JANUARY
MARCH
2025

# 05 SenForFire NEWSLETTER

*SENFORFIRE. LOW-COST WIRELESS SENSOR NETWORK FOR FOREST FIRE PREVENTION AND EARLY DETECTION (S1/1.1/E0040)*

SenForFire and BRIF participants in the prescribed burning carried out in pilot area P2 (Encinedo, El Bierzo, León)

In this issue:



## Advances in technology, strategy and collaboration

**This edition of the SenForFire Newsletter** highlights the main activities and achievements of the working groups during the first quarter of 2025. Among the most notable milestones are the evaluation of results following the tests in Ávila and Madrid, and the first progress interview with the Joint Secretariat of the Interreg Sudoe program, during which new strategic priorities were agreed upon. Initial contacts were made with the regional governments of Catalonia and Madrid to replicate the environmental monitoring campaigns using RIS sensors, and the SenForFireNews magazine was launched.

In addition, the joint master's program EMJM-MIDA-ESN was approved by all participating universities, and its proposal was officially submitted to the Erasmus Mundus program call. Articles were also prepared for the 9CFE and EXPAT25 conferences, and the corporate video was disseminated. On the technical front, the new SEC prototype was completed, and the MOX modules were updated and tested under real conditions during prescribed burns in Ávila and Encinedo (León). Meetings with end users allowed for the adjustment of the pilot campaign design and the integration of volunteers, reinforcing the collaborative approach of the RIS system for early wildfire detection.

Interreg Sudoe
Co-funded by the European Union
SenForFire

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FEBRUARY
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**Follow-up of the Communication Plan of the project.** The head of communication Macarena Parejo (UEX) has attended the follow-up meeting convened by the Joint Secretariat (JS) to present the progress made in relation to the approved Communication Plan. As a result of what was presented during the meeting, we have been asked in writing for an extension of the interview questionnaire, including more detailed information on the milestones achieved and the pending objectives. The added information is available here.

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**SenForFire News: Fire-fighting technology**. Design and launch of a quarterly magazine aimed at the general public. Published in Spanish and English, its aim is to bring technological advances, research and initiatives in forest fire prevention closer to the general public, thus promoting greater awareness and social involvement.

**Social Media Management**. Update of dissemination campaigns on LinkedIn, Facebook, X and Youtube channels.

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**Technical visit to Ray Ingeniería.** The team from the University of Extremadura visited the Ray Ingeniería facilities in the town of Mirabel (Cáceres, Extremadura). They discussed about the sensors that should be incorporated in the low consumption modules, comparing technical data and results obtained in past experiences.

**Meeting to evaluate the results.** A meeting was held with the project participants, attended by the UEX team, where the results obtained in the tests carried out at the INIA-CSIC facilities and in Arenas de San Pedro (Ávila, Castilla y León) were discussed.

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**1st Project Progress Interview.** The 1st progress interview of the project required by the Joint Secretariat (JS) of the Interreg Sudoe programme was held. The interview was attended by the SenForFire project manager (Alexandra Lopes), the programme communication manager (Antonio Teles) and the JS director (Isabelle Roger) and nine people from the SenForFire project: the coordinator (Esther Hontañón), the communication manager (Macarena Parejo), the heads of the task groups (ICIFOR-INIA-CSIC, CNRS and UEX) and representatives of Arantec, the University of Évora and the University of Coimbra.

During the interview, the JS highlighted several priorities for 2025: to collect testimonies from end-users on the suitability and benefits of RIS technology in the prevention and early detection of fires at local scale; to expand the scope of the project by replicating or implementing new pilot activities in other territories of the Sudoe; to create synergies with other Interreg projects (Sudoe, Poctep, Poctefa) and other European programmes; and to increase the production of audiovisual materials for the communication and dissemination of the project and its results.

MARCH

**New environmental measurement campaigns.** Contacts have been initiated with new end-users, who have expressed interest in replicating in their territories similar activities to those to be carried out in the pilot areas of the project. In particular, sensor-based soil moisture and forest fuel (live and dead) moisture monitoring campaigns.

