FIRE-RES

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Integrated Fire Management IFM

WP1 D1.9 IA 1.4. brief 1: Integrated fire management model: demonstration, training and piloting activities, including new-fire prone areas.

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IA presentation.

28/05/2024

Funded by the European Union

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037419. It does not necessarily reflect the view of the European Union and in no way anticipates the Commission's future policy in this area.

Integrated Fire Management

1. Extreme Wildfires and Challenges addressed by Integrated Fire Management
2. What is Integrated Fire Management
3. Implementation of Integrated Fire Management
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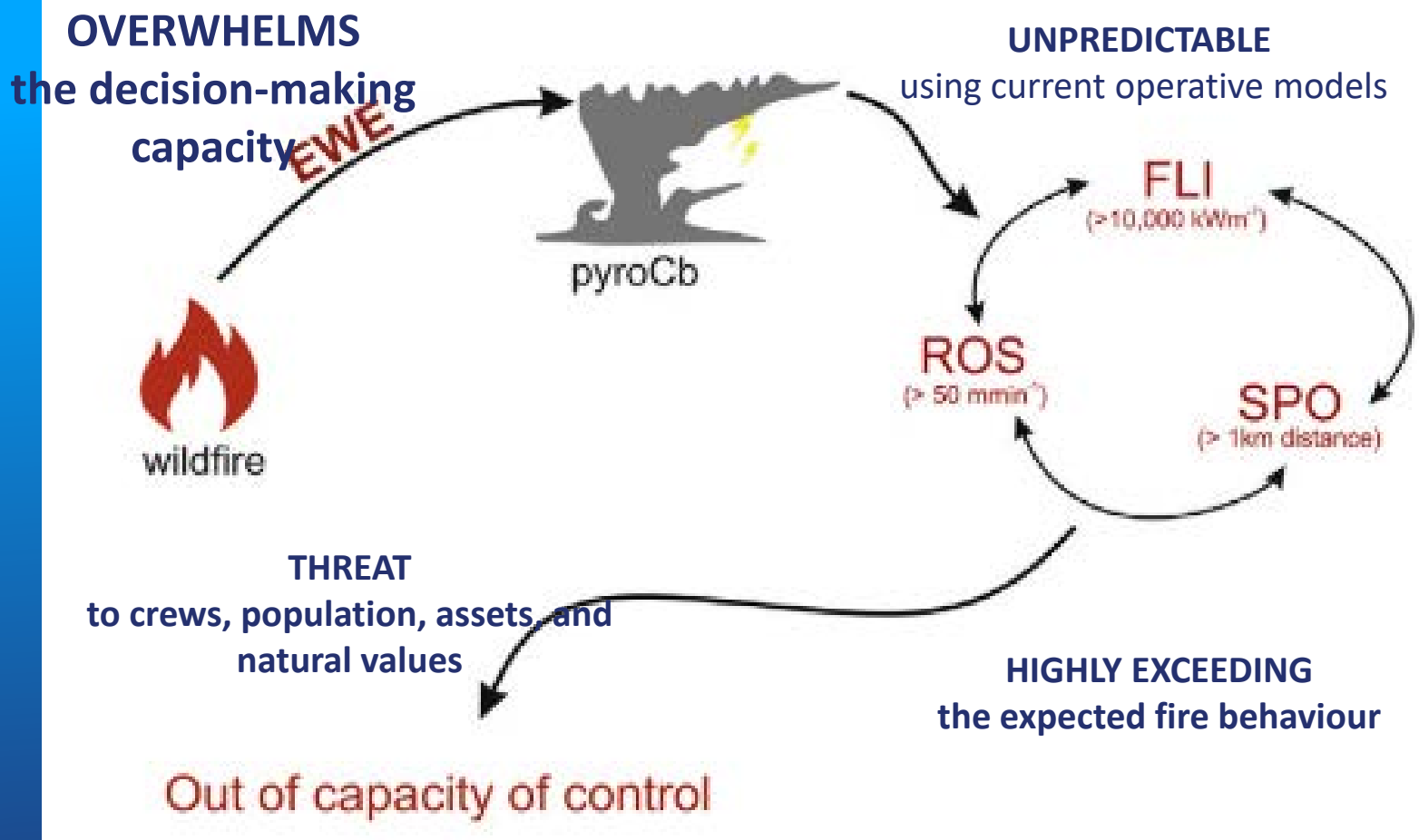
        1. Wildfire Management
            1. Technical Fire
            2. Wildfire suppression planning
        3. Fire as ecological process
            1. Prescribed burnings for ecosystems management purposes
            2. Managed wildfire

4.Knowledge, Research, and Experience

Integrated Fire Management

1. Extreme Wildfire Events and challenges that IFM could respond



1:Tedim, F.; Leone, V.; Amraoui, M.; Bouillon, C.; Coughlan, M.R.; Delogu, G.M.; Fernandes, P.M.; Ferreira, C.; McCaffrey, S.; McGee, T.K.; et al. Defining Extreme Wildfire Events: Difficulties, Challenges, and Impacts. Fire 2018, 1, 9. https://doi.org/10.3390/fire1010009

Extreme Wildfire Events (EWE)

These are wildfires with **large-scale complex interactions** between **fire and atmosphere** generating **pyroconvective behavior and coupling processes**, resulting in fire behavior that is fast, intense, uncertain, and rapidly changing.

