Firelogue

# Fire Up the Dialogue

## D3.1 IMPACT ASSESSMENT METHODOLOGY HARMONIZATION

Project: Cross-sector dialogue for Wildfire Risk Management

Acronym: Firelogue

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## Glossary

| Abbreviation | Meaning |
|---|---|
| AI | Artificial Intelligence |
| CSA | Coordination and Support Action |
| D | Deliverable |
| DL | Deep Learning |
| DSS | Decision Support System |
| EI | Expected Impact |
| EO | Earth Observation |
| EU | European Union |
| IA(s) | Innovation Action(s) |
| KPI | Key Performance Indicator |
| ML | Machine Learning |
| TRL | Technology Readiness Levels |
| UAV | Unmanned Aerial Vehicles |
| UGV | Unmanned Ground Vehicles |
| WFRM | Wildfire Risk Management |
| WUI | Wildland Urban Interface |
| WG | Working Group |



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## Executive Summary

This document (D3.1) presents the first attempt to discuss the impacts mentioned in the call, as well as the first iteration of some impact assessment methodologies developed by the Innovation Actions (IAs), with the ultimate goal to find common grounds at a later stage.

The document is structured as follows:

- **Section 1** introduces the scope of the deliverable.
- **Section 2** provides an extensive list of the expected impacts (EI), a brief definition of each of them and some Key Performance Indicators (KPIs) suggested making the impacts to be easier to be measured.
- **Section 3** focuses on the technologies/innovations that will be developed under the three IAs.
- **Section 4** provides insights for the methodology of each IA on how the expected impacts will be measured.
- **Section 5** lays out an initial approach of the joint impact assessment methodologies, regarding data to be used for measuring the KPIs; the common aspects of the impact assessment methodologies set by the IAs against common criteria; as well as the key stakeholders that could play a crucial role in these discussions.
- **Section 6** summarises the deliverable and presents the way forward.

Special thanks for this deliverable have to be given to the relevant teams of the three IAs.



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# 1 Introduction

Firelogue, as a Coordination and Support Action (CSA), aims to fulfil the CSA's remit by integrating the Innovation Actions' (IAs) findings across stakeholder groups and fire management phases. One of Firelogue's key objectives is to facilitate the impact assessment of WFRM measures and proposed solutions towards the impact expected by the call, while at the same time critically reflecting about those goals.

This document (D3.1) sets the groundwork for a common impact assessment methodology of the three WFRM IAs, which facilitates the harmonization of the different impact assessment methodologies (towards the impact defined by the call) that the specific IAs (DRYADS, SILVANUS, FIRE-RES) will develop. D3.1 describes the detailed methodology to be followed for a coordinated evaluation of the impacts of technologies with respect to their contribution towards the expected impacts defined by the EC. Through this task, Firelogue partners, supported by the partners from each of the IA projects extract valuable and easily measurable information regarding the contribution of each IA to the expected impacts.

It should be mentioned that, the second version of the present document (D3.1) is the Deliverable 3.4: Impact Assessment Methodology Harmonization II (Month 24). Furthermore, under WP3 these is also the Deliverable 3.2 Baseline Assessment Report to be submitted (Month 18).



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## 2 Expected Impacts as per the 2030 Green Deal Targets

Table 1 lists the expected impacts for all three IAs, as defined in the respective Horizon 2020 calls. For each one, the Table provides a short description, the related Phase of wildfire management and some indicative KPIs to measure it.

*Table 1: Expected impacts' definition*

| # | Expected Impact (EI) | Definition | Phase[1] | KPIs |
|---|---|---|---|---|
| EI1 | 0 fatalities from wildfires | Fatalities are defined as those that would not have otherwise occurred, if there had not been a wildfire. This includes direct fatal casualties (in the fire), as well as any indirect fatalities as a result of injuries caused by a wildfire incident. Even if the casualty dies at a later date, any fatality whose cause is attributed to a wildfire is included. | A, B, C | • %[2] less fatalities from wildfires (and not as a number as a percentage will be more realistic)<br>• Number of engaged people participating in trainings, exchanges, awareness activities<br>• Number of fire fighters trained<br>• Number of awareness campaigns and real-time emergency workshops<br>• Number of fire danger scenarios reviewed from historical and fictional case-studies |

