Title

Adaptation to Increasing Risks of Forest Fires

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Abstract

This work presents a quantitative assessment of adaptation options in the context of forest fires in Europe under projected climate change. A standalone fire model (SFM) based on a state-of-the-art, large-scale forest fire modeling algorithm is used to explore fuel removal through prescribed burnings and improved fire suppression as adaptation options. The climate change projections are provided by three climate models reflecting the SRES A2 scenario. The SFM's modeled burned areas for selected test countries in Europe show satisfying agreement with observed data coming from two different sources (European Forest Fire Information System and Global Fire Emissions Database). Our estimation of the potential increase in burned areas in Europe under ''no adaptation'' scenario is about 200% by 2090 (compared with 2000-2008). The application of prescribed burnings has the potential to keep that increase below 50%. Improvements in fire suppression might reduce this impact even further, for example, boosting the probability of putting out a fire within a day by 10% would result in about a 30% decrease in annual burned areas. By taking more adaptation options into consideration, such as using agricultural fields as fire breaks, behavioral changes, and long-term options, burned areas can be potentially reduced even further.

Adaptation to Increasing Risk of Forest Fires

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Key Messages

For climate change projections reflecting the SRES A2 scenario:

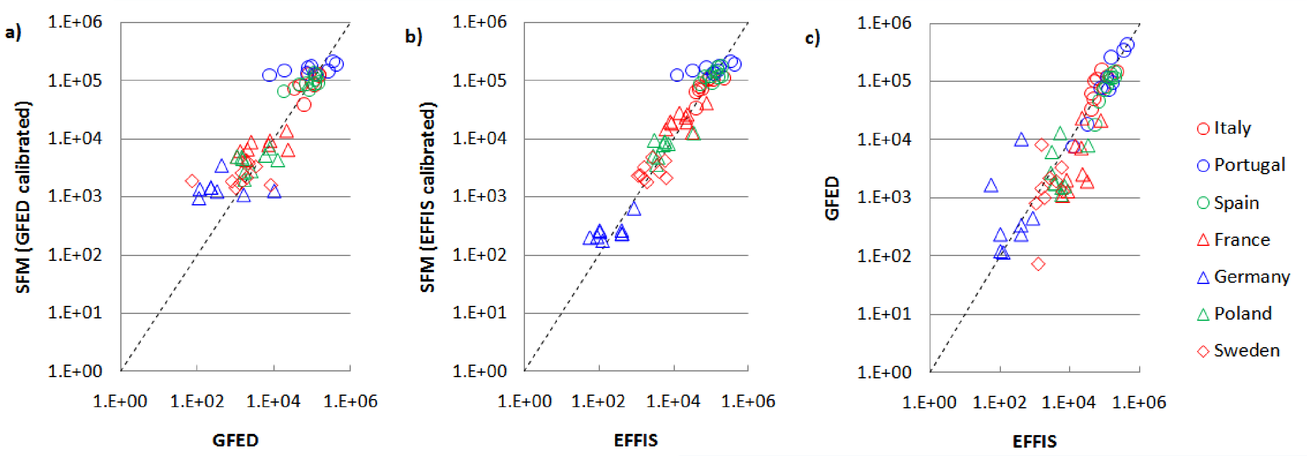
1) Estimated potential increase of burned areas in Europe under "no adaptation" scenario is about **200% by 2090** (compared to 2000-2008).
2) The application of prescribed burnings has the potential to keep that increase below **50%**.
3) Fire suppression might reduce this impact even further, e.g. boosting the probability of putting out a fire within a day by 10% would result in about a 30% decrease in annual burned areas.

Current modeling limitations call for **a fundamental upgrade** of the existing continental-scale fire models.

Figures to the right: Projected impacts and effect of fuel removal (prescribed burnings) on burned areas (in thousands of hectares) as assessed by Standalone Fire Model (SFM_{MRI}, SFM_{CNRM}, and SFM_{CSIRO}) calibrated using Global Fire Emissions Database ver.3 (GFED) for European regions. Solid lines represent "no adaptation" scenario, dashed lines – prescribed burnings (PB, [Litter C + CWD C] / 2).

Climate models: CNRM-CM3 (France), MRI-CGCM2.3.2 (Japan), CSIRO-Mk3.0 (Australia) from WCRP CMIP3 multi-model dataset.

Validation – Historical Annual Burned Areas

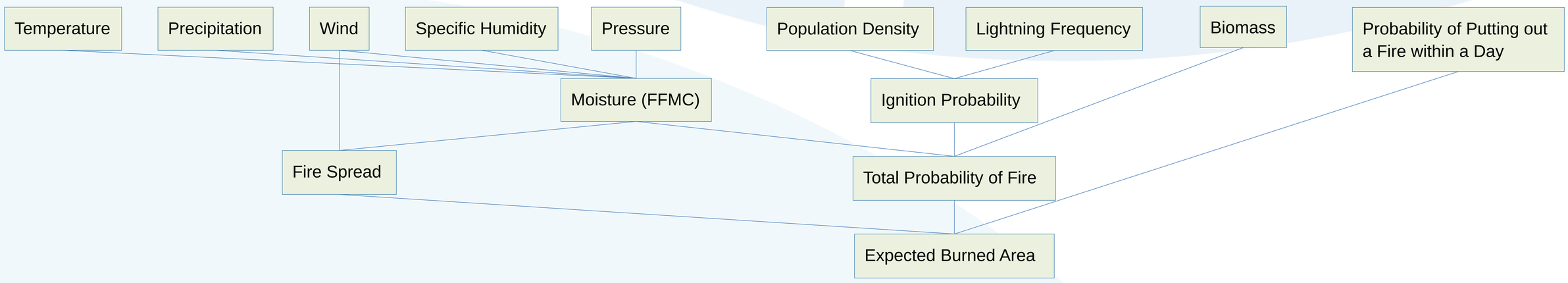


Top row figures: Inter-annual variability of burned areas in hectares as reported (EFFIS, European Forest Fire Information System) and reproduced by the model (FS). Last figure shows also GFED data.

Figures to the left: Scatter plots of yearly burned areas: modelled (SFM) vs. reported and GFED vs. EFFIS - in hectares on a log scale for selected European countries.

Historical daily weather data: Princeton dataset at 1 arc degree, years 1948-2008, values: temperature, precipitation, wind, specific humidity, and surface pressure. Sheffield J, Goteti G, Wood EF (2006) Development of a 50-year high-resolution global dataset of meteorological forcings for land surface modeling. J Clim 19:3088–3111

Model Schematic



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