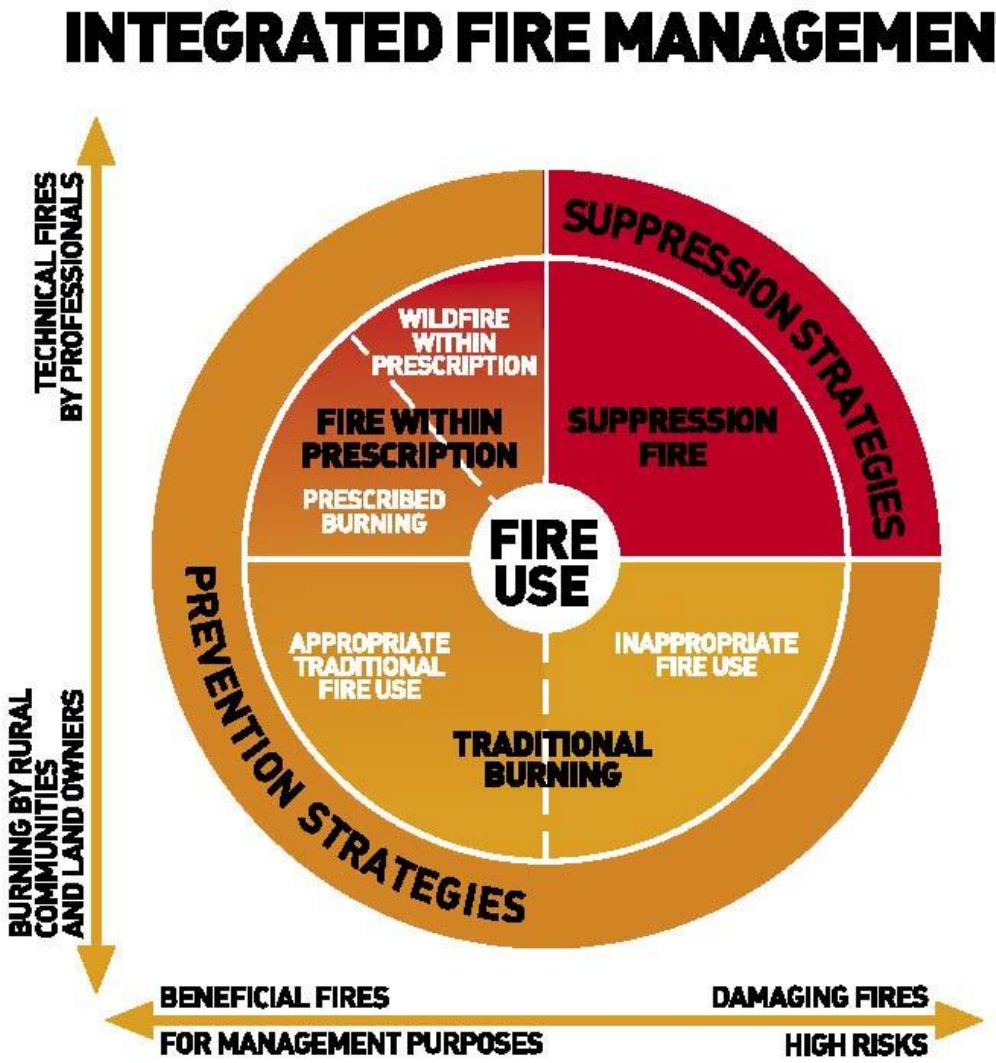
This leads to fire behavior that exceeds the limits of control (fireline intensity of 10,000 kW/m; rate of spread >50 m/min; spotting distance >1 km and massive spotting based on Tedim et al. 2018, and extreme growth rate values (surface per hour, ha/h)).

At the same time, given current operational models, this extreme fire behavior is **unpredictable** using existing operational models, with observed fire behavior often far exceeding the expected behavior. This **overwhelms the decision-making capacities of the emergency system** (firefighter crews and emergency managers, infrastructure managers, and the civilian population).

It may represent an increased threat to crews, populations, assets, and natural values, as well as have significant negative socioeconomic and environmental impacts.

Integrated Fire Management

2. What is the Integrated Fire Management?



The IFM strategy is defined as an approach that addresses the challenges and considerations posed by **both damaging and beneficial fires**. It considers the natural environments and socio-economic systems in which these fires occur. It provides a conceptual framework for planning and operational systems that encompass social, economic, cultural and ecological assessments with the objective of minimizing fire damage and maximizing its benefits (Rego et al. 2010; Faivre et al. 2018). The strategy involves evaluating and balancing the **risks associated with fire, while also recognizing its potential ecological and economic benefits** that it may play in specific areas, landscapes or regions (Myers 2006).

Integrated Fire Management

2. What is the Integrated Fire Management?

Integrated Fire Management is a **strategy** that should help us prepare the territory to accommodate a fire regime updated to the current situation.

In order to:

- **Reduce the intensity** of wildfires, which should help reduce the probability of having an Extreme Wildfire Event
- **Decrease human, material, and ecological losses**
- Restore **the role of fire in the ecosystem**
- Address the **fire paradox**
- Introduce the possibility of establishing an **ecological flow** of fire

Integrated Fire Management

2. What is the Integrated Fire Management?

Living Lab Catalonia

The Scenario of Climate Change and the Search for a Fire Regime Adapted to the Current Situation

45.000 ha/year
Forecast of Areas Burned with High Intensity in the Context of **Climate Change**, with the continuing the current firefighting strategy

30.000 ha/year (aprox 2% of forested land in Catalonia)
Approach to a Possible Fire Regime in which the Area Burned with High Intensity Could be Significantly Reduced by Implementing 15,000 ha/year of Prescribed Burn or Managing Wildfires.

