A Holistic Fire Management Ecosystem for Prevention, Detection and Restoration of Environmental Disasters

TREEADS D2.3: Prevention and Preparedness Understanding and Technical Requirements Report

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LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation	Meaning
AS-IS	The current operational processes relevant to TREEADS, the existing pain points, information, key performance indicators, baseline assessments, existing equipment, technology infrastructure and other important information
CCTV	Closed-circuit television
DoA	Description of Action
D.	Deliverable
FR	Functional Requirements
GA	Grant Agreement
ICT	Information and Communication Technology
KPI	Key Performance Indicator
M	Month
MET	Norwegian Meteorological Institute
MSB	Swedish Civil Contingency Agency
NFR	Non-Functional Requirements
TO-BE	The new operational processes within TREEADS, the information to be monitored before, during and after the fire, the new key performance indicators to be defined and monitored, the new TREEADS systems and technologies infrastructure to be integrated and lastly, the permits and ethic requirements in relation to pilot studies

TRL	Technology Readiness Level
WBI	Forest Fire Hazard Index (Waldbrandgefahrenindex)
WP	Work Package
WUI	Wildland User Interface

EXECUTIVE SUMMARY

This document is the deliverable entitled "D2.3 Prevention and Preparedness Understanding and Technical Requirement Report V1" associated with *Task 2.3: Prevention and Preparedness Understanding and Technical Requirement* developed under *WP2: Understanding the Lifecycle of Wildfires* of the TREEADS project.

This deliverable focuses on the pre-fire phase of Prevention and Preparedness, providing a first approach to Prevention and Preparedness, taking into account responses of Pilots to a set of related questionnaires and providing a general Pilot description of the current situation that is going to be the goal of the Prevention and Preparedness technologies.

This deliverable focuses mainly on the technical requirements, functionals and non-functionals that have been derived from the Pilots and are presented in detail.

INTRODUCTION

Background

This document has been prepared with inputs from each pilot coming via questionnaires prepared by WP2. The present deliverable is a "living report" as the project is in progress and complimentary with the Deliverables D2.5 and D2.7, the same as the updates.

Purpose and scope

This document specifies functional and not functional Requirements in the Prevention and Preparedness phase of wildfires.

The current deliverable will focus on eight piloting countries (Norway, Italy, Romania, Spain, Austria, Germany, Greece & Taiwan). We studied the relevant literature in the countries, and we surveyed the relevant first responders and national planners to learn about their insights. We then provide, within this document, an analysis, outlining the desired functional and non-functional end-user requirements.

These requirements have been identified through eight online workshops with the countries, where feedback and ideas were collected and discussed. The feedback and the ideas generated here, in combination with the earlier made promises (Grant Agreement) for each tool, have been formulated as end-user requirements. These requirements will guide the technical partners in their efforts to develop the TREEADS holistic fire management platform for prevention, detection, and restoration of environmental disasters.

THEORETICAL FRAMEWORK

Approach

The consequences of wildfires are visible in susceptible communities around the globe on an annual basis. Climate change predictions suggest that wildfires may become more frequent and more intense due to global climate changes. Compounding this issue is progressive urban development at the peri-urban fringe (wildland–urban interface), where continued infrastructure development and demographic changes are likely to expose more people and property to this potentially disastrous natural hazard. Proper groundwork in advance of the wildfire season is seen as a fundamental behavior that can both reduce community wildfire vulnerability and increase hazard resilience – it is an important element of adaptive capacity that allows people and communities to coexist with the hazardous environment in which they live[1].

Prevention is defined as those activities taken to prevent a natural phenomenon or potential hazard from having harmful effects on either people or economic assets[1].

Preparedness is defined as thoughtful planning and decisions in advance about how emergencies will be handled[2].

Natural hazard prevention & preparedness is generally considered to be the preferred mechanism to encourage proactive actions (behavioral, cultural, structural, or institutional) to mitigate the disastrous potential of these events. Preparation has dual objectives: to reduce vulnerability to a potential threat and to increase the resilience of the public, nature, livestock, and natural vegetation exposed to a threat[2]. By increasing awareness, decreasing vulnerability and focusing on resilience, the care for preparation can be considered as a critical element of the social system's adaptive capacity – an adaptation that permits the individual, household, or community to coexist with the potential threat and consequences of environmental hazards like wildfire[3].

