

WILDFIRE RESILIENCE BLUEPRINT

FIREURISK DUAL FRAMEWORK APPROACH



October 2023

ACKNOWLEDGMENT AND SCOPE STATEMENT

This paper is a collaborative effort stemming from the involvement of the FirEURisk project [1] in organizing the RISE-SD 2023 Wildfire Management Workshop [2] in Rhodes (Gr) in cooperation with Firelogue Concerted Support Action [3] and other relevant Greendeal research projects. The paper is authored by the FirEURisk Steering Committee, comprising leading experts in the field: Domingos Viegas, Emilio Chuvieco, George Eftychidis, and Ioannis Gitas and by the Chairman of the Quality Review Board of the Project. As an integral part of FirEURisk's mission, the perspectives presented in this paper are not merely academic conjectures but are under active elaboration within the project's ongoing research and policy development activities. Thus, the work represents an amalgamation of cutting-edge scientific approaches and emergent policy perspectives designed to shape future wildfire management strategies, both at the National and European Union levels.

FIREURISK PROJECT

Advancing Wildfire Management in a Climate Change Context: A Call for the Integration of Holistic Ecosystem and Landscape Management Frameworks in EU Policies

George Eftychidis¹, Domingos Viegas², Emilio Chuvieco³, Doerr, S.⁴, and Ioannis Gitas¹

¹*Aristotle University of Thessaloniki (AUTH), Thessaloniki, Greece (GR)*

²*Association for the Development of Industrial Aerodynamics (ADAI), Coimbra, Portugal (PT)*

³*University of Alcalá (UAH), Alcalá de Henares, Spain (ES)*

⁴*University of Swansea, United Kingdom (UK)*

ABSTRACT

The urgency of a systemic response to the risk from increasingly catastrophic wildfire events, heightened by the ongoing climate change crisis, cannot be overstated. This policy brief advocates a coherent, integrated strategy that combines Integrated Wildfire Risk Management (IWFRM) and Holistic Landscape Fire Management (HLFM). The principal aim is to refine these frameworks for greater clarity and applicability in future landscape and fire risk management policies.

This brief, stemming from outcomes of the recent RISE Wildfire Management Workshop and the FirEURisk project, advances a dual and inclusive framework strategy that brings together IWFRM and HLFM within a broader ecosystem risk management context. The brief further identifies shortcomings of the current technologically-driven focus of some EU policies, advocating instead the inclusion of more science-based approaches grounded in fire ecology, fire sociology, and rural economy. We argue that the standardization of terminology and a clear definition of the concepts will contribute to a nuanced and consensual approach to wildfire management – taking advantage of effective fire science approaches instead of predominantly technological solutions – that is imperative for effective policy formulation and implementation. The fire science approaches highlighted include key outcomes of the FirEURisk project, which are proposed to aid in developing future wildfire and forest management policies in the EU.

INTRODUCTION

In addressing the escalating challenges of wildfires in the context of climate change, we face both terminology and strategy divides. One such divide exists between the so-called 'Integrated' and 'holistic' approaches to wildfire risk management. These terms, often used interchangeably, result in conceptual ambiguities that hamper effective policymaking and stymie research efforts. This policy brief addresses two urgent challenges. Firstly, the necessity for standardized terminology to enable clear communication and understanding between researchers, operational agents, citizens, and policymakers; and secondly, the need for an integrated wildfire management system that aligns properly with holistic ecosystem management, particularly within the framework of the European Union's future strategies and policies.

CLARIFICATION AND STANDARDIZATION OF TERMINOLOGY

The development of informed wildfire management policies hinges on clear and consistent terminology. 'Integrated' and 'Holistic' are terms often deployed without clear definition and differentiation, creating gaps in understanding and application. For example, the term "Integrated Wildfire Risk Management" (IWFRM) typically emphasizes targeted wildfire aspects like prevention, preparedness, and response. In contrast, "Holistic Landscape Fire Management" (HLFM) adopts a broader scope, considering long-term sustainability, resilience and the multifunctionality of landscapes. Standardizing these terms would eliminate conceptual ambiguity and support a common epistemological ground, bridging the gap between scientific inquiry and policy making. Recent research underscores the importance of linguistic precision in achieving policy objectives, and in the realm of wildfire risk management, this is a very important issue.

