

# DECODING

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## Forest fires

Understanding, predicting  
and anticipating wildfire risk

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INRAE

## SUMMARY

In recent years we have seen exceptional fires in terms of both size and number and the fire season has been extended, starting earlier in the hot season and continuing late into the autumn. From Australia to the Amazon, from Greece to California, the world's forests are burning.

As the risk factors multiply, increasing pressure is put on these highly valuable ecosystems. Fire risk has dramatically increased with climate change and human activities, putting plant and animal life as well as our entire society in danger.

INRAE has long been working on the issues associated with forest fires, fielding two leading research units on the topic: one in Aix-en-Provence (RECOVER) and the other in Avignon (URFM).

These two units together host 13 scientists who, between them, have published some 60 scientific papers since 2016, while working on around thirty research projects. During this same period, the teams have built many European and international partnerships, with Australia and the United States in particular and two international ForestFire conferences have been organised (Aix-en-Provence, 2016 and Marseille, 2019).

The understanding, prediction and anticipation of fire risk, support for public policy and decision making, as well as support for forest regeneration form the three pillars of INRAE's work in this area and have allowed the Institute to build productive working partnerships across France, particularly that formed with Météo France and the ONF (the French National Forests Office) to predict fire risk.

What follows is a brief snapshot of the research and experiments that our teams continue to develop in order to improve our understanding of fires, to protect and anticipate them, and to help ecosystems to adapt and recover.

## GLOSSARY

**Combustibility:** ability of vegetation to burn and spread fire.

**Extreme fires:** fires that are not only of exceptional size (> 10,000 hectares burned), but are above all defined by their impact: collapse of the emergency response system and deep and long-term impacts on society, the economy and the environment.

**Ignition:** fire ignition, mostly as the consequence of humans (behaviours, social factors), but sometimes due to natural phenomena such as lightning strikes.

**Forest fire:** at least 0.5 continuous hectare of forest is affected by the flames and at least a part of the canopy is destroyed. By extension, it also includes fires affecting particular types of wildland habitats found in France such as the maquis, garrigue and landes.

**Flammability:** ability of the vegetation to ignite and burn from a source of heat.

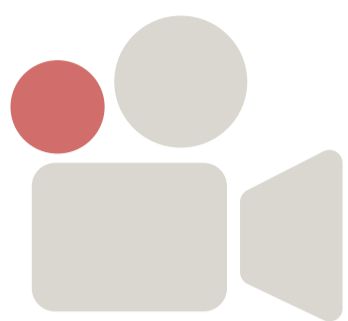
**Wildland/urban interface:** transitional zone between wildland and human settlements and/or development.

**Ornamental vegetation:** vegetation surrounding dwellings in wildland/urban interfaces, including both local and exotic species.

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### Research sites

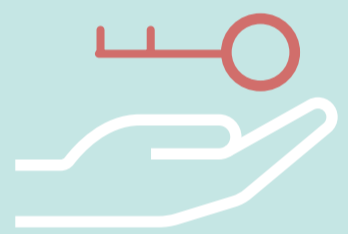


- ▶ **The fire laboratory at Aix-en-Provence:** experimental studies on fire behaviour. Measurement of flammability parameters, i.e. time to ignition and ignition frequency, rate of spread of emerging fire on small to medium scale fuel samples (litter, leaf or shoot).
- ▶ **The Fontblanche site:** monitoring of the long-term evolution of a mixed forest of *Pinus halepensis* (Aleppo pine) and *Quercus ilex* (holm oak) subjected to water stress. **How it works:** 4 experimental zones of 900m<sup>2</sup> each, 30% are shielded from rainfall. The crowns of the trees are studied using scaffolding of between 9 and 12 metres in height. Many environmental factors are continuously monitored.
- ▶ **The Saint-Mitre-les-Remparts site:** diversification and forest restoration of Aleppo pine stands by planting broadleaves. Introduced species are adapted to drought and can resprout after a fire. 1600 deciduous trees have been planted and 4000 acorns sown.

### Project profiles



- ▶ **Fire-RES:** 34 partners in Europe and Chile. **Goal:** to make landscapes more resilient to extreme blazes. **How it works:** A Living Lab (using a participative approach) is partnered with local fire-risk managers. INRAE is developing an early-warning system for extreme fire occurrence in Southern Europe.
- ▶ **MEDSTAR and INTERMED:** two projects included in the Italy-France Coastal Interreg Marittimo programme. **Goal:** to share good fire-risk management practices, particularly at the wildland/urban interface.
- ▶ **ITN pyrolife:** European project to train the next generation of wildfire scientists. INRAE has particular responsibility for exploring risk at wildland/urban interface regarding the vegetation around housing.



- ▶ **Vulnefeux:** a website to assess fire risk at neighbourhood scale.
- ▶ **Firelihood:** predictive model for regional wildfire activity developed by INRAE. Makes prediction possible at timescales from days to decades, incorporating weather and climate information and fire numbers spatio-temporally distributed across a given region. Used in the Fire-RES project.
- ▶ **RUImap:** multiscale mapping tool for wildland/urban interfaces available to local representatives at village, town, county and regional scales.

## Taking Action

On average, **90%** of fires are caused by humans, **half of them** at the wildland-urban interface.

Design your house with non-combustible materials



Iron



Stone



Solid wood

Plan your garden...

... and look after it

Defensible zone



10 metres

Small plants



Tidy trees



Forest



50 metres minimum



Water supply point



Succulents

Sweep up leaves



follow a low-watering regime



prune and trim shrubs and trees



24000 hectares

burned from 4000 ignition points each year in France

6000

communities at risk in France (2/3 in the South of France)

20 years

for an Aleppo pine forest to regenerate following a fire

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