

This quarterly publication addresses environmental education in the face of fires, with news from the SenForFire project and stories about the science of fire. More than a journal, it is an invitation to care for the Earth.

SenForFire NEWS

FIRE FIGHTING TECHNOLOGY

Journal of the SenForFire project for the development of sensor networks for the prevention and early detection of forest fires.



JANUARY-MARCH

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SENSOR NETWORKS

The territory's nervous system
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through networks
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SENFORFIRE TECHNOLOGIES

At SenForFire Interreg Sudoe, we have opted for a suite of complementary technologies: low-power environmental sensors capable of operating autonomously for years, compact weather stations, low-power, long-range wireless communication technologies and protocols (LoRaWAN), and artificial intelligence platforms for real-time data processing. This combination allows the network to be adapted to different landscapes and needs, from isolated woodlands to urban-forest interface areas.

The LoRaWAN protocol has proved particularly well-suited to forest environments: its energy consumption is minimal, it is compatible with devices powered by small solar panels, and it allows data to be transmitted over several kilometres without conventional infrastructure. The artificial intelligence platforms analyse the data in real time and identify risk patterns, reducing false alarms.

SENSOR NETWORKS: THE TERRITORY'S NERVOUS SYSTEM

In the forest, every second counts. A slight change in temperature, an unusual smell in the air or an image captured from a high vantage point can make the difference between an early warning and an out-of-control fire. That is why forest sensor networks have become a key component of modern fire prevention. They function as a 'nervous system' spread across the territory, capable of detecting signals invisible to the human eye and transmitting them immediately to the teams responsible for surveillance.

These networks combine various technologies designed to monitor the environment continuously. They are mainly installed in forests, woodlands, tree plantations, agricultural and grazing areas, and specially protected zones such as nature reserves. They are also used in active mining operations or industrial sites, where a fire outbreak can spread rapidly. The strength of this technology lies in the range of parameters it is capable of detecting: air or ground temperature, unusual presence of smoke, gases or particles in the atmosphere, as well as meteorological data that help interpret the evolution of fire risk, such as relative humidity, wind speed and precipitation.

In many cases, early detection is supplemented by visible and/or infrared cameras installed on watchtowers, stations and mobile units. These images enable any anomalies to be visually confirmed, improving the accuracy of the alert and reducing false alarms. Once the system identifies a risk pattern, the information is automatically transmitted via wireless or satellite networks, triggering alerts at control centres, on mobile devices or via specific apps for technicians and forest rangers. In areas with poor mobile coverage, the systems rely on long-range radio frequency communications to ensure that every alert reaches the control centre, no matter how remote the point of origin. This continuity of transmission is just as important as the detection itself.

The result is a distributed, continuous surveillance system that is far faster than traditional methods. A silent yet vigilant infrastructure that extends the 'senses' of the area and enhances its ability to respond to fires.

COMMUNITIES ALREADY MONITORING THE REGION USING TECHNOLOGY

Innovation is no longer the preserve of large urban centres. In recent years, early warning and forest monitoring systems have begun to be rolled out in municipalities and local authorities that have traditionally been on the front line in the fight against wildfires. Technology is reaching rural areas of the Sudoe region to strengthen their monitoring capabilities and improve environmental safety.

Innovation is no longer the preserve of large urban centres. In recent years, early warning and forest monitoring systems have begun to be rolled out in municipalities and local authorities that have traditionally been on the front line in the fight against wildfires. Technology is reaching rural areas of the Sudoe region to strengthen their monitoring capabilities and improve environmental safety.

The first results can be seen in places such as Caminomorisco and Nuñomoral (Extremadura), where the complex terrain makes conventional surveillance difficult; Palos de la Frontera (Andalusia), which has a particularly sensitive urban-forest interface; Aras de los Olmos (Valencia), a pioneer in rural innovation initiatives; Pola de Allande (Asturias), where prevention is key given the surrounding forest cover; or Alpedrinha (Portugal), a municipality criss-crossed by traditional routes and areas of great ecological value.

This implementation process has been neither straightforward nor uniform. In many rural municipalities, the adoption of new digital tools requires overcoming specific barriers: a shortage of specialised technical staff, the difficulty of maintaining complex systems on limited budgets and, at times, a lack of trust in solutions that have not been designed with the actual conditions of the area in mind. The projects with the best results have been precisely those that combined the installation of technology with ongoing training and close technical support. The experience gained in each of these municipalities is generating highly valuable practical knowledge on how to adapt the systems to such diverse environments.

In the case of Caminomorisco and Nuñomoral, the steep slopes and dense vegetation cover of the Sierra de Gata made conventional surveillance extremely difficult. The sensor network has made it possible to cover blind spots that were previously out of reach for forest rangers, improving coordination with provincial emergency centres.

In all these cases, local authorities have shown a growing interest in integrating sensors, cameras and digital platforms into their prevention strategies. The result is a new model of distributed surveillance –more connected and accessible– which strengthens response capacity and reduces detection times.

ANALYSIS OF PILOT PROJECTS IN SENFORFIRE

The pilot projects launched by SenForFire Interreg Sudoe have demonstrated that collaboration between local authorities, forestry experts and research centres accelerates the adoption of new tools.

