Horizon Europe (HORIZON)

SEMEDFIRE
South Eastern Mediterranean
Excellence Development in Fire Research

Project number:	101079337
Project name:	South Eastern Mediterranean Excellence Development in FIre REsearch
Project acronym:	SEMEDFIRE
Call:	HORIZON-WIDERA-2021-ACCESS-03
Topic:	HORIZON-WIDERA-2021-ACCESS-03-01
Type of action:	HORIZON-CSA
Service:	REA/C/03
Project starting date:	fixed date: 1 December 2022
Project duration:	36 months

D4.3 Integrated Fire Management Strategy for Cyprus and the Region

Work Package	WP4
Deliverable Number	D4.3
Lead Partner	European University Cyprus (EUC)
Deliverable Type	R – Report
Dissemination Level	PU – Public
Due Date	Project Month-30 | 31/05/2025
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SEMEDFIRE has received funding by the European Union's Horizon Europe Programme, under Grant Agreement no. 101079337.

Version	Date	Changed page(s)		Cause of change	Partner
V1	07/02/2025	First draft			EUC
V2	20/02/2025	General review		Global review by Michael Cacciapaglia (WUR)	WUR
V3	14/03/2025	All remarks and comments from reviewers		Refinement by EUC (Matthieu Jost, Pierantonios Papazoglou)	EUC
V4	31/03/2025	General Review		Further Refinement by EUC (Matthieu Jost)	EUC
V5	16/04/2025	Final Draft to be reviewed and validated by Steering Committee		Validation by Steering Committee AND by Quality Assurance Managers	EUC
V6 (SyGMa submission)	07/05/2025	Final Draft reviewed and validated by Steering Committee		Incorporation of any Validations by Steering Committee AND by Quality Assurance Managers, and submission to SyGMa	EUC

Table of Contents

1 Introduction

The "South-eastern Mediterranean Excellence Development in Fire Research – SEMEDFIRE" project is funded by the European Commission, through Grant Agreement no. 101079337, under its HORIZON EUROPE Programme, and more particularly within the WIDERA-2021-ACCESS-03-01 Twinning Topic. In full alignment with the WIDERA-Twinning-topic's requirements, SEMEDFIRE aims to enhance the capacities and knowledge-acquisition of the Widening institution; EUC, in Research-&-Innovation (R&I) and Research-Management-Administration (RMA) relating to Fire Safety and Fire Management. This is aimed through networking activities with five top-class leading counterparts at EU level: IMPERIAL COLLEGE, WAGENINGEN UNIVERSITY, PAU COSTA FOUNDATION, FRENCH GENERAL DIRECTORATE OF CIVIL SECURITY AND CRISIS MANAGEMENT and NIMES-Metropole, which represent a multifaceted, but complementary and synergistic, 'geography' of R&I philosophies and approaches, comprising:

- two leading Academic institutes in the areas of fire safety and integrated fire management;
- a leading Foundation in investigating fires and community engagement;
- a Governmental Agency leading the EU effort in operationally combating wildfires;
- an Agglomeration of Municipalities providing the tangible example of local governance in wildfires;
- representation of both Member States and an Associated Country;
- linking of the European Research Area (ERA) in a "compass" fashion: from north (UK) to central Europe (FR, NL), to the west (ES), and to the Mediterranean biogeographical region (ES, FR, CY) and its South-Eastern area (CY).

The networking-for-excellence and twinning-contributions of the internationally leading Advanced Partners in knowledge transfer and capacity building, focus on both EUC and its surrounding targeted stakeholders from public governance, industry/ entrepreneurship, and civic society, at local and regional levels. It is hence scoped to raise the profile and reputation of EUC to such a level of ERA-excellence that it will be able to become a lighthouse of spreading fire-science excellence in Cyprus and the SE Mediterranean.

The document at hand, in accordance with the Grant Agreement (GA), constitutes Deliverable **D4.3 Integrated Fire Management Strategy for Cyprus and the Region**, prepared by the Widening Institution; European University Cyprus (EUC), collaboratively and with strong support from the Advanced Partner Wageningen University (WU). Deliverable D4.3 constitutes the culmination of the work of Work Package 4 (WP4) and highlights how the Widening Institution EUC puts to tangible use and praxis the expertise and knowledge transferred by the Advanced Partner WU.

Contextualization for the Present Strategy document

In Cyprus, wildfires have been part of the picture for ages but today climate change and land abandonment have increased the vulnerability of its eco-systems and the risk of large wildfires. As outlined by our consortium in a recent letter to Nature[1], fire suppression is under great pressure, and there is a strong need to strengthen fire prevention through methods such as valuing living rural areas and improving landscape resilience through vegetation management. An integrated fire management approach could support a paradigm shift and a correspondingly strong change in behaviours, when also considering fire as an efficient technical tool for fire prevention.

[1] Stoof, C., M. C. Ribau, P. F. Moore, and G. Boustras. 2025. To solve the global wildfire crisis, don't just focus on flames. Nature **637**:34-34

Under the Auspices of the Ministry of Agriculture Rural Development and Environment (MARDE) of the Republic of Cyprus (RoC), through the SEMEDFIRE EU-funded project, and complementary under the Auspices of the Office of the Environment Commissioner of the Republic of Cyprus through the RESALLIANCE EU-funded project, the Centre-of-Excellence in Risk and Decision Sciences (CERIDES) of the European University Cyprus (EUC) brought together a great diversity of actors to support the development of integrated fire management in Cyprus. During participatory workshops, EUC-CERIDES facilitated participation from experts from Cyprus and across Europe to share their knowledge and to progressively develop, in collaboration with the participants (list of organisations involved Chapter 7), a strategy and action plan for becoming a country more resilient to wildfire. In this work, contrary to past approaches that were more focused on wildfire suppression, a greater emphasis was placed on wildfire prevention, land management and collaboration between firefighters, foresters, farmers, livestock breeders, landowners, local communities and authorities to improve landscape resilience.

Drawing upon the discussion with the stakeholders involved (governmental authorities, civil society organizations, private companies and research institutes), **12 key challenges were identified with specific objectives in the short and medium term to better protect the lives, infrastructures and ecosystems of Cyprus from uncontrolled wildfires**. They are listed on the next page and briefly presented in the chapter 3. This analysis is a starting point, inviting stakeholders of Cyprus to more deeply consider how they could actively participate in this change to build up a more fire-resilient island.

12 key challenges for an integrated fire management in Cyprus to better protect lives, infrastructures and ecosystems from uncontrolled wildfires

Governance and Policies

- CHALLENGE 1 – Develop a long-term vision and a prioritized plan with short- and long-term actions to better protect people, infrastructures and ecosystems from destructive wildfires.
- CHALLENGE 2 – Identify a lead agency for coordination and facilitation, assign responsibilities to key stakeholders for implementing and monitoring the integrated fire management action plan.
- CHALLENGE 3 – Adopt policies and regulations for management of fuel (biomass) to facilitate implementation of fire prevention and mitigation measures, including controlled grazing and prescribed burning.

Land Planning and Land Abandonment

- CHALLENGE 4 – Develop land planning by defining strategic management areas to better protect lives, infrastructures and ecosystems and to create safer conditions for firefighters when responding to wildfires.
- CHALLENGE 5 – Manage the fuel load through adequate fuel reduction interventions prioritizing the wildland-urban-interface and the strategic management areas.

