Table 2: First meeting of the CWI in Aquitaine.

First CWI (CRIFF) meeting	
Date	Wednesday, June 15, 2022 – 10:00 a.m. to 5:00 p.m.
Location	Mimizan, France
Objectives	-Share current wildfire prevention strategies and challenges. -Identify priority issues for innovation in fire risk management. -Present SUPERB project tools and methods (e.g., Firelihood, LIDAR). -Gather feedback to co-develop future actions in the living lab. -Strengthen collaboration between public, private, and scientific stakeholders.
Participants	C. Orazio & B. Gardiner & B. DeGuerry (IEFC) E. Rigolot J-L. Dupuy (INRAE) P. Macé & M. Laquerre (ARDFCI) E. Duverger & J-Y. Perez & R. Desbieys (SDIS 40) P. Mayer (MISSO-GROUPAM) M. Richard & Mme Roblez (Gascony Landes Natural Park) M. Pujos (Mimizan municipality) M. Tonnelle (Mios municipality) M. Maugard (ONF) M. Arenoux & M. Lamothe-Mauroux & Mme Maris (CNPF)
Outcomes	The meeting brought together key stakeholders involved in wildfire risk management in the Landes de Gascogne, within the framework of the SUPERB living lab. The SDIS 40 (Fire and Rescue Service) emphasized the increasing wildfire risk and their strategy of rapid response using a large professional and volunteer force (300 professionals, 1800 volunteers). They rely on high-resolution weather forecasting and the Prometheus model to anticipate fire spread. The region is also equipped with 19 surveillance towers with automated fire detection. Concerns were raised about limited access in some forest stands (e.g., 2x2m spacing), vulnerable interfaces with tourist sites, and the need to update fire risk maps and infrastructure. The ARDFCI (Forest Defense Association) stressed the importance of historical community-based prevention structures (ASA), and the increasing demographic pressure (1 million new residents in 30 years). Cultural shifts in risk awareness, land-use planning, and adherence to legal obligations (e.g., fuel clearance) were identified as major challenges. The ARDFCI also highlighted the growing continuity of fuel after storms and the outdated funding model that relies primarily on forest owners. Other interventions included: • The Regional Natural Park, focusing on land planning and public awareness. • MISSO-GROUPAMA, which insures 300,000 ha in the region, highlighted the need for better risk evaluation criteria and discussed possible links between home insurance and fuel management obligations. The IEFC and INRAE presented project objectives and innovations, including advanced fire danger indicators (Firelihood), LIDAR-based fuel characterization, and the involvement of local actors in designing and testing fire resilience strategies. The group agreed to focus on megafire risks, urban expansion, new forest

	practices, and insurance gaps as priorities for future innovation and demonstration actions.

Table 3: Second meeting of the CWI in Aquitaine.

Second CWI meeting	
Date	Tuesday, October 26, 2023 – 9:00 a.m. to 6:00 p.m.
Location	Mimizan, France
Objectives	-Share an updated overview of wildfire risk management in the Landes de Gascogne massif, following operational upgrades implemented in 2022–2023. -Present ongoing scientific and technical developments within the FIRE-RES Living Lab Nouvelle-Aquitaine. -Strengthen collaboration between operational actors, researchers, and land managers to better integrate innovation into fire prevention, preparedness, and land-use planning strategies.
Participants	In-person participants: -Daniel Pujos & Gilbert Badet & Ivan Alquier & Stéphane Cazade (Communauté de Communes de Mimizan) -Pierre Macé (DFCI Nouvelle-Aquitaine) -Colonel Duverger & Lieutenant-Colonel Perez & Richard Desbieys & Laurent Vigneau & Benoit Lavigne (SDIS 40) -François Pimont & Eric Rigolot & Jean-Luc Dupuy (INRAE) -Christophe Orazio & Lucas Moreews (IEFC) -Pascal Mayer (MISSO) -William Caudron (PNR des Landes de Gascogne) -Ghislain Colmagro (Biscarosse municipality) -Patrick Lacombe (DRAAF) -Robert Tauzin (Luxey municipality) -Kévin Danieau (Gascony Landes Natural Park) -Guillaume Pécastaing (ONF)
Outcomes	The meeting began with a reminder by Daniel Pujos (CC Mimizan) of the strategic importance of wildfire risk (DFCI) for the municipality and department, followed by a short video on Mimizan. Pierre Macé (DFCI) stressed that FIRE-RES should invest more in scientific advances and saw the event as an opportunity to catch up on progress. Colonel Duverger (SDIS40) presented a detailed review of the 2022 fire season, highlighting exceptional fire conditions and the regional reinforcements deployed (air and ground units). He noted the upcoming addition of a pélicandrome and new aerial bases in Limoges and Bordeaux. He also addressed weather index discrepancies and affirmed the use of tactical fires since 2022. A multidisciplinary fire cause investigation unit led to eight arson arrests. In 2023, fire activity dropped by two-thirds, with very few severe events. Christophe Orazio (IEFC) presented updates on FIRE-RES: in 2024, Nouvelle-Aquitaine will host the annual consortium meeting, with growing stakeholder engagement. Innovations include fire behavior modeling, decision support tools, and awareness efforts like the "Play with Fire" serious game. Lucas Moreews (IEFC) presented work on parametric insurance using satellite-based damage assessment from the Landiras fire, supported by Pascal Mayer (MISSO), who highlighted method limitations. Concerns were raised over the

	accuracy of COPERNICUS fire perimeters, and alternative data sources were suggested. Advances in fire simulation with BURN-P3 and PROMETHEUS were presented, along with potential applications for planning and risk communication. Key feedback included integrating terrain accessibility, fire intensity, improved meteorological data (via Météo France), and riparian buffers. Fuel maps will be updated accordingly. François Pimont (INRAE) introduced FIRELIHOOD and LIDAR-based fuel updates, stressing their utility for prevention and legal clearing obligations. The day ended with a call for finalizing CRIFF documents via Nextcloud by October 13.

Table 4: Third meeting of the CWI in Aquitaine.

Third CWI meeting	
Date	Wednesday, September 11, 2024 – 1:30 p.m. to 5:30 p.m.
Location	Cestas, France
Objectives	- Share the latest progress made on the project, - Review upcoming events and work.
Participants	In-person participants : - Guillaume Bouffard (Misso Groupama), - Yoann Bichot (SYBARVAL), - William Caudron (Parc Naturel Régional des Landes de Gascogne), - Eric Duverger (SDIS40), - Richard Desbieys (SDIS40), - Bernard Rablade (DFCI), - Séverine Fleith (Pays Barval), - Jean-Yves Perez (Expert indépendant feux de forêt), - Alexandra Gaulier (Experte indépendante urbanisme et aménagement), - Daniel Pujos (Commune de Mimizan), - Stéphane Cazade (Commune de Mimizan) - Myriam Rondet (Groupement Forestier de la Compagnie des Landes), - Christophe Orazio (IEFC), - Barry Gardiner (IEFC), - Lucas Moreews (IEFC), - Daphné Villain (IEFC). Remote participant : - Eric Rigolot (INRAe), - Jean-Luc Dupuy (INRAe), - François Pimont (INRAe), - Roberta Baggio (Université de Corse), - Jean-Baptiste Filippi (Université de Corse), - Bernard Lazarini (Région Nouvelle-Aquitaine), - Guillaume Pecastaing (ONF).

Outcomes	- Suggestions were made to increase the reliability of the parametric insurance model - Smoke propagation models were presented by Jean-Baptiste Filippi and Roberta Baggio (University of Corsica) - The Open Innovation Challenge was presented to stakeholders - The partnership between Pays Barval and IEFC was introduced - Policy clinics: the principle of the study was presented to participants, and a workshop was held to review the results of the literature review

Table 5: Fourth meeting of the CWI in Aquitaine.