3.300ha/year (0,24% forested land in Catalonia)
Current Average Area Burned with High Intensity in Catalonia

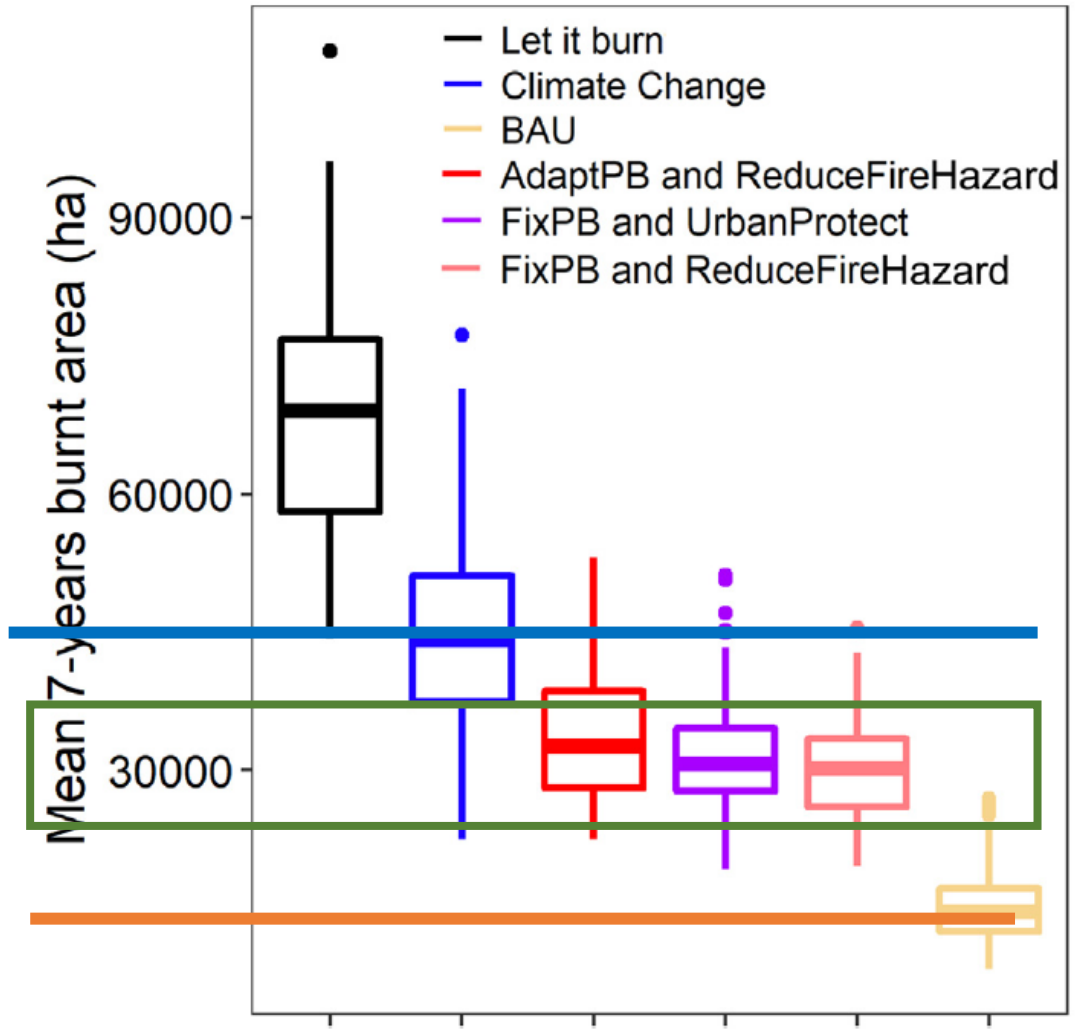


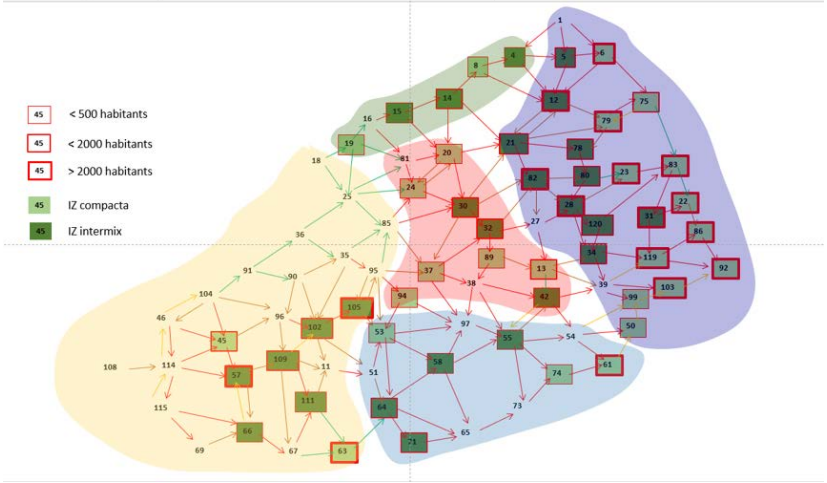
Fig. 8. Total interannual variability of area burnt in high-intensity for the six scenarios (Table 1). (BAU: Business-As-Usual; PB: Prescribed burning).