Cooperation and Coordination

- CHALLENGE 6 – Facilitate intersectoral discussions at national and local level involving local authorities and local population/volunteers in training and coordination to better involve them in prevention and suppression measures.
- CHALLENGE 7 – Encourage a better cooperation at regional and international level to foster preparedness and capacity for suppression and improve collectively the resilience of the region to wildfire by sharing best practices on preventive measures.

COMMUNICATION AND EDUCATION

- CHALLENGE 8 – Develop a communication strategy to improve the knowledge of citizens on how to prevent wildfires and get more involved in protecting themselves and their environment from destructive wildfires.
- CHALLENGE 9 – Educate society to better live with fire and advocate for a proper use of fire (prescribed and controlled burning) to reduce the impact of wildfires and protect biodiversity.

DIGITAL INFORMATION MANAGEMENT AND INNOVATION

- CHALLENGE 10 – Develop wildfire risk analysis; harmonize and share fire information across sectors via a common GIS fire database with a standardized methodology.
- CHALLENGE 11 – Improve digital operational communication systems and early fire-detection through testing and adoption of adequate new technologies.

FINANCIAL MECHANISMS

- CHALLENGE 12 – Develop financial mechanisms to support wildfire management measures, especially for prevention measures (e.g. agroforestry, controlled grazing, prescribed burning) prioritized on strategic management areas.

2 Vision on Wildfire Management for Cyprus

The first goal of wildfire management is to **protect lives, infrastructures and ecosystems.** The vision developed during the past two years of consultation in the SEMEDFIRE project is that this will only be achieved through horizontal **and intersectoral planning** with the engagement of a large part of the society's stakeholders. Wildfire management needs a clear risk analysis and a land planning strategy with the involvement of state agencies in charge of urban planning as well as local authorities supported by NGOs. The core points of the joint vision we developed with the diversity of stakeholders involved are:

- Effective wildfire management in Cyprus can only be achieved through a **preventive strategy increasing the landscape resilience.** While suppression efforts remain essential, today there is growing global agreement that large wildfires should also be addressed through effective preventive vegetation management. **Supporting living rural landscapes and empowering local communities** are the only ways to reduce land abandonment, a key factor in the increasing vulnerability of rural Cypriot communities to wildfire.
- **Traditional practices, such as agro-pastoralism, drystone walling and traditional burning, have key roles to play in wildfire management** in Cyprus. If innovation and technology are encouraged especially for fire detection and propagation, traditional practices should be also supported through a specific framework with regulatory tools and a funding scheme.
- The **technical use of fire (also known as prescribed burning) can be a key element in prevention to reduce the intensity of large wildfires.** Prescribed burning is a technical tool that should only be managed by trained people and authorized by governmental agencies. Traditional burning can have a role to play in wildfire management, but it should be implemented only in very specific conditions. Alternative solutions to traditional burning like grazing, pruning, energy generation or composting should be encouraged and supported as well.
- Investing in prevention, supporting rural living communities and implementing an ambitious vegetation management programme can reduce the number of wildfires, their intensity and the number of lives lost and infrastructures destroyed. Protecting and preserving ecosystems, such as forests and other natural areas, can also protect society and ecosystems from other natural hazards (e.g. heatwaves and floods).

3 Key challenges for an integrated wildfire management in Cyprus

As presented in the introduction, drawing upon the discussion with the stakeholders involved (governmental authorities, civil society organizations, private companies and research institutes), 12 key challenges were identified with specific objectives in the short and medium term to better protect the lives, infrastructures and ecosystems of Cyprus from uncontrolled wildfires. They are briefly presented below. This analysis is a starting point, inviting stakeholders of Cyprus to more deeply consider how they could actively participate in this change to build up a more fire-resilient island.

3.1 Governance and Policies

Today in Cyprus, there is not one agency in charge of integrated fire management, but the Department of Forests (DoF) oversees preparing and implementing an integrated forest fire management system. Nevertheless, its area of responsibility is the public forests and a buffer of 2km around them with the Cyprus Fire Service (CFS) being in

charge of fire suppression outside these areas. An adequate wildfire fire governance and legislative framework would foster long-term planning and investments in integrated fire management and facilitate the development and enforcement of laws and regulations concerning the use of fire. We also advise the Republic of Cyprus to consider promoting and regulating the use of prescribed burning, controlled agricultural fires, traditional fires and grazing. The development of long-term planning needs a leading agency to facilitate inter-ministerial consultation and cooperation with local authorities. Currently the governmental body responsible for planning integrated fire management is the DoF. At the moment, the Republic of Cyprus, based on a Technical Support funded by the European Commission, is in the process of reinforcing its National Civil Protection Mechanism. It is anticipated that the responsibility for managing IFM will still be under the DoF.

CHALLENGE 1 – Develop a long-term vision and a prioritized plan with short- and long-term actions to better protect people, infrastructures, and ecosystems from destructive wildfires.

- **Short-term objectives:**
  - Improve understanding of key stakeholders regarding the content and importance of an integrated fire management strategy and action plan.
  - Communicate the present co-built integrated fire management strategy to prioritize short-term actions and responsibilities for each risk management phase.
  - Support the international Landscape Fire Governance Framework (see chapter 4.5) to raise the need for integrated fire management policies and regulations at European level.

- **Medium-term objectives:**
  - Develop an adequate fire governance framework and elaborate an official and validated vision on fire management in Cyprus for 15 to 20 years with operational guidelines.
  - Ensure good cohesion between the Cyprus fire management strategy and others European and national policies, strategies and action plans.

CHALLENGE 2 - Identify a lead agency for coordination and facilitation, assign responsibilities to key stakeholders for implementing and monitoring the integrated fire management action plan.

- **Short-term objectives:**
  - Ensure coordination and facilitation on fire management through a technical working group managed by the Ministry of Agriculture, Rural Development and Environment.
  - Reinforce the role and capacity of the Department of Forests regarding fire prevention in all non-urban areas through training and adequate equipment.

- **Medium-term objectives:**
  - Identify the governmental authority in charge of leading the elaboration and implementation of an inter-ministerial fire management strategy and action plan.
  - Define clear responsibilities of each identified key stakeholder for fire management regarding planning, prevention, preparedness, suppression and recovery measures.

CHALLENGE 3 - Adopt policies and regulations for management of fuel (biomass) to facilitate implementation of fire prevention and mitigation measures, including controlled grazing and prescribed burning.

- **Short-term objectives:**
  - Define new regulations for land management in the rural urban interface and strategic management areas facilitating the use of prescribed burning and controlled grazing.
  - Adopt and implement strict regulations to reduce the number of wildfires from intentional causes and negligence, particularly during days of high fire danger.
- **Medium-term objectives:**
  - Consolidate the different laws dealing with fire management into a global set of policy and regulations.
  - Validate the responsibilities of key stakeholders on the different wildfire risk management phases through a new wildfire policy and regulations.