Fourth CWI meeting	
Date	Friday, January 17, 2025 – 9:00 a.m. to 5:00 p.m.
Location	Mios, France
Objectives	- Share the latest advances in the work carried out as part of the project; - Review the work currently being launched for 2025; - Hold participatory workshops as part of the Policy Clinics consultation; - Provide information and discuss the next steps for the project (opportunities, funding, etc.).
Participants	In-person participants: - Richard Desbieys (SDIS40), - Fanny Faivre d'Arcier (Commune de Belin-Béliet), - Bernard Rablade (Commune de Belin-Béliet), - Jean-Yves Perez (Expert indépendant feux de forêt), - Daniel Pujos (Commune de Mimizan), - Cédric Barlet (ARDFCI), - William Caudron (Parc Naturel Régional des Landes de Gascogne), - Héloïse Gaget (PAT Pays Barval), - Christophe Orazio (IEFC), - Lucas Moreews (IEFC), - Daphné Villain (IEFC). Remote participants : - Eric Rigolot (INRAe), - Clara Ottavioli (CNPF), - Guillaume Bouffard (Misso Groupama), - Rémi Lassoureille (SDIS33), - Sylvain Lafont (SDIS40).
Outcomes	- Local stakeholders showed great interest in the new AI mental models currently being deployed. They provided numerous suggestions for stakeholders to involve, contact, or report results to. - Areas for improvement were proposed in the modeling section, particularly regarding fuel types and the parametric insurance model. - The Policy Clinics workshop was successfully conducted on two topics: The impact of the Local Urban Development Plan on land use and The impact of ecological continuity on securing urban interfaces. - With the FIRE-RES project and its funding coming to an end in November 2025,

	local authority partners were receptive to the issues surrounding the financing of the Living Lab and will return to the IEFC with either financing proposals or contacts with potential financiers in an attempt to support the work currently underway with local authorities for at least another two years. - The presentation of the OICs to stakeholders took place and generated proactive discussions: ForestGuard case: Due to the cost of the system and issues of liability in the event of loan and loss of equipment during the fire season, CRIFF members considered the innovation unsuitable for the needs of the Landes de Gascogne forest, but may be able to connect with other operators in specific areas: camping, solar panels, etc. - Wildflyer: This innovation received more interest from the attendees, especially SDIS40, for whom this innovation would complement ongoing work.

Table 6: Fifth meeting of the CWI in Aquitaine.

Fifth CWI meeting	
Date	Friday, April 18, 2025 – 2:00 p.m. to 5:00 p.m.
Location	Belin-Béliet, France
Objectives	- Share progress on fuel typology and the latest improvements in modelling work; - Update participants on possible project follow-ups and 2025 funding; - Report on the results of the Policy Clinics workshop; - Present the results of the first phase of the IA Mental Models.
Participants	In-person participants: - Fanny Faivre d'Arcier (Commune de Belin-Béliet), - Bernard Rablade (Commune de Belin-Béliet), - Jean-Yves Perez (Expert indépendant feux de forêt), - Romain Alessandrini (SDIS33), - Arthur Guérin-Turcq (POPSU Habiter les cendres), - Daniel Pujos (Commune de Mimizan), - William Caudron (Parc Naturel Régional des Landes de Gascogne), - Héloïse Gaget (PAT Pays Barval), - Christophe Orazio (IEFC), - Lucas Moreews (IEFC), - Daphné Villain (IEFC), - Axel Florant (IEFC), Remote participant : - Clara Ottavioli (CNPF).
Outcomes	- Suggestions were made regarding terminology, the content of the fuel sheet, and possible factors to be added. - It was agreed that participants would provide letters of support to back the IEFC's regional funding application to keep the Living Lab running. - The presentation of the Policy Clinics' results revealed connections

	with similar work undertaken by certain partners, the complementarity of which will need to be investigated; it also identified shortcomings that will need to be corrected for future use of the results.

Table 7: Sixth meeting of the CWI in Aquitaine.

Sixth CWI meeting	
Date	Friday, June 30 2025 – 2:00 p.m. to 5:00 p.m.
Location	Belin-Béliet, France
Objectives	-Present the latest avenues for improving the simulation models developed; -Present the expanded version of the study on the regulatory framework and urban planning tools; -Report the results of the second phase of the study on mental models related to wildfire risk perception; -Inform the working group members about progress in securing funding.
Participants	In-person participants: • William Caudron (Parc Naturel Régional des Landes de Gascogne), • Noémie Rochel (Cofor 33), • Arthur Guérin-Turcq (POPSU Habiter les cendres), • Muhammed Ali Örnek (ForestGuard), • Nour San (ForestGuard), • Christophe Orazio (IEFC), • Lucas Moreews (IEFC), • Daphné Villain (IEFC), • Axel Florant (IEFC). Remote participants: • -Eric Rigolot (INRAe), • Sylvain Lafont (SDIS40), • Jean-Yves Perez (Expert indépendant feux de forêt),- Richard Desbieys (SDIS40), • Alexandre Gobin (CNPF).
Outcomes	-Fuel typology structuring: Review and refinement of the regional fuel catalogue, including harmonized variables (structure, continuity, deadwood, litter, seasonality) and ongoing linkage with LIDAR data. Updated fuel type sheets: Presentation of an enriched example (“young maritime pine”), illustrating the shift from qualitative to structured, semi-quantified descriptions, with suggestions for clearer naming.

	Inclusion of mixed qtands: Agreement on the need to integrate mixed broadleaf–conifer types and document their influence on fire behavior, supported by ongoing research (GRIFFON, INRAE, operational references). Inflammability criteria review: Discussion on the basis for assigned flammability levels; confirmation that current values rely on expert judgment and literature, with a collaborative review document shared for summer feedback. Next steps & deliverables: Plan to organize a September workshop with NRCan and partners to critically review the sheets, test LIDAR-based mapping workflows, and produce a provisional catalogue version for further validation.

A final meeting will be organised in November 2025.

During the project, significant progress has been made at the CWI level, beyond unformal knowledge exchanges. The main achievements are summarised below:

Technical progress

Improved modelling of fire ignition probability through the development and dissemination of the FIRELIHOOD model (INRAE).

Enhanced fuel mapping capacity using LiDAR and the new European fuel map.

Collaboration with Greek colleagues on new risk modelling methodologies for high-risk areas.

Risk mapping for the Landes and Gironde departments, combining two landscape reorganisation scenarios and three climate scenarios using the BURN-P3+ model, in partnership with Canadian researchers.

First simulations of smoke dispersion from the 2022 La Teste fire, with exchanges on the use of these techniques in the CWI with CNRS Corsica.

A meeting was held from 1 to 5 September 2025 with Marc-André Parisien (NRCan), the Landes fire services and INRAE to present the new tools currently under development and to discuss priority improvements. The session provided an opportunity to review the updated fuel-type sheets, explore LIDAR-based mapping workflows, and gather operational feedback from field experts. This collaborative exchange helped refine the methodological choices and identify the next steps needed to strengthen the regional fuel catalogue and its applications for fire behaviour modelling and risk management.

Impact on risk culture and stakeholder engagement

Organisation of forums in multiple municipalities and intermunicipal structures (Lüe, Mimizan, Belin-Béliet, SYBARVAL, Luxey, Saint-Magne…) to present PROMETHEUS model simulations and possible land-use planning adaptations.

Implementation of mental models to understand ignition risk perception and inform risk communication strategies.

Organisation of policy clinics exploring legal and policy changes to support more resilient landscapes (e.g., legally binding low-fuel zones).

Participation in various local forums and events to reinforce community engagement.

Communication and visibility

Participation of French wildfire specialists as speakers in FIRE-RES events.

Organisation of the FIRE-RES general assembly in Cestas, with the presence of the president of the Landes department and national officials.

Delivery of a webinar series to present Innovation Actions.

Representation of the project at international conferences and symposia.

Launch of a dedicated Living Lab webpage:

https://www.plantedforests.org/infrastructures/fire-res/

3.4.2. The IA demonstration results at LL level

IA1.3 Early-warning indicators of EWEs

Accurate and timely warnings are essential to prevent and mitigate the impacts of EWE. In IA1.3 we used advanced probabilistic modelling to forecast the daily occurrence of EWEs at an 8 km resolution across Europe up to 9 days in advance. Our model significantly improved the current estimation of EWE probability while providing key insights into the environmental and climatic drivers of EWEs. Compared to the Fire Weather Index (FWI), our model increased precision by a factor 5 for EWE predictions at the NUTS3 level and by a factor of 10 at 8km resolution. To assess further assess it operational relevance, we evaluated the model's forecasting skill in a test area. Our results demonstrate that EWE forecasts up to nine days in advance outperformed FWI- based nowcasts, emphasizing the model's potential for operational use and its superiority in anticipating EWEs compared to current fire danger rating systems

IA2.1 Data acquisition for landscape design

The main goal of IA 2.1 has been to provide innovative methodologies based on Earth Observation data, to generate scalable key geoinformation to take preventive decisions, about the state and changes of the forestland related to clearcuts, damages, WUI, pathways or fuel:

- Innovative results have been carried out on the use of new LiDAR data and a new model for fuel determination from identification of different forestland morphologies at Aquitania living Lab.

