# Towards scientifically supported and integrated wildfire management and policy in Belgium

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Belgian Wildfire Network

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# Summary for policymakers

**Climate change is increasing wildfire risk across Europe, including in countries traditionally considered less fire prone, such as Belgium.** Longer droughts and shifting land use (urbanisation, insect-driven forest degradation, ...) are creating conditions for large and hard-to-control fires, as seen in Achouffe (2025), the simultaneous wildfires in Antwerp and Limburg in April 2020, or Belgium's biggest wildfire in recent times in Baelen (2011). Belgium's dense wildland urban interface (WUI), limited public awareness, fragmented governance, and lack of wildfire expertise further increase vulnerability.

**This document outlines key challenges and priority actions identified by wildfire stakeholders across Belgium and united in the Belgian Wildfire Network to initiate this process.**

## 1 Data collection during and after wildfires

Belgium lacks a standardized and reliable system for collecting wildfire data, which prevents effective wildfire management, risk assessment. Existing datasets are incomplete, inconsistent, and often misclassified. To overcome this, Belgium must:

- Establish definitions and a unified, reliable wildfire database;
- Create standardized protocols for collecting, storing, and processing drone and aerial data;
- Implement an investigation protocol for determining wildfire cause and ignition;
- Mandate a federal agency to collect wildfire data, maintain and share the database.

High-resolution satellite images, drones, and smartphone data offer emerging opportunities for data collection. A wildfire database is essential to support prevention campaigns, resource planning, early detection systems and risk mapping.

## 2 Post-fire recovery monitoring

Belgium lacks the scientific insight needed to understand how its diverse ecosystems recover after wildfires. Without monitoring, it is difficult to assess ecological damage, prioritize firefighting efforts, or guide post-fire land management. So, Belgium should:

- Launch coordinated post-fire monitoring with neighbouring countries that share similar ecosystems;
- Establish representative study sites and standard protocols for field and satellite-based recovery assessment;
- Develop national guidelines and good practices for managing fire-affected landscapes.

## 3 Wildfire danger and risk assessment

A national wildfire danger and risk assessment system is essential to protect people, infrastructure, and ecosystems, especially in areas with a dense WUI. Risk maps provide critical information for land-use planning, preventive measures, evacuation planning, and raising public awareness. To establish an effective system, Belgium should:

- Adopt a single methodology for all regions, aligned with neighbouring EU countries;
- Assign a responsible agency to maintain and host Belgium's danger and risk assessment systems;
- Define legal measures for high-risk zones, including restrictions or preventive actions.

## 4 Fuel assessment

Vegetation fuels are a key driver of wildfire behaviour, influencing ignition, fire intensity, spread and vertical propagation. Accurate information on fuels is essential for modelling fire behaviour, identifying vulnerable ecosystems, evaluating preventive measures, identifying WUI and design fire-safe environments. Belgium currently lacks a framework to systematically collect field data describing the different fuel layers. To overcome this, Belgium should:

- Develop and implement standardized protocols for quantifying fuel characteristics across major forest and wildland types;
- Establish and implement a methodology for producing and regularly updating a national fuel type map;
- Establish a network of representative field plots to capture species, age, and structural variability, providing reference data for surface and canopy fuel quantification;
- Create a database of common Belgian species and their measured burn properties.

## 5 Spread modelling

Wildfire spread models are essential for forecasting fire propagation, supporting operational decisions, evacuation planning, containment strategies, and design of fire safe landscapes. They provide insights through scenario analyses that cannot be obtained in the field. No wildfire simulators are available yet and the required data are largely unavailable. So, we should:

- Conduct a comparative study of available wildfire simulators for a selection of wildfires in the Benelux;
- Test the operational potential of a wildfire simulator with the emergency services taking into account the needs, data flows, responsibilities, and so on;
- Use the wildfire spread model for scenario analyses under different climate scenarios.

## 6 Training and equipment

Effective wildfire response relies on well-trained personnel, regular exercises, and access to appropriate equipment. This reduces the risk of fires becoming uncontrollable and minimizes damage to people, infrastructure, and ecosystems. Belgium currently has limited training capacity, fragmented exercises, inconsistent access road policies, and uneven availability of specialized ground and aerial equipment. To overcome this, we need to:

- Set up a uniform and basic wildfire training for all stakeholders at national level;
- Stimulate specialized training for experts by increasing Belgium's participation in international training programs;
- Conduct regular mono- and multidisciplinary exercises to strengthen operational preparedness and coordination;
- Increase Belgium's participation in international wildfire forums;
- Equip regional teams with dedicated vehicles, specialised equipment, protective clothing, and other resources;
- Strengthen aerial assets to support rapid detection, monitoring, and suppression.

## 7 Awareness by education

Because most wildfires in Belgium are caused by humans, increasing public and political awareness is essential. Clear communication, risk-informed behaviour, and rapid reporting can significantly reduce the likelihood that a small fire becomes uncontrollable. Belgium's current communication is fragmented. In order to resolve this, we should:

- Establish a legal framework for a wildfire risk assessment and its consequences;
- Strengthen and harmonize public communication on wildfire danger and risk, with clear explanations of risk codes and concrete guidance;
- Raise awareness among residents in the WUI and provide practical safety advice;
- Launch a national wildfire awareness campaign and learn from international best practices;
- Provide wildfire education and training for professionals, policymakers, and schools.

## 8 Organisation and cross-boundary exchange

Belgium's wildfire expertise is limited and fragmented. Flanders and Wallonia often use different systems (e.g. operational and tactical maps), creating operational inconsistencies and potential confusion during interventions. Uniform national standards are urgently needed, so we should:

- Strengthen and unify Belgian expertise through the Belgian Wildfire Network, ensuring shared goals, shared procedures, and wide stakeholder participation;
- Increase interaction with other EU countries to learn from similar wildfire regimes;
- Remain active in European working groups (e.g., EGFF, NW EU roundtable) to learn from other countries with more expertise.

# Why should we bother?

Being confirmed by countless scientific studies covering practically all regions of the world, it has become clear that man-induced climate change is impacting our natural and urban environment and inflicting ecological, financial, societal and human costs. Examples of the consequent natural disasters due to hurricanes, storms, floods, mud streams, and wildfires [1] are manifold. Even though the latter are often part of well-functioning ecosystems, the intimate interaction between climate change and land use changes seems to be reshaping wildfire dynamics. This has given rise to an increase in the number of uncontrollable wildfires. A recent study points out that such wildfire disasters from 1980 to 2023 were most likely to occur in places where dense populations are also relatively wealthy.

Even though megafires are not anticipated in the near future in countries that are less fire prone, many studies point out that their wildfire risk is emerging and poses a significant threat because such countries often have a densely populated wildland-urban interface (WUI), low public awareness and preparedness, and high fuel loads. This is especially true in Northwestern Europe, where particularly floods and storms have shaped natural disaster policy and preparedness. Still, an increased frequency of long periods of drought in the last decades in combination with human- (increased urbanization, limited fuel management) and nature-induced (insect infestations) land use changes (e.g. loss of 500 000 ha of agricultural land since 1834 in Belgium), have resulted in periods with a sustained high wildfire danger and consequent vast and difficult to control wildfires (London, 2022; Ede, 2025, Baelen, 2011; Achouffe, 2025) that sometimes stretch emergency services to the limit of their capabilities. The latter becomes even a more pressing issue in case of multiple simultaneous wildfires, like we faced on April 2020 when there were three major wildfires in or near the Provinces of Antwerp and Limburg (Liereman, Meinweg and Deurnese Peel) limiting the emergency response that was still available for urban fires, accidents, and other incidents.

