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## Clustering arid rangeland pixels using NDVI series and fractal analysis to classify land uses. Case in Southeastern Spain.

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Rangelands ecosystems contain more than a third of the global land surface, sustaining key ecosystem services and livelihoods. Unfortunately, they suffer from severe degradation on a global scale. Normalized Differenced Vegetation Index (NDVI) has been used to monitor low ground cover vegetation, especially relevant for arid and semiarid regions.

MODIS data are commonly used to calculate NDVI to monitor rangelands. In this study, we used time series metrics and Hurst Exponent from multifractal detrended fluctuation analysis to cluster different rangeland types to monitor and classify temporally and spatially diverse rangelands.

The Northwest (Noroeste) agricultural region in the province of Murcia was selected from the Southeast of Spain. We selected approximately 20.000 pixels to cover different areas that include land uses that are utilized for grazing. The selection aimed to collect pixels where other land uses were kept to a minimum, given the great spatial variability in Spain. We collected the time series using satellite data of MODIS (MOD09Q1.006) from 2000 to 2020. The pixels have a spatial resolution of 250 x 250 m<sup>2</sup> and a temporal resolution of 8 days. This selected area represents a mix of cereal croplands, tree croplands, grasslands, scrublands, and forested areas; all of them with an arid climate.

We used unsupervised random forest and compared the produced clusters with the classification from the Spanish parcels classification systems to test our model. Our goal is to study the ability of unsupervised clustering using NDVI time series and their multifractal character to categorize and monitor their vegetation status, key information for farmers and managers to adapt to a changing situation due to climate change. This information can be used in other arid areas with similar geophysical conditions.

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