorder), anxiety, and depression have been observed among firefighters in Portugal and Greece following large-scale wildfire events.[251] In Spain, increased use of anxiolytics was recorded after wildfires, indicating broader population-level mental health impacts.[252] Whereas limiting wildfire-induced fatalities requires adapted emergency preparedness and response capacities, the more silent human health consequences can only be reduced by limiting the outbreak and intensity of wildfires.[253]

CURRENT ARRANGEMENTS

Currently, policies are aimed at immediate response and recovery, with less emphasis on long-term prevention, inclusive planning, and systemic resilience.[254] Only a few countries in the EU have focused on demographic development and urbanization in their risk assessments. The UCPM strengthens cooperation between EU countries in wildfire response and aims to protect vulnerable populations during disasters.

The ageing of Europe's population is a significant demographic trend that has implications for climate vulnerability and adaptive capacity.[255] The proportion of people aged 65 and older is increasing across EU countries, with an average rise of 3 percent from 2012 to 2022. This trend is especially pronounced in rural areas where the outmigration of younger individuals heightens the ageing of the population by location.

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[249] *Firelogue, Fire-Res, Treeds, Silvanus, n.d.*

[250] *Szönyi, M., V. Roezer, T. Deubelli, J. Ulrich, K. MacClune, F. Laurien, and R. Norton. 2022. PERC Floods Following "Bernd." Link.*

[251] *Oliveira, J., Aires Dias, J., Duarte, I.C., Caldeira, S., Marques, A.R., Rodrigues, V., Redondo, J. and Castelo-Branco, M., 2023. Mental health and post-traumatic stress disorder in firefighters: an integrated analysis from an action research study. Frontiers in Psychology, 14, p.1259388.*

[252] *Caamano-Isorna, F., Figueiras, A., Sastre, I., Montes-Martínez, A., Taracido, M. and Piñeiro-Lamas, M., 2011. Respiratory and mental health effects of wildfires: an ecological study in Galician municipalities (north-west Spain). Environmental Health, 10, pp.1-9.*

[253] *OECD 2023a.*

[254] *EC 2024c.*

[255] *European Environment Agency 2024a.*

Many countries have social protection arrangements in place, although not all of them are updated to be adaptive to wildfire (or other natural hazard) shocks.[256] These social protection systems are critical for supporting vulnerable populations during and after disasters, but the degree to which they are integrated with DRM and adaptation varies. Some countries report having soft law measures and policies to complement legal frameworks for civil protection which may include some aspects of social protection.

Mental health is becoming part of the EU's disaster recovery efforts. The European Commission established a new initiative on mental health in 2023. A comprehensive, prevention-oriented multi-stakeholder approach to mental health has been developed after extensive consultation with MS, stakeholders, and citizens. Mental health needs arise in situations of displacement and natural disasters; therefore, the Commission's Mental Health and PsychoSocial Support is an essential element of comprehensive crisis response and is integrated into the EU-funded humanitarian aid operations with €111 million dedicated to this priority since 2019.[257]

The EU's Biodiversity Strategy 2030 focuses mainly on environmental concepts, but it also includes social dimensions. Most relevant is the inclusion of rural and indigenous communities in conservation and land management. As wildfire prevention and effects are critically linked with protected areas under the Biodiversity Strategy, the enviro-social connection is made formally through this policy.

KEY CHALLENGES

In countries such as Greece, wildfires have had negative effects on communities, affecting health, livelihoods, and ecosystems. For example, between 1998 and 2004, wildfires in the greater Athens area were associated with a 6 percent increase in the number of cardiovascular deaths and a 12 percent increase in the number of respiratory-related deaths.[258] In Portugal, growing wildfire risk increases threats to human health and well-being. Wildfires have already affected thousands of people, with a single event, such as those of 2017, claiming 100 lives and leaving more than 2,700 people homeless. Fires are also associated with a surge of respiratory problems in Portugal.[259]

Research on the societal impact of insurance has shown that insurance has the potential to exacerbate social inequalities, especially without state support using subsidies, zoning, and other tools for access and maintenance.[260] Insurance companies often exclude certain areas from their coverage or request high premiums. In addition, insurance for economically used forest areas that includes wildfires is not yet widely available across Europe, notably not in wildfire-prone countries like Portugal, Greece, and Italy. In these countries, the government tends to provide financial support for families on an ad hoc basis. In this way, wealthier communities are able to afford insurance and maintain/recover higher quality homes, which is not possible for lower-income groups or communities.

KEY OPPORTUNITIES

Integrating mental health services into disaster risk reduction and recovery is key for holistic social wellness. While the EU's Mental Health and PsychoSocial Support fund is a promising start to this, it is unclear how much of this is being used post-disaster. Furthermore, having preventive mental health care as part of wildfire management planning can ensure that resources are prepositioned and appropriately deployed during and after crisis situations.

Applying Adaptive Social Protection as often as possible increases inclusion, especially of vulnerable populations.[261] Adaptive Social Protection strengthens the resilience of poor and vulnerable households by investing in their capacity to prepare for, cope with, and adapt to shocks, ensuring they do not fall deeper into poverty. Studies highlight the importance of integrating the often-disconnected sectors of social protection, DRM, and adaptation to create a mutually reinforcing approach that reduces household vulnerability and builds resilience.

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[256] *EC 2024c.*

[257] *EC. 2023a. Communication from the Commission to the European Parliament, The Council, the European Economic and Social Committee and the Committee of the Regions on a Comprehensive Approach to Mental Health. Link.*

[258] *Analitis, A., I. Georgiadis, and K. Katsouyanni. 2012. "Forest Fires Are Associated with Elevated Mortality in a Dense Urban Setting." Occupational and Environmental Medicine 69(3): 158–162.*

[259] *OECD 2023b.*

[260] *Firelogue, Fire-Res, Treeds, Silvanus, n.d.*

[261] *World Bank. 2020. Adaptive Social Protection: Building Resilience to Shocks. Link.*

Examples include participatory planning for wildfire risk management, addressing power inequalities, inclusive EWSs which can reach all sectors of society, and integration of local knowledge, among others.

Furthermore, clarifying and strengthening the role of indigenous communities in wildfire management can improve risk reduction. The EU Biodiversity Strategy acknowledges the role of indigenous communities and can further make the connection and provide resources to ensure that local populations who are acutely aware of the land and environment have a key role in shaping current and future land management policies and programs.

In addition, IWFRM presents an opportunity to address justice dimensions by ensuring equitable distribution of costs and benefits, inclusive decision-making, and restorative practices that recognize historical inequalities. The living-with-fire paradigm balances ecological resilience with risk management through community participation and cross-sectoral collaboration. By incorporating justice frameworks, IWFRM can promote equity, amplify marginalized voices, and enhance resilience to wildfires.[262] EU's draft IWFRM Strategy as of May 2025 emphasizes the need to integrate justice aspects into IWFRM policies and ensure coherence across sectoral policies with wildfire risk implications. Justice aspects includes looking at the distribution of risk, the representation of stakeholders in risk management, and the impacts of compensatory measure.[263]

Finally, ensuring that more segments of society are able to access wildfire insurance, either through government or EU-sponsored programs or through public-private partnerships, can improve wildfire resilience. This can help not only increase insurance penetration and use but also provide additional protection for assets and economic services to avoid community displacement following wildfires, both temporary and permanent. Box 16 includes lessons learned in 2022 to increase EU Cohesion Policy funding impact on social resilience and to enhance integrated wildfire management, funding accessibility and impact, and risk reduction across Europe.