Adapted from Duane et al 2019. Adapting prescribed burns to future climate change in Mediterranean landscapes

1. Integrated Fire Management

3. Implementation of Integrated Fire Management

3.1 Planning the Territory



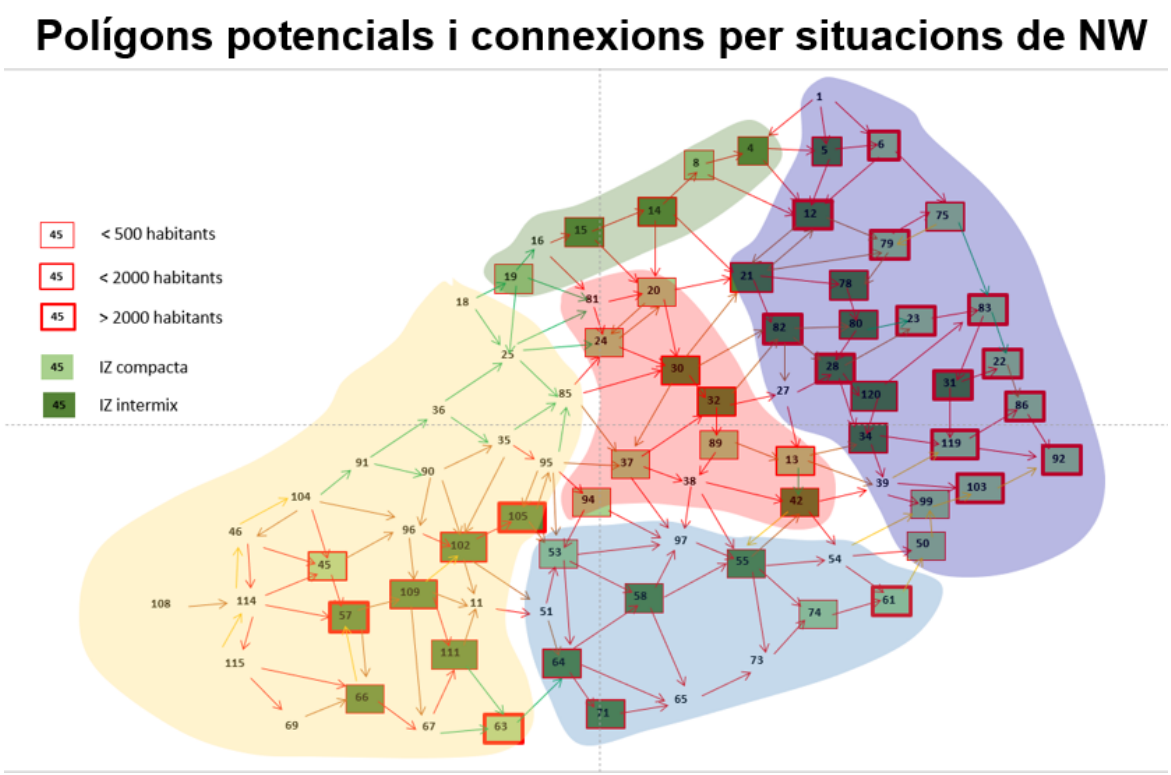
3.2 Implementing planned activities through fire use In to main different situations:

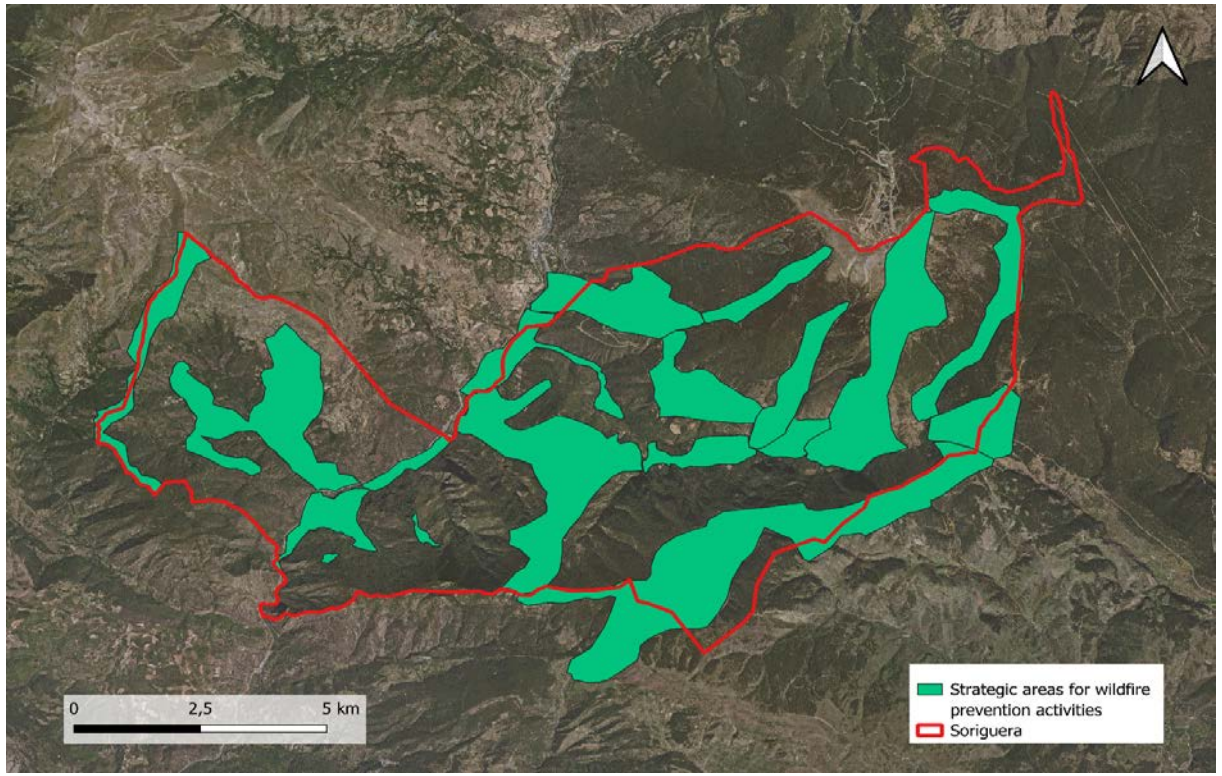
1. As a tool to manage (formerly suppress) a Wildfire