3.2 Landscape planning and land abandonment

Similar to managing flood risk, dealing efficiently with wildfire risk means first ensuring adequate landscape planning to mitigate the impact of wildfires. In addition, wildfire ignitions are mainly due to human activities; as such their spread could be reduced through landscape planning and land management. In Cyprus, as in the whole Mediterranean, a large portion of the rural population moved to urban areas during the past decades, leading to the current situation of widespread land abandonment and its subsequent buildup of dry vegetation leading to high levels of wildfire risk. Valuing rural areas is part of a strategy which aims to improve land management through adequate fuel (vegetation) reduction interventions that reduce the wildfire risk. Priority should be given to the rural urban interface and strategic management areas (see Glossary, Ch. 6) aiming to prevent the occurrence and intensity of wildfires. Urban planners should be made more aware of wildfire risks and mitigation measures to restrict the construction of new infrastructure in high-risk areas. Otherwise, there is a possibility that Cyprus reaches a point where insurance companies may decide to no longer insure against wildfire in these high-risk areas.

CHALLENGE 4 - Develop land planning by defining strategic management areas to better protect lives, infrastructures, and ecosystems and to create safer conditions for firefighters when responding to wildfires.

- **Short-term objectives:**
  - Implement an initial simplified risk analysis to identify strategic management areas where preventive measures should be prioritized.
  - Train people who are involved in land and urban planning on wildfire risk management, especially regarding the rural urban interface and associated measures.
- **Medium-term objectives:**
  - Develop a long-term vision to adapt forest management to climate change and more extreme weather conditions (e.g. wildfire, drought, floods, heat waves).
  - Develop a legal framework that supports partnerships between landowners, local authorities, and government to reduce wildfire risk in strategic areas.
  - Take in consideration wildfire risk in land planning documents by developing a landscape management strategy to better adapt to climate change.

CHALLENGE 5 - Manage the fuel load through adequate fuel reduction interventions prioritizing the wildland-urban-interface and the strategic management areas.

- **Short-term objectives:**
  - Enhance fuel management through pilot projects on prioritized areas with communities actively involved in prevention and suppression activities.
  - Train a team within the DoF for the implementation of prescribed burning and implement an initial prescribed burning plan supported by experts.
- **Medium-term objectives:**
  - Create value outside state forests to reduce land abandonment, especially through green firebreaks (agroforestry and vineyards) and institutional support for controlled grazing.
  - Define a multi-year prescribed burning plan focused on strategic management areas and the rural urban interface, with adequate training and qualification programme.

3.3 Cooperation and Coordination

All stakeholders have a role to play in fire prevention, and cooperation is essential at both local and regional levels. Facilitating a living and constructive wildfire community is the best way to raise the understanding of the main issues to be addressed for wildfire management and ensure implementation of the necessary and coordinated actions. This coordination should occur not only during fire season but on a more permanent basis with even more activity outside of the fire season when stakeholders involved in fire suppression are more available for workshops and training. A framework and specific operational procedures should be progressively clarified for coordination on prevention and suppression measures. At the southeastern regional level, the RoC has illustrated its willingness to be a pillar of stability in regional collaboration (in SE Mediterranean) with a focus on wildfire management. An example of this is the joint declaration between the Hashemite Kingdom of Jordan and the RoC to collaborate in the establishment of a regional air firefighting base in Cyprus. This was followed by stationing throughout the fire season 2024 of a number of Jordanian and Egyptian aerial firefighting means in Cyprus; this is anticipated to continue in 2025. We believe that the present cooperation could be extended to the complete wildfire risk cycle by collaborating on prevention, mitigation and recovery measures.

CHALLENGE 6 - Facilitate intersectoral discussions at national and local level involving local authorities and local population/volunteers in training and coordination to better involve them in prevention and suppression measures.

- **Short-term objectives:**
  - Update operational fire suppression and evacuation plans to clarify roles and responsibility of leading agencies and local authorities in preparedness and suppression operations.
  - Develop training for fire volunteers' teams in prevention and pre-suppression actions and improve coordination mechanisms with authorities.
  - Ensure better involvement of local authorities in wildfire management through training and engagement in decision making, especially to identify adequate preventive and preparedness measures tailored to the local socio-economical context.

- **Medium-term objectives:**
  - Ensure coordination and facilitation of fire management through a technical working group managed by the Ministry of Agriculture, Rural Development and Environment.
  - Develop a legal framework to register volunteers and ensure their safe and adequate participation in fire management in prevention and pre-suppression actions.

CHALLENGE 7 - Encourage a better cooperation at regional and international level to foster preparedness and capacity for suppression and improve collectively the resilience of territories to wildfire by sharing best practices on preventive measures.

- **Short-term objectives:**
  - Promote regional cooperation on wildfire management by pooling means and facilitating coordination during the fire season.
  - Facilitate regional and international exchanges of best practices between countries under similar climatic and wildfire risk conditions.
- **Medium-term objectives:**
  - Build up a regional alliance for wildfire management to enhance capacities for the implementation of integrated fire management and enhancement of resilience to climate change.
  - Promote international cooperation, through agreements, training and qualification programmes and courses, digital platforms and the use of operating standards that support the sharing of knowledge and good practices, as well as the use of data
  - Participate actively in the reduction of carbon emission in the region to limit global warming and its associated impacts, such as extreme weather conditions that increase wildfire risk.

3.4 Communication and Education

Communication regarding the topics of wildfire should be based on a proper risk analysis to target the most relevant audience with specific messages aimed at reducing fire ignition and propagation. In Cyprus, people are used to deal with wildfire historically, but climate change and the land abandonment issue now call for a drastic change in behaviors to avoid catastrophic developments in coming years. Firstly, wildfire is not the exclusive responsibility of the CFS or the DoF. It's a shared responsibility of all stakeholders, and involvement of all citizens is needed, especially in rural areas. More than a communication strategy, an education program is needed to improve the understanding of wildfire management and enhance the resilience of rural communities and their environment. In addition, the use of fire should be better regulated, on one hand to facilitate its use as a tool for fire management by skilled and certified people (prescribed burning) but also to update its traditional use to modern standards that ensure a safer use, preserving ecosystems and avoiding uncontrollable wildfires.

CHALLENGE 8 - Develop a communication strategy to improve the knowledge of citizens on how to prevent wildfires and get more involved in protecting themselves and their environment from destructive wildfires.

- **Short-term objectives:**
  - Implement a pilot prevention and preparedness program in affected and at-risk communities to assess vulnerability and improve resilience of the communities and their environment.

- Develop an adequate communication campaign that spreads awareness of the need to improve vegetation management before fire season begins each year, focused on rural and peri-urban population with targeted messages to each stakeholder group (e.g. residents, landowners, tourists/visitors, migrants, etc.).

- **Medium-term objectives:**
  - Develop sectoral and local wildfire communication programs based on the outcome of statistics, reports and risk perception analysis as well as the knowledge, interests and needs of communities involving media to better reach target audience
  - Create a communication and education plan on risk prevention and climate change (including wildfire management) for educational institutions using creative methods.

CHALLENGE 9 - Educate society to better live with fire and advocate for a proper use of fire (prescribed and controlled burning) to reduce the impact of wildfires and protect biodiversity.

