

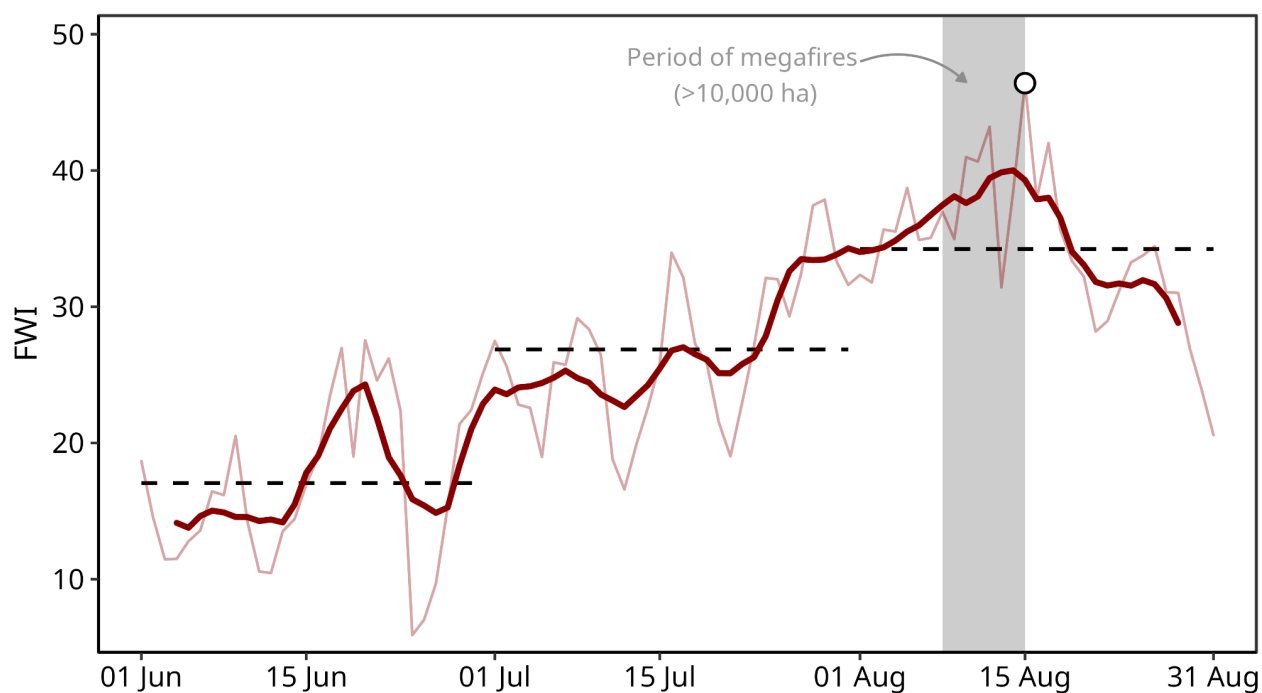
Supplementary information for: **Anthropogenic warming shifted southwestern Europe into fire-weather conditions exceeding operational suppression thresholds**

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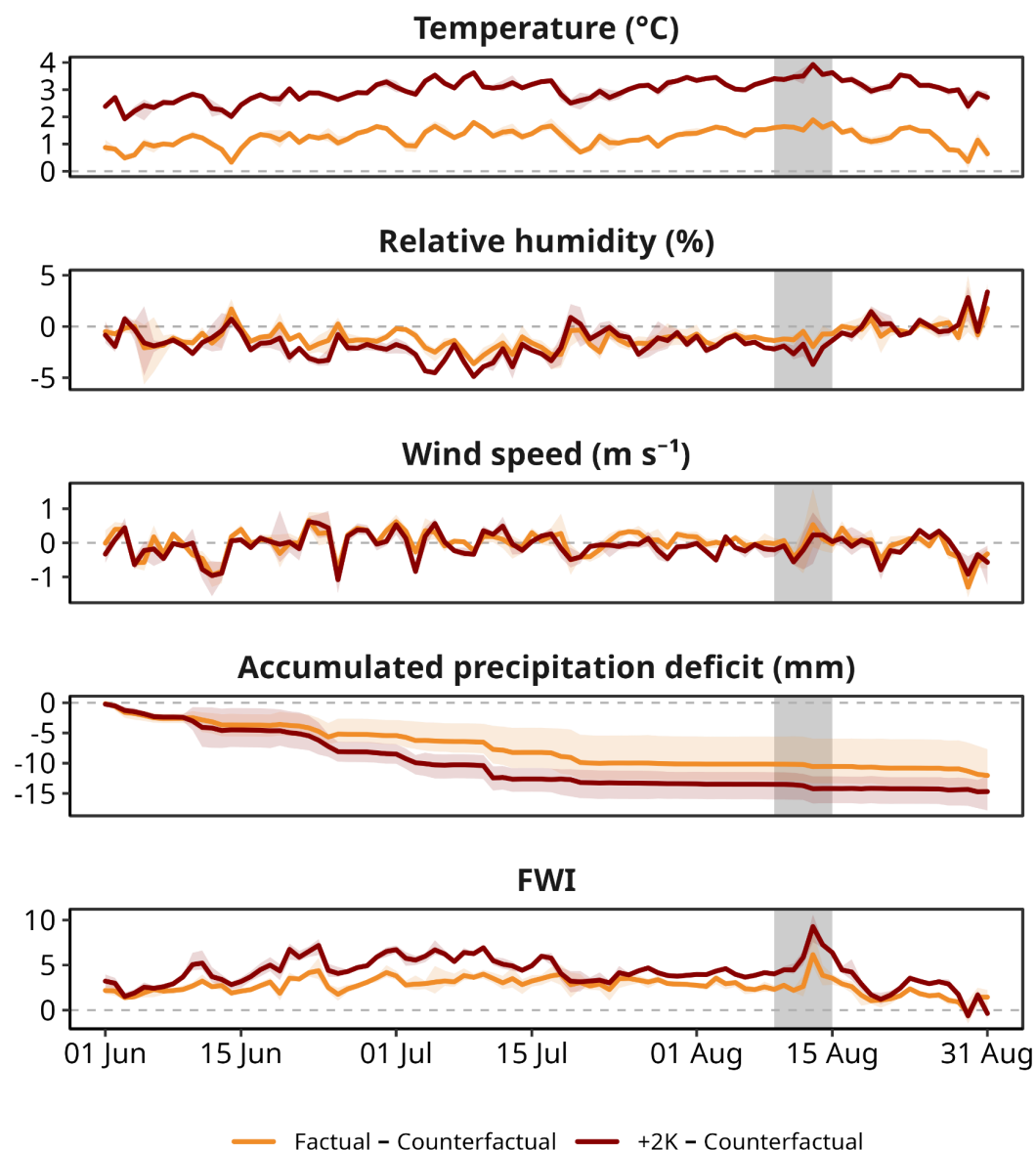
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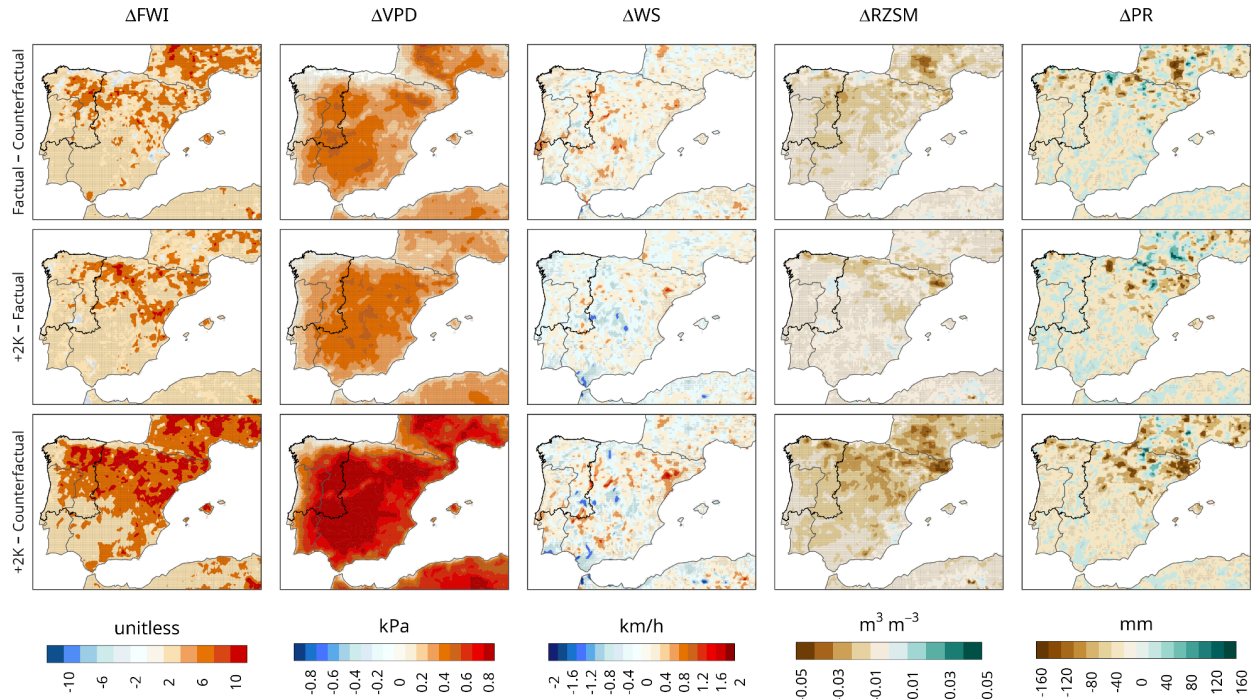
