Synthesising the review of past fire events

A meta-analysis of fire reports

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Abbreviation	Meaning
AGIF	Agency for the Integrated Management of Rural Fires
ATV	All-Terrain Vehicle
BA	Burned area
CNE	Central and Northern Europe
CP	Civil Protection
DRM	Disaster Risk Management
ECPP	European Civil Protection Pool
EFFIS	European Forest Fire Information System
EMS	Emergency Management Service
ERCC	Emergency Response and Coordination Centre
ERDF	European Regional Development Fund
EU	European Union
EWE	Extreme Weather Event
GFMC	Global Fire Monitoring Center
JRC	Joint Research Centre
KPI	Key Performance Indicator
SD	Standard deviation
SE	Southern Europe
UCPM	Union Civil Protection Mechanism
WF PRAF	Wildfire Peer Review Assessment Framework
WFF	Wildland Fire Fighting
WUI	Wildland-Urban Interface

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Introduction

Several reports reviewing wildfire events of the past years have been launched recently. They include an “Analysis of 2021 critical wildfire events in the Mediterranean region” by Almeida et al. 2023[1], the report on “Forest Fires of Summer 2022” for the European Parliament (Pronto et al., 2023)[2] or reports by research and innovation actions that have been recently funded (e.g. D1.1 Transfer of Lessons learned on extreme fire events to key stakeholders” of the FIRE-RES project) (Castellnou et al., 2022)[3]. However, the reports differ in geographic focus (from Mediterranean to the whole of Europe), the type of events analysed (large/critical vs. extreme events), the temporal scope (annual analysis vs. insights over the past seven years), their objectives, and the types of conclusions and recommendations they draw (from the local, operational context to European investment funds and support mechanisms).

This report hence aimes to synthesise thesw findings. It reviewes the conclusions and recommendations of the reports and clusteres them into eight topics:

- Governance
- Northern European Challenges
- Risk Awareness and Communication
- Funding
- Urban planning and landscape management
- Housing and self-protection
- Response
- Training and guidelines

The recommendation clusters were further discussed with forty experts during a workshop on 5th June at the 2024 EU Civil Protection Forum in Brussels, Belgium. This report presents the recommendations along with the insights from the additional discussions. They are supported by an analysis of wildfire data over the period from 2010 to 2023 to contextualise the occurrence and impacts of wildfires.

Overall, this report is an interim result of the Firelogue project[4] which aims to synthesise insights from ongoing wildfire risk management projects under the European Green Deal. The report is one of several activities that will help to formulate policy suggestions at multiple scales across projects.

[1] https://publications.jrc.ec.europa.eu/repository/handle/JRC133972 (17.01.2024)

[2]https://www.europarl.europa.eu/RegData/etudes/STUD/2023/747280/IPOL_STU(2023)747280_EN.pdf (17.01.2024).

[3] https://fire-res.eu/wp-content/uploads/2023/02/D1.1.pdf (17.01.2024)

[4] Firelogue (27.09.2024).

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Overview over the synthesised documents

The **"Analysis of 2021 Critical Wildfire Events in the Mediterranean Region"** report is a detailed technical report produced by the Joint Research Centre (JRC). It provides an overview of the 2021 wildfire season in the Mediterranean, with specific case studies of major fires in Portugal, France, Italy, Greece, and Cyprus. The report analyses the conditions leading to these fires, their development, and the impact on the environment and communities. It emphasizes lessons learned to improve wildfire management.

The document, titled **"Forest Fires of Summer 2022: Lessons to Draw from the Cohesion Policy Response,"** provides an in-depth analysis of the unprecedented wildfire activity in Europe during the summer of 2022. The report highlights the severe impact of fires, particularly in France, Spain, Romania, Germany, Czechia and other regions traditionally considered low-risk. It discusses the effectiveness and challenges of the European Union's response mechanisms, focusing on the use of Cohesion Policy Fund he report underscores the need for better prevention, improved coordination, more informed allocation of funds, and comprehensive management strategies, particularly in vulnerable and protected areas. Recommendations include enhancing wildfire prevention, increasing investment in fire managementtraining, and improvingthe alignment of EU funds with global wildfire initiatives.

The report titled **"FIRE-RES D1.1 Transfer of Lessons learned on extreme fire events to key stakeholders"** focuses on addressing Extreme Wildfire Events (EWE) through improved response strategies, landscape management, and community engagement. The report emphasizes enhancing emergency management through better communication, training, and innovative tools for predicting EWE. Interoperability among different response units and real-time data collection are crucial for effective firefighting. It advocates for creating fire-resilient landscapes by reducing fuel loads, using prescribed burns, and adapting land use. These strategies aim to minimize the risk and impact of wildfires. Finally, community involvement is seen as essential in both prevention and response. The report highlights the importance of public awareness, local participation in decision-making, and training communities in fire management practices. Engaging communities helps build resilience against EWEs, making them better prepared to handle future wildfire threats.

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Analysis of wildfires in Europe

2.1 Cumulative analysis of fire occurrence (2010-2023)

The analysis of fire occurrence is based on the EFFIS burned area perimeters from 2010 to 2023, obtained through the EFFIS website request form[5] . This dataset identifies burned area using medium and coarse resolution optical sensors to classify pixels as burned based on changes in pre- and post-fire surface reflectance. The EFFIS perimeters were obtained through a semi-automatic algorithm complemented by visual interpretation, using surface reflectance from MODIS and, starting on 2018, also from Sentinel-2. This dataset has the advantage that it is created in near real time but has the disadvantage that not all European countries were included in EFFIS since 2010, with some of them included as late as 2019 (as in the case of Lithuania, Slovakia and Austria). Additionally, fires smaller than 30 ha have not been systematically mapped, and only started to be included in the database since 2018. Still, around 95% of the total burned area (BA) in Europe is included in the EFFIS dataset[6]. Although other BA datasets exist, the EFFIS one is the only that includes fire perimeters updated until 2023, and for this reason was selected for this evaluation.

For the purpose of the analysis, the European countries were divided in two groups:

- Southern Europe (SE): Albania, Bosnia and Herzegovina, Croatia, Cyprus, France, Greece, Italy, Kosovo, Malta, Montenegro, North Macedonia, Portugal, Serbia, Slovenia and Spain. This corresponds to the classification of Southern Europe by the UN Statistics Division[7], plus France, because the majority of the large fires occur in the southern region of the country, Cyprus, which is technically part of Western Asia but for our purposes is considered a European country, and Kosovo, which does not appear listed as a country in the UN portal, but it appears in EFFIS.
- Central and Northern Europe (CNE): the rest of the European Countries.

The total burned area reported by EFFIS for the period 2010-2023 is of approximately 68,600 km2, with around 87% of it located in the SE countries. **Figure 1** shows the geographic location of the fires detected by EFFIS during 2010-2023. The regions most affected are Northern Portugal – Northwest Spain, Southern Italy and the Western Balkans. **Figure 2** shows the trend of BA for both European regions, including all sizes of fire perimeters. A general increase trend can be observed, although extreme fire events in particular years, such as 2012, 2017 and 2022 have the highest contribution to BA, while in other years the burned area is much less. These extreme fire years in some countries are generally related to meteorological conditions (high temperatures, droughts, strong winds, etc.) which cause the fires to escape control and burn larger areas: e.g. Portugal 2017, United Kingdom 2022, Greece 2023.

[4] https://forest-fire.emergency.copernicus.eu/apps/data.request.form/ (22.08.2024).

[5] https://forest-fire.emergency.copernicus.eu/about-effis/technical-background/rapid-damage-assessment (22.08.2024).

[6] https://unstats.un.org/unsd/methodology/m49/#geo-regions (22.08.2024).

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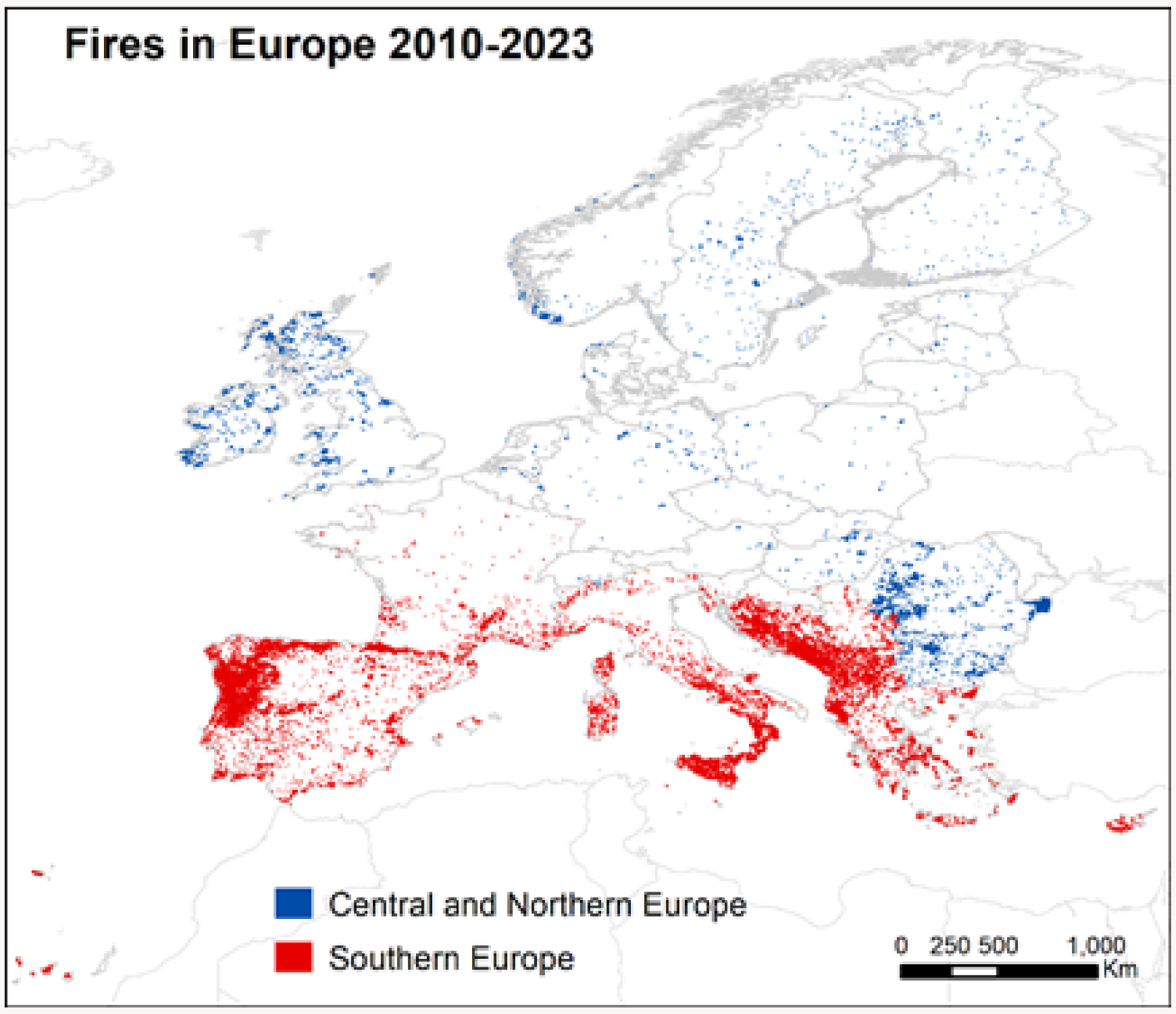

Figure 1: Geographic location of fires of all sizes detected by EFFIS in the period 2010-2023.

