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## What makes a fire grow extremely large?

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Wildfires are an important disturbance in global ecosystems and are a critical driver of trends in the land carbon budget. Fire is an extreme phenomenon, with the largest burned area often occurring during extreme fire seasons generating large fires. Days with fire conditions conducive to fire ignition and spread are increasing in a warming climate in many regions of the world, contributing to increases in fire occurrence and annual burned area. However, the climate, fuel, and weather conditions that lead to extremely large fires in different biomes are poorly understood.

Here, we explore the temporal evolution of extremely large fires in temperate and boreal regions using new satellite-derived fire event tracking datasets optimized to match higher resolution time series of fire progression from aircraft and other sources. We aimed to understand the specific environmental conditions required for the development of a large fire. Our analysis revealed a disproportionate impact of multiple fire ignitions in creating large fires through merging. Our findings suggest that the largest fires in both biomes may be commonly created through multiple fires growing together. We hypothesize that a combination of physical and anthropogenic factors may accelerate merging, making these fires extremely difficult to contain and more robust to environmental controls regulating extinction. In our analysis, we use the Fire Events Database, the Arctic-boreal Fire Atlas, and GOFER, which enable attribution of ignition sources. Our analysis may contribute to an improved understanding of the influence of large-scale lightning storms in creating extremely large and destructive fire events.