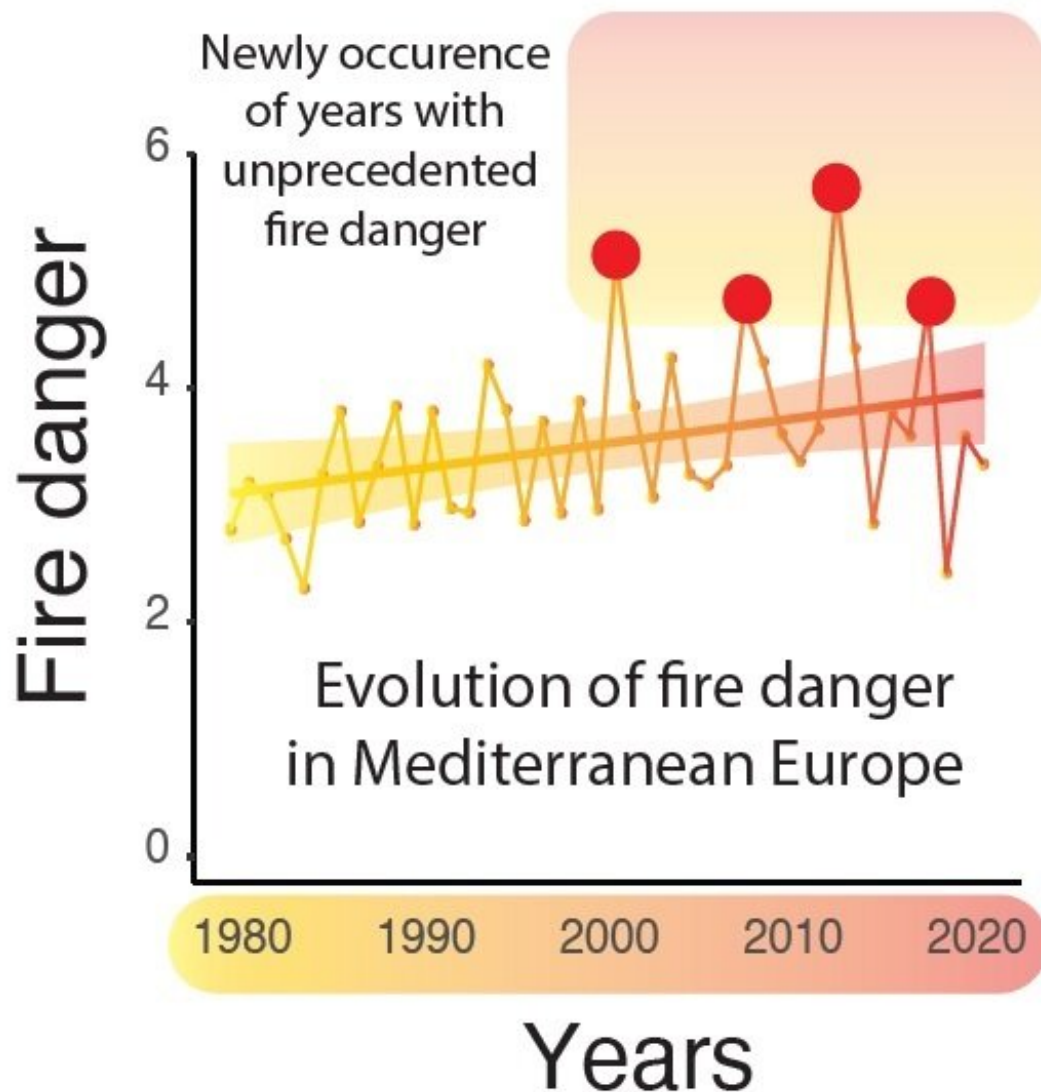


# Study reveals an unprecedented change in Europe's fire regime

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Evolution of fire risks in the Mediterranean basin over the last 30 years,

documented by the study published in Scientific Reports. The study detects the emergence of summer seasons with unprecedented extreme values of fire risks over the last decades. Credit: University of Barcelona

A study reveals an unprecedented change in the fire regime in Europe which is related to climate change. The affected areas are in Southern, Central and Northern Europe but this historical change in Europe's fire regime is more intense in the Mediterranean area. The study, published in the journal *Scientific Reports*, is led by Jofre Carnicer, lecturer of Ecology at the Faculty of Biology, and member of the Biodiversity Research Institute (IRBio) of the University of Barcelona and the Centre for Ecological Research and Forestry Applications (CREAF).