For the purposes of the current deliverable, the following methodology was meticulously designed and implemented in order to satisfy the purpose of the document, understanding the Prevention and Preparedness phase and gathering of Technical Requirements. Data was gathered from the 8 different pilots. Stakeholders that are involved as part of the pilots were engaged to comprehend their perspectives and their needs. Requirements of the stakeholders were gathered through questionnaires that were circulated to the pilots. Subsequently, the requirements were collated into a table, leading to their categorization of functional and non-functional requirements as well as into sub-categories that will be presented in more detail[1].

FIRST APPROACH OF PREVENTION & PREPAREDNESS- PILOT CASES

Questionnaire pilot responses

The technological advancements that will be part of the TREEADS project heavily depend on the requirements, functional and non-functional, that the stakeholders involved in the pilot scenarios have shared. It is also important to consider the existing tools and systems before designing new ones. TREEADS aims to also build upon state-of -the art high TRL products and integrate them in a holistic fire management platform, which will involve several innovative technologies and develop new ones with a combination of highly divergent sources of informative data. Most importantly, TREEADS brings together a variety of tools that together provide a system that enables prevention and preparedness at both strategic and operational level.

This deliverable focuses on eight countries (so-called "piloting countries"): Norway, Italy, Romania, Spain, Austria, Germany, Greece & Taiwan. We used our close connections with national planners and first responders in these eight countries to validate the preliminary insights that can be distilled from the literature.

The main goal is the in-detail mapping of all the prevention and preparedness technical requirements, and their categorization into functional and non-functional, with a scope to achieve setting all the objectives and develop a safety culture in wildfire- emergency management. We performed an analysis of existing prevention and preparedness systems. We focused on the systems and tools that are currently being used within the existing wildfire frameworks of the piloting countries.

For each pilot country, we conducted a literature review. In an earlier stage of this task, a questionnaire was provided, in which the end-user partners were required to write down an overview of a wildfire lifecycle and involved actors (in the scope of TREEADS), the major stakeholders that need to be involved in project consultations, the description of the wildfire incident/event(s) relevant for TREEADS. In the AS-IS situation the description of current operational processes (tasks) relevant to TREEADS, the existing pain points (Constrains/Risks), the information monitored at each phase (pre-fire, active fire & post-fire), the key performance indicators (KPIs) and baseline assessments (depending on each phase), the existing equipment and/or ICT and technology infrastructure and any important additional pieces of information that need to be included. While in the TO-BE situation they were asked to describe new operational processes (tasks) within TREEADS based on the needs and areas of improvement for each relevant phase, the information to be monitored before, during and after fire, the new key performance indicators (KPI) to be defined and monitored, the existing and new TREEADS ICT systems and technologies infrastructure to be integrated and last the permits and ethic requirements in relation to pilot studies. All this information was provided in order a consolidated initial long list of potential needs and requirements to be created.

Tools can only be proven useful through validation from the people that will work with them (end-users). To ensure that the TREEADS approach fits the needs and ideas of first responders and planners in the field, the project's end-users are actively involved in each stage of the platform architecture development. They help guide the development of state-of -the-art products through the formulation of end-user requirements, to which this deliverable is devoted. When the tools are further along in development, end users will be invited to use the tools themselves and provide feedback. In the final stages of development, the tools will be validated in the field by end users since they test several scenarios designed to demonstrate each tool's uses and capacities.

This deliverable is the first documentation of this necessary engagement between end users and technical developers. End users contributed by critically evaluating and embellishing on an initial list of requirements, as initially described in the GA. Additional requirements have been created as a result of these fruitful discussions and existing requirements were validated. End users determined the prioritization of requirements. D2.3 is a 'living document' since end-user requirements will keep being collected as the tools are developed. The initial end-user requirements are therefore somewhat generic in nature, but they will be further developed in a more detailed manner over the upcoming months. The collaboration between end users and technical partners will be intensified and accommodated. A second version will be presented in M21: D2.4: Prevention and Preparedness Understanding and Technical Requirements (Final Version).

