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Forest fire risk assessment with soil data in Croatia

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Forest fire research can comprise forest fire case studies, laboratory experiments, fire detection by ground sensors, unmanned aerial vehicles and satellites, development of fire behaviour models, fire danger forecast, fire risk assessment, and much more. Commonly used and accepted Canadian method for forest fire danger forecast is expressed as *Fire Weather Index* (FWI) uses weather data. The index estimates the danger of wildfire and is based on meteorological parameters (air temperature, air humidity, wind speed, and rainfall amount) referring to 12 UTC for that day at the meteorological station or on a numerical weather prediction model grid point.

Knowing how weather and soil interact and affect each other, we propose a new fire risk index based on the innovative *Soil Index.* Using open-access data, we collected different soil data such as soil temperature and soil moisture, land cover, vegetation, slope, etc. Since there are different types of vegetation and states, Leaf Area Index (LAI) and Normalized Difference Vegetation Index (NDVI) are considered as well. Being focused on forest fires, data about the burned area were also taken into account as well as the slope of the terrain for which the fire risk is calculated.

Since all mentioned data have a diverse horizontal and temporal resolution, we decided to group them by temporal resolution: static, semi-static, and dynamic data. Static data refers to data that rarely change (never or every few years; e.g. land cover). Semi-static data refers to data that vary weekly or monthly (e.g. LAI). Dynamic data group refers to data that is strongly influenced by weather conditions (like soil temperature) and varies every hour. Because of various horizontal resolutions, soil parameters are interpolated to the same horizontal grid. Soil parameters are analysed concerning historical forest fires in Croatia. Despite *Soil Index* being based on soil parameters, we compared it with *Fire Weather Index* using data records for historical forest fires in Croatia. Obtained results indicate that the soil index has a better prediction performance compared to FWI. This study also highlights that not only the meteorological environment but also soil conditions are important parameters for fire risk assessment.