



## Project Deliverable D3.4

### Collection of proposed actions towards streamlining EU wide prevention strategies in emergency management

<b>Call / Topic</b>	H2020-MSCA-ITN-2019		
<b>Project Acronym</b>	PYROLIFE		
<b>Project Title</b>	Training the next generation of integrated fire management experts		
<b>Project Number</b>	860757		
<b>Project Start Date</b>	01/10/2019		
<b>Project Duration</b>	63 months		
<b>Contributing WP</b>	WP 3 – Risk Communication		
<b>Dissemination Level</b>	Public		
<b>Contractual Delivery Date</b>	March 2023		
<b>Actual Delivery Date</b>	April 2023 – with 1 Month extension		
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<b>Keywords</b>	Extreme Wildfires, Wildfire Prevention, Policymakers, Challenges, Recommendations		
<b>Document History</b>			
<b>Version</b>	<b>Date</b>	<b>Modifications</b>	<b>Source</b>
1.4		Final version to be submitted to the portal	EUC

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## Glossary

Following is the list of basic definitions used in the deliverable adapted from the European Glossary of Wildfires and Forest Fires, EUFOFINET, 2012<sup>1</sup> and Forest Fire Multilingual Glossary<sup>2</sup>

- **Wildfire** – Any uncontrolled fire which requires a decision or action regarding suppression. Wildfires are commonly classified according to the size and/or impact upon suppression resources.
- **Extreme wildfire** – “A wildfire demonstrating abnormally extreme fire behavior. Extreme wildfire usually represents a significant challenge to suppression agencies because are very resources intensive to suppress and can pose a significant risk to the safety of suppression personnel.
- **Wildfire Prevention** – “A collective term for all proactive activities that are implemented with the aim of reducing the likelihood of fire occurrence, severity, and spread of wildfires”.
- **Wildfire Prevention Strategies** – “A scheme or programme of activities which is formulated in order to prevent wildfire incidents”.
- **Fire behavior** – “The reaction of a fire to the influence of fuel, weather, and topography”.
- **Integrated Fire Management** – “IFM is a holistic approach that involves the coordination of multiple stakeholders and strategies to prevent, prepare, suppress and recovery from wildfires.”
- **Wildfire management** – it refers to the activities and processes undertaken to prevent, suppress, or control wildfires. This can include activities such as fire prevention education, early detection, and reporting of fires, and the deployment of firefighting resources.

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<sup>1</sup> [European Glossary](#)

<sup>2</sup> [English Reference](#)

- **Effective Wildfire Management** – refers to the implementation of strategies and tactics that successfully achieve the desired outcomes of wildfire management. Effective wildfire management not only involves the technical aspects of fire suppression and prevention but also the social, economic, and ecological contexts in which fire occur. This includes working with communities to create fire-resistant landscapes, developing partnerships and cooperating among different stakeholders, and using fire as a tool to restore natural fire regime and reduce the risk of extreme wildfires.
- **Operational factors** – operational factors are specific aspects or variables that can influence the effectiveness and efficiency of management operations. In this case wildfire management.

## **Executive Summary**

### Aim and Purpose of the Deliverable

Fires are essential and a natural process that aid in shaping the landscape of Earth. This deliverable is aimed at identifying the best practices for preventing wildfires across the European Union. The goal here is not to promote complete wildfire exclusion, but to reduce the likelihood of fire ignition and manage the growth and intensity of extreme fire events.

This is accomplished by first identifying the operational factors that affect the wildfire management and then making suggestions for wildfire prevention based on those factors.

Based on the interviews conducted, some of the actions have been proposed towards **streamlining Cyprus wide prevention strategies**, followed by a list of the wildfire prevention activities categorized under the operation prevention component of **Education** (considered as one of the key components in raising awareness about wildfires in Cyprus) to aid the audience.

### Audience

The deliverable is particularly useful for those people and organizations involved directly and indirectly in planning, implementing, and improving wildfire prevention measures. This includes **wildfire managers, policy-decision makers, and scientists**.

Additionally, this deliverable can also be useful to the **media** to further tailor wildfire information on prevention strategies.

### Conclusion

Wildfires are a significant and recurring threat in Cyprus, therefore shifting towards an integrated approach might be a helpful solution to reduce the likelihood of extreme wildfire event. This approach could involve various initiatives such as doing more adult education, high visibility patrolling, enforcing laws, or training in preventive techniques. For this reason, the factors influencing wildfire prevention strategies in Cyprus were investigated to provide a comprehensive list of suggestions for improvement.

## 1. Introduction

Warmer temperatures and drier conditions along with various other factors such as land abandonment, increased fuel load, and many more are changing the wildfire issue in Europe (Costa et al., 2011; Mohammadi et al., 2022). Today, wildfires are more difficult to contain, more expensive to suppress, and a threat to the safety of firefighters and public due to the accumulation of naturally igniting fuels and fuel beds (Jenkins et al., 2012; Xanthopoulos et al. 2006; Wollstein et al., 2022).