2. To restore ecological processes

Integrated Fire Management
3. IFM Implementation

3.1 Planning the Territory

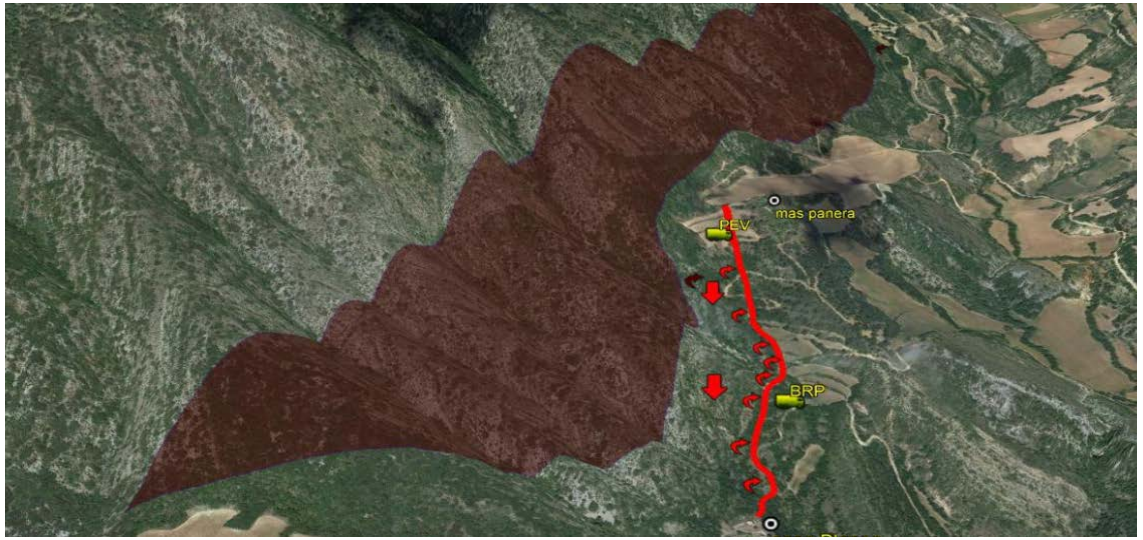


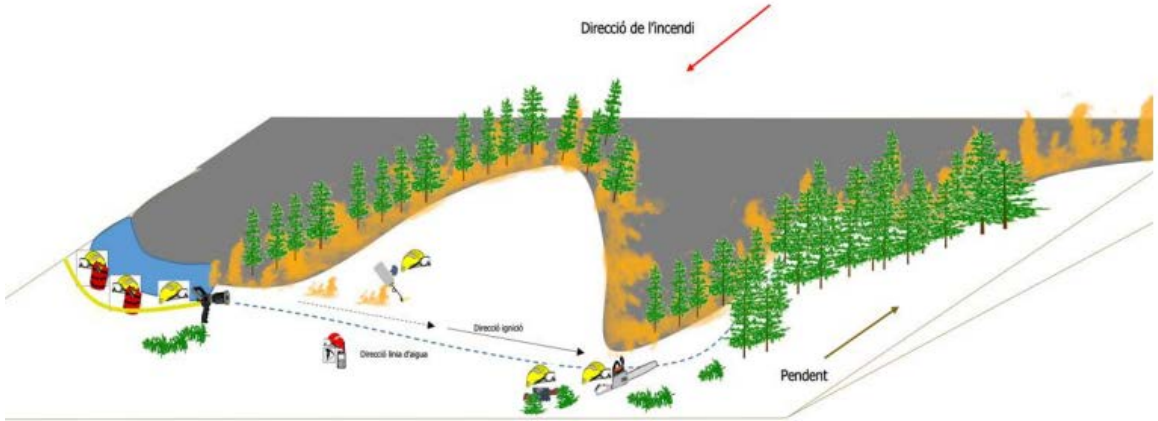


Source: D1,3 IA 1.1 brief: Piloting the adaptation of methodology of Forest Fire Potential Polygons to improve decision making on EWE events. Operacions i maniobres d'extinció. Departament d'Interior (gencat.cat)

Integrated Fire Management
3. IFM Implementation

Technical fire: Fire use during wilfire suppression operations





Example videos from training resources CFRS:
[08 Foc tècnic crema d'eixamplament (youtube.com)]
[09 Maniobra combinada (youtube.com)]

Prescribed burning

Prescribed burning is the planned use of fire to achieve precise and clearly defined management objectives and makes a vital contribution to the delivery of ecosystem goods and services.

[Crema Prescrita a Montserrat 30/06/2018. Bombers de la Generalitat (youtube.com)]

Integrated Fire Management
3. IFM Implementation
3.3 Fire as an Ecological Process

Managed wildfires can be incorporated into the integrated fire management model to provide a framework for fire decision making. It provides a set of technical decisions and actions to monitor an unplanned ignition and to conduct a fire to a predetermined limit of contention to achieve planned resource management objectives (Rego et al. 2010).

