

JULY
SEPTEMBER
2025

07 SenForFire NEWSLETTER

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



SenForFire research team at the EXPAT'25 conference (Experiment@ International Conference 2025).

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**DEPLOYMENT OF NODES FOR
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International award and advances in early detection

The summer of 2025 has been particularly productive for the SenForFire Interreg Sudoe project, which continues to strengthen its network of smart sensors for the prevention and early detection of forest fires. During this period, the new monitoring nodes were deployed in the pilot areas of Fundão, Guadarrama, Andorra, and Cáceres, creating a wireless network capable of recording atmospheric and soil variables in real time. Progress was also made in the development of gas, wind, and infrared microsensors, the results of which were presented at the international conference EXPAT'25, where the team won the award for best paper.

In parallel, an audiovisual identity manual was developed, video productions were coordinated in the pilot areas, and the official project poster was validated. Furthermore, collaboration with local entities and forestry services is enabling the training of technicians in sample collection and plant moisture analysis, reinforcing the applied and participatory dimension of the project in protecting the Sudoe area.

**Interreg
Sudoe**



Co-funded by
the European Union

SenForFire

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Social media management. Updating outreach campaigns on [LinkedIn](#) and [Facebook](#) channels . and [X](#).

Audiovisual Identity Manual. The SenForFire Audiovisual Identity Manual has been developed, a document intended to ensure the visual and communicative coherence of all audiovisual materials produced within the framework of the project. This manual defines the graphic criteria, visual styles, fonts, color palette, and guidelines for using the logo, as well as recommendations for video editing. Consult [here](#).

AUGUST
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Meetings with audiovisual production companies: The audiovisual content under development is being reviewed through advisory meetings with the production teams responsible for the videos in the pilot areas: Aldea Visual (Fundão), SatiCam (Cáceres), Paco Quintans (Guadarrama), and Alca Films (Andorra). These meetings have allowed for the coordination of technical and communication criteria, the unification of messages, and the adequate representation of the project's objectives and results in each audiovisual piece.

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At the same time, the Joint Secretariat was consulted about the possibility of creating an interactive page on the project website to display the videos from the pilot areas; as this was not possible, alternative digital dissemination strategies were chosen. Within this framework, a publication and promotion schedule for the videos on official channels, including YouTube and the project's other social media platforms, has been developed.

Press release and dissemination: The research team of the SenForFire Interreg Sudoe project was awarded the Best Article Award (Best Paper Award) at the Experiment @ International Conference 2025 (EXPAT'25) for his study «On the applicability of low-cost air quality sensors for early stage forest fire detection». The Communications Department wrote and disseminated a news article about this recognition, highlighting the importance of the work. Access the article [here](#).

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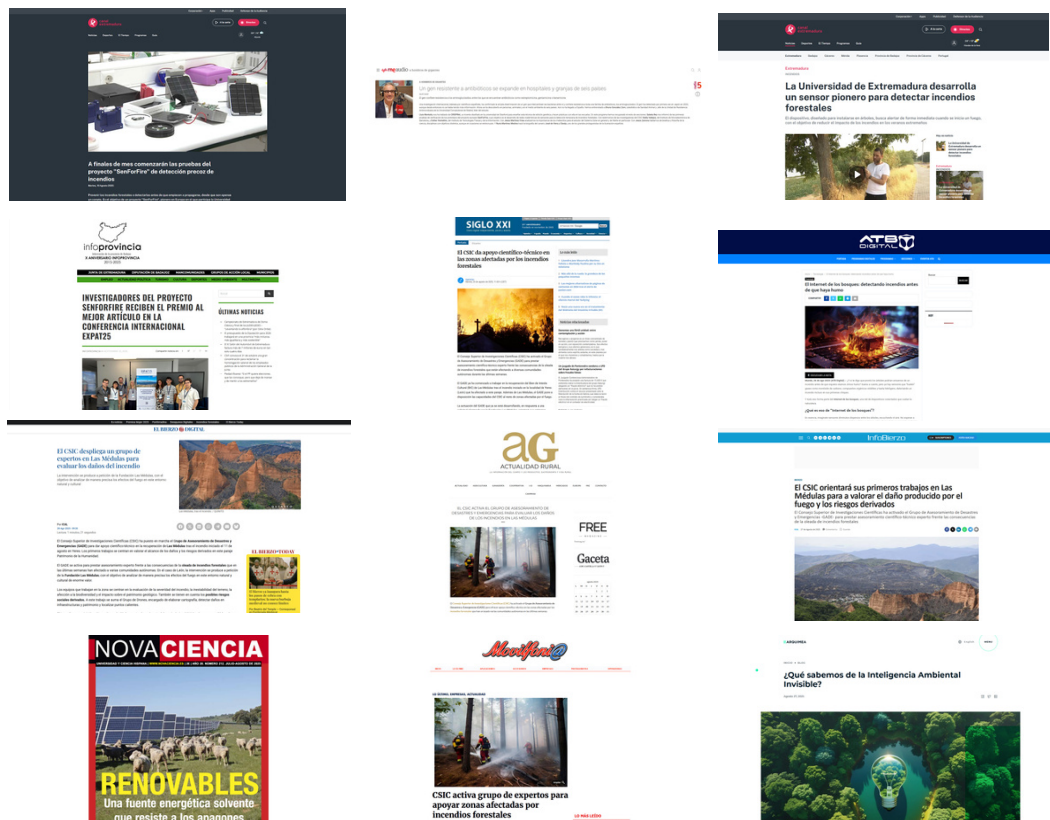
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Project poster validation: The Joint Secretariat has officially validated the project poster task. This action responds to a regulatory communication obligation set out in Article 50 (section d) of Regulation (EU) 2021/1060, and detailed in Fact Sheet 11 of the Interreg Sudoe Guide. According to this regulation, each beneficiary entity of an Interreg Sudoe project must place a poster of at least A3 size—or an equivalent electronic screen—in a visible and publicly accessible location, such as at the entrance to its facilities. This poster must include key information about the project and highlight the financial support received from the European Regional Development Fund (ERDF).