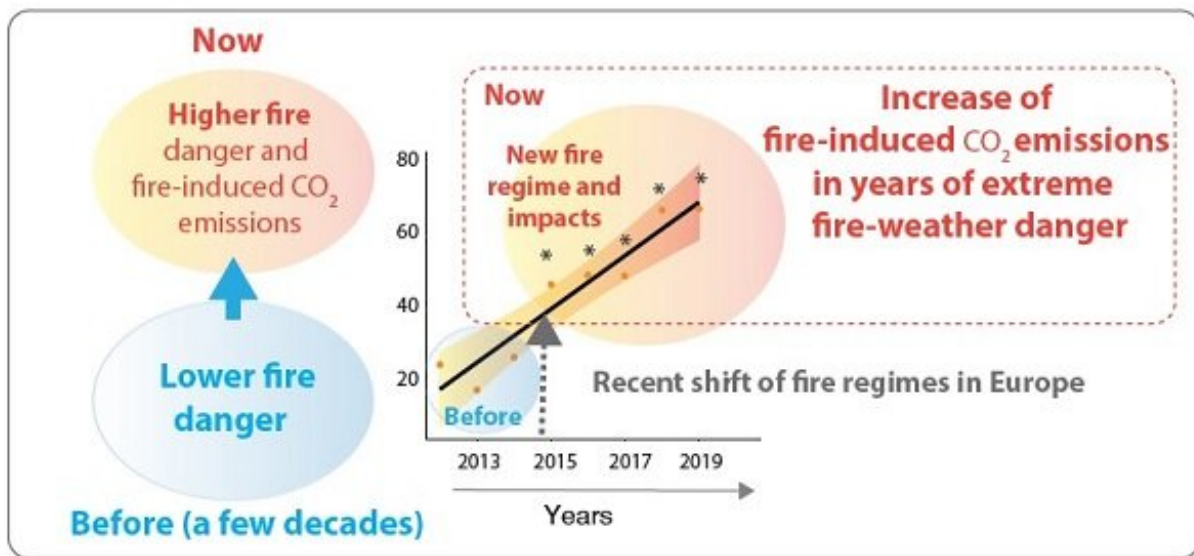
Among the authors of the study are distinguished climatologists, experts on forest fire risks and forestry ecology, members of an international consortium of research institutions in which the UB, CREAM the Intergovernmental Panel on Climate Change (IPCC), the European Centre for Medium-Range Weather Forecasts (ECMWF), Institute for Environmental Research and Sustainable Development of the National Observatory of Athens, the European Space Agency (ESRIN), the University of Salento (Italy), and the University of Patras (Greece).

## **Spring and summer seasons with a high fire risk**

The study detected summer and spring seasons with unprecedented values of fire risks over the last years, so many areas of southern Europe and the Mediterranean are reaching [extreme conditions](#) conducive to fires. These adverse conditions are becoming more frequent due to the increasing heatwaves and hydrological droughts.

"This increase in extreme fire risk is quite recent and at critical times it

exceeds the fire-fighting capabilities of European societies, causing higher CO<sub>2</sub> emissions associated with fire in extremely hot and dry summers," notes Jofre Carnicer, first author of the study and member of the Department of Evolutionary Biology, Ecology and Environmental Sciences of the UB.



The patterns the study detected represent a shift in a historical trend over a period of more than 50 years (1950-2000) during which the surveillance and fire-fighting services had reached a reduction or stabilization of the burnt area and the fire-induced CO<sub>2</sub> emissions in many areas in the Mediterranean basin. The dynamics have changed with the arrival of climate change. Credit: University of Barcelona

## Forests and carbon sinks, threatened

The study links the increase in fire risk to a higher number of fire-induced CO<sub>2</sub> emissions measured in satellite observations over the