The following section is divided, as mentioned before, between *as is* and *to be situation*, with an additional fragment describing general aspects of the pilot site and previous wildfire events. Answers are grouped in similar responses; particular and interesting aspects are specifically pointed out.

GENERAL PILOT DESCRIPTION

The majority of the pilot projects are focused on wildfires that occur between forest/shrubland and urban areas, or WUI zones (wildland-urban interface). Because of the connection between human-populated areas and flammable ecosystems, both the risk of igniting and the vulnerability of the people can rise.

Every pilot location has had at least one fire that happened at the same time as the research (or nearby). Due to their temperature and vegetation features, Mediterranean countries - Italy, Spain, and Greece - supplied more than two episodes with a significant surface extension. Wildfires are typically smaller and less frequent in Central and Northern Europe (Norway, Romania, Austria, Germany), but prior summer seasons have demonstrated that this trend could be reversed as a result of climate change, which includes rising temperatures and longer drought waves.

Wildfire events recorded included from crown to ground fires and affected a variety of ecosystems and vegetation. Those pilots that estimated severity show that it mainly depended on vegetation cover and duration of the fire. However, not all pilot sites offered a full understanding and correct measure of severity.

AS IS SITUATION

Because of their climate, some of the pilot sites are accustomed to a regular fire regime: with long hot summers and scarce rainfall (sometimes almost none), the Mediterranean countries have developed specific guidelines and national or regional legislation regarding wildfire in response to this disrupting situation. These guidelines, which have been created to varying degrees of depth, are primarily focused on fire prevention and direct interventions and reactions. Some countries have also agencies and institutions in charge of developing and implementing restoration plans as well as overseeing post-fire recovery efforts.

Central and Northern European countries merely have policies regarding prevention and response to fire. The main actors involved in firefighting just contemplate prevention and attacking phases.

TO BE SITUATION

All pilots focus their attention on the solutions that will improve aspects from prevention- preparedness and detection- response phases.

A description of each pilot is presented in the below section in order to provide a better understanding of the main goals of each pilot and the current situation.

NORWAY PILOT

The Norwegian pilot aims to provide suggestions for WUI safety zones, to provide a Guideline for the protection of wood buildings and steel infrastructure and to provide input to fire test methods relevant to wildfires.

Currently, the prevention and preparedness approach includes a model from the Norwegian Meteorological Institute (MET) that calculates forest fire danger, 6 days of projected forest and grass fire danger, as well as a fuel map, which is provided by Swedish Civil Contingency Agency (MSB), as well as a mobile app (Brandrisk Ute), with the same maps and information about fire bans in different areas.

Furthermore, Sweden shares resources such as the forest fire helicopter with Norway. Finally, there are guidelines for forestry operations, coupled with the forest fire danger system on how to mitigate risks during high-danger periods.

ITALY PILOT

The Italian pilot aims to validate an innovative Infrastructures Fire Emergency Management Strategy applied to the design of a Cable-Car System in the Sorrento Peninsula, the validation of eco-sustainable construction materials with increased fire resilience, the simulation of fire detection and response in a real environment, and preventive risk analysis in protected forest areas and possible economic restoration solutions after forest fires.

The plan for the prevention measures includes actions such as reforestation of bare and bushy land and reconstitution of degraded woods or woods destroyed by fires, improvement and strengthening of forest roads and fire prevention, refurbishment of service tracks and useful paths for forest fire prevention and others.

ROMANIA PILOT

The Romanian pilot aims to reduce human negligence in forest fire incidents by utilizing state-of-the-art technological prevention measures.

Currently, the National Directorate of Forests carries out a series of educational actions regarding forest fire prevention measures. Also, a series of measures are in place to increase the preparedness for wildfires. At the same time, there are no sensors deployed related to wildfires, and no relevant software is used in the process.

SPAIN PILOT

The Spanish pilot aims to improve all phases of wildfires through the useful information gathered into the TREEADS Holistic Platform through the different included technologies such as aerial means, research software, and enhanced cartography.