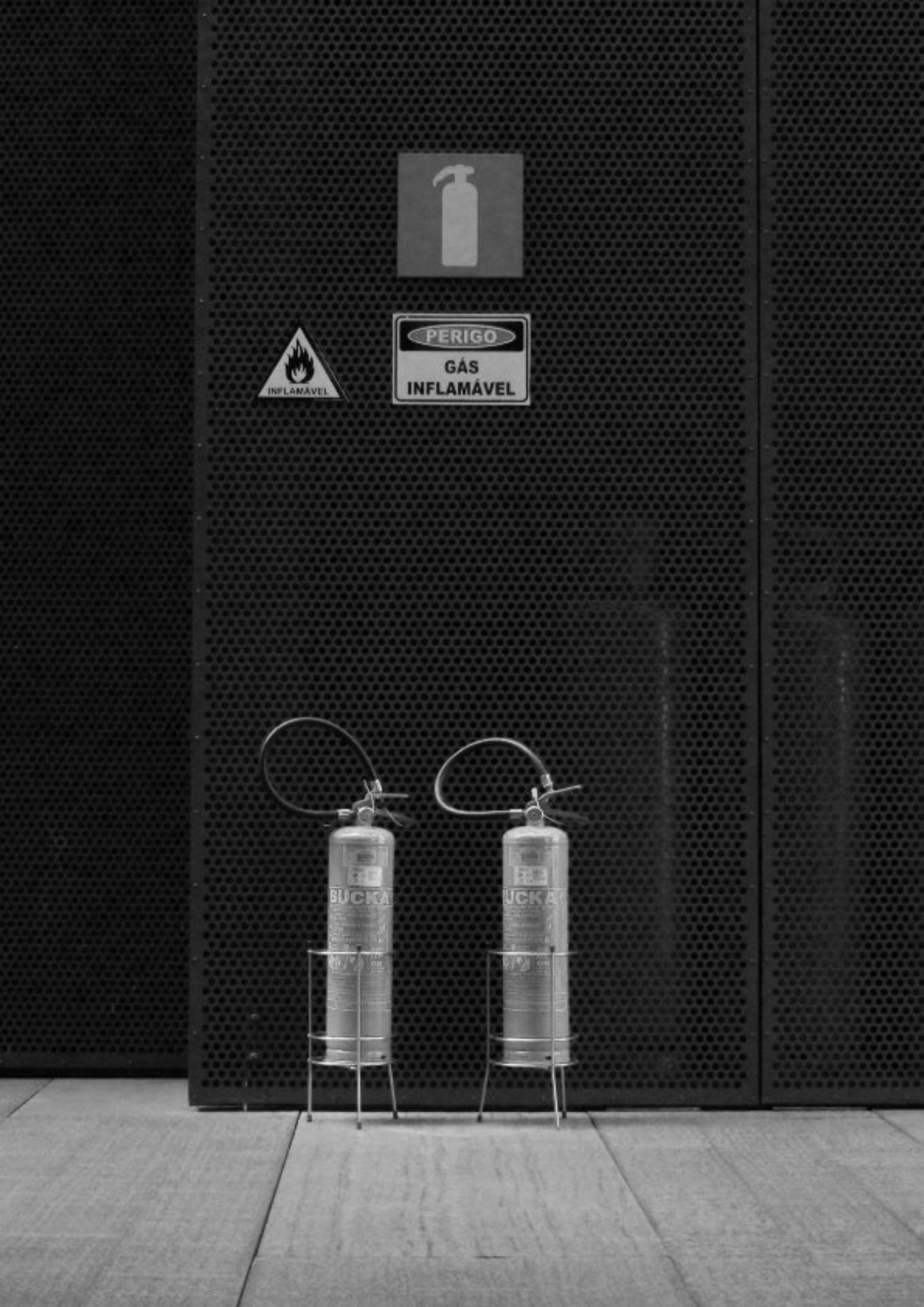
[262] *Schinko, T., C. Berchtold, J. Handmer, T. Deubelli-Hwang, E. Preinfalk, J. Linnerooth-Bayer, A. Scolobig, M. Serra, and E. Plana. 2023. "A Framework for Considering Justice Aspects in Integrated Wildfire Risk Management." Nature Climate Change 13 (8): 788–795. Link.*

[263] *Berchtold (née Bach), C. 2025.*

Box 16. Lessons learned from the 2022 European fires: Social resilience

- Community engagement is essential for wildfire risk reduction, with educational campaigns that should be implemented for social resilience.
- Strengthening community resilience involves integrating wildfire risk management into land use planning and sectoral policies. This would help reduce vulnerability and promote sustainable development in fire-prone areas.
- Collaboration and capacity building in climate-aware sustainable fire management and integrated wildfire management are essential. A participatory approach involving diverse stakeholders is key to fostering social resilience.

Source: Pronto et al. 2023.


INFLAMÁVEL
PERIGO
GÁS
INFLAMÁVEL

CROSS-CUTTING TOPIC: PRIVATE SECTOR

This chapter considers the role of the private sector in wildfire risk management across all phases. It highlights opportunities for leveraging public-private partnerships and technological advancements to enhance wildfire resilience while addressing key challenges such as regulatory enforcement, fragmented land ownership, and funding gaps.

CURRENT ARRANGEMENTS

The involvement of the private sector in wildfire risk management is important for all phases of wildfire risk management and includes landowners, forest managers, insurance companies, energy firms, and others, all of whom have a role and often a stake in managing wildfire risks.

Private landowners are increasingly integral to reducing wildfire risks by managing fuel loads in efforts for wildfire prevention. In France, Portugal, and Spain, programs exist that incentivize grazing and other fuel management activities on private lands. These initiatives are supported by public-private partnerships to reduce fuel accumulation on private lands. Portugal's *Condomínio de Aldeia* program promotes active land management to increase the resilience of settlements located in the WUI. The program also aims to increase the profitability of private lands and to encourage tourism. In addition, the *Aldeia Segura, Pessoas Seguras* program encourages the implementation of buffer zones and fuel management to protect settlements and infrastructure in the WUI.[264]

The insurance industry plays an important role in mitigating the economic impacts of wildfires through risk transfer**.** Parametric insurance and multi-hazard bundling can help transfer the financial risks associated with wildfires. Public-private partnerships in this sector, especially in countries like France and Spain, are important for ensuring adequate financial coverage of wildfire risks.[265]

Private infrastructure providers are developing regulations that require infrastructure owners and operators to comply with fire safety standards and create contingency plans.[266] The degree of enforcement and implementation varies, and many measures are still voluntary. Private companies, especially in the energy sector, are actively managing vegetation and fuel loads near their assets to reduce wildfire risk. Portugal's largest energy provider, Energias de Portugal, exemplifies this proactive approach. Additionally, in Greece, electricity network operators IPTO and HEDNO work with authorities to clear vegetation along power lines. Furthermore, Portugal requires infrastructure projects to consider scenarios, including wildfire risk, during the approval process, which is a positive step toward mainstreaming wildfire management within critical infrastructure sectors and projects. Public-private partnerships are also increasingly used across EU Member States as a financing tool for wildfire-related infrastructure, particularly for services such as fire stations and shelters.

The private sector can also support innovation and technology needed in wildfire risk management. State-of-the-art remote sensing, AI, and big data analytics can assist in enhancing the capacity to monitor and respond to wildfires. EU-funded projects like FIRE-RES integrate research, technology, civil protection, policy, and governance related to wildfires.[267] In addition, forest-based industries can play a significant role in wildfire risk management through land management, sustainable forestry practices, and innovation in renewable materials like bioplastics. Paper packaging, for example, has

[264] *OECD 2023b.*
[265] *EC 2024e.*
[266] *OECD 2023a.*
[267] *EC 2024f.*

emerged as a success story driven by demand for sustainable alternatives to plastics. These industries play a key role in forest and land management in relation to fire management as well.

KEY CHALLENGES

A major challenge is that many forested lands are owned by private owners, yet many are not identified on land registries. In addition, enforcement of fuel management regulations on private lands tends to be challenging. Highly fragmented land ownership structures, such as in Portugal, limit the profitability and the incentives for active land management. In Portugal specifically, the ageing population and high rates of land abandonment in rural areas add to these challenges. Such abandonment leads to a growing number of unmanaged lands, exacerbating wildfire risk.[268]

Another challenge is the lack of strong regulatory mechanisms for the collection, valorization, and management of biomass waste generated by the forestry and agriculture sectors. Improved enforcement of waste management would reduce the use of fire in rural areas and incentivize active land management.[269]

There is a lack of comprehensive and enforced regulations for wildfire resilience within MS' energy sectors.[270] Fragmented and inconsistent enforcement, along with the reliance on voluntary actions, limits the effectiveness of wildfire risk mitigation efforts in the private sector. Additionally, there is limited funding for smaller operators to implement comprehensive wildfire prevention measures.[271] There is a need for knowledge sharing among private critical infrastructure providers of all sizes to ensure that best practices, opportunities for funding, risk mitigation strategies, and overall resilience to wildfires are disseminated. Proactive enforcement and maintenance of infrastructure can mitigate potential fire impacts and prevent cascading failures.

