Factsheet

Technology Thematic Strand

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Purpose

Factsheet

This Factsheet defines a common framework used by Firelogue Thematic Strand (TS) on Technology, to foster a discussion across the working groups on how technology can help improve or challenge the approaches to Wildfire Risk Management. We are keen to foster the discussion on how technological developments with different technology readiness levels (TRL) in different areas of WFRM have been used and adopted within each working group topic.
The overall aim of this TS is to help foster the discussion and benchmark novel technological developments that are currently being developed and could potentially be implemented soon to accomplish the high-level impacts that were set by the EU in the IAs Green deal calls.
We define technology or technological developments as a set of tools that can be based on hardware or software components, sensors, or automated processes that are utilized to address different areas of WFRM.

Why is this topic important in the context of WFRM?

Throughout the years within the EU, a broad approach was applied to the wildfires problem and now most recently to extreme wildfires event. The EU has made a significant effort in the development of knowledge, methodologies, and technologies to address wildfire problems in the face of climate and environmental changes, as well as new social and cultural trends with growth dynamics. Examples of the advancement of EU instruments that have been playing a key role in fire knowledge, enhancing operational management, and supporting stakeholder decisions of tools and/or cooperation mechanisms are the European Forest Fire Information System (EFFIS)**[i]** that provides fire weather forecasts, the DRMKC Risk Data Hub**[ii]** for risk assessment on natural hazards, the Copernicus EMS**[iii]** (which EFFIS is now part of), the Copernicus Land Monitoring Service (CLMS)**[iv]** and the Copernicus Atmosphere Service (CAMS)**[v]** that utilize earth observation data to detect/monitor events and provide support information.

A range of technologies has been developed to facilitate WFRM. Among others, future trends will develop more advanced techniques, models, solutions, and capabilities for preventing, predicting, monitoring, and fighting wildfires, and mitigating their impact, including better and advanced technologies, equipment, and decision support systems for first responders. However, some of them (i.e., modelling) can be subject to uncertainties that need to be put into context or bind several sectors together, for example when developing new risk transfer solutions also relating to cascading effects of infrastructure failure.

Furthermore, technologies can target the development of novel detection & response technologies by fostering an integrated approach using heterogeneous means including the joint efforts of sensors technology, ground sensors, and crowd-sourced information systems (Tavra et al, 2021), earth observation data (Maxwald et al, 2022), early warning systems (Ayanz et al, 2012), communications systems (Leonor, 2018), and drone technology (Unmanned Aerial Vehicle - UAV) (Partheepan et al, 2023), all combined into a single detection & response system capable of the forecast, detect and combat faster and efficiently ignitions before these become extreme fire events.

To foster the discussion of technological developments, the thematic strand proposed topics can be divided according to the following three dimensions to allow the discussion between Working Groups, see Figure 1:

- Disaster resilience communities [yellow colour]: Focus on the societal application of the technology (McCaffrey, 2015)
- Sustainable landscape [green colour]: Improved technology to support environmental monitoring, mainly in the preparedness, recovery, and mitigation scenarios
- Emergency management [red colour]: Technological tools that will help to manage a crisis event, more related to the response phase in the emergency cycle

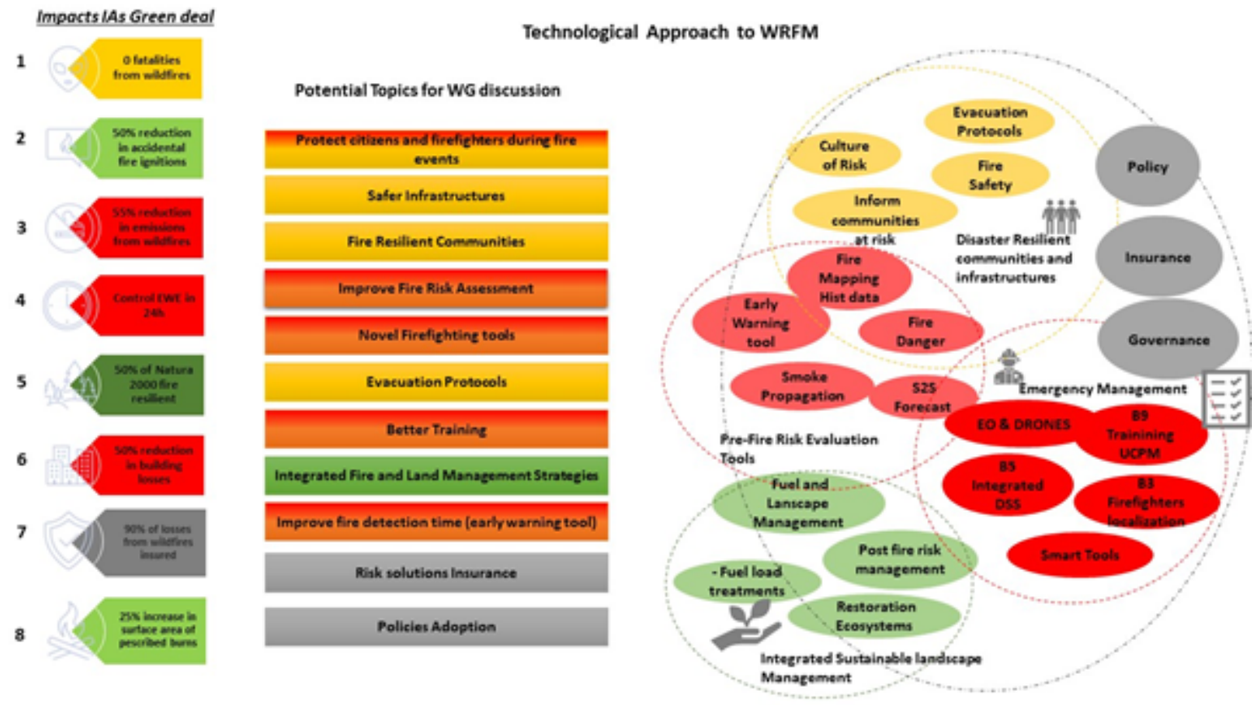

Figure 1. Technological Approach to WFRM based on Societal, Landscape and Emergency Management Topics

