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Integrated High Resolution Monitoring of Mediterranean vegetation

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The study of the vegetation features in a complex and highly vulnerable ecosystems, such as Mediterranean maquis, leads to the need of using continuous monitoring systems at high spatial and temporal resolution, for a better interpretation of the mechanisms of phenological and eco-physiological processes. Near-surface remote sensing techniques are used to quantify, at high temporal resolution, and with a certain degree of spatial integration, the seasonal variations of the surface optical and radiometric properties. In recent decades, the design and implementation of global monitoring networks involved the use of non-destructive and/or cheaper approaches such as (i) continuous surface fluxes measurement stations, (ii) phenological observation networks, and (iii) measurement of temporal and spatial variations of the vegetation spectral properties.
In this work preliminary results from the ECO-SCALE (Integrated High Resolution Monitoring of Mediterranean vegetation) project are reported. The project was manly aimed to develop an integrated system for environmental monitoring based on digital photography, hyperspectral radiometry , and micrometeorological techniques during three years of experimentation (2013-2016) in a Mediterranean site of Italy (Capo Caccia, Alghero).
The main results concerned the analysis of chromatic coordinates indices from digital images, to characterized the phenological patterns for typical shrubland species, determining start and duration of the growing season, and the physiological status in relation to different environmental drought conditions; then the seasonal patterns of canopy phenology, was compared to NEE (Net Ecosystem Exchange) patterns, showing similarities. However, maximum values of NEE and ER (Ecosystem respiration), and short term variation, seemed mainly tuned by inter annual pattern of meteorological variables, in particular of temperature recorded in the months preceding the vegetation green-up. Finally, green signals (gcc, ExG) from digital images was also in according to the spectral signature (NDVI) obtained for single species (in particular for Juniperus phoenicea and Pistacia lentiscus).
The integrated system developed during this project can provide continuous and high-resolution data, providing a valuable support for both ecological and environmental studies in particular for the analysis of phenological plants responses to environmental and climate changes, and the validation of eco-physiological models, and supporting research on climate change adaptations. This research was funded by the Regional Administration of Sardinia, RAS, L.R. 7/2007 “Scientific Research and Technological Innovation in Sardinia ”.