Conceptual model assessment of vegetation vulnerability to fire in SE Spain: severity and recurrence effects using Google Earth Engine

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Wildfires have an important influence on desertification's advance. Due to climate change, it is foreseeable that the number of wildfires and their burned surface will increase. The alteration of fire regimes and its effect on the vegetation recovery, soil properties and fuel structure are one of the imperative research needs at this time to be able to establish vegetation vulnerability limits or ranges and vegetation resilience against forest fires.

The aim of this study is to implement a conceptual model assessment of vegetation vulnerability and-or vegetation resilience after forest fires. It starts with a bibliographic research to establish the concepts and definitions of vulnerability and resilience, with which undertake the practical case of generating a model or an indicator of resilience and vulnerability from the effects that the severity and recurrence of forest fires have had in two large forest fires in the southeast of Spain in 1994 and 2017. From the processing of the satellite scenes within the Google Earth Engine platform, several spectral vegetation indices are calculated such as NDVI, NBR or dNBR and four zones belonging to the Habitat type 9540 of Annex I of Directive 92/43/EEC are digitalized depending on their fire severity and fire recurrence: not burned in 1994 and burned in 2017; burned in 1994 and not burned in 2017; burned in both 1994 and 2017 and, finally, not burned in both 1994 and 2017. From this design a time series graph is made to evaluate the vegetation recovery rate in each of the areas.

Once this is done, it is possible to check how many years each zone requires to recover the spectral values before wildfires, which zones require more time to get recovered and, depending on the severity values, which zones should be treated to improve its natural recovery. With all the results, the last process is to create the cartography for identifying the most vulnerable zones depending on their ecological characteristics so we can be aware and do preventive treatments to increase the resilience of those most vulnerable areas in future extreme events. Google Earth Engine has proved to be an extremely useful tool for managing big datasets due to its high-level processing, versability and reproducibility, because once the script is done it is way easy to update the current study or to implement the same case of study in other areas to compare both results.