The most relevant end-users are the governments of the Autonomous Communities of Catalonia and Madrid. In the Community of Madrid, campaigns to measure soil moisture and forest fuel with low-cost sensors are planned to start in May.

On the other hand, ITEFI-CSIC has reached an agreement with the Madrid City Council to carry out measurements of air pollutants (gases, volatile organic compounds and particles) with sensor nodes for the detection of fire emissions and air quality monitoring located in stations of the City Council's Air Quality Network from May onwards. The aim of these campaigns is to calibrate the sensors.

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JANUARY-MARCH

## A 1.5

**Launch of the corporate video.** The corporate video of the project produced by the audiovisual animation company Ozonemotion has been published. Three versions have been produced: with English, Portuguese and French subtitles. The video can be viewed on YouTube. Video with English subtitles: https://youtu.be/nWj2aJuNXYc?si=JSIe19nx7tR6n6YU


SenForFire Interreg Sudoe - Vídeo animado explicativo do projeto - Legendas PT

SenForFire 3 suscriptores · Suscrito · 0 · Compartir · Clip


SenForFire Interreg Sudoe - Vidéo animée explicative du projet. Sous-titres FR

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## A 2.1

### JANUARY

**Follow-up meeting on tests with gas microsensors.** Participation in the online follow-up meeting of activity A2.4 to share the results obtained with the IMB-CSIC gas microsensors in the tests carried out at INIA-CSIC.

**Bimonthly meeting on advances in the manufacture and testing of microsensors.** Attendance at the bimonthly meeting corresponding to activity A2.1, dedicated to the sharing of advances in the manufacture of gas, airflow and infrared microsensors. The CNRS-LAAS reported on the completion of the manufacturing process of the first gas sensor wafers. CNRS-CIRIMAT presented the first laboratory measurements of gases. Tests included exposure to various gases, including hydrogen, carbon monoxide, carbon dioxide, nitrogen dioxide, methane, ethanol and acetone.

### FEBRUARY

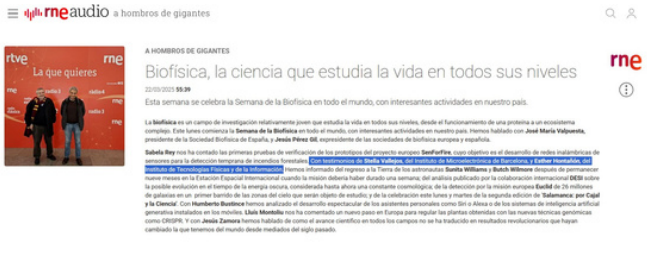
**Analysis of results and submission of abstract to EXPAT'2025.** Analysis of the results obtained with the gas microsensors developed by IMB-CNM and preparation of an abstract based on these results for submission to the Experiment@ International Conference 2025 (EXPAT'2025), within the special session Innovation in Forest Fire Risk Management (IFFRM'25).

MARCH 22

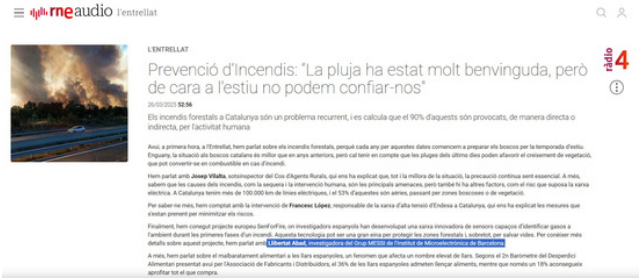
**Dissemination of the project on RNE:** participation in A hombros de gigantes. Participation of ITEFI-CSIC and IMB-CSIC in the programme A hombros de gigantes on RNE, where the objectives of the project were explained and the first results of the field tests were presented. The podcast was published on 22 March 2025. Listen podcast