Given that the risk of wildfires is likely to rise in the context of a warmer and drier environment, this is a blatant sign that they are becoming a constant threat (Bednar-Friedl et al., 2022). In addition, based on a [report by the European Commission](#), 2022 was the year with the most fires since 2006, which was the precursor of what is anticipated to be the worst drought in Europe in 500 years (European Forest Fire Report, 2022). Despite the fact that 97% of all wildfires are suppressed before getting out of control, it seems that we are struggling to efficiently manage the increasing concern due to high suppression costs, significant damage to natural, cultural, and private resources, and a disproportionately high risk to the lives of the firefighters and public. The fundamental reason for this could be that the 3% of wildfires that do manage to elude suppression systems result in extremely dangerous blazes which can only be put out when the fuel runs out or the weather changes (San-Miguel-Ayanz et al., 2021).

If we want to reduce the damage done due to extreme wildfires, it is high time to put the ideas for Integrated Fire Management (IFM) into practice in addition to comprehending the contradiction that researchers have been contemplating for at least a decade (Rego et al., 2007; European Commission, 2010; FAO, 2010; Costa et al., 2011). It is not an option to put most of the money in firefighting personnel, apparatus, and tactics (Heikkilä et al., 2007; Dube, 2013). Therefore, *in order to effectively limit unwanted and uncontrolled fire spread, minimize damage from escaped fires, and protect people from harm, "reactive" fire suppression systems must be transformed into "proactive" fire management programs that properly utilize fire prevention and hazardous fuel reduction approaches.* The investments directed towards proactive prevention strategies both at the EU and national levels would lead to successfully limiting the damage caused by destructive wildfires as explained by Castellnou et al., (2010) and Winter and Fried, (2000).

This may involve changing the way things are done, aiming for a different goal, or breaking the “fear trap” defined by Castellnou et al., (2019) as “*negative stress that the situation inflicts*

*upon agencies in charge of responding to them as they keep building resources and technologies trying to maintain efficiency and provide safety against increasingly fast, intense, and overwhelming wildfires”*. It will necessitate analyzing **WHY** we are focusing on Integrated Fire Management, **HOW** well we are performing, **WHAT** will have the biggest impact on the wildfire issues, and **WHEN** to take action.

Once we are able to answer the **WHAT**, **WHY**, **WHEN**, and **HOW** of the extreme wildfire situation, we might be able to reduce the number and impacts of extreme wildfires. However, the mere possession of knowledge does not necessarily translate into pragmatic policy decisions. Multiple factors such as political situation, economic considerations, and societal norms, can influence decision-making at the policy level and may prevent the implementation of evidence-based strategies (Swinburn et al., 2005; Liverani et al., 2013; Brownson et al., 2017). For example, despite the overwhelming scientific consensus on the urgency to take action against climate change, many policymakers in some countries do not always take effective measures to mitigate greenhouse gas emissions (Haines et al., 2009). Therefore, it is crucial to consider a range of contextual factors that may affect policy implementation (Beierle and Cayford, 2002; Blamey and Mackenzie, 2007), in addition to the knowledge gained from scientific research, to ensure that policies are effective and pragmatic (Sarkies et al., 2017; Nikolakis and Roberts, 2022).

Additionally, to effectively address the wildfire issues in an area, it is crucial to consider not only the **WHAT** but also the **WHO** and **WHERE** aspects of the problem. Identifying the target audience (**WHO**) for the proposed changes is essential in determining the necessary actions to promote behavioral change and increase awareness towards wildfire prevention. Moreover, understanding the geographic location (**WHERE**) of the wildfire-prone areas and the associated environmental and socio-economic factors is fundamental in developing context-specific interventions and improving the efficacy of wildfire prevention measures. Hence, a comprehensive understanding of the **WHAT**, **WHY**, **WHEN**, **HOW**, **WHO**, and **WHERE** aspects of wildfire situation is important for designing effective wildfire management strategies.

This deliverable thus discusses the complex sociopolitical situation and how it interferes with wildfire prevention strategies in Cyprus and suggests recommendations to overcome it.



## 2. Methodology

This deliverable evolves from the PhD thesis of ESR 13<sup>3</sup>, and the subject matter presented in this deliverable is a result of the following:

- Literature Review – with a main focus on the wildfire prevention strategies, as a part of the integrated wildfire management approach at the EU level (section3), followed by the factors that influence effective wildfire management in Cyprus.
- Semi structured Interviews – 10 semi-structured interviews were conducted with wildfire managers, volunteers, fire officials, and academicians involved in wildfire management **in Cyprus**. These interviews helped the researcher to gain insight on the effective wildfire management approach.
- Case Study Approach – Cyprus is used as a case study region for this deliverable because it is one of the Mediterranean countries facing the increasing risk of extreme wildfires. Also, this country was chosen due to the easy access to information and researcher’s restricted movement during Covid-19<sup>4</sup>. In this case study, the sociopolitical context in Cyprus was examined to determine whether and how it affects the strategy for managing wildfires. Furthermore, the factors influencing the implementation of wildfire prevention measures were considered, followed by the recommendations on effective wildfire prevention were presented, which were a result of the interviews conducted in the area.
- Recommendations and Summary – The findings from the conducted interviews have led to the formulation of several recommendations (section 5) aimed at enhancing the coherence and effectiveness of wildfire prevention strategies across Cyprus. Specifically, a comprehensive list of wildfire prevention activities has been developed under the “operation prevention” component of EDUCATION, which is recognized as a crucial factor in promoting public awareness and engagement towards wildfire prevention efforts in Cyprus. These recommendations are expected to inform the planning and implementation of future wildfire prevention measures, thereby improving the overall resilience of Cyprus against increasing wildfire threats.