In addition, economic interests that drive land development decisions into WUI zones increase wildfire exposure. For example, the rebuilding of informal developments in WUI regions post-wildfire in the Attica region of Greece is often influenced by private, local pressure groups, such as associations representing developers and local property owners.[272] Furthermore, private sector goals are not aligned with EU policies, and these policies could be improved. For example, bioplastics that rely on forestry are categorized alongside conventional plastics under the EU Single-Use Plastics Directive, which reduces incentives for their development and potential for sustainable forestry.

KEY OPPORTUNITIES

Increasing incentives for private land management is key for wildfire risk reduction. Developing and expanding programs that provide financial assistance and tax incentives for actions such as forest thinning and controlled burns (where appropriate) could encourage more private landowner involvement. Such actions are particularly important in rural and WUI zones in Southern Europe.

Expanding insurance access through private sector involvement is another mechanism to improve post-disaster recovery and both physical and environmental asset protection. Robust parametric insurance for wildfire risk can be especially useful in areas highly prone to wildfires.

A coordination mechanism is needed in Member States to include private sector infrastructure involvement in wildfire resilience. Encouraging the integration of private sector efforts with national and regional wildfire management plans, including fuel management programs and land use policies, can create a more cohesive and effective approach to wildfire risk reduction. Furthermore, ensuring that new infrastructure projects consider future scenarios is important for 'climate proofing' projects that have long operational lives. Lastly, investing in research and development, such as advanced monitoring systems and fire-resistant materials that are contextually appropriate to the Member States, can improve infrastructure resilience.

Improving technological innovation through more private industry involvement can help with prediction, early warning, and response capabilities. By embedding AI and other state-of-the-art technologies with the help of private sector knowledge and tools, platforms such as Copernicus can

[268] *OECD 2023b.*
[269] *Ibid.*
[270] *OECD 2023a.*
[271] *OECD 2023b.*
[272] *OECD 2024.*

be strengthened in efforts to identify current and future risks to fires as well as early detection and response capabilities for fire services.

Policy integration and sustainability synergies with private sectors can improve forest and land management practices. Aligning EU environmental directives with industry objectives can drive innovation and sustainability within the forest sector. Public-private partnerships can encourage private sector investments in fire-resistant infrastructure, landscape management, and early warning technologies. Policies at the EU and national levels can leverage the private sector's interest in renewable materials and can foster alignment with broader wildfire resilience and biodiversity goals.

Box 17 includes lessons learned in 2022 to increase Cohesion Policy funding impact on the private sector to enhance integrated wildfire management, funding accessibility and impact, and risk reduction across Europe.

Box 17. Lessons learned from the 2022 European fires: Private sector

- The private sector plays a large role in wildfire risk management, and insurance companies can incentivize prevention measures to enforce compliance with regulations.
- Private landowners should be encouraged and supported to implement fire prevention measures. This could involve providing technical assistance and financial incentives for fuel management and other risk reduction activities.
- Collaboration and capacity building in climate-aware sustainable fire management and integrated wildfire management are essential. A participatory approach involving diverse stakeholders is key to fostering social resilience.

Source: Pronto et al. 2023.

INVESTMENT NEEDS AND RECOMMENDED APPROACHES

This chapter proposes key priorities for reforms and investment areas, which may be considered as part of technical assistance, policies, or instruments. It is informed by desk research and consultations.

KEY INVESTMENT AREAS

1. **Climate resilience in public and private sectors.** Systemic adaptation across all levels of society is required. Investment in resilience should be included in micro-fiscal policies and emphasize NBS as well as local adaptation strategies. The EC has been supporting the development and implementation of adaptation strategies across government levels, yet the rate at which wildfire risk is growing requires amplification of resilience investments.[273] Funding gaps exist for infrastructure upgrades and post-disaster assessments, and therefore funding and a clear regulatory mechanism are needed to guide the investments.

2. **Fuel and land management and Nature Based Solutions (NBS).** Investment in fuel management, especially in high-risk areas, is essential. Creating firebreaks, buffer zones, and strategic fuel mosaics reduces the landscape's flammability. Sustainable land management practices, including prescribed or controlled burning (where contextually appropriate), should be scaled up. Forest management with NBS includes promoting agroforestry, silviculture, and mixed grazing regimes to meet multiple objectives.[274] In addition, res-toration of degraded ecosystems also plays an important role in mitigating wildfire risk.[275]

3. **Investing in wildfire agencies and community champions.** Establishing a national and/or regional fire protection association or task force can unify stakeholders and promote integrated fire management. These associations can foster collaboration among national agencies, municipalities, and private landowners, ensuring alignment on shared objectives for resilience. Funding a community champion or facilitator to improve local or grassroots-level wildfire management empowers communities and equips them to manage wildfires with self-efficacy**.** AGIF in Portugal is a good example of how a multi-agency can consider multiple actors in both the public and private sectors to support unified and strategic wildfire management**.**

4. **Early Warning Systems (EWSs) and monitoring technology.** Improving EWSs and data outputs can enhance monitoring pre-disaster and resource deployment/ management during wildfire events. At the EU level, EFFIS can be bolstered with AI technology to support time-sensitive and scale-relevant operational decisions for wildfire prevention and response**.**[276]

5. **Investment in additional peer reviews. Expanding** the number of countries that participate in the UCPM Wildfire and DRM Peer Reviews is an important mechanism to understand strengths, weaknesses, and opportunities to enhance wildfire risk reduction while also growing institutional and capacity-building knowledge**.**

[273] *World Bank and European Commission 2024.*
[274] *Held, A., and L. Pronto. n.d. Reducing Wildfire Risk in Europe through Sustainable Management. Link.*
[275] *OECD 2023a.*
[276] *EC 2024c.*

6. **Disaster risk financing and insurance incentives**. Governments should incentivize risk reduction behaviour by offering lower premiums for properties that comply with building standards. Insurance coverage gaps, especially in wildfire-prone regions in Greece, highlight the need for policy reforms to promote insurance uptake.[277]

7. **Infrastructure development and building codes.** Investing in disaster-resilient infrastructure in wildfire-prone communities and regions is critical. Building codes and land use regulations with improved and sustained enforcement can restrict development in fire-prone areas like the WUI and ensure fire-resilient design.[278] Examples include building codes that require fire-resistant materials, zoning laws that limit development in high-risk areas, and funding for research on wildfire behaviour and mitigation.

8. **EU-developed wildfire priority guidelines.** The EU should consider developing guidelines for Member States that include multi-year, multi-stakeholder conversations to unify and negotiate priorities for IWFRM. Such guidelines can help multiple sectors, horizontal and vertical government agencies, and private citizens and entities to strategically and deliberately inform a country-wide set of wildfire priorities that engages all stakeholders.

9. **Investment in rural communities.** Rural communities should be provided with funds and resources for their active land management in various Member States because they are managing landscapes organically while developing agriculture and cropland sectors. This active management reduces the need for government or state-sponsored interventions that can potentially create unsafe situations for fire service personnel. It can also promote tenure and maintain or reverse some of the trends of rural depopulation which is a critical driver of wildfire risk in the EU.

10. **Establishment of a consistent and shared definition of forest and wildfire policy at the EU level.** Integrating various objectives such as biodiversity conservation, adaptation, disaster risk reduction, and resilience into a unified framework while addressing gaps in communication and cultural acceptance of fire management measures is critical for improved governance and coordination for wildfire management. Some stakeholders would welcome a directive similar to the EU Floods Directive.