**IMB-CSIC presents SenForFire on L'Entrellat (Ràdio 4 - RNE).** IMB-CSIC's intervention in the radio programme L'Entrellat (Ràdio 4 - RNE), broadcasted on 26 March 2025, in which issues related to forest fire prevention and the SenForFire project were discussed Listen interview

MARCH 26




Presentation of the A hombros de gigantes podcast. 22nd March




Presentation of the L'Entrellat programme. 26th March

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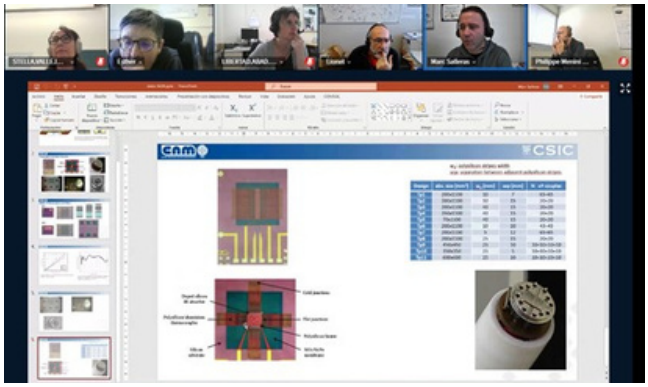
## A 2.1

### MARCH

**Bimonthly A2.1 meeting: advances in the manufacture of microsensors.** Bimonthly meeting of the A2.1 activity focused on the exchange of advances in the manufacture of gas, airflow and infrared microsensors. IMB-CSIC reported on the manufacture of the first generation of infrared microsensors, as well as on the forthcoming tests planned with these devices. It also reported the finalisation of the manufacturing processes of new gas microsensors for field testing. CNRS-LAAS announced the production of a new set of sensors with two different topologies, while CNRS-CIRIMAT presented progress in the implementation of new gases and measurements in simplified devices.




Follow-up meeting. Marc Salleras from IMB-CSIC explains the design and main elements of IR microsensors.

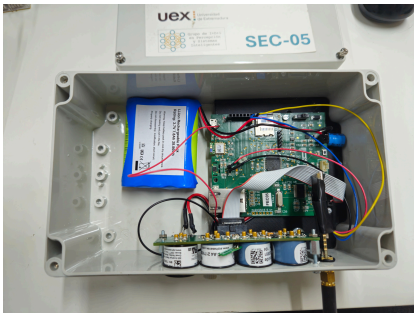
Philippe Menini, from CNRS-LAAS, shows the first batch of completed gas microsensors.

**Preparations for the 2nd SenForFire follow-up meeting in Barcelona.** IMB-CSIC is taking the necessary steps to organise the second follow-up meeting of the SenForFire project, which will take place in Barcelona on 8 and 9 April. More information

## A 2.2

### JANUARY-MARCH

**Completion of prototype 4 SEC.** The development of prototype 4 (SEC - EC-sensors) has been completed, consisting of three electrochemical sensors (CO, $NO_2$ and VOC) and a PID sensor (PhotoIonisation Detector). The device incorporates a battery to provide autonomy and has integrated LORA communication, which allows it to transmit data over long distances. Six modules of this type have been manufactured.


**MOX prototypes update.** The MOX prototypes have been upgraded from measuring only $CO_2$ and temperature via an SCD40 sensor, to also include VOC readings via the SGP40 and ENS160 sensors.

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## A 2.3

### JANUARY

**Regular technical meeting.** Weekly meetings between the University of Évora and the University of Coimbra to coordinate the work between the backend system in the cloud and the frontend.

### FEBRUARY

**Regular technical meeting.** Weekly meetings between the University of Évora and the University of Coimbra to coordinate the work between the backend system in the cloud and the frontend.

**API connected to the frontend.** Integration of the backend API in the cloud to provide data to the frontend.

**Integration of the prediction system in the cloud.** Meeting between the University of Évora and the University of Coimbra to discuss the integration of the forest fire risk prediction system in the cloud platform.

