CÓMO INFLUYE EL CAMBIO CLIMÁTICO ANTROPOGÉNICO EN EL COMPORTAMIENTO DE LOS INCENDIOS FORESTALES EN LA PENÍNSULA IBÉRICA

HOW ANTHROPOGENIC CLIMATE CHANGE INFLUENCES WILDFIRE BEHAVIOUR IN THE IBERIAN PENINSULA

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SUMMARY

Climate change affects wildfire spread both by increasing fuel dryness and by causing changes in vegetation. However, the direct effect of global warming on wildfires is hard to quantify due to the multiple non-climatic factors involved in their ignition and spread. By combining wildfire observations with the latest generation of climate models, we show that in more than half of the large wildfires (area>500 ha) that took place in the Iberian Peninsula between 2001 and 2021 there is a significant increase in the rate of spread with respect to what it would have been in the pre-industrial period, attributable to global warming. The influence of enhanced vegetation growth on the increase in the rate of spread since the pre-industrial period could potentially be even higher than that of the temperature increase. We also show that other parameters associated with wildfire behaviour, such as heat release or flame length, also show the same climate change-induced amplification effect.

Wildfires are an important component of the Earth system continuously interacting with other components such as the atmosphere, vegetation or humans (Bowman et al., 2020; Bowman et al., 2009; Flannigan et al., 2009). Global increases in fire activity were linked to ongoing climate change (Jolly et al., 2015; Abatzoglou et al., 2018; Ellis et al., 2022; Liu et al., 2022; Jones et al., 2022), but the complex interactions between the effects of climate, vegetation and humans on fire activity involve that these changes are spatially and temporally heterogeneous (Williams and Abatzoglou, 2016).

By using wildfire observations and outputs from different general circulation models, we quantified the influence of climate change on the rate of spread of wildfires that took place in the Iberian Peninsula between 2001 and 2021. A general increase of the rate of spread in between 2.0% and 8.3% on average was found since the pre-industrial period attributable to the reduction in fuel moisture associated with a warmer atmosphere. This growth in the rate of spread is significant in more than 50% of the events. Further increases in the rate of spread (~12.7%) are expected by the end of the 21st century according to an intermediate-emissions scenario. We find similar increases for heat release and fire intensity indexes, implying that the fire-atmosphere coupling may be intensifying, which may lead to more erratic fire spread. Climate change and atmospheric CO_2 fertilization are also enhancing vegetation growth (Allen et al., 2024; Pausas and Keeley, 2021; Wu et al., 2015; Zhu et al., 2016), whose influence on wildfire behaviour could potentially be even higher than that of the temperature increase.

REFERENCIAS

Abatzoglou, J. T. et al. (2018): *Global patterns of interannual climate–fire relationships*. Glob. Change Biol. 24, 5164–5175.
Allen, R. J. et al. (2024): *Enhanced future vegetation growth with elevated carbon dioxide concentrations could increase fire activity.* Commun. Earth Environ. 5, 1–15.
Bowman, D. M. et al. (2009): *Fire in the Earth system*. Science 324, 481–484.
Bowman, D. M. et al. (2020): *Vegetation fires in the Anthropocene*. Nat. Rev. Earth Environ. 1, 500–515.
Ellis, T. M. et al. (2022): *Global increase in wildfire risk due to climate-driven declines in fuel moisture.* Glob. Change Biol. 28, 1544–1559.
Flannigan, M. D. et al. (2009): *Implications of changing climate for global wildland fire*. Int. J. Wildland Fire 18, 483–507.
Jolly, W. M. et al. (2015): *Climate-induced variations in global wildfire danger from 1979 to 2013*. Nat. Commun. 6, 7537.
Jones, M. W. et al. (2022): *Global and regional trends and drivers of fire under climate change.* Rev. Geophys. 60, e2020RG000726.

Liu, Z. et al. (2022): *A global view of observed changes in fire weather extremes: uncertainties and attribution to climate change*. Clim. Change 173, 14.
Pausas, J. G., Keeley, J. E. (2021): *Wildfires and global change*. Front. Ecol. Environ. 19, 387–395.
Williams, A. P., Abatzoglou, J. T. (2016): *Recent advances and remaining uncertainties in resolving past and future climate effects on global fire activity.* Curr. Clim. Change Rep. 2, 1–14.
Wu, M. et al. (2015): *Sensitivity of burned area in Europe to climate change, atmospheric CO2 levels, and demography: A comparison of two fire-vegetation models.* J. Geophys. Res. Biogeosciences 120, 2256–2272.
Zhu, Z. et al. (2016): *Greening of the Earth and its drivers*. Nat. Clim. Change 6, 791–795.