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Estimation of pasture production at different scales using remote sensing in a holm oak savanna rangeland

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Dehesas are Mediterranean oak savannas with multiple uses (livestock, agriculture, hunting, cork, etc), which also provide important ecosystem services as the prevention of forest fires, the protection of soils or the conservation of key habitats for biodiversity. The management of these large areas needs effective instruments and accurate data to assist decision-making at different levels. This work focuses on the monitoring of grassland production using remote-sensing data. An adaptation of Monteith crop production model based on the relation between plant growth and incident solar radiation has been applied on the dehesa area in Andalusia (Southern Spain) where this ecosystem covers 1.2 million ha.

The application of the model was carried out with spatially interpolated meteorological data and satellite images at two spatial scales: 1) over the whole dehesa area of Andalusia with MODIS data during the hydrological years 2013-2104 and 2014-2015; 2) In small plots after the application of several improving pasture technologies, part of the conservation actions of LIFE-BioDehesa project, using SENTINEL-2 data during the hydrological years 2015-2016 and 2016-2017.

The adaptation of the Monteith model proposed in this work pays special attention to several factors: the spatial and temporal interpolation of meteorological variables; the presence of a tree layer with variable density as part of the ecosystem that influences spectral data and, thus, needs to be accounted for and subtracted accordingly; the estimation of the fraction of photosynthetically active radiation absorbed by the pasture (fPAR) using a procedure previously calibrated with field data of an ASD radiometer and leaf area index (LAI); and the empirical estimation of the light use efficiency for natural grasslands using biomass field measurements.

The results obtained regarding the estimation of pasture production from images of medium-low spatial resolution and meteorological data presented an admissible error of around 10% and proved that the model can be used to monitor environmental indicator of management actions.