[1] A: Prevention/Early Warning, B: Response, C: Recovery/Restoration

[2] To be defined at a later stage



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|---|---|---|---|---|
| EI2 | 50% reduction in accidental fire ignitions | Human-caused wildfires as result of accidental (not intentional) ignition sources are ignitions that were not intentional, and can be altered through prevention efforts (USDA White, R. & USDA, 2000). In these fire ignitions, all human causes (electrical network, railroad, campfire, smoking, fire use, candles, cooking/electrical appliances, equipment, railroad, juveniles, farm machinery etc.) are included. | A | • Number of accidental fire causes evaluated<br>• Number of demonstration activities on accidental fire ignitions<br>• Number of awareness campaigns and real-time emergency workshops<br>• Number of WUI homeowners informed |
| EI3 | 55% reduction in emissions from wildfires | • Carbon dioxide (CO2) emissions<br>• Nitrous oxide (N20) emissions<br>• Hydrogen emissions<br>• A wide range of organic compounds and reactive gases<br>• Greenhouse gases (GHG) emissions | A, B | • % reduction in levels of CO2 emissions on selected areas<br>• % reduction in detection latency of the fire between the first detection and the launching of the initial attack<br>• % increase in suppression capacity of fire fighters<br>• % of fires extinguished in the initial attack, before reaching 1 hectare<br>• Number of demonstrations for deployment of UAVs to the front line<br>• Number of Member States introducing fire-resilient considerations |
| EI4 | Control of any extreme and potentially harmful wildfire in less than 24 hours | Control is the process of completely suppressing the combustion in the perimeter of the wildfire. Control occurs by removing one of the three ingredients fire needs to burn: heat, oxygen, or fuel, within 24 hours since the recording of the initial ignition time. Harmful wildfires are | A, B | • % increase in response time of fire fighters<br>• Number of different fire suppression types to be evaluated<br>• Number of deployments of different command centres to tackle the origin of a fire<br>• Number of demonstrations on training scenarios curated for worst-case scenario and fire simulators |



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| | | those that can potentially become social, economic and environmental disasters. | | • % reduction in time lapses for data provision to support the end-users in controlling wildfires in <24h<br>• Number of response collaborations with international platforms<br>• Number of users of response systems ready |
| EI5 | 50% of Natura 2000 protected areas to be fire-resilient | • Officially declared Natura 2000 areas<br>• Fire resilience based on the geographical coverage area<br>• Fire-resistant ecosystems by promoting the resilience of old-growth forests or by adapting young forest under natural evolution to expected climate change impacts, optimizing protection and provision functions in managed areas<br>• Two forms of resilience: (i) Adaptive resilience to wildfire centres on managing both the human and non-human environment in response to changing climate and fire regimes and increasing wildfire risks and exposure of human communities; (ii) Transformative-resilience requiring a profound shift in the human relationship with the environment and the wildfires, that embraces the dynamic and rapidly changing role of fire in social ecological systems (McWethy, D. Et al, 2019) | A, C | • Number of demonstrations for enhanced resilience across IAs pilots<br>• Number of Member States adopting relevant measures<br>• Number of Natura 2000 managing entities reached regarding respective activities<br>• Number of Nature 2000 protected areas developing a fire prevention plan |
| EI6 | 50% reduction in building losses | A building is a structure with a roof and walls, such as a house or factory.<br>Structural loss means any loss as a result of wildfire ignitions. | A, B | • % of structures destroyed<br>• Number of Member States introducing urban planning regulations for risk prevention and mitigation |



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| EI7 | 90% of losses from wildfires insured | Types of insured losses include home property, garage, tool shed, belongings, vehicles, businesses, etc. and anything else that can be insured. | A, C | • Number of insurance schemes<br>• Number of insurance companies working on offering catastrophe bonds<br>• Number of insurance companies interested in the IAs insurance solutions<br>• Number of insured properties<br>• Number of campaigns to inform the public<br>• Number of proposals to legislators new policies on this regard |
| EI8 | 25% increase in surface area of prescribed fire treatments at European (EU) level | • Prescribed fire treatments includes the planned use of fire to achieve precise and clearly defined objectives<br>• Introduced in south Europe to control fire regimes by managing fuels, counteracting the disappearance of biomass-consuming practices and reducing the fire risks inherent in highly flammable forests and shrublands<br>• The primary objective prescribed burning is to reduce risks to human and natural assets via modifications to fire behaviour, although prescribed burning can be undertaken to promote ecological assets or for cultural purposes (Penman et al., 2011). | A | • Number of consultations of decision makers on fire-treatments<br>• Number of Prescribed Burning applied<br>• % increase in acceptance of Prescribed Burning (No. people attending transference or training activities; Number of people informed through material and educational platforms)<br>• Number of regional/national legal frameworks related to Prescribed Burning in EU Member States |



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Furthermore, Firelogue started a discussion about each expected impact and some views regarding achievability are presented below. Firelogue needs to foster the discussions involving the IAs, as the community cannot just take these EIs for granted. Improving them by making them more theoretically sound and realistic could be an important achievement by Firelogue.