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<sup>3</sup> P.Pandey (2023). PhD thesis on Interagency Exchange and Collaboration in Wildfire Management. Thesis will be confidential to the European University Cyprus and would require permission to be published.

<sup>4</sup> Originally, the PhD program was intended to have a Pan-European focus, incorporating countries from both the northern and southern regions to facilitate cross-regional knowledge exchange and best practice sharing. However, due to pandemic’s disruptive effects, the program’s priorities shifted towards prioritizing accessibility in terms of participant selection. As a result, PhD became more geographically localized, with a greater emphasis on regional cooperation and collaboration to facilitate effective and efficient delivery of thesis.

### **3. Wildfire Prevention in context of Integrated Fire Management**

Wildfire prevention is a crucial component of integrated wildfire management (Mateus and Fernandes, 2014) which encompasses prevention, preparedness, response, and recovery. It involves measures to reduce the risk of wildfires starting or spreading, such as fuel management, prescribed burns, public education, and infrastructure planning, to name a few. Despite being a natural part of ecosystem function, wildfires are also a serious environmental and socioeconomic danger on a global scale, particularly in light of climate change (Camia et al., 2017; Knorr et al., 2016; Spies et al., 2010). Thus, focusing on an integrated approach can be a potential solution to deal with the increasing wildfire risk.

#### **3.1 The EU Context**

Wildfires are a significant threat to the environment, economy, and society in Europe. The frequency, intensity, and severity of wildfires have increased in recent years due to climate change, land-use changes, and socio-economic factors. The European Union (EU) recognizes the importance of wildfire prevention and has implemented several measures to reduce the risk of wildfires and promote Integrated Fire Management (IFM).

At the EU level, wildfire prevention is a key component of the [Forest Strategy](#) and the [EU Green Deal](#). The Forest Strategy aims to increase the resilience of forests to climate change, protect biodiversity, and enhance the role of forests in mitigating and adapting to climate change. The EU Green Deal is a comprehensive plan to make the EU's economy sustainable and reduce greenhouse emissions. It includes several initiatives related to wildfire prevention, such as the [renovation wave](#), [the biodiversity strategy](#), and [the circular economy action plan](#).

The EU supports wildfire prevention through funding, research, and policy initiatives. For example, the [EU's Horizon 2020](#) program funds research projects related to wildfire prevention and management. The EU has also developed several initiatives to support these measures, such as European Forest Fire Information System ([EFFIS](#)) and the Fire Information Exchange Platform ([FIEP](#)). EFFIS provides information on wildfire risk and helps coordinate the fire suppression efforts across Europe. The EU's [Civil Protection Mechanism](#) supports the coordination of emergency response to wildfires and other natural disasters. On the other hand, FIEP, facilitates the exchange of knowledge and best practices among stakeholders in the field of wildfire prevention and management.

### **3.2 EU assistance to member states**

The European Union (EU) is committed to helping its member states tackle the increasing threat of wildfires. The EU's efforts in wildfire prevention are based on a comprehensive strategy that encompasses risk assessment, prevention measures, early detection and warning systems, firefighting resources, and post-fire recovery measures. Through its initiatives (some of them mentioned below), the EU provides assistance to its member states in wildfire prevention that are part of its broader approach to integrated fire management (IFM). Some of these initiatives include:

- 3.1.1 The EU's Forest Fire Information System (EFFIS): EFFIS provides real-time information on forest fires and their potential spread, as well as data on forest fire risk and prevention measures. It allows for the monitoring of forest fires and facilitates cross-border cooperation in wildfire prevention and management.
- 3.1.2 The EU Civil Protection Mechanism: The Civil Protection Mechanism allows for the coordination of emergency response efforts among EU member states during disasters, including wildfires. It provides support in the form of equipment, personnel, and expertise to countries affected by wildfires.
- 3.1.3 The EU' Horizon 2020 research: Horizon 2020 funds research and innovation projects aimed at improving forest fire prevention, early detection, and firefighting techniques. The program also aims to develop new technologies and tools for integrated fire management.
- 3.1.4 The EU's Rural Development Program: The [RDP](#) provides financial support to member states for the implementation of wildfire prevention measures, such as forest management, and land use planning.
- 3.1.5 The EU's LIFE program: The [LIFE](#) program provides funding for projects that promote the conservation and sustainable use of natural resources, including measures aimed at reducing the risk of wildfires.

These initiatives, among several others, are designed to improve the EU's overall capacity to prevent and manage wildfires, as well as to promote a more sustainable approach to forest management. However, there are several factors that could influence these actions, some of which we will try to cover in the next section based on a case study analysis from Cyprus.

## 4. Case Study – Cyprus

### 4.1 The sociopolitical situation in Cyprus

Cyprus is a Mediterranean island with a complex sociopolitical situation that can interfere with wildfire prevention strategies. This situation is characterized by long-standing political tensions between the North and South, where the Republic of Cyprus is the internationally recognized entity, and Turkey occupies almost 40% of the island, since 1974. The divided nature of the country hinders the implementation of effective wildfire prevention strategies as responsibility for managing the environment and natural resources falls under different authorities, often with limited coordination and collaboration.