The pilot projects have enabled sensors to be tested in real-world conditions, municipal staff to be trained and alert protocols to be fine-tuned. Furthermore, they have confirmed that local involvement is essential for scaling up these solutions.

The project comprises a network of pilot sites covering a wide range of areas: Carucedo and Arenas de San Pedro, in Castilla y León; Sant Julià de Lòria and La Massana, in Andorra; Cañaverall, Coria and Santibáñez el Alto, in Extremadura; Guadarrama and Madrid (Comunidad de Madrid); and Fundão, in Portugal. Each represents an environment with its own climatic and topographical conditions, types of ecosystems and land uses, which has enabled the systems to be tested and fine-tuned in a wide variety of real-world scenarios.

This year, Legarda (Navarra), Ripollet (Barcelona metropolitan area) and Villarrubia de Santiago (Toledo) have joined the network, expanding it into new geographical and institutional contexts.

The training and development of local and regional technical staff responsible for forest fire protection is key to ensuring the continuity of the systems once the project has concluded and the local authority takes over their management independently.

UNA RED DE ZONAS PILOTO DIVERSIDAD DE TERRITORIOS, UN MISMO OBJETIVO



Zonas piloto en España, Andorra y Portugal



Nuevas zonas incorporadas este año



Distintos entornos, mismo compromiso: proteger nuestros bosques y territorios



Zonas piloto actuales

Nuevas zonas piloto 2026



Bosque



Agrícola y ganadero



Urbano y periurbano

Map designed by +magín.

CIT: A DRIVING FORCE FOR NEW FIRE PREVENTION SOLUTIONS

The Territorial Innovation Centres (CITs) have emerged as forums for dialogue between institutions, businesses, the public and knowledge-based organisations. Their main objective is to stimulate rural innovation by promoting projects that improve the quality of life in local areas and generate new economic and social opportunities. In this context, the CITs are emerging as a strategic partner in driving forward advanced fire prevention solutions.

The CITs function as hubs of collaboration where local expertise, the productive sector and scientific research converge. Their affiliation with the Ministry for Ecological Transition and the Demographic Challenge (MITECO) reinforces their role within public policies aimed at territorial cohesion and the sustainable management of rural areas.

To understand their potential in the forestry sector, it is worth placing them in the context of the demographic challenge facing many inland municipalities. The CITs were established precisely in response to this challenge: they are physical and relational spaces that seek to empower local areas to take the lead in their own transformation, drawing on scientific knowledge and the capabilities of the local community. They are not service desks or mere grant administrators; they are structures designed to generate sustained innovation processes over time, with a real impact on the economy and quality of life of those living in rural areas.

In the field of forest fires, these centres can play a decisive role. On the one hand, they facilitate the testing of new technologies, offering controlled environments and technical support to validate sensors, data platforms or communication systems. On the other hand, they act as bridges between research and the local area, enabling innovations to be adapted to local conditions. Finally, they help to promote comprehensive solutions, combining prevention, the rural economy and sustainable landscape management.

The role of technology validation deserves special attention. In the development of any forest monitoring system, there is a significant gap between the laboratory prototype and the operational tool capable of functioning in real-world conditions. CITs can act as transitional spaces between these two extremes, shortening validation cycles and reducing the time it takes for an innovation to reach the field. This capability is particularly valuable in a sector where high-risk seasons follow one another in quick succession and one cannot wait years to have effective tools on the ground.

For example, the experience of the Badajoz Provincial Council's CITLabs clearly illustrates the potential of these centres. As part of MITECO's CIT Network, these digital fabrication laboratories are located in Villanueva de la Serena, Olivenza and Jerez de los Caballeros, and feature a Mobile CITLab that takes its resources to any part of the province. Their mission is to bring social, environmental and business value to rural areas through innovation and Industry 4.0. Key strategic priorities include support for entrepreneurship, digital education, and a focus on innovation and development, aimed at research centres and companies with R&D&I projects.

The collaboration between the CITs and projects such as **SenForFire** opens up a promising avenue: together, they could bridge the gap between applied research and the regions most in need of practical solutions to the problem of wildfires.



The icon of the Interreg Sudoe programme, under the slogan 'Cooperation is in your hands', highlights here news directly related to the SenForFire project.



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SENFORFIRE AND THE CREATION OF KNOWLEDGE-SHARING NETWORKS



SenForFire Interreg Sudoe does not merely develop technological tools: it also facilitates the creation of networks for knowledge exchange among technicians, researchers, public authorities and local communities. Through workshops, field visits and training sessions, the project promotes mutual learning and the dissemination of best practices, thereby strengthening a shared culture of risk prevention and management.

These networks have a value that goes beyond the transfer of technical information. When a forest ranger from Chile shares their experience with a technician from Extremadura, or when a researcher explains how a sensor works to a group of councillors, something deeper is being built: trust, a common language and a collective capacity to tackle a complex problem. Fire prevention is not just a matter of technology; it is also a matter of culture and relationships.

Face-to-face workshops have proven to be indispensable for certain types of learning. Hands-on experience with the equipment, observing its installation in the field and discussing real-life emergency scenarios foster an understanding that cannot be achieved through manuals alone. The cross-border nature of the Sudoe region further enriches this exchange by bringing together different approaches and forest management cultures from Spain, Portugal, Andorra and France.

MORE INFORMATION



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