- **EI1:** Difficult to be achieved and somehow unrealistic considering the decreased timeframe to achieve this EI. Most of the actions identified will need long-term implementation. To achieve this EI, a multi-parametric approach is needed: early alert systems for the population; faster response; more efficient firefighting techniques; excellent knowledge of the area that is burned; controlled and correct evacuation; protective equipment for firefighters (professionals and volunteers); good and modern equipment; training/education of everyone (the public and firefighters); increased citizen/communities' preparedness and resilience to wildfires; besides there is the possibility of having accidents related to the use of vehicles (cars, trucks, aircraft) and machinery related to fire management activities.

- **EI2:** Not easily achievable. To achieve it, the following is required: training and education; risk awareness; media and social media campaigns; fuel management; patrol and law enforcement; more efficient monitoring. Several accidental ignitions can be modulated through regulations limiting the days when certain activities can be performed during the fire season. At the prevention phase, the improved fire weather/danger index assists decision making on restrictions that will reduce chances of ignitions. Due to climate change, practices with fire that in the past were not risky could be of a greater impact in fire prone conditions (e.g. waste burning in agriculture). The measures must be extended and scaled-up to the whole of Europe.

- **EI3**: Achievable, but this target is more of a result of other actions and expected impacts. Also, apart from control we need to take into account the "Let it burn" strategy, which in terms of fire suppression operations occurs when firefighters assume the best option is to let fire run until operations can be done under safe and effective conditions. In particular, if accidental fires are reduced, a reduction to emissions is achievable. So, EI3 is directly related to EI2. Over the period 1999-2003, the emissions from wildfires in Europe were estimated to be approximately 11 million tones CO2/year, and a reduction of emissions from forest fires can be feasible if prescribed burning would have been more extensively applied (Narayan et al, 20073). So, EI3 is directly related to achievements in EI8. Furthermore, EI3 is also related to EI2, as the faster the control of wildfires, the least the emissions that will be released.

- **EI4:** Achievable, but to minimize the time lapse to control wildfires it is important to have: early detection, early warning and communication systems, as well as a faster first response but also to spot fires during the wildfire duration, especially on behalf of first responders. Most times, the initial attack has to be made within the first 30 minutes; otherwise, the situation may not be controlled. Still, suppression of all fires might have an impact on fuel

[3] Narayan, C., Fernandes, P. M., van Brusselen, J., & Schuck, A. (2007). Potential for CO2 emissions mitigation in Europe through prescribed burning in the context of the Kyoto Protocol. Forest Ecology and Management, 251(3), 164-173.



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building that could cause more severe fires in the future, so this needs to be addressed in parallel to fuel management strategies, such as EI8, among others.

- **EI5:** Achievable. To achieve this, the following measures are needed: creation of fire prevention plans; execution of fuel reduction activities in strategic management areas to improve the chances to contain the fire in reduced perimeters and therefore prevent large uncontrolled fires from happening; patrol and law enforcement; stricter penalties for breaking the law in Natura zones; creation of safe perimeter with fire proof zones.
- **EI6:** Achievable. To achieve this EI, the following is needed: Training and education of the public on how to protect houses; education of at-risk communities in risk culture, self-protection, and sense of responsibility to take action; policy to build fire resilient settlements for example with safe zones around the perimeter. In Wildland Urban Interface (WUI) areas, current challenges are to improve risk awareness and emergency management in order to improve self-protection skills of residents and their houses (e.g. no fuels in direct contact with the structure).
- **EI7:** Achievable, but it is also a policy issue. Insurance schemes could become an obligation, but citizens, entrepreneurs, etc. must be given incentives. EI7 does not make sense from an economic point of view. Not all losses can and should be insured. There are many different instruments to tackle losses from wildfires; insurance is one of them, but others must be considered as well. should be based on the data available, or a range of percentages would be more suitable. In general, the high degree of confidence in the wildfire intervention offers the financial sector a high-degree of confidence to insure the relevant resources. The proximity of the predictive models, with the actual events that have been recorded, leads to the higher degree of confidence in the insurance sector. The description mentions explicitly only the insurance of material assets, but the insurance of people health or life is not considered. In case of injuries or death of civilians or operational agents, the cost of indenisations can be very high if there are no insurances.
- **EI8:** Achievable, but it is a political decision and general strategy that must be followed in all EU territory as a holistic approach and strategic planning. In the future, prescribed burning in Portugal could lead to a reduction in the severity of the fires, but not to a reduction in the extent of the wildfires. Extensive training is required for those responsible for prescribed burning. Also, the reporting of prescribed burning activities to the governments by the fire units should be improved, since currently there is not a clear picture of the actual prescribed fire actions taken by the different Member States.

After defining and commenting on all these impacts, it is obvious from the above comments that all the expected impacts are inter-connected and there is no end to the discussion.