The United Nations has established a buffer zone that runs across the island, separating the two communities, which also presents difficulties in implementing wildfire management measures that span across the island. Furthermore, large number of actors in the country can result in delayed decision-making processes and hinder the effective coordination of resources, which can be crucial in the event of a wildfire outbreaks. Additionally, the political situation can lead to disputes over land ownership and management, which can impact the ability to implement effective wildfire prevention strategies. For example, occupied areas may not be accessible to the Republic of Cyprus's fire department, making it challenging to implement fire prevention measures in those areas.

Another issue is the impact of the tourism industry on wildfire prevention (Boustras and Boukas, 2013). Cyprus is also highly dependent on tourism as a major source of income (Sharpley, 2002; Boustras and Boukas, 2013), which can create conflicting interests between the need to protect natural resources and the need to sustain a vital economic sector. This can lead to a lack of political will to implement strict regulations on the use of land, which can increase the risk of wildfires, especially in areas that have experienced urban encroachment into the wildland-urban interface.

With regard to the aforementioned rationale, this report concentrates on the Republic of Cyprus, owing to the geographical location of the researcher and the political context that precludes cooperation and data sharing.

#### **4.2 Wildfire situation in the Republic of Cyprus**

Wildfire management in the Republic of Cyprus is generally concentrated on suppression (Boustras et al., 2013; Papageorgiou and Papageorgiou, 2012) since efforts to put out large wildfire always draw a lot of media attention. In addition, there are several organizations participating in fire management (Constantinides, 2013) and in this context, cooperation among all these agents is essential for effective fire management. However, a lack of coordination among all the organizations is perceived as a significant constraint (Herrero et al., 2010). Despite the prevalent emphasis on suppression, it is now widely acknowledged that prevention is the most crucial strategy for managing wildfires (Marino et al., 2014; Lasanta et al., 2018; Alló et al., 2020). Many initiatives at various stages, such as policymaking, forest management, education, and training, go into the prevention phase of wildfires ([Department of Forest](#), Cyprus; Tymstra et al., 2020; [European Commission](#), 2021). The common objective of these initiatives is **to reduce the likelihood of a fire starting and control the spread and intensity of fire incidents**. In order to understand what needs improvement, or what can be changed we must fully understand the strategies being considered to manage wildfires in a region. Thus, following describe the wildfire management strategies in Cyprus.

#### **4.3 Wildfire related Institutional Framework/Responsibilities in Republic of Cyprus**

In order to identify the factors that influence the wildfire prevention in a region, it is important to have knowledge and understanding of the institutional framework of that area to identify gaps and challenges and provide recommendations. The institutional framework for wildfire management in Cyprus, along with the roles and responsibilities of all wildfires managing bodies, are defined through –

- The Forest Law
- The Firefighting Action Plan in Rural Areas

As per these documents, the Department of Forests, which operates under the Ministry of Agriculture, Rural Development and Environment, holds legal, administrative, and technical responsibility for the effective control and extinguishing of forest fires.

The Forest Law is the primary legislation in Cyprus that governs forest management. This law mandates the protection and management of forested areas, including the prevention and suppression of wildfires. The law stipulates penalties for individuals who start or allow fires in forested areas and requires immediate reporting of any discovered fires to the authorities.

*The forest department* is solely responsible for prevention, preparedness while fire service, volunteers, and private sectors also help in response and recovery. The department of forests main objective is to terminate fire caused by human influence and this is accomplished by enforcing forest law, public engagement through education, formation of picnic areas and camping areas (table 1).

WFM Strategies	Actions	Objectives
<b>Prevention</b>	<ul style="list-style-type: none"> <li>- Law Enforcement</li> <li>- Awareness campaign</li> <li>- Management of picnic and camping sites</li> </ul>	Prepare for wildfire hazard
<b>Preparedness</b>	<ul style="list-style-type: none"> <li>- Fire lookout station</li> <li>- Patrolling</li> <li>- Fuel breaks</li> <li>- Forest telecommunication system</li> <li>- Fuel management</li> <li>- Water facilities</li> </ul>	Reduce exposure to unwanted fires
<b>Response</b>	<ul style="list-style-type: none"> <li>- Forest fire fighting task force</li> <li>- Fire engines and Aerial firefighting</li> <li>- Cooperation with other agencies</li> <li>- Voluntary firefighting squads</li> </ul>	Enhance safety and increase the efficiency of suppression measures
<b>Recovery</b>	<ul style="list-style-type: none"> <li>- Natural regeneration</li> </ul>	Enhance recovery and biodiversity, re-establish normal life conditions

Table 1: Wildfire management in the Republic of Cyprus. *Source – [Department of Forests](#)*

Furthermore, apart from some cooperation with the authorities involved, there is no evidence of engagement between the municipalities and communities in wildfire management.

#### 4.4 Wildfire Management in the Republic of Cyprus

Table 1 demonstrates that the Forest Department places significant emphasis on prevention, preparedness, response, and recovery, and because this report focuses on the prevention strategies, we will discuss the fire prevention action below.