- **Short-term objectives:**
  - Pilot test prescribed burning and highlight demonstration results to develop specific recommendations to facilitate its adequate use in Cyprus by the DoF.
  - Assess the use of traditional burning to better regulate its use during fire season and promote the use of alternative technics.
- **Medium-term objectives:**
  - Integrate education about the cultural use of fire in the education plan on risk prevention and climate change for scholarly institutions.
  - Value rural areas and environment protection through dialogue and participation of citizens in vegetation management actions (like mechanical clearing around villages to create defensible space).

3.5 Digital Information Management and Innovation

Technology and innovation should strengthen the understanding of the fire risk in Cyprus and support adoption of adequate and responsive measures for prevention and suppression efforts. A technical working group on wildfire risk including governmental and research agencies would enhance data-sharing to merge efforts and generate more collaborative projects that complement each other, rather than supplement. This working group would be able to create an accessible and comprehensible GIS database on wildfire (probable cause, starting point, burnt area delimitation, date) which should be shared to facilitate studies to improve fire prevention and suppression. The wildfire risk analysis should focus on the vulnerability of people, buildings, and ecosystems, especially using fire modelling[2]. Social science studies to better understand the human-caused ignition process would be needed to better target the communication campaign and reduce accidental fire ignitions by people. We advise a single authority to be responsible for developing and/or coordinating wildfire risk assessment processes at the national level and across various sectors.

CHALLENGE 10 - Develop wildfire risk analysis; harmonize and share fire information across sectors via a common GIS fire database with a standardized methodology.

- **Short-term objectives:**
  - Clarify and harmonize wildfire investigation procedures to have a systematic standardized continuous data collection process (fire occurrence, behavior, cause, impacts).

[2] See final deliverable 3.3 of SEMEDFIRE on Basic-Fire-Management-Suite, Chapter 6 on Fire Modelling Tools

- Harmonize and share with relevant services and research institutes a wildfire GIS database to improve understanding of wildfire risk in Cyprus.

- **Medium-term objectives:**
  - Develop fire risk analysis in Cyprus to better understand local and regional fire regimes and identify strategic management areas to prioritize necessary preventive measures.
  - Train fire analysts in the DoF to improve their skills in preventing and suppressing wildfire in Cyprus.

CHALLENGE 11 - Improve digital operational communication systems and early fire detection through testing and adoption of adequate new technologies

- **Short-term objectives:**
  - Improve communication tools for the general public and responsible authorities for prevention, preparedness and emergency.
  - Test and develop the use of smart sensing devices for early detection and real-time monitoring and support innovation in this domain.
- **Medium-term objectives:**
  - Use a fire propagation model to improve prediction and response by improving the fire-modelling capacity of the relevant authorities (DoF).

3.6 Financial Mechanisms

Fire management is not a service for which citizens pay directly like water. Therefore, the introduction of new financial mechanisms or adaptation of the existing ones are called for. In Cyprus, the Common Agriculture Plan gives some subsidies for a few fire prevention measures through the Cyprus Organization of Agricultural Payments (CAPO), but they are insufficient to ensure a substantial change in the landscape. Firstly, pilot initiatives to improve community engagement and vegetation management need to be promoted and funded. Then, these initiatives should prompt the opportunity to develop a global framework (policy and regulation) with associated financial mechanisms to extend their impacts by engaging new communities. If ensuring a good financing of preparedness and suppression is essential, developing new financial opportunities to promote fire prevention is the real shift needed to better protect our lives, infrastructures, and eco-systems.

CHALLENGE 12 - Develop financial mechanisms to support wildfire management measures, especially for prevention measures (e.g. agroforestry, controlled grazing, prescribed burning) prioritized on strategic management areas.

- **Short-term objectives:**
  - Increase state budget allocated to wildfire management initiatives, especially preventive measures, through existing financial mechanism (CAP funding).
  - Promote the use of incentives or tax deduction for clearing dry vegetation around houses and villages to create defensible space (rural urban interface).
- **Medium-term objectives:**
  - Assess the possible contribution of the insurance companies through a surcharge on insurance policies for natural hazards or other financial mechanisms.
  - Develop a financial mechanism to widely promote vegetation management measures like controlled grazing in strategic management areas and the rural urban interface.

4 Call for an integrated fire management in Cyprus

4.1 High wildfire risk in Cyprus

Cyprus is the third largest island in the Mediterranean with an area of 9251 km^2 (925,148 ha); it is situated at the southeast of the Mediterranean basin, just northwest of the coast of the Middle East. 42% of the total area of the island is covered with natural vegetation (Land Cover 2020[3]) of which:

- 19% is covered by high coniferous forests,
- 14% is covered by Maquis vegetation (shrubs),
- 9% by Garique vegetation (dwarf shrubs)

The Department of Forests (DoF)[4], which manages state forests, has the responsibility for wildfire prevention, suppression and restoration. DoF is a Department of the Cyprus Ministry of Agriculture, Rural Development and Environment (MARDE)[5]. The natural forests of Cyprus, as well as the newly established plantations, consist of thousands of hectares of resinous pine trees like the Calabrian pine (*Pinus brutia*), the Black pine (*Pinus nigra*), the Cedar (*Cedrus brevifolia*) and the Cypress (*Cupressus sempervirens*). The pine overstory is always associated with understory vegetation of bush species and other herbaceous plants which dry out during the summer period.

Figure 1: Natural stand of Pinus brutia

Figure 2: Natural stand of Pinus nigra

Figure 3: Natural stand of Cedrus brevifolia

According to the DoF, fire is by far the most destructive single agent, threatening the forests of Cyprus, and no real progress can be made in forest development unless the forests are adequately protected. The long, hot and dry summers, the frequently strong winds, the composition of the topsoil layer and the flammability of the vegetation all favor the outbreak and quick spread of fires. Furthermore, urbanization, the abandonment of rural areas, and the climate crisis have raised the fire risk to very high levels.

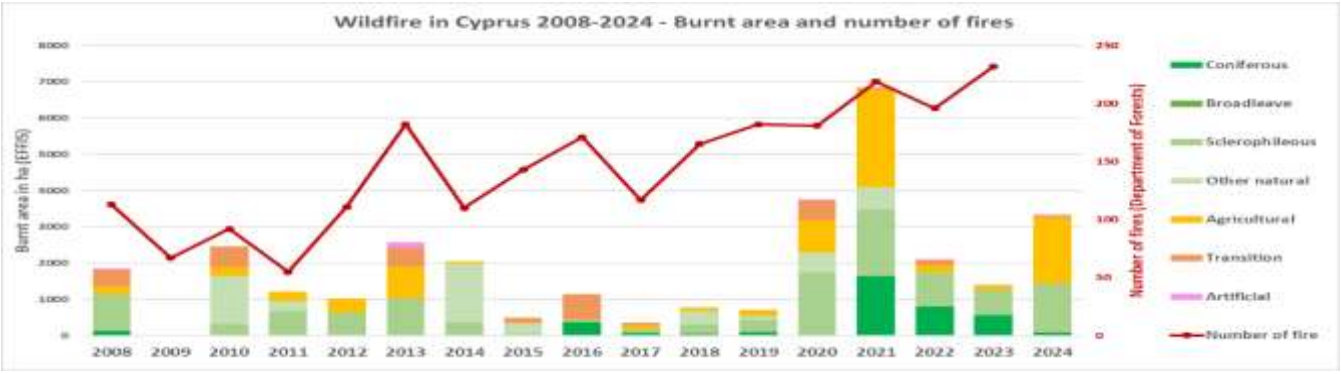

Figure 4: Burned area and number of fires in Cyprus. EUC-CERIDES from available EFFIS and Republic of Cyprus database

[3] European Space Agency WorldCover 10 m 2020 : https://worldcover2020.esa.int/download
[4] Department of Forests: https://www.moa.gov.cy/moa/fd/fd.nsf/index_en/index_en?OpenDocument
[5] Ministry of Agriculture, Rural Development and Environment: https://moa.gov.cy/?lang=en

Most of wildfire ignitions in Cyprus are of human origin; mainly the consequences of negligence and lack of attention. However, in some cases, they are the results of arson.