INTEGRATED AS PART OF HOLISTIC: A DUAL FRAMEWORK APPROACH

Traditionally, IWFRM and HLFM have functioned in parallel, each attending to its own set of objectives and timeframes. However, such segregation is inadequate and perilous in an era of changing climate and heightened wildfire risks. What is proposed here is simple but transformative: **Integrate IWFRM into HLFM, establishing a dual framework to address climate change issues.** IWFRM can address excessive wildfire potential, which may threaten community activity and assets that ecosystem management, even when performed holistically, cannot contain. Such integration allows for a balance between the ecological role of fire and the imperative to protect human life and property. Moreover, it fits perfectly within the broader scope of ecosystem and landscape management, thus providing a comprehensive approach to wildfire governance.

"Integrated risk management", as defined in the ISO 31000:2018 standard, are coordinated activities to direct and control an organization with regard to risk. This involves aligning risk management with an organization's objectives and strategies, integrating risk management into decision-making processes, and ensuring that risk management is a continuous process.

While "holistic risk management" is not explicitly defined in ISO 31000:2018, the standard emphasizes a holistic approach to risk management. This approach should be integrated into an organization's overall management system and decision-making processes, considering both internal and external factors, as well as the needs and expectations of stakeholders.

The European Commission also underscores the importance of integrated and holistic risk management in its policy documents. For instance, the Commission's White Paper on Adaptation to Climate Change (2009) highlights the need for "integrated, cross-sectoral, and multi-level approaches to climate change adaptation" [4]). Similarly, the European Commission's Communication on the EU Strategy on Adaptation to Climate Change (2013) emphasizes the importance of a "holistic approach to climate change adaptation" [5]).

Finally, the E.C./H2020 LC-CLA-15-2020 topic [6], "Forest Fires risk reduction: towards an integrated fire management approach in the E.U." calls for an Integrated Fire Management strategy that promotes holistic landscape, land use, and forest management and considers the interaction among all phases of the wildfire

management process (i.e. fire prevention and preparedness, fire detection and response, post-fire restoration and adaptation).

In light of the evident lack of standardized definitions for "integrated" and "holistic" risk management in the field of wildfire management, there is a need to resolve this terminological and semantic vagueness. This is essential for achieving conceptual precision and functional effectiveness in wildfire management practices. To this end, based on a comprehensive review of the wide utilization of these terms in pertinent scientific literature and policy reports, we put forth the following rigorously defined terms, each carrying distinct conceptual weight and operational scope:

- **Holistic Landscape Fire Management (HLFM)** combines wildfire management with broader landscape management objectives. It recognizes that wildfires are a natural process that can benefit ecosystems and biodiversity and that managing wildfires holistically requires an understanding of the whole landscape and its ecological dynamics. HLFM is based on four core principles: ecological restoration, fire prevention, fire management, and community engagement.
- **Integrated Wildfire Risk Management (IWFRM)** aims to reduce wildfires' negative impact on humans and the environment. It involves collaboration among landowners, firefighters, policymakers and the public to integrate risk-reduction strategies into land-use planning. The approach focuses on prevention, preparedness, and response.

Here we advocate the concept of an integrated WFRM in the sense of involving all aspects, components, scales, and phases of the overall process. In our perspective, it also encompasses the term "holistic" as we are looking at the various components as a "whole," considering the various aspects that are included in the above definitions, namely those that are mentioned in one of them but not in the other.

We propose the adoption of a unified wildfire management strategy that fundamentally opposes the siloed mentality often exhibited by individuals or institutions, including scientists. Such a siloed approach involves viewing the wildfire issue solely through one's own disciplinary or institutional lens, thereby marginalizing or underestimating alternative perspectives and methodologies. Instead, a cohesive approach would encourage interdisciplinary collaboration and holistic problem-solving, ensuring that all facets of wildfire management are adequately addressed.

For this reason, we designate our approach and our effort as a Roadmap toward a dual-framework strategy, combining holistic and integrated fire risk management within a broader landscape management context for Europe to ensure that we are addressing the problem from its various perspectives.

IMPLICATIONS FOR EU POLICIES

In line with the European Green Deal and the EU Biodiversity Strategy for 2030, integrating IWFRM into holistic ecosystem management could be a cornerstone for future EU policies. This integration would imply a deepen consideration of fire science into EU policies (including fire ecology as well as economic and social aspects of rural economies). The change will not only align objectives and synchronize actions but also leverage synergies

between different policy domains. This concept is primed to be a lynchpin in the EU's strategies to address the increasingly volatile wildfire landscape under climate change conditions.