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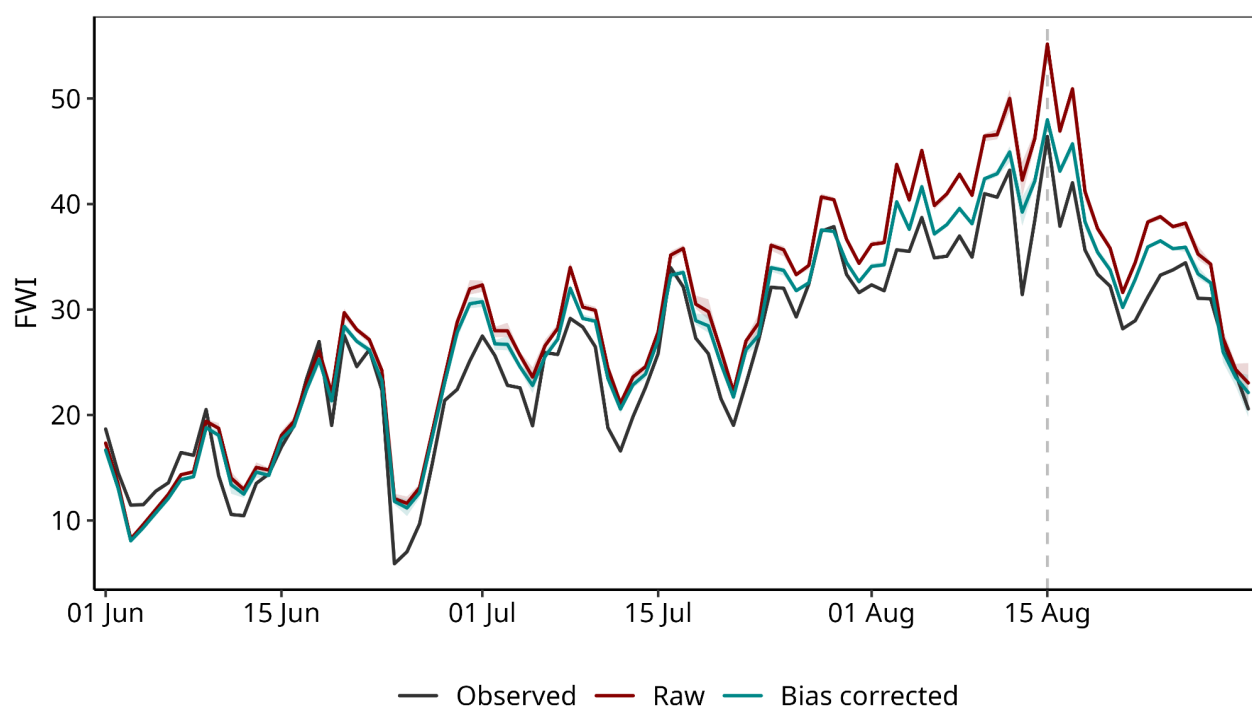
Supplementary Figure 1 | Daily fire weather conditions over northwestern Iberia during summer 2025. Daily Fire Weather Index (FWI) averaged over northwestern Iberia (NW-IP) from ERA5-Land for June–August 2025. The thin red line shows daily FWI values, while the thick red line represents the centred 7-day running mean. Dashed horizontal lines indicate the monthly mean FWI for June, July and August. The grey shading denotes the period when megafires (burned area per fire >10,000 ha) started (8–15 August), and the circle indicates the maximum daily FWI (15th August) during the study period.