Several preventive measures are put into practice in Cyprus to reduce the likelihood of forest fires caused by the numerous factors listed in table 2; these include the following.:

- 4.1.1 Law Enforcement – The Cyprus Forest Law stipulates that it is strictly prohibited to light any fire within a distance of 1 km from the boundaries of the state forests. Anyone found to have caused a forest fire is liable to imprisonment for a term not exceeding five years or fine not exceeding eight thousand euros, or both, upon conviction.
- 4.1.2 Awareness campaign – since the majority of forest fires in Cyprus are of human origin, the Forestry Department has developed a comprehensive awareness campaign that seeks to secure the support and cooperation of the general public through a well-planned and directed publicity and educational programme.
- 4.1.3 Management of picnic and camping sites - To mitigate the risk of forest fires arising from picnickers and forest visitors, the Forestry Department has established picnic and camping sites within the forested area. These sites provide visitors with amenities such as fireplaces (for safe cooking fires), benches and tables, potable water, playgrounds, among others, where picnickers are concentrated instead of being scattered out without any supervision.

<b>Primary fire causes in Cyprus</b>
Burning grass – gorse or stubble by farmers
Fires caused by careless visitors and picnickers when using fire for cooking and grilling.
Military exercises with ammunition or explosives of any kind.
Hunting during the summer period
Burning of rubbish at non organized rubbish dumps
Fires caused by people or machines engaged in any activity associated with forest engineering and forest production
Some fires are caused by lightning, but these fires are not significant because these fires are usually accompanied by rainfall.
Burning cigarette ends and matches used by careless smokers

Table 2 – Causes of fire in the Republic of Cyprus. Source: *Department of Forest*

Although the Department of Forest (DoF) has implemented various measures that have significantly enhanced the wildfire prevention, there are still some factors that hinder effective wildfire prevention in Cyprus. These factors (mentioned in the next section) were identified during the researcher's examination of the barriers to interagency exchange and collaboration in wildfire management. The factors are substantiated by the [Assessment Report by the Audit Office of the Republic of Cyprus](#) and relevant remarks obtained from interview transcripts.

#### 4.5 Factors influencing wildfire prevention in Republic of Cyprus

**4.5.1 Availability of resources** – For an organization, it is most important that the resources are available and accessible to effectively manage wildfire programs (Miller et al., 2020). There are several key resources that are critical for effective wildfire prevention efforts, some of the resources from the case study includes:

**Personnel** – The availability of trained personnel, such as firefighters and other emergency responders, is essential for preventing and controlling wildfires. In Cyprus, the number of trained personnel available for wildfire prevention can vary depending on funding by the forestry department.

**Equipment** – Effective wildfire prevention requires access to specialized equipment, such as fire trucks, hoses, and other firefighting tools.

**Funding** – Adequate funding is essential for implementing effective wildfire prevention measures. This includes funding for personnel, equipment, training programs, and public outreach efforts.


**Technology** – Advancements in technology, such as early warning systems and remote sensing tools can greatly enhance wildfire prevention efforts. However, these technologies can be expensive to implement and maintain, which can limit their availability.


Effective wildfire prevention strategies can be challenging to implement without adequate availability of resources. In Cyprus, interviewees have indicated that a **lack of resources**, including data and funding, has made it difficult to keep up with the increasing risk of wildfires.




*“When there are two major flames blazing at the same time, like what happened in 2021 in Cyprus, resources cannot be shared. There should be more of them” – Firefighter 1, Cyprus, (2022).*



 “We will always struggle to plan ahead because we are using the same technologies from 90s and people are hesitant to bring in the change. Some people think what they are doing the best way” – Firefighter 2, Cyprus, (2022).

 “Improve training resources and budgets.”

4.5.2 **Employee training and situation awareness** – In order for the organization and its staff to completely carry out their purpose (in this case effective wildfire management), understanding of the situation and development of an operational picture is a key criterion in wildfire management (Berchtold et al., 2020). Employee training and situation awareness are crucial factors in wildfire prevention in Cyprus. As effective training programs can improve the knowledge and skills of employees, allowing them to be aware of their surroundings and any potential fire hazards, as well as any changes in weather conditions that may increase the risk of wildfires. This can also help them take proactive steps to prevent wildfires and respond quickly and effectively if a fire does occur.


 “Training is an important skill to have, and we are learning, we are getting there, the EU projects aim towards training the people to not only suppress wildfires but also to learn from researchers like yourself, is helping a lot, but we need more of it” – Firefighter 1, Cyprus, (2022).


4.5.3 **Organizational collaboration** – A degree of openness to adapting and learning from one another is necessary for collaboration and for planning the wildfire prevention strategies (Yung et al., 2022). The ability of organizations to adapt to collaborative arrangements, particularly in the context of dynamic and external environments, is facilitated by their technological infrastructure, flexibility, and culture (Doane et al., 2006; Black et al., 2008).

In the context of wildfire prevention in Cyprus, effective organizational collaboration is crucial for several reasons. Firstly, it can help to ensure that all relevant stakeholders

are involved in the prevention efforts, which can improve the effectiveness of those efforts. Secondly, organizational collaboration can help to ensure that resources are used efficiently and effectively. By working together, organizations can share information about the area's most at risk of wildfires, coordinate the allocation of resources such as firefighting equipment and personnel. Thirdly, organizational collaboration can help to build trust and foster a sense of shared responsibility among stakeholders. When different organizations work together towards a common goal, they are more likely to feel a sense of ownership and commitment to the success of the prevention efforts.