In this context, the 13 project beneficiaries have met this requirement, submitting the required materials, which have already received approval from the Sudoe Program. It should be noted that this step is essential to move forward with the project's expense declaration.

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Third project follow-up meeting. The third follow-up meeting for the SenForFire project will take place in Évora from November 12th to 14th, and will be organized and hosted by the University of Évora. A draft agenda for the meeting is currently available.

During the meeting, in addition to presenting the progress made by the various task groups since the last project meeting (held in Barcelona on April 8 and 9), the planning of the project's first workshop, scheduled for May 2026 in Toulouse, will be discussed. The event will be organized by the two CNRS beneficiaries (CIRIMAT and LAAS), together with Arantec.

One of the main objectives of the workshop will be to identify pilot areas in the French Sudoe area in which to develop forest fire prevention and/or detection campaigns. Furthermore, during the Évora meeting, lessons learned from the fires that occurred in the Sudoe area during the summer of 2025 will be analyzed, as well as their implications for the development of the SenForFire project.

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A 1.5

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Recordings in the SenForFire pilot areas: The main beneficiary, ITEFI-CSIC, has contracted audiovisual production services for the production of videos corresponding to the project's pilot areas.

During the period between July and September, recordings took place in the following locations:

- Parishes from Souto da Casa (Monte Carvahal) and Alcongosta , in the municipality of Fundão , on July 3 and 4.
- Municipality of Guadarrama (Madrid), on July 9.
- Parishes of Sant Julià de Lòria (Monte Aixàs) and La Massana (Monte Beixalis), in Andorra, on July 23 and 24.
- Municipalities of Cañaveral (Montes de Navas de Abajo and Navas Altas) and Coria (Montes de Mínguez), in Cáceres, on September 12.
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The recordings were made coinciding with the deployment of soil and atmospheric sensors in the same pilot areas.

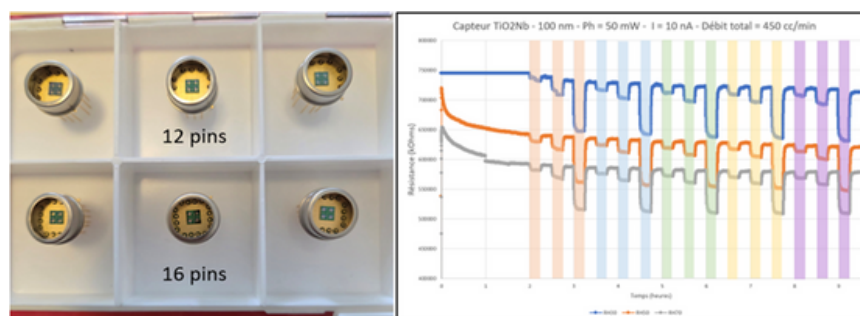
The videos are currently being edited, under the supervision of the project's Communications Manager, Macarena Parejo, of the University of Extremadura (UEX).