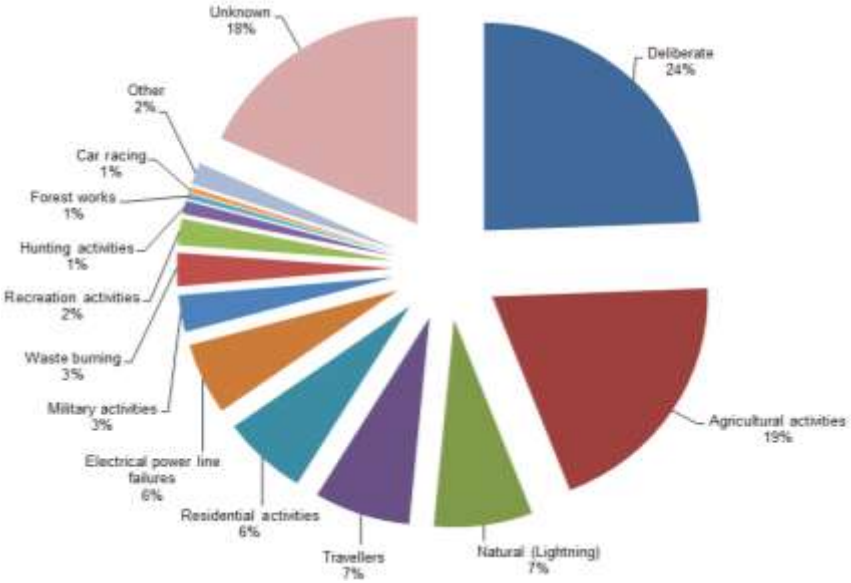

Figure 5: Causes of wildfires within the zone of responsibility of the DoF, 2000-2023: Causes of wildfires within the zone of responsibility of the DoF, 2000-2023

Nowadays, floods, droughts, wildfires and extreme weather events are frequently cited as recent changes but also as climate-related impacts. The climate crisis and its rising temperatures inevitably increase the vulnerability of Cyprus to wildfires. Simultaneously, land abandonment has increased the accumulation of shrubs and other herbaceous fuels, constituting flammable biomass which facilitates wildfire spread, size, and possible impact.

Desertification is a main concern for Cyprus. **A National Action Plan (NAP) and Programme of Measures for Combating Desertification was prepared in 2012 and revised in 2018.** It includes identification of environmentally sensitive areas that are threatened, the evaluation of current policies, measures and actions for sustainable land use and water resources management, concrete and practical measures necessary for the prevention and combating of desertification, the mitigation of the effects of drought and land degradation, and awareness and consultation campaigns with stakeholders.

4.2 Recent development of Forestry and Agricultural Sectors

In October 2023, in the framework of the ResAlliance project aiming at developing a more resilient landscape, a participatory workshop was held in Cyprus permits to collectively identify the recent development of forestry and agricultural sectors. The following SEMEDFIRE workshops were built on these first elements which are a good introduction to the actual situation and need for change. In the chapter below, “participants” refers to the participants of this ResAlliance workshop organized in October 2023. Most of these people joined also the following SEMEDFIRE workshops.

In this workshop, one of the main changes highlighted by the participants was the **abandonment of rural areas and agricultural lands,** which has various causes and consequences. This abandonment is mostly in mountainous areas where agriculture conditions are difficult due to the higher slope. Private abandoned agricultural lands are usually

re-colonized by the nearby forest, bringing an increase of forested area. It's usually small farming businesses which are supporting the move to bigger farming businesses in more fertile areas with better irrigation capacities.

The new forests established in private abandoned lands are growing on their own, with species like pine trees and a few invasive species (*Acacia saligna, Ailanthus altissima* (Swingle), *Robinia pseudoacacia* as well as one shrub species *Dodonaea viscosa*)[6]. This **land abandonment generates an extension of the forest area**, which could be seen as a positive change; given that forest facilitates storage of carbon, improves soil retention, water filtration, slow down water cycle, regulate extreme temperature, improve air quality and soil health, increase wildlife and biodiversity, reduce impact of floods and droughts, provide foods for animals and humans, etc. Planting and protecting trees can directly and indirectly contribute to 15 of the 17 Sustainable Development Goals.[7]

Nevertheless, for the moment, these abandoned lands are becoming mainly wild and unmanaged forests, without livestock farming and grazing, resulting in an **accumulation of shrubs and herbaceous, highly flammable biomass**. Overgrazing was considered a problematic issue in the past century and continues to be an issue in a few places. However, nowadays, the issue may be more the *lack of* grazing, especially around the Troodos forest. While overgrazing may have contributed to the reduction of the area of forest a long time ago, it should be highlighted that shepherds' practices can positively impact wildfire prevention. Grazing decreases fuel loads and thereby reduces the spread and intensity of wildfires, creating more opportunities to stop unwanted fires. Today, land abandonment and the lack of grazing around the forests **increase the risk of wildfire** because of increased **highly flammable** biomass accumulation**.**

It is worth noting that the recent **halloumi certification** is also a driver of change with **new investments in the sheep and goat sector and** can thereby potentially help to manage fuel loads through grazing. Participants of workshops organized in Cyprus also raised the potential negative cumulative effects on biodiversity from small farmers who get less restrictive environmental constraints than big farmers that have stricter environmental obligations to meet. No main changes have been reported regarding tree pests (pine infestation fluctuates). On the other hand, the **weakening capacity of communities in agriculture** has been raised as a concern. The lack of quantitative data and information on the values of agroforestry have also favored the move to monocultures.[8] Other concerns regarding changes in land uses have been reported, especially **fertile land taken for other uses** (e.g.: photovoltaic, urbanization, etc.), as well as **protected areas disputed for urbanization and tourism development**. 36% of wildfire ignitions were found to be deliberate for the period 2010 to 2020. **Decrease in biodiversity and loss of habitats and species** have been also reported by participants.

In the past 20 years, a few changes have occurred in legislation. I**n 2012, the new Forestry Law[9] was adopted,** which mainly concerns state forests, and to a much lesser extent private forests and forest industries. Also, in 2013, the Law on the Control of the Trade of Timber and Timber Products[10] was adopted. From 2016 onwards, Strategic Planning also plays a key role in the overall government policy for a more targeted allocation of resources.[11] As indicated in the Wildfire Prevention Law of 1988 (220/1988): the burning of vegetation residues is possible between December 1st and March 15th with permission from the DoF.