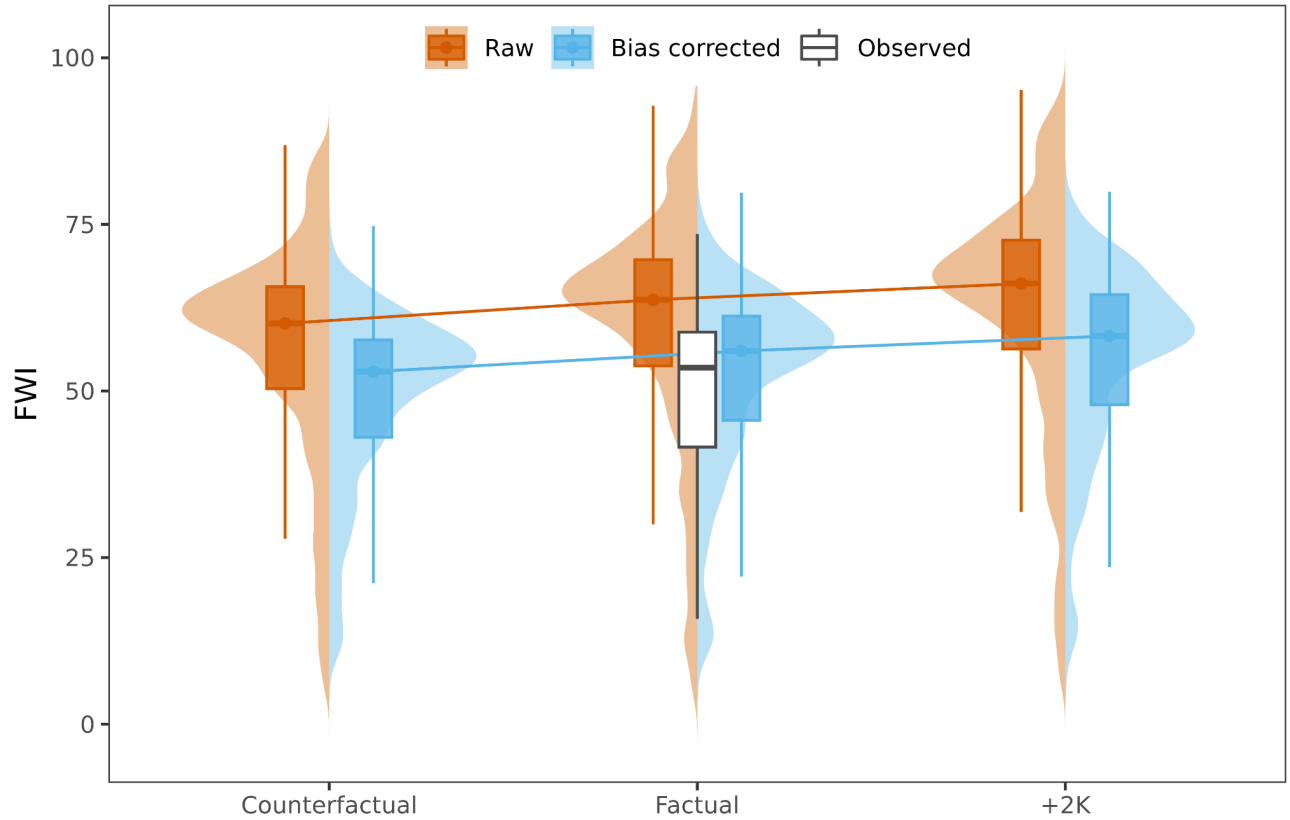
Supplementary Figure 2 | Temporal evolution of fire-weather drivers across climate storylines over northwestern Iberia. Daily spatially averaged differences in temperature, relative humidity, wind speed, accumulated precipitation, and Fire Weather Index (FWI) over the NW-IP study domain from 1 June to 31 August 2025. Orange and dark-red lines show ensemble-mean differences between the Factual and Counterfactual and +2K and Counterfactual storylines, respectively. Shaded bands indicate standard deviation across the five ensemble members. The grey vertical band denotes the peak period of the August 2025 wildfire episode (8–15 August) based on megafires (> 10,000 ha) occurrence.