Being located in Northwestern Europe, Belgium is one of the countries facing an emerging wildfire risk. Given its considerable WUI (>50% following the methodology of Modugno et al. (2016)), relatively small size, limited expertise, awareness and relevant data, and complex administrative and political organisation, the country is especially vulnerable to this increasing risk (see Box Belgian wildfires in numbers). Its emergency services and preventive policy are well tuned to water-related natural disasters, but to a much lesser extent to wildfires. Moreover, expertise on wildfires is fragmented, limited, and concentrated within a small number of organizations and individual specialists. This creates a disproportionate burden for a few key individuals, and also a structural vulnerability because continuity, scalability, and national preparedness are at risk when knowledge is concentrated in such a small group.

[1] A wildfire is any uncontrolled and non-prescribed combustion or burning of plants in a natural setting such as a forest, grassland, brush land or tundra, which consumes the natural fuels and spreads based on environmental conditions (e.g., wind, topography). Wildfires can be incited by human actions, such as land clearing, extreme drought or in rare cases by lightning. Examples of wildfires are: forest fires, shrub fires, grass fires, peat fires, and so on (United Nations Office for Disaster Risk Reduction).

# Box: Belgian wildfires in numbers

Figure 1 (left) showing the relative frequency of wildfires in Belgium throughout the year clearly demonstrates that most wildfires in Belgium occur in springtime when the sap flow has not yet started. This aligns with observations in other countries in Northwestern Europe.

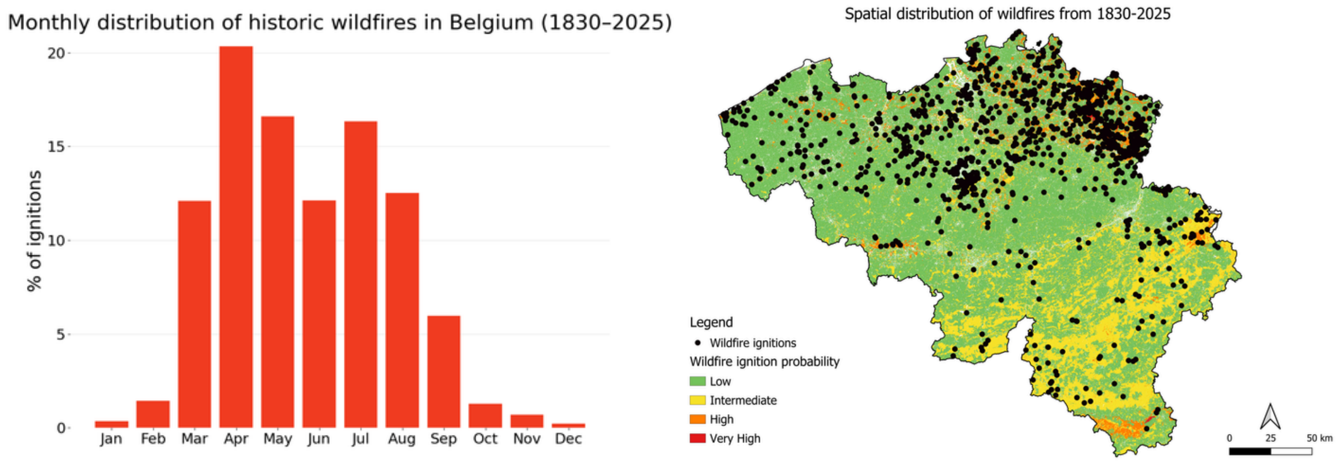


Figure 1: Belgian wildfires in numbers (left) and the spatial distribution from 1830-2025 (right).

Figure 1 (right) visualizing the spatial distribution of the wildfires in the period 1830-2025 across the country, should be interpreted with care since there is no official data on wildfires available for Belgium prior to 2010, and the official data are of low quality. Still, it indicates that the majority of the wildfires in Flanders occured in the Province Limburg and in Wallonia in Liège.



Fortunately, being embedded in EU, Belgium can rely on the expertise and know-how of fire prone countries like the MED5-countries (France, Italy, Greece, Portugal and Spain), or countries in Northwestern Europe that are increasing their preparedness (e.g. The Netherlands, Ireland, northern France, Switzerland), to move forward relatively rapidly in shaping a scientifically supported integrated wildfire management and policy, involving 1) review and analysis, 2) risk reduction (resilient landscapes), 3) readiness, 4) response (safe and effective) and 5) recovery. Moreover, it can benefit from the tools, guidelines and good practices that have been proposed over the years by the EC Expert Group on Forest Fires (EGFF), so there is no need to start from scratch, but the need is there to adapt existing well-functioning frameworks to a Belgian context. This urgency is also underlined in the 2025 report by CERAC on the readiness of Belgium in light of the future.

Given the urgency to evolve towards a scientifically supported and integrated wildfire management and policy in an era of budgetary limitations, we list the main challenges and possible solutions that have been identified by the key stakeholders of the Belgian Wildfire Network, which were presented during its first meeting on September 12, 2025. This network unites more than 25 wildfire stakeholders in Belgium across administrative, political and organisational boundaries.

**The main challenges and solutions were grouped per topic and are related to wildfire knowledge (1-2), prevention (3-4), operations (5-6) and awareness (7-8).**

In this way, we hope to get Belgium on track towards the establishment of a scientifically supported and integrated wildfire management and policy that is backed by the involved stakeholders across the country.


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# Key challenges and possible solutions

## 1 Data collection during and after wildfires

### Value

As baseline information to assess the effects of climate change, land use changes, and preventive and suppression actions, accurate information on where, when, how and why wildfires occur is essential. In regions with emerging wildfire risk, such statistics are essential for increasing public and political awareness of this increasing risk (Section 7).

Further, the design of effective prevention and awareness campaigns would also benefit from assessing the wildfire origin and cause using standardised approaches. Given the historical role that wildfires have played in fire prone countries, several such EU countries have a long-standing tradition in collecting wildfire-related data (burnt area, cause, damage, duration, point of ignition, perimeter, wildfire type, etc.) following a standardised protocol that is defined at country level. Over the last decades, most other EU and associated countries have adopted such protocols, which have enabled them to establish a data-informed wildfire management and policy, and allows them to identify changes in wildfire trends and getting prepared for future situations.

### Current situation

Unfortunately, up to this date, Belgium lacks such a standardized wildfire data collection protocol, nor is there a complete historical wildfire database. The sole wildfire data available are those collected within the framework of a 2019 study by Ghent University by consulting digitalized newspapers from 1830 to 1950, and digital newspapers from 1995 to 2010, and the intervention database compiled on the basis of the intervention reports provided from Belgium's intervention zones to the Federal Public Service Interior for the period from 2010 to 2016.