The current situation in Spain is that there are guidelines and policies for wildfires, depending on the details of the fire, such as intensity, proximity to civil areas, and others. The emergency plans can be provincial, autonomic, or national. Regarding specifically the prevention measures, in Avila, local operators manage and maintain forest areas and critical points in the forest-urban interface. Studies of forest fires and possible sensitive areas to determine strategic management points, prescribed burns, forest fuel management, and environmental education are all current prevention measures that are performed from November to mid-March, which is considered the fire off-season.

AUSTRIA PILOT

The Austrian pilot aims at international networking and resource exchange, an increase in sensors, improved communication, and an improved situation map. Also, it is desirable to have a platform with a user-friendly interface with reliable information. Something to additionally keep in mind is that the nature of fire incidents in Austria necessitates information communication near real-time.

In Austria, wildfire prevention relies on the related authorities, with Austrian local fire brigades performing school visits and communicating the importance of wildfire prevention. There are currently laws and regulations for forest fire prevention.

Some of the prevention measures at the moment are forest management, forest fire research, controlled burning, awareness raising, fire hazard estimation systems as well as announcements related to the outputs of the fire hazard estimation systems.

On the other hand, currently, there is no monitoring system, ground or air.

GERMANY PILOT

The German Pilot aims at the characterization of fire types concerning vegetation fires, identifying influencing factors for fire development, closing the gaps in knowledge of how fire starts and spreads, and the characterization of smoke formation, spread, and composition.

In Germany, there are nationwide recommendations regarding the prevention of wildfires. The current preventive measures that are in place are the creation of forest fire barriers, the creation of wound strips by harvesting, as well as, the promotion of information especially in kindergartens and schools.

Currently, the federal states of Germany are the ones that regulate the details regarding fire departments through their central legislation. In the event of major incidents, there are laws that regulate the coordination between fire departments. In order to prevent fires, risk analysis is carried out, and forest fire mission maps are provided by the state with information about water supply points and other features of the areas are supplied to optimize the planning.

The Forest Fire Hazard Index (Waldbrandgefahrenindex, WBI) is used on a daily basis to describe the wildfire hazard and is used by state authorities to assess the wildfire danger and inform the public.

Germany also uses a central emergency information and messaging app to inform the public of emergencies such as major fire incidents.

GREECE PILOT

The Greek pilot aims to better predict adverse conditions on the pilot site, to detect potential wildfires in time, and to provide fast and weather-informed guidance to the first responders for the visitors' evacuation. The main focus is on the evacuation of the pilot area, the Samaria Gorge.

Currently, a daily forest fire risk map is broadcasted during the summer period with 5 levels of Risk of Fire. The Samaria Gorge is usually closed to visitors when the level is at 4 or 5.

A remote sensing system of five cameras sends images to relevant authorities and at the same time, there is a network of five meteorological stations that record temperature, rain, wind speed and relative humidity.

TAIWAN PILOT

The Taiwan pilot aims to develop fire-resistant materials using wood ashes.

The current situation in Taiwan is that wildfire monitoring is done in traditional ways, such as by the reporting of civilians or CCTV, which leads to the request of firefighters to extinguish the fire. Some sensors are also available that monitor weather data.

FUNCTIONAL AND NON-FUNCTIONAL REQUIREMENTS

Next section summarises functional and non-functional requirements of the prevention and preparedness phase, considering different features: pilot's site nature, current objectives, available technology, existing management, pre-fire interest, and the feasibility of the application for a potential pre-fire assessment and application of prevention techniques for each pilot case.

Based on the book "Software Requirements", functional requirements specify the behaviors the product will exhibit under specifc conditions [4]. Functional Requirements have been identified by end users as necessary for the tool. They describe the tools core functionalities. Often, they represent promises made in the Description of Action (DoA). Should there be no possibility to integrate these promised features, this should be addressed and clearly justified in the update of the present deliverable (deliverable D2.4), as well as the updates of the other linked deliverables (deliverables D2.6. and D2.8).

Based on the book "Software Requirements", non-functional requirements describe the product's characteristics in various dimensions that are important either to users or to developers and maintainers, such as performance, safety, availability, and portability [4] Non- Functional Requirements apply to functionalities that ensure the tool achieves sufficient business value. These can be postponed to the tool's final version but are necessary for the release of the commercial version of the tool. Again, should there be no possibility to integrate these promised features, this should be addressed and clearly justified.