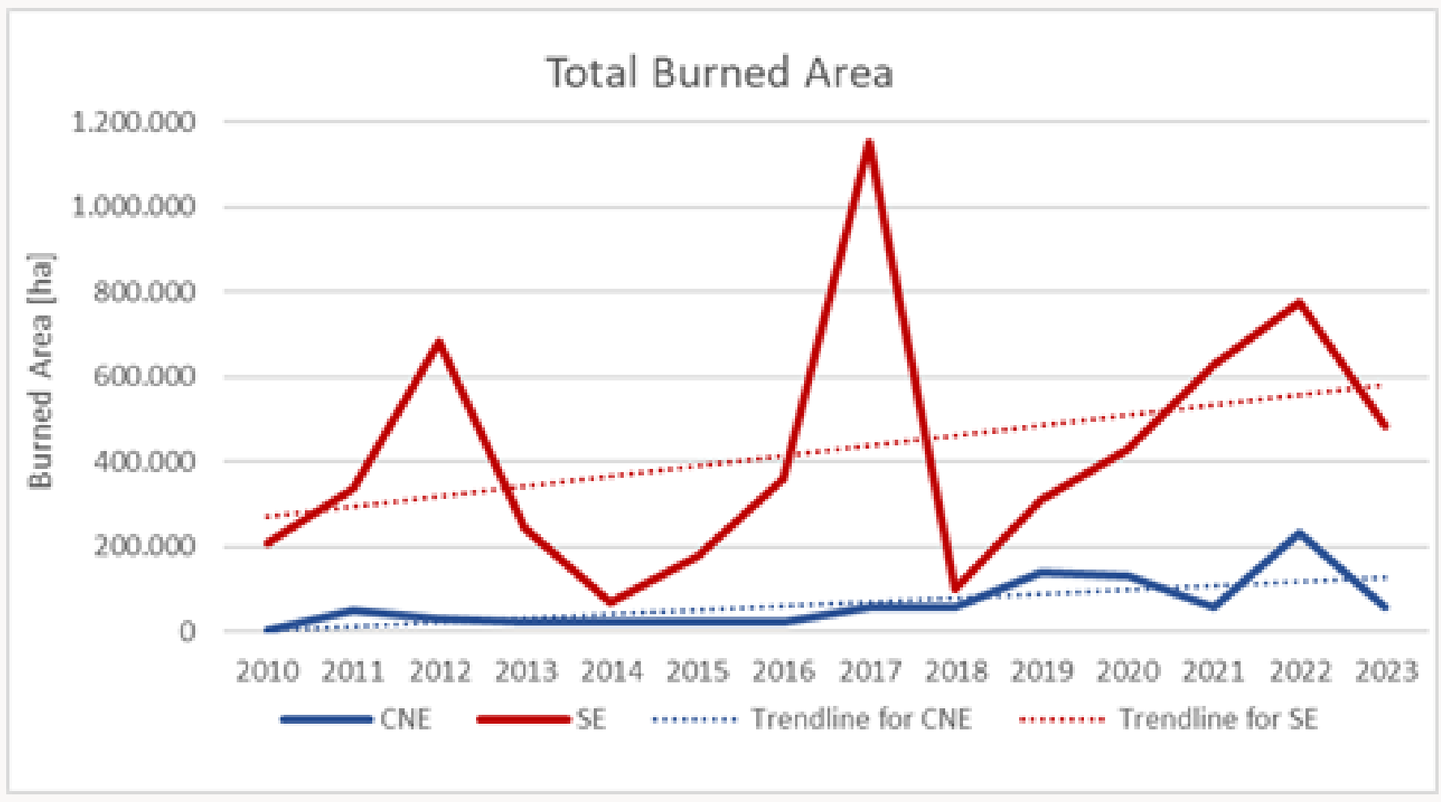

Figure 2: Total burned area per European region (CNE: Central and Northern Europe, SE: Southern Europe) for the period 2010-2023, as reported by EFFIS.

2.2 Extreme fire events

There is not a general consensus on the exact definition of an extreme fire, as different aspects of it can be used to declare it as “extreme”, being the most common size, intensity, behaviour, resistance to control, or socioeconomic and environmental impacts.[8] It is important to note that frequently, the extreme events are related to their potential in overwhelming response capacities, specifically if they show pyro-convective behaviour.[9]

For this analysis, a simple definition of “extreme“ was used, based on fire size. Some countries have in their legislation a classification of “large” fires (e.g., in Spain it is more than 500 ha and exceeding the copying capacity) while others don’t. Additionally, depending on the fire history of each country, a 400-ha fire could be large in some regions where fires are not common, but not significant enough in southern European countries with a long history of frequent fires.

[8] Even the term “extreme fire” is used interchangeably with other terms. Tedim et al. (2018) p. 12, in their review of the scientific literature, identify 25 terms to label and characterise powerful and extraordinary wildfires, such as "Megafires," "Extreme wildfire events," "catastrophic fires," and "disastrous fires."

[9] E.g. FIRE-RES Deliverable 1.1, pp. 17 ff: D1.1.pdf (fire-res.eu) (26.08.2024).

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For this reason, to classify a fire as large, or in this case extreme, the fire sizes of each country were assessed for the study period 2010-2023, and a fire was classified as large if it was bigger than the mean burned area for the country plus two standard deviations (SD). In this way, it is possible to capture only the most extreme events in terms of fire size considering the particularities of each country. For example, for Greece the mean fire size was 408 ha, with a SD of 3170 ha, so a fire was classified as extreme if its size was larger than 6750 ha, which corresponds to 2% of all fires in that country. On the other hand, in the UK the mean fire size was of 109 ha, with a SD of 300 ha, and 6% of the fires were classified as large, having burned more than 707 ha each.

Figure 3 shows the geographic location of these large fires. They correspond roughly to 7% of all the fires in Figure 1. They cover around 28300 km2, also 87% located in SE countries. The largest fires detected by EFFIS happened in Greece (Alexandroupoli, August 2023, 96610 ha), followed by the fires in Portugal in 2017 (67520 ha and 64320 ha). The 30 largest fires in Europe were in three countries: Greece, Portugal and Spain. The largest fire recorded in CNE countries was in Sweden (12500 ha burned in July of 2014), followed by 10200 ha burned in eastern Romania on March 2019. The 30 largest fires in the CNE region were in Sweden, Romania, Ireland, the United Kingdom and Bulgaria.

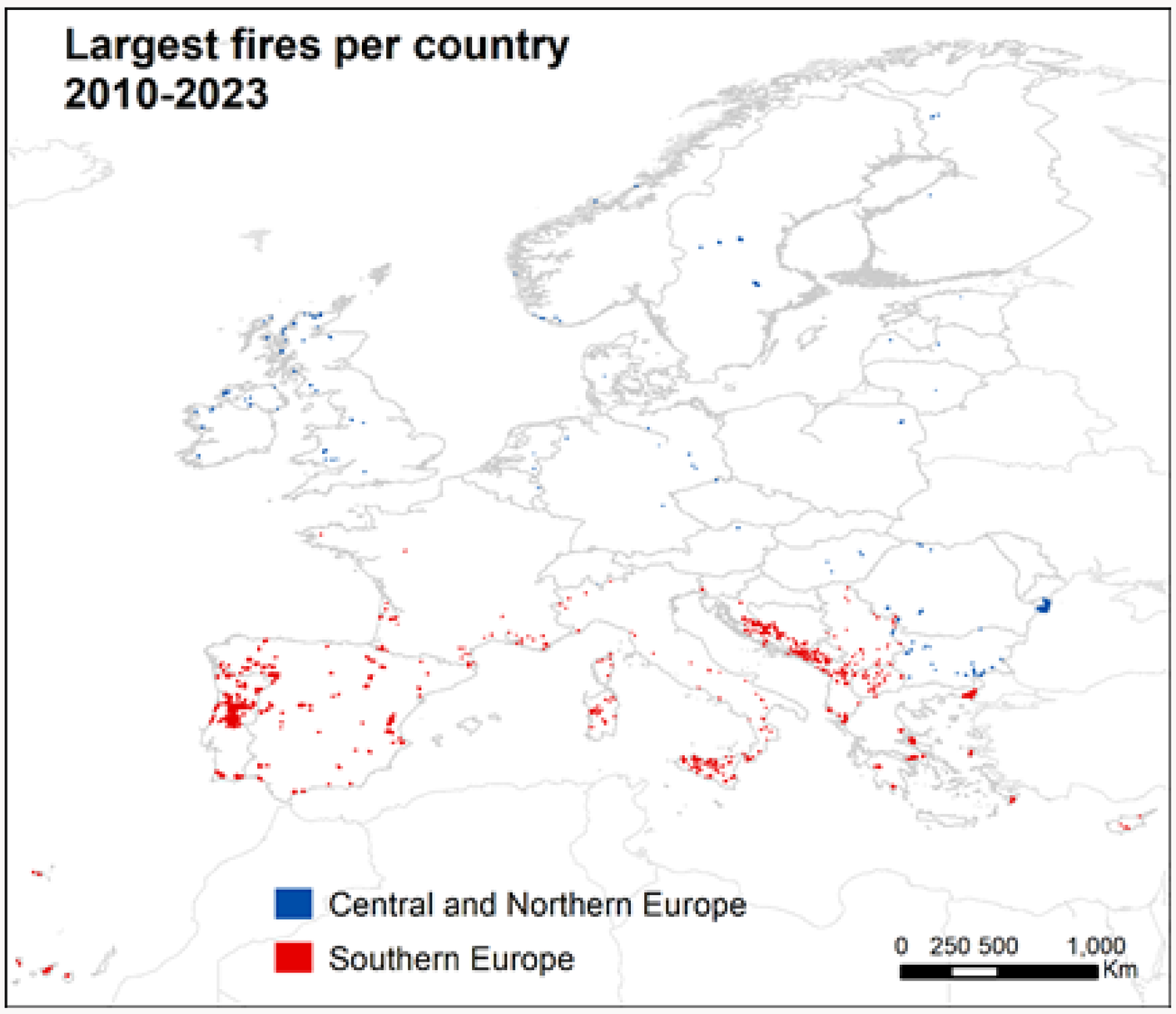

Figure 3: Geographic location of the largest fires (mean size + 2 standard deviations for each country) for the period 2010-2023.
Source: EFFIS

Figure 4 presents the temporal distribution of the largest fires per country grouped in the two classes: SE and CNE. It has a similar trend as **Figure 2**, except for the years 2019 and 2020, when less large fires occurred. Again, the large-fire years 2012, 2017 (in particular) and 2022 explain the rising trend. This trend is not as clear in the CNE region, where the peak in 2022 is caused by the large fires occurred during January-April in Romania, and in 2019 the largest contribution was from spring fires in Romania and UK.

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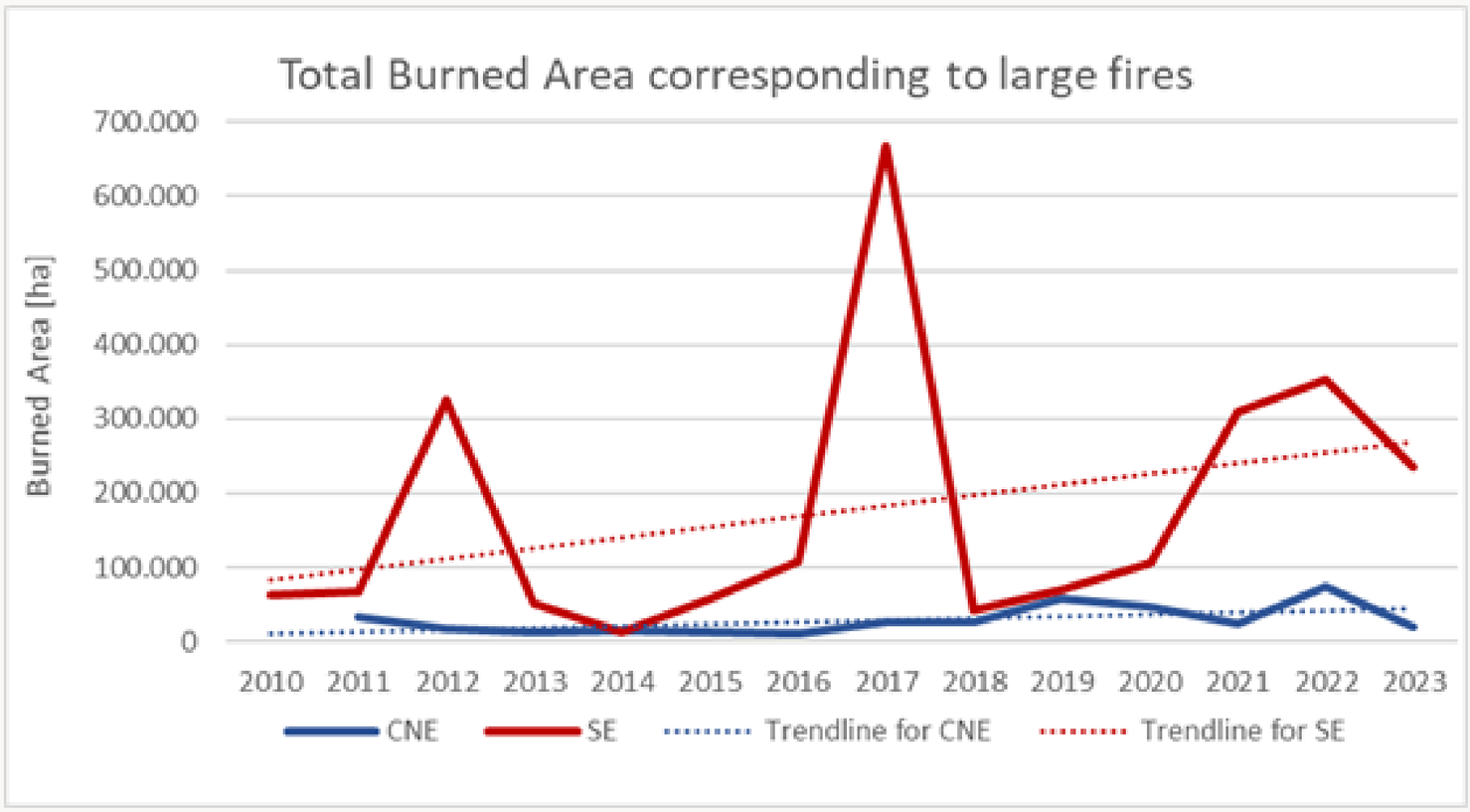

Figure 4: Yearly trend of large fires in the period 2010-2023.
Source: EFFIS

As previsouly mentioned, one limitation of this analysis is that until 2018 only fires larger than 30 ha were recorded by EFFIS, which means that smaller fires (as small as 1 ha) do not appear in the database prior to that year, and were thus not included in the mean and SD calculation. This could impact the values of the large fire classification for each country, since a large number of small fires would decrease the mean fire size for a country, and in turn would also decrease the threshold to consider a fire as large. Another limitation, as mentioned before, is the inconsistent start of the database for some countries, where the data starts in 2014, 2017 or even 2019. Still, these countries (except for Malta) are located in the CNE region, where fire occurrence has been historically infrequent.