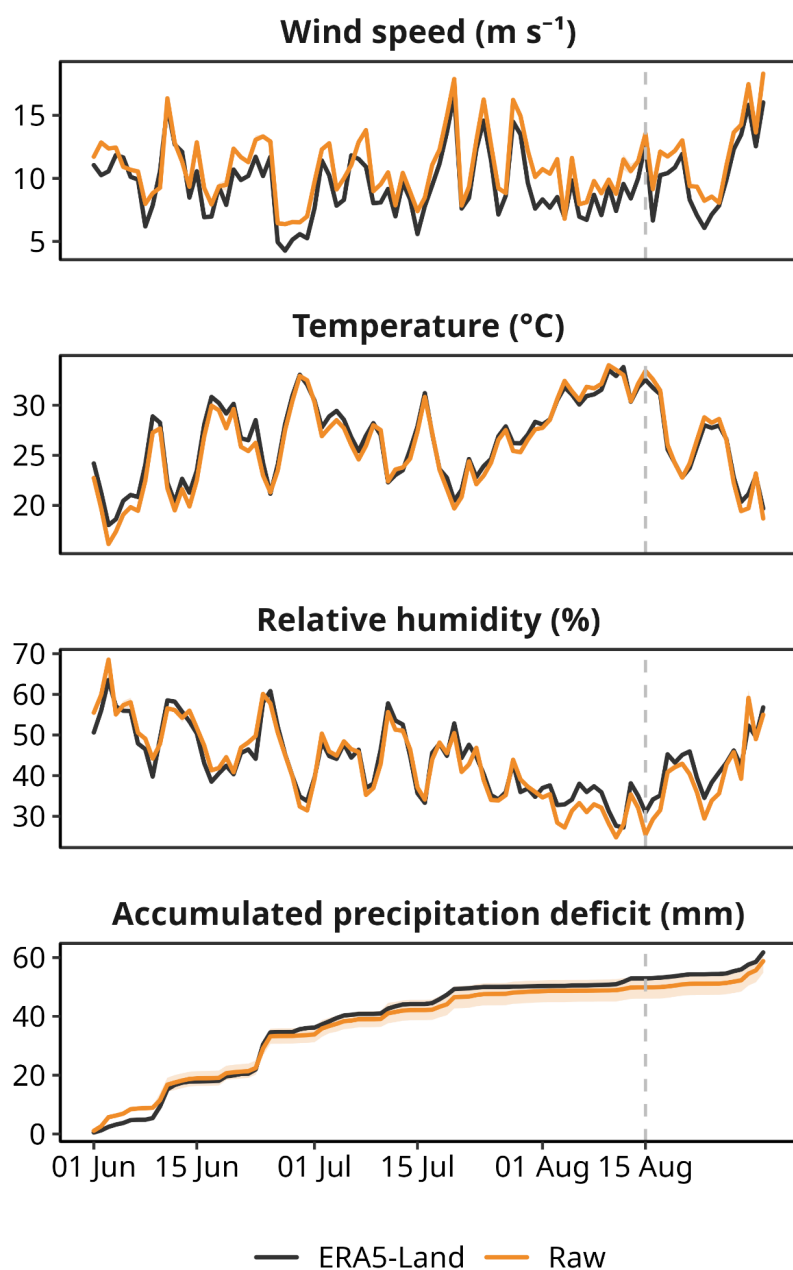
Supplementary Figure 3 | Changes in fire-weather drivers across climate storylines during 8-15 August 2025. 8-15 August mean differences in Fire Weather Index (FWI), vapour pressure deficit (VPD), 10-m wind speed (WS), root-zone soil moisture (RZSM), and accumulated summer (JJA) precipitation (PR) across the Iberian Peninsula study domain. Rows show differences between the Factual and Counterfactual storylines (Factual - Counterfactual; top), the +2K and Factual storylines (+2K - Factual; middle), and the +2K and Counterfactual storylines (+2K - Counterfactual; bottom). Values represent ensemble means across the five storyline members, with shaded areas indicating locations where all five members agree on the sign of the change.