This database is, however, of low quality because for many entries only the date and municipality are available, and, if available, exact wildfire locations are unreliable. These concerns also apply to the wildfires extracted based on the intervention database because it is address-based, does not contain additional information, and lacks clear definitions on what is meant by a wildfire and the relevant intervention codes (1.6.0-3). Hence, the value of the current wildfire database for supporting the development of an integrated wildfire management or policy for Belgium is limited. It also makes that Belgium cannot supply reliable data to the European Commission (e.g. EFFIS reports) or the Food and Agricultural Organisation.

### Additional challenges

Given that the size of Belgian wildfires is typically relatively limited, supranational wildfire detection platforms like the EFFIS Current Situation Viewer or NASA's Fire Information for Resource Management System are typically useless because of the limited resolution of the satellite sensors used (MODIS, VIIRS). On the other hand, the administrative and operational fragmentation of roles and responsibilities with regard to wildfires, but also the differences in terrain ownership, make it unclear who should be made responsible for registering wildfire data post factum. Moreover, if different parties would be mandated to do this, it is likely that data collection protocols might diverge and/or that there will be considerable training overhead. In other EU member states and associated countries, it are most frequently national forestry or environmental agencies and to a lesser extent civil protection services that are mandated to do this regardless of terrain ownership.

## Opportunities & solutions

In recent years we have seen a growing availability of high-resolution satellite imagery (Sentinel 1-2, Pléiades), as well as the emergence of new drone-based technologies that might support wildfire data collection both during and after the event. Likewise, portable technologies available through modern smartphones offer an easy way to collect data and visuals of wildfire sites and wildfire dynamics that could be incorporated in a comprehensive wildfire database. So, making use of these technological advances, and acknowledging the data-related challenges we are facing, we identify the following priorities:

- Set wildfire-related definitions that are accepted throughout all administrative, organisational and political levels;
- Establish a reliable, timely and comprehensive wildfire database that:
  - can be fed with field-, satellite- or drone-based wildfire data;
  - includes information on wildfire origin and cause, area, perimeter, type of vegetation and fuel, duration, damage, meteorological conditions, suppression actions and deployed material;
  - can be enriched with photos and videos of the event;
  - is aligned with databases of other EU countries;
  - is accessible to relevant stakeholders;
  - is to some extent accessible to the general public in a web-based wildfire viewer that also incorporates the wildfire danger and risk reports;
- Mandate a governmental agency to collect data in situ, if needed, irrespective of the terrain ownership (like for the forest inventory in Flanders [2]);
- Set up data collection, storage and processing protocols for drone and aerial (RAGO) data collected by emergency services (Firefighters, Civil Protection, Police departments) during wildfires;
- Establish a protocol for retrieving wildfire cause and point of ignition (e.g. by a multidisciplinary team consisting of representatives from the firefighters, police, forest service and wildfire researchers) to serve a legal basis for possible prosecution, and define which parties (e.g. police, fire department, forest service,...) can initiate such an investigation (police only today);
- Mandate a federal agency (e.g. Brandweer België - Sapeurs-Pompiers de Belgique) for hosting, maintaining, curating, updating and sharing the Belgian wildfire database, and for compiling and communicating Belgium's wildfire statistics;
- Foster the use of the Belgian wildfire database for future research on the impact of climate change and the identification of changes in wildfire dynamics, the design of prevention and awareness campaigns (Section 5), the allocation of wildfire suppression means (Section 6), the deployment of early detection systems, the compilation of wildfire risk maps (Section 3) and the compilation of summarizing reports to supranational organisations.

[2] https://emis.vito.be/nl/actuele-wetgeving/3-maart-2025-ministerieel-besluit-tot-aanwijzing-van-gewestelijke-toezichthouders

# 2 Post-fire recovery monitoring

## Value

Depending on fire severity and duration, wildfires can have a relatively mild to devastating impact on natural ecosystems, especially to those that are not adapted to such disturbing events. Moreover, wildfires might inflict changes in the species distribution and promote the settlement and further expansion of (invasive) exotic species.

Studies conducted in fire-prone landscapes provide crucial insights into the dynamics of vegetation recovery and its drivers. Such studies can support land management and damage prevention with a view to mitigating two of the many risks associated with altered fire regimes: habitat loss and biodiversity decline. These studies also help terrain managers develop post-wildfire landscape management guidelines.

Wildfires can have equally devastating impact on animals, insects, fungi, and any other living organisms. For instance, according to the World Wildlife Fund for Nature, an estimated number of 3 billion animals were killed or displaced during the catastrophic 2019-20 bushfires in southeast Australia. On the other hand, burned vegetation brings opportunities for rare specialist species (pyrophiles), which could benefit from a more regular occurrence of wildfires.

## Current situation

Up to this day, there are only a few small-scale studies on how Belgian ecosystems react to wildfire activity. Therefore, insight into the relationship between fire severity, damage and recovery is limited for our natural landscapes. This knowledge gap complicates informed allocation of limited intervention teams and equipment. The lack of such monitoring studies is, however, common across countries with limited wildfire tradition. So, not only at the national level, but rather at the scale of north-western Europe, there is still much work to be done, and cross-country collaboration is probably the most promising way forward.

## Additional challenges

Since ecosystems in Belgium are not adapted to wildfires, we expect that wildfires, especially the intense and longer-lasting ones, significantly affect their composition, functioning and resilience. Moreover, Belgium's natural landscape is very diverse in terms of vegetation (e.g. grass lands, bogs, and coniferous, deciduous and mixed forests), hydrology (e.g. relatively dry to relatively wet), soil texture (e.g. sand, silt, clay), and topography (e.g. plane versus hilly). This diversity complicates the construction of a comprehensive overview of post-fire recovery dynamics.

Additionally, the relatively small extent of the Belgian wildfires complicates the use of high-resolution remotely sensed satellite data to consistently monitor ecosystems during their post-fire recovery. Finally, to assess a relationship between wildfire intensity and recovery, the flame length, for instance, should be well documented, which is typically not done (See 1).

## Opportunities & solutions

Since neighbouring countries, with similar natural landscapes and environmental conditions, are likewise coping with periods of increased wildfire danger, we advocate for joining forces to move forward on this theme, while making use of the newest technologies:

- Initiate interactions about post-fire monitoring with the relevant governmental stakeholders from The Netherlands (Staatsbosbeheer), the Grand Duchy of Luxembourg (Administration de la Nature et des Forêts), northern France (Office national des forêts) and eastern Germany;
- Select representative study sites in these countries across the spectrum of vegetation types, environmental conditions, and so on;
  - Identify key representative study sites that will be monitored both in situ and remotely (e.g. satellite imagery);
  - Define the optimal duration of post-fire monitoring studies and the responsibilities per study site;
- Set up a protocol for field inventories (e.g. soil, fungi, vegetation and insects with particular attention for pyrophilic species), possibly assisted by airborne vehicles, and satellite-based inventories;
- Compile guidelines and good practices for managing wildfire affected landscapes (e.g. tree removal, flood and rock fall protection, removal of burnt timber, replanting, supportive measures for natural regeneration, breaking the hydrophobic layer, preventing pollutant runoff, etc.);
- Seek and pursue funding opportunities for such a multi-country collaboration.

# 3 Wildfire danger and risk assessment

## Value

Wildfire risk is the potential for adverse consequences or impacts due to the coincidence of wildfire activity, exposure of humans, infrastructure and ecosystems, and the systems' vulnerabilities.