2.3 Impacts

In line with the depicted trends in area burnt, the impacts of wildfires are increasing.[10] The following sections provide an overview over the changes in fatalities, building damages and evacuations as well the requested support in relation to the area burnt.

The data on injuries, fatalities, damaged buildings, and evacuations pertains to Croatia, France, Greece, Ireland, Portugal, Spain, and the UK, and was sourced from the Global Fire Monitoring Center (GFMC) reports between 2012-2022[11]. In contrast, the data on the burned area was obtained from EFFIS, involving all the countries listed in section 2.1, with the burned area figures this time being aggregated for both Southern and Central/Northern European countries.

2.3.1 Challenges of the data basis

Figure 5 compares the burned area with the number of civilians, i.e., citizens who are not formal civil protection agents, injured and killed in the last 10 years (data series 2012-2022) for some European countries. Between 2012 and 2022, Europe witnessed some of the most devastating wildfires in recent history, with significant loss of life and injuries. The 2017 fire season was particularly catastrophic, with Portugal at the centre of the tragedy. In this year alone, 128 people were killed and 589 injured, with fires ravaging 693,572 hectares of land. The Pedrógão Grande fire in Portugal, which claimed 66 lives, was among the deadliest. In neighbouring Spain, wildfires caused widespread destruction as well.

Similarly, Greece suffered immensely during 2018, especially in the Mati fire, which resulted in over 100 fatalities despite burning a relatively small area. In later years, such as 2022, Europe continued to experience large-scale fires, with over 426,436 hectares burned. Despite this, the number of casualties was lower, with 41 people killed and 171 injured. This can in part be contributed to improved firefighting capabilities and sharing, preventative measures, the development and implementation of strategies to safeguard citizens, such as the protection and evacuation of communities, improved coordination between relevant agencies, and in some cases the improvement or establishment of governance structures most notably in Portugal (creation of the Agency for the Integrated Management of Rural Fires, AGIF) and Greece (Greek ministry of climate crisis and civil protection).

[10] The occurrence of novel extreme wildfire events not reported previously has also been documented e.g. by Duane et al. (2021) and most recently by Cunningham, Williamson and Bowman (2024).

[11] Global Fire Monitoring Center, Fire News and Bulletin Archive, accessed 30.07.2024, https://gfmc.online/media/bulletin_news.html.

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While Southern Europe saw the most dramatic human and environmental impact, Central and Northern Europe were not spared from significant wildfires. In 2018, Sweden faced its worst fire season in modern history, with wildfires burning through more than 25,000 hectares. Although there were no recorded fatalities, dozens of injuries were reported, and the scale of the fires highlighted the growing vulnerability of even traditionally cooler, wetter regions. Germany also experienced heightened wildfire activity, particularly in 2019, with more than 1,700 hectares burning in Brandenburg. Though the burnt area was smaller than in Southern Europe, the rapid spread of fires in regions unaccustomed to such events strained local firefighting resources and posed considerable risks to human life and infrastructure.

This comparison reveals that the human impact of wildfires is not solely determined by the area burned, but by the complex interaction of climatic conditions, regional preparedness and firefighting capacity, fire accessibility (e.g. on contaminated lands), and population/infrastructure density.

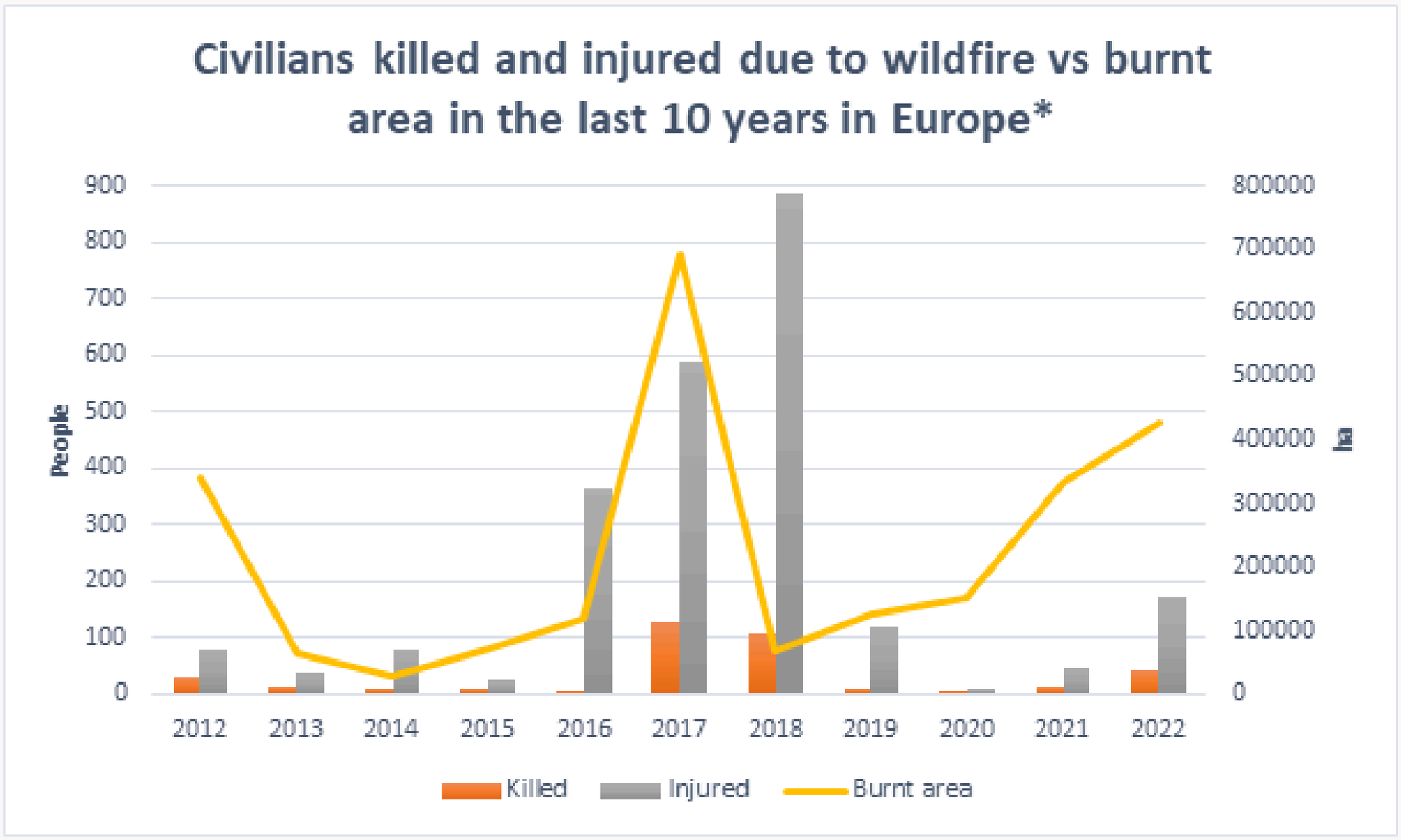

Figure 5: Civilian killed and injured due to wildfire
Source: EFFIS and GFMC.

Figure 6 compares the burned area against the buildings destroyed or damaged for the same countries. Between 2012 and 2022, the correlation between the burnt area and the number of buildings destroyed or damaged in Europe fluctuates significantly. Countries in Southern Europe, such as Portugal and Spain, have faced significant building damage during this period, often exacerbated by severe wildfires. Central and northern European countries have seen fewer buildings destroyed, though wildfires have still posed risks. For example, in 2018, Central Europe experienced one of its hottest summers, contributing to widespread fires and damage, with 2,935 buildings impacted. Moreover, in 2015, the number of buildings destroyed or damaged surged to 14,106, even though only 70,782 hectares were burnt, indicating the possible concentration of fires in more urban or vulnerable areas.

In conclusion, while the area burnt does contribute to the number of buildings destroyed or damaged, other factors such as geographical location, climate, and fire management strategies including the state of prevention, mitigation and fire protection measures, play a significant role in determining the extent of destruction.

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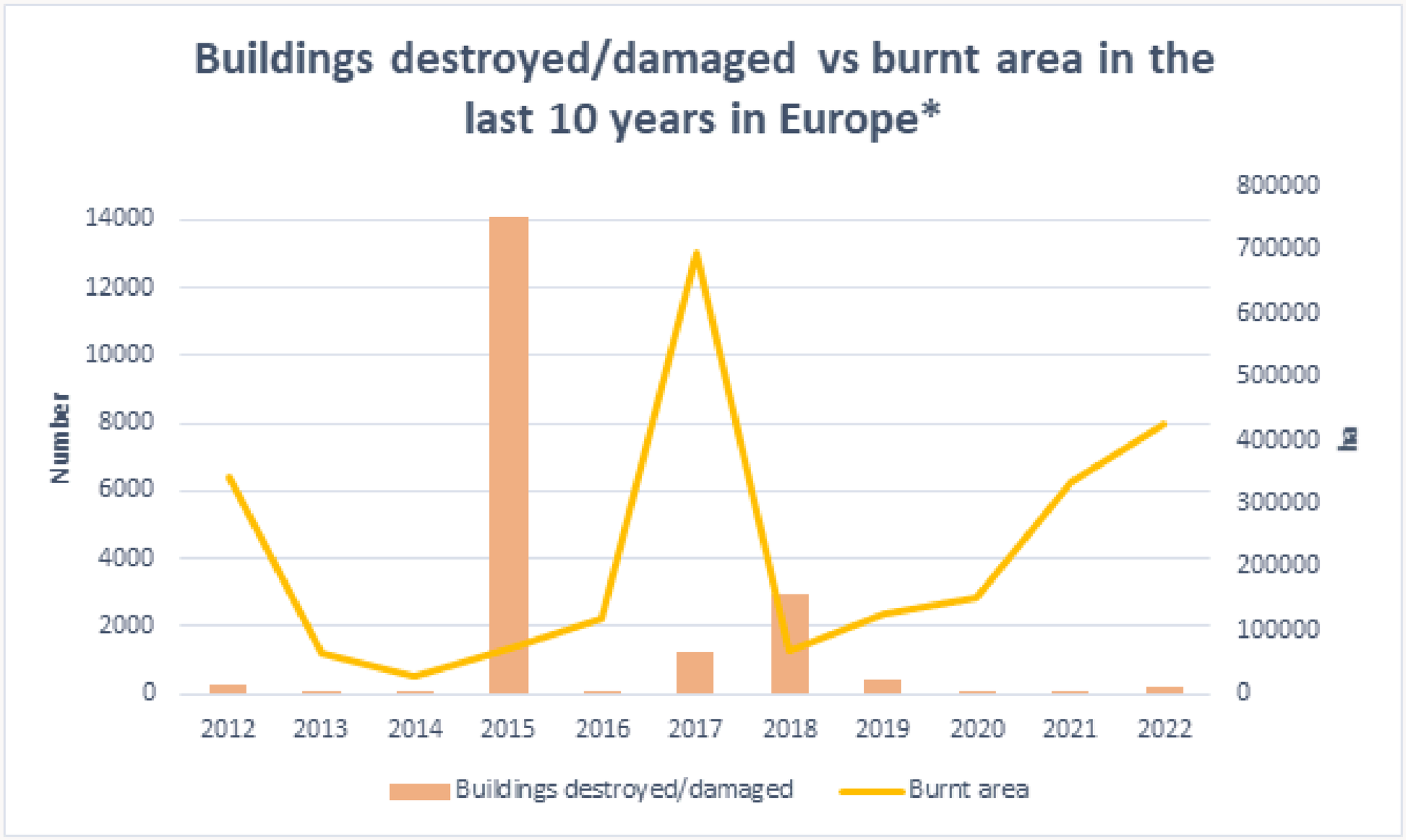

Figure 6. Buildings destroyed due to wildfire in the period 2012-2022.
Source: EFFIS and GFMC.

Finally, Figure 7 compares the burned area against the number of people evacuated during the period 2012-2022. The data reflects that certain years, such as 2017 and 2022, saw both high evacuations and large burnt areas, indicating severe wildfire seasons. In 2017, for example, over 36,000 people were evacuated, with a massive 693,572 hectares burnt, largely impacting southern European countries like Portugal and Spain. Similarly, in 2022, nearly 95,000 people were evacuated across Europe, and the burnt area spanned over 426,000 hectares. This reflects the growing intensity of wildfires in recent years, likely exacerbated by climate change, especially in southern regions. In contrast, in 2019 the burnt area was lower at 126,906 hectares compared to other years, but the number of evacuees was much higher, with nearly 79,000 people evacuated.