[277] *OECD 2024.*
[278] *OECD 2023a.*

RECOMMENDED INVESTMENT APPROACHES: REGIONAL WILDFIRE (NOT IN ANY PARTICULAR ORDER)

1. **Prioritization of prevention investments.** Investments in prevention are far lower than those in response and should be prioritized.

2. **Whole-of-government approaches.** Supporting cross-government and agency collaboration on wildfires is essential. Portugal's Agency for the Integrated Management of Rural Fires is an example of a designated authority to centralize planning and efforts for wildfire risk management.

3. **Cross-border and multinational cooperation.** Encouraging and bolstering the use of Copernicus and EFFIS in countries that have not yet embedded them into their prevention and response systems can improve transboundary wildfire risk reduction through shared data practices and procedures.[279]

4. **Nature-baded Solutions.** Encourage the development and management of ecosystems such as forests and wetlands which can act as natural buffers against wildfires and floods and ensure that ecosystem benefits are not hampered due to increased wildfire risk.[280]

5. **Public-private partnerships and collaboration.** The use of tax breaks, subsidies, and other financial incentives can encourage property owners and businesses to adopt risk-reducing measures which can include retrofitting buildings to comply with fire-resistant standards or investing in resilient agricultural practices.

A list of recommendations is provided in Table 2, in line with the report's structure. Table 3 provides a quick overview of key areas in terms of types of investments. Box 18 provides a summary of practical insights for European wildfire management from wildfires in the USA in 2025 and its recovery process.

[279] *EC 2024c.*
[280] *EC. n.d. EU Adaptation Strategy. Link.*

Table 2. Key investment recommendations for the EU in wildfire risk management

Risk governance	• Reform wildfire governance frameworks to reflect integrated risk management, not only forest protection. • Support centralized coordination bodies (for example, Portugal's AGIF). • Promote EU-wide wildfire risk guidelines and priority setting.
Understanding risk	• Increase support for wildfire peer reviews and lessons sharing through UCPM. • Improve risk mapping, behavioral forecasting, and fire modeling through cross-border data exchange and technological enhancements.
Risk prevention, reduction, and mitigation	• Prioritize investments in prevention (for example, fuel breaks, mosaics, agroforestry). • Scale up prescribed/controlled burning where appropriate. • Restore degraded ecosystems and manage fire-prone landscapes using NBS. • Strengthen fire-safe building codes and land use planning, especially in WUI zones. • Fund fire-resilient infrastructure (for example, fire-resistant materials, backup water/power systems). • Support zoning enforcement in high-risk areas. • Develop incentives for risk reduction (for example, insurance premium discounts). • Address insurance coverage gaps, especially in high-risk areas like Greece. • Explore risk-layered financing and public-private reinsurance mechanisms.
EWSs and public awareness	• Upgrade wildfire early warning systems with real-time AI and satellite-based monitoring (for example, EFFIS, Copernicus EMS). • Improve data integration for time-sensitive decision-making.
Preparedness and emergency response	• Expand cross-border cooperation through joint simulations and shared protocols. • Invest in emergency response capacity (aircraft, personnel, resource prepositioning). • Enhance community preparedness and local coordination.
Recovery, reconstruction, and post-disaster financing	• Proactively prepare for wildfire recovery through disaster recovery legislation and frameworks while building in room for flexibility to adapt to practical challenges. • Integrate DRF strategies within the recovery framework. • Adopt a risk-layering approach in DRF strategies. • Incentivize insurance uptake to reduce government liabilities.
Social resilience and inclusion	• Fund grassroots 'community champions' to lead local preparedness. • Support rural communities managing fire-prone landscapes (for example, through tenure or subsidies). • Ensure inclusivity in recovery support and risk communication.
Private sector	• Encourage fire-resilient business practices and retrofitting via tax breaks and subsidies. • Promote public-private partnerships in early warning, landscape management, and infrastructure investment. • Foster insurance innovation by funding research and pilot applications.

Table 3. Key areas for wildfire risk management investments

Source: World Bank and European Commission 2024.

Risk	Wildfire
Analytics and policies	• Wildfire risk analytics for current and future projections • Advanced technologies (satellite monitoring for early warning) • Established mutual aid agreements for coordinated response • Land use planning and zoning policies, especially related to WUI • Risk transfer policies
Infrastructure and equipment	• Physical barriers, such as firebreaks, to prevent the spread of wildfires and protect communities • Specific design/protection of high-risk facilities (fuel depots and so on) • Firefighting equipment
Human capital and social aspects	• Training programs for firefighters • Community drills to promote fire safe practices and evacuation plans • Public awareness campaings on how to avoid wildfires
Environment and sustainability	• Vegetation management through controlled burns, defensible space creation, and forest thinning to reduce fuel for wildfires • Restoration of ecosystems and biodiversity (for example, reforestation and drought/heat management programs)

Box 18. Lessons learned from 2025 Los Angeles fire and wildfire recovery

Experience from the Los Angeles fires in January 2025 and its recovery can offer practical insights for European wildfire management. *The lessons below highlight critical gaps and opportunities that align with Europe's focus on wildfire resilience, community engagement, and integrated planning.*

Lessons learned from critical gaps

- **Underestimation of fire behavior:** Existing wildfire protection plans failed to anticipate the scale and intensity of firestorms with multiple ignitions, underscoring the need for planning for worst-case scenarios.
- **Water system vulnerabilities: Firefighting** efforts in Ventura were hindered by empty hydrants and power-dependent water tanks. This reinforces the need for resilient water infrastructure with backup systems, echoing a lesson from the Karst fires in Slovenia.
- **Debris removal challenges:** Miscommunication and lack of trust between residents and agencies complicated debris removal, especially with respect to seemingly intact building foundations. Clear guidance and public education are essential for post-wildfire recovery protocols and necessities.
- **Emotional and logistical burdens on survivors:** Many survivors struggled with navigating complex recovery steps while facing trauma, emphasizing the need for empathetic, accessible support services.
- **Challenging permitting processes:** Rebuilding in LA was slowed by bureaucratic complexity, prompting efforts to streamline procedures.
- **Insurance disparities:** Inconsistent advice and underinformed claim settlements highlight the need for better insurance literacy and coordinated evaluation standards.
- **Risk of exploitation:** Reports of unethical actors targeting vulnerable survivors underscore the need for protective mechanisms and trusted local resources.
- **Lack of long-term vision:** Recovery efforts must go beyond restoration and integrate future wildfire risk and climate adaptation into rebuilding plans from the outset.

Los Angeles fire management successes:

- **CAL FIRE Damage Inspection Data (DINS)**: A systematic, publicly available dataset provides accurate damage assessments to support recovery planning.
- **Centralized recovery website:** Recovery.LAcounty.gov provides step-by-step guides, FAQs, mapping tools, and property-specific resources to assist affected residents.
- **One-stop development centers:** Permitting offices in Altadena and Calabasas consolidate agency services, which streamlines the rebuilding process.
- **Unified application process:** A single permit application for all relevant departments reduces complexity for property owners.
- **Strong interagency collaboration:** LA County's coordination across departments, cities, and community organizations demonstrates the value of a unified, multi-stakeholder response model.

Sources: American Institute of Architects (AIA) California. 2025. Fire Response Webinars. Link. APA California. 2025. American Planning Association (APA) California Response to the LA Fires: Recovering and Rebuilding Webinar Series. Link.

