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Investigating fuels, fuel moisture and fire severity in the Bohemian-Saxon Switzerland region (Czech Republic/Germany): the need for dynamic fire risk assessment and management

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Until recently, forest fires were considered a rare phenomenon in the temperate forests of Central Europe due to the moderate summer temperatures and the humid climate. However, many of those forests (e.g. monocultures of *Picea abies*, Norway Spruce) were affected by bark beetle infestations in the past years and recent fires such as in the Bohemian-Saxon Switzerland in 2022 raised widespread debates about the effects of forest mortality on fuel accumulation and hence fire occurrence and severity. Here we mapped and investigated fuel types, fire severity and started to continuously monitor fuel moisture in the Bohemian-Saxon Switzerland. We enhanced a European fuel type classification with a class for dead and dying spruce and mapped fuel types. Satellite observations from VIIRS, Sentinel-2 and Landsat were used to map fire intensity and severity of the fire from 2022.

We found the highest fire intensities at sites with dead spruce forests and single beech trees. Burn severity was moderate with high variability across all fuel types but highest severities occurred in dead spruce stands. Fire severity derived from satellite observation correlated positively with char height and torched trees, especially seen in dead spruce stands, which was likely caused by the high amount of dry fine woody debris and the initial natural regeneration. Our results demonstrate that surface fuel accumulation from past bark beetle disturbances resulted in more intense fires and higher burn severity. The results demonstrate that the recent rapid changes in Central European temperate forests cause a need for a dynamic mapping and monitoring of fuel types and fuel moisture for fire risk assessment and for cross-border fire risk management in landscapes previously not considered as fire-prone.