The methodology of using functional and non-functional requirements presents many benefits to the development of a product, service, tool, either hardware or software. One of the primary benefits is meeting user needs, as through the process of communicating with stakeholders and end-users, the tool can be developed to meet their needs. Another benefit is the system performance, as with setting non-functional requirements related to the system performance, the development can proceed accordingly so that the end-user is satisfied with how fast the product is working, how efficiently and others. Furthermore, quality assurance can be achieved, as the development process is guided to meet the predefined standards. The functional and non-functional requirements also serve for better communication between the developers of the tool and the end-users and stakeholders, mitigating this way risks of miscommunication. Finally, all the above help with cost and time management, as neither resources nor time are spent on functionalities, tools and features that will not finally serve the end-user.

Functional and non-functional requirements are grouped by categories based on the most common requirement layers for functional requirements and non-functional requirements, respectively.

The following functional and non-functional requirements are backed from information derived from multiple sources such as the book "Software Requirements" [4], ISO/IEC 25010 Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) and other relevant sources [6][7].

Functional requirements

For the description of the functional requirements, we have used a table grouped by categories based on the most common functional requirements layers, with the functional requirement categories presented in Table 1.

Table 1. Functional requirement categories.

FUNCTIONAL REQUIREMENT CATEGORY	CATEGORY ABREVIATION (CAT)
INPUT	IN
DATA	DAT
PROCESSING	PROC
CONFIG	CONF
OUTPUT	OUT

The definition of the identifiers (**ID**) of these requirements uses the following nomenclature

FR-CATN-M

FR = Functional requirements
CAT = Category abbreviation
N = index
M = subindex

Non-functional requirements

For the description of the non-functional requirements, we have provided Table 2 with the categories based on the most common non-functional requirements (see also Deliverable D2.5 for more details).

Table 2. Non-functional requirement categories.

NON-FUNCTIONAL REQUIREMENT CATEGORY	SUBCATEGORY (With…)	CATEGORY ABREVIATION (CAT)
AVAILABILITY		AV
ACCESIBILITY		ACC
INTEGRITY		INT
SECURITY		SEC
INTEROPERABILITY		IOP
	DEVICES	IOP-DEV
	SYSTEMS	IOP-SYS
	PHYSICAL RESOURCES	IOP-PR
	CONNECTIVITY	IOP-CON
COMPATIBILITY		COMP
CAPACITY		CAP
PERFORMANCE		PERF

The definition of the identifiers (**ID**) of these requirements uses the following nomenclature

NFR-CATN-M

NFR = Non-functional requirements
CAT = Category abbreviation
N = index
M = subindex

The system refers to all pre-fire key actors, processes, data, resources, management, techniques, and actions performed.

The Pilot Functional Requirements Summary is presented in **Error! Reference source not found.** and then the Pilot Non-Functional Requirements Summary is presented, showing the diversity of requirements from the different pilots.

Both of the tables are intended to be used in order to progress from the AS-IS situation to the TO-BE situation. This way, the requirements take into account the AS-IS situation but describe the requirements of the TO-BE situation.

PILOT FUNCTIONAL REQUIREMENTS SUMMARY

Table 3: Functional Requirements Summary

NUM	ID	Description	Norway	Italy	Romania	Spain	Austria	Germany	Greece	Taiwan
1	**FR-IN1**	The system must be able to retrieve, store and manage the information generated by all the sensors used for prevention and preparedness	**x**		**x**	**x**	**x**	**x**	**x**	x
1.1	**FR-IN1-1**	Cameras/optical sensors	x		x	x	x	x	x	x
1.2	**FR-IN1-2**	Infrared cameras/optical sensors	x		x	x	x	x	x	
1.3	**FR-IN1-3**	Wind speed sensors	x							x
1.4	**FR-IN1-4**	Wind direction sensors	x							