ANNEX 1. ADDITIONAL INFORMATION – EXPANDED SUMMARY

The EU faces a growing wildfire risk due to changes in the climate, rural land abandonment, and expanding Wildland Urban Interfaces (WUI). *The Mediterranean region of Europe continues to experience the highest risk for wildfires, but, Northern Europe and other previously low-risk areas are now increasingly exposed to wildfire hazards. Countries such as Spain, Portugal, Greece, and Italy have experienced several large-scale wildfires. Countries such as Germany, Czechia, and Slovenia are experiencing a higher frequency of wildfires, which had previously been more common in Mediterranean regions.[281] The expanding risk potential requires enhanced preparedness and coordinated response measures across the EU.[282]*

Several key factors drive the wildfire risk in Europe including the following:

- Increasing hazards: Rising temperatures and prolonged droughts are key factors increasing the intensity and frequency of wildfires. The European Commission's Strategy of Adaptation to Climate Change highlights the need for enhanced and accelerated adaptation to these rising risks. By 2100, extreme wildfires are projected to increase by 50 percent and will place great pressure on national member state firefighting resources.[283]

- *Rural depopulation*: The abandonment of rural lands and the related decrease in traditional farming practices/grazing have resulted in increased vegetation buildup, which serves as fuel for wildfires. Fewer residents in these areas mean lower capacity for early detection and quick response and increases wildfire vulnerability particularly in Southern Europe.[284]

- *Expansion of WUI*: The growth of human settlements near wildland areas significantly heightens the likelihood of fire ignition, whether through human activity or structural vulnerability. Countries such as Greece and Portugal have experienced an increase in wildfire occurrences linked to the expansion of WUI zones.[285]

WILDFIRE GOVERNANCE

The EU has introduced numerous policies and frameworks aimed at managing wildfire risks in areas of governance, coordination, prevention, and financing. The EU Forest Strategy for 2030, for example, focuses on enhancing sustainable forest management and wildfire prevention, promoting ecosystem restoration, and reducing fuel accumulation.[286] The Union Civil Protection Mechanism (UCPM) coordinates cross-border firefighting support, ensuring the pooling of resources when national capacities are overwhelmed. More recently, strategic positioning of resources ahead of wildfires has been implemented. Also, several peer reviews of wildfire risk management practices have been conducted in Greece, Italy, and Brandenburg.[287]

Key opportunities going forward on wildfire risk management governance include the following:

- *Improving policy coherence*: Wildfire risk should be considered consistently within the broader disaster risk management (DRM), land use/forest management/nature restoration, and adaptation and mitigation frameworks, including national wildfire management strategies in EU Member States. In countries where wildfire risk is nascent or emerging, integrating wildfire risk into national risk assessments is critical to identify hotspots and provide data that can drive sustainable development.[288]

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[281] *EC. 2024e. EU Preparing for the 2024 Wildfire Season. Link.*

[282] *EEA 2024c.*

[283] *UNEP. 2022. Number of Wildfires to Rise by 550 Percent by 2100 and Governments Are Not Prepared, Experts Warn. Link.*

[284] *OECD. 2023a. Taming Wildfires in the Context of Climate Change. Link.*

[285] *Nunes, A. N., A. Figueiredo, C. Pinto, and L. Lourenço. 2023. "Assessing Wildfire Hazard in the Wildland–Urban Interfaces (WUIs) of Central Portugal." Forests 14 (6): 1106.*

[286] *European Parliament. 2022. New EU Forest Strategy for 2030. Link.*

[287] *European Union. 2024f. UCPM Peer Review Programme. Link. Separately, there have also been several reviews conducted by the Organisation for Economic Co-operation and Development (OECD) - see website Link.*

[288] *Casartelli and Mysiak 2023.*

- *Greater institutional coherence*: Strengthening coordination between national and local authorities to improve landscape management, zoning, prevention, and response. This may include enhancing enforcement and clarifying land ownership and property fragmentation. Additionally, national policies need to be aligned with broad EU priorities, contributing to overall harmonization of efforts on prevention, preparedness, and response.[289]

- *Increasing investments in prevention and preparedness*: Although there has been an increase in funding for emergency response and suppression of wildfires (such as equipment), there are opportunities to further increase investments in preventive measures, including technical capacity building, expert knowledge exchange, and research and development. Financial instruments in agriculture and forestry as key sectors need to include and encourage more adaptive measures for fire prevention.

UNDERSTANDING OF WILDFIRE RISK

The EU has developed tools and frameworks to enhance understanding and management of wildfire risks across MS. Key initiatives include the **European Forest Fire Information System (EFFIS)**, which provides near real-time data on fire activity, weather conditions, and fuel loads, as well as historical data on wildfire regimes across Europe, the Middle East, and North Africa. Similarly, the **Copernicus Emergency Management Service** (EMS) supports emergency managers with satellite imagery and geospatial analysis for wildfire preparedness, response, and recovery.[290] Projects like FirEUrisk and FIRE-RES further contribute by integrating research, technology, and policy to advance holistic wildfire risk strategies, while projects like Firelogue facilitate dialogue that includes data-related issues and opportunities. Other key projects, such as TREEADS, FIRE-RES, SILVANUS, FirEUrisk, EWED, and SAFERS, improve our understanding of wildfire risk information and management.[291] National-level initiatives complement these efforts, such as Portugal's development of a national wildfire risk map and Greece's integration of projections into subnational assessments.[292]

There are several opportunities to strengthen the understanding of wildfire risk, including the following:

- *Improved analysis*: There is an opportunity to strengthen wildfire risk assessments across the EU by incorporating long-term projections. Expanding data collection and reporting efforts can enhance consistency and ensure a comprehensive understanding of wildfire risks. The development and adoption of probabilistic models can improve future scenario understanding and planning.[293]

- *Improved data:* Standardized data on wildfire losses, fatalities, and prescribed burns integrated with projections and advanced modeling can create a robust baseline for assessing programs, informing policy decisions, and facilitating effective cross-border collaboration in wildfire management across the EU. Establishing a common framework for reporting wildfire losses, fatalities, and prescribed burns can provide a robust baseline for assessing progress in wildfire prevention and mitigation. [294]

WILDFIRE PREVENTION, RISK REDUCTION, AND MITIGATION

The EU promotes sustainable forest management, land use planning, and community engagement. For example, the EU Forest Strategy for 2030 promotes practices such as controlled burns and vegetation management to reduce fuel loads, aiming to shift from mere fire suppression to effective prevention. Additionally, the European Commission's Wildfire Prevention Action Plan, developed after the 2022 wildfire season, outlines 10 action items to

[289] *OECD 2023a.*

[290] *OECD 2023a.*

[291] *Firelogue. 2024. Key Projects. Link.*

[292] *Fernandez-Anez, N., A. Krasovskiy, M. Müller, H. Vacik, J. Baetens, E. Hukić, M. Kapovic Solomun, I. Atanassova, M. Glushkova, I. Bogunović, and H. Fajković. 2021. "Current Wildland Fire Patterns and Challenges in Europe: A Synthesis of National Perspectives." Air, Soil and Water Research 14: 117. DOI 86221211028185.*

[293] *OECD 2023a.*

[294] *EC. 2024c. Report from the Commission to the European Parliament and the Council on Progress on Implementation of Article 6 of the Union Civil Protection Mechanism. Link.*

enhance wildfire prevention, including capacity building, improved risk assessment, and increased financing for preventive measures.[295]

There are several opportunities to strengthen wildfire risk prevention, risk reduction, and mitigation:

- *Balancing prevention and emergency response investments*: There is an opportunity to increase funding of fuel management, firebreaks, and controlled burns. EU Member States can prioritize sustainable, long-term funding strategies to maximize the effectiveness of wildfire management efforts and strengthen overall resilience.
- *Enhancing coordination in land use planning*: Collaborative land management strategies offer a promising pathway to overcome challenges related to fragmented land ownership. Involving private landowners, local communities, and government agencies in coordinated land use planning can streamline fire prevention efforts and promote sustainable forest management and adaptive agriculture.
- *Expanding the use of prescribed burning as a prevention tool:* Prescribed burning presents a valuable opportunity to enhance wildfire prevention and fuel management. By simplifying regulatory processes, expanding training programs, and increasing public awareness of the benefits of prescribed or mild burns, more regions can integrate prescribed burns into their wildfire mitigation strategies.

EARLY WARNING AND PUBLIC AWARENESS

EU mechanisms like rescEU, Copernicus, EFFIS, and FIREPRIME support wildfire preparedness by enhancing monitoring, early warning, and rapid response. RescEU provides deployable firefighting aircraft, while upgrades to EFFIS now include tools for assessing wildfire severity and risk, improving decision-making on prevention and management. These tools collectively strengthen the EU's ability to prepare for and respond to extreme wildfire events.[296]
National programs, such as Portugal's *Safe Village, Safe People*, demonstrate how local engagement can reduce wildfire risk through public education and evacuation drills. FIREPRIME further supports this by fostering awareness and preparedness in vulnerable communities, with pilot programs in Spain, Austria, and Sweden.