[6] Guide for the Control of Invasive Trees in Natural Areas in Cyprus: Strategies and Technical Aspects, Department of Forests, Republic of Cyprus, Dr. Jean-Marc Dufour-Dror, December 2013
[7] The benefits of trees for livable and sustainable communities, Jessica B. Turner-Skoff , Nicole Cavender
[8] World Agroforestry Centre, Section 3: Regional Examples, Leontiades, L.: "Traditional Agroforestry Practices under the Edaphoclimatic Parameters of Cyprus"
[9] Cyprus Forest Law, Law 25(I)/2012 as amended by Law 104(I)/2018
[10] Law 139(I)/2013
[11] Department of Forest Strategic Planning 2021-2023

Participants also reported that climate change generates further environmental obligations to EU members and an obligation to act. More targeted ecological schemes and subsidies are in place to favor good practices (organic farming, soil retention technics, biodiversity island, stone wall restauration). Environmental awareness also increased the global understanding of the importance of conservation, especially for Natura 2000 areas. Positive technological advances have additionally been reported by participants, such as early fire detection with sensors, which permits a rapid response to avoid large wildfires and helps to reduce burnt area every year.

4.3 Wildfire Management by the Department of Forests

The Department of Forests (DoF) is the Agency responsible for the prevention and suppression of fires in the forest and within a radius of 2 km from the boundaries of the state forests in the Republic of Cyprus.[12] As such, DoF takes a series of measures aiming to reduce the number of fire outbreaks and minimize the damages, while prioritizing quick detection and early reporting of fires, rapid intervention and effective control of wildfires.

Wildfire ignitions are often traced to man-made causes typically related to negligence and, to a lesser extent, malicious, intentional actions (See Figure 5, Causes of fires within the zone of responsibility of the DoF, 2000-2023). The main ignition sources of forest fires include agricultural activities (burning of pruning and other agricultural residues), discarding lit cigarette butts or matches, lighting fires in unauthorized areas, burning waste and garbage in unsanitary areas, hunting activities, residential activities such as the use of power tools that cause sparks, short circuits of overhead power lines, etc. The estimated **average annual damage caused to forest vegetation by these fires is approximately € 24M€**.[13] The protection of forests from fires is a priority of the DoF because they consider uncontrolled wildfires to be destructive factor for the forests and wooded areas of Cyprus. The importance attached to the fight against forest fires is reflected in the budget of the Department and the number of staff involved in extinguishing them. About one third of the Department's budget is spent on firefighting, while almost all of the Department's staff during the summer is involved in fire prevention and response. The DoF owns and leases a fleet of small and larger fire trucks, as well as helicopters. The protection of forests from fires by the DoF is presently achieved through actions such as the preparation and implementation of fire protection plans, development and maintenance of infrastructure (forest roads, fire zones, water tanks, water mouths, etc.), the purchase of firefighting equipment and supplies, carrying out enlightenment campaigns, recruitment and management of staff (fire / immediate teams intervention, forest duty watchdog, training), conducting ground and air patrols, and the suppression of forest fires by soil and air.

4.4 Protection of Forests from Fires - a Shared Responsibility

The Department of Forests of the Republic of Cyprus considers that forest fires, favored by climatic conditions, constitute the greatest danger for Cypriot forests since they threaten their very existence. Effectively, the very dry weather conditions in Cyprus make it very hard for forests to be restored after a wildfire. And taking into account the impact of climate change, we could consider that in the coming years, it may be very hard to restore forest in some burnt areas ending in increasing desertification. In addition, the risk of forest fires is only expected to increase further due to climate change, the abandonment of the countryside and the increase in the number of visitors to

[12] See Cyprus Forest Law, 2012, Appendix II, article 46 page 39 available *http://www.cylaw.org/nomoi/indexes/2012_1_25.html*
[13] Strategic Planning of Forest Department 2021 – 2023 available https://www.moa.gov.cy/moa/fd/fd.nsf/fd48_gr/fd48_gr?OpenDocument

forests. In its strategic planning of 2021, the DoF targets a strengthening of the forest protection system against fires, so as to deal with the increasing risk but also to seek a reduction in the number of fires, a reduction in the annual burned area and a reduction in the average burned area per fire.

The protection of forests from fires is presently ensured by the Cyprus Forest Law of 2012[14], the implementation of the legislation as well as the **preparation and implementation of an integrated forest fire management system.** Special attention is paid to protecting protected areas and areas with ecosystems that are difficult to regenerate. The existing system will be strengthened by the **preparation and implementation of a Fire Protection Plan**, which will cover all three areas of action: prevention, preparedness, and suppression. Among the issues that should be given special importance is the **development of operational fire suppression plans** depending on the risk of explosion and spread of fires as well as an **Incident Command System.** These actions are presented in the DoF strategic plan, but **an effective integrated fire management plan would exceed the perimeter of action for the DoF as this department is in charge of forest fires only within public forests and a 2km buffer around**. Presently, outside this perimeter, the Cyprus Fire Service (CFS) is in charge of wildfire suppression, but no one oversees prevention. Such planning needs a change in the method with a more integrated approach. **The DoF has a key role and understanding of the actions to be taken but support from all stakeholders is needed**.

The map below shows that wildfires starting from a natural ignition (e.g. lightning) did not burn big areas, whereas **human activities are responsible for the vast majority of wildfire ignitions** with a risk exacerbated in a climate change context, inducing higher temperatures and dry vegetation. **Most fires are started in rural and peri-urban areas where fire prevention is a shared responsibility**.