THE PITFALLS OF A TECHNO-CENTRIC APPROACH

Current EU policies, perhaps understandably so, are inclined towards technologically-driven solutions for wildfire management. The allure of technology is hard to resist: drones for surveillance, artificial intelligence, advanced software for real-time video analytics, and innovative firefighting equipment, including improved aerial means, promise immediate results. However, this creates an illusion of competency, progress effectiveness in addressing wildfire challenges. Technological solutions are often reactive and concentrate on suppression measures, thereby sidelining proactive fire management strategies rooted in a scientific understanding of wildfires, including their ecological, social and economic implications.

TECHNOLOGY AND THE NEGLECT OF FIRE SCIENCE

Focusing solely on technology can be likened to treating the symptoms while ignoring the root cause of a disease. Wildfires, especially those exacerbated by climate change, are not just isolated incidents that can be 'put out' – they are manifestations of more significant societal, ecological and climatic imbalances. For instance, ignoring the role of atmospheric and biological processes, the physical processes associated to fire ignition and development, fire ecology and socio-economic factors in the problem of wildfire risk, in favor of technology, results in a skewed understanding of fire's role in ecosystems, leading to less efficient fire risk reduction and restoration policies. For example, it is well established that fire is a natural process of many landscapes, having a crucial role in nutrient cycling, habitat creation and maintenance, and natural succession of plant communities. Blind wildfire suppression without understanding these ecological aspects has led to unintended and often adverse consequences, including the accumulation of flammable biomass and the disruption of natural fire regimes. Given the current trajectory of climate change, more landscapes will be affected by wildfires in Europe, and therefore new strategies to reduce vulnerability and reinforce resilience, both of social and ecological communities are required (cf. [7] and [8]). Policy gaps and the absence of science-based fire management can set the stage for uncontrollable conflagrations in the next decades.

ACCUMULATED CHALLENGES AND FUTURE CONFLAGRATIONS

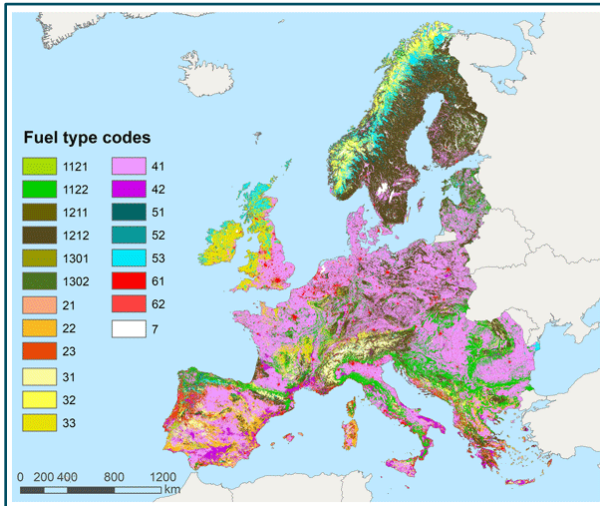
The European Forest Fire Information System (EFFIS) reports that the number of forest fires in the EU decreased by 60% between 1980 and 2020, while the burned area increased by 100% in the same period [9]. In the Mediterranean region, which is the most affected by forest fires in the EU, the number of fires decreased by 50% between 1980 and 2020, while the burned area increased by 150% [6]. The increased burned area, despite the decrease in the number of fires, is a serious concern. Large wildfires can lead to conflagrations with a devastating impact on the environment, economy, and society.

While climate change and land-use shifts contribute to this trend, it's crucial to highlight that aggressive firefighting policies, although effective under mild fire conditions, appear less successful in mitigating large, severe fires.

This could be the root cause of the increased burned area, questioning the long-term efficacy of current fire management strategies.

Furthermore, the ramifications of neglecting fire science are far-reaching, extending beyond immediate fire events.

STANDARDIZATION: FOREST FUEL CLASSIFICATION THROUGH FIREURISK AND EFFIS



One of the most critical aspects of effective wildfire management is the ability to engage with standardized information. The need for standardization becomes evident when considering the diverse geographic and ecological landscapes across the European Union, each with its own fire behavior characteristics and risk factors. An important initiative in this regard comes from the FirEURisk project, funded under the Horizon 2020 program. It has developed a "Classification and mapping of European fuels using a hierarchical, multipurpose fuel classification system," [9].