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# 3 Innovation Actions' proposed technologies

The impact assessment shall be performed for the technologies/innovations proposed/developed under the three IA projects. An initial list of technologies is presented in this Section by using the input that has been provided by the IAs. The exhaustive list of the IAs' innovations will be provided at a later stage together with the pilot case studies where they will be applied.

All the innovations can be classified under the following classes: Technologies; WFRM measures; Standard Operating Norms/Procedures and Processes. More specifically the technologies can be categorised in the following domains: Cameras & Sensors; Earth Observation (EO); Simulations & Models; Materials; Networks & Applications; Machine Learning (ML) / Deep Learning (DL) / Artificial Intelligence (AI); Aerial and Ground Means; Analytics and Agroforestry.

## 3.1 DRYADS

The initial list of innovations to assist towards achieving the expected impact in DRYADS can be seen in the following Table. A revised version will be made available by DRYADS at a later stage.

*Table 2: List of DRYADS Innovations and the targeted Expected Impact*

| # | Innovation name | Short description | Category | Technology Domain | Phase | TRL | Expected Impact |
|---|---|---|---|---|---|---|---|
| D1 | Accurate Forest Mapping | Image Spectrometry and LiDAR Forest Scanning | Technology | Cameras/Sensors | A | 5-6 | EI1 to EI6 |
| D2 | Risk analysis tool | Copernicus; LiDAR; ML | Technology | EO; Cameras/Sensors; ML/DL | A | 5-6 | EI1 to EI6 |
| D3 | Fire Prevention System | Integration of heterogeneous info; Computer vision; ML/DL models | Technology | Simulations/Models | A | 5-6 | EI1 to EI6 |
| D4 | EO toolkit for fire exposure & Risk assessment | Copernicus; GIS platform; Early warning; Modelling | Technology | EO; Simulations/Models | A | 5-6 | EI1 toEI6 |
| D5 | ML for fire Risk Analysis and Fire Spread | ML | Technology | Simulations/Models; ML/DL | A | 5-6 | EI1 toEI6 |



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|---|---|---|---|---|---|---|---|
| D6 | Passive fire protection for key infrastructures and residential buildings | Passive fire protection products | Technology | Materials | A | 4-5 | EI6 |
| D7 | Fire-resistant wooden construction materials | Wooden construction products | Technology | Materials | A | 4-6 | EI5, EI6 |
| D8 | Nature-based and fire-resilient solution | Ash to be used as construction material | Technology | Materials | A, C | 5-6 | EI1 to EI6 |
| D9 | Insurance Model and Risk Transfer Solutions | Insurance Model; Risk | Technology | Simulations/Models | A | 5-6 | EI7 |
| D10 | Forest black box monitoring nearby flammable gas & smoke emissions | Internet of things (IoT) platform; Gas/Smoke/Temperature; Humidity and sound sensors | Technology | Networks/Applications; Cameras/Sensors | A, B | 6-7 | EI1 to EI6 |
| D11 | Infrastructures fire emergency management strategy | Verify the effect of innovative systems/procedures on a wide range of non-standard emergency scenarios | Technology | Simulations/Models | A | 5-7 | EI1 to EI6 |
| D12 | Hotspot detection | Computer vision; artificial vision; 5G | Technology | Cameras/Sensors; Networks/Applications | B | 5-6 | EI1 to EI6 |
| D13 | Visual Object Recognition on embedded systems | Sensors; object recognition; DL; MobileNet | Technology | Cameras/Sensors; ML/DL | B | 5-6 | EI1 to EI6 |



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|---|---|---|---|---|---|---|---|
| D14 | Forest fire spread simulation | Near real-time simulation of wildfire | Technology | Simulation/Models | B | 5-6 | EI1 to EI6 |
| D15 | Wind field model | Simulation of wind and spread of forest fires; ML | Technology | Simulation/Models; ML/DL | B | 5-6 | EI1 to EI6 |
| D16 | Atmospheric pollutants dispersion model | Forecasting simulation of fire smoke cloud dispersion | Technology | Simulation/Models | B | 5-6 | EI3 |
| D17 | Analysis of Fire Behaviour and Spread for developing safety Measures | Experimental and numerical investigation to understand vegetation‘s fire behaviour; predict fire propagation | Technology | Simulation/Models | B | 4-6 | EI1 to EI6 |
| D18 | Resilient, event-driven, context-aware fire detection and decision support for response processes | Fire detection using heterogenous sensor data; decision support for fire response process management | Technology | Simulation/Models | B | 5-6 | EI4 |
| D19 | Augmented reality helmet | Multi-modal interaction with sensors; 5G | Technology | Cameras/Sensors; Networks/Applications | B | 6-7 | EI1 to EI6 |
| D20 | 5G Portable Communication System | 5G Communication; Edge Computing | Technology | Networks/Applications | B | 6-7 | EI1 to EI6 |
| D21 | X/BELLO instant messaging | Voice over Internet Protocol (VoIP) and instant messaging application supporting voice chat, real-time video calling, and multimedia | Technology | Networks/Applications | B | 6-7 | EI1 to EI6 |



