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Development of a model to predict ash transport and water pollution risk in fire-affected environments

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After wildfires or managed vegetation burns the ash that commonly covers the ground is highly mobile and contains undesirable pollutants. Delivery of this ash in runoff and eroded sediments can have major impacts on water quality, potentially affecting water supply for more than 750M people in the world. Current erosion models can predict post-fire soil delivery and anticipate its impact on aquatic ecosystems. However, ash displacement has not been included in these estimations so far, even though recent studies have reported ash-induced levels of toxic and carcinogenic elements up to 120 times the recommended limits in downstream water reservoirs. We have therefore developed a model, currently at proof-of-concept stage, that allows prediction of ash delivery to the hydrological network. It is based on recent advances in knowledge on ash production, properties and fate, coupled with a widely proven risk-based runoff-erosion modelling approach. The model uses the climate input and runoff and erosion outputs of the Water Erosion Prediction Project model (WEPP) as input data to predict ash availability and transport. The model integrates the main processes involving ash, from its production to its decomposition, transport and redeposition by wind or water.

The model is operational and preliminary validation of this first attempt to predict ash transport and its delivery to the stream system are encouraging. However, further information on ash properties and transport processes by runoff, wind and eroded sediment are needed for improving the model and validating its outputs for different environments. With this model we aim to anticipate the risk of ash delivery and support land managers in designing adequate prescribed burning plans and effective post fire actions to control ash delivery after prescribed and uncontrolled fires.