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Impact of wildfires on long-term erosion rates: comparing connectivity indices and landscape evolution modelling

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Mediterranean countries, such as Portugal, are often associated with soil erosion and land degradation risks, which cause an increasing pressure on ecosystem services. In most of these countries, wildfires occur during the summer, and are usually followed by heavy rainfall events which, in combination with steep slopes and in some cases lack of vegetation cover, can easily provoke runoff and erosion. This is generally due to three main erosion contribution processes: i) a reduction of interception and evapotranspiration; ii) a decrease in infiltration and soil water retention; iii) a reduction in obstacles. For the latter, burnt areas tend to increase water and sediment connectivity by changing vegetation cover and physico-chemical soil properties. Sediment connectivity in a specific catchment is affected by its size, land cover and land use, and the distribution of hillslopes and floodplains (Borselli et al., 2008). Taking this in mind, this study aims to assess post-fire soil erosion patterns at the decadal scale comparing different approaches. The methodology comprises i) a process-based model that is able to investigate long-term and large-scale spatial landscape evolution, LAPSUS; (ii) an index that represents a connectivity assessment based on local landscape information, the Borselli Index of Connectivity (IC); and (iii) an index that represents the sediment eroded that actually reaches the stream based on local landscape information, combining the IC with the Revised Universal Soil Loss Equation (RUSLE) model. Results include a comparison between the approaches used in the context of specific fire events between 1979 and 2020 for the Agueda watershed in central Portugal. The authors believe that assessing the spatial-temporal evolution of connectivity in the actual landscape with the right tool is extremely important to estimate the probability that a given part of the landscape transfers its sediments elsewhere in the catchment.

References

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