INITIATIVE ON
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Early warning system for unseasonal forest flammability

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In most forests, dead fuel material is continually present in high enough abundance to sustain a fire whenever it dries out to ignitable moisture levels. Fine dead fuels such as leaf litter and twigs respond relatively quickly to atmospheric moisture and can shift a forest from a non-flammable to a flammable state within days.

Current operational fire danger indices such as the Canadian Forest Fire Weather Index (FWI) or the Australian Forest Fire Danger Index (FFDI) incorporate a simple soil water balance to quantify fuel dryness that is often poorly correlated with the actual moisture content of fine dead fuels. FWI and FFDI are therefore of limited use for predicting the development of critical forest flammability due to the rapid drying of fine dead fuels.

Here, we show that fine dead fuel moisture content can be reliably predicted over large heterogeneous areas from gridded vapour pressure deficit. We apply the methodology to recent forest fire events in Europe and Australia to demonstrate that these major fires occurred when predicted dead fuel moisture content exceeded empirically derived thresholds of extreme forest flammability. In the European case study dead fuel moisture content had dropped to record values for the time of year.

The presented methods provide essential building blocks for spatially explicit mapping and forecasting of extreme forest flammability. Early warning of the development of critical conditions would help fire management agencies to more strategically allocate resources, raise awareness among affected communities, and mitigate fire risks.