This classification system, which is not only hierarchical but also serves multiple purposes, offers an in-depth understanding of forest fuels, thereby allowing for more precise risk assessments and targeted risk reduction strategies and is compatible with more detailed or local approaches of fuel modeling and mapping. What adds substantial value to this classification system is its alignment with and utilization by the European Forest Fire Information System (EFFIS), which serves as a continental hub for wildfire data and information.

The FirEURisk fuel classification serves as a model example of how standardization can facilitate not just scientific research but also practical applications in the realm of policy-making. By utilizing a common framework for fuel classification, the European Union can ensure that researchers, policymakers, and practitioners alike are speaking the same "language," thereby enhancing communication, coordination, and ultimately the effectiveness of wildfire management strategies.

Such initiatives pave the way for multi-disciplinary collaboration and enable an integrated, science-based approach to wildfire management. It is a robust illustration of how research outcomes can be actively incorporated into policy frameworks to promote evidence-based decision-making.

A MODEL APPROACH TO HOLISTIC WILDFIRE MANAGEMENT

A paradigm shift in wildfire management is required, incorporating the main drivers that impact fire risk conditions, as well as their future trends. Within this framework, the FirEURisk project has developed a holistic wildfire management strategy [10] that seamlessly integrate three core dimensions: wildfire risk assessment, reduction, and adaptation with measures aimed at enhancing systemic resilience as a central strategy. In risk assessment, this integrated strategy includes a comprehensive consideration of fire risk factors, not just those traditionally

used in fire danger estimation (weather conditions, mostly affecting dead fuels), but also the vulnerability and exposure of the population, ecosystem services, and ecological values, thus broadening the concept of risk by considering not only the probability that a fire ignites or propagates (danger) but also the potential damages it may cause (vulnerability), in the line with standards concepts used for other natural hazards [10]. For risk reduction, the FirEUrisk project integrates, among others, traditional and innovative nature-based solutions, such as grazing and prescribed burning, aiming to decrease the vulnerability of both natural and human systems. The third dimension, adaptation to risk, addresses long-term resilience by incorporating climate change and land use change projections and ecological models into land-use planning and restoration ecology. This multi-tiered approach encapsulates the philosophy of integrating IWFRM and HLFM, and serves as a pragmatic model that can inform and enrich EU policies. It also embodies the holistic consideration of both technology and fire science, providing a balanced blueprint for effective wildfire management.

CONCLUSION

This policy brief proposes the integration of IWFRM and HLFM into the ecosystem management framework as a powerful tool for the European Union to effectively address the climate crisis and its impact on wildfire risks. The aim is to urge the scientific community and policymakers to adopt this comprehensive approach as a cornerstone for future strategies and policies, given the increasing frequency of climate change-driven wildfire events. As we move into an era where climate change-driven wildfire events are becoming the new norm across the E.U. and the World, the time for coherent, integrated action is now.

Furthermore, while technology provides invaluable tools in managing and mitigating wildfire risks, it is not a silver bullet. The technological approach must be balanced and integrated with an understanding grounded in fire ecology and science. Doing so not only ensures a more effective immediate response but also a sustainable, long-term strategy that can adapt to future challenges, especially those exacerbated by climate change. Therefore, this brief calls for a recalibration of EU strategies and policies, urging a more balanced approach that duly incorporates the insights of fire science. The extended discussions that were launched following the RISE-SD 2023 workshop on wildfire management aim to shed light on an often-overlooked aspect of wildfire management and serve as an urgent call for re-evaluating and re-aligning the EU's current strategies.

The reference to the FirEUrisk project not only underlines the feasibility of a comprehensive approach to wildfire management, but also aligns with the broader EU initiatives and the dual-framework strategy we propose. Such a framework calls for a synergistic model that could serve as a foundation for future policy discussions and implementations.

KEY RECOMMENDATIONS

A. Establish a Consensus on Wildfire Risk Management Terminology. Promote and adopt standardized terminology concerning wildfire risk management across all European Union policy documents, academic publications, and scientific discourse facilitating a more cohesive and integrated approach to wildfire

governance. This avoids ambiguities in terminology that can hinder effective communication and strategy alignment.

