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RPI Engine Regeneration trajectories in Large Forest Fires in Spain and dissemination in a web platform

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This poster is available on http://www.sergisat.es/

Abstract

This work presents a tool for web visualization that enable analyzing post-fire vegetation regeneration at the pixel level. Post-fire regeneration is represented through spectral indices obtained from multitemporal Landsat image series. Making use of Earth Engine Code Editor (EECE) platform, it has been possible to write algorithms to generate those indexes using JavaScript language. We have developed a tool, called RPI Engine, where the user can visualize and interact with the results. The viewer has been tested over several Large Forest Fire (LFF) events occurred in Spain in the 90s. The RPI engine allowed to visually appraise the temporal evolution of the burned areas.

Google Earth Engine & RPI Engine

Earth Engine is a platform for scientific analysis and visualization of geospatial datasets, for academic, non-profit, business and government users (Gorelick et al., 2017). Earth Engine hosts satellite imagery and stores it in a public data archive that includes historical earth images going back more than forty years. The images, ingested on a daily basis, are then made available for global-scale data mining(https://earthengine.google.com/faq/).

The web tool developed in this study has been called RPI Engine (Post-Fire Engine Regeneration) and it is accessible at the following quick response code for register members. If you don't have a Google Earth Engine account, you have to create one totally free for use the visor.

Objectives

- The main goal of this work is to develop a tool for web visualization that allows us to visually analyze, at a pixel level, the post-fire regeneration.
- As specific objective, this tool can select zones that followed similar regeneration trajectories and analyze the trends for each pixel (Martínez et al. 2017 and Viana-Soto et al. 2017).

Datasets

Study Areas

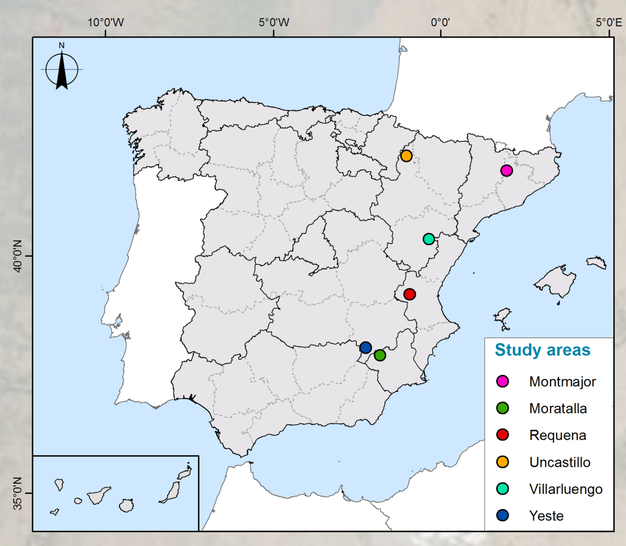

Figure 1: Study areas in SERGISAT project. Source: www.sergisat.es

Methodology

DATA

From Google Catalog

- Landsat 5 TM
- Landsat 7 ETM
- Landsat 8 OLI
- Forest Cover 2016 (PALSAR2)

From SERGISAT project

- LFF perimeter.
- Forest coverage pre-fire.
- Fire Severity (GEOCBI).

METHODS

Landsat images processing

- Surface Reflectance Tier 1 from GEE.
- Selected images (from 1993-2016, only summer months).

Spectral Index

- NDVI, Normalized Difference Vegetation Index
- NBR, Normalized Burn Ratio
- TCW, Tasseled Cap Wetness

Forest Regeneration Process → FormaTrend ALGORITHM

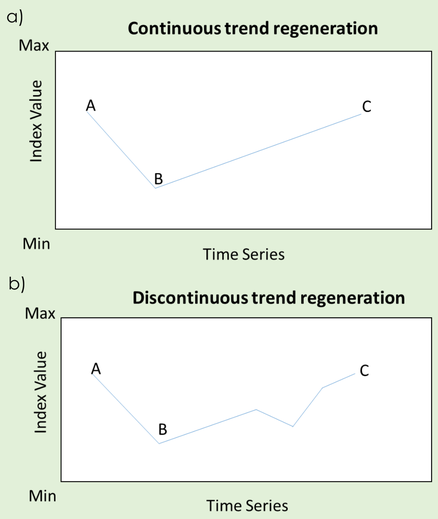

Figure 2: Idealized regeneration trajectories for pixel values

In order to detect continuous trend regeneration we have used the FormaTrend algorithm (*ee.imageCollectionFormaTrend*). This algorithm can be used to compute either the long and short-term trends of a time series. We have selected the short-term which is computed as the windowed minimum over time series.

Figure 2 a-b, shows an idealized pixel trajectory within time series 1993-2016. Point A: Pixel value before forest fire; B, pixel value after disturbance caused by wildfire (1994) and C: pixel value after recovery process with different slopes.