### MARCH

**Regular technical meeting.** Weekly meetings between the University of Évora and the University of Coimbra to coordinate the work between the backend system in the cloud and the frontend.

**Upgrade of the cloud platform** to integrate the new systems tested in León.

**Monitoring of prescribed burning in pilot area P2** to ensure proper data collection.

## A 2.4

JANUARY 31

**Joint evaluation of tests and sensors.** A meeting was held on 31 January involving the teams from ICIFOR-INIA-CSIC, ITEFI-CSIC, IMB-CSIC, UNEX, RAY-IE and ARANTEC. The objective was to present and discuss the results obtained in the series of tests carried out during the months of October and November 2024, both at the ICIFOR-INIA-CSIC facilities and in the prescribed burn of Pilot Zone 1 (Arenas de San Pedro). These tests focused on evaluating different types of sensors and verifying the transmission of the collected data.

The meeting helped to guide the next phases of the project, identifying the most suitable types of sensors according to the characteristics of each Pilot Zone, as well as to advance in the design and construction of new sensors.

MARCH 31

**Sensors successfully validated in León.** Tests were carried out in Encinedo (León) on 31 March 2025, where both the new prototype 4 (SEC) and the updated version of prototype 2 (MOX) were evaluated. A total of 10 modules (6 SEC and 4 MOX) were installed.

The results were positive: the sensors became saturated during the first minutes in the presence of fire, confirming their high sensitivity.

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## A 2.5

**Articles presented in the framework of the EXPAT25 conference.** Two scientific articles have been prepared and presented for participation in the 7th International Experimental EXPAT25 Conference. The studies, entitled respectively 'Multisensor System for Early Fire Detection Using Gas and Particulate Sensors' and 'Early Wildfire Detection with Metal Oxide Gas Sensors: A Smart Approach for Real-Time Monitoring', address innovative approaches in early fire detection using gas and particulate sensors, with special emphasis on smart systems and real-time monitoring.

## R 2.1

### JANUARY

**Institutional approval of the joint master's degree by all participating universities.** Formal acceptance of the terms and conditions of the Erasmus Mundus Joint Master on Intelligent Data Analysis for Environmental Sensor Networks (EMJM-MIDA-ESN) programme has been achieved by the governing boards of all universities involved. This approval represents a key step in the consolidation of the international academic consortium that will support the joint master's degree.

### FEBRUARY

**Final coordination meetings for the EMJM-MIDA-ESN proposal.**

FEBRUARY 15

**Official submission of the EMJM-MIDA-ESN proposal** to the corresponding call of the European Union, within the framework of the Erasmus Mundus programme.

Dear Proposal Participant,

The following proposal has been submitted to the Funding & Tenders Portal Submission System:

| | |
|---|---|
| Submitted by | : Katia Cardoso (katia.cardoso@uc.pt) |
| Proposal acronym | : MIDA-ESN |
| Proposal ID | : 101241290 (internal reference number: SEP-211117354) |
| Call | : ERASMUS-EDU-2025-PEX-EMJM-MOB |
| Type of action | : ERASMUS-EMJM-UN |
| Topic | : ERASMUS-EDU-2025-PEX-EMJM-MOB |
| Call closure | : 2025-02-13 17:00:00 |
| Date of submission | : 2025-02-13 15:39:58 |

### MARCH

**Application for national accreditation in Portugal for the joint master's degree.** The formal application was submitted to the Portuguese national university accreditation body (A3ES) for the validation of the EMJM-MIDA-ESN as a joint master's degree. The proposal includes detailed information on the courses offered and the teaching staff involved by each of the participating universities.

**Start of planning for a MOOC on sensor networks for forest fire prevention.** The initial planning phase for the development of a Massive Open Online Course (MOOC) focused on the use of low-cost wireless sensor networks for the prevention and early detection of forest fires has begun. This initiative seeks to broaden the impact of the knowledge generated by the master's degree, reaching a wider audience interested in technological solutions for environmental management.