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| D22 | Pre-fire status model of forest for accurate Post-Fire Restoration | First Order Fire Effects Model; Post-fire tree mortality models for assisting forest land managers | Technology | Simulations/Models | C | 5-6 | EI1 to EI6 |
| D23 | Agroforestry for Restoration | Rotational grazing of livestock and recycling forest waste into biochar; restore soil to a fertile state | Technology | Agroforestry | C | 5-6 | EI1 to EI6 |
| D24 | Reforestation/ Drones for Agriculture - using capsule for aerial mass releases | Capsule making the transition from drone to the soil in order to ensure the growth of the seedling; contain space for fertilizers and be manufactured with special material composition | Technology | Agroforestry | C | 5-6 | EI1 to EI6 |
| D25 | Restoration of ecological balance - using Bioclip release principles | Device ensuring success of restoration of ecological balance with a keen on beneficial insects who protect seedlings by plant predators | Technology | Agroforestry | C | 5-6 | EI1 to EI6 |
| D26 | Preparation of bio-material for post-fire bioremediation and re-vegetation trails | Development of bio-material units dropped from the air on burnt-out sites | Technology | Agroforestry | C | 5-6 | EI1 to EI6 |



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| D27 | Decision Support System (DSS) Restoration Module for adaptive postfire management | Remote sensing; drones; Ground-level sensors; Satellite data; remotely piloted aircraft system thermal imaging to sample mammals | Technology | Aerial/Ground Means; EO; Simulations/Models | B, C | 5-6 | EI1 to EI6 |
| D28 | Interoperability Environment for Rescue and Logistics Processes using ISO standards | Modelling | Technology | Simulations/Models | B, C | 4-5 | EI1 to EI6 |
| D29 | Unmanned Aerial Vehicle Deployable Air Command and Control | Command and Control Communication Manager; UAVs; Aerial means; Telemetry systems | Technology | Networks/Applications; Aerial/Ground Means | B, C | 5-6 | EI1 to EI6 |
| D30 | Artificial Intelligence (AI) for mission planning & swarm coordination | Path Planning for Fire Prevention and Damage Estimation; Resource Management System for Optimal Situational Awareness; DSS for Optimal Guidance of Fire Suppression | Technology | Simulations/Models; ML/DL/AI | A, B, C | 6-7 | EI1 to EI6 |
| D31 | Virtual Reality (VR) safe training in workplace competency | Interactive Virtual Scenarios; simulations; online modelling system | Technology /Process | Simulations/Models | A, C | 5-6 | EI1 to EI6 |
| D32 | Data Format Fusion Mechanism | Communication components; GPS; Sensors; other accessories | Technology | Networks/Applications; EO; Cameras/Sensors; | B, C | 6-7 | EI1 to EI6 |



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|---|---|---|---|---|---|---|---|
| | | | | Simulations/Models | | | |

## 3.2 FIRE-RES

FIRE-RES has not provided any input yet. Input is envisaged at a later stage.

## 3.3 SILVANUS

The innovations that are expected to contribute to the achievement of the expected impact of SILVANUS can be seen in the following Table. These innovations are the ones that will be included in the first version that of the platform. A revised version will be made available by SILVANUS at a later stage, which will include all technologies proposed in the Grant Agreement.

*Table 3: List of SILVANUS Innovations and the targeted Expected Impact*

| # | Innovation name | Short description | Category | Technology Domain | Phase | TRL | Expected Impact |
|---|---|---|---|---|---|---|---|
| S1 | AR/VR training toolkit for fire fighters | AR/VR Technologies; emergency management scenarios | Technology | Simulations/Models; ML/DL | A | 5-8 | EI1, EI3, EI4, EI6, EI7 |
| S2 | Fire danger risk assessment | Computation of fire danger index; Forecast the probability of fire threat | Technology | Simulations/Models; EO | A, B | 5-7 | EI2, EI6, EI7, EI8 |
| S3 | Fire detection based on social sensing | Retrieve tweets; analysis on-the-fly; visualize on the UI; data/metadata extraction, fake news detection | Technology | Analytics | B | TBC | EI1, EI3, EI4, EI6, EI7 |
| S4 | Fire detection from IoT devices | IoT devices; cameras; secure mesh network utilising drones and robots; edge | Technology | Aerial and Ground Means Cameras/Sensors; EO; | A, B | 5-7 | EI1, EI3, EI4, EI6, EI7 |