To quantify risk, each dimension should be considered: most studies consider wildfire hazard, exposure and vulnerability, with 'hazard' understood as wildfire danger. This implies that wildfire danger is only one of the components of wildfire risk, and not its synonym (a recurrent misinterpretation).

We zoom in on the three components of wildfire risk (Figure 3):

- Wildfire danger refers to the likelihood that a fire ignites and propagates in a certain area and period;
- Wildfire exposure quantifies the extent to which people, infrastructures, but also ecosystems, could be affected by wildfires;
- Wildfire vulnerability refers to damage potentially caused by wildfires.

Wildfire risk maps provide valuable information for land managers, decision-makers, researchers, and fire brigades who use them to design and optimise preventive and control measures. Moreover, risk can be taken into account in landscape planning and for setting access protocols. Especially in regions with a considerable WUI, they are also useful for developing effective evacuation plans and for raising public and political awareness of emerging wildfire risk. The latter is especially needed in Belgium, where fire activity is increasing but remains poorly understood.

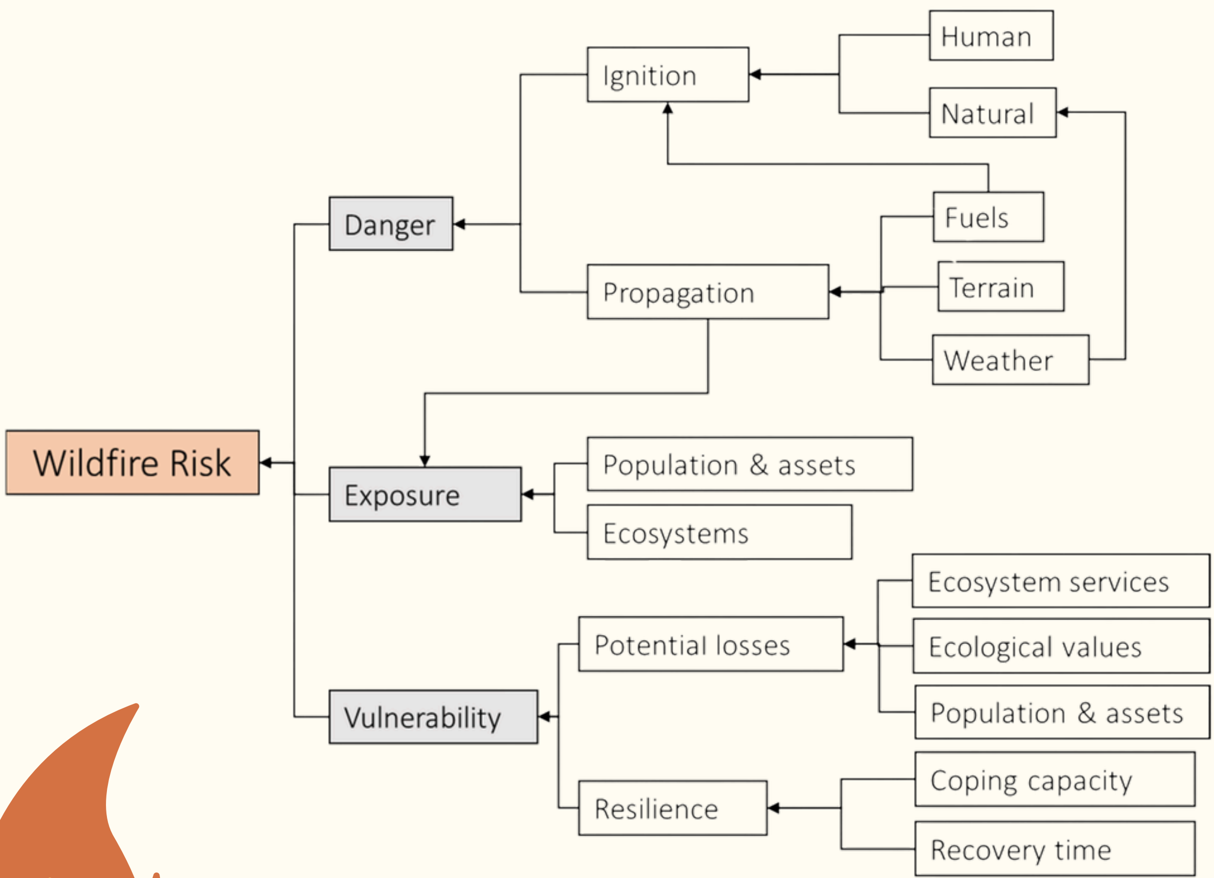



Figure 3: Components of wildfire risk (Chuvieco et al., 2023).

## Current situation

Since wildfire risk assessments are key to support and design a country's integrated wildfire management, most EU countries, also the ones in Northwestern Europe, have already invested in setting up risk assessment methodologies and protocols. Typically, the developed methods focus on the wildfire danger component, because it can be quantified relatively easily based on readily available spatio-temporal terrain data, meteorological conditions, and the historical wildfire incidence (Section 1) among others. Moreover, wildfire danger is immediately useful for daily operations and emergency response as it reflects the fire behaviour potential under current conditions. A comprehensive risk assessment, on the other hand, focuses more on the long term and supports prevention and planning.

Quantification of wildfire risk and danger largely varies across countries. Most countries publicly announce wildfire risk and/or danger. The same risk quantification protocol is adopted for the entire country, irrespective of the administrative organization, but local adaptations are possible if required and the legal consequences of a certain risk level may vary across different administrative units.

To this date, no scientifically sound and validated system to quantify wildfire danger is available for Belgium. Meanwhile, ANB uses an empirical system to define its wildfire danger codes (green, yellow, orange, and red), and DNF studies the correlation between internationally established wildfire indices and national wildfire occurrence. For Belgium, a preliminary wildfire risk assessment is available, using historical wildfire data. However, this risk assessment does not evolve with weather conditions, vegetation health/dryness or climate change effects.

## Additional challenges

Belgium has a considerable WUI, which makes it even more important to have a comprehensive and sound wildfire risk and danger assessment. Unfortunately, its administrative organisation complicates implementing a nationwide methodology because there is sometimes a mismatch in data availability between the different regions, and different viewpoints might exists on the vulnerability of potential damage to ecosystems and man-made structures. Furthermore, there is only limited wildfire data (Section 1) to support and validate the design of danger and risk assessment systems for Belgium.

## Opportunities & solutions

Belgium's key wildfire stakeholders are convinced that setting up a wildfire danger and risk assessment system is one of the key priorities to move forward. These systems should be scientifically supported, consistent across the different regions, and aligned with approaches in neighboring countries. In this process, Belgium can build on the assessment systems that have been established in other countries and rely on the historical wildfire database (Section 1). We identify the following priorities:

- Make an inventory of existing wildfire danger and assessment systems in the EU, and the required underlying datasets, with special attention to countries in Northwestern Europe;
- Identify the responsible agency(ies) to host and maintain Belgium's danger and risk assessment systems (e.g. RMI, CERAC,...), that integrate a continuous monitoring of the risk, a forecasting system, as well as a projection of the risk under changing climate;
- Select the most informative wildfire indices for Belgium, depending on the region and season, based on a comparative study (Section 1);
- Use the 'best' wildfire indices to deploy a wildfire danger assessment system for Belgium and share this with the general public;

- Together with the relevant stakeholders, and aligned with risk assessments that have been conducted for other natural disasters (e.g. floods), identify the parameters to be included in a wildfire risk assessment;
- Deploy a wildfire risk assessment system for Belgium;
- Define how and to what extent legal implications (e.g. no construction allowed or preventive measures imposed in high-risk zones) are possible based on the wildfire risk assessment.