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A 2.1

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Advanced characterization of gas microsensors: A more in-depth hydrogen characterization of the gas microsensors developed by the CIRIMAT and LAAS teams at the CNRS is underway. This work will optimize the sensitivity and reliability of the devices in early fire detection environments.



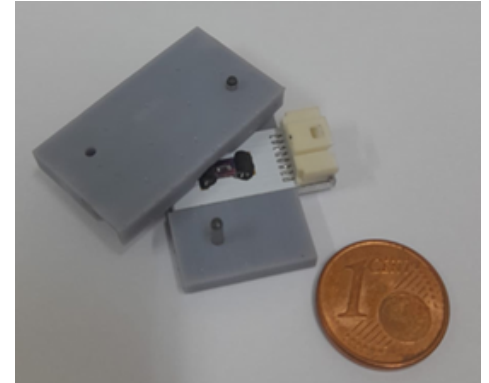
Photograph of the TiO₂Nb layer-based gas sensors developed by CIRIMAT and LAAS-CNRS with 12- and 16-pin configurations.

Chart: Sensor Response in front of different H₂ concentrations.

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Simulation optimization and new nanostructures for sensors: The IMB-CSIC research team is making adjustments to airflow simulations with the goal of manufacturing optimized encapsulations that facilitate laminar flow over the surface of the wind sensor.

In parallel, new synthesis processes are being carried out to obtain nanostructures of n- type metal oxides, modified with other oxides of the same type, in order to evaluate their advantages in early fire detection.

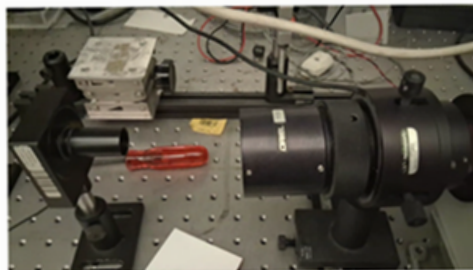


Photograph of the flow microsensor and its packaging to ensure laminar flow over the sensor.

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Installation of equipment for IR microsensors: Through a collaboration between the IMB-CSIC and the University of Barcelona (UB), the necessary equipment for the characterization of infrared microsensors has been installed.

• preamplifier + monochromator + PC controlled



Experimental setup carried out in collaboration between the IMB-CSIC and the University of Barcelona (UB) for the characterization of infrared microsensors.

Manufacturing and testing of wind sensor encapsulations: Various encapsulations with different characteristics are manufactured and integrated to achieve laminar flow over the wind sensors. The IMB-CSIC conducts tests on these components to evaluate and select those with the highest performance.

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Presentation of results at EXPAT'25: The results of the laboratory tests carried out at INIA-CSIC with the IMB-CSIC gas microsensors are presented as an oral presentation at the EXPAT'25 conference (Experiment @ International Conference 2025). Other members of the project's research team also give presentations. The conference serves as a meeting point for sharing progress with the scientific community and the SenForFire project members. More information about this in A2.5 (pages 7 and 8).



Oral presentation, by Joel Perez i Ponceles, from the work «Bench-scale evaluation of a novel sensing system based on gas/vapor microsensors for early wildfire detection and monitoring» in EXPAT'25.

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Electronic adaptation and new series of measurements: CIRIMAT and LAAS (CNRS) are working with RAY Ingenieria to adapt an electronic method for performing a new series of measurements at INIA-CSIC, together with IMB-CSIC. The tests are scheduled for the last week of October.

A2.1 Bi-monthly Meeting: The A2.1 bi-monthly meeting is held to share progress in the manufacturing of gas, airflow, and infrared microsensors.



Online follow-up meeting of A2.1 activities.