The number of evacuated and displaced people may thereby also reflect a change in the strategy of first responders. After the catastrophic fires of 2017 and 2018, in several SE countries, CP authorities considered that the best approach would be to evacuate communities threatened by fire, often well before the fire front reached them. Prior to 2017, this practice was rare in Europe, and evacuations only occurred in extreme situations. However, there are also several important limitations to consider to these strategies:

- The evacuation data compiled by the Annual Global Wildland Fire Fatalities and Damages Reports published by the GFMC are based largely on media reports which may vary in accuracy based on fire profile (e.g., media coverage) or credibility of the initial source.
- In general, evacuations are under-reported.
- Evacuation protocols vary widely across different countries and contexts ranging from highly precautionary evacuations to not issuing evacuation notices at all.
- Extreme fire events, especially wind-driven fires, may not allow for enough time to issue evacuation warnings or for people to actually evacuate – like in the tragic instances of Greece and Portugal where many fatalities resulted from people evacuating.
- While countries like the U.S. and Australia have clear evacuation criteria and procedures, there is rarely consensus in European countries; the stone construction of many homes in SE make sheltering in place potentially safer than evacuating.

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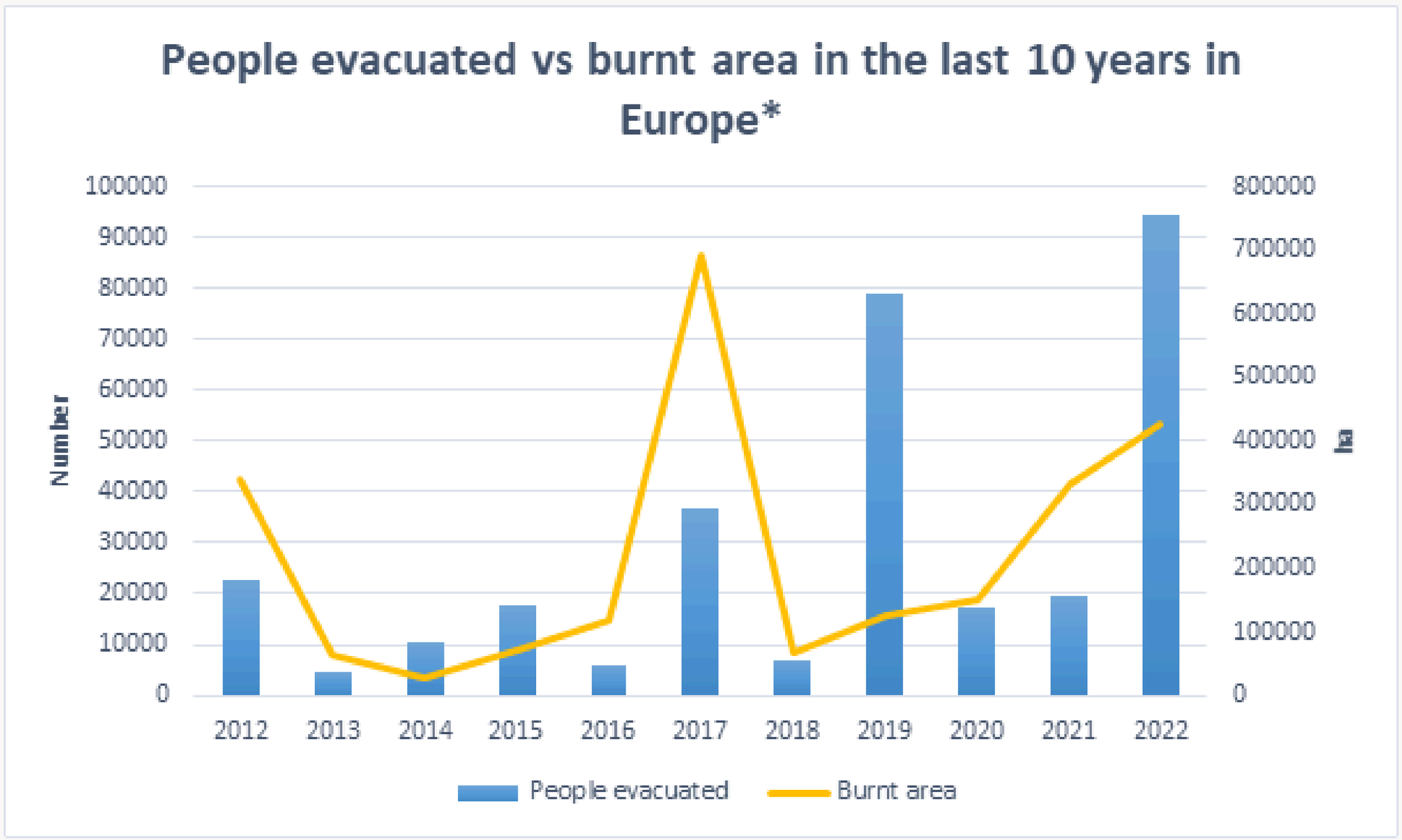


Figure 7. People evacuated due to wildfire emergencies in the period 2012-2022.
Source: EFFIS and GFMC.

2.3.2 Requests for support in response operations via the Union Civil Protection Mechanism (UCPM)

Since 2012, UCPM and Copernicus Emergency Management Services (mapping) have been increasingly activated for wildfire emergencies across Europe and even outside the EU. Figure 8 shows the number of wildfire-related UCPM activations between 2013 and 2020. The number of activations varied between 32 in 2017 and five activations in 2018. The average number of activations between 2009-2018 was 22.8. In 2023, wildfires accounted for 13 activations and were hence the most important natural hazard triggering the UCPM, followed by floods with six activations.[12]

[12] https://civil-protection-knowledge-network.europa.eu/news/world-eu-civil-protection-mechanism-activations-2023 (26.08.2024).

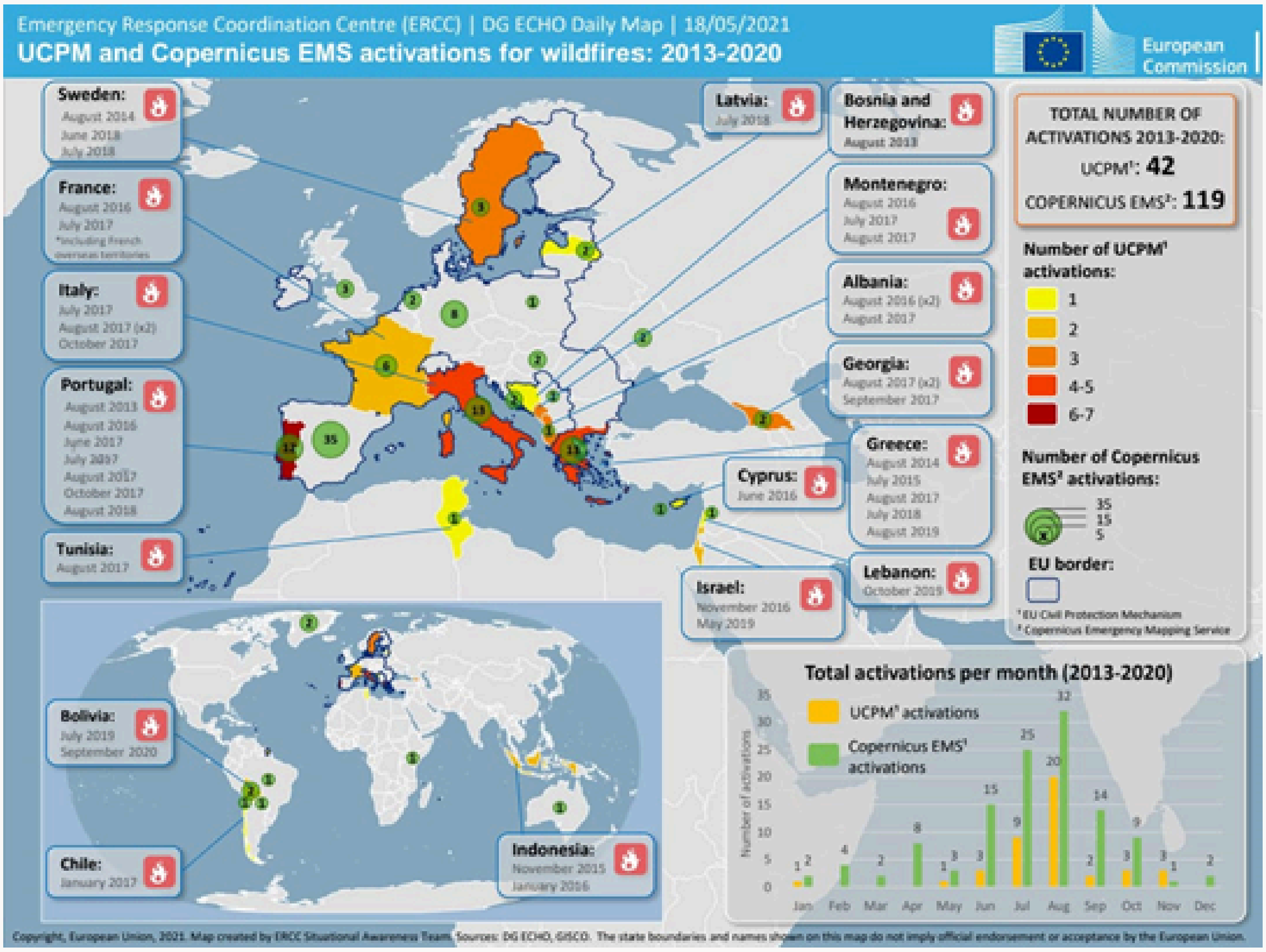


Figure 8: UCPM and Copernicus activations for wildfires: 2013-2020
Source: DG ECHO Daily Map, available via Maps (europa.eu) (11.09.2024).

Overall, regions across Europe have been affected by wildfires in different ways. Following the intense fire season of year 2017 in Southern Europe, particularly in Portugal, severe fires occurred in Northern Europe in 2018, prompting UCPM activations in Sweden and Latvia.[13]
Overall, two typical scenarios for assistance requests can be identified: (1) when fires reach extreme levels across Europe, which is often the case in southern countries (e.g., Portugal in 2017), and (2) when fires are average moderate or below average on a European scale but occur in regions with a limited history of wildfires and are consequently less prepared to handle them, even at smaller scales (e.g., the Carso Fire in Veneto, Italy).

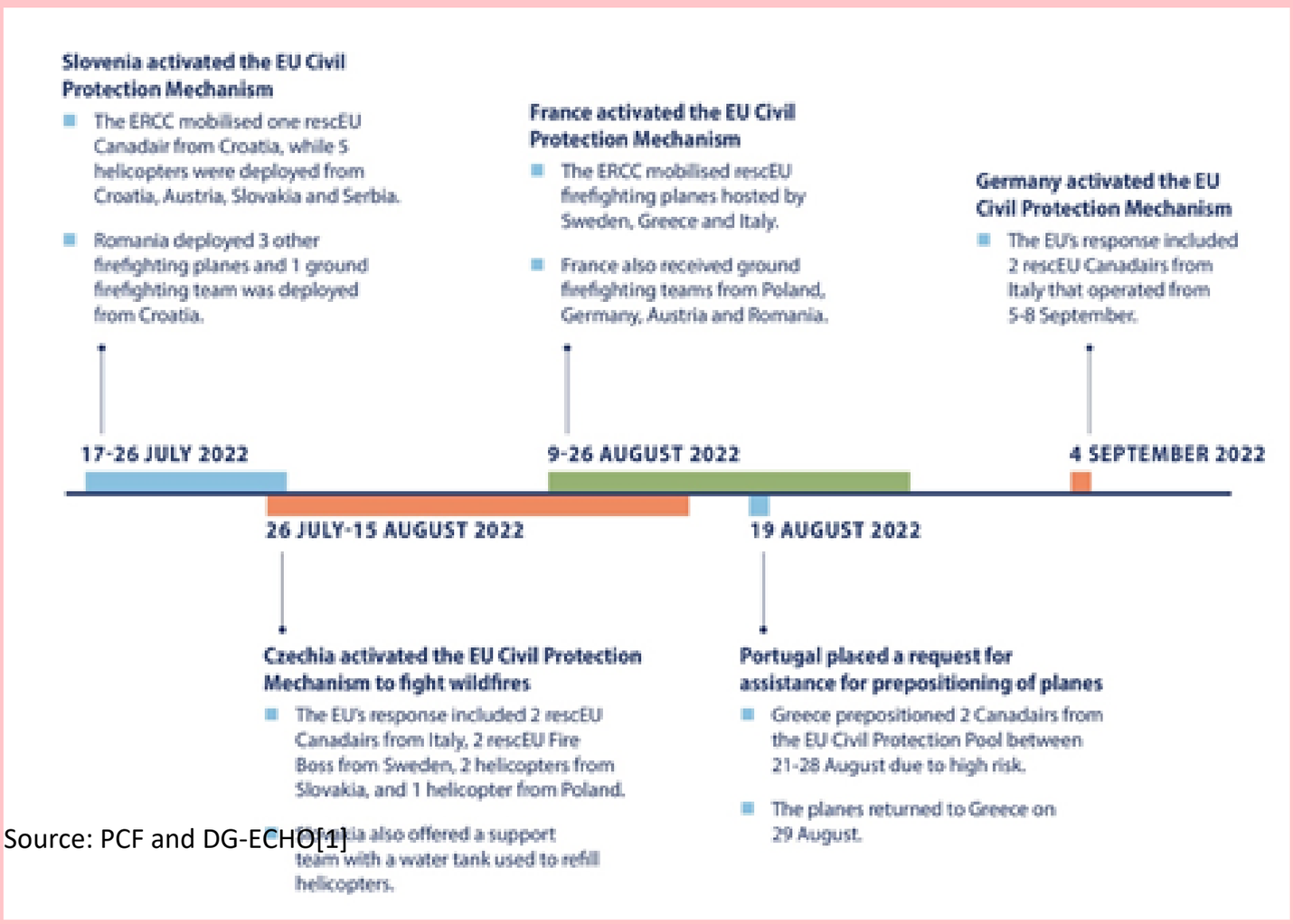
Due to increasing requests for support via the Union Civil Protection Mechanism (UCPM), additional forest fire firefighting capacities are continuously being developed including the development of additional modules across countries. In 2023, Commissioner for Crisis Management Janez Lenarčič announced the doubling of the rescEU aerial firefighting fleet.[14] In addition to the increasing number of requests for resources to support response operations, additional challenges that have been identified over the past years are a lengthening of the fire season, increasing deployment durations, more extreme fire behaviour and the occurrence of simultaneous activations which strain the Mechanism (also in terms of responding to incidents outside Europe).[15]