Several opportunities exist to strengthen early warning and public awareness. Some of these are as follows:

- *Advancing early warning systems for greater preparedness:* The EU has made strong progress in wildfire early warning through satellite technology, but further gains can come from real-time monitoring, AI analytics, and integrated data to support faster, more informed decision-making.
- *Expanding public awareness and training programs*: Community-focused programs, such as Portugal's *Safe Village, Safe People*, show the importance of public awareness and preparedness training in reducing wildfire risk and encouraging proactive community responses.
- *Strengthening coordination in public communication:* Harmonizing alert systems and adopting unified, multilingual communication protocols across Member States can increase the clarity, urgency, and effectiveness of public wildfire warnings.

WILDFIRE RISK PREPAREDNESS AND EMERGENCY RESPONSE

The UCPM remains a critical resource for wildfire risk preparedness and emergency response in the EU, providing support when EU Member States' capacities are stretched. The UCPM facilitates cross-border cooperation and ensures rapid mobilization of firefighting resources through the rescEU initiative. The deployment of rescEU resources was critical during the 2023 wildfire season in Greece. RescEU's capacity to pool resources from across the EU is a unique and essential element of the EU's disaster response framework.[297]

Several opportunities to improve wildfire risk

[295] *EC. 2023d. Wildfires. Link. In 2024, a collection of good practice on Wildfire Risk Awareness and Communication was published by the EC. Link.*
[296] *JRC 2024.*
[297] *EC. 2024c.*

preparedness and emergency response exist including the following:

- *Expanding emergency response capacity:* The EU has significantly increased its investment in wildfire response, growing the UCPM budget from €13 million in 2014 to €150 million in 2022, and adding €55 million to expand the rescEU fleet in 2023–2024. These funds support firefighting aircraft, personnel, and coordination mechanisms. To ensure long-term resilience, the EU can adopt strategic, risk-based budgeting and explore innovative financing, resource prepositioning, and cross-border sharing to better manage intensifying wildfire seasons.

- *Strengthening coordination and governance:* With 31 countries in the UCPM, the EU has an opportunity to enhance wildfire response through improved coordination and harmonization. Standardized procedures, shared terminology, and joint communication protocols can boost cross-border interoperability. Joint training and simulation exercises further ensure that multinational teams respond more effectively and cohesively to wildfire crises.

ANNEX 2. REFERENCES

Agencia para a Gestão Integrada de Fogos Rurais (AGIF) 2020. National Plan for Integrated Wildland Fire Management. Link.

Almeland, S.K., E. Depoortere, S. Jennes, F. Sjöberg, J.A.L. Basanta, S. Zanatta, C. Alexandru, J.R. Martinez-Mendez, C.H. van der Vlies, A. Hughes, and J.P. Barret. 2022. "Burn Mass Casualty Incidents in Europe: A European Response Plan within the European Union Civil Protection Mechanism." Burns 48 (8): 1794–1804. Link.

Al-Shamsi, M., M. Moitinho de Almeida, L. Nyanchoka, D. Guha-Sapir, and S. Jennes. 2019. "Assessment of the Capacity and Capability of Burn Centers to Respond to Burn Disasters in Belgium: A Mixed-Method Study." Journal of Burn Care & Research 40 (6): 869–877. Link.

Analitis, A., I. Georgiadis, and K. Katsouyanni. 2012. "Forest Fires Are Associated with Elevated Mortality in a Dense Urban Setting." Occupational and Environmental Medicine 69 (3): 158–162.

Arbinolo, M., G. Patimo, E. Rey, O. Stokkeland, J. C. Verde, V. Casartelli, A. Marengo, S. Melinato, J. Mysiak, D. Salpina, S. Afentoulidis, C. Brăilescu, and J. Sørensen. 2024. Wildfire Peer Review Report: Greece 2024. Union Civil Protection Mechanism - Peer Review Programme for Disaster Risk Management. Link.

Berchtold (née Bach), C. 2025. "An Integrated Wildfire Risk Management Strategy for the EU: developing resilient landscapes and safer communities". Zenodo. Link.

Blattert, C., S. Mutterer, T. Thrippleton, J. Diaci, G. Fidej, L. G. Bont, and J. Schweier. 2024. "Managing European Alpine Forests with Close-to-Nature Forestry to Improve Climate Change Mitigation and Multifunctionality." Ecological Indicators 165: 112154.

Caamano-Isorna, F., Figueiras, A., Sastre, I., Montes-Martínez, A., Taracido, M. and Piñeiro-Lamas, M., 2011. Respiratory and mental health effects of wildfires: an ecological study in Galician municipalities (north-west Spain). Environmental Health, 10, pp.1-9.

Canadas, M.J., M. Leal, F. Soares, A. Novais, P. F. Ribeiro, L. Schmidt, A. Delicado, F. Moreira, R. Bergonse, S. Oliveira, and P. M. Madeira. 2023. "Wildfire Mitigation and Adaptation: Two Locally Independent Actions Supported by Different Policy Domains." Land Use Policy 124: 106444.Link.

Casartelli, V., and J. Mysiak. 2023. Union Civil Protection Mechanism - Peer Review Programme for Disaster Risk Management: Wildfire Peer Review Assessment Framework (Wildfire PRAF). Link.

Chuvieco, E., M. Yebra, S. Martino, K. Thonicke, M. Gómez-Giménez, J. San-Miguel, D. Oom, R. Velea, F. Mouillot, J. R. Molina, and A. I. Miranda. 2023. "Towards an Integrated Approach to Wildfire Risk Assessment: When, Where, What and How the Landscapes May Burn." Fire 6 (5): 215.

Confederation of Fire Protection Associations Europe (CFPA-Europe) CFPA Europe. 2022. Fire safety in Camping Sites. CFPA-E Guideline No 20:2022. Link.

De Rigo, D., G. Libertà, T. Durrant, T. Artes Vivancos, and J. San-Miguel-Ayanz. 2017. Forest Fire Danger Extremes in Europe under Climate Change: Variability and Uncertainty. Link.

DISTRELEC. 2024. The Costs of European Wildfires 2023 Report. Link

DLA Piper. 2024. Italian Budget Law on Mandatory Insurance against Catastrophic Events Raises Several Questions. Written by Chiara Cimarelli and Francesco Ascione. Link.

European Commission. 2018. Forest Fires: Sparking FireSmart Policies in EU. Link.

European Commission. 2020. Commission Staff Working Document: Preparing for Mass Burn Casualty Incidents. Link.

European Commission. 2021a. European Climate Law (europa.eu) OJ L 243, 9.7.2021, p. 1.Link.

European Commission. 2021b. Communication from the Commission to European parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: New EU Forest Strategy for 2030. Link.

European Commission. 2022. Overview of the Wildfire Prevention Action Plan. Link.

European Commission. 2023a. Communication from the Commission to the European Parliament, The Council, the European Economic and Social Committee and the Committee of the Regions on a Comprehensive Approach to Mental Health. Link.

European Commission. 2023b. Sendai Framework for Disaster Risk Reduction, Midterm Review. Link.

European Commission. 2023c. EU Reaffirms Support at Sendai Framework for Disaster Risk Reduction Midterm Review. Link.

European Commission. 2024a. Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions: Strengthening the EU through Ambitious Reforms and Investments. Link.

European Commission. 2024b. Disaster Risk Awareness and Preparedness of the EU Population. Link.

European Commission. 2024c. Report from the Commission to the European Parliament and the Council on Progress on Implementation of Article 6 of the Union Civil Protection Mechanism (Decision No. 1313/2013/EU) Preventing and Managing Disaster Risk in Europe. Link.

European Commission, Joint Research Centre, M. Almeida, M. Soviev, J. San-Miguel, T. Durrant, D. Oom, A. Branco, et al. 2024. Report on the Large Wildfires of 2022 in Europe. Publications Office of the European Union, Luxembourg. Link., JRC138859.