A 2.2

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Development of prototype nodes for fire prevention, carried out by ITEFI -CSIC:

- A probe consisting of an elongated printed circuit board with four temperature and humidity sensors (Texas Instruments HDC302x-Q1) encapsulated in a transparent plastic cylindrical tube with perforations at the sensors. The probe can be fully inserted into the soil to measure temperature and humidity at different depths, or partially inserted so that one of the sensors is exposed to the air, thereby measuring atmospheric temperature and humidity. Tests have been conducted to verify the effect of the protective tube on the temperature and humidity measurements of the sensors, both when buried in the soil and when exposed to air.
- A small, compact and highly portable mini-weather station that integrates microsensors that measure air temperature and humidity (Sensirion SHT35-DIS-F2.5kS), wind speed and direction (Renesas FS3000-1015) and precipitation (Grove Water Sensor). The performance of this station is currently being verified against a low-cost commercial station that uses conventional mechanical sensors (a three-cup anemometer, a wind vane and a rain gauge) and also against an ultrasonic wind sensor (Rika RK120-07).
- A node comprising the aforementioned temperature and humidity probe and a low-cost sensor that measures soil volumetric water content (VWC) (DFRobot SEN0308). Eight nodes of this prototype have been installed in the pilot areas of Fundão, Guadarrama, Andorra, and Cáceres.

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Particle detection module: UEx has begun developing a new module for particle detection. This module features LoRa communication and integrates the BME688 and BMV080 sensors.

The first will provide readings of temperature, relative humidity, volatile organic compounds, and atmospheric pressure, while the second will provide readings of PM1, PM2.5, and PM10 particle concentrations.

All electronics will be powered by solar energy and a small lithium battery, and their dimensions will be less than 5x5 cm.



Module ULP_BMV080.

A 2.5

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3-4



Stand at the 4th Fundão Agricultural Innovation Fair.

Fundão Agricultural Innovation Fair. The project team took advantage of their stay in Souto da Casa (Fundão, Portugal, one of the pilot areas where soil moisture, meteorological, and gas sensors have been installed) to participate in the 4th Agricultural Innovation Fair.

During the event, held at the Agrotech Center, SenForFire presented a stand and held an exhibition (led by Juan Luis Gómez, ITEFI-CSIC), showing the project's institutional video, a poster explaining the pilot tests and the prototype sensors developed for fire prevention and early detection, as well as live demonstrations of their operation.

SenForFire project presented seven papers related to GT2 activities during the 7th Experiment @ International Conference (EXPAT'25), held in Faial (Azores, Portugal) from 3 to 5 September, in the special session "Innovation in Forest Fire" Risk Management (IFFRM'25)».

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Four of the papers showcased new gas microsensor prototypes developed by IMB-CNM-CSIC and the multisensor nodes of ITEFI-CSIC, RAY-IE, and UEx, which integrate commercial sensors. The results of the detection of plant fuel emissions, including gases, volatile organic compounds, and particles, were also presented. These emissions were evaluated in burns conducted at ICIFOR-INIA-CSIC, both at laboratory and pilot scales, and in the field using prescribed burns.

The UEx, the IMB-CNM-CSIC, the University of Évora, the CSIC, and the University of Coimbra presented contributions on early fire detection, monitoring platforms, low-cost sensors, and machine learning-based prediction models. The CSIC's work, «On the applicability of low-cost air quality sensors for early stage forest fire detection», was awarded the prize for best article at the conference. Access the press release [here](#).

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The conference provided an important meeting point for sharing the project's progress with the scientific community, as well as with SenForFire members, strengthening the visibility and impact of technological developments in early detection and monitoring of forest fires.

More details on presentations for the EXPAT'25 international conference:

#33 - «An early warning system for remote sensing of wildfires»: Marta Oliveira, Luís Malarmey, Pedro Casau, Paulo Pedreiras, Sandra Millán Arias, Cristina Montesinos Barrios, João Barraca and Pedro Fonseca.

#36 - «Bench-scale evaluation of a novel sensing system based on gas/vapor microsensors for early wildfire detection and monitoring»: Joel Perez i Poncelas, Murat Gunes, Ana Carmen de la Cruz, Mercedes Guijarro, Javier Madrigal and Stella Vallejos Vargas.

#40 - «A Cloud-Based Platform for Wildfire Risk Monitoring using Wireless Sensor Networks»: João Cardoso, Leonardo Sousa, Pedro Salgueiro, Filipe Araújo, José Saias, Luís Rato, Vitor Nogueira, Teresa Gonçalves and Catarina Silva.

#42 - «On the applicability of low-cost air quality sensors for early stage forest fire detection»: Lidia Abad, Sofia Aparicio, Raimundo Alfonso, Mercedes Guijarro, Javier Madrigal, Ana Carmen de la Cruz, Juan Luis Gómez-González, Eisharc Jaquet and Esther Hontañón.

#49 - «Early Wildfire Detection with Metal Oxide Gas Sensors: A Smart Approach for Real-Time Monitoring»: Cristina Bruguera, Félix Meléndez, Angel López, Patricia Arroyo, Víctor González, José Ignacio Suárez, José Luis Herrero, José Manuel Perea and Jesús Lozano.

