



Comparing the impacts of wildfire and meteorological variability on hydrological and erosion responses in a Mediterranean catchment

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Background

Mediterranean regions have always been affected by wildfires. Studies of wildfire effects on hydrology and erosion have mostly been conducted at plot or hillslope scale, while relatively few studies investigated post-wildfire hydrological responses and erosion at the catchment scale ($\sim >10 \text{ km}^2$) in the Mediterranean.

In July 2003, a wildfire occurred in the south-western part of the Monchique mountains in southern Portugal, which destroyed more than 21300 ha. Our catchment was burnt with moderated-to-high severity.

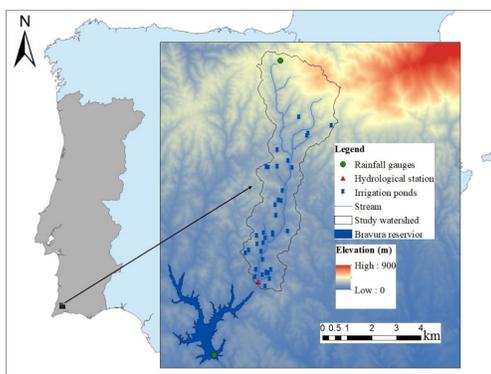


Figure 1. Study area

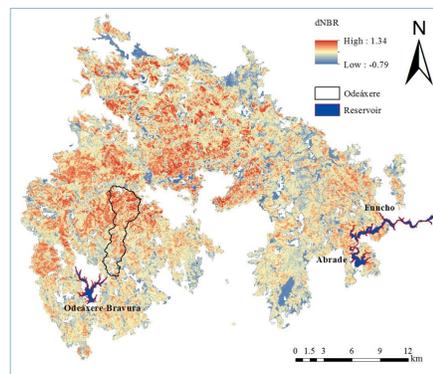


Figure 2. Burn severity (dNBR)

Objective

To improve understanding of fire-induced hydrological changes and soil erosion at the scale of the catchment.

Hydro-sedimentary responses to rainfall

Quicker and higher runoff response with a two fold increase in suspended sediment after the fire, but no statistically significant difference for any of the hydro-sedimentary variables.

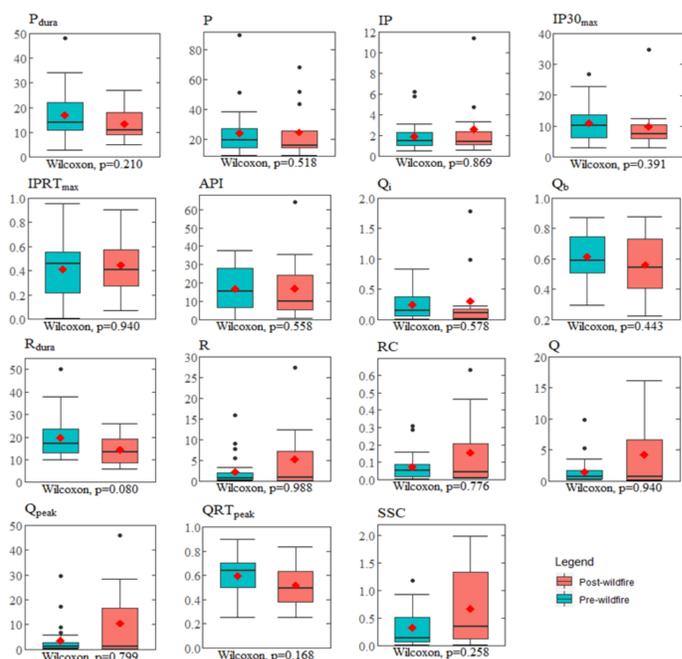


Figure 3. Boxplots of rainfall, antecedent conditions and hydro-sedimentary variables

Runoff events PCA analysis

- Little impact of fire on hydrological and erosion responses for runoff events with a return period below 1 year.
- Enhanced hydrological and erosion responses only for larger events with longer return periods

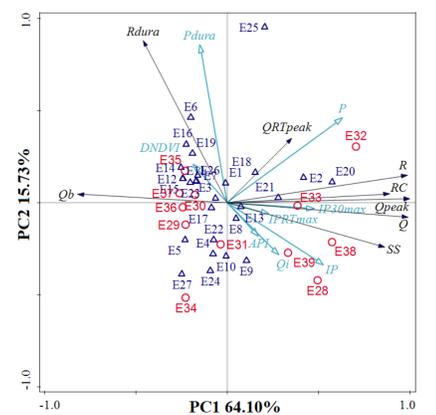


Figure 4. The plane of PCA analysis

Sediment connectivity

- Before the fire, the relatively higher sediment connectivity values close to the channels and outlet.
- After the fire, the higher values throughout the entire catchment.
- Post-wildfire connectivity increased by 20%.
- The largest increases at relatively large distances from the catchment outlet.

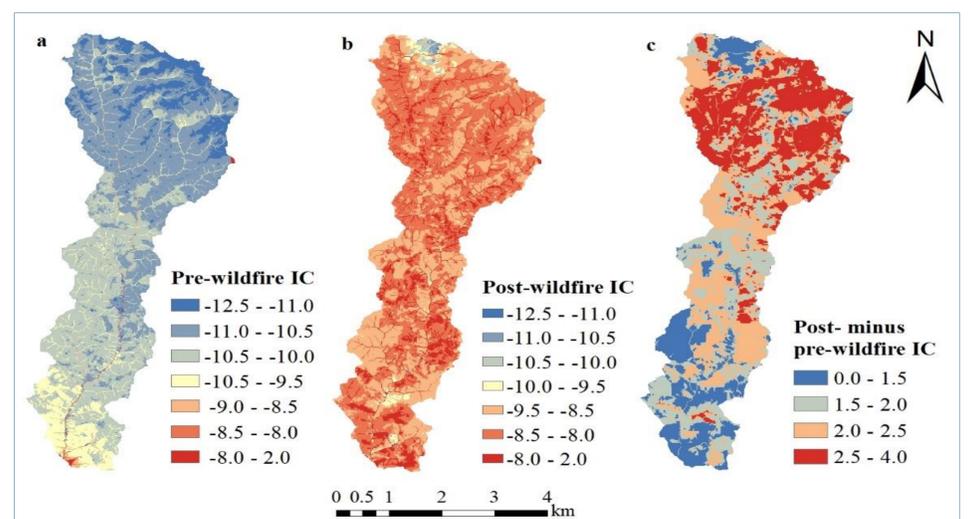


Figure 5. Map of the connectivity index (IC) (a) before the fire, (b) after the fire and (c) difference between pre- and post-wildfire.

Conclusions

At the meso-catchment scale, pollution of downstream water bodies by contaminated soil and ash may not occur immediately. Rather, because sediments and associated ashes and contaminations are first being transported to the areas around the stream networks, they only reach the outlet during heavy events which do connect the entire catchment.