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| | | processing; detect new fire incidents; alerting features | | Analytics; ML/DL/AI | | | |
| S5 | Fire detection from Unmanned Aerial vehicles (UAV)/ Unmanned ground vehicles (UGVs) | Data analysis; undercanopy conditions; fire spread forecast; prediction of the probability of the fire spreading | Technology | Aerial and Ground Means Cameras/Sensors; EO; Analytics; ML/DL/AI | A, B | 4-7 | EI1, EI3, EI4, EI6, EI7 |
| S6 | Fire spread forecast | Probability of the spreading; assist in deploying firefighting resources; planning possible evacuation routes | Technology | Simulations/Models; Analytics; ML/DL/AI | B | TBC | EI1, EI3, EI4, EI6, EI7, EI8 |
| S7 | Biodiversity profile mobile application | Collecting information about biodiversity of forests; processing and extracting high level information; spreading awareness | Technology | Analytics; ML/DL/AI | A | TBC | EI2, EI5, EI7 |
| S8 | Citizen's engagement programme and mobile application | awareness of wildfire prevention, response and forest fire prevention and restoration; information about events | Technology, WFRM measures | Networks & Applications; Analytics | A, B, C | TBC | EI1, EI2, EI3, EI4, EI6, EI7 |



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# 4 Impact assessment methodology and criteria per IA

This section aims to present the methodology that each IA intends to develop and apply in order to assess the projects' achievements against the expected impacts. This collection of IAs' impact assessment methodologies will form the basis for creating a common methodology for all the three IAs within Firelogue. This joint impact assessment will then be applied to present streamlined results to the EC.

It should be mentioned that currently the impact assessment methodologies have not been finalised by the IAs, hence only some first ideas are included by SILVANUS.

## 4.1 DRYADS

No input has been given at this point.

## 4.2 FIRE-RES

No input has been given at this point.

## 4.3 SILVANUS

The alignment of SILVANUS products and services are is designed in consultation with the stakeholders, who broadly representing have the interest from thein various forest landscape managers and service providers. The innovation capacity of SILVANUS relies on the development and demonstration of the technology intervention to combat the spread of wildfire but also to protect and naturally rehabilitate the forest regions. From a commercial standpoint, the forest land management market is an industrial sector, which supports construction, housing, pulp, paper, bioenergy, furniture and feature timbers among other sectors. In contrast to the industries supported by the goods, the forest land management encompasses various types of services such as investment services, appraisal and valuation services, and technical services for due diligence, reforestation, wildlife management and recreational services. Addressing both the commercial interest and the ecological balance to be maintained, SILVANUS has been conceived to deliver a balanced approach in the protection and restoration of forests.

SILVANUS will adopt an indirect approach to measure the impacts in the pilots. The project activities will be evaluated based on historical records of past wildfire events and considering new and emerging threat scenarios developed in consultation with firefighters. The fictional case studies will be developed based on the experiences of firefighter's experiences.



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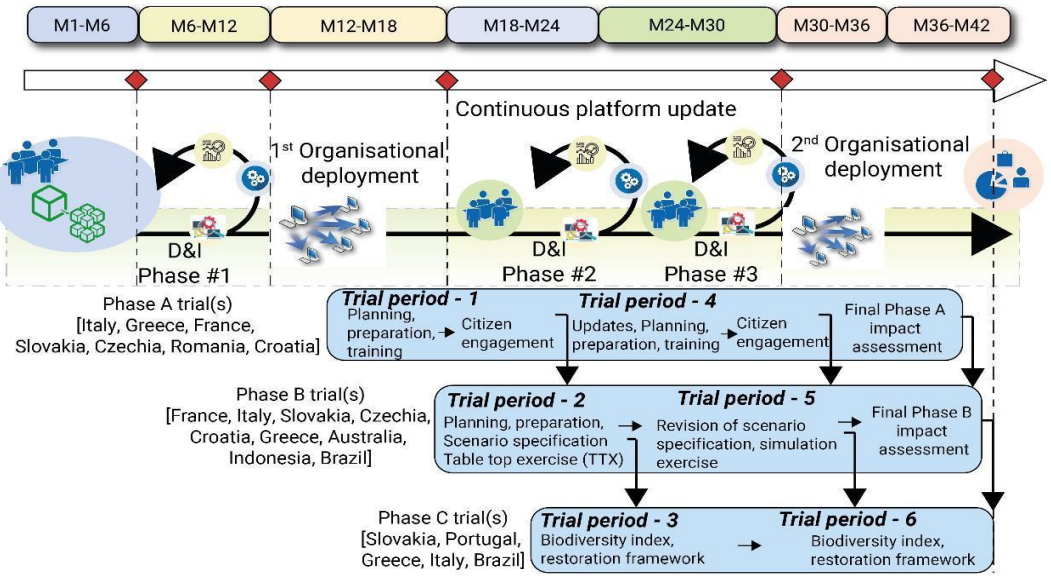


