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.

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03

THIS ISSUE:

FOREST EMERGENCY IN SUDOE

2025 confirmed the upward trend in the severity of forest fires in southern Europe compared to 2024. In Spain, the number of hectares burned rose from around 120,000 to more than 300,000, with critical hotspots in Galicia, Extremadura and Castilla y León, notably the Jarilla and Carucedo fires. Portugal also suffered an upturn: in 2024, the flames ravaged around 45,000 hectares, while in 2025 they exceeded 100,000, especially in the Serra da Estrela and Beiras. The south of France saw the area affected triple: from around 10,000 hectares in 2024 to more than 30,000 in 2025, with the fire in Corbières symbolising the fragility of the territory. These data confirm that climate change, rural depopulation and lack of prevention multiply the intensity and frequency of fires in the region, and underline the importance of coordinated initiatives within the framework of the Interreg Sudoe cooperation programme.

THE CHALLENGE OF SUMMER FIRES

The summer of 2025 will be remembered as one of the most devastating in Spain, Portugal and southern France. Extreme heat waves, prolonged drought and the accumulation of dry vegetation created the perfect conditions for large-scale fires. More than half a million hectares were destroyed, forcing the evacuation of thousands of people and leaving the landscape unrecognisable.

In Spain, more than 300,000 hectares burned in Galicia, Castile and León, and Extremadura, with villages destroyed, mass evacuations, and the tragedy of the Carucedo fire (León), which threatened the World Heritage Site of Las Médulas. In Portugal, more than 100,000 hectares were burned in the Serra da Estrela and Beiras, despite the deployment of thousands of personnel, and in France, the fire in Corbières (Aude) destroyed an area several times the size of Paris. The magnitude of these disasters has reignited the debate on prevention, rural depopulation and Europe's vulnerability to an increasingly extreme climate.

Climate change was the backdrop: according to the World Weather Attribution consortium, heatwaves were five times more likely due to global warming. Added to this are factors such as rural depopulation, the accumulation of unmanaged biomass and urban expansion in forest interface areas, which increase the risk. The pressure on Mediterranean ecosystems, already vulnerable due to their seasonality, intensifies with each extreme summer.

The international response, although rapid, remains largely reactive. The expert community is calling for more investment in structural and technological prevention: early detection systems, risk sensors and prediction tools. In this context, projects such as SenForFire Interreg Sudoe —which promote smart forest management and cross-border cooperation in south-western Europe— are key to anticipating fires, reducing their impact and protecting the most vulnerable territories.

The fires of 2025 highlight the urgent need to apply land management models adapted to the new climate regime. Integrating science, technology and local participation will be essential to anticipate extreme scenarios, reduce vulnerability and strengthen the resilience of landscapes in future crises.

CARUCEDO AS AN OPERATIONAL MODEL

Forest fires are a recurring threat during the summer months, especially in areas where the natural environment coexists with urban centres: the well-known Urban-Forest Interface (UFI). In these areas, the risk is measured not only by the presence of flammable vegetation, but also by the proximity of homes, infrastructure and transport routes, which complicate emergency management. Faced with this reality, the role of local councils is more than just administrative: they are the first link in a chain of prevention that can make the difference between an orderly evacuation and an uncontrolled crisis.

Local councils have two key instruments at their disposal: the Forest Fire Self-Protection Plan (PAIF) and the Municipal Action Plan (PAMIF). These documents are not mere administrative requirements, but management tools that enable them to anticipate risk and organize their response. Their value lies in their cartographic and logistical precision: they define evacuation routes, safe assembly points, self-protection areas and command structures. All of this reduces improvisation and improves coordination at critical moments. In addition, they establish clear operational roles —from liaison with 112 to the activation of strategic infrastructure such as water reservoirs or restricted access— which speeds up decision-making when the margin for error is minimal.

The municipality of Carucedo (León) represents an advanced model of local planning. In collaboration with INIA-CSIC, it has developed a PAIF based on geospatial analysis, incorporating variables such as vegetation fuel load, orography and prevailing winds. This risk mapping allows preventive interventions —such as clearing forest tracks or creating buffer strips— to be prioritised in the most vulnerable areas. This approach transforms reactive logic into a strategy of territorial self-management, where the municipality does not wait for the fire to arrive, but acts to prevent it.

However, replicating this model in other municipalities presents challenges. The first is the lack of operational capacity: many local councils lack machinery, trained personnel or local brigades, which limits their initial containment capacity. The second is citizen co-responsibility: regulations require safety strips to be kept clear around homes, but compliance depends on individual involvement, which is not always the case. Finally, there is a gap in human capital training. Having a plan does not guarantee its effectiveness if mayors, technicians and citizens do not receive practical training.

