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Revealing Land Management Practices Effects on Ecosystem Recovery Using Ndvi

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Abstract

Soil degradation and desertification represent major challenges for Mediterranean ecosystems. A clear example is found in the marginal maquis shrublands of Messara, Crete (Greece), where unsustainable land management practices and particularly overgrazing have altered vegetation structure and density, accelerating soil erosion and desertification processes (Alexakis et al., 2017; Daliakopoulos et al., 2017; Jucker Riva et al., 2017). Because of that, ecosystem restoration projects have become established, adopting strategies such as livestock exclusion and revegetation. However, the effectiveness of these interventions has not been adequately assessed. For this reason, we applied Landscape Function Analysis (LFA), a widely recognized methodology (Maestre & Puche, 2009), in conjunction with remote sensing index analysis to evaluate the effectiveness of 2 different ecosystem restoration practices, foresting and fencing, compared to "business as usual" management. Three such plots were located per management practice, in Messara valley, in the Island of Crete, Greece, where "Foresting" and "Fencing" took place in 2003 as a pastureland recovery practice. LFA assessment was conducted using two 30 m transects per plot, while remote sensing assessment was conducted using the Normalized Difference Vegetation Index (NDVI). NDVI values for the plots during the period 01/01/85 to 27/06/25 were obtained using Google Earth Engine (GEE). The process involved combining data from Landsat 4, 5, 7, 8, 9 and Sentinel-2 sensors and pixel level cloud masking to filter low quality data. Monthly commutative NDVI values per plot were analysed with double mass curve and Pettitt's test, using package *trend* in the R programming environment. Results from the LFA assessment show no statistically significant differences between management practices for soil "Infiltration" and "Nutrient cycling", but statistically significant differences in soil "Stability" with 67.7% score from "Forested" plots. On the other hand, commutative NDVI values shows a break point from the business as usual, for both management practices in late spring of 2005, 3 years after the ecosystem restoration actions were implemented with the "Forested" plots exhibiting a fast recovery.

Keywords: LFA, landscape function analysis, NDVI

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