*Figure 1: Timeline of SILVANUS project activities*



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# 5 Common Impact Assessment

FIRELOGUE envisages acting as a catalyst towards a more efficient and coordinated mitigation of extreme wildfire impacts. This section aims to establish an effective, well-coordinated methodology for harmonising WFRM impact assessments towards 2030 across the IAs.

## 5.1 Data requirements and sources

The Green Deal Call aims to measure the aforementioned expected impact against the baseline year 2019. The table below provides an indicative list of data and sources required for measuring impact that has been collected from Firelogue and the IAs. These data will be used as a reference for assessing how the technologies above address the 2030 Green Deal targets. For providing more realistic results, the baseline period should be calculated on multi-year average or trends.

*Table 4: Analysis of potential data sources to be used for impact assessment*

| Description | EI | Frequency | Area | Availability | Access |
|---|---|---|---|---|---|
| EFFIS annual report: No. fires, No. fatalities (not in all countries) etc. | EI1 | Annually | Europe | Yes | Yes |
| Global Fire Monitoring Center: No. fires, burnt area, total fees, causes of fire, fire prevention measures, engaged trucks, machines and aerial vehicles, Engaged people, Use of prescribed fire | EI1, EI2, EI6, EI8 | Historical | Global | Yes | Yes |
| EM-DAT International Disaster Database: No. wildfires, origin of wildfire, Disaster magnitude scale, Start/End date, Total deaths, No. injuries, No. affected people, No. homeless, Reconstruction costs, Insured damages, Total damages | EI1, EI7 | Annually | Europe | Yes | Yes |
| GFED: Global Fire Data: Burnt area, Emissions | EI3 | Monthly, Daily | Europe | Yes | Yes |
| Earthdata NASA: Air quality | EI3 | - | Europe | Yes | No |
| Fire INventory from NCAR (FINN): Simulated emissions from wildfires in Europe | EI3 | Daily | Europe | No | No |
| LANCE NASA: EO data; imagery; radiometer; spectro-radiometer; topography etc. | All | Near-real time | Global | Yes | Yes |
| FIRMS NASA: hotspot/fire location information | All | Near real time & historical | Global | Yes | Yes |



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| | | | | | |
|---|---|---|---|---|---|
| EEA Forest fires in Europe: No. fires, days with fire danger, Natura 2000 areas (2021) | EI5 | Historical, Future (Simulations) | Europe | Yes | Yes |
| Natura 2000 Viewer: Regions of Natura 2000 | EI5 | - | Europe | Yes | Yes |
| NATURA 2000 \| WWF: Burnt area, Emissions, Fatalities, Building losses | EI1, EI3, EI6 | - | Global | Yes | Yes |
| GWIS Country Profile: Burnt area, fire frequency, Emissions | EI3 | Historical | Global | Yes | Yes |
| EU FireStat: Building losses | EI6 | Historical | Global | No | No |

More analysis on the data required and how to address the baseline assessment will be available on the D3.2 Baseline Assessment Report (Month 18).

## 5.2 Harmonized Common Assessment KPIs and Joint Methodology

This section plans to describe the framework that will be built based on common aspects of the impact assessment methodologies defined by the IA against common criteria. This section will be revised at a later stage through the Deliverable 3.4 to present thoughts towards the impact assessment methodologies.

Until today, discussions have been ongoing regarding the scale that the impact assessment should be conducted. At a national scale, there are definitely more data and statistics to make the analysis. However, it is much more efficient to measure the IA impacts at a pilot level as all the technologies and measures will be applied in relevant pilot regions. So, an extrapolation is suggested. After measuring an impact in the pilot site, it would be an idea to upscale it to regional, national and then EU level and assume that the applied solution will be implemented also in other regions. For the extrapolation, we need to be realistic and not expect that all regions or pilots can achieve these expected impacts (e.g. it is unrealistic to expect a penetration of 100% to the market). Furthermore, a good idea would be to make this assessment scalable at EU level. Finally, an aggregation will be conducted to assume the EU benefits from the suggested technologies.

After assessing all the methodologies and discussing with the IAs all the relevant parameters, FIRELOGUE will then provide a benchmarking of the commonly assessed impacts against the expected impacts towards handing over a roadmap towards 2030.