The fight against forest fires requires active shared responsibility. Local authorities must take the lead with technical planning, but neighbourhood collaboration is essential. The Carucedo model shows that science can strengthen preventive strategy, but to scale it up, municipalities need to be provided with resources, training and institutional support. Because the best firefighting is the kind that never happens.

Photos: César Hernández (CSIC)

PENDING PLANS

Municipal Action Plans (PAMIF) and Intermunicipal Action Plans (PAIF) are not recommendations, they are legal obligations. However, many municipalities do not have them or have outdated ones, leaving us vulnerable to forest fires.

These plans are essential strategic tools. Their purpose is to organise the response to fires in advance, coordinating resources,
defining protocols and optimising the intervention of emergency services.
A good plan reduces reaction time, which translates into fewer victims and less impact on infrastructure, economies and biodiversity.

In addition, a well-designed plan is not limited to response, but also details preventive actions: vegetation management, the creation of firebreaks and evacuation plans. This is crucial to increasing the resilience of exposed communities and protecting nearby forest ecosystems.

In the context of climate change, with more intense heat waves and prolonged droughts, fires are becoming increasingly extreme. Therefore, having these plans in place is not only a legal requirement, but a vital necessity to reduce the vulnerability of our territories.

It is urgent that local councils make the development and periodic review of PAMIFs and PAIFs a priority. Without adequate planning, fires will continue to be predictable disasters, putting human lives and the natural wealth around us at risk. Organised prevention is, now more than ever, the best defence.

THE SOIL: A SILENT VICTIM

When a forest fire ravages an area, attention focuses on the visible destruction: charred trees, fleeing wildlife and families forced to abandon their homes. However, there is a silent victim that is rarely mentioned: the soil. Soil, the true foundation of forest life, is key to the recovery of the ecosystem and the community. The fires that occurred this summer have reminded us once again of its vulnerability and the urgency of protecting it.

Soil is not just earth. It is a complex ecosystem that retains water, harbours biodiversity and provides essential nutrients for the regeneration of flora. Fire, by altering it, not only burns organic matter, but also changes its structure, making it less permeable and hindering the growth of new vegetation. The capacity for recovery varies according to the type of soil: the driest and most unprotected soils suffer the greatest degradation, while those rich in organic matter are more resilient. Protecting it is the key to bringing life back to the forest.

The battle to protect forest soil begins long before a fire breaks out. On this front, technology plays a decisive role. Projects such as SenForFire develop sensors that, when installed in risk areas, allow soil moisture to be monitored in real time. This variable is not only crucial for assessing the vulnerability of the soil itself, but is also closely related to the moisture content of dead and living fuels, key elements in predicting fire risk and danger. Thanks to this information, it is possible to identify critical areas more accurately, guide prescribed burns and apply other fuel management techniques with unprecedented effectiveness. This technological monitoring improves emergency response and protects a resource that would otherwise be overlooked.

The lesson from recent fires is clear: the resilience of forests does not depend solely on extinguishing fires, but on comprehensive management that focuses on prevention. This involves a combination of strategies: fuel management and controlled burning help reduce the load of flammable material, while monitoring technology enables informed decision-making. In addition, maintaining firebreaks and clear roads limits damage and speeds up recovery. For these measures to be truly effective, collaboration between scientists, fire managers and policymakers is essential, as this is the only way to adapt strategies to the specific characteristics of each territory.

In short, the protection of forest soil is an essential piece of the puzzle in the fight against fires. Prevention, restoration and technology must be inseparable allies in caring for this silent but absolutely vital resource.

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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SOIL MOISTURE AND FIRES

Soil moisture is a crucial factor in the prevention and management of forest fires. It acts as an indirect indicator of fire danger, as it influences the amount of water available to vegetation and the moisture content of materials that can burn. When the soil is dry, vegetation and other fuels such as dry leaves also dry out, making them easier to ignite. Low soil moisture means that vegetation, or 'live fuel,' is dehydrated. This dryness makes it more susceptible to ignition, and once a fire starts, it spreads more quickly and vigorously. Similarly, 'dead fuels,' such as dry leaves and branches, absorb moisture from the soil. If this moisture is low, the materials become extremely flammable.

When fuels are dry, fires can advance with great speed and intensity. Low moisture content in the environment not only facilitates ignition, but also makes it difficult to control and extinguish the fire. Real-time monitoring of soil moisture is essential for effective fire management. Technologies such as those used in SenForFire employ sensors to measure soil temperature, water content, and water potential. The combination of this data obtained in situ, together with remote sensing and advanced models, allows for accurate assessment of fire risk and potential. Furthermore, this information is vital for planning and executing controlled burns, reducing the risk of uncontrolled fires in the long term.

MORE INFORMATION