NUM	ID	Description	Norway	Italy	Romania	Spain	Austria	Germany	Greece	Taiwan
1.5	**FR-IN1-5**	Humidity sensors						x		
1.6	**FR-IN1-6**	Smoke detectors	x		x				x	x
1.7	**FR-IN1-7**	Ambient temperature sensors	x					x		x
1.8	**FR-IN1-8**	Ambient soil temperature sensors	x					x		
2	**FR-IN2**	Information from other systems	x	x	x					
2.1	**FR-IN2-1**	Information relative to rainfall for the area	x		x					
2.2	**FR-IN2-2**	Information relative to first responders' location	x	x						
3	**FR-IN3**	The system must be able to allow the	x			x		x	x	

NUM	ID	Description	Norway	Italy	Romania	Spain	Austria	Germany	Greece	Taiwan
		input, storage and management of information								
3.1	**FR-IN3-1**	Relative to characterized soil samples	x					x		
3.2	**FR-IN3-2**	Relative to fire response teams	**x**			x			x	
3.3	**FR-IN3-3**	Relative to fire extinction resources	**x**							
3.4	**FR-IN3-4**	Relative to terrain information	**x**							
4	**FR-DAT4**	The system should be able to manage information concerning fire prevention teams	**x**			**x**	**x**		**x**	

NUM	ID	Description	Norway	Italy	Romania	Spain	Austria	Germany	Greece	Taiwan
4.1	**FR-DAT4-1**	Firefighters	x			x	x		x	
4.2	**FR-DAT4-2**	Volunteers	x			x	x		x	
4.3	**FR-DAT4-3**	Civil protection	x			x				
4.4	**FR-DAT4-4**	Regional emergency services	x						x	
4.5	**FR-DAT4-5**	Police	x							
4.6	**FR-DAT4-6**	Forest rangers	x							
4.7	**FR-DAT4-7**	Coast guard	x							
5	**FR-DAT5**	Fire response teams’ information should include dynamic infor	**x**		**x**	**x**	**x**		**x**	

NUM	ID	Description	Norway	Italy	Romania	Spain	Austria	Germany	Greece	Taiwan
		mati on								
5.1	**FR-DAT5-1**	Schedules	x							
5.2	**FR-DAT5-2**	GPS Location	x		**x**	**x**	**x**		**x**	
5.3	**FR-DAT5-3**	Specialization level	x			**x**	**x**			
5.4	**FR-DAT5-4**	Availability	x			**x**	**x**			
5.5	**FR-DAT5-5**	Number of troops	x			**x**	**x**			
6	**FR-DAT6**	The system should be able to manage information concerning firefighting resources	x	**x**	**x**	**x**	**x**	**x**	**x**	**x**
6.1	**FR-DAT6-1**	Firetrucks	x		**x**					**x**
6.2	**FR-DAT6-2**	Helicopters	x			**x**			**x**	
6.3	**FR-DAT6-3**	Water pumps	x							**x**

NUM	ID	Description	Norway	Italy	Romania	Spain	Austria	Germany	Greece	Taiwan
6.4	**FR-DAT6-4**	Specific fire extinguishers	x							**x**
6.5	**FR-DAT6-5**	Third party provided resources	x	**x**			**x**			**x**
6.6	**FR-DAT6-6**	Water supply networks	x				**x**	**x**		
7	**FR-DAT7**	Firefighting resources information should include dynamic information	x	**x**	**x**	**x**	**x**			**x**
7.1	**FR-DAT7-1**	Related to their condition	x		**x**	**x**				**x**
7.2	**FR-DAT7-2**	Type of resource	x	**x**	**x**	**x**				**x**
7.3	**FR-DAT7-3**	Quantitative measurement s	x	**x**	**x**	**x**	**x**			**x**
7.4	**FR-DAT7-4**	Capabilities	x			**x**				**x**

NUM	ID	Description	Norway	Italy	Romania	Spain	Austria	Germany	Greece	Taiwan
7.5	**FR-DAT7-5**	Availability	x		**x**	**x**	**x**			**x**
8	**FR-DAT8**	The system should manage terrain information	x	**x**		**x**	**x**	**x**	**x**	
8.1	**FR-DAT8-1**	Characterized ecosystems	x					**x**	**x**	
8.2	**FR-DAT8-2**	Characterized biomes	x	**x**				**x**		
8.3	**FR-DAT8-3**	Terrains topography	x			**x**	**x**			
9	**FR-PROC1**	The system must have the ability to operate with different data managed by it, store and provide results	**x**			**x**				**x**
9.1	**FR-PROC1-1**	To obtain fire speed propagation	**X**							