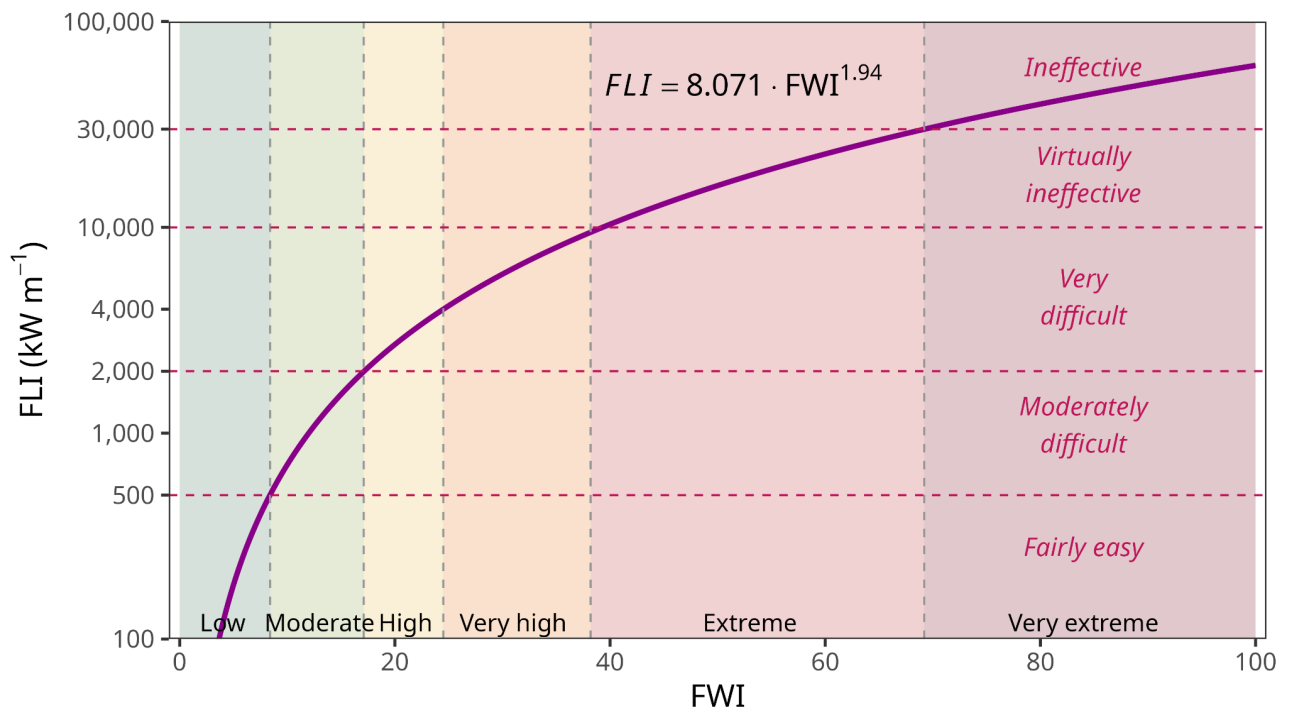
Supplementary Figure 4 | Bias correction of fire weather index for summer 2025. Daily average Fire Weather Index (FWI) from 1 June to 31 August 2025 over the NW-IP domain. The black line shows the observed time series based on ERA5-Land, while the red and light blue lines show the raw and bias-corrected FWI, respectively, from the factual IFS–FESOM storyline simulation. The vertical dashed line marks 15 August, the cut-off date used for the attribution analysis.