Conclusion & suggested points for discussion in WG exchange

Technology and Technological developments are at core of novel and most innovative ways to prevent, respond and recover from wildfires, and therefore are fundamental Disaster Risk Management tools to prevent, reduce and mitigate the negative impacts of wildfire on the ecosystems, peoples, and goods.

A potential way for working groups to start the discussion on technology and technological developments would be to list all major developments within their WG topic based on technological assets over the past decade, and if the technology or tools that were developed were adopted and by whom? Ideally this information could be crossed-checked with the technological developments that are being conducted by the IAs and other wildfires related projects to foster the discussion on the needs and requirements of these technologies to be adopted by the wildfire community and stakeholders.

Therefore, we propose to group the technological developments based on their end-application, namely on how these technologies can help people (making the disaster community more resilient), allow a more sustainable landscape, and help during the response phase and aftermath of the crisis management.

- Examples of TS technological discussion topics are proposed in Table 1., for each working group but other topics can be added to the list based on expert group opinions and common interests

Table 1: Technology discussion topics proposed for WG exchange

	Topic 1 Disaster Resilient Communities	Topic 2 Sustainable Landscape	Topic 3 Emergency Management	Other comments
Environmental & Ecology WG	• WUI (Wild-urban interface)[vii] • Fire risk index • Classification of vulnerable areas • Self-assessment tools with mixed reality applications	• Tool to supply fuel landscape management and ecosystem restoration data. • Fuel Mapsviii • Improve vegetation index. • Technological tools for post-fire analysis measurement of direct and indirect impacts	Fuel Breaks localization	**All the IAs (FIRE-RES, TREEADS and SILVANUS) and FIRE-RISK** are developing toolkits for improving landscape resilience and promoting integrated WFRM governance. Some technological innovations include the development of novel methods for updating weather forecast, fire simulation models, detailed forest mapping using in-situ and remote sensing technology and social media analysis. All projects are also developing Novel models for Fuel Mapping and Wildfire Modelling. These efforts require the creation of novel data management profiles using the combination of EO/Drones tools and AI
Societal WG	• Provide communities with science-based fire information knowledge. • Tools to evaluate if the communities are at risk.	Crowdsource systems	• Emergency response to communications • Evacuation Plans • Citizen Preparedness	**SILVANUS and TREEADS** are developing communication protocols to engage citizens during a wildfire event, including the use of chatbots and social media accounts
Infrastructure WG	• Tools to evaluate if the infrastructures are at risk in all states of the disaster risk cycle. • Design fire safety assessments of buildings and infrastructures and with attention to new building materials with fire protection		• Critical Infrastructures monitoring • Prevention measurement • Study of cascading effects	**TREEADS** is evaluating the use of AI for identifying forest fire risk areas along high voltage power lines

Insurance WG	• How technology can help fire risk assessments • Parametric insurance • Artificial Intelligence as tool for catbounds • Data Science as a tool to evaluate insurance risk parameters.		Assessment of direct and indirect impacts of wildfires and associated costs	
Civil Protection WG	• Evacuation plans • Fire Risk Forecast/ Resource Disposal • Augmented Reality • Simulation Tools		Enhance evolution forecast of wildfire risks: • Fire danger risk • Weather forecast • Early warning system • Historical data analysis • Improve emergency response tools (UAVs, smart garment tools) • Crowd source system raining • Decision support systems • Interoperability under UCPM	IAs and FIRE-RISK are developing novel tools to address the response phase, including novel ways to spread the resources on the terrain, novel decision support systems, fire spread simulators, ground combat vehicles, new voice communication radios based on ad-hoc cellular connectivity, biometric sensors for first-responders, novel emergency communication systems, ioT early warning systems

Open Questions related to technological developments to all WGs?

1. How has technology impacted your WGs developments in the past 10 years? Positive/Negative impacts?
2. What was the adoption rate, what processes were automized? If not? Why not?
3. How has the development of AI impacted your WGs topics and to what extent?
4. How is data being handled by the different stakeholders, and particularly in your WG developments? What novel products/services are ongoing based on new data-oriented developments?
5. What technological requirements/gaps did your WG identify, that are not yet being addressed?
6. From your WG perspective what are the main reasons why technological advances take too long to be adopted in WFRM?

Firelogue

Key references and sources for further information

i) https://effis.jrc.ec.europa.eu/
ii) https://drmkc.jrc.ec.europa.eu/risk-data-hub#/
iii) https://emergency.copernicus.eu/
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v) https://atmosphere.copernicus.eu/
vi) https://effis.jrc.ec.europa.eu/about-effis/technical-background/active-fire-detection
vii) https://www.usfa.fema.gov/wui/what-is-the-wui.html
viii) https://fire-res.eu/fireurisk-and-fire-res-sharing-knowledge-on-how-to-map-fuel-availability-at-the-european-level/

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