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## A 3.3

JANUARY
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**Evaluation of sensors in prescribed burning in the pilot area P1.** A prescribed burn was conducted on a forest plot in pilot area P1 (Arenas de San Pedro, Ávila) as part of the Budget Transfer from MITECO to ICIFOR-INIA, CSIC for the project "Wildfire prevention: evaluation of prescribed burns and strategic management points." The objective of the burn was to gather information to establish scientific and technical criteria for wildfire prevention through the evaluation of the effectiveness of prescribed burns under tree cover, as well as to provide training for personnel from the Forest Fire Reinforcement Brigades (BRIF) of the Ministry for the Ecological Transition and the Demographic Challenge (MITECO). The burn lasted approximately one hour and covered an area of about 900 m².

For the first time in the project, the performance of various low-cost sensor technologies for early wildfire detection was evaluated, focusing on the measurement of gases, volatile organic compounds, and airborne particles under conditions similar to real fires. To this end, a network of four nodes was deployed: three nodes with multisensor modules developed by ITEFI-CSIC, RAY-IE, and UEX, and a weather station supplied by Arantec, which includes a fine forest fuel moisture sensor. The three nodes were placed approximately 30 meters from the fire ignition point, where the weather station was also located. Sensor data was wirelessly transmitted to the cloud server enabled by the University of Évora, via the LoRaWAN gateway provided by Arantec, and visualized in real time.
ICIFOR-INIA-CSIC participated in this activity as the beneficiary entity of the MITECO Budget Transfer, conducting measurements before, during, and after the prescribed burns to assess their effectiveness as a preventive tool.

JANUARY AND FEBRUARY

## A 3.4

**Preparation of articles for the dissemination of results at conferences.** Several articles have been prepared to disseminate the results of the fire detection tests using low-cost commercial sensors, carried out at the ICIFOR-INIA-CSIC (Madrid) pilot facility in November 2024, and of the prescribed burning carried out in the P1 pilot area on 16 January 2025.

The articles have been sent for presentation at the 9th Spanish Forestry Congress (9CFE) in Gijón (16-20 June 2025) and at the special session on Innovation in Forest Fire Risk Management (IFFRM) of the Expat'25 international conference in Horta, Azores (3- 5 September 2025).

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JANUARY AND FEBRUARY

## A 3.3

**Meetings with end users of the project.** ITEFI-CSIC and ICIFOR-INIA-CSIC held remote meetings with each of the end users of the project technology. These included both the beneficiary public administrations and agencies (Municipality of Fundão and General Directorate of Cultural Heritage of the Junta de Castilla y León), and the partners (General Directorate of Forest Fire Prevention of the Junta de Extremadura, Diputación de Ávila and the Agency for Research and Innovation of Andorra).

The aim of the meetings was to determine the scope and specific objectives of the RIS validation campaigns to be implemented in each of the pilot areas (prevention, early detection and/or air quality monitoring), as well as to define the groups of volunteers to be recruited for their implementation.

## A 3.3

MARCH 31

**Prescribed burning in the pilot area P2.** A prescribed burn was carried out in a plot of the P2 pilot area (Encinedo, El Bierzo, León) with the aim of recovering the plot for livestock grazing. The burning was carried out by members of the BRIF, with the collaboration of ICIFOR-INIA-CSIC personnel. For approximately three hours, an area of around 5 ha was burned.

A RIS was deployed that included the four nodes used in the previous burn, as well as several additional nodes. The burn was divided into two stages of approximately one hour duration each, with one hour in between. During this interval, ambient air conditions were restored thanks to the strong wind in the area, which favoured the rapid clearing of the atmosphere. Unlike the P1 burn, in the P2 burn the nodes were distributed at distances varying between 300 and 1000 metres from the fire starting point.


Deployment of RIS for fire detection during prescribed burning in the pilot area P2