 *“We only coordinate during a wildfire event, not before that, not after that” – Volunteer, Cyprus, (2022).*


 *“Hierarchical power leads to conflicts in decision making, experienced advise is valuable but no harm in considering some new ideas.”*

 *“Collaborate and have better relationship with other European countries and have an international tie-up.”*


 *“Create centrally organized – unofficial firefighting teams of volunteers.”*


 *“Better networking opportunities for firefighters from around Europe”*

 *“Encourage engagement by expressing support from organizational leaders”*

 *“Provide incentives to families of fire fighters.”*

 *“Be in agreement with operational fire manager’s decisions.”*


 *“Harmonization of standard operational procedures to set a common ground for collaboration.”*

 *“It is important to understand where and with whom difference may arise, so it doesn’t conflict during a response activity”*


4.5.4 Government Law and Policies – Government policy plays an essential role in wildfire prevention by setting regulations and guidelines for land management, fire prevention, and suppression activities (Carreiras et al., 2014; Tedim et al., 2015; Kocher and Busic, 2017; Mockrin et al., 2018). Effective policies should be in place for the organization to engage more people to contribute to wildfire management programs and make sure that the conditions they offer are on par with the ones that government has and are adequately institutionalized (Colavito, 2021). However, the forest law of Cyprus does not cover a more holistic approach.


In Cyprus, the Forest Law (N. 25(I)/2012) clearly outlines the Director of the Department of Forests’ responsibility for designating and implementing measures to prevent and suppress forest fires within state forests and two kilometers from their demarcation lines. However, the DoF can only implement prevention measures within state forests, while the zone two kilometers from the demarcation line mostly comprises private plots and forest communities where the constitution’s Articles 16 and 23 safeguard the inviolability of residences and property rights, respectively.

Thus, by neglecting to enforce laws aimed at minimizing the probability of fires happening beyond their purview, there is ample space for mistakes to occur.

 *“There must be a body that brings all the stakeholders under one roof to discuss and plan the ways ahead before a wildfire strike not on the day of a wildfire” – Firefighter, Cyprus, (2022).*

 *“Revise current strategies more often than not.”*

 *“Incorporate local knowledge.”*


 *“Make a similar lexicon for European nations”*


4.5.5 Community Engagement – in the wildfire literature, much attention is given to community engagement, highlighting the sensitive issues of WHO should participate in decision-making (Eckerberg and Buizer, 2017).


Community engagement is a crucial factor that can influence wildfire prevention in Cyprus. It involves active participation and collaboration between the local community and relevant authorities, such as firefighting agencies and local governments, to raise awareness, educate, and promote responsible behavior towards reducing the risk of wildfires.

Through community engagement, residents can be encouraged to adopt preventive measures such as clearing dry vegetation and maintaining their properties, and to report suspicious activities that may lead to wildfires.

The researcher's own observation of the absence of community involvement was made during the Arakapas fire incident of 2021.

 *“People prefer approaches where the agency has to manage the landscape” – Forest Official, Cyprus (2022).*

 *“Some people are not interested in collaborating and learning unless they have suffered from a wildfire loss” – Firefighter, Cyprus (2022).*

 *“Include community in planning the wildfire prevention strategies near areas of high risk.”*

 *“Wildfire Education for all”*

## 5. Recommendations for Wildfire Management (Prevention) – towards a balanced strategy in Cyprus

Wildfire management strategies depend on people, administrative and resource contexts, and the geographic location under consideration (Paton, 2013; Blanchard and Ryan, 2003; Syphard and Keeley, 2015; Tedim et al., 2020). While wildfire prevention activities do not normally reduce the number of natural ignitions (National Wildfire Coordinating Group, 1998), Education, Enforcement and Administration can be effective in mitigating the losses in areas along with a historical data of natural caused ignitions (European Civil Protection; Swedish Rescue Service Agency, and Department of Forests Cyprus).

For example, an area with high hazard fuel containing summer homes and experiencing intense summer thunderstorms would be an area where effective fire prevention program can be designed to minimize damage and losses in case of lightning fire. Property owners in this situation can **receive education** on how to reduce hazardous fuels on their property and how to design using fire safe materials.

Such an example of successful wildfire preparedness through education and awareness campaign can be seen in [Firewise communities of Italy](#)

In this section, we provide some of the potential strategies for an effective wildfire prevention in Cyprus. The potential strategies discussed here are the result of the **interviews** conducted by the researcher in Cyprus.

The suggested preventive measures can be implemented on several levels in the fire-prone countries; however, it is important to keep in mind that the causes of the increased exposure in Europe differ geographically and along different socioeconomic scales, and that the degree of risk is influenced by a number of large-scale factors such as population growth, shifting settlement patterns, and changes in natural resource management practices (McCaffrey et al., 2020).

For example, to raise awareness for a large, targeted audience over a vast area, number of “**education**” initiatives such as media messages, school programs, public displays, etc., may be designed. While these strategies focus on the specific fire causes in Cyprus (table 2). It is crucial that reliable fire occurrence information is available and accessible. As the precise information on fire causes, locations, and dates will help in assessing which prevention measure and method would be most effective in addressing the specific fire cause and reducing the impact in a particular place.