Overall, such challenges, trends and related future needs are identified by Lessons Learned workshops. However, these workshops mainly attracted civil protection authorities focused on response which may miss stakeholder input from outside, e.g. from the prevention side. Also, not every affected member state always participates and differences between southern countries and, for example, northern European ones are not necessarily addressed. As the workshops address different types of emergencies, wildfire expertise during the evaluation and discussions is not necessarily present or balanced amongst participating authorities.[16]

[13] OUTCOMES OF THE LESSONS LEARNT MEETING ON THE 2018 UCPM ACTIVATIONS BRUSSELS, BELGIUM, 15 FEBRUARY 2019, European Commission, DG ECHO.
[14] Wildfires: EU doubles rescEU firefighting fleet summer 2023 (europa.eu) (23.08.2024).
[15] UCPM LESSONS LEARNT PROGRAMME MEETING ON WILDFIRES AND FLOODS IN 2023 30 NOVEMBER – 1 DECEMBER 2023 ROME, ITALY (Report), European Commission, DG ECHO.
[16] https://www.europarl.europa.eu/RegData/etudes/STUD/2023/747280/IPOL_STU(2023)747280_EN.pdf, pp. 43 ff, (26.8.2024)

UCPM response during the Wildfire Season 2022

In 2022, the Emergency Response and Coordination Centre (ERCC) reported 12 wildfire activations, with 11 in Europe and 1 in South America. Seven countries activated the UCPM, and 10 Member States provided support through teams and in-kind assistance. This response included 33 firefighting planes, 8 helicopters, 6 ground modules, and 369 first responders with 97 vehicles. The Copernicus EMS was activated 56 times, producing 322 maps, which accounted for 57% of all maps delivered in 2022. These maps aided in both response and recovery. The 2022 wildfire season saw a significant increase in large wildfires and burned areas. Challenges faced by UCPM included limited resources, with a shortage of aerial assets at peak times. To address this, a €55 million budgetary boost was allocated to expand the rescEU fleet in 2023 and 2024. Other challenges included varying transportation times for assets and simultaneous emergencies in different regions. ERCC emphasized the importance of clear communication, accurate information, and coordination between air and ground resources for optimal wildfire response and between local emergency resources and modules from European Civil Protection Pool (ECPP). They also highlighted the broader capabilities of the ECPP beyond just aerial support and the need to stablish a common operational framework at EU level to respond to wildfire emergencies.[1]



Source: PCF and DG-ECHO[1]

Synthesis of recommendations

3.1 General observations

The cumulative analysis of wildfire events in Europe from 2010 to 2023 reveals significant country variations and evolving patterns in wildfire occurrences. Southern Europe has consistently experienced the highest severity of wildfire impacts, with Spain, Italy, Greece, and Portugal enduring the most significant damage. The data analysed indicates a pronounced trend of increasing fire frequency and intensity, likely influenced by climate change and other human activities. In southern Europe, this trend is exacerbated by fuel build-up in less intensively managed rural and peri-urban areas, where abandoned lands allow for the accumulation of dry vegetation. This situation, intensified by prolonged heatwaves and droughts, creates ideal conditions for extreme wildfires. In contrast, Central and Northern Europe have traditionally seen fewer wildfires due to cooler, wetter climates. However, rising temperatures and increased drought are now leading to more frequent outbreaks. While fuel build-up is less common in managed forests, the lack of robust fire management strategies leaves these regions vulnerable to unpredictable fire events[17].

The role of the Union Civil Protection Mechanism (UCPM) has been instrumental in managing these escalating wildfire threats. The UCPM was activated multiple times during critical wildfire events, specifically in 2017, to coordinate and assist affected countries. Notably, the 2018 wildfire season was particularly severe, prompting UCPM activations in Sweden and Latvia. This marked a notable shift in the geographic distribution of significant wildfire events. The 2022 wildfire season further underscored the growing challenges, with the UCPM facilitating a substantial response that included deploying aerial firefighting assets, ground units, and providing critical geospatial support through the Copernicus Emergency Management Service. These efforts underscore the necessity for robust cross-border cooperation and resource sharing to effectively respond to wildfires.

The imperative for integrating diverse wildfire management strategies and enhancing training and operational guidelines is evident. The previous sections underscore that reliance on suppression forces alone is insufficient. There is a critical need to incorporate methodologies such as integrative landscape management approaches and adaptable operational frameworks, which can be well supported by governance frameworks linking all DRM phases. Furthermore, addressing the unique challenges presented by wildfires in the Wildland-Urban Interface (WUI) necessitates a comprehensive approach which includes increased risk awareness and individual responsibility and balances the protection of property and infrastructure with the safety of at-risk populations.

Nonetheless, current wildfire management practices have significant gaps. Enhanced risk awareness, improved communication strategies, tailored funding mechanisms, integrated governance schemes, and adaptive resource management are essential for increasing resilience against future wildfire events. Insights gained from the most affected regions highlight the necessity for a coordinated European response framework. By integrating lessons learnt from past events, Europe can enhance its preparedness and response capabilities, ensuring more effective, efficient, and inclusive wildfire management across the continent.

[17] San-Miguel-Ayanz, J. et al (2023). A comprehensive analysis of wildfire trends across Europe is provided in the annual reports "Forest Fires in Europe, Middle East and North Africa" by San-Miguel-Ayanz, J. et al.

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3.2 Summary of recommendations from the reports

The recommendations of the mentioned reports could be clustered among the following topics which are detailed in the subsequent chapters:

- Governance
- Northern European Challenges
- Risk Awareness and Communication
- Funding related to wildfire management
- Urban planning and landscape management
- Housing and self-protection
- Response, also including aspects of interoperability and efficiency
- Training and guidelines

Overall, the recommendations should be aligned with recent policy initiatives such as the Landscape Fire Governance Framework[18]. They relate to specific findings from past incidents but need to be embedded into overall and holistic governance approaches to be effective.

The clustered recommendations were discussed with forty experts during a workshop on 5th June at the 2024 Civil Protection Forum in Brussels, Belgium.[19] The number and profile of the participants cannot be regarded as representative for the relevant stakeholders in integrated wildfire risk management. However, the discussions around the mentioned clusters added some interesting aspects to the portfolio of recommendations are hence presented in the following sections in separate grey boxes.
The figure below provides a visual illustration of the workshop. Expert contributions are highlighted in a separate paragraph for each cluster in the following chapters.

Figure 9: Session visual from the “Advancing Wildfire Risk Management Governance” workshop at the European Civil Protection Forum, 5th June 2024. Source: Mara Callaert.

[18] Agency for the Integrated Management of Rural Fires, I.P. (AGIF) (2023): Landscape Fire Governance Framework, available via: LFGF_EN_2023.pdf (agif.pt) (28.08.2024).
[19] The workshop “Advancing Wildfire Risk Management Governance” lasted 90 minutes: https://civil-protection-knowledge-network.europa.eu/CPF-agenda (26.08.2024).

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3.2.1 Governance

Effective governance in wildfire management requires a nuanced approach that balances fire prevention and suppression, integrating preparedness and recovery too. This balance is not merely about allocating finances; it's equally about aligning with the interests of various stakeholders and ensuring robust forest management and status monitoring throughout the year as well as the alignment of policies and legislation. Such comprehensive measures are fundamental to safeguarding landscapes from destructive fires.[20]

To coordinate these efforts, the establishment of an inter-ministerial/inter-organisational exchange at national level is crucial. Currently, there is a significant gap in wildfire management expertise within the ministries and agencies tasked with the allocation of resources, designing and implementing related programs. This deficit often leads to oversimplified investments that focus primarily on preparedness and response, neglecting broader and more effective strategies. This is in part due to how responsibility for wildfire response is allocated to civil protection agencies, while mandates for wildfire prevention and mitigation are lacking or scattered amongst various other stakeholders.[21] The exchange across countries is hence similarly important and several activities are in place at the European level such as the Union Civil Protection Knowledge Network, or the Peer Review programme and Exchange of Experts programme. However, feasibility and necessity of a dedicated wildfire exchange have been the focus of various past European projects.[22] This platform could facilitate integrated fire management and foster collaboration and communication among all relevant parties while respecting the subsidiarity principle. binding frameworks or directives. These frameworks would standardise approaches across Member States, ensuring consistency and compliance in wildfire management practices and draw on experience from managing other hazards like floods.[23]

Additionally, creating a close collaboration between local stakeholders can distribute risk management responsibilities and capabilities more evenly. This involves not only local authorities but also individual citizens and municipalities, who should be integral to the planning process. Involving citizens helps address issues of discrimination and disadvantage among socially diverse groups and helps to make the planning process more inclusive, promoting equality, equity, and justice in the development of fire-resilient landscapes. For these plans to be effective, the ambassador of the proposed initiatives must be a local authority. This ensures that the technical studies are adapted to the local realities and that the planning process remains participatory— listening to and discussing with the local community to tailor strategies that meet their specific needs and circumstances.[24]

[20] Castellnou et al. (2022), pp. 63 ff; Pronto et al. (2023), pp. 31, 66 ff; Almeida et al. (2023), e.g. pp. 27; 37; 97;
Specific agreements between agro-sylvo-pastoral farms and community/national/regional agencies should be promoted to tie a portion of funding to the performance of adequate prevention activities (Almeida et al. (2023), p. 58.
[21] Pronto et al. (2023), p. 31.
[22] For example, the NERO (european Network on Extreme fiRe behaviour) project is a cost Action that facilitates exchange of knowledge on extreme fire behaviour (european Network on Extreme fiRe behaviour, 27.09.2024).
[23] Pronto et al. (2023), p. 75.
[24] Castellnou et al. (2022), e.g. pp. 65, 72.

During the workshop, two recommendations were discussed in more detail:

Coordination between agencies

To enhance governance in fire management, it is essential to consider social dimensions and socio-economic aspects. Breaking down "silos" at national and EU levels, and creating "focal points," is critical. While various groups and platforms exist, they are often disconnected. At a minimum, it is necessary to map these actors and establish connections between them.

Minimum Standards for Data Collection

To enhance wildfire risk management, it is crucial to expand the list of minimum data to collect related to fires. This data can form the basis for creating a comprehensive directive on Wildfire Risk Management (WFRM). It could include data about the incidents, the source of ignition, data related to fire behaviour, fuel characteristics (pre and after fire), environmental impact, lessons learned regarding response and operations, post-fire monitoring and habitat recovery, as well as human and social impacts. Currently, there is very limited data available to analyse and compare events across countries or time and derive systematic insights for better informed decision-making.

Guidance for WFRM

It is recommended to develop guidelines for a national wildfire risk management plan, including budgeting, and actively engage local and regional stakeholders in the process. Consider all phases of Disaster Risk Management (DRM) – prevention, preparedness, response, and recovery – and ensure they complement rather than confront each other.

Therefore, a common framework and standards should be established to support Member States and partner states internally, facilitating regional governance. It should be aligned with the Wildfire Peer Review Assessment Framework (WF PRAF) and the Landscape Fire Governance Framework (AGIF 2023) and should include the specification of key performance indicators (KPIs).

The guidance could come in the form of an EU Directive.

Overall, the cost-efficiency of available resources needs to be enhanced through more effectively designed funding instruments. Solidarity across territories to foster cooperation and support in wildfire risk management efforts should be supported.