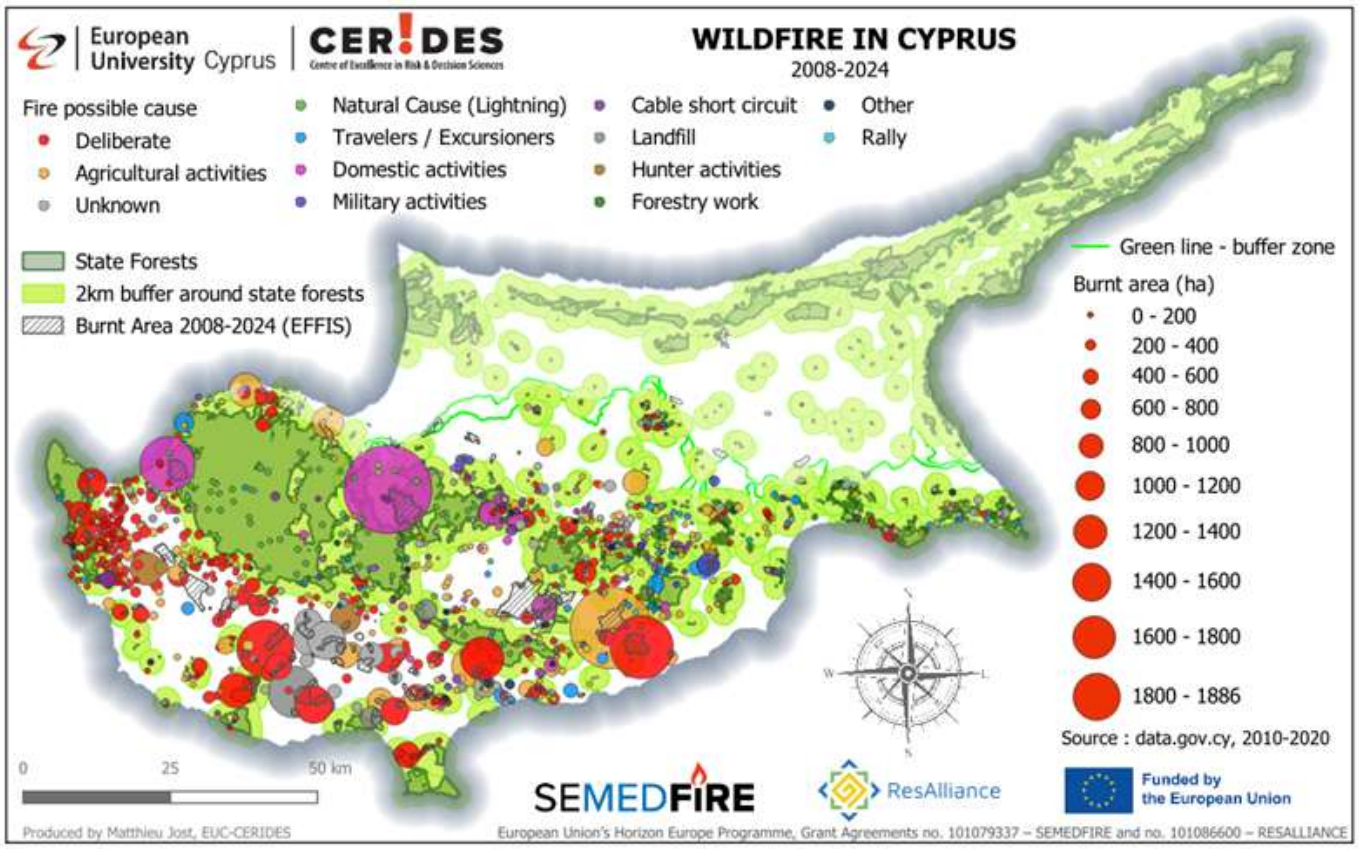

Figure 6 : Wildfire in Cyprus - 2008 to 2024, EUC-CERIDES

[14] Cyprus Forest Law of 2012: *http://www.cylaw.org/nomoi/indexes/2012_1_25.html*

On the map of Figure 6, the dots represent the ignition point of fires and their possible causes (color) for the period 2010-2020 and 2023 (data produced by the DoF and available only in the areas under the effective control of the Government of the Republic of Cyprus). The black hatch marks indicate the burnt areas, available for the period 2008-2024 (source: EFFIS). The green hatch marked areas are the public forests, and the 2km buffer around these areas indicates where the DoF oversees the planning and implementation of any measures deemed necessary to prevent forest fires (Cyprus Forest Law, 2012).

This document is a **call for more and better communication, collaboration and prevention in wildfire management in Cyprus**. Last but not least, wildfire management is not only a technical issue but also integrates strong economic and political issues. Regarding wildfire prevention in Cyprus, one of the main issues expressed during the workshops organized in the framework of SEMEDFIRE is the **need for a better rural development taking in account the land abandonment issue** which is greatly increasing the buildup of fuel vegetation around public forests. In addition to facilitating access to mountainous Troodos areas, **it's the development of more resilient and living communities and landscapes which is needed to effectively prevent damage from wildfires.**

4.5 Supporting the landscape Fire Governance Framework

To better prepare societies to achieve sustainable development goals and ensure lower losses in fires, the technical and scientific community at the 8th International Wildland Fire Conference in Porto, proposes a fire governance model (Landscape Fire Governance Framework) that brings governments, businesses, academia, and members of civil society together in balanced and technically supported solutions. This framework presents the guidelines for the development of this model.

The Landscape Fire Governance Framework has been developed by AGIF, the Agency for the Integrated Management of Rural Fires in Portugal, after the major wildfire disasters in 2017 (https://www.agif.pt/app/uploads/2023/08/LFGF_EN_2023.pdf). It is a **voluntary set of guiding principles to adjust landscape fire strategies, policies and management, to global change**. It is a useful example for countries to develop more integrated fire management. The below figure shows the theory of change totally fits Cypriot context.

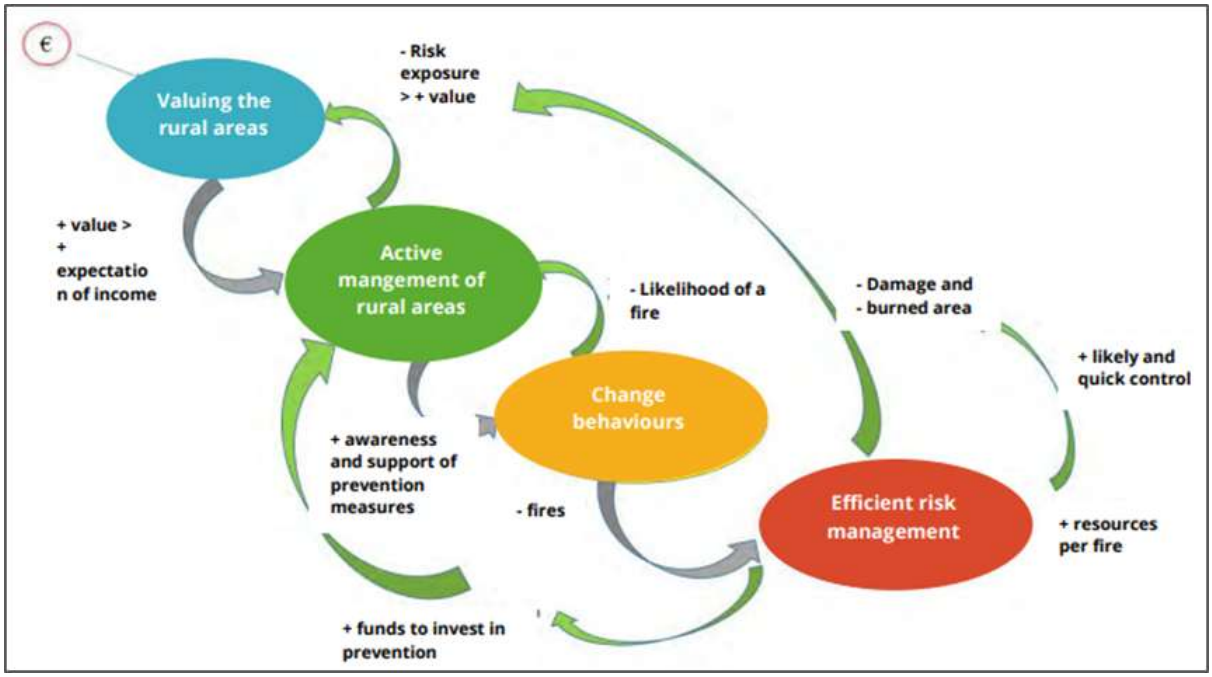

Figure 7 : Theory of change: cascade diagram of the positive reinforcement cycles that contribute to efficient risk management, 20-30 National Plan for Integrated Rural Fire Management, AGIF

In the Framework of SEMEDFIRE, EUC-CERIDES has encouraged the RoC to support the Landscape Fire Governance Framework initiative. WU also facilitated the visit of João Verde, Deputy for Integrated Management Policy from AGIF, for the October 2024 SEMEDFIRE workshop in Cyprus. It has been the opportunity to share the AGIF experience on integrated fire management to all workshop's participants as well as with the Ministry of Agriculture Rural Development and Environment.