- B. Endorse Dual Frameworks in Policy.** Commission an interdisciplinary task force to identify intersections and compatibilities between IWFRM and holistic ecosystem management. Draft policy proposals that integrate these frameworks and circulate these drafts for public and expert commentary before formal adoption.
- C. Adopt FirEURisk's Fuel Classification for Policy Uniformity.** Policymakers may consider endorsing using the FirEURisk's hierarchical, multipurpose fuel classification system as a standard for all wildfire risk assessment and management initiatives within the European Union. Aligning with this classification system, already used by the European Forest Fire Information System (EFFIS), will streamline data collection, facilitate cross-border collaboration, and enable more targeted, evidence-based strategies for wildfire risk reduction and ecosystem resilience.
- D. Strategically Utilize Scientific Research in Policy Formation.** Actively assimilate key findings from research and development efforts into both policy discussions and operational frameworks, establishing a continuous feedback loop between scientific research entities and policymakers. This approach aims to use scientifically validated evidence to make decisions, leading to more effective strategies for managing wildfires. This could involve generating impact reports analyzing the effectiveness of policies based on scientific criteria to achieve this goal.
- E. Integrate Fire Science.** Form a multidisciplinary committee to assess how fire science can be harmonized with existing technological solutions. A balanced approach that integrates fire science into technological solutions is imperative. Understanding the role of fire in different ecosystems allows for targeted, effective use of technology where it can be most effective. Amend existing policies to integrate scientifically validated fire management techniques.
- F. Incorporate Vulnerability Assessments:** Alongside hazard mapping and fuel classification, vulnerability assessments should be conducted to identify at-risk communities, critical infrastructure, and ecosystems. These assessments should consider social determinants such as population density, age demographics, and economic factors like the viability of rural economies.
- G. Engage Local Communities in Policy Formation:** Develop participatory governance models that actively involve local communities in wildfire prevention and management strategies. This could include community-led initiatives for creating defensible spaces, fuel management and use programs, and volunteers' involvement.
- H. Address Demographic Challenges:** Given the depopulation trends in many rural areas across Europe, tailor policy proposals to be realistic and implementable in the context of changing demographics. Strategies may include incentivizing younger populations to engage in landscape management and fire prevention activities, potentially embedded in broader rural development programs.
- I. Re-Assess and Harmonize Policy Priorities.** European Commission policymakers are encouraged to critically re-examine the current emphasis on augmenting firefighting capabilities, as manifested through initiatives like RescEU. Such re-evaluation should be geared towards integrating these capabilities within a broader framework that also includes forest management plans for risk mitigation and the incorporation of nature-based solutions. This holistic approach aims will enhance both immediate responsiveness and long-term resilience to wildfire occurrence and its associated risks.
- J. Long-term Strategies.** EU strategies to address wildfire challenges should be designed with a long-term perspective, linking integrated fire management to forest stewardship, restoration ecology, community

resilience, and climate change adaptation. These components should supersede short-term, reactive approaches that lack comprehensive planning. Policy documents need to be updated to align with these newly established priorities and should undergo a stringent review process that incorporates both scientific scrutiny and stakeholder engagement.

ACKNOWLEDGMENT

The FirEURisk project has been granted funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement no. 101003890.

REFERENCES

1. FirEURisk project website: <https://fireurisk.eu/approach/>
2. RISE-SD 2023 Wildfire management workshop: <https://rise-sd2023.eu/workshops/>
3. Firelogue CSA website: <https://firelogue.eu/>
4. European Commission, 2009, p. 4 - <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52009DC0147>
5. European Commission, 2013, p. 2 - <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0216>
6. https://cordis.europa.eu/programme/id/H2020_LC-CLA-15-2020
7. Forest Fires in Europe: State, Trends and Drivers (published by the European Environment Agency)
8. Annual Report on Forest Fires in Europe, the Middle East and North Africa (published by the European Commission's Joint Research Centre)
9. Aragoneses, E., García, M., Salis, M., Ribeiro, L. M., and Chuvieco, E.: Classification and mapping of European fuels using a hierarchical, multipurpose fuel classification system, *Earth Syst. Sci. Data*, 15, 1287-1315, <https://doi.org/10.5194/essd-15-1287-2023>, 2023.
10. Chuvieco, E., et al. (2023). Towards an Integrated Approach to Wildfire Risk Assessment: When, Where, What and How May the Landscapes Burn. *Fire*, 6(5), 215. <https://doi.org/10.3390/fire6050215>