IA2.2 Novel management practices - Component 2

The methodology implemented aimed to optimize forest management practices to mitigate fire risk by incorporating fire simulator models, developing updated fuel maps, and testing fire behaviour under different land-use arrangements. To that end, key forest management parameters were identified and integrated into fire simulation models. The methodology was applied to the main forest types in Landes region with the aim to reduce fuel loads and improve forest structure to mitigate fire spread. Using information on forest structure and fuel categories, a fuel map for the Landes department was prepared to simulate wildfire behaviour under different land-use scenarios, including a modification in forest age structure and re-arrangement of fuel types to act as barriers to fire spread. By simulating wildfire behaviour across different land-use and forest management scenarios, LL Nouvelle-Aquitaine was able to evaluate the effectiveness of various land-use arrangements and forest management interventions in reducing fire spread and enhancing overall landscape resilience.

IA2.4 Landscape and fire management policies to minimize expected losses - Component 1 (Nouvelle Aquitaine Fuel Treatment Study)

IA 2.4 aims to optimize landscape configuration and fire management policies to reduce the expected losses caused by Extreme Weather Events. This is achieved by using stochastic wildfire simulations performed with the Canadian BURN-P3+ model, which allows estimation of areas within the landscape that are likely to experience population exposure and other fire-related risks.

The model runs numerous random fire scenarios to evaluate different landscape configurations and fuel management strategies rapidly. This approach facilitates the testing and comparison of various policies to determine the most effective ways to allocate fuel treatments and organize the landscape to mitigate fire spread and reduce risks to communities and assets.

Additionally, a collaboration with the AEGEAN University (Greece) has been established to enhance modelling capabilities by providing essential data inputs required to perform advanced wildfire simulations using the ForSys modelling framework. This partnership allows for the integration of regional data and scientific expertise, improving the accuracy and applicability of fire behaviour projections within the Living Lab territories.

IA4.1 Fire forums

During the 2021–2025 period, Aquitaine developed a stakeholder forum relevant to the themes addressed by Fire Forums, though it did not strictly follow the FIRE-RES methodology. Nonetheless, its inclusion underscores the importance of community-based approaches and participatory governance in EWE preparedness and wildfire risk management. A large number of municipalities have been involved in the process (see https://www.plantedforests.org/infrastructures/fire-res/).Further details can be found in the related FIRE-RES deliverables.

IA4.2 Methodology for risk communication to improve WUI homeowners' culture of risk

In the Aquitaine Living Lab, IA4.2 replicated the mental models' methodology to address wildfire ignition risks linked to three activity domains: leisure activities, debris burning, and professional agricultural and forestry practices. The approach was adapted to the French context and aimed to capture the diversity of reasoning and behaviours among WUI users and professionals in wildfire-prone rural areas.

Expert knowledge was consolidated through a literature review and interviews, which led to the construction of expert mental models for each activity domain. These models mapped ignition sources, risk factors, and behavioural dynamics specific to the French context.

To explore public reasoning, confirmatory surveys were developed and implemented for each target group. Data collection was completed, with a solid number of responses obtained from leisure users (45) and domestic fire users (35). The number of responses from agricultural and forestry professionals remained low (6), due to challenges in accessing this group directly, often requiring mediation through cooperatives or unions.

Despite this limitation, the survey results provided valuable insights into reasoning patterns, prevalent misconceptions, and information channels within the two main user groups. These findings served as the basis for the design of targeted communication messages, prioritized according to the prevalence of dissonances, behavioural impact, and group-specific needs.

The outcomes from Aquitaine contributed to cross-comparison between Living Labs and supported the development of context-sensitive risk communication strategies adapted to different rural and WUI profiles.

IA5.1 Integrative umbrella system for estimating EWE risk and impact

The Living Lab will have the opportunity to test the web-based tool (ISS) developed under IA 5.1, as with all other participating Living Labs. This platform aims to provide an integrated framework for estimating the risk and impacts of EWE, supporting decision-making and early warning efforts.

The ISS application's main page highlights different LLs, including Aquitaine. By clicking on this area, you can view the implemented services and solutions for the Aquitaine region. For the Aquitaine LL the following services and solutions have been implemented.

TSYLVA analysed external services, considering outcomes from WP1, and integrated a set of EUMETSAT and Copernicus services into the ISS to provide users with EWE conditions forecasts.

The ISS integrates the CNRS pyro convective simulation system (IA 5.2) that includes two simulation tools, i) FOREFIRE, a wildfire surface spread model and ii) Meso-NH, an open-source numerical weather prediction (NWP) tool. The simulator addresses the simulation of the fire and smoke behaviour of fires with high potential of EWE. It can run in the LL and has been tested on real wildfire scenarios in collaboration with the operational fire services from the LL.

The ISS integrates the weather layers from the SPIRE weather forecast (IA 5.5) from the Basic, Upper-Air and Thunderstorm bundles.

IA5.2 Real-time EWE simulation and smoke spread

In addition to local developments on fire risk mapping and DSS tools, the Nouvelle-Aquitaine Living Lab collaborated with the University of Corsica on IA5.2, specifically focusing on coupled fire-atmosphere modelling and smoke plume dynamics. A simulation of the 2022 La Teste fire was carried out using a coupled model to better understand the interactions between fire spread, wind turbulence, and smoke dispersion.

Based on this simulation, several types of graphical outputs are being produced to support both scientific analysis and communication with operational stakeholders:

- Surface smoke density maps, with contours indicating concentration levels.
- Plots of plume top and base altitude, capturing vertical structure over time.
- Surface wind and turbulent kinetic energy (TKE) maps, highlighting gust zones and vertical wind speeds above 3 m/s near the fire front.
- Vertical velocity maxima plots at approximately 100 m above ground level.
- Hourly outputs are generated, oriented northward and viewed from above for clarity.

These visual products are designed to support early warning and evacuation planning, particularly for civil protection services. To ensure consistency with operational mapping standards, IGN base maps were provided to the University of Corsica, so their figures match those used by fire services (SDIS).

A first presentation of this work was made to our CWI, which raised strong interest especially regarding the potential use of smoke propagation models for evacuation planning during extreme fire events.

Finally, this collaboration initiated a reflection on the definition of a minimal data format to be systematically stored in future simulations, in order to enable reproducibility and shared use.

IA5.6 High Altitude Pseudo Satellites

The simulation done in the Living Lab of Aquitania is only an approach because not all the area of the living lab was simulated. In this case, the HAPS unit was deployed only in August to September. This tailored approach allows Aquitania to cover 100% of burnt area monitored, with arrival times below 1 hour and 16 min as average.

IA5.10 Pan-European system to define management priorities

The innovation action "Pan-European System to Define Management Priorities for Mitigating Fire Impact" aimed to design a prototype system for identifying strategic fuel management priorities based on multiple criteria.

To develop this system, we began by defining a set of relevant criteria and assessing the need to model and map these variables. Among the most critical variables were fuel accumulation and potential fire behaviour, which, at the start of the project, were not adequately covered by existing information. During the initial years, the University of Padova mapped all fuel-related variables necessary to estimate fuel accumulation and simulate fire behaviour. This effort resulted in four scientific articles and the development of a server where the information is publicly available for download (https://www.cirgeo.unipd.it/fire-res/app/). Technosylva used this data to simulate high-intensity fire behaviour across the EU. Simultaneously, ISCI developed a multi-criteria decision support system calibrated to the generated data. This system can assign priority scores once the data is harmonized, and criteria are weighted accordingly. Currently, a strategic prioritization exercise is underway for the Iberian Peninsula, demonstrating the supranational capacity of this analysis and illustrating how large-scale, policy-oriented frameworks are most suited for this system. After the Iberian exercise is completed, the multi-criteria system, programmed as a QGIS plugin, will be publicly available.