3.2.2. Northern European Challenges

In Northern Europe, wildfire risk management is related to a number of challenges shaped by the region's specific geographical and climatic conditions which is historically less fire-prone than the European South. Despite the frequently comparatively small size and severity of fires in Northern Europe, there is a noticeable shift away from historical fire regimes, possibly driven by climate change. This shift demands a re-evaluation of existing fire management and awareness strategies to better prepare for and respond to this new reality. Raising awareness in areas with traditionally low to medium wildfire frequency is thereby a particular challenge and more appropriately training and equipping response agencies is crucial. In addition, some of the Northern European environments that are typically not prone to fires are difficult to access such as in mountainous or alpine regions, regions with heavy concentrations of deadwood from storm damage and beetle kill, or areas contaminated by unexploded ordinance. Fire risk management in these areas is hence specifically challenging and require tailored strategies, tools and innovations.[25]

Another characteristic of fires in Northern Europe is that traditional agricultural practices such as crop burning are frequently applied which can inadvertently lead to uncontrolled wildfires. To mitigate this risk, it is crucial to refine these practices, find alternatives, and or enhance monitoring, regulations, and enforcement to prevent fire escapes. [26]

[25] Pronto et al. (2023), p. 12.

[26] Pronto et al. (2023), p. 14.

Moreover, another specific concern is the areas contaminated with unexploded ordnance (UXO) resulting from a wide range of conflicts and military activities over the past 150 years. This presents a significant risk during fires, complicating firefighting efforts and increasing danger to firefighting teams. Special protocols and equipment are necessary to handle these hazards safely.[27]

The effectiveness of fire containment efforts is significantly influenced by the demographic characteristics of the region, the availability of fire suppression resources, and the level of training and experience of firefighting personnel. Addressing these variables is essential for improving response and containment capabilities. This holds specifically true since experiences with large fires is low in regions where such fires are rare. Developing training programs that include simulation-based learning and fostering inter-regional cooperation can help build the necessary expertise to manage large-scale fire incidents effectively. Finally, enhanced disaster relief measures and post-fire recovery assistance are more developed in areas accustomed to wildfires, ensuring that rapid response and recovery mechanisms are in place. [28]

Together, these challenges require a tailored approach to wildfire management in Northern Europe, emphasising preventive measures, specialised training, and strategic planning to enhance the region's capacity to manage and mitigate the impacts of wildfires.

During the workshop, it was discussed, how **Southern European examples** can be integrated into Northern European contexts. For example, forest management practices which are an integral part of wildfire risk reduction may be difficult to establish since forest and land managers and fire suppression agencies have very different responsibilities, mandates and objectives. Thus, more exchange of knowledge and needs and overall collaboration is required.

In addition, it was stressed that no standard operating **procedures** in **Northern Europe existed for the use of airplanes in firefighting operations**. However, the overall understanding about the actual potential of integrating measures from Southern Europe to Northern European contexts is currently limited. There is an urgent need for more knowledge about Northern European needs and the potential of Southern European practices. This includes for example **the incorporation of aerial means** such as heavy drones and Union Civil Protection Mechanism (UCPM) airplanes, into fire management strategies or the use of prescribed burns including clear recommendations for **prescribed burning as a means for better protecting the Wildland-Urban Interfaces (WUI)**. Needs and application potential must be matched with the availability of funding and the engagement of country-specific organisations in charge of prevention and preparedness.

[27] Pronto et al. (2023), pp. 12, 20.

[28] Pronto et al. (2023), p. 15.

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3.2.3 Risk awareness and communication

Risk awareness and perception form the cornerstone of effective disaster mitigation. Social media has emerged as a potent tool in this effort, offering vast potential to survey and disseminate vital information throughout all stages of wildfire risk management, with an emphasis on the critical post-analysis of fire incidents. It is imperative, however, to exercise discretion in both the sources of information and its application, especially during the response phase to prevent the propagation of misinformation and fake news.[29]

In addition to social media platforms, a range of mobile applications have been developed, especially in the U.S., which have become invaluable for communicating near-real-time information to the public such as fire progression maps, firefighting efforts, evacuation alerts, etc. For instance, Watch Duty, is mobile application which has a team of professionals working around the clock to vet information, monitor and interpret emergency scanner traffic, monitor wildfire cameras, satellites, and other public information sources such as official announcements from law enforcement and fire services.[30] The high value and extreme demand for such reliable information was apparent when in mid-September 2024, Watch Duty topped the App Store charts, passing other top application like Google, ChatGPT and Tick Tock.[31] Expanding the use of such applications in the European context could be invaluable.

To tackle the increasingly unpredictable nature of extreme events, there is an urgent need to shape a clear and coherent narrative that addresses new challenges in responding to such emergencies. Communication strategies must be robust, encompassing the period before, during, and after an event, ensuring that the community remains informed regardless of whether the news is positive or negative.[32] Europe must promote wildfire risk awareness to empower citizens to make informed decisions and build a resilient society. The goal is to foster a culture of prevention and preparedness, with everyone contributing to their own safety and the safety of others. In 2023, the EU adopted Disaster Resilience Goals, with Goal 2 specifically targeting increased risk awareness and preparedness. This aligns with DG ECHO's Wildfire Risk Action Plan. An analysis of good practices in wildfire risk awareness and communication was published in 2024 further emphasized the need for a comprehensive strategy that includes all societal sectors, especially vulnerable groups.[33]

Moreover, integrating the tourist community through multilingual guidance is essential for both self-protection and the safeguarding of the wider community. Understanding the risk perception of local communities requires a deep appreciation of their culture, history, and long-held beliefs. To this end, the development of more effective strategies for public information is essential. One focal point should be the management of fuel on properties in anticipation of the summer season, which includes issuing press notices that alert the public to the fire hazards associated with warmer weather. [34]

Finally, the overwhelming number of emergency calls, such as those to 112, poses a significant challenge. In response, alternative methods of public information dissemination must be identified, necessitating a collaborative approach with journalists; the above example from the U.S. also offers an alternative. Partnerships between journalists and other relevant actors could enhance the reach and impact of important safety messages, thereby reducing the strain on emergency services and potentially saving lives.[35]

[29] Almeida et al. (2023), pp. 71, 89
[30] https://www.watchduty.org/how-it-works/overview (retrieved 12.09.2024)
[31] (retrieved 12.09.2024)
[32] Castellnou et al. (2022), pp. 62 ff; Pronto et al. (2023), pp. 11, 60, 63f, 66f.
[33] Plana et al. (2024), pp. 5ff.
[34] Pronto et al. (2023), pp. 20; Castellnou et al. (2022), pp. 65, 70, 95
[35] Castellnou et al. (2022), pp. 45f.

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In addition to these aspects, experts discussed the following aspects during the Civil Protection Forum:

It is vital to find the **right balance between negative messages** (shock notification) and **positive and engaging** (never dull) communication. There is no one-size-fits-all and the successful ratio depends on the culture it is meant for. It is recommended, however, to **standardise approaches** as much as possible when it comes to warning indicators, like colour-coding in warnings. Currently, for example an orange **warning** in France could correspond to a yellow warning in Portugal. Such standardisation and implementation efforts need to be conducted as soon as possible.

Citizens' general risk awareness can be further improved by making use of the well-trained and highly motivated **volunteers** within the community. **Tourists** or other temporary residents, could be made aware of potential risks via different means of technology (e.g. when booking hotels, flights, on boarding passes, via SMS).

It is recommended to create a **general terminology**. Decision makers must be aware of the dangers low risk perception and understanding can pose and see the benefits of the recommended efforts.
Media coverage should go beyond just reporting catastrophic events, but also produce engaging content which better communicates risk and safe behaviour.
By making it also accessible and memorable for tourists, the overall level of knowledge and risk perception will be raised.
These efforts would not only involve the media but many other groups within society such as local communities, citizens, tourists, policy makers, civil protection agencies and firefighters. Overall, by improving the perception of risk it would also lead to an improved approach to hazards in general, analysing responses of different cultures and how they adapt to hazards and risks. **Cooperating** with **conferences, media campaigns**, funding opportunities, tourism agencies, as well as the **insurance sector** could help maximise the effects and successes.

Another recommendation would create a **shock and awe campaign** as well as instate **permanent programs** and sufficient funding. By creating a shock and awe media campaign, even using video footage from real catastrophic fire events, would help raise the overall awareness within the general public of the dangers of wildfires. Subsequently, a less sensational, **friendly "cool" campaign** would then promote safe behaviour as well as inclusivity and justice. Both campaigns would involve and address citizens, landowners, local communities, the business sector, academia, and tourists. It would help to also find commonalities to other disasters, raising the general awareness for risk of natural hazards. It is imperative, however, to consider a possible countereffect of such campaigns as well as possible defiance among certain cultures.

3.2.4. Funding

The recommendations related to funding refer to several specific aspects and funding mechanisms evaluated by the study Forest Fires of Summer 2022 focusing on Cohesion Policy Funds. It should be pointed out there are various other national and European funding mechanisms that address the wildfire topic.

The shared management of **Cohesion Policy funds**, which have aided in addressing wildfire management among Member States, is a joint responsibility between the European Union and national agencies. Unfortunately, the bureaucratic administration of these funds can present a labyrinth of procedures hindering understanding, accessibility, and proper utilization of these crucial financial resources.[36] A further apparent gap is lacking fire management expertise within the ministries responsible for administering Cohesion Funds and implementation approaches leading to a greater emphasis on bolstering preparedness and response capabilities.[37]

[36] Pronto et al. (2023), pp. 50 ff, 62.
[37] Pronto et al. (2023), p. 59.

The **Solidarity Fund** has been considerably helpful in bolstering economic recovery following fires, contributing significantly to immediate post-disaster needs. However, it falls short of aligning with the progressive "build back better" principle outlined in the Sendai Framework for Disaster Risk Reduction, which advocates for improving resilience and reducing risk in the reconstruction process, not just restoring burned areas to their pre-disaster conditions.[38] **The European Regional Development Fund (ERDF)** which is designed to take a more regional approach to reducing economic and social disparities and supporting sustainable urban development, also addresses wildfire risk reduction in some European countries. However, lacking information/ transparency on specific supported measures, means very little can be concluded on how effective ERDF is in addressing wildfire risk reduction and integrated fire management.[39]

Of the evaluated funding mechanisms, Interreg provided the most consistent source of comprehensive approaches to integrated fire management with large investments in fuel management, training and knowledge exchange, planning, early warning, and education and communication activities – especially in the case of Spain and Portugal; clearly wildfire expertise was exploited in the initial design of program investments in wildfire risk reduction.[40]

Overall, Cohesion Policy funding schemes can be effective for wildfire prevention, preparedness, mitigation, and adaptation but less so for recovery efforts. While some countries have successfully used these funds to reduce wildfire risk and enhance socio-ecological resilience, the overall impact has been limited to short-term investments with minimal long-term risk reduction. More must be done to sustain these efforts beyond the project duration, create sustainable jobs to maintain fire management infrastructure, and monitor funding mechanisms to assess the long-term impact.[41]

Recognising various gaps, a dedicated **European Wildfire Mitigation Fund** is one proposed mechanism to provide accessibility to a wide range of stakeholders involved in integrated fire management at the landscape level, not just civil protection agencies. It would support sustainable funding for activities like training, expert exchanges, study tours, workshops, and conferences, providing ongoing resources for sharing best practices and promoting valuable networking activities.[42]

[38] Pronto et al. (2023), pp., 57 ff, 62.
[39] Pronto et al. (2023), pp. 50, 54, 64f.
[40] Pronto et al. (2023), pp. 50, 56.
[41] Pronto et al. (2023), p. 64.
[42] Pronto et al. (2023), p. 78.

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To enhance fire management strategies, it was additionally recommended to establish a dedicated fund on topics indirectly related to fires, such as the water cycle, and consider if there is a need for the EU to support other countries, like those in North Africa.

In terms of a potential central resources allocation, it was recommended to consider the unique characteristics and needs of each country, at regional and local level, to avoid the misconception that one size fits all.
Evaluators with expertise in fire management should be involved to ensure effective planning. In case of central fund, the following criteria should be considered to ensure a fair distribution based on specific criteria:

1. Vulnerable areas
2. Hazard levels
3. Current resources, technology, and infrastructure
4. Exposure
5. Occurrence of simultaneous events

Additionally, the frequency of assessments should be determined (e.g. yearly or seasonally, in relation to the phases of fire).

In order to establish a respective mechanism, it would need to be discussed how it could be established (Who has the money, who is getting the money?), how established funding could be monitored (potentially creation of a database) and how it could be ensured that the funding increases wildfire resilience. Specific criteria for funding (e.g., prioritize needs, set evaluation for who gets the money) would need to be developed.

Other ideas that came up during the workshop was the design of a progressive tax policy to ensure a fair contribution from wealthier companies and channel funds to underserved communities. It was suggested to improve business support through grants and mentoring for small businesses, particularly in marginalized area and to offer low-interest soft loans to support start-ups owned by underrepresented groups. Finally, it was proposed to create inclusive insurance policies to protect low-income populations from financial risks.