**5.1 Following are some of the proposed actions towards streamlining Cyprus wide prevention strategies in wildfire management:**

**Collaborative Approach** – foster collaboration and partnership between EU countries, local communities, and stakeholders, including forest owners, land managers, fire officials, and firefighters. Encourage the sharing of knowledge, resources, and expertise in preventing, detecting, and managing wildfires.

For example, the “[National Operational Program for Forest Fire Control](#)” in Greece is a collaborative program that aims to prevent and manage wildfire through coordinated actions by various agencies, including the Ministry of Environment and Energy, the Hellenic Fire Service, and the Forest Service.

**Enhance preparedness** – increase preparedness by conducting regular risk assessments, developing evacuation plans, and improving communication system. Utilizing new technologies such as fire detection systems, drones, and satellite imagery for early detection and monitoring of wildfires.

For example, in Portugal, the [Integrated Rural Fire Management \(SGIFR\)](#) program was established in 2018, which aims to promote a coordinated and integrated approach to rural fire management. The program includes measures such as fuel reduction, and fire prevention education.

**Promoting prevention measures and land use planning** – encourage and support forest management practices that reduce the risk of wildfires, such as thinning, and grazing. Implementing strict regulations and enforcement mechanisms to prevent illegal activities that can cause wildfires. Prioritizing land use planning that reduces the risk of extreme wildfires, particularly in high-risk areas such as forests, grasslands, and shrublands. This can be achieved through measures such as zoning regulations.

For example, Italy has developed a [National Forest Fire Prevention Plan](#) that aims to reduce the risk of wildfires through better land management practices.

**Increasing public awareness** – raise awareness among the general public of the dangers of wildfires, the role they can play in preventing them, and the need for responsible behavior. Using age-appropriate education campaigns, social media, and community engagement to spread awareness and encourage public participation.

For example, Italy has implemented a [National Fire Prevention week](#), which include public awareness campaigns and educational programs on fire prevention and safety measures.

**Improve coordination** – improve coordination among different agencies and stakeholders involved in wildfire management, including the national and local authorities, emergency services, and civil protection agencies. Establish clear lines of communication and collaboration to ensure a timely and effective response to wildfires.

For example, In Spain, the National Plan for the Prevention and Control of Forest Fires ([INFOMA](#)) was established in 2006 to coordinate the response to wildfires. The Plan includes representatives from various agencies, including the fire service, police, and civil defense, as well as volunteers and private companies.

Similarly, in Portugal, the National Civil Protection Authority ([ANPC](#)) is responsible for coordinating the response to wildfires. The ANPC includes representatives from various agencies.

**Research and innovation** – invest in research and innovation to develop new technologies, practices, and strategies to prevent and manage wildfires. Develop a knowledge base of best practices and share it across the neighboring states and with EU to enhance prevention efforts. For example, in Finland, the Finnish Meteorological Institute (FMI) conducts research on wildfire prevention and management. The FMI develops new technologies and strategies for predicting and monitoring wildfires, as well as providing training and education on wildfire management.

Similarly, in Spain, the Center for Forest Fire Research ([CIFOR](#)) was established in 1987 to conduct research on wildfire prevention and management. The center collaborates with various stakeholders, including universities, government agencies, and private companies.

Since these measures were developed based on the interviews conducted during research in Cyprus, they specifically target certain causes of wildfire in Cyprus. However, these recommendations can be implemented in any country that is susceptible to fire. Though, it is important that precise information regarding fire occurrence and causes are available and accessible. Without this information, it is challenging to determine the areas that require improvement in order to manage the risk of fires.

Furthermore, the following table provides an exhaustive list of education measures which may be considered in planning for wildfire prevention strategies in Cyprus. **Education** to raise awareness among the community is critical in preventing wildfires in Cyprus because many *wildfires in Cyprus are caused by human activity*, such as careless use of fire or littering, and can be prevented by changing human behavior. By **educating the public about the causes of wildfires, the risks associated with them, and how to prevent them, people can take action to reduce the likelihood of wildfires starting**. This involves the following activities to be taken into account to reduce the likelihood of occurrence of unwanted wildfires.

WILDFIRE PREVENTION STRATEGY			
EDUCATION – initiatives that use awareness and education			
Community	Media	Signage and high visibility public contact	Public education
<ul style="list-style-type: none"> <li>Deliver homeowner fire safety resources (<a href="#">FireWise</a>)</li> <li>Deliver fire safety programs in conjunction with community association (<a href="#">Forest Intervention Zone</a>)</li> <li>Organizing and getting involved in neighborhood town meetings (<a href="#">Building Fire Resilient Communities</a>)</li> <li>Organize collaborative activities through yearly and bi-yearly campaigns (spring clean-up, neighborhood watch, weed abatement program)</li> </ul>	<ul style="list-style-type: none"> <li>Prepare Public service announcement.</li> <li>Coordinate the local stations’ participation in the national fire prevention program.</li> <li>Airing recurring radio and television messages about benefits of fire prevention activities and community programs.</li> <li>Release timely news to local printed media.</li> <li>Training media personnel on effectively communicating about wildfire (<a href="#">national Day Radio</a>)</li> </ul>	<ul style="list-style-type: none"> <li>Develop and annually update the fire prevention sign plans such as location signs (highway, road, etc.), type of message (seasonally)</li> <li>Maintain and repair current signs.</li> <li>Create engine patrol routes and use them in need such as on vacations, weekends.</li> <li>Creating interagency education programs to maintain high visibility of fire prevention effort.</li> </ul>	<ul style="list-style-type: none"> <li>Take part in educational initiatives like fairs, exhibits, and service groups to keep preventative efforts visible (school campaign in Cyprus)</li> <li>Create and lead a fire prevention month or week (<a href="#">Wildfire Awareness Month</a>)</li> <li>Run outdoor fire safety campaigns.</li> <li>Create a safety equipment education campaign.</li> <li>Create and conduct character appearances programs as per standard guidelines (<a href="#">Respectthe Flame</a>).</li> <li>Create bilingual and multicultural fire prevention such as team teaching, special use permits, fire regulations</li> </ul>