# 4 Fuel assessment

## Value

Vegetation fuels are a key driver of wildfire dynamics and behaviour. Their quantity, health status and moisture content directly determine ignition potential, flammability, fire intensity and rate of spread. Surface fuels such as litter, grass, and deadwood sustain surface fires, while canopy fuels promote crown fires that are far more intense and harder to control. Intermediate fuel layers are critical for vertical fire propagation. Fire behaviour is determined by the interaction between fuels, weather, and topography (Fire behaviour triangle), but the former is the only one that can be actively managed. Accurate and spatially explicit information on fuels is therefore essential to simulate and model fire behaviour. Such modelling capacity is fundamental to identify vulnerable ecosystems, evaluate preventive management options, and anticipate how climate change may alter fire dynamics and regimes. Reliable fuel data underpins both operational fire suppression and long-term prevention planning. Furthermore, this spatial fuel information is needed to design fire-safe environments. This is particularly crucial for steep, south-facing slopes with shallow, well-drained soils that are affected by forest dieback and sanitary issues. Limited management in these areas, driven by poor timber quality, difficulties with regeneration and climate constraints, can lead to fuel accumulation and shrub encroachment. This strongly increases the future fire hazard, especially in Wallonia.

In this context, developing a robust national fuel assessment and mapping framework would provide the scientific foundation needed to improve wildfire prevention, inform awareness and communication strategies, support adaptive forest management, and strengthen Belgium's overall capacity to manage and mitigate wildfire risk.

## Current situation

In Belgium, information on vegetation fuels across forested and open habitats remains fragmented and incomplete. There is currently no national framework for systematically collecting field data describing the different fuel layers that influence fire behaviour. Current forest inventories focus primarily on timber production, biodiversity and ecosystem monitoring, but they lack the level of detail needed to describe vegetation structure and fuel distribution.

Across Europe, several countries have already developed standardized approaches for fuel characterization and national-scale fuel maps. These frameworks provide consistent, spatially explicit information that helps assess fuel loads, understand fire dynamics and guide prevention strategies. The absence of comparable tools currently restricts Belgium's ability to model fire behaviour, assess wildfire hazards at the national scale and produce fuel maps consistent with those used in other EU countries.

## Opportunities & solutions

To overcome current limitations, a multi-source approach should be developed, combining remote sensing and field-based observations, in order to 1) develop a national map of fuel types (i.e., vegetation types), and 2) complement this map with a quantification of fuel load, both at the surface and canopy levels, depending on vegetation health and dryness. The former could be based on established methodologies, whereas the latter can be addressed either by linking mapped fuel types to standard fuel models, i.e. sets of parameters defining fire behaviour, or by directly and continuously mapping the main variables included in those models, such as fuel height, load, and bulk density. Regardless of the chosen approach, a network of representative field plots should be established to capture species, age, and structural variability. These plots would provide reference data for quantifying both surface and canopy fuel categories using standardized field protocols. Based on this, our recommendations are:

- Develop and implement a standardized protocol for quantifying the physical parameters of fuels across the main forest and wildland types in Belgium;
- Establish and implement a methodology for producing and regularly updating a national fuel type map, as well as a continuous monitoring of the dryness conditions of the vegetation;
- Establish a network of representative field plots to capture species, age, and structural variability to provide reference data for quantifying both surface and canopy fuel categories.
- Set up a database of the most common species in Belgian landscapes and their in vitro measured burn properties.

