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Mapping of potential groundwater dependent vegetation zones in the Mediterranean using a simple index based on global-available geodata and high-resolution remote sensing

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Groundwater resources are biodiversity hotspots, and provide crucial ecosystems services. Yet, groundwater dependent ecosystems (GDEs) are exposed to several anthropogenic threats, including climate and land use change. Tackling these threats requires improving the on-the-ground identification of GDEs at the global scale and especially in vulnerable areas such as the Mediterranean biome where water is scarce.

In order to identify the location of groundwater dependent vegetation (GDV) in the landscape and create a harmonized global map of GDV a novel multi-instrument and multi-scale approach was developed. The approach combines a geodata-based potential GDV zones-index (pGDVZ) together with high-resolution vegetative, hydrogeological and topographic remote sensing parameters.

The pGDVZ integrates global and openly available datasets to combine groundwater vegetation interaction, land use, soil characteristics and landscape wetness potential. The index is currently tested for the whole Mediterranean. Results can help to pinpoint areas of high GDVZ potential where regional high-resolution identification of GDV is necessary.

The regional GDV-mapping concept implements different criteria aiming at: 1) high vitality and wetness during dry periods (e.g., Enhanced Vegetation Index, Normalized Difference Vegetation Index, Normalized Difference Water Index), 2) low seasonal changes in vitality, 3) low interannual changes in vitality, 4) high topographic potential of water accumulation and low water table depth and 5) general topography (elevation, slope). Processing of different remote sensing data (e.g., Sentinel 1;2, Digital Elevation Models, MODIS) is performed using the Google Earth Engine. Botanical mapping as well as integration of several geodata is used for validation and calibration of derived GDV-likelihoods. Furthermore, the integration of vegetation plots extracted from sPlot, the global vegetation database introduces a novel methodology to train machine learning algorithm for classification and modelling of GDV.

After successfully testing the mapping approach at local scale in the ‘Cilento, Vallo di Diano and Alburni National Park’ in Campania (Italy), a two-step upscaling methodology is currently designed

to implement the concept on regional (county) and global (biome) scale.