European Commission/Union Civil Protection Knowledge Network. 2024. Success Stories: Prevention and Preparedness Projects Supported by the Union Civil Protection Mechanism. Link.

European Commission/Union Civil Protection Knowledge Network. 2023. Wildfire Peer Review Assessment Framework. Link.

European Commission/European Civil Protection and Humanitarian Aid Operations. Wildfire Peer Review report Greece. Link

European Environment Agency. 2024a. Economic Losses from Weather- and Climate-Related Extremes in Europe. Link.

European Environment Agency. 2024b. European Climate Risk Assessment. Link.

European Investment Bank and European Commission. 2023. Investing in Nature Based Solutions. Link.

European Parliament. 2022. New EU Forest Strategy for 2030. Link.

European Union. 2011. Directive 2011/85/EU. Link

European Union. 2017. Ideas for Interreg Post-2020: Cross-Border Programmes. Link.

European Union. 2020. Land-Based Wildfire Prevention. Link.

European Union. 2021. Regulation (EU) 2021/1060. Link.

European Union. 2024a. Regulation of the European Parliament and to the Council of 24 June 2024 on Nature Restoration. Link.

European Union. 2024b. EIOPA Consults on Natural Catastrophe Risk Reassessments in the Standard Formula. News Article. Link.

European Union. 2024c. Building Fire Resilience Using Recycled Water in Riba-Roja de Túria, Spain. Link.

European Union. 2024d. FIREPRIME. Link.

European Union. 2024e. Safe Village, Safe People: Working with the Local Community. Link.

European Union. 2024f. UCPM Peer Review Programme. Link.

European Union. 2024g. UCPM Training and Exercises Programme Page. Link.

European Union, Copernicus. 2024. Observer: ESOTC 2023 – Europe Experienced an Extraordinary Year of Extremes with Record-Breaking Heatwaves, Wildfires, Floods, and Drought. Link.

Fernandez-Anez, N., Krasovskiy, A., Müller, M., Vacik, H., Baetens, J., Hukić, E., Kapovic Solomun, M., Atanassova, I., Glushkova, M., Bogunović, I. and Fajković, H. 2021. "Current Wildland Fire Patterns and Challenges in Europe: A Synthesis of National Perspectives." Air, Soil and Water Research 14. Link.

Fire-Res. 2022. FirEUrisk and FIRE-RES: Sharing Knowledge on How to Map Fuel Availability at the European Level. Article, 7 December 2022. Link.

Fiorucci, P., U. Pernice, G. Meschi, A. Trucchia, and E. Ponte. 2024. Technical Guidelines for Forest Fire Risk Assessment: An Output of the Programme "EU Support to Flood Prevention and Forest Fires Risk Management in the Western Balkans and Turkey - IPA Floods and Fires." Link.

Freise, M., and A. Walter. 2024. "Motivations and Expectations of German Volunteer Firefighters." Journal of Civil Society 1–19.Link.

GEM. 2018. Improving Post-Disaster Damage Data Collection to Inform Decision Making. Link.

Generalitat de Catalunya. n.d. Department of Interior. Link.

Government of Ireland. 2022. Be Summer Ready. Link.

Government of Italy. 2019. School Camps. Department of Civil Protection - Italy. Link.

Government of Portugal. 2019. National Plan for Climate Change.

Government of Portugal. n.d. Portugal Chama. Link.

Government of Romania. N.d. National Strategy for Disaster Risk Reduction 2024-2035. Link.

Held, Alex, and Lindon. Pronto. n.d. Reducing Wildfire Risk in Europe through Sustainable Management. Policy Brief. Forest Europe. Link.

Huidobro, G., L. Giessen, and S.L. Burns. 2024. "And It Burns, Burns, Burns, the Ring-of-Fire: Reviewing and Harmonizing Terminology on Wildfire Management and Policy." Environmental Science & Policy 157: 103776.

IPCC. 2020. Special Report on Climate Change and Land. Link.

IPCC. 2022. Sixth Assessment Report: Europe. Link.

Joint Research Centre, European Commission. 2024a. Cross-Border and Emerging Risks in Europe. Link.

Joint Research Centre, European Commission. 2024b. Advance Report on Forest Fires in Europe, Middle East and North Africa 2023. Link.

Jones, M. W., Kelley, D. I., Burton, C. A., Di Giuseppe, F., Barbosa, M. L. F., Brambleby, E., Hartley, A. J., et al. 2024. State of Wildfires 2023–2024. Link.

Kvarnlöf, L., and K. Eriksson. 2024. "Filling the Void: Rural Disaster Volunteerism during the Swedish Wildfires of 2018." International Journal of Disaster Risk Reduction 105: 104393. Link.

Leclerc, T., F. Sjöberg, S. Jennes, J. R. Martinez-Mendez, C. H. Van der Vlies, A. Battistutta, J. A. Lozano-Basanta, N. Moiemen, and S. K. Almeland. 2023. "European Burns Association Guidelines for the Management of Burn Mass Casualty Incidents within a European Response Plan." Burns 49 (2): 275–303. Link.

Marey-Perez, M., X. Loureiro, E. J. Corbelle-Rico, and C. Fernández-Filgueira. 2021. "Different Strategies for Resilience to Wildfires: The Experience of Collective Land Ownership in Galicia (Northwest Spain)." Sustainability 13 (9): 4761. Link.

Miner, K. R., M. R. Turetsky, E. Malina, A. Bartsch, J. Tamminen, A. D. McGuire, A. Fix, C. Sweeney, C. D. Elder, and C. E. Miller. 2022. "Permafrost Carbon Emissions in a Changing Arctic." Nature Reviews Earth & Environment 3 (1): 55–67.

Moreira, F., D. Ascoli, H. Safford, M. A. Adams, J. M. Moreno, J. M. Pereira, F. X. Catry, J. Armesto, W. Bond, M. E. González, and T. Curt. 2020. "Wildfire Management in Mediterranean-Type Regions: Paradigm Change Needed." Environmental Research Letters 15 (1): 011001.

Müller, M. M., L. Vilà-Vilardell, H. Vacik, C. Mayer, S. Mayr, P. Carrega, Y. Duche, S. Lahaye, F. Böttcher, and H. Maier. 2020. "Forest Fires in the Alps: State of Knowledge, Future Challenges and Options for an Integrated Fire Management." EUSALP Action Group 8. Link.

Neidermeier, A. N., C. Zagaria, V. Pampanoni, T. A. P. West, and P. H. Verburg. 2023. "Mapping Opportunities for the Use of Land Management Strategies to Address Fire Risk in Europe." Journal of Environmental Management 346: 118941.Link.

Nunes, A. N., A. Figueiredo, C. Pinto, and L. Lourenço. 2023. "Assessing Wildfire Hazard in the Wildland–Urban Interfaces (WUIs) of Central Portugal." Forests 14 (6): 1106.

OECD. 2023a. Taming Wildfires in the Context of Climate Change. Link.

OECD. 2023b. Taming wildfires in the Context of Climate Change: The Case of Portugal. Link.

OECD. 2024. Taming Wildfires in the Context of Climate Change: The Case of Greece. Link.

Oliveira, J., Aires Dias, J., Duarte, I.C., Caldeira, S., Marques, A.R., Rodrigues, V., Redondo, J. and Castelo-Branco, M., 2023. Mental health and post-traumatic stress disorder in firefighters: an integrated analysis from an action research study. Frontiers in Psychology, 14, p.1259388.

Olsen, M. 2020. Western US Smoke From Fires Stretching Across the Country. Link.

Oom, D., D. de Rigo, H. Pfeiffer, A. Branco, D. Ferrari, R. Grecchi, T. Artés-Vivancos, T. Houston Durrant, R. Boca, P. Maianti, G. Libertá, J. San-Miguel-Ayanz, et al. 2022. Pan-European Wildfire Risk Assessment. EUR 31160 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-55137-9, doi:10.2760/9429, JRC130136. Link.