4.6 A co-built IFM strategy through a participative process

The SEMEDFIRE project started in December 2022 and from the beginning EUC-CERIDES team agreed on defining a participative process to develop the IFM strategy to ensure that we correctly answer to the needs but also to have an IFM strategy and action plan sustained by local stakeholders. More than an academic product, we aimed at supporting the design and implementation of a realistic, but ambitious, plan for Cyprus to improve wildfire management.

We could highlight a few points of this participative approach:

- The full process was developed under the auspices of the Ministry of Agriculture, Rural Development and Environment supporting involvement of governmental agencies and giving more legitimacy to the outputs.
- In all workshops organized we had participants from governmental institutions, research and academic agencies, non-governmental organizations and private companies giving a complete view of society's stakeholders. A few people participated in every workshop organized.
- Invitations to workshops were also sent to a wide range of sectors: agriculture, forest, water, environment, urban planning, fire service, civil protection, tourism.
- We used participative tools in every workshop as well as creative technics like a serious game[15] and a graphic recording to facilitate inter-sectorial dialogue. This approach has been very well appreciated by participants and was essential to build the integrated strategy.
- Each step of collaboration with local stakeholders has been supported by European experts on fire management and was a mutual learning experience which permits to progressively rise the knowledge of all stakeholders on integrated fire management.
- After each workshop, a strong work of compilation and structuration of the participants' and expert's inputs has been done, to go back to stakeholders a step forward on the way to an IFM strategy for Cyprus.

More than 50 organizations (see list chapter 7) and 100 people have been involved in one or more workshops of SEMEDFIRE and ResAlliance to develop this integrated wildfire management strategy, and we thus thank them for their active participation and essential contributions. We specify, however, that opinions expressed in this document are SEMEDFIRE consortium's observations, derivations and statements, and do not bindingly engage any stakeholders involved. This list also expresses the diversity of the stakeholders involved.

[15] Pyrowtown, a serious educational game for students of Integrated Fire Management: https://doi.org/10.5281/zenodo.15090000

5 Conclusion

As presented in the introductory words, the analysis presented herein represents just a foundation upon which Cyprus authorities are called to further develop a wildfire strategy that can transform this first attempt into a robust national policy for an integrated fire management in Cyprus. Nevertheless, we highlight that the present document has been co-produced in strong coordination with the Ministry of Agriculture, Rural Development and Environment and other key authorities involved in wildfire management in Cyprus. Consequently, we advise this foundational strategy to be adopted and sustained by these stakeholders.

In line with this strategy, a stakeholder engagement plan has been produced to give more information on the actions needed and parties responsible for such actions. While engagement of all stakeholders is needed to develop a truly integrated wildfire management approach, the designation of a strong leading agency is, nevertheless, still necessary to ensure a global effort. Today, most actions on fire prevention are implemented solely by the DoF, but they should not be the only stakeholder involved if effective wildfire management is the goal. We recommend setting up a monitoring system to follow the proper implementation of the action plan and answer to the challenges and objectives listed herein.

During the participatory process of building this strategy, we saw a strong willingness of Cypriot stakeholders involved in fire management to improve the situation and plan for the future. To reinforce this willingness, strong regulations and adequate funding are needed.

We give our special acknowledgement to all the stakeholders who joined in the various workshops which enabled us to build up this strategy. Your contributions were essential!

6 Glossary

Prescribed Burning: Defined as fire intentionally applied by wildfire experts in a knowledgeable manner to forest fuels on a specific land area under selected weather conditions to accomplish predetermined, well-defined management objectives tailored to that site

Strategic management areas: Wildfire strategic management areas are land areas identified by wildfire experts (e.g. fire services, forest engineers) where vegetation management treatments should be carried out to reduce fuel loads and reduce the risk of large wildfires occurring. Strategic management areas are always defined within the territorial scope of an association of forest owners, Natural Park or forest massifs with the aim to carry out actions jointly with a landscape vision and thus optimize investments in forest management for fire prevention (Costa, et al. 2011).

Rural urban interface: The rural urban interface also referred as wildland–urban interface (WUI) is a zone of transition between wilderness (unoccupied land) and land developed by human activity – an area where a built environment meets or intermingles with a natural environment. Human settlements in the rural urban interface are at a greater risk of catastrophic wildfire.

7 List of participants

The organizations listed below have been involved in one or more workshops of SEMEDFIRE and ResAlliance to develop this integrated fire management strategy, and we thus thank them for their active participation and essential contributions. We specify, however, that opinions expressed in this document are SEMEDFIRE consortium's observations, derivations, and statements, and do not bindingly engage any stakeholders of the list below. This list also expresses the diversity of the stakeholders involved.

Name of the organization	Number of persons involved
Business and Industry	**8**
Cyprus Chamber of Commerce and Industry	1
ENVI Services Ltd	1
Geomatic	1
Inntenet	1
Things Green AE ltd	2
Self-employed	1
Kitasweather	1
Civil society organization	**10**
BirdLife Cyprus	1
Friends of the Earth	1
Laona Foundation	2
Terra Cypria	3
Phoenix	1
Paradisiotis LTD	1
KEMA	1
Farmers & representatives	**7**
Euroagrotikos	1
New Agricultural Movement (NAK)	1
Panagrarian Union of Cyprus (PEK) - Farmers Union	3
Panagrotikos Agricultural Association	1
Union of Cypriot Farmers (EKA) Agricultural Association	1
Government & local authorities	**51**
Civil Defense	7
Cyprus Deputy Ministry for Tourism	1
Cyprus Organization Of Agricultural Payments (CAPO)	1
Defense Fire and Rescue Service	2
Department of Agriculture	5
Department of Environment	6
Department of Forests	7
Department of Meteorology	2
DG Growth - Director of Directorate for Sustainable Development	1
Fire Brigade	2
Game and Fauna Service	2
Ministry of Agriculture, Rural Development and Environment	1

Office of the Commissioner for the Development of Mountain Communities	1
Office of the Minister of Agriculture, Rural Development and Environment	2
Platres Community Council and Troodos Network of Thematic Centers	1
Sewerage Board of Limassol-Amathus (SBLA)	1
Water Development Department	5
Office of the Commissioner for the Environment	3
MARDE - Directorate General for the Environment	1
Research Community	**11**
Agricultural Research Institute (ARI)	2
Cyprus University of Technology - Eratosthenes Centre-of-Excellence	2
Eratosthenes Center of Excellence	3
Frederick University (Nature Conservation Unit)	1
KES Research Center	1
Open University of Cyprus	2
Partners	**26**
European University Cyprus - CERIDES	14
Wageningen University, the Netherlands	4
Pau Costa Foundation, Spain	3
DGSCGC, France	3
Nimes Metropole, France	1
EMYS, Spain	1
Imperial College of London, UK	2
AGIF, Portugal	1
Others	**2**
Ambassade de France à Chypre	2
Grand Total	**118**

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