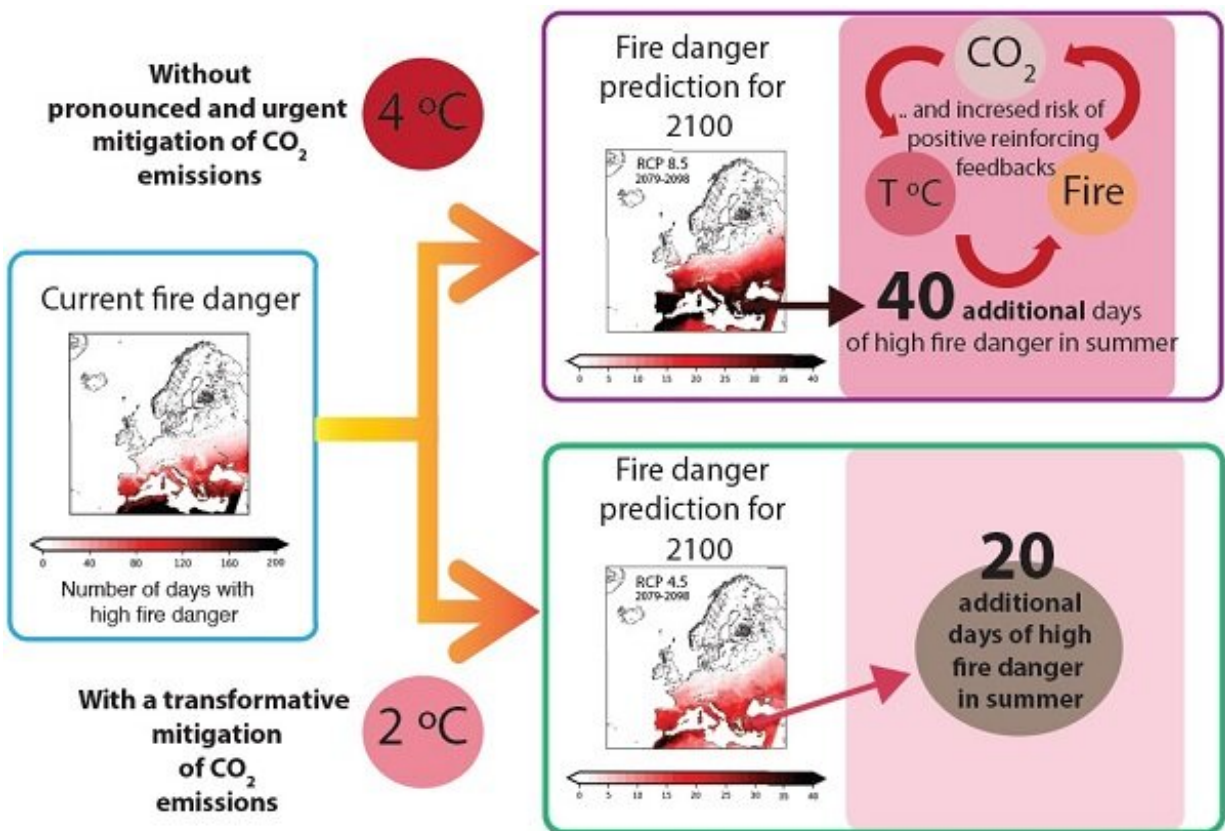
European continent. This phenomenon is occurring the Mediterranean Europe but also in the colder, northern and boreal Europe, which has important carbon sinks in the tundra and boreal forests.

The fire risk and impacts estimates based on meteorological data and satellite detection of fire impact have changed over time. This is the first time the recent increase in fire risks due to weather conditions has been detected and it translates into a significative increase in fire-associated CO<sub>2</sub> emissions in periods of extreme heat and danger of fires in summer.

"Forest and mountain areas in the southern and central Europe are the areas where the highest fire risks are detected," notes Jofre Carnicer.

"These areas are large carbon sinks that would be threatened by the fire, such as the Pyrenees, the Iberian and Cantabrian massifs in Spain, the Alps, the French central massif, the Italian Apennines in central Europe, the Carpathian Mountains, the Balkans, the Caucasus and the Pontic in the southeast area of Europe."

The study provides continental maps of fire danger and predicts the evolution of the fire risk in Europe until 2100, through different trajectories of climate change (2 degrees Celsius, 4 degrees Celsius) and reduction of CO<sub>2</sub> emissions.



Expected change in fire risks for the upcoming decades, until 2100, depending on the efforts to reduce carbon dioxide emissions. Credit: University of Barcelona

"The conclusions suggest the fire regime could rapidly change in regions affected by climate change, such as the Mediterranean, Euro-Siberian and boreal areas of Europe," notes the researcher.

"The most significant increase in fire risk will affect the areas in southern Europe that have forests and carbon sinks which are key for the regulation of climate," says the expert, and adds that "the forests in the European continent absorb about 10% of the total emissions from greenhouse gas emissions annually. Specifically, they capture around 360

million tons of CO<sub>2</sub> per year, more than the emissions of a country like Spain, with a value around 214 million tons."

The increase in fire risks described in the study is a challenge to the development and application of the new European Forestry Strategy, which proposes to maintain an annual reduction of at least 310 million tons of CO<sub>2</sub> from the forestry and agricultural sectors by 2030 in Europe. As a consequence, the detected increase in fire risk could jeopardize decarbonization strategies based on forest and land uses if effective forest management strategies are not adopted to reduce these risks," highlights Carnicer.

"Moreover, the increase in this risk could promote a mechanism of positive feedback on climate change, in progressive cycles of warming, increased fire danger, and higher [fire](#)-induced CO<sub>2</sub> emissions. In this context, reducing the CO<sub>2</sub> emissions drastically in the next two decades (2030-2040) is key to reach a lower risk of fires in Europe and worldwide," notes the author of the study.

Jofre Carnicer is a member of the Intergovernmental Panel on Climate Change (IPCC) and of the National Committee for Climate in Spain (CNC). He is one of the authors of the Sixth Assessment Report by the Working Group II at IPCC, presented in February 2022, which revealed the impacts of climate change in the ecosystems and societies worldwide, the expected environmental and social risks for the upcoming decades, and the available adaption options to reduce the impact of [climate change](#).

**More information:** Jofre Carnicer et al, Global warming is shifting the relationships between fire weather and realized fire-induced CO<sub>2</sub> emissions in Europe, *Scientific Reports* (2022). [DOI: 10.1038/s41598-022-14480-8](https://doi.org/10.1038/s41598-022-14480-8)

Provided by University of Barcelona

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