Modelling the linkages between structural fire risk and fire impacts in forest areas: the case of Águeda catchment

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Abstract

Erosion and sediment connectivity are key processes to determine sediment transport and delivery to downstream water bodies. These crucial processes are also impacted and often enhanced by wildfires. To our knowledge, there are no studies that explicitly model the combination between structural fire risk, post-fire erosion risk and sediment connectivity, particularly in forest areas. In this study, we couple in-stream aquatic sensing, three approaches of risk assessment already tested for Águeda catchment, namely, the Structural fire risk (SFR), the Morgan–Morgan–Finney erosion model (MMF), and, the Index of Connectivity (IC), using Monte Carlo uncertainty analysis, to generate a new Fire Risk-Erosion-Sediment Connectivity Mapping (FESCM) framework. We then evaluate the predictor variables associated with FESCM using the algorithm Random Forest. FESCM was mapped using five classes to be aligned to the Portuguese law and the results indicate that the most important predictor variable was the vegetation. This study provides a method for combining SFR, MMF and IC in a new tool (FESCM) to identify spatial patterns in fire risk and erosion-sediment-connectivity to aid in the understanding and management of watershed sedimentation.

Keywords: Structural fire risk, post-fire erosion risk, sediment connectivity, MMF, IC