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Contrasting patterns and interpretations between fire spread simulators and machine learning models when mapping burn probability

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Abstract

The natural and socioeconomic costs associated with wildfires led to developing tools to anticipate decisions to reduce wildfire impacts. Indeed, mapping fire-prone areas (i.e., burn probabilities) is a common practice by fire agencies to design firefighting and prevention campaigns. Two main approaches are commonly used to map burn probabilities: fire spread simulators and machine learning models. Despite they based mostly on the same environmental variables, they differ on how they handle them. Thus, since fire managers sometimes mostly focus on the outputs without acknowledging the difference between approaches, it makes worthy to assess for differences on both results and interpretations. Burn probabilities were calculated for the Apulia region, Southern Italy, using FlamMap and Random Forest (RF). Results showed that RF project more uniformly distributed results (both spatially and statistically) than FlamMap, which concentrate most of its values close to zero except for some locations with medium-high probabilities. In addition, burn probabilities from FlamMap and RF change across fuel types and environmental conditions. Interpreting results suggest that decisions based on fire simulators might be more tightly linked with actions preventing fire spread, whereas those based on machine learning might be more linked with fire occurrence that is not necessarily related to spreading, e.g., socioeconomic causes. Thus, paying attention to this, both approaches should provide complementary information for fire agencies.

Keywords: Wildfire simulators, Burn probability, Fire occurrence, Fire spread