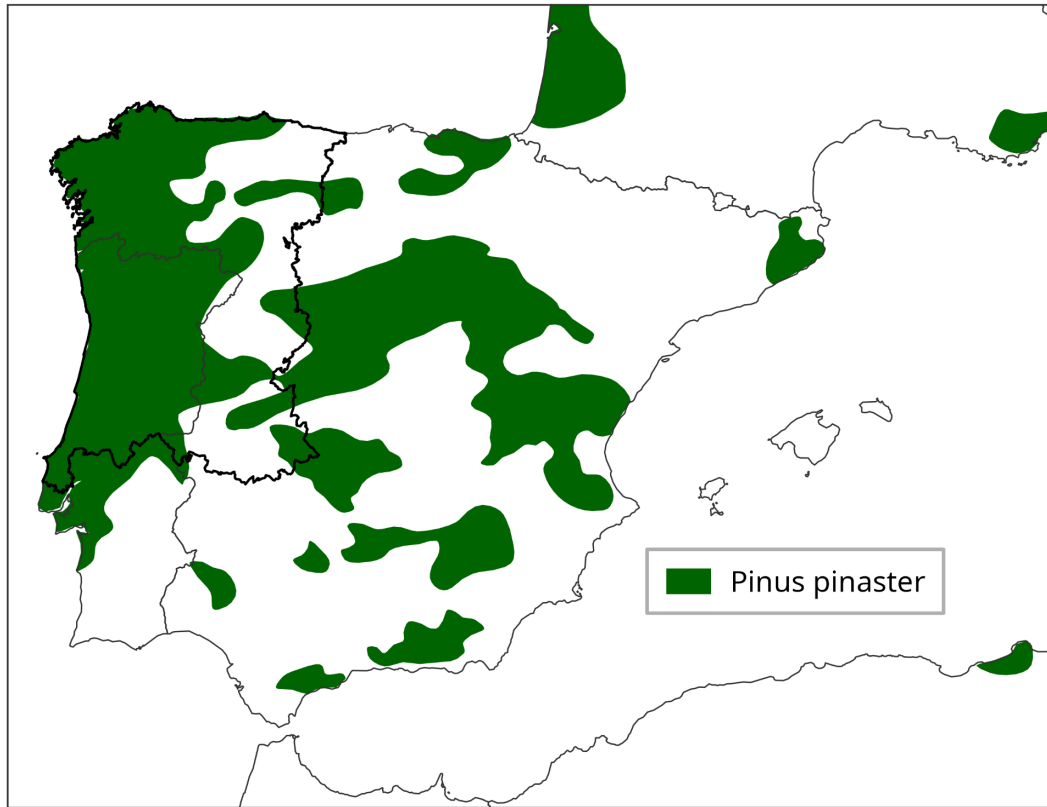
Supplementary Figure 5 | Effect of bias correction on simulated Fire Weather Index distributions. Distribution of the daily maximum Fire Weather Index (FWI) during August 2025 over the NW-IP study domain for the raw and bias-corrected Counterfactual, Factual, and +2K storylines. Orange and blue boxplot and distributions show raw and bias-corrected FWI, respectively, while the white boxplot shows the corresponding ERA5-Land reference distribution. Bias correction was performed using quantile delta mapping, calibrated against ERA5-Land using daily summer (JJA) FWI over 2018–2025. Lines connect the median FWI across storylines for the raw and bias-corrected simulations.



Supplementary Figure 6 | Comparison of simulated and observed meteorological variables used as input for the fire weather index during summer 2025. Daily evolution of wind speed, temperature, relative humidity and accumulated precipitation deficit from 1 June to 31 August 2025 over the NW-IP domain. The black line represents ERA5-Land, while the orange line shows the corresponding raw values from the factual IFS–FESOM storyline simulation. The vertical dashed line marks 15 August, the cut-off date used for the attribution analysis.



Supplementary Figure 7 | Transformation of Fire Weather Index into potential fireline intensity and operational suppression categories. Relationship curve between Fire Weather Index (FWI) and potential fireline intensity (FLI) based on the empirical equation of Palheiro et al. (2006) for *Pinus pinaster* ($FLI = 8.071 \cdot FWI^{1.94}$). Coloured vertical bands indicate the standard EFFIS FWI danger classes (Low, Moderate, High, Very high, Extreme and Very extreme). Horizontal dashed lines denote FLI thresholds of 500, 2,000, 10,000 and 30,000 kW m^{-1} , used to define increasingly challenging operational fire-suppression conditions, from fairly easy to ineffective (Tedim et al., 2018).



Supplementary Figure 8 | Distribution of *Pinus pinaster* across the Iberian Peninsula. Spatial distribution of *Pinus pinaster*, the dominant tree species across the NW-IP study domain and the species for which the empirical FWI–FLI relationship of Palheiro et al. (2006) was developed. The mapped distribution of *Pinus pinaster* encompasses approximately 68.2% of the NW-IP study domain.