Adding wildfire management into a IFM model requires to:

- evaluate whether the effects of a wildfire in a given area results in a desired or undesired future condition,
- weighing relative benefits and risks and
- responding appropriately and effectively based on stated objectives for the area in question.
- According FIRE-RES D1.1 the management of wildland fires to accomplish specific pre-stated resource management objectives in predefined geographic areas outlined in Fire Management Plans. The current debate over managed wildfire is political rather than technical or scientific.
- In the U.S., there is controversy over simultaneous "let it burn" fires with other large wildfires as resources are limited, as well as constrains linked with its social impacts and air quality.
- At the European level, in Portugal, a new law was recently passed that allows some fires to burn. It will not be translated into action on the ground but will be used to regulate the legal consequences in those cases where the authorities are not able to control the fires because of a lack of resources or uncontrollable fire behaviour.
- In Catalonia, la Vall d'Aran region is a good example of how to incorporate the use of wildland fire. A strategic plan has been adopted as requested by the stakeholders and general public of the territory (Conselh Generau d'Aran 2022). Within this program, there are **management objectives** that can be achieved with conventional prescribed burning, but in some specific locations the option of wildland fire use, that is a "let it burn" strategy, can also be considered. This strategic plan consists of a reference document (strategic design), a dynamic environment GIS for managers, an assessment of landscape dynamics through modelling, and a monitoring program.

Integrated Fire Management
3. IFM Implementation
3.3 Fire as an Ecological Process

Managed Wildfire

Wildfire as an opportunity to recover the fire role as an ecological process.

The fire in Canejan on March 16, 2023, occurred in an area compatible with multifunctional landscape management with prescribed fire as part of the Strategic Plan for the Sustainable Management of the Fire Regime in Val d'Aran (Plan Estrategic de Gestion Sostenibla deth Regim de Huec ena Val d'Aran). The Strategic Plan for the Sustainable Management of the Fire Regime in Val d'Aran is not just a controlled burning program.

[2023. Departament d'Interior (gencat.cat)]

Figura 13. Perspectiva aèria el migdia del 16 de març (13:30 h), en què s'aprecia la vall secundària de

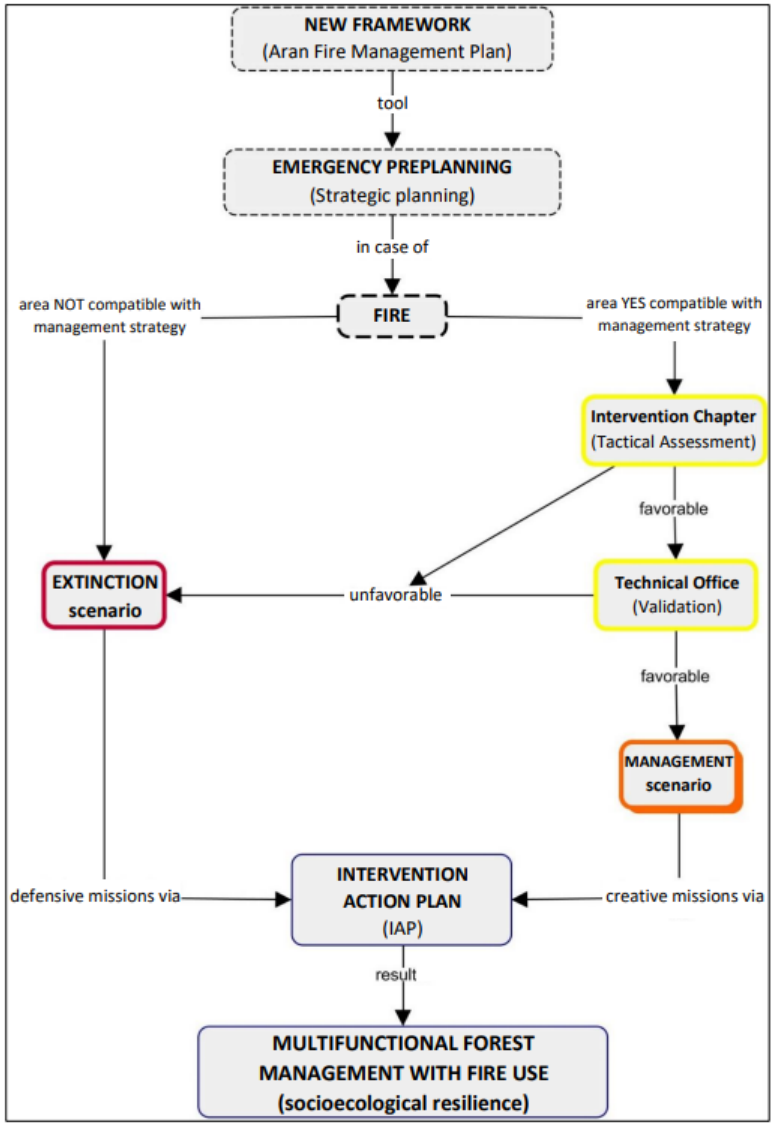
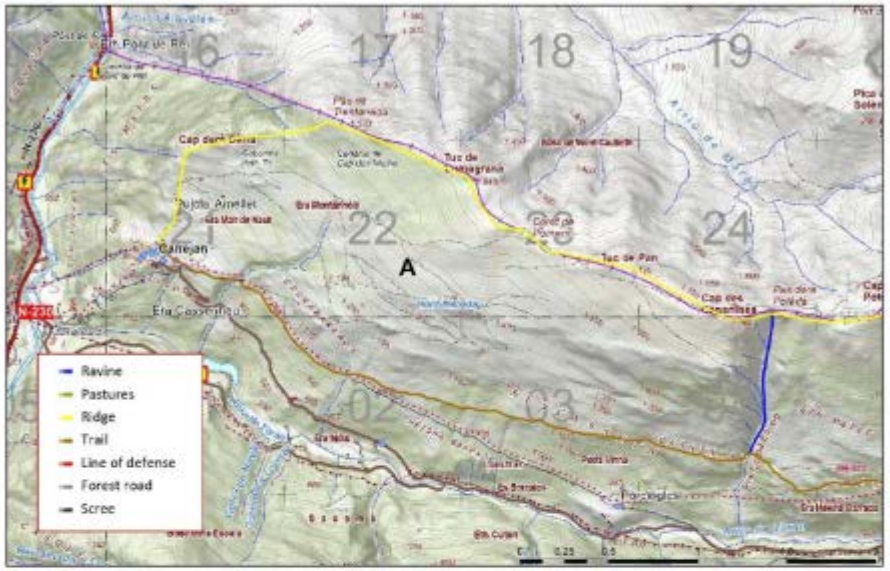