Table 3: Proposed educational wildfire prevention strategies with evidence from effective initiatives from other countries. Source – P.Pandey (2023), Interviews.

In conclusion, the recommendations for wildfire prevention strategies are a result of the literature review carried out for researcher’s thesis, along with the interviews conducted to



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understand the barriers that hinder the integrated approach. Additionally, it might be helpful to evaluate and implement the suggested measures in a Europe-wide context.

## 6. Conclusions

Wildfires are significant and recurring threat in Cyprus. The combination of high temperatures, low humidity, and strong winds creates favorable conditions for wildfires to ignite and spread rapidly. In recent years, wildfires in Cyprus, such as the one that occurred in 2021 in the Arakapas region, have caused significant damage to forests, vegetation, and infrastructure, and have posed a serious threat to human lives and property. Additionally, wildfire management in Cyprus is generally concentrated towards suppression efforts. Therefore, shifting towards integrated wildfire management approach might prove to be a helpful a solution that can help reduce the likelihood of a fire starting and control the spread and intensity of fire in Cyprus.

As a result, examining the factors to the implementation of wildfire prevention strategies is a useful first step in determining the gaps in integrated wildfire management. This deliverable first identified the barriers to wildfire prevention in Cyprus, then it provided a comprehensive list of suggestions and a list of education initiatives built around those suggestions.

Furthermore, Cyprus can also benefit from the curation of a wildfire prevention strategies guide which is also a part of the researcher's thesis (Pandey. P., 2023 – Wildfire Management in Cyprus (pending)).

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**Appendix 1 – Additional Reading and List of initiatives and projects with links, along with other preventive strategies within the EU countries**

- [ArcFUEL Project](#) – Mediterranean fuel maps geodatabase for wildland and forest fire safety
- [ASSESSMENT OF THE EFFECTIVENESS AND ECONOMY OF THE MEASURES IMPLEMENTED BY THE DEPARTMENT OF FORESTS IN RELATION TO FOREST FIRE PREVENTION](#)
- [Avaliação dos Incêndios ocorridos entre 14 e 16 de outubro de 2017 em Portugal Continental](#) – Fire risk assessment in Portugal
- [CAP - European Agricultural fund for rural development](#)
- [Cost-efficient integration of megafire prevention into forest management in the Mediterranean](#) – Life+ project
- [Common Agricultural Policy](#)
- [EU Forest Strategy](#)
- [Fire brings new life to woods](#) – The Life Taiga Project: this report discusses the overview of the project results.
- [Forest Fires in the Alps](#) – this report discusses the state of knowledge, future challenges, and options for an integrated fire management.
- [Forest Fire Protection](#) – Self-protection against forest fires
- [Global Assessment Report on Disaster Risk Reduction](#) – Fuel breaks: a part of wildfire prevention
- [GRAZELIFE project](#) – Grazing for wildfire prevention ecosystem services, biodiversity, and landscape management.
- [Hellenic Society for Protection of Nature](#) – HSPN and the Institute of Forest Ecosystems in Greece mobilized local citizen of Kythira island to prevent, and better response to, future wildfires.
- [JRC Technical Report](#) – European wildfire danger and vulnerability in a changing climate: towards integrating risk dimensions
- [Land-based wildfire prevention](#) – EU report on principles and experiences on managing landscapes, forests and woodlands for safety and resilience in Europe
- [National Operational Program for Forest Fire Control](#)
- [Operational tools and guidelines for improving efficiency in WF reduction in EU landscapes](#) – An EU Sponsored “FIREfficient” project report.
- [Pla de Prevenció en Urbanitzacions](#) – Forest Fire Prevention Program in Urbanizations and Population Nuclis (PPU)
- [Prevention of fires and other incidents](#) – Report and recommendations, European Civil protection and Swedish Rescue Services Agency
- [PREVENTIVE LIVESTOCK GRAZING](#) – RAPCA Programme where goat and sheep farmers are rewarded for helping with biomass reduction in fire-prone landscapes.
- [Prescribed Fire Training Exchange](#) – TREX ANDALUCIA 2019
- [Safe and Resilient Forests](#) – commission works for wildfire prevention in Europe and globally.
- [Story Maps](#) – Development of wildfire management strategies in Ireland. Examples from Cuilcagh and Sliabh Beagh Protected Areas, PCF, 2021
- [The Strategic Plan for the Prevention and Fight against Forest Fires in Cantabria 2017 - 2020](#) – this report covers the 6 general objectives and 27 specific objectives concentrated in the area of prevention.