#50 - «Multisensor System for Early Fire Detection Using Gas and Particulate Sensors»: Ángel López, Patricia Arroyo, Alejandro Bernal, José Ignacio Suárez Marcelo, Mercedes Guijarro, Javier Madrigal, Ana Carmen de la Cruz, Eduardo Pinilla-Gil and Jesús Lozano.

#52 - «Evaluating Machine Learning Models for Wildfire Prediction Across Different Geographic Regions»: José Silva, Jacinto Estima and Alberto Cardoso.

#86 - «A multimodal spatial and temporal features-based dataset for wildfire risk prediction»: João Lopes, Catarina Silva, Cidália C. Fonte and Alberto Cardoso.



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R 2.1

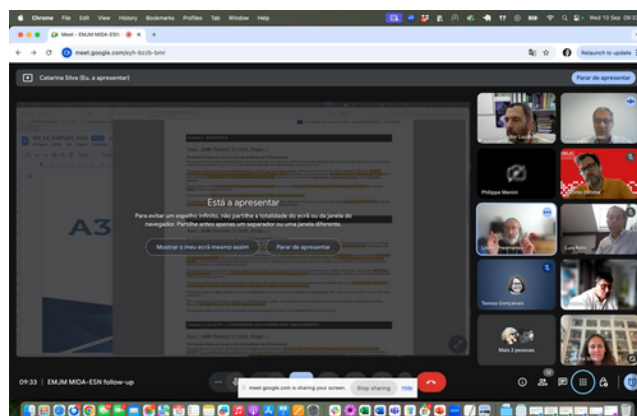
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Internal consortium meetings to prepare for the accreditation of the Master's Degree in Intelligent Data Analysis of Environmental Sensor Networks (MIDA-ESN) in Portugal.

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Participation in the EXPAT'25 conference, which included the organization of a scientific workshop entitled " Innovation in Forest Fire Risk Management."

Internal meeting to review the European Union's feedback on the initial submission and to begin preparations for the new 2026 submission.



10th meeting held in September.

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A 3.2

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Deployment of nodes for soil and air monitoring. The beneficiaries ITEFI-CSIC, RAY-IE, and Arantec have deployed nodes to monitor soil properties at different depths in the following pilot areas:

- The parishes from Souto da Casa (Monte Carvahal) and Alcongosta in the municipality of Fundão, on July 3 and 4.
- The municipality of Guadarrama in Madrid, on July 9.
- The parishes of Sant Julià de Lòria (Monte Aixàs) and La Massana (Monte Beixalis) in Andorra, on July 23 and 24.
- The municipalities of Cañaveral (Montes de Navas de Abajo and Navas Altas) and Coria (Montes de Mínguez) in Cáceres, on September 12.

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The soil sensors used are low-cost commercial ones, such as the SEN0308, and intermediate-cost ones, such as the TEROS10, TEROS11, and TEROS22. Furthermore, in the pilot areas of Cáceres, the UEx has installed nodes to monitor the concentration of volatile organic compounds (VOCs) in the air, using BME688 and ENS161 sensors.

A wireless sensor network (RIS) consisting of a total of 32 nodes has been deployed, providing real-time data on atmospheric properties (temperature, humidity, and VOC concentration) and soil properties (temperature, volumetric water content, and water potential). The network also includes six gateways. LoRaWAN and 2 commercial weather stations, all supplied by the beneficiary Arantec.



Installation of sensors within the deployment planned for 2025 for the early detection of forest fires.

A 3.3

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Training in sample collection and vegetation moisture measurement: Simultaneously with the deployment of the RIS of atmospheric and soil sensors in the pilot areas mentioned above, ICIFOR-INIA-CSIC has carried out the training of members of the Forest Fire Prevention and Analysis Team (EPAIF) of the Ministry for Ecological Transition and the Demographic Challenge (MITECO), of the forestry services of the Municipality of Fundão and of the Research and Innovation agency of Andorra (AR+I).

The training focused on the procedure for collecting representative vegetation samples from the pilot areas—herbaceous plants, scrub, bushes, and tree canopies—with the goal of subsequently determining vegetation moisture in the laboratory using the gravimetric method.

Currently, weekly samples of selected plant species in each pilot area are being taken and their moisture is being measured, in order to establish correlations between live forest fuel moisture, soil moisture, and fire danger.

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