Figure 2. Decision tree for forest fires in the context of the new framework in Aran. Source: Adaptation from the Strategic Plan for Sustainable Fire Regime Management in Aran. The right column illustrates the validation process of a fire management scenario. In this case, using the same toolbox (maneuvers), the intervention action plan draws from creative missions (multifunctional forest management) without limiting the ability to take defensive, offensive, or containment actions in other parts of the fire.

Integrated Fire Management
3. IFM Implementation
3.3 Fire as an Ecological Process

Fire Management Area, Canejan - UNITS

UNIT A — Area: 346 Ha
HONT HEREDA (main details) — Perimeter: 8776 m



OPERATIONAL RECOMMENDATIONS

1- During the day, topographical winds will try to open the right flank. It will be the engine of the fire. In the East, the ravine of the Laueg gorge functions as the axis of containment.
2- The left flank can be anchored in the track and ridge (western side of the plot). At night with descending topographical winds tending to open the first third of the left flank, assess change of priorities.
3- The whole tail is anchored in the track. Assess the descent (fire behavior) and the window for anchoring (timeframe). Extend the discontinuity of fuel (line of defense) and use tactical fire cautiously if necessary.
4- The head of the fire is likely to be anchored alone in the ridge, helped with the snow, change of slope or simply for the fuel model (alpine grass with rocks). Monitoring this zone with the helicopter is highly recommended (effective and safe scenario) instead of putting crews on the top (highly exposed scenario).

PLOT CONDITIONINGS

Vulnerable elements

A. Village of Canejan, in the lowest part of the left flank.
B. Cabanes deth To and Pujola-Amellet.
C. Cabana de Montanhòla.

Conditionings

- Smoke can potentially affect the village of Canejan and traffic in the secondary valley. At night, and especially when converging with synoptic situations with high atmospheric stability, smoke accumulation in the bottom of the central valley and the road N-230. Helped by local police, assess, and manage traffic according to fire

FIRE MANAGEMENT AREA (FMA_12) — CANEJAN

General Data

Capacity: 806 ha
Power: 346 ha
Perimeter: 20.080 m
Aspect: South

Height: Maximum – 2175 m
Minimum – 922 m

Slope: Average – 45 %
Maximum – 86 %

SCENARIOS PRE-PLANNED ☒ Prescribed burning ☒ Managed Wildfire

GENERAL MAP

VEGETATION STRUCTURE

UNIT	Toponymy	Area (ha)	Dominant cover	Woodland cover
A	Hont Hereda	346	Scrubs	F.sylvatica/Q.petraea
B	Era Tueta	173	Scrubs/Fagus sylvatica	F.sylvatica/Q.Petraea
C	Eth Pruët	287	Scrubs	F. sylvatica/Abies alba

SPECIFIC SAFETY ASPECTS

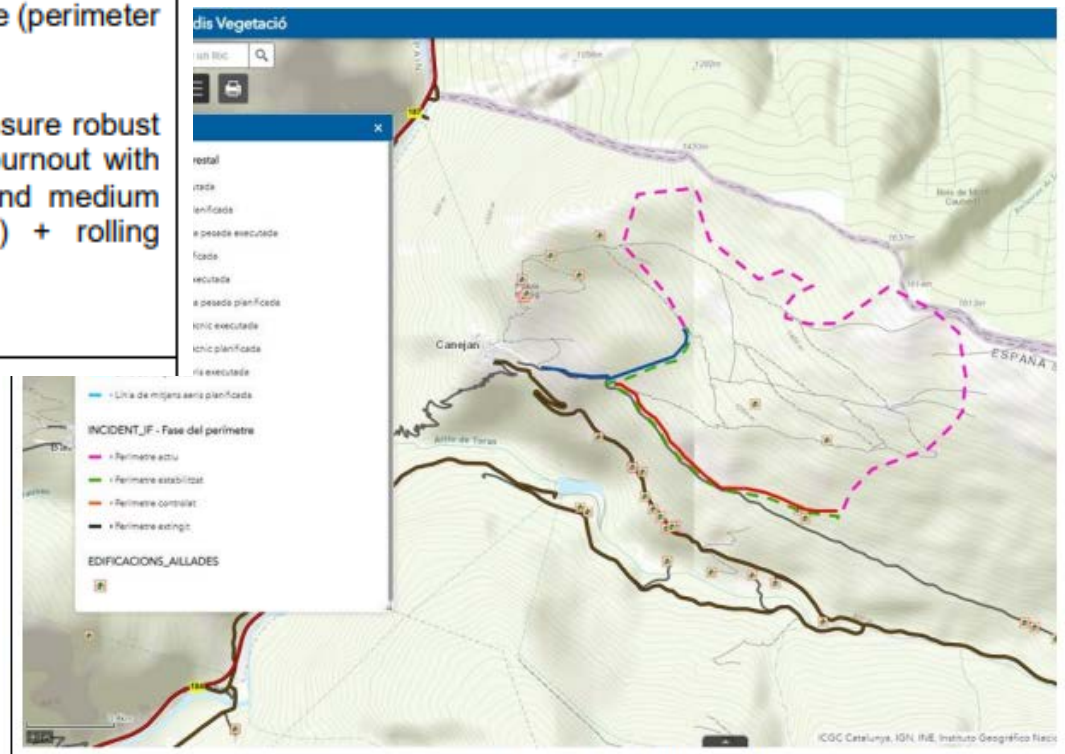
- Steeply sloping areas
- Ravines that (temporally) are not traversable (too exposed/technical)
- Falling stones, especially in the ravines and the track from Canejan to Sant Joan de Toran
- Telecommunications coverage cannot be guaranteed everywhere, anytime
- Positioning of the lookout (other slope)