Results

RPI Engine interface

The main screen of RPI Engine shows the different options with which the user can interact at the beginning of the application. It is organized in three sections: 1) the central one, which corresponds to the selected forest fires using a Landsat image (display area), 2) the right part, consisting of a panel where different forest fires could be selected, as well as to calculate the spectral index and add other interesting information, and 3) the left panel, which shows the spectral trajectories of the queried pixel. Figure 3 shows the results obtained for Uncastillo fire.

Visual section

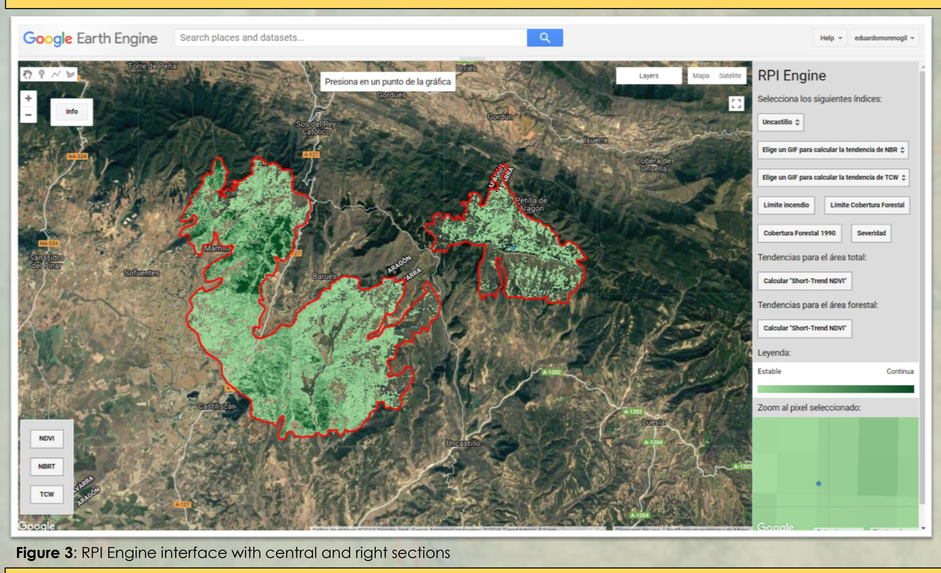

Figure 3: RPI Engine interface with central and right sections

The FormaTrend algorithm allowed us to identify areas with continuous regeneration from forest fire impact. These areas are showed in green color.

On the contrary, many areas had some disturbance for the studied period. In spite of their interest, these areas have not been considered in this study.

Plot Regeneration Trajectories section

The left section in the RPI Engine interface shows graphics providing spectral trajectories.

The user selects one index (NDVI in the Figure 4) and its trajectory is plotted for the Landsat sensor: TM, ETM and OLI.

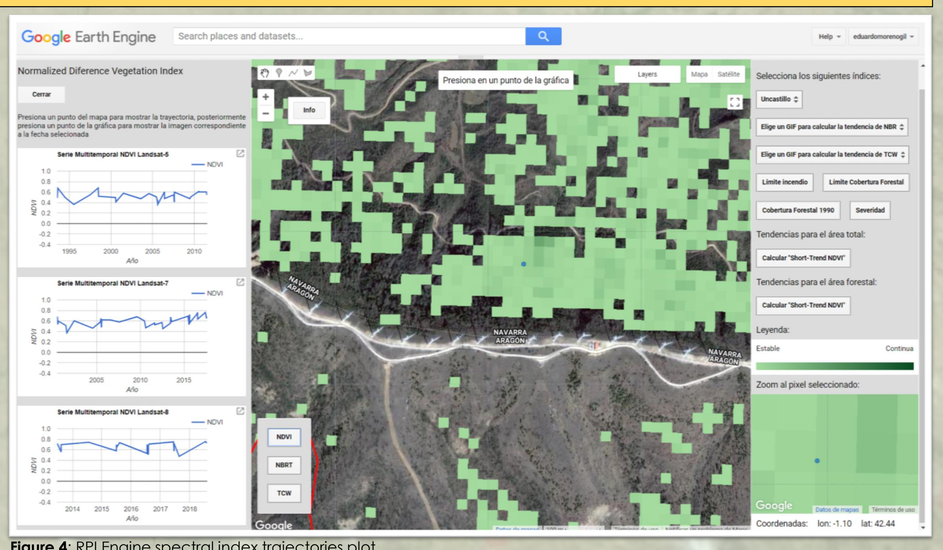

Figure 4: RPI Engine spectral index trajectories plot.

Conclusion

Results from this research could help to decision-makers in determining which forest areas would have difficult regenerating processes after LFF and thus would require the implementation of specific restoration programs. In addition, web visualization will provide users with information and other spatial analysis functions necessary for studies to be carried out in other environments in similar areas.

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