NUM	ID	Description	Norway	Italy	Romania	Spain	Austria	Germany	Greece	Taiwan
9.2	**FR-PROC1-2**	To obtain heat fluxes	**x**							
9.3	**FR-PROC1-3**	To track/trace location of the responders	**x**			**x**				**x**
9.4	**FR-PROC1-4**	To obtain the location of the response teams	**x**							**x**
11	**FR-CONF2**	The systems must allow parameters configuration	x	x			x			
11.1	**FR-CONF2-1**	Notification alarm receivers	x	**x**			**x**			

PILOT NON-FUNCTIONAL REQUIREMENTS SUMMARY

Table 4: Non-Functional Requirements Summary

NUM	ID	Description
1	**NFR-AV1**	System must be available to field actors during prevention & preparedness phase
2	**NFR-INT**	Responders' personal devices must correctly receive and report fire alarms
3	**NFR-IOP-DEV1**	The system should have sensors and devices installed to capture all the parameters to be considered in wildfire prevention & preparedness
4	**NFR-IOP-CON1**	The system should have connectivity with sensors and devices involved in the detection of parameters related to the prevention & preparedness phases of a wildfire
5	**NFR-IOP-CON2**	Communication between system connected participants (users, devices, platforms, connected resources, TREEADS services as decision support system) should be established using telematic means that always ensures communication.
5.1	**NFR-IOP-CON2-1**	4G/5G mobile connectivity
5.2	**FR-IOP-CON2-2**	Internet
6	**NFR-IOP-PR1**	The system should have access to aerial means capable of transporting sensors and/or cameras
6.1	**NFR-IOP-PR1-1**	Unmanned aerial means as drones
6.2	**NFR-IOP-PR1-2**	Helicopters
7	**NFR-COMP1**	The information should be retrieved using Open-Source Framework
7.1	**NFR-COMP1-1**	The information should be retrieved using Arrowhead Framework (the IoT Open-Source Framework)

NUM	ID	Description
8	**NFR-COMP2**	The information managed by the system should be stored in a repository based/standardized database on open standards
8.1	**NFR-COMP2-1**	The information should be stored in a repository based on open standards (ISO 10303) in STEP data format.

CONCLUSIONS

This deliverable presents the technical requirements and their distinction into functional and non-functional, achieving all the objectives to develop a safety culture in wildfire-emergency management in the prevention and preparedness phase of wildfires. These requirements will guide the technical partners in their efforts to develop the TREEADS holistic fire management platform for the prevention, detection, and restoration of environmental disasters.

The requirements described can be used as a framework for the development of forest fire management systems. Analysis of the requirements is essential because stakeholders and the team of analysts have different conceptual approaches for the functionalities and capabilities of the system.

Furthermore, Deliverable 2.3 has a close relationship with the Deliverable 2.5 "Detection and Response Understanding and Technical Requirements" & the Deliverable 2.7 "Detection and Response Understanding and Technical Requirement".

SUGGESTIONS

Nevertheless, these requirements could be prioritized in future versions of this deliverable. The levels of priority are Mandatory, Important, and Interesting.

Mandatory requirements (MUST) have been identified by end users as absolutely necessary for the effectiveness of the tool. They also provided their insights for the description of the tool's core functionalities. Often, they represent promises made in the Description of Action (DoA). Should there be no possibility to integrate these promised features, this should be addressed and clearly justified.

Important requirements (SHOULD) apply to functionalities that ensure the tool achieves sufficient business value. These can be postponed to the tool's final version but are needed for the release of a commercial version of the tool. Again, should there be no possibility of integrating these promised features, this should be addressed and clearly justified.

Interesting requirements (COULD) are features that would bring added value to the tool, but do not limit the tool's value if they are absent. These features are the wishes of end-users but may prove to be outside the scope of the TREEADS project or its time plan or resources. Nevertheless, this could be addressed in future projects.

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TREEADS

A Holistic Fire Management Ecosystem for Prevention, Detection and Restoration of Environmental Disasters

The Members of the TREEADS Consortium:

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