Pastor, E., Muñoz, J.A., Caballero, D. et al. Wildland–Urban Interface Fires in Spain: Summary of the Policy Framework and Recommendations for Improvement. Fire Technol 56, 1831–1851 (2020). Link

Pirc, G. 2022. Slovenia Social Briefing: The Excessive Temperatures, the Devastating Wildfire in the Slovenian Karst, and the Effects of Global Warming. Link.

Plana, E., M. Serra, A. Smeenk, A. Regos-Sanz, C. Berchtold, M. Huertas, L. Fuentes, A. Trasobares, J. N. Vinders, C. Colaço, and J. A. Bonet. 2024. Framing Coherence Across EU Policies Towards Integrated Wildfire Risk Management and Nature-Based Solutions.

Plana, E., M. Serra, S. Nebot, A. Smeenk, P. Macri, J. Vendrell, L. Pronto, G. Canaleta, J. Gomes, and L. Alfonso. 2024. Wildfire Risk Awareness and Communication: Analysis of Good Practices. Union Civil Protection Knowledge Network. Link.

Price, O. 2019. "Bushfires." In Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires, edited by S. Manzello. Springer, Cham. Link.

Pronto et al. 2023. Research for REGI Committee - Forest Fires of Summer 2022. European Parliament, Policy Department for Structural and Cohesion Policies, Brussels. Link.

Salvati, Luca, and Francesco Ranalli. 2015. "'Land of Fires': Urban Growth, Economic Crisis, and Forest Fires in Attica, Greece." Geographical Research 53 (1): 68–80.

Schinko, Thomas, Christine Berchtold, John Handmer, Teresa Deubelli-Hwang, Elisabeth Preinfalk, Joanne Linnerooth-Bayer, Anna Scolobig, Marta Serra, and Eduard Plana. 2023. "A Framework for Considering Justice Aspects in Integrated Wildfire Risk Management." Nature Climate Change 13 (8): 788–795. Link.

Silva, J.S., ed. 2010. Towards Integrated Fire Management: Outcomes of the European Project Fire Paradox. No. 23, pp. ix–229. Joensuu, Finland: European Forest Institute. Link.

Silvanus. N.d. Citizen Engagement Course. Link.

Szönyi, Máté, Verena Roezer, Teresa Deubelli, Jan Ulrich, Kathryn MacClune, Franziska Laurien, and Richard Norton. 2022. PERC Floods Following "Bernd." Link.

Tedim, Fantina, Gavriil Xanthopoulos, and Valerio Leone. 2015. "Forest Fires in Europe: Facts and Challenges." In Wildfire Hazards, Risks and Disasters, 77–99. Elsevier.

UNDRR. 2020. Evolving Risk of Wildfires in Europe - Thematic Paper by the European Science & Technology Advisory Group. Link.

UNDRR. 2024. Global Status of Multi-Hazard Early Warning Systems 2024. Link.

United Nations Environment Programme (UNEP). 2022. Number of Wildfires to Rise by 550 Percent by 2100 and Governments Are Not Prepared, Experts Warn. Press Release Feb 22, 2022. Link.

Wild Europe. 2013. A Working Definition of European Wilderness and Wild Areas. Link.

Williams, A. Park, John T. Abatzoglou, Alexander Gershunov, Juliana Guzman-Morales, Daniel A. Bishop, Jennifer K. Balch, and Dennis P. Lettenmaier. 2019. "Observed Impacts of Anthropogenic Climate Change on Wildfire in California." Earth's Future 7 (8): 892–910.

World Bank and European Commission. 2021a. Economics for Disaster Prevention and Preparedness: Investment in Disaster Risk Management in Europe Makes Economic Sense. Link.

World Bank and European Commission. 2021b. Understanding the Needs of Civil Protection Agencies and Opportunities for Scaling Up Disaster Risk Management Investments - Technical Report. Link.

World Bank and European Commission. 2024. From Data to Decisions: Tools for Making Smart Investments in Prevention and Preparedness. Link.

World Bank. 2020. Adaptive Social Protection: Building Resilience to Shocks. Link.

World Bank. 2024. Financially Prepared - The Case for Pre-Positioned Finance in European Union Member States and Countries under EU Civil Protection Mechanism. Economics for Disaster Prevention and Preparedness. World Bank. Link.

Xu, Rongbin, et al. 2020. Wildfires, Global Climate Change, and Human Health. Link.

WEBSITES/DATABASES:

Agencia para a Gestão Integrada de Fogos Rurais (AGIF). Website Link.

American Institute of Architects (AIA) California. 2025. Fire Response Webinars. Link.

APA California. 2025. APA California Response to the LA Fires: Recovering and Rebuilding Webinar Series. Link.

DIREKTION. n.d. Disaster Resilience Knowledge Network. Link.

EUMETSAT. 2024. Ceasefire. Link.

European Commission. n.d. Civil Protection-Performance. Link.

European Commission. n.d. Cohesion Fund. Link.

European Commission. n.d. DRMKC- Risk Data Hub. Link.

European Commission. n.d. EU Adaptation Strategy. Link.

European Commission. n.d. LIFE Programme. Link.

European Commission. N.d. European Forest Fire Information System (EFFIS), Link.

European Commission. n.d. Together, One Step Ahead of Wildfires: How Croatia's Firefighters Helped Slovenia Extinguish the flames. Link.

European Commission. 2021c. Forest Fires. Link.

European Commission. 2021d. Improvement of Insurance Conduct Supervision in Greece. Link.

European Commission. 2023d. Wildfires. Link.

European Commission. 2023e. Enhancing EU resilience: A step forward to identify critical entities for key sectors. Link.

European Commission. 2023f. Emergency Response Coordination Centre (ERCC). Link.

European Commission. 2024c. A Holistic Fire Management Ecosystem for Prevention, Detection, and Restoration of Environmental Disasters. Link.

European Commission. 2024d. Climate Resilience Dialogue. Link.

European Commission. 2024e. EU Preparing for the 2024 Wildfire Season. Link.

European Commission. 2024f. Fighting the Flames: EU-Funded Projects Protecting Forests from Fire Destruction. Link.

European Commission. 2024g. Innovative Technologies and Socio-Ecological-Economic Solutions for Fire Resilient Territories in Europe. Link.

European Commission. 2024h. 49th meeting of the Expert Group on Forest Fires. Link.

European Environment Agency. 2023. Scaling Nature-Based Solutions for Climate Resilience and Nature Restoration, EEA Briefing No 21/2023. Link.

European Environment Agency. 2024c. Climate Change Impacts, Risks and Adaptation. Link.

European Union. n.d. Climate-ADAPT. Link.

European Union. n.d. Guardian: Green Urban Actions for Resilient Fire Defense of the Interface Area. Link.

European Union. n.d. How We Recover Wetlands to Reduce CO2. Link.

European Union. N.d. Civil Protection Funding Disaster Management. Link.

European Union. Firelogue. Link.

Fire-Res. n.d. Fire-res. Link.

FirEUrisk. n.d. Dissecting Risk to Prevent Extreme Wildfires: A Unified European Response to an Increasing Hazard. Link.

Firelogue, Fire-Res, Treeds, Silvanus. n.d. Green Deal Wildfire Risk Management Targets.

Firelogue, J. Linnerooth-Bayer. 2024. Firelogue-Naturance Insurance Working Group.

Firelogue. 2024. Key Projects. Link.

Food and Agricultural Organization of the United Nations. 2024. FAO Launches Updated Guidelines to Tackle Extreme Wildfires. Link.

Global Wildfire Information System (GWIS). Link.

Goliat. n.d. Section 5: Communication. Link.

Nature Conservancy and Aspen Institute. 2023. Roadmap for Wildfire Resilience: Solutions for Paradigm Shift. Link.

Programme of the European Union. 2024. Copernicus. Link.

Renewables Grid Initiative. N.d. Decision Support System – Increasing Infrastructure Resilience to Wildfires. Link.

SAFERS. N.d. Structured Approaches for Forest Fire Emergencies in Resilient Societies. Link.

TREAADS. n.d. TREEADS. Link.

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