

Wildfires in the context of climate change

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During the Critical Decade for Climate Action Conference, hosted by the Tyndall Centre for Climate Change Research at the University of East Anglia (UEA), climate experts gathered to showcase evidence-based ideas and critically evaluate opportunities for climate action. This briefing note serves as a summary of Session 11c on Wednesday 10 September 2025.

Wildfires are becoming more intense, severe, and widespread, increasingly impacting the world's forests. This session explores cutting-edge research on wildfire trends, including shifts in extent and severity, as well as the key drivers behind these changes. Topics include case studies of individual fires and fire seasons, their cascading impacts, and attribution studies linking extremes to climate change and land-use practices. We will examine the critical role of achieving climate targets in reducing future wildfire risks and explore the potential of forest management as a mitigation strategy. Join us to engage with these pressing challenges and identify pathways to a fire-resilient future.

There are startling shifts in global wildfires with them becoming more intense, severe and widespread. Although in some areas wildfire incidence is decreasing, in others, particularly forests, wildfire incidence is increasing along with the worsening of fire impacts on both human and non-human populations.

Categorising 'extreme' or 'extraordinary' fire and its impacts:

Although the total burned area on Earth is declining, extraordinary fires are increasing in some places; predominantly in forests, and climate change is setting the stage for this increase. When it comes to classifying extreme fire, there is 'no single scale of gravity' as it is inherently multidimensional and can be 'extraordinary' in many different ways. Researchers identify a way of categorising fires as 'extraordinary' through six physical dimensions; *size, duration, pyroCB (pyrocumulonimbus), biodiversity impacts, fatalities, speed, structure lost and intensity*, concluding that fires don't have to be extreme in all physical measures to be considered 'extraordinary'.

In terms of impacts of fire, 'Major' impacts were quantified as >10 deaths or major economic losses. Over time,

researchers have found that there has been a fourfold increase in major economic disasters relative to the GDP of each country as a result of wildfire events. Additionally, a threefold increase in major fatalities has been discovered.

Is increasing fire incidence globally attributable to climate change?

Fire attribution involves determining what alters the likelihood or intensity of wildfire events. This could unlock potential for direct inputs to disaster risk reduction as uncovering what drives fire can generate response. However, there are three challenges identified in fire attribution, the first being that definitions and proxies that don't reflect real-world drivers. The second challenge involves difficulties quantifying attribution amidst uncertainty, variability and lack of data. For example, fires are incredibly hard to model as a result of many different drivers. The fire weather index is a way of overcoming the noisiness of fire modelling, and large progress has been made in being able to quantify how much more likely fire weather is in different climate change scenarios. Lastly, the third challenge is difficulties with deciding which aspects of fire (e.g. size, intensity, frequency)

are meaningful for both science and society.

Researchers have made huge progress in addressing the first two challenges, but the third is awaiting significant progress. In the 2010s, climate change was expected to have an impact on wildfire incidence, but it was hard to accurately attribute this. Now, researchers can officially say that it is virtually certain that fires are larger in Canada and Amazonia due to climate change¹.

Focusing specifically on Canada, researchers found that area burned is increasing alongside an increasing number of lightning-caused fires. In 2023, bad fires occurred from coast to coast with the burned area in most regions significantly exceeding the average, which was unprecedented compared to the average fire seasons. In terms of impacts, fire management in this year had severe resource constraints, an unprecedented number of evacuations and over 5000 air quality alerts. Additionally, 146 fire events occurred in 2023 as a result of pyrocumulonimbus events in which a fire gets so large, plume-driven smoke results in thunderstorm clouds which can generate lightning, starting new fires. Researchers have identified the following drivers of this unprecedented fire season: early snowmelt, rapid drying, sustained drought, extreme spring fire weather, and record-breaking fire weather over the whole fire season². However, there it is difficult to disentangle the roles of natural variability and climate change and that the contribution from warming and climate change is unclear in some regions³. In sum, there has been significant progress in attributing fires to climate change, but some serious challenges still remain.

Forecasting fire

Fire forecasting is key, as prediction enables the building of resilience to extreme fire events, which appear to be increasing globally. Researchers have created a fire triangle to represent fire forecasting, containing the three main components that are key to predicting fire: **weather, ignition and fuel**⁴.

However, the weighted contribution of each of these elements varies by place. Research on Amazonia, Canada and the Congo basin determined that weather is the dominant factor in each assessed location, even in places where fire is not traditional. Warmer weather can amplify rain, floods and droughts in a process called hydroclimatic intensification. For fire, this process results in fuel acclimation during rainy periods, which when dry, provides fuel for fires. Researchers claim that including all three of these components in forecasting fire present a step towards more accurate forecasts. However, even if all components are included in modelling, fire forecasts may still be inaccurate. Researchers have suggested that AI could be a way to further improve forecasts, alongside the the

consideration of human fire suppression in forecasting future fires.

An example of a fire forecasting system in the UK is **FireInSite**: an accessible, integrated fire behaviour prediction system for wildfire management inspired by flood warning systems and developed by researchers⁵. There are huge challenges of preaching fire risk in the UK to those who may not consider it a huge threat compared to the obvious fire impacts elsewhere. However, the UK has a complex fire regime, and existing tools in traditionally fire prone regions are inappropriate as they are based on very different climates. Additionally, the UK's fire regime is out of phase with our most extreme fire weather, hence fire weather alone is not enough to model the risk. FireInSite was therefore developed to provide user orientated, customisable and accessible fire data underpinned by rigorous science across varying locations in the UK. Users such as land managers and fire rescue services can select the location and fuel type(s) that are most relevant to them to see current fire behaviour and forecasts for the next 7 days. In the 2025 fire season, the site had 232 visitors with a peak in mid-August, coinciding with a period of high wildfire incidence in the UK. The future goals for FireInSite include more advanced user capabilities, embedding the tool within organisations and further plans for co-developing with users in an iterative process to meet user needs. Lastly, FireInSite represents how important it is for fire forecasting to be locally relevant, as sweeping generalisations in modelling may provide inaccurate forecasts.

Climate change is altering prescribed burn windows

Prescribed burning is an important land management strategy, often used for wildfire hazard reduction, ecological conservation and pastoral management. However, these burns can only take place under certain weather conditions, meaning that climatic change may shift windows in which these burns can take place.

Researchers have developed **GlobalRx**: a new global dataset on prescribed burning in the Mediterranean in a changing climate⁶. This dataset produced the following key conclusions about prescribed burning in these areas in a changing climate. Prescribed days are expected to decrease on average by 5.7 days per year per increase in warming (1.5, 2, 3, 4 degree increase scenarios), with the largest decreases expected to occur between April and October. Therefore, the timing of prescribed burn days may shift from autumn and spring towards the winter. Lastly, researchers concluded that temperature is the dominant control on prescribed burn days across most of the European Mediterranean.

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