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Global attribution of anthropogenic and lightning fires

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Fires can have anthropogenic or lightning origins. The spatiotemporal niches of anthropogenic and lightning fires are different. Lightning fires usually occur during a discrete apex in seasonal lightning occurrence. Conversely, anthropogenic fires have an expanded temporal niche and occur throughout the year. In addition, lightning and anthropogenic fires occupy different parts of the landscape. While human accessibility is a key determinant of anthropogenic ignitions, lightning ignitions prevail in remote landscapes.

We used these differing temporal and spatial niches between anthropogenic and lightning fires to construct random forest models that attribute causes, lightning vs. anthropogenic, to global fire activity. We built two separate models. The first model predicts the fraction of lightning fires, whereas the second model predicts the fraction of burned area from lightning. Our model ingests two geospatial predictor variables that quantify the differences between the temporal and spatial niches of lightning and anthropogenic fires. The first predictor is the seasonal correlation between lightning and burned area. The second predictor is the fraction of low impact land. These fire cause predictors capture 47 % of the spatial variability in ignition cause, and 40 % of the spatial variability in burned area cause, compared to reference data from six different parts of the world.

Our global fire cause attribution contrasts savannas and agricultural lands with human-dominated fire regimes from temperate and boreal forests with lightning-dominated fire regimes. Our global fire cause attribution can be implemented in fire and Earth system models to further optimize projections of future fire activity under changing socio-economic and climatological conditions.