Looking ahead, we plan to develop a dedicated server where users can easily download relevant data for such analyses. This platform will also store new data, especially concerning values and risk assessments, alongside existing datasets.

3.4.3. Next steps until 2030

To consolidate and build upon the progress made during the FIRE-RES project, the IEFC will seek new funding (regional, departmental, national, European) to pursue the following priority actions:

1. Sustain Living Lab coordination and stakeholder engagement

Continue the animation of the Nouvelle-Aquitaine Living Lab, particularly through the coordination of the CRIFF (regional committee on wildfire innovation) and the COPIL (working group gathering IEFC, INRAE, SDIS, MISSO, ARDFCI).

Organise meetings and events to maintain multi-actor dialogue and integrate additional stakeholders.

Represent the Living Lab at national and international events to ensure continuity and visibility.

2. Promote forums and policy clinics

Expand the reach of forums and policy clinics in new municipalities and risk-prone areas.

Encourage the use of simulation tools and mental models in policy dialogues.

Disseminate legal and operational recommendations developed during FIRE-RES, especially regarding zoning regulations and resilient infrastructure.

3. Promote the reorganisation of landscapes based on modelling outcomes

Use results from FIRELIHOOD, PROMETHEUS, and BURN-P3+ to support regional and local landscape redesign initiatives aimed at reducing exposure to EWE.

Continue the production and sharing of simulation outputs to inform planning strategies (e.g. strategic firebreaks, forest age mosaics, WUI buffer zones).

Collaborate with local authorities to translate these models into concrete planning and land-use recommendations.

4. Disseminate mental model results and strengthen fire-risk culture

Promote the use of mental model findings to enhance risk communication strategies, particularly for homeowners, professionals, and local authorities.

Support the development of education and outreach materials based on the cognitive and behavioural insights gathered.

Contribute to the consolidation of a shared fire-risk culture across stakeholders and territories.

3.5. CWI feedback

Based on the collected survey responses, 100% of respondents indicated they were either satisfied or very satisfied with the CWI meetings. All participants stated that the topics addressed were fully aligned with their institution's priorities. 75% reported having had the opportunity to express their organization's needs during the meetings. Some suggestions included the possibility of holding meetings online to reduce travel time and environmental impact, and a desire to continue CWI activities beyond the FIRE-RES project.

4. Bulgaria (BG)

Authors: Zlaty Dryanov, Nikolai Ivanov, Georgi Kostov

4.1. Wildfire context

4.1.1. Fire regime, socio-ecological context, and impacts

Frequency of forest fires in Stara Zagora region - Bulgarian Living Laboratory

During the period from 01.01.2000 to 06.12.2022, a total of 545 fires with a total burned area of 15,446.9 ha occurred in the forest territories of the area of activity of the Regional Directorate for Forests /RDG/ Stara Zagora, of which 5,209.0 ha were crown fires.

Most fires occurred in the months of March, July, August, and September. The most common causes of fires are "carelessness" and "burning of stubble and pasture".

Most of the fires have an area of less than 500 ha. During that period, there were 6 large fires with an area of more than 500 ha. They represent 1% of the total number of forest fires. The total burnt area of these six fires amounts to 5,565.5 ha, which amounts to 36% of the burnt area during the considered period.

The forest fires that occur on the territory of the Stara Zagora region, where the "Living lab" is located, are directly dependent on the specific meteorological situation. Fires depend on certain values of temperature, air humidity, soil water reserves and wind speed. These parameters can be predicted, and this, in turn, makes it possible to predict the risk of forest fires in the region under a given synoptic situation.

Of particular importance when considering fires is to know their nature. During the study of the fires, some important questions were considered, such as the type and spread of forest fires by territory, distribution of forest fires by seasons, the dependence of forest fires on the properties and composition of forest stands, the economic condition of plantations, meteorological conditions, causes of occurrence of forest fires and their consequences.

Depending on which parts of the forest stands the fires spread to, three types are found on the territory of the Stara Zagora region (living laboratory): Underground fires, surface fires, and crown fires.

In most fires that occurred on the territory of the Stara Zagora region forest floor appears as the primary source material from which all fires start.

The humidity of the litter is important. At 30% humidity, peat and humus litter do not burn.

The humidity of branches with leaves and conifers changes very slowly and varies within small limits. The materials of this group serve as the basis of crown fires. Such fires were observed in the Stara Zagora region in 2007. The fire hazard in places where forestry interventions are carried out, like thinning or feelings, depends on the type and number of combustible materials, their humidity, quantity, and structure.

The trees in the forest stands are the secondary material for the occurrence of fires, which ensures the further spread of the fire. Coniferous stands (man-made in the LL region) are most at risk of fires. The natural stands, composed of beech and oaks are less threatened.

The flammability of pines is due to the high content of balsamic resin. The fires depend on the size of the forest massifs, the nature of the forest vegetation, and the relief of the terrain, as well as on the preventive measures taken. The nature of the terrain surface affects the spread and intensity of wildfires, due to the large effort to concentrate people and equipment at the fire scene.

Based on the experience and analysis of the fires in the territory of the Stara Zagora region, it was established that: The fires occurred on the southern slopes of Stara Planina and Sredna Gora, where there are steep slopes with coniferous plantations and coppice forests, mainly with an altitude of up to 500 m above sea level with a high density of trees and understorey. In forest stands with a low density and a tree height of more than 15-20 meters, a slow spread of the fire is observed.

Of the available forest areas in the Stara Zagora district, about 15% are more resistant to fires. These are the forests that are more than 800 meters above sea level, broad-leaved high forests, and stands with trees above 15-20 meters in height.

There are 45,000 permanent residents in the forests at risk of fire. On weekends, this population increases and can grow to 50-60,000 people, because those living in the big cities go home to the small settlements where they have properties.

The regional city of Stara Zagora has a population of 125 thousand people, and it is located in the foothills of Sredna Gora mountain. A large part of the population uses the forest for recreation during the hot days of summer. Part of the city's large districts border forest areas.

The population that is potentially vulnerable to a forest fire is 21% of the population of the Stara Zagora region. The houses in which these 21% live are mostly built of wooden structures. The fire resistance of the properties of those living in vulnerable areas is extremely low. The threat of fire and its rapid spread is great. At the moment, there are no legal requirements for the separation of settlements from forest areas with fire-resistant areas and the creation of a buffer zone.

The consequences of forest fires are:

During the period from 01.01.2000 to 06.12.2022, the fires in the forest territories in the area of activity of the RDG Stara Zagora caused damage in the amount of BGN 12555532.

341 m3 of wood was burned, which was harvested and stored in a warehouse in the forest worth BGN 10,107.

The damaged standing trees are in the amount of 454255 m3 or worth about BGN 5654717.

Destroyed 3077303 pcs. afforested saplings for young forests worth BGN 218,786, which were burnt in the fires.

BGN 6,671,922 was spent on other damages and costs for extinguishing the fires.

In extinguishing forest fires from 01.01.2000 to 06.12.2022, the following participated:

- Forestry employees - 5,807 units.
- Employees of the fire department – 4,478 pcs.
- Military personnel – 3,097 units.
- Volunteers – 3,968 units.
- Technique used:
- Forestry vehicles – 1,691 units.
- Fire trucks – 1,240 units.
- Heavy machines /bulldozers/ - 163 pcs.
- Airplanes – 11 pcs.
- Helicopters – 10 pcs.

The meteorological parameters that are of great importance for forest fires are precipitation, wind, temperature, and soil water reserve. During the summer and autumn days, drying of the surface soil layer occurs. This favours the occurrence and rapid spread of fire. Wind plays a major role in the speed of fire spread and its shape.

The area that a fire could cover could be predicted based on values for wind speed and direction, taking into account humidity. The wind has a certain cyclicity. At night, it is weak and relatively constant in speed and direction. In the morning, its speed increases, reaching its maximum, and in the evening, it decreases to its minimum value. Wind with a speed of 6-10 meters per second is unstable, with a speed of 10 meters per second and more it is sustainable and extremely dangerous. Strong summer heat increases evaporation from plants and this, in turn, leads to a decrease in the water reserve in the soil. Therefore, in the months of July, August, and September, the frequency of forest fires in the Stara Zagora region increases.