## 5.3 Key Stakeholders

This section lists a number of indicative stakeholders that are involved or could be actively involved in the impact assessment discussions, as well as stakeholders that could be contacted to be informed about the activities. Domain experts need information about to be involved in order to assess which factors influence each impact (e.g. regarding fatalities we need the evacuation plans available, the evacuation time, etc.) and how we can see changes e.g. in a controlled limited pilot area.



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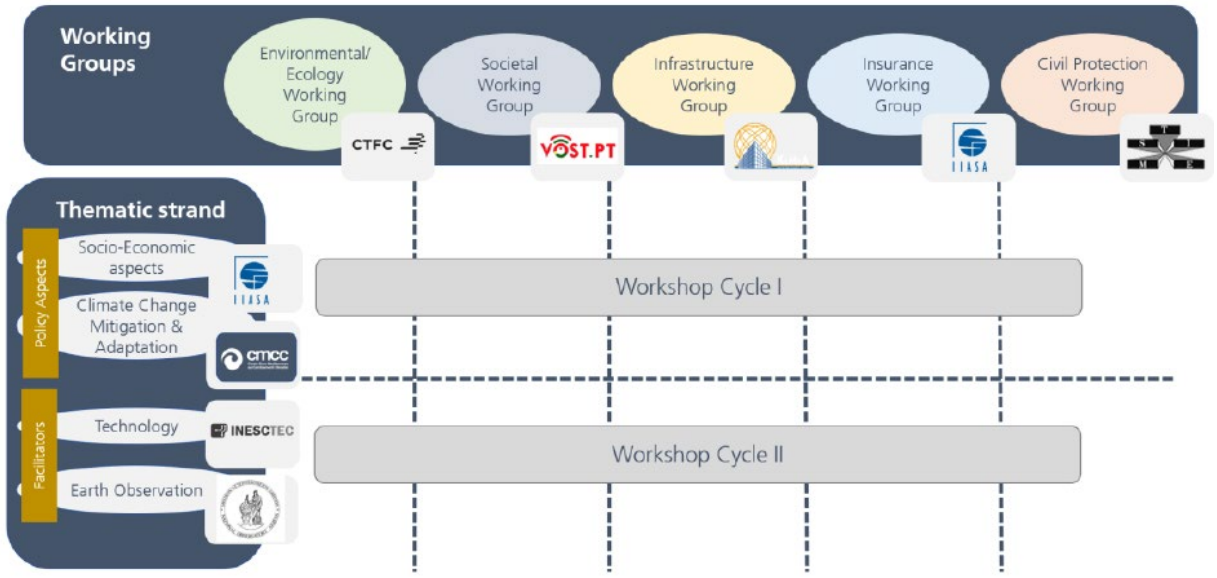


*Figure 2: Matrix structure of the FIRELOGUE Working Groups*

More specifically, the stakeholders involved will be from the following categories as identified in Deliverable 7.2 and Deliverable 6.4:

- **Emergency management organizations**, e.g., firefighters; civil protection; medical services and police; first responders performing operations in the field; fire analysts.
- **Scientific community**, e.g., research and academic institutions involved in diverse scientific areas related to wildfire management; fire safety engineers.
- **Policy making bodies**, e.g., administrations acting at different territorial levels; EU commissioners; politicians.
- **Land management groups**, e.g., landowner associations; land planners; farmers; foresters, whose activity has direct implications over fuel load management through burning, cutting, grazing and other activities.
- **Environmental associations,** e.g., conservation organizations; environmental consultancies; environmental educators.
- **Media**, e.g., journalists; communicators in the environmental field; social media influencers.
- **Society**, e.g., social groups; volunteer associations; representatives for certain citizen groups; vulnerable groups.
- **Industry, technology, and innovation**, e.g., the industry around sectors of energy, construction, infrastructures, timber, fire prevention and firefighting equipment; Banking, Financial Services, and Insurance industry.



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# 6 Conclusions

Using the joint impact assessment framework discussed in this deliverable, Firelogue aims to create an open discussion regarding the impacts mentioned in the call, how the projects funded under this Call may achieve them, and how this could be assessed consensually. Working together all the three IAs regarding the impact assessment works as a multiplier by working together and creating an added value, as more regions inside and outside the EU are covered and the IAs assist one another with penetration to the market.

It should be noted that this deliverable is the initial version for the Task 3.1. More information and the future work on the topic will be found in the last version of this Deliverable 3.4: Impact Assessment Methodology Harmonization II that will be delivered in month 24. Apart from that, the Deliverable 3.2 Baseline Assessment Report will be submitted in month 18, focusing on how to benchmark the baseline for the assessment (year 2019). During the next months, Firelogue plans to continue with the Impact assessment Workshops every three months and to foster the discussion on impact assessment among the IAs.



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