Integrated Fire Management
3. IFM Implementation
3.3 Fire as an Ecological Process

Managed Wildfire. 2023 Canejan Fire

Tactical Chronology and Associated Maneuvers

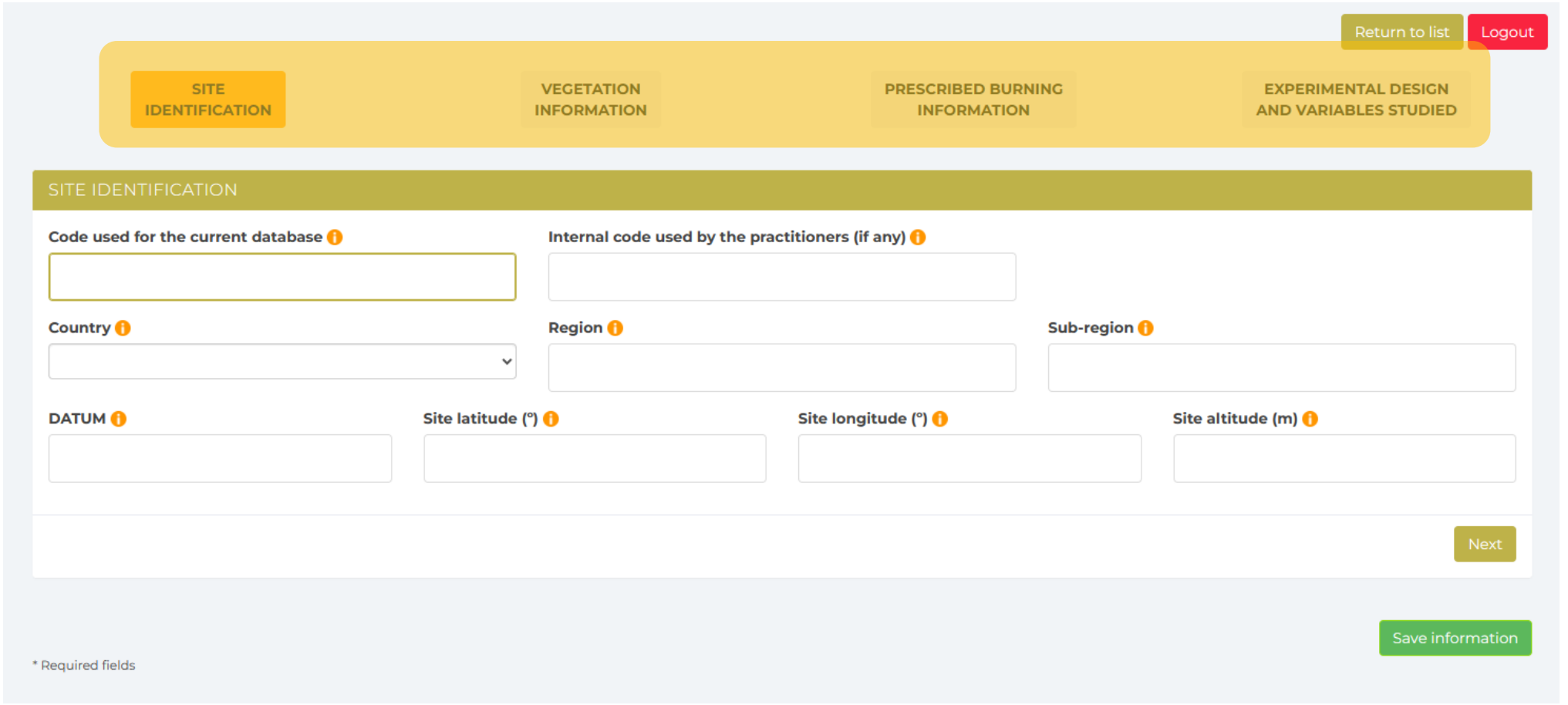
Incident Day	Tactical Priorities	Maneuvers
March 16th Operational Period Day 16 (13:30) Day 17 (09:00)	**Situational Awareness upon arrival:** adverse weather conditions with main valley suction (LF[1]), widespread fuel availability, and lack of snow cover at the high part (ridge). - Avoid impact on Canejan by stopping the back-LF relocation. - Contain the fire within the pre-planned management sector, anchoring the back-RF[2] to the pre-planned trail.	Back-LF => Direct attack with hand tools, water hoses, and technical fire (perimeter definition) Back-RF =>Hand tools to ensure robust anchoring + technical fire (burnout with backing patterns and low and medium surface intensity behaviors) + rolling control from behind. LF-Head => Aerial means



Sketch Day 16. Phase of the perimeter and maneuvers

Table 1. Tactics and associated maneuvers on March 16, 2023.

Database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EXPERIMENTAL DESIGN AND VARIABLES STUDIED
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