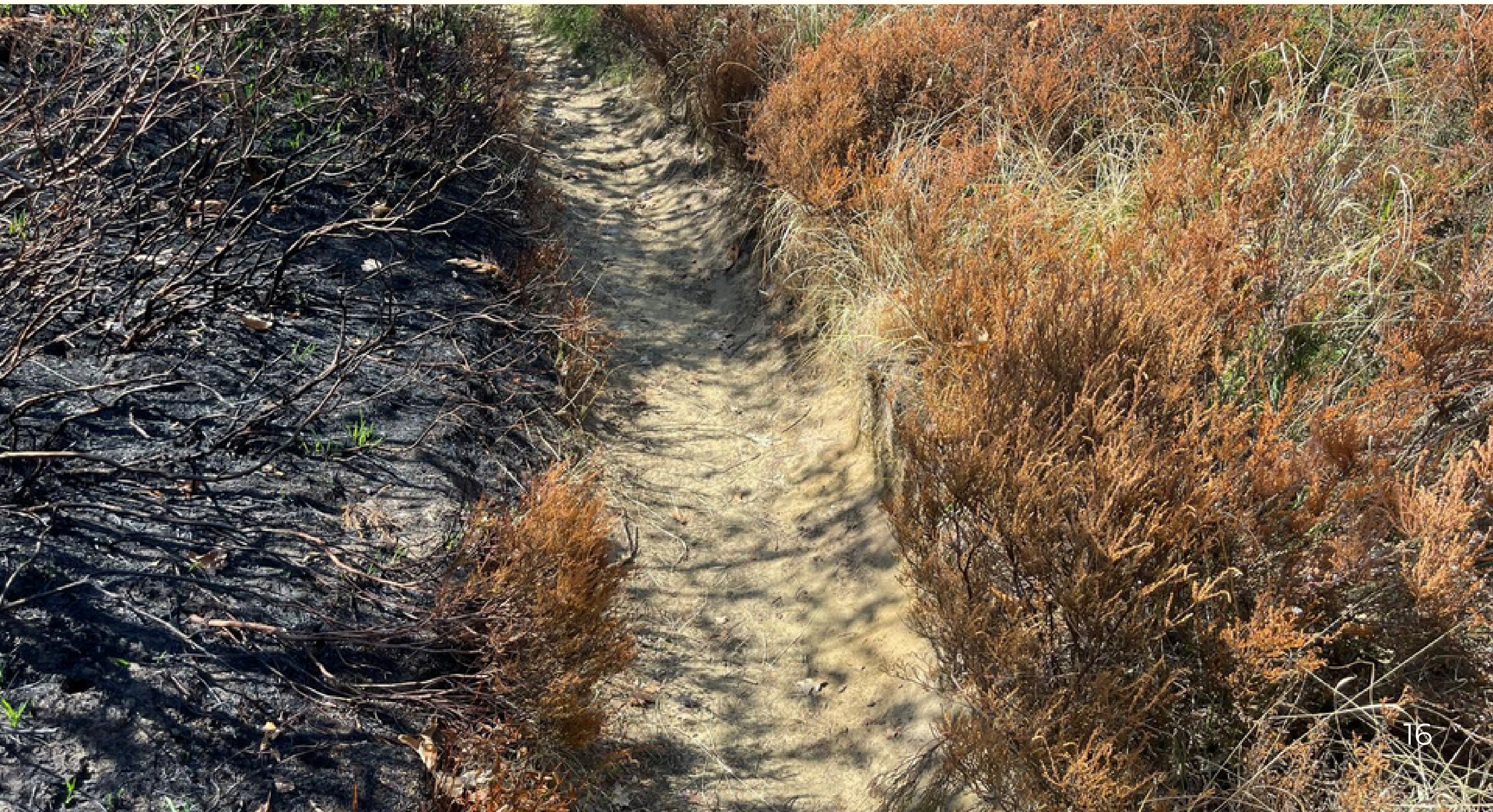
# 5 Spread modelling

## Value

Basically, wildfire spread models enable us to take a look into the future for what concerns the propagation of wildfires, and as such they offer a more objective way to, for instance, evaluate or optimize suppression scenarios, decide whether additional operational capacity is required and of what type it should be, inform firefighting teams, evaluate the need for evacuation, and judge whether much harm is to be expected if we do not (further) intervene or halt suppression. Furthermore, such models can support wildfire policy and smart landscape design, especially in the light of climate change, because they enable scenario analyses. For instance, they can be relied on to quantify potential wildfire damage under different climatological conditions, or to assess which fire break design is optimal given the landscape and fuel present. Likewise, they can be used to optimize fuel management or reforesting plans. As such, they constitute a true cornerstone in the development of an integrated wildfire management.

## Current situation

Many European countries have invested in the development, validation and operational availability of wildfire spread models, even those confronted with relatively small wildfires (e.g. The Netherlands). Essentially, when restricting to models incorporating the physics behind wildfire spread, there are two main families of such models, namely those based on Huyghens' principles of wave propagation and those based on cellular automata. Since the 1970s many of such simulators (FARSITE, Prometheus, Cell2Fire,...) have been developed and subsequently been adopted operationally by forestry and emergency services, following a prior phase of local adaptation, testing and validation. For instance, the MED5 countries, but also the Netherlands, Germany, Sweden, Norway, Switzerland, and Austria, all have such locally adapted models available for operational purposes. Similarly, also urban planners and landscape designers have increasingly been appreciating their advents and added value because they deliver quantitative insights into the outcome of the complex interaction between the landscape, vegetation and man-made structures. In Belgium, however, no such simulator is available.





## Additional challenges

Even though the discussed wildfire simulators are based on physical principles encoded in mathematical equations, they are still relatively data hungry, in the sense that their accuracy depends strongly on the availability, resolution and quality of meteorological, fuel, terrain and operational data. Such fuel data is still not available for Belgium (See Section 4), while the latter requires an intimate link between the command centre in the terrain and modelling environment. Moreover, to tune them to a Belgian context, calibration and validation data are indispensable. Such data typically come as a time series of growing wildfire perimeters observed in the field, or at the least the final wildfire perimeter. Unfortunately, as mentioned in Section 1, even the latter are typically unavailable for Belgian wildfires. A final challenge for deploying such models resides in the fact that they are also computationally and technically demanding since they yield high-resolution spatio-temporal simulations. In an operational context, this requires a specialized back office.

## Opportunities & solutions

Drones are increasingly deployed to assist the emergency services during wildfire events (Section 1). They also offer a means to acquire data on how wildfires spread across Belgian landscapes, and hence they enable us to tune wildfire simulators to a Belgian context. Moreover, the final wildfire perimeters available through the anticipated Belgian wildfire database (Section 1), as well as a fuel assessment for the Belgian territory (Section 4), would fill two other important gaps that currently hinder the model deployment. Acknowledging further that we have high-resolution elevation (NGI) and meteorological (RMI) data, we suggest the following steps to further expertise on this topic:

- Conduct a comparative study of established wildfire simulators for Belgium for a selection of historical wildfires in the Benelux;
- Test the operational potential of a validated wildfire simulator with the emergency service taking into account the needs, data flows, responsibilities, and so on;
- Conduct scenario analyses under different climate scenarios.

# 6 Training and equipment

## Value

To prevent wildfires from becoming uncontrollable it is crucial to be prepared through a combination of risk analysis, training, exercises and suitable equipment. If people in the terrain are well trained and have access to the right equipment and information, they can prepare themselves in a better way.

## Current situation

In several provinces, exercises are being conducted on a regular basis. These exercises can either be mono- or multi-disciplinary. Some provinces, like Limburg, also organize exercises together with Defense.

Basic wildfire training for firefighters is now being introduced in Belgium. The first level, NBB1 (Natuurbrandbestrijding), aimed at operational personnel, is currently being delivered. The second level, NBB2, designed for middle management, has also been developed and the initial training sessions are underway. The development of the advanced levels, NBB3 and NBB4, is still ongoing. These programmes are being created by a small group of specialists who are also strongly involved in other wildfire-related responsibilities, which makes it challenging to produce comprehensive and high-quality training modules within the expected timelines.

Furthermore, integrating the NBBs into the broader national command and operational framework for firefighting raises additional organizational and procedural questions, which must be addressed before the programme can be fully embedded in Belgium's overall incident command system. Overall, the current capacity for training development remains fragile and heavily dependent on few experts. Strengthening and expanding this capacity is essential to increase wildfire preparedness.

Today, access roads within natural landscapes are not well regulated, and the rules that do apply differ significantly between owners. Due to the fragmentation of land ownership, it is difficult to implement uniform access policies or enforce consistent standards. As a result, emergency services encounter significant challenges when attempting to reach wildfires, and ultimately the timely deployment of specialized wildfire equipment gets jeopardised. This reduces overall effectiveness and increases the risk that an initially manageable incident escalates.

Specialized ground equipment for wildfire response is expensive, and not every intervention zone has the financial capacity to invest upfront. Although progress has been made and several agreements now exist to provide mutual support between intervention zones and services, procurement remains fragmented. Firefighting services, Defense, and the police each issue their own independent tenders, which results in a lack of standardization and interoperability. Aerial means for wildfire operations are provided solely by the Federal Police, but this is of limited capacity and not yet structurally integrated into a broader national wildfire strategy. Expanding and strengthening this aerial component would significantly improve Belgium's ability to detect, monitor, and suppress wildfires.

## Additional challenges

When a wildfire grows in scale, suppression efforts can take several weeks, requiring the mobilisation of firefighters, nature and land managers, police, medical teams, civil protection units, crisis managers, crisis communications managers, and various support services. In such cases, hundreds of responders may have to be deployed for a single incident. The first challenge lies in rapidly mobilising this level of response capacity. The second, and often even more demanding challenge, is ensuring sustained rotation and replacement in and of the teams. Prolonged operations therefore require a pool of trained personnel and a robust logistical system to maintain operational continuity.

