New map on potentially groundwater-dependent vegetation in the Mediterranean biome

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A new map shows Mediterranean's potentially groundwater-dependent vegetation. Credit: L. El-Hokayem

Decreasing rainfall and increased groundwater use are threatening

vegetation and ultimately biodiversity in the Mediterranean biome. Plants that depend on groundwater are particularly vulnerable.

We have developed a novel, easy-to-use index to map potentially groundwater dependent vegetation (pGDV) based on environmental site conditions and vegetation characteristics. Our concept combines globally available geodata and remote sensing and has recently been published in *