4.1.2. Wildfire governance

In the period from 2014-2019, normative changes were made in Bulgarian legislation. The reasons are related to trends in climate change; the analysis of response capabilities; risk management capabilities. The main direction is given to prevention measures and related organizational preparation.

To fulfil these legal requirements, a Disaster Risk Reduction Council was established by the Council of Ministers. Regional Disaster risk reduction councils have also been established at district and municipal levels. Their main task is to take measures and actions to reduce the risk of disasters, including the risk of a forest fire. Action plans are developed for this purpose. The measures of the councils are mainly preventive.

At the national level, an update of the National Disaster Risk Reduction Strategy, and the National Disaster Risk Reduction Programme has also been developed.

A priority area for action in the Risk Reduction Strategy is: Increasing preparedness for effective response to disasters and applying the principle of "build again, but better".

Increasing preparedness for effective disaster response and applying the "build again but better" principle in reconstruction can be realized through measures that are currently not fully implemented. They are:

- A unified system for conducting training, exercises, and exercises of the constituent parts of the unified rescue system, including mechanisms for monitoring and evaluation; Currently, there is no monitoring mechanism.
- Improving the effectiveness of voluntary formations, as a supporting part of the unified rescue system. At the moment, there are established voluntary formations, but there are a number of difficulties before them. The volunteer formations in Stara Zagora and Kazanlak are the only ones involved in extinguishing fires when necessary.
- At the moment, there is no system for monitoring and reporting the financial resources spent on prevention, response, restoration, and support in the event of forest fires.

Not long ago, a Strategy for adaptation to climate change and an Action plan until 2030 was approved. The aim is to reduce the country's vulnerability to the effects of climate change and to improve the adaptation capacity of ecological, social, and economic systems to the impacts of the change in the climate. The long-term goal of the Strategy is: "Proactive actions to achieve long-term and highly effective economic, social and environmental resilience and resilience so that Bulgarian citizens, the private sector and government institutions can prepare and protect appropriately against the vulnerability arising from climate change". The Action Plan, part of the Strategy envisages an "integrated approach" in financing mitigation and adaptation actions and monitoring.

The legislation, which is related to the care and management of forests in the Republic of Bulgaria, includes various laws - for forests, for the fire department, and for the prevention of disasters and accidents:

Fire Service is called the Main Directorate "Fire Safety and Protection of the Population" of the Ministry of the Interior. It is responsible for the Implementation of the Law.

The Executive Forest Agency, its structures, and specialized territorial units control the implementation of actions, measures, and events, as well as compliance with the requirements for the protection of forest territories from fires.

State forestry enterprises, as well as municipal and private forestry structures, organize a system for the timely detection of fires in forest territories, create an organization and participate in their extinguishing.

For all forest territories, regardless of their ownership, fire protection activity plans are prepared, which are at the expense of the state budget and are an integral part of the forest management plans. In all forest enterprises (divisions of state forest enterprises) there are fire prevention warehouses (depots), which are coordinated with the municipalities.

In the area of the living lab, the forest enterprise has a total of 3 Toyota Hilux off-road vehicles, equipped for extinguishing forest fires, which are kept in constant readiness during the fire season. These vehicles indicate a great help in extinguishing fires, but they are not enough. The structures have a need for more cars because it has been proven in firefighting.

In each division of the forestry administration, there are specialized groups formed to participate in actions in extinguishing fires in forest territories, provided with personal protective equipment and protective clothing.

At the beginning of the fire-dangerous season, the forest officials instruct the persons carrying out activities in the forest territories to comply with the fire prevention rules. Such a briefing is also given to hunters before each hunting trip during the hunting season.

Measures for the protection of forest territories from fires are planned, implemented, and maintained as a common system for all forest territories, regardless of their ownership, territorial and functional purpose.

The National Disaster Protection System is based on the Disaster Protection Act. This law regulates public relations related to ensuring the protection of the life and health of the population and the protection of the environment and property in the event of disasters. Protection planning is carried out at the municipal, regional and national levels. Disaster protection plans are prepared in parts for each of the hazards specific to the respective territory.

There is a total of 64 settlements in the territory of the Stara Zagora region (LL) that are located in forests or border forest massifs. The population in these 64 places is about 45,000 inhabitants. The settlements are located in mountainous areas of Stara Planina, Sredna Gora, or near them. A careful analysis of the fires reveals that most of the fires in the regions were caused by activities in the fields of farmers or by burning dry grasses and bushes in the yards of citizens for the purpose of cleaning. A small part of the fires occurred directly in the forest massif.

The supporting structural elements of the buildings in the forests and the houses in the settlements are stones, bricks, wooden columns, and reinforced concrete columns. In more than 90 percent of the buildings, combustible materials, such as wooden beams and columns, were used in the construction.

Homes of citizens in areas threatened by forest fires usually do not have fire insurance. At the moment, there is no legislative requirement for this to be done by citizens. At the initiative of a small circle of the population, it is possible for certain properties to have insurance. No studies have been conducted in this direction.

The firefighting strategy aims to reduce the burned area and limit the impact of the fire on the population and the environment at the same time

The fire response is managed by the services of the unified rescue system. Emergency response services are included in the unified rescue system. When a fire occurs and a 112 signal is received, employees from the fire department and the police are sent to the scene of the fire, and if there is information about injured people, employees from the emergency medical assistance centre are also sent.

The coordination of forces and means in case of large fires is managed by the operational centre for Fire Safety and Protection of the Population, located in the city of Stara Zagora.

Upon arrival at the scene of the accident, the most senior officer from the structural unit for "Fire Safety and Protection of the Population" is the head of the fire extinguishing operation on site. The manager decides what forces and means are necessary to deal with the fire. At his discretion, additional forces and means may be required, such as activation of the voluntary formation, activation of the modular formations of the Ministry of Defence, etc. When a fire signal is received, together with the professional fire-fighters, forest management employees immediately go to the scene and assist the professional fire-fighters in making extinguishing decisions and in extinguishing the fire itself.

Each forest fire is divided into sections, and for each section, a leader is appointed from the professional fire-fighters. Volunteers, military personnel, forest management representatives, volunteers from legal entities, etc. may be included in the sections.

Making an adequate decision on extinguishing forest fires depends on the on-site manager receiving objective information about the situation in a timely manner. The first action taken is reconnaissance.

During reconnaissance, in order to quickly and accurately respond to a forest fire, it is determined:

- Type, rate of spread, and shape of the fire area.

- The most dangerous directions of the spread of the front and flanks of the fire.
- The topography of the area.
- The danger to settlements and individual buildings.
- Presence and type of natural obstacles in front of the fire front.
- Presence of transmission lines, clearings, and type of plantations.
- Presence of natural water sources, the road to them, and the possibility of use.
- Presence of areas that can accelerate the speed of fire spread (coniferous forest, juniper plantations, timber warehouses, etc.).
- Safe places for base stations of the equipment used.
- Conditions for creating support strips for "counterfire".
- Quantity and type of forces that can be used for extinguishing (population, voluntary formations, military personnel, foresters, etc.).

The main tactical ways of introducing the forces and the means that are used, depending on the characteristics of the fire, are:

1. Simultaneous introduction of the forces and means along the entire perimeter of the fire - used in extinguishing weak and medium above-ground fires, when the forces and means are sufficient (Fig. 4).

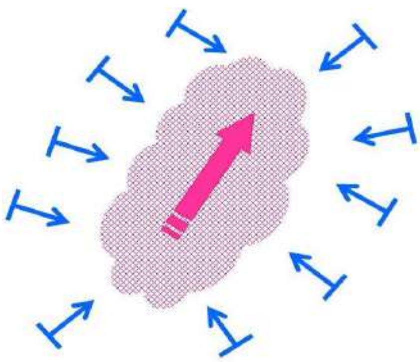


Figure 4: Tactical strategy for firefighting: Simultaneous introduction of the forces and means.