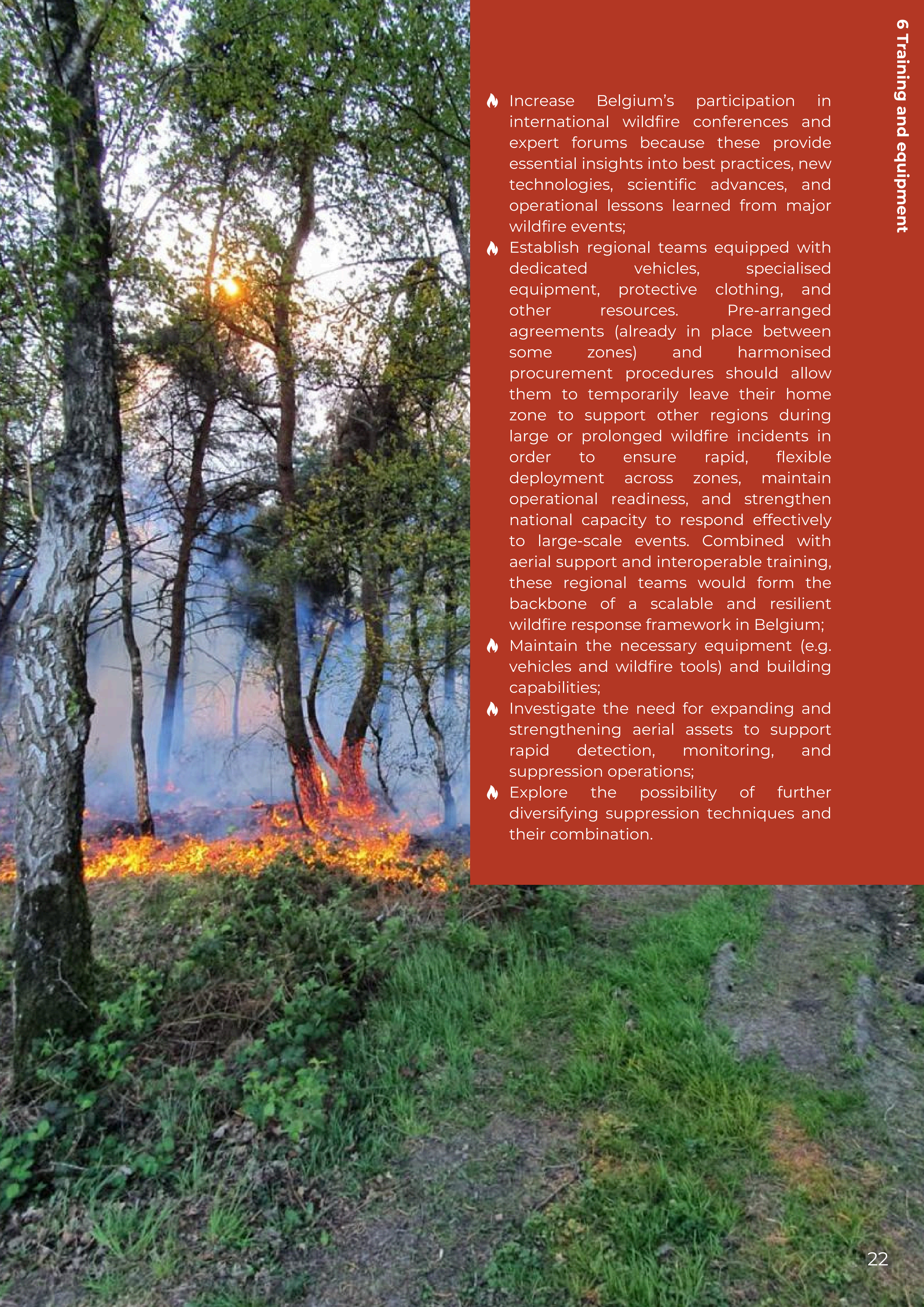
Belgium faces additional constraints linked to its limited geographical scale. Its ability to shift resources efficiently from north to south is limited since the number of specialized teams and equipment is limited, which reduces flexibility during long-lasting incidents. Moreover, Belgium is not yet ready to participate in international wildfire assistance frameworks, neither for providing support (e.g. EU Prepositioning Programme) nor for receiving large-scale foreign assistance during extreme events. This limits interoperability with European partners and constrains the country's ability to scale up capacities during major crises.

# Opportunities & solutions

Although several (inter)national operational training opportunities for wildfire suppression already exist, participation by Belgian stakeholders is limited. This jeopardises Belgium's ability to develop expertise, build networks, and keep pace with rapidly evolving wildfire science and operational strategies across Europe and beyond. As the national risk profile evolves, it becomes essential for Belgium to invest more strategically in both basic and specialized training to build a robust and sustainable knowledge base. For that reason, we recommend the following:

- Set up a uniform and basic wildfire training for all stakeholders at national level:
  - All actors in wildfire prevention, preparedness, response, or recovery should have access to this training;
  - Possible starting points for such a training are the Postgraduate Programme in Wildfire Management by the University of Applied Sciences PXL, a wildfire training module for forestry services that is under development by DNF, and some aspects of the well-established Postgraduate Programme in Disaster Management;
  - This training could be the seed to set up a national taskforce devoted to wildfires, and as such foster best-practice exchange at a strategic level.

- Stimulate specialized training for experts by increasing Belgium's participation in international training programs, such as
  - Wildfire Researcher Training offered by the NIPV (The Netherlands) and focused on post-incident analysis of wildfire behaviour;
  - Feux de Forêts training (France) constitutes a structured multi-level training approach for forest firefighting, covering tactics, command, and operational deployment;
  - The Pau Costa Foundation (Spain) offers advanced courses in wildfire weather, fire behaviour analysis, and operational strategy;
  - The EU Pre-Positioning Programme enables firefighters to be deployed in the MED5 countries;
  - NERO Network (European COST Action – Extreme Fire Behaviour) is a European science and technology collaboration focused on research and knowledge exchange;
  - UCPM training programme offered by the European Commission provides knowledge, competencies and skills required to prevent, prepare for, and respond to disasters both within and outside the EU. It also enables countries to request and receive international assistance.
- Integrate mono- and multidisciplinary exercises on a regular basis to strengthen operational preparedness and ensuring that knowledge acquired during training is effectively translated into practice. This also improves coordination between disciplines, response capabilities, and reinforces overall preparedness for wildfires;



- Increase Belgium's participation in international wildfire conferences and expert forums because these provide essential insights into best practices, new technologies, scientific advances, and operational lessons learned from major wildfire events;
- Establish regional teams equipped with dedicated vehicles, specialised equipment, protective clothing, and other resources. Pre-arranged agreements (already in place between some zones) and harmonised procurement procedures should allow them to temporarily leave their home zone to support other regions during large or prolonged wildfire incidents in order to ensure rapid, flexible deployment across zones, maintain operational readiness, and strengthen national capacity to respond effectively to large-scale events. Combined with aerial support and interoperable training, these regional teams would form the backbone of a scalable and resilient wildfire response framework in Belgium;
- Maintain the necessary equipment (e.g. vehicles and wildfire tools) and building capabilities;
- Investigate the need for expanding and strengthening aerial assets to support rapid detection, monitoring, and suppression operations;
- Explore the possibility of further diversifying suppression techniques and their combination.

# 7 Awareness by education

## Value

Since most wildfires in Europe are caused by humans, it is key to raise awareness, and subsequently inflict behavioural changes, amongst the broader population. Now, most people are not aware of the risk, among WUI residents. There are two main reasons for raising awareness and promoting behavioural changes. First, it is important to educate people so they know that careless behaviour such as smoking cigarettes, leaving behind litter or other careless behaviour can lead to (uncontrollable) wildfires. Second, a rapid intervention by the fire brigade can prevent wildfires from spreading and becoming uncontrollable. People need to understand that a swift and quick notification to the fire brigade can make a huge difference.

Also sensibilization of the political level is of the utmost importance as it defines policies, provides the necessary financing and monitors progress. This can be achieved by, for instance, conducting a wildfire risk assessment (Section 3).