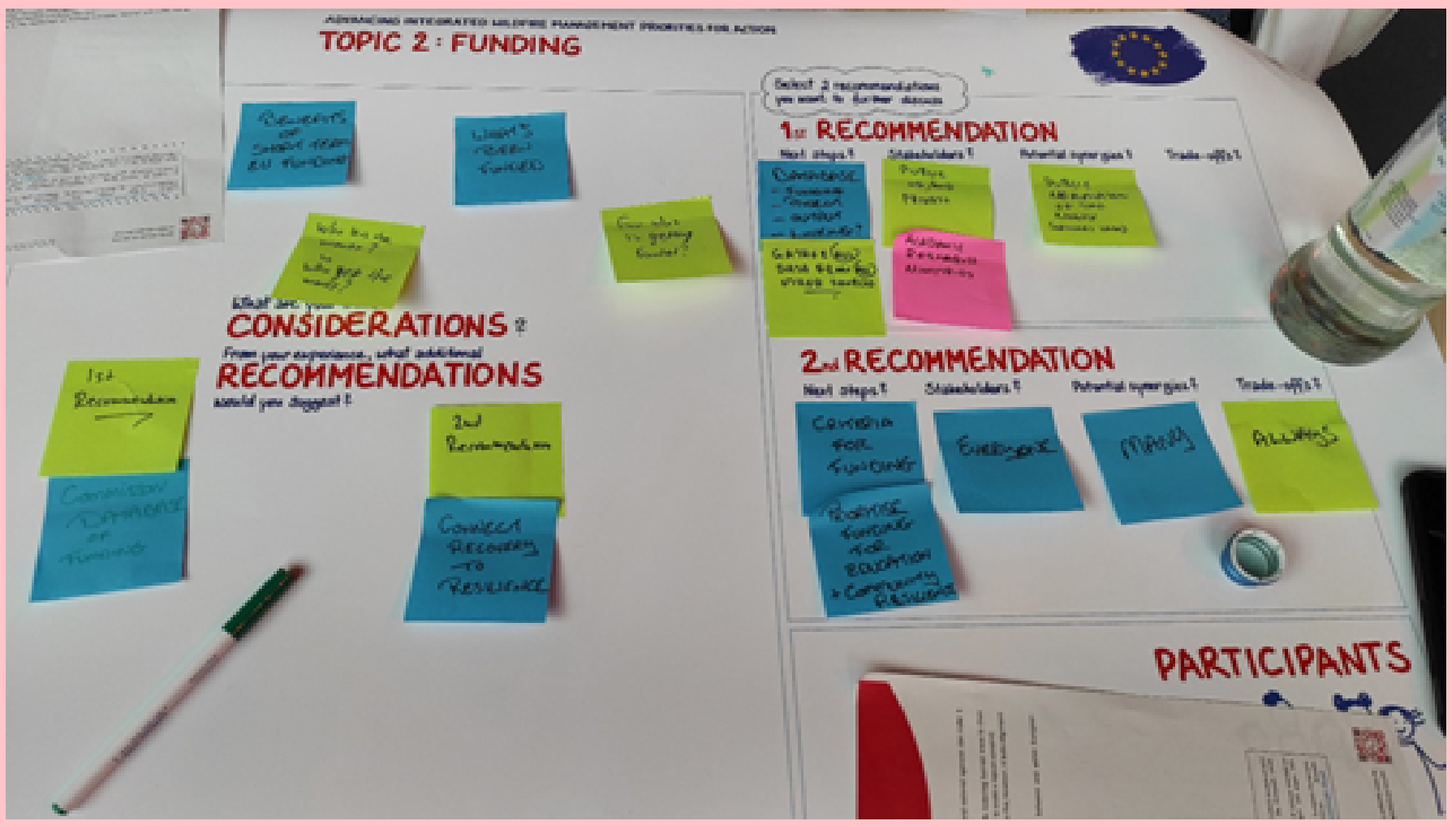

Figure 10: Discussion template of the Finance Workshop Group during the Civil Protection Forum
Source: own picture by Nikolaos Kalapodis.

The imperative to weave fire risk considerations into the fabric of urban planning is clear. Protecting areas through diligent fuel management and prevention activities not only supports the maintenance of urban spaces but also secures them against the threat of wildfires. The concept of fire-resilient landscapes thereby introduces a new paradigm. The goal is to strategically manage landscapes to diminish the fuel available for fires, thereby ensuring that a fire's intensity does not exceed the capacities of extinguishing efforts.[43]

When considering ecology and landscape management, policies must foster the dual objectives of farmland protection—such as reversing land abandonment—and the adoption of fire-smart practices, which collectively cultivate more robust landscapes. Managing forest vegetation becomes indispensable, especially in the wake of large-scale natural disturbances like storms or pest infestations that contribute to the accumulation of fuel loads, heightening fire risks.[44]

The enforcement of vegetation clearance obligations is a critical component, with experts calling for sterner fines and penalties to ensure compliance. Furthermore, the promotion of grazing and browsing treatments is recommended for their efficacy in reducing fuel loads, mitigating fire severity, and ultimately shaping fire-resilient landscapes. This framework posits the potential for collaborations with private investors to further these objectives. It also suggests integrating ecosystem services and nature-based solutions into fire risk reduction strategies, alongside recognizing and financially valuing environmental services provided by the landscape, thereby fostering a bioeconomy linked to forests. [45]

Addressing the challenges of biomass reduction and landscape-level distribution necessitates a nuanced understanding of where land use changes and treatments are needed. The complexity of managing large, fragmented regions and organizing such efforts efficiently while balancing risk reduction with other landscape values is a multifaceted task. The role of agro-silvo-pastoral activities becomes crucial in this context. They are essential for managing wildland and rural fuels, supporting populations in remote areas, and countering rural depopulation and economic loss. This multi-dimensional, co-creative, and transformative paradigm requires an exploration and definition of each landscape’s system of values through planning that is responsive to risks, climate change, and adaptation. It involves accepting burned areas as a natural part of landscape dynamics and re-evaluating the societal limits of suppression-centric approaches.[46]

Finally, establishing specific agreements between agro-silvo-pastoral farms and the community at various governance levels can provide the necessary funding and incentives for performing adequate prevention activities. These agreements ensure that farms continue their crucial agro-silvo-pastoral productions while contributing to the overarching goal of wildfire risk reduction and landscape resilience.[47]

The planning process for building new homes, the renovation of existing structures or the reconstruction of damaged or destroyed homes/structures (e.g., by fire) in these vulnerable zones should be inextricably linked to risk mitigation measures. This necessitates a collaborative approach that brings together all public entities responsible for spatial planning and risk management, alongside the local communities and homeowners who are directly impacted.[48]

[43] Almeida et al. (2023), p. 58.
[44] Castellnou et al. (2022), p. 67.
[45] Almeida et al. (2023), p. 97; Pronto et al. (2023), pp. 66, 71; Castellnou et al. (2022), pp. 59, 67.
[46] Castellnou et al. (2022), pp. 59, 67; Almeida et al. (2023), pp. 58, 71.
[47] Almeida et al. (2023), p. 58.
[48] Castellnou et al. (2022), p. 72

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The post-fire recovery phase is also critical in terms of both building back better and restoring landscapes appropriate for present and anticipated conditions and fire regimes as an opportunity to bolster the ecosystem's resilience against future fires. By introducing and establishing fire-adapted species, particularly those that can resprout after a fire, the landscape is not only restored but transformed into one that can better withstand and adapt to subsequent wildfires. Before introducing new species, burned areas should be allowed a period to recover – as most European landscapes have been intensively managed, allowing for natural regeneration frequently yields more fire-adapted landscapes. Furthermore, there should be strategic consideration for altering the land use of areas that have been burned. This may involve, for example, converting areas previously forested into pasture or agricultural land. Such changes could reduce the likelihood of future fires or at least mitigate their potential impact. This is a proactive approach that introduces broader adaptive measures into the affected ecosystems.[49]

Incorporating these adaptive strategies into the recovery process ensures that the rebuilding phase not only restores lost assets but also fortifies communities against the possibility of future wildfires. It underscores the need for a forward-looking perspective in the face of natural disasters, one that integrates resilience and sustainability into the fabric of community restoration and land management practices.

During the workshop, it was recommended that fire risk needs to be **integrated into urban planning at an early stage. New houses** being built, especially in high fire risk areas, should be required to **adhere to high standards**, addressing the increased risk of fire.

It was further recommended that after a fire, **restoration efforts should be taken to improve the ecosystem's resilience in the future**. This would include, for example, allowing for natural ecosystem recovery or, if necessary, the planting of more fire and drought resistant species. It would further require an adapted management of the forest vegetation as well as additional activities that improve or support forest management, including the reduction of biomass (fuel), for instance, in strategic regions or corridors.

3.2.6. Housing and self-protection

The efficacy of structures as an option for self-protection ("shelter in place") hinges critically on their design, which must be congruent with anticipated fire behaviour—this includes not only the amount of fuel present but also an understanding of how fire propagates across the landscape. For cultural assets nestled within forested areas, developing a fire protection plan is important. Such plans would safeguard these invaluable treasures against the ravages of uncontrolled blazes.[50]
At the core of ensuring the survivability of structures without the need for public firefighting resources, are several key principles: a) strategic placement in areas less vulnerable to fire, such as avoiding canyons or steep slopes prone to rapid fire spread; b) adherence to superior construction practices, which encompass fire-resilient architectural design elements like fire-resistant materials beneath roof tiles; c) diligent management and clearance of flammable materials in proximity to buildings; d) self-sufficiency regarding water and energy supplies, ensuring autonomy during crises; and e) the incorporation of self-protection mechanisms, for example, water sprinklers.[51]

In the Wildland-Urban Interface (WUI), the challenges are compounded, especially during simultaneous fires where it becomes highly challenging to safeguard every structure. This raises an essential question: Are the current protection measures robust enough to withstand extreme fire events? Consideration must also be extended to potentially flammable or dangerous items within or in close proximity to structures, such as air conditioning units, vehicles, fuel tanks, barbecues, electrical installations, industrial products (e.g., cleaners, paint), shade awnings, etc., which can exacerbate fire risks or pose additional hazards during a wildfire.[52]

[49] Castellnou et al. (2022), p. 68.
[50] Almeida et al (2023), p. 27.
[51] Almeida et al (2023), p. 27.
[52] Almeida et al (2023), p. 24.

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Furthermore, it is imperative that all settlements and villages craft and maintain a detailed, scenario-based fire protection plan, ready to be executed during emergencies. This plan should address critical decisions, such as the identification of individuals who will evacuate versus those who will remain to execute defensive actions. It must also detail the roles and responsibilities of those staying behind, ensuring clarity and efficiency during chaotic situations. Such comprehensive planning is vital in enhancing the resilience of communities against the threat of wildfires, ensuring safer and more effective wildfire response, and balancing proactive measures with responsive strategies to ensure the safety and preservation of both, human lives and cultural legacies.[53]

Overall, the need for citizens to have the capacity for self-protection and fire risk management is crucial as in catastrophic situations, where civil protection resources may be insufficient to respond to all calls for help, citizens may be left to rely on their own preparedness and the preventive measures implemented beforehand.

To maximize the impact of funding, it is important to integrate topics from different fields, achieving multiple benefits with the same resources. Residents can save their own lives and sometimes their buildings by being aware of risks and knowing how to mitigate them.
Cooperation plans should serve as an umbrella to consolidate emergency plans designed for houses or communities. Addressing abandoned property in rural areas is also crucial. Facilitating communication between people in the vicinity and fostering cooperation between forest owners, the fire brigade or other relevant agencies are essential steps.
Wildfire safety initiatives focused on fire prevention for houses will further enhance overall fire management and safety.

Overall, the following two recommendations were discussed during the workshop:

1) Empower citizens with the knowledge and skills to mitigate wildfire risk. This requires to first change the perception that civil protection agencies will always be there to rescue people in need (in case of wildfires). Second, a context specific awareness needs to be fostered, as well as training, engagement and education. A clear and continuous two-way communication between the residents of an area and their respective civil protection authorities is necessary as well as obtaining support from other key actors.
Lastly, communities need to be open and eager to learn from other fire prone areas, exchange knowledge and experiences, to build sustainable and effective resilience. These measures would include citizens, experts, local civil protection authorities as well as local leaders to create synergies between regional and local emergencies and possible prevention plans.
2) In the design phase of buildings or retrofitting houses, it is recommended to already integrate multiple initiatives for multiple wins (e.g. energy efficiency) that also include fire safety. Further, an integration of community recovery plans is necessary.

3.2.7. Response

Several recommendations have been developed in relation to response operations as detailed below.
Interoperability is the operational cornerstone in the response phase of disaster management. The Union Civil Protection Mechanism (UCPM) underscores the necessity to enhance cross-border collaboration amongst responding agencies, municipalities, states, and regions. This not only applies internationally but also at the national level, where a common system for joint emergency response is indispensable. National firefighting schools play a pivotal role in supporting this interoperability, equipping responders from across the country with cohesive training and competencies. The pre-positioning of UCPM resources was thereby perceived very positively since it allowed also for critical training. Nevertheless, there is an imperative to leverage training in “peacetime” to address the substantial gaps in training, compatibility, comprehension, and overall readiness, particularly for less experienced countries.