2. On the front with movement on the flanks - used in case of insufficient forces and means, when it is necessary to quickly stop the movement of fire (Fig. 5)

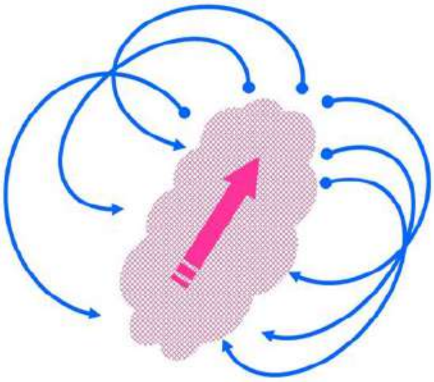


Figure 5: Tactical strategy for firefighting: On the front with movement on the flanks.

3. In the rear with movement along the flanks - it is used in strong crown fires when a security barrier in front of the fire is available (wide meadow, lake, dam, resilient forest stands, etc.) (Fig. 6).

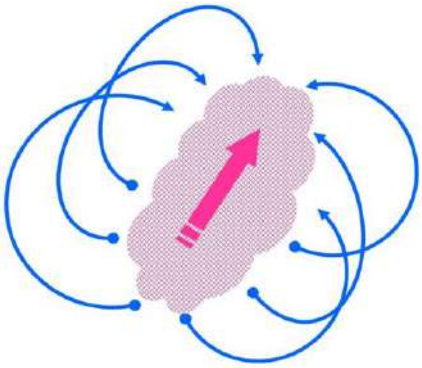


Figure 6: Tactical strategy for firefighting: In the rear with movement along the flanks.

The commander on the ground chooses the method of concentration and introduction of the forces and means depending on the created situation and the amount of the forces and means.

In the event of a danger of the fire spreading to settlements, buildings, cottage areas, etc., the main forces and means are introduced to eliminate the burning in these directions.

In case of large fires, a headquarters is established, which includes officials from all institutions involved in extinguishing the fire. The headquarters for extinguishing forest fires must keep an account of all the forces and means involved.

At present, forest fire fighting strategies do not adopt an early fire attack with aerial means of extinguishing. Emergency response services do not have aerial fire-fighting equipment. In case of complex fires, for which it is necessary to use helicopters for search, a request is made from the operational centre of the Regional Directorate of the Fire Service to the National Operational Centre of the General Directorate "Fire Safety and

Protection of the Population" and from there a request is made to the Minister of Defence for the inclusion of helicopters from the armed forces of the Republic of Bulgaria in dealing with the fire. The initial attack of the fire is carried out on land by the forces and means of the unified rescue system, foresters, volunteers, military, citizens, etc.

There are currently no fire analysts in the structures of fire safety and population protection. Post-fire analyses are performed by the management personnel in the system. All participants from the authorities for fire safety and protection of the population are present during the analyses. The analysis highlights the operational actions of emergency response teams, discusses good practices, and analyses weaknesses. There is a lack of a comprehensive analysis regarding the use of financial resources, a mechanism to improve the system of prevention, preparedness, and interaction between the structures involved in dealing with large forest fires, causing irreparable consequences to the climate, business, and people in the region.

The disclosure of the causes of forest fires in the territory of the Stara Zagora region is fully subordinated to the Criminal Code and the Criminal Procedure Code. The investigation is carried out by the prosecutor's office and the investigative bodies of the police. Fire department officials are included in the commissions of investigation. The authorities for fire safety and protection of the population prepare fire technical expertise based on the collected information. Uncovering the causes of fire in forest areas is extremely difficult. The system does not have sufficient capacity to detect all the causes of ignitions. It is difficult to identify the original outbreak, witness statements are used to guide investigators, but in most cases, they are conflicting. There is a lack of a unified system to track what is happening with the investigations and what are the results achieved.

During the fire season, numerous information campaigns are organized with the aim and focus on the danger of fire in forest areas. Emphasis is placed on preventive measures to prevent fires. Executive authorities take additional measures by conducting joint inspections of activities near the forest and in the forest. The activity of the agricultural producers is checked, regarding the securing of the agricultural fields with ploughed strips with a width of 6 meters, for the separation of crops from roads, apiaries, forest areas, etc. When a fire occurs in agricultural areas, it is reported to the Regional Office of Agriculture for taking additional actions and sanctioning possible violators of the fire prevention rules. Control activity in recent years has given positive results regarding fires that have occurred in agricultural areas and their transfer to forest areas, i.e. the number of such fires is less.

According to the provisions of the Forest Act, burned areas are reforested by the owner of the respective forest territory, if they have not regenerated naturally within a three-year period after cutting down the wood damaged by the fire.

4.2. Vision for wildfire-resilient landscapes in 2030

4.2.1. A 2030 wildfire-resilient landscape in Bulgaria

To debate on the concept of Resilient Landscape, a general meeting was held on 06.07.2022 with the interested parties. The basis for the conversation was the *Miro e platform* debate on Fire - Resilient Landscape. It was found that the attendees understood fire resistance as static, i.e. instantaneous, not dynamic, in time. Individual elements are visible, not the overall landscape-level picture.

The expectation of ensuring resilience is aimed at the different departments. It is not perceived as a commitment of every citizen. The latest example is the one with a natural flood in a neighbouring region (Karlovo in September of this year).

The general understanding until now is that each individual institution should mainly fulfil the obligations attributed to it by law. It could be argued that integrated management is more wishful thinking. Available connections are usually on a personal basis.

There is a lack of comprehensive regulatory harmonization of the responsible services for ensuring prevention. For example, control services for agriculture or forests, or road infrastructure, or mayors of settlements cannot sanction violations for non-implementation of prevention measures, outside the territories entrusted to them.

An insufficient media campaign is reported for the potential danger of fires throughout the year. The campaign is seasonal and inconsistent.

A relatively new vision for everyone presented in the *Miro platform* is resilience to be seen as an opportunity to quickly self-restore and preserve the majority of ecosystem services, incl. biodiversity and economic activity in the considered area (landscape).

For this purpose, a need for more information on the various types of activity of the affected parties is identified.

4.2.2. Resilience in fire preparedness and prevention

In the country, resp. in the region of LL, there are a number of contradictions in interests, resp. in the actions of individual interested social groups. For example, farmers often do not allow agricultural roads to be used for forestry purposes. Sometimes forestry activities, such as various types of felling, are performed poorly, which leads to an increase in waste and dry wood mass on the surface. This increases the preconditions for easy ignition.

The construction and maintenance of a dense and fire-safe forest road network are insufficient. Owners of roads that pass-through forest territories must implement fire prevention measures. There are many of them and they are not always fully implemented.

At the moment, fire prevention measures, which are included in the forestry plans, are being implemented. In some years, there is a delay in implementation, which is dictated by various reasons. *There are no analyses about the direct impact of the preventive measures taken and their implementation in the LL.*

Who decides when a "fire season" is defined and what requirements does it introduce?

The Forest Act regulates the procedure for declaring the so-called "fire season", namely: Every year, on the proposal of the director of the regional forest directorate, the regional governor by order determines a fire season in the forest territories of the district.

The order is made public on the website of the relevant regional administration, the regional forestry directorate, and the Executive Forest Agency.

The "fire season" regime introduces the requirement for increased control, and readiness to respond in the event of a forest fire.

During the fire season, it is prohibited to light an open fire and carry out fireworks at fewer than 100 m from the borders of the forest territories.

Fire safety and population protection authorities and employees of the Executive Forest Agency and its structures have the right to stop activities or machinery and equipment that do not meet fire safety requirements or create a risk of forest fires.

Currently, there is no monitoring system for forest areas during the fire season. There is a project for the construction of fire watch towers for the territory of the Stara Zagora District, but none have been built now.

Vision 2030 for the key aspects mentioned above

The National Strategy for Adaptation to Climate Change states the following vision of the country's government: *"To develop the highest possible level of resilience of the country against climate change by taking all necessary and feasible measures and thus ensuring unimpeded functioning of the country's economic sectors, protection of the health and well-being of the population and protection of natural resources*"

For the territory of BG-LL, this includes:

- *Improving the awareness of the interested parties, by objectively establishing vulnerable and critical areas for the occurrence of forest fires. Inclusion of new data, when planning fire prevention activities.*
- *Building a system for constant monitoring, in the fire season, starting from the most vulnerable places.*
- *Technical equipment and renovation of existing structures responsible for fire safety*
- *Maintenance of the road network, at least in the area of the most vulnerable territories*

4.2.3. Resilience in wildfire emergency management

On the territory of the Living Lab, the legally required notification scheme is observed at all levels in the event of a fire in the forest areas. Current information about fires that have occurred should be transmitted to the Duty Officers at the Regional Security Council.