## Current situation

In Flanders, ANB assesses the wildfire risk using a four level scale (similar to the KMI risk scale): green – yellow – orange – red. During the wildfire season, the risk code is determined weekly. ANB leads communication towards the public, which is reinforced by several stakeholders like emergency planning and crisis management departments, fire brigades, municipalities and nature reserve managers.

In Wallonia, there is currently no uniform risk coding system. In the Hautes Fagnes a flag is used to communicate wildfire risk, though elsewhere signboards make people aware of the current situation. Some provinces have already developed flyers to explain the meaning of the risk code and wildfire risk to raise public awareness.

The National Crisis Center (NCCN) is planning a nationwide information campaign about resilience and community preparedness, including wildfires (2028) and floods. For that purpose, two municipalities in wildfire or flood prone areas will serve as examples to design the communication material to the local needs and concerns that will subsequently be put at the disposal of the other municipalities. Although this is a valuable initiative, wildfires are just one aspect in this campaign, and might be overshadowed by others. Still, the developed communication materials will remain available to other partners. Also on a more local level, information campaigns about wildfires are on the way. Limburg and Antwerp, for example, are planning an information campaign targeting residents of the WUI.

## Additional challenges

At the moment, Belgium does not have a standardized method for assessing wildfire risk perception, wildfire risk and danger (See Section 3). Consequently, the communication towards the public is not uniform, which creates confusion among citizens and leaves them insufficiently aware of the situation. This lack of clarity may reduce people's willingness to adhere to measures put in place.

Furthermore, different public authorities and agencies often communicate measures that do not align with those required to effectively reduce wildfire risk. Such inconsistencies not only complicate public understanding but also undermine trust in official guidance and make coordinated risk mitigation efforts more challenging.

## Opportunities & solutions

We envisage the following priorities for increasing wildfire awareness:

- Establish a legal framework for a wildfire risk assessment (and its consequences) within the region's forestry laws (if needed);
- Strengthen public communication by reinforcing communication about wildfire risk, wildfire danger and by providing clear explanations of the risk codes with concrete guidance while ensuring alignment with other public communication efforts related to other risks. For example, a code 'red' might mean that there is a very high and acute risk of wildfires and the consequent instruction could be to not go into the woods;

- Make residents of the WUI aware of the wildfire risks and providing them with information to protect themselves as they may be the first ones to be confronted with wildfires, just as has been done for flood-prone areas. This would be achieved by
  - Learning from information materials for people living in the WUI;
  - Providing information on the mutual risks, such as the potential for wildfires to spread to houses and vice versa;
  - Using guidance on the 'home ignition zone' and checking whether adjustments of legislation are necessary and possible;
  - Offering concrete safety advice for activities like BBQ, harvesting, construction works, fire smart design of gardens and so on;
  - Creating a WUI and wildfire risk map (Section 3) to make people aware of the potential wildfire risks on their (future) property, similar to the maps of flood-prone areas. Potentially, this map could be the basis to enforce building restrictions, for example.
- Learn from international awareness campaigns. In Belgium, Arthur the Squirrel was introduced in the 2012 national action plan wildfires, but no consequent campaigns were organised. Launching such a campaign in a modernized way by also involving social media platforms should be considered;
- Raise awareness among professional stakeholders and at the political level. This can be achieved through basic training programs (See Section 6), and workshops with speakers from fire-prone regions;
- Raise awareness among children and adolescents by developing educational packages. Similar initiatives already exist for other risks.

# 8 Organisation and cross-boundary exchange

## Value

Expertise concerning wildfires in Belgium is very limited and concentrated within only a few organizations and stakeholders. Therefore, it is important to invest in training within organizations. In other countries, there is already a lot of expertise on wildfires, so Belgium can learn from these countries, especially from Northwestern European countries. We should not waste time reinventing the wheel but instead build upon the knowledge that is already available.

## Current situation

There exist different groups and initiatives on wildfires:

- Operational workings groups from the fire brigades in Flanders ("Netwerk Brandweer") and Wallonia ("REZONWAL") that cover monodisciplinary agreements within the fire brigades concerning the management of wildfires;
- Walloon working group (will be expanded during 2026) on wildfires with members from DNF, CORTEX, SPWARNE and several intervention zones designated by REZONWAL (one per province), and invited members from ULG, IRM and ISSeP;
- (Flemish) Network Wildfires brings together several Flemish and Federal stakeholders, such as UGent, KULeuven, PXL Hasselt, KMI, FPS Interior, National Crisis Center, ANB, INBO, Natuurpunt, NGI, Brandweer België, different fire brigades,... Through this network, information is exchanged about ongoing projects and efforts are made to harmonize the different initiatives;
- Belgian Wildfire Network that was established in the fall of 2025 by Ugent, ULG and other partners. It brings together all Belgian stakeholders on the topic to provide a comprehensive overview of the current state of wildfire management in Belgium, to harmonize the different initiatives and to support the various stakeholders through scientific research;
- Northwestern European Wildfire Roundtable joins wildfire experts from various countries from the Northwestern of Europe to exchange information and share good practices among countries whose wildfire regimes differ from that of fire prone countries;
- Expert Group on Forest Fires (EGFF) from the European Commission (EFFIS working group on European level) brings together wildfire experts from EU member states and surrounding countries. For Belgium, it offers a way to get a good understanding of the best practices in other countries;
- International agreements with firefighting and civil protection departments of neighbouring countries for mutual operational assistance in case of cross boundary wildfires;
- Belgium takes part in EU UCPM (Union Civil Protection Mechanism) actions and begins to participate in wildfire management by sharing mainly information and knowledge;
- Ongoing participation in international projects like the Interregs Natuurbrandbeheersing and Hawkeye.

## Additional challenges

There is a notable difference between the Flemish and the Walloon part of Belgium, where the former tends to take inspiration from The Netherlands, and the latter from France. Consequently, both regions have not always evolved in the same direction concerning the management of wildfires, though it has in the meantime become clear that some aspects (data collection, risk, danger and fuel assessment, training) should be uniformised at national level, just as other countries have done.

An example of this divergence is the use of operational and tactical maps. Flanders uses the system of the NGI (with uniform symbology, emergency index grid and standard classification of roads), whereas Wallonia uses the cartography from France. Yet, the opposite is true for some of the wildfire brigades where both Walloon and Flemish fire brigades take part in a French training course, so both use the same command structure and degrees (FDF3, FDF4, ...). Moreover, also the Standard Operating Procedures (SOP) should be the same for both regions. Divergence can lead to operational chaos and confusion, creating conditions that allow a wildfire to spread rapidly and become difficult to control.

## Opportunities & solutions

We notice that different stakeholders are keen to build more expertise. The following opportunities can contribute to this goal:

- Expand and consolidate the expertise in Belgium through the Belgian Wildfire Network:
  - Invite other people who are working with wildfires to participate in the network;
  - Make sure that people are working towards the same goals;
  - Ensure the dissemination of procedures and good practices for all stakeholders across Belgium;
  - Be more involved in European initiatives by participating in study days and be open for trainings or internships and encourage stakeholders to participate;
- Increase interaction on wildfires with other countries in Northwestern Europe;
- Participate in international working groups like the Northwestern European wildfire roundtable and the EGFF to learn from other countries.

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