[53] Almeida et al (2023), p. 71.

As more countries that are typically less prone to fires increasingly require European and international assistance to handle fire events on a scale they are not accustomed to, it is crucial to build on the “Host nation support” principles to extend the interoperability concept to the “battle field”. Equally important are guidelines for assisting countries that are more prone to fires and are now facing increasingly catastrophic events. In these last cases, there is already some historical precedent and, therefore, more experience to draw upon. Combining these two cases, with a particular emphasis on the exchange of experiences, would enhance the efficiency of European and international assistance operations. [54]

The planning for extreme events requires existing emergency protocols to be updated, incorporating the reality of Extreme Weather Events (EWE) and climate change impacts. A deeper understanding of extreme fire behaviour is vital, alongside an increase in knowledge exchanges between Member States to foster the development and sharing of best practices. **Evacuations** must be handled with prudence; while the preservation of human life is a priority, overuse of evacuation can undermine public trust in civil protection services; it should also be carefully considered ahead of an emergency whether evacuating people could be more dangerous than sheltering in place due to factors like too little time, clogged or cut-off evacuation routes etc. Evacuations, especially in coastal areas threatened by fire, must consider rescue operations via sea using boats – however respective guidelines or knowledge sharing (at least) are lacking.[55]

Operational challenges are compounded by heavy loads of forest fuels, and biomass accumulation. Planning for such challenges include **identifying strategic areas** that may offer **advantages to firefighters** and prioritizing these for preventive fuel reduction. **Aerial and ground firefighting forces** must always work in tandem and an over-dependence on water can leave areas vulnerable, especially during multiple fires or extreme drought.[56] In the face of simultaneous events, response operations may struggle with addressing two large fires in the same region. **Prioritisation procedures** (forces concentration) for resources become essential in these scenarios. Again, respective guidelines and decision support could be enhanced.[57] In addition, high-risk conditions (e.g., strong winds) can render even aerial suppression forces insufficient. Hence, there is **a need for better integration of practices like dry firefighting methods and tactical fire use** and more flexible operational frameworks.[58]

Firefighting in the **wildland-urban** interface (WUI) presents unique complexities and hazards, involving not only property protection but also the safety of citizens management, including vulnerable populations and animals.[59]

Communication of **emergency messages** must be tailored to the profile of the recipients, recognizing that individuals in different areas may have varying levels of resilience and adaptability to fires. The absence of **concrete plans for protecting villages and their properties after the evacuation** has sometimes resulted in the local population disregarding evacuation orders. This underlines the necessity of including property protection in the evacuation protocols.[60]

Volunteer efforts are crucial, particularly to adapt responding agencies posture to high intensity periods, without neglecting a permanent involvement of these people. Legal statute, insurance and ad-hoc training for volunteers must hence be improved.[61]

[54] Pronto et al. (2023), p. 61; Almeida et al (2023), p. 88
[55] Almeida et al. (2023), p. 88.
[56] Almeida et al. (2023), p. 37.
[57] Almeida et al (2023), p. 71.
[58] Almeida et al (2023), pp. 88f.
[59] Almeida et al (2023), p. 88.
[60] Castellnou et al. (2022), pp. 46f, 90; Pronto et al. (2023), pp. 47f.
[61] Almeida et a. (2023), pp. 27, 71, 89.

Workshop participants discussed the necessity of improving prediction and use **sheltering** rather than evacuation, when appropriate. In case of extreme wildfires, evacuation could lead to more fatalities, while sheltering could be more useful or safer, e.g. in churches where the stone structure could withstand the fire. However, it is necessary to consider cultural considerations when debating whether to stay or to evacuate. Education needs to be provided about how to "stay and defend". It also requires effective early warning systems and sufficient sheltering options.

Focussing on prevention, it is recommended to **include responders already early** in the field of forest management. Examples for this involvement are prescribed burning, fuel management, safe model villages (a village designed so that civilians can protect themselves for a period of time in case of a rural interface fire, until civil protection agencies arrive), managing of mosaic landscapes and implementation of effective agro-eco forestry.

To improve **interoperability**, focus on command-and-control systems can be a first step for an enhanced management of EUCPM experts for the benefit of the affected country. Also, technical and tactical procedures have to be explored with respect to their harmonisation potential for cross-country deployments. Others aspects contributing to increase interoperability are among others regulations, language, tools and materials. For example, addressing language challenges and having a liaison officer that is not just a language translator, but also a provider of relevant capabilities insight to the host nation command and control system could be useful. Finally, increasing and diversifying the number of registered teams in the European civil protection pool, e.g. with a special focus on WUI defence or tactic fire crews, could be useful.

Focussing on firefighting, in general, it **is recommended to enhance the capabilities of wildland firefighters**, providing for example more specialized training, increasing skills for example associated with dry firefighting tactics and mop-up, tactical fire use, or better coordination between air and ground resources. While special teams already exist all over Southern Europe (at least Portugal, Spain, France, Italy, Croatia, Greece…), extending the knowledge of these specialised teams to non-fire prone countries can be beneficial. There is also room for improvement with more versatile vehicles (e.g. ATVs, pickups with slip-on units, etc.), specialized tools and equipment, appropriate personal protective equipment and gear. The integration of more innovation is also needed, for example UAVs, decision-support software, optimization of tools and water-delivery systems, environmentally friendly fire retardants and suppressants, etc. Furthermore, the response world needs more science and a better management of their formulation.

Training and guidelines need more investment and emphasis. Specialised knowledge like wildfire behaviour analysis and fire weather expertise are increasingly in high demand. Experts have pointed out that **only a few countries have firefighters adequately trained** and equipped for current and future wildfire challenges and the over-reliance on aircraft or water-based approaches is a concern many countries share.[62]

Prescribed fire and fire-management programs for protected areas must be tailored to the specific needs of various ecosystems, ranging from fire-dependent/adapted to fire-sensitive and potentially threatened ecosystems.[63]

Guidelines for contaminated areas, such as those affected by nuclear incidents or unexploded ordnance, need to be established. Similarly, **guidance for countries newly prone to fires** is necessary.[64] In addition, guidance strategies for dealing with **animal installations during fires** including aspects on how to protect infrastructure and whether to evacuate animals, recognizing that different species may react differently to fires.[65]

[62] Pronto et al. (2023), pp. 47f, 59.
[63] Pronto et al. (2023), p. 69.
[64] Pronto et al. (2023), pp. 70, 76.
[65] Almeida et al (2023), p. 27.

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During the workshop, two recommendations were discussed in-depth:

- Minimum requirement levels of training for responding to wildfires
- The development of specific international trainings for wildfire fighting

An agreement at EU-level is recommended about minimum-required levels of training for firefighters to improve coordination among response agencies.

An EU-level agreement is recommended to establish minimum training standards for wildfire response, aiming to enhance interoperability among firefighting organisations. This initiative can draw on the pre-positioning scheme from the Union Civil Protection Mechanism (UCPM) and other UCPM initiatives, as well as align with INSARAG (International Search and Rescue Advisory Group) procedures and similar frameworks. By standardising training protocols across Europe, responders will share a common understanding of terminology, operational procedures, equipment handling, and safety protocols, leading to safer, more efficient, effective, and cohesive responses during wildfire incidents. Such an agreement would include the definition of roles, competencies for each position, and the creation of qualification processes that encompass specific training and practical experience hours. Leveraging the success of UCPM's coordinated approach, the implementation of these minimum training standards will improve interoperability, facilitate better resource sharing, and ultimately strengthen the overall effectiveness of the European wildfire response framework. The development of opportunities to share operational practices knowledge (trainings, workshops, MODEX etc.) will obviously, by simple comparison, work slowly towards harmonisation and will extend these practices to countries which are only recently facing wildfire threats. However, the EU should stimulate the work on harmonisation, by funding comparative studies and responders' roundtables. However, it's immediately possible to massively increase the training program on operational practices, even if harmonisation guidance is not yet edited. This new training programme may be developed and supported by DG ECHO as an addition of the already existing one (EUCPM training programme).

The development of specific roles in relation to special units for wildland firefighting (WFF) should be defined and related to specific practices. Respective practices should then be linked to dedicated qualification and certification schemes.

The development of specific roles within specialised wildland firefighting (WFF) units should be meticulously defined, with each role clearly linked to distinct practices essential for effective wildfire management. Drawing on a robust qualification system, is crucial to establish comprehensive competencies for each position. This involves identifying the specific skills, knowledge, and abilities required for each role within WFF units. Once these competencies are outlined, tailored qualification processes must be created for each position. These processes should encompass both specific training programmes and a requisite number of working hours to ensure practical experience. Implementing dedicated qualification and certification schemes aligned with these competencies will ensure that personnel are not only well-prepared but also consistently meet the high standards necessary for effective wildfire response. By systematically defining positions and their associated competencies, and then linking these to rigorous qualification processes, the preparedness, efficiency, and safety of WFF units can be enhanced, ultimately improving their capability to manage and mitigate the undesired impacts of wildfires.

Conclusion

With this report, we aim to synthesise the findings of three major publications on reviewing wildfire events in the European region over the past years. The reports provide a long list of suggestions for enhancing wildfire risk management along different topics and at different scales. We identified eight central topics for wildfire risk management by analysing the recommendations and conclusions. Subsequently, the clustered recommendations were discussed by experts at the Civil Protection Forum 2024 which further enriched the suggestions. Overall, this report is an interim result of the Firelogue project which aims to synthesise insights from ongoing wildfire risk management projects. The report is one of several activities that will help to formulate policy suggestions at multiple scales.

The first topic of recommendations aims to improve **the governance** in wildfire management. To ensure an effective coordination between all stakeholders and risk management phases, it is suggested to form an inter-organisational platform and to establish an EU-wide guidance framework for compliance in wildfire management. Additionally, it is recommended to involve not only local authorities but also individual citizens and municipalities in a participatory approach to promote inclusiveness and equality. Experts also suggested that the minimal amount of collected data of fire events should be expanded.

The second bundle of recommendations focuses on the growing number of fire events in **Northern and Central Europe** and the demand for re-evaluation of existing fire management practices and awareness strategies to be prepared for and respond to this new reality. It was thereby stressed that the overall understanding about the actual potential of integrating measures from Southern Europe to Northern European contexts is currently limited; prepositioning resources, training and networking events, study tours and expert exchanges are in part, currently addressing this transfer of knowledge.

Raising awareness and ensuring ongoing and robust **communication** is an important point in the third cluster of recommendations for improved wildfire risk management. During their discussion, experts addressed various aspects of communication strategies. On the one hand, it is important to find a balance between negative messages and positive information. On the other hand, in case of a warning messages, Europe needs a standardised and harmonised approach. This also includes the use of a general terminology. To improve risk awareness in local communities, trained and motivated volunteers could function as multipliers.

Furthermore, **funding and corresponding mechanisms** were another subject of the analysed recommendations. Funding mechanisms need to support long-term measures to increase resilience. In case of central funds, the distribution should be based on objective criteria like exposure and vulnerability patterns.

Resilient landscapes and **urban planning** play a key role in effective wildfire risk management. Experts emphasised urban planning needs to comprise diligent fuel management and prevention activities. However, even existing requirements and obligations are often accompanied by weak enforcement mechanisms and hence may lack adherence. It was stressed the complexity of managing large, fragmented regions and organizing such efforts efficiently while balancing risk reduction with other landscape values requires the consideration of agro-silvo-pastoral activities. Finally, post-fire recovery activities should be used as an opportunity to build-back-better, strengthen the ecosystem's resilience, and to consider future wildfire exposure to resources, infrastructure and communities.

Another cluster of recommendations centres around planning more fire resistance **housing/ communities and self-protection measures**. This includes avoiding building in canyons or steep slopes prone to rapid fire spread, the adherence to construction practices and use of fire-resistant materials, cleaning of fuel around houses and the incorporation of self-protection mechanisms such as sprinklers.

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The seventh topic of recommendations relate to wildfire **response** measures. It was stressed that interoperability of response resources across borders and on national level is an important cornerstone and that it was crucial to leverage training in “peacetime” to address gaps in training, compatibility, and overall readiness, particularly for less experienced countries. Overall, it was suggested to (better) include responders in forest management activities for an effective prevention strategy. Finally, it was suggested to develop prioritisation procedures for resources deployment in case of simultaneous incidents.

The eighth and last cluster of recommendations addresses the **training** of firefighters and **guidelines** concerning special operations. Experts recommended an agreement on European level about minimum training standards for wildland firefighters to improve firefighter safety, incident coordination, and improve operational efficiency and effectivity. Additionally, it was suggested to define specific roles in relation to specialised units for wildland firefighting based on qualification and certification schemes, and international good practice.

In conclusion, the three analysed reports complement each other and the given recommendations address many important components of integrated fire management. The identified clusters are closely related and interdependent, highlighting the complexity of the subject and the need for a holistic approach to strategy design. Overall, this synthesis report offers several actionable suggestions to enhance wildfire risk management.

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