The specialized all-terrain vehicles for initial attack and extinguishing forest fires deployed evenly in the area.

When extinguishing forest fires, all available water sources that are in the forest territory (e.g., dams, rivers, etc.) are used. In the summer days and months, however, these water sources are not sufficient to extinguish large forest fires. The available rivers have little water, and the large dams are a long way from the fire.

In recent years, the practice of supplying water with tankers owned by honest companies has become established. They can supply places with stable roads. This practice creates difficulties in more inaccessible terrain.

Vision 2030 for the key aspects mentioned above:

- *Sufficient funds are provided for extinguishing activities near vulnerable areas.*
- *Sufficient sources of water for firefighting needs have been built in suitable places in all forest regions.*
- *When extinguishing fires, participants are provided with sufficient special clothing and shoes (personal protective equipment).*
- *The interaction between the different structures has been improved, through additional specialized training, incl. of voluntary formations.*

4.2.4. Resilience in post-fire management and adaptation

The restoration of forest areas damaged by fire is indicated above. It is normatively clear and is implemented by the state forest structures. This is not the case with reimbursement of funds spent to cover damages. There are a lack of insurance culture and a regulatory requirement for such.

Vision 2030 for the key aspects mentioned above:

- *Improved insurance culture and stakeholder accountability*

4.2.5. Other resilience aspects

The municipalities, through their representatives, are called to be closest to the interests and problems of the people living and working in their territorial scope. They are most interested in local welfare. Currently, they do not have the obligation and capacity to comply with the implementation of all fire prevention, extinguishing and recovery measures. Their commitments are mainly to the settlements themselves (urbanized territories).

The vision is in this direction:

Making municipalities a dedicated hub to ensure rapid communication and interaction between responsible parties and stakeholder groups for every aspect of understanding fire-resilient landscapes.

In accordance with the current legislation and the available strategic documents at the national level, the stakeholders in **BG-LL consider the following vision for fire-resistant landscapes to be appropriate**:

Harmonized, financially justified, and competent management of all social, ecological, and economic sectors and groups in the region for effective implementation of commonly identified measures for prevention and for protection and recovery from forest fires with a view of sustainable provision of traditional ecosystem benefits from forestry, agriculture and other territories in all municipalities in the region.

4.3. Gaps to reach that vision

4.3.1. Preparedness phase

A major problem in this phase is the insufficient exchange of information between responsible institutions. A possible solution is to consider a coordinating body at the local level.

Maintaining the road network to all affected areas is a problem. In addition, provision of water tanks for the summer should be added. The potential solution is long-term and requires a reallocation of resources among all stakeholders.

The training of volunteers is also important. For this purpose, we need a law on volunteering.

Providing the necessary equipment and machinery for fire brigade personnel (helicopters). A potential solution is to use the EU Recovery and Resilience Plan

4.3.2. Prevention phase

Identifying the most viable areas based on objective criteria is also a challenge. The possible solution is to create a multi-criteria recognition tool.

Improving forest planning for fire prevention measures in identified vulnerable areas. Management capacity at all levels needs to be improved.

Year-round campaign among all interested groups at local level. To engage, including financially, national and local media.

Introducing more effective measures to detect and punish those who cause fires.

4.3.3. Detection phase

Creation of a hotline in local areas (municipality level), which will be active continuously. A campaign is needed among the leadership of municipalities, especially for small settlements.

Providing better information through visual materials on roads, streets and other public places on how to react.

Coordination of fire data with all institutions, especially important with aviation. Legal changes are most likely needed.

Introduction of new detection technologies based on cheap sensors with coordinates. The solution needed is related to central budgeting.

4.3.4. Response phase

New technologies are needed for use in firefighting. Possible solutions include drones providing live updates.

Organizing volunteers and ensuring their mobility in all vulnerable areas. The Volunteering Act should solve it.

Calling in specialized aircraft. A likely solution is to purchase a suitable such mattress for recovery and sustainability.

Exchange of experience and information with fire departments from countries with more experience.

4.3.5. Restoration and adaptation phases

Funding is a problem. A possible solution is to involve volunteers at the local level.

A different approach to landscape and forest planning is needed to avoid the craze for conifer afforestation. The possible increase in the budget of municipalities to improve actions at the landscape level to maintain resilient landscapes

4.4. Steps and milestones: the roadmap

4.4.1. Progress achieved during the project (at CWI level)

Classification of challenges

When processing the surveys made in the CWI group, the identified challenges (problems) were classified by importance and probability of achievement. The data do not allow searching for statistical regularities but indicate trends. According to them, CWI participants classify the challenges in the separate parts of the challenge frame as:

1. Relatively easy challenges to solve

2. Relatively difficult challenges to solve

Solutions to the first set of problems depend largely on the CWI participants themselves, or the departments they represent. They are as follows by phase:

Relatively easy to solve challenges:

A. Prevention & Preparedness

1. Improvement of communication between the stakeholders and responsible state departments, with the municipality as the centre at the regional level. Focus on managing not a single resource (item), but the entire landscape *.
2. Organization of educational campaigns (including according to knowledge in countries with more experience in forming fire-resistant landscapes) to improve the capacity of different administrations *.
3. Clarification of the necessary technical means and personnel for monitoring and preparation for response.
4. Clarification of the so-called hotspots (places with the highest probability of fires occurring) and focusing existing resources there *

B. Detection & Response

1. Communication clarification of the responsibilities of individual departments and what actions they take with the available budgets. Coordination by the municipal management for this activity.
2. Persistence of the fire prevention campaign at all levels through educational institutions and the media. The involvement of professional PR experts in the forest and fire service.
3. Improving the capacity of the various state and municipal administrations through additional training for possible innovative solutions.
4. Increasing real-time surveillance, starting from the places at risk that are identified by firefighters and new technologies based on GIS*.
5. Creation of a centre in the municipality and town halls for receiving reports of irregularities in relation to fire safety and others (affecting the so-called public order).

6. Training of the voluntary formations through cooperation with NGOs, such as hunting organizations, tourist associations, as well as with the available local industry and farmers.

C. Adaptation & Restoration

1. Conducting a permanent information campaign about the problem - causes of fires, funds spent, and consequences.
2. Clarification of the concept of landscape in planning activities in the responsible departments (agrarian, forestry, urban - cadastre) and improvement of communication during their coordination*;

According to the expert opinion of the participants in the analysis, the listed challenges are solvable within the framework of the implementation of the experimental activities in Living Lab BG, i.e. until the end of the project.

The solution to the second type of challenges does not directly depend on the participants in the CWI group. Political, financial and governance interests and views at the national level intervene here. Therefore, they are defined as more complex and difficult to solve challenges as follows:

Relatively hard to solve challenges:

A. Prevention & Preparedness

1. Preparation of a General sustainability plan for the territory and a regional plan for the development of the forest territories, which organizes the planned activities at the municipal and regional level
2. Revision of the regulatory framework to introduce mandatory elements of an integrated approach in the laws relating to land use *
3. Ensuring timely funding for all planned activities
4. Introduction of requirements for insurance of certain assets

B. Detection & Response

1. Creation of GIS-based information for the entire territory, incl. with information about the fuel and finding experts to handle it *
2. Coordination of departmental budgets to ensure the necessary funding for modern prevention (surveillance) and extinguishing equipment, incl. specialized aircraft
3. Review of fire service strategic plans and their funding

C. Adaptation & Restoration

1. Introducing an understanding of landscape resilience into planning *
2. Normative (legislative) changes in the requirements for investigation, establishment and analysis of the causes of fires
3. Financing and technical provision of the above actions and political context (to be understood as a lack of strategic, long-term actions)

The activities of the FIRE-RES project help to identify or confirm existing analyses in all stages of the creation of fire-resilient landscapes. The same are marked in the individual phases with a signature*.

Achieving positive results on the second group of challenges requires more time. According to the expert opinion of the participants in the CWI group, this period will probably last 4-6 years after the end of FIRE-RES, while it will depend on the follow-up policies at the EU level.

Possible Road Maps

In formulating the road map, the recurring challenges in the individual phases that have been put in the foreground have been traced. Two variants of the road map are proposed:

A realistic version of the roadmap includes relatively easy-to-solve challenges, goals and needs in the challenge frame as follows:

- Communication campaign between departments
- Clarification of responsibilities, needs and gaps
- Adoption of the understanding of common planning, as part of a common integrated management of the problem of forest fires
- Determination of common priorities in prevention and preparation
- Determination of opportunities for provision with technology, equipment and people at vulnerable points
- Educational activities based on the experience of countries with more experience in training equipment and personnel
- Providing with a PR campaign at every step

The optimistic version includes the following addition to the realistic one:

- ➢ Analysis of the regulatory framework and introduction of elements of integration in management and criminal liability for non-implementation of fire prevention measures in all objects of the landscape
- ➢ Stimulation of territory insurance

- Coordination between departments through the mediation of municipalities and full information from the cadastre of operational management plans of the territories
- Development of the monitoring systems based on GIS and satellite images
- Preparation of a General sustainability plan for the territory and a regional plan for the development of the forest territories or at least in their part for prevention and action in the event of disasters and accidents
- Financial provision of these plans Consistency in financing the technical provision of combat equipment with fires (incl. aircraft)
- Securing with a PR campaign at every step

The analyses of the state of fire safety in nature, which are reflected in the roadmap, have been presented to the management of the national fire department. Within the framework of the FIRE-RES project, the country actively participated in the creation of an improved fuel map at the European level (FIRE-RES GEOCATCH app) – **AI 4.1** (Improvement of fuel maps used for simulations).

On task 6.3. -After a working meeting of the CWI (**AI 4.1 Fire forums**) group on the topic: Integrated landscape management for the prevention of significant fires – pilot actions during the 2024 fire season on 28.05.2024, at which a CONCEPT was presented for the content and expected results of this working meeting, integrated management at the landscape level was adopted for pilot implementation (Fig. 7).

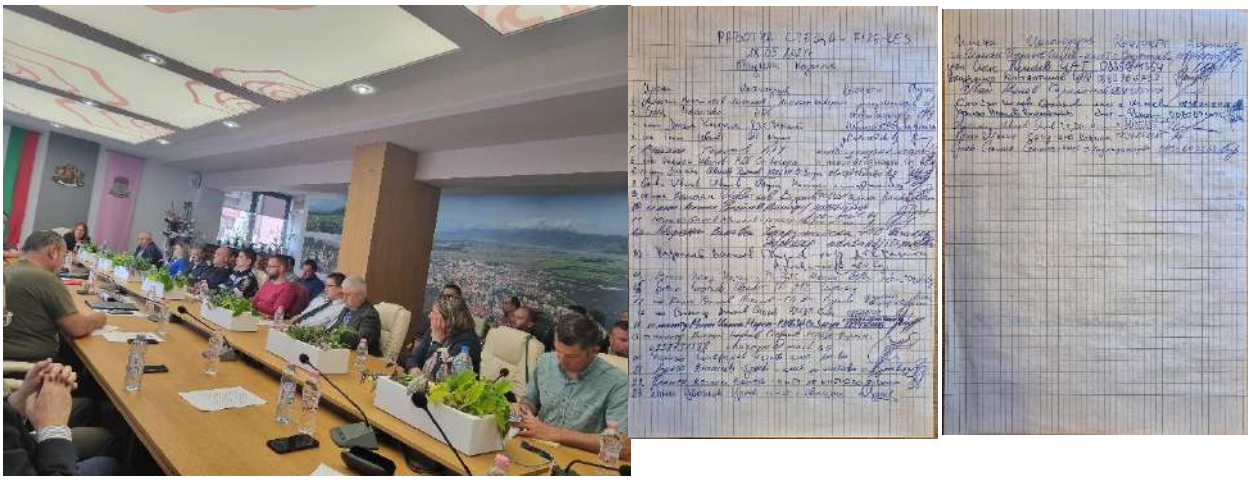


Figure 7: Meeting for the concept discussion on 28.05.2024 and list of participants

<u>Here are the solutions:</u>

The municipalities in the Stara Zagora region. The same, within the framework of the current preventive activity, will take over its coordination, as part of the field observations, through their employees and through the hotlines on duty. The communication system with the hotline operators will be expanded using a single smartphone application, which includes all employees from the interested departments.

Forestry employees in the divisions of the State enterprises in the Stara Zagora region, as well as the employees of the EFA, will be involved in the control of fire safety on all types of territories within the scope of their daily activities in an appropriate manner.

The employees of the Fire department are committed to actively participate in a communication campaign on fire prevention and to respond as quickly as possible to signals from the employees of the other institutions included in the group. On days with the highest fire danger, an increase in the mass media with specific data and recommendations is expected.

Representatives of the UF, Sofia, engaged in the FIRE-RES project are committed to providing the responsible institutions in the Stara Zagora district with maps of the regions and places with the highest probability of occurrence and rapid spread of fires, where to focus monitoring and invest funds for prevention.

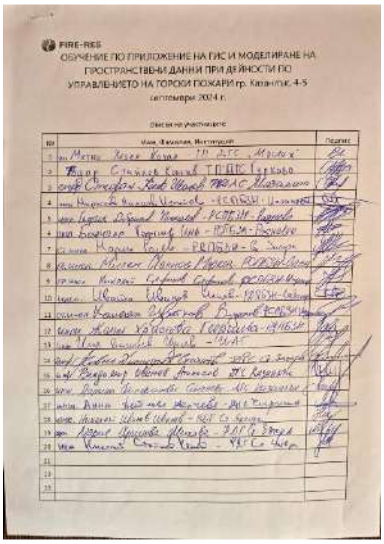
All other public institutions will be welcome to be included in the framework agreement, which should be signed this year.

This is formalized **through an agreement** concluded between the main institutions involved on 15.07.2024: Kazanlak Municipality, as the lead, represented by the Mayor, Ministry of agriculture – represented by the deputy minister; Regional Fire Department – represented by the Director; Executive Forest Agency – represented by the Executive Director and University of Forestry – represented by the Rector (Fig. 8).

Figure 8: After signing the cooperation agreement (Stoyan Toshev – Director of the EFA; Dimcho Radev – Director of the State Enterprise in LL region; Galina Stoyanova – Mayor of Kazanlak; Stoyan Kolev – Director of Regional Fire Service, Miroslav Marinov – Deputy minister of agriculture and food; Nikolai Ivanov – Deputy director of Regional Forestry Directorate; Petar Antov- Vice rector UF, Georgi Kostov – Fire-Res)

A static **multi-criteria model** was developed for assessing fire risk in the forests of Stara Zagora district (over 50 thousand stands are covered, and 4 groups and 33 indicators are used) – part of IA 5.2 and 5.6.

Contribution to **Task 7.1** - two training courses on working with the model were carried out in the LL region on 4-5.09.2024 (Fig. 9) in Kazanlak, and then at the national level in Sofia on 12.12.2024 (Fig. 10)



FIRE-RES

ОБУЧЕНИЕ ПО ПРИЛОЖЕНИЕ НА ГИС И МОДЕЛИРАНЕ НА ПРОСТРАНСТВЕНИ ДАННИ ПРИ ДЕЙНОСТИ ПО УПРАВЛЕНИЕТО НА ГОРСКИ ПОЖАРИ гр. Казанлък, 4-5 септември 2024 г.

Figure 9: Training in LL and list of participants 4-5.09.2024

FIRE-RES

Figure 10: National level training and list of participants – 12.12.2024

The most important event in the LL was the organization of the **Innovation Days**, held on April 24-25, 2025, in Kazanlak (Fig. 11 from the opening). Participation of more than 200 people and 80 children from primary schools.

Figure 11: Opening of the ID by the Mayor and the Minister of Internal Affairs

Many of the achievements in the LL on **AI 2.4** were demonstrated. Optimisation of landscape configuration and fire management policies to minimise expected EWE losses (WP2). Posters were displayed on soil changes and potential costs of prevention through understory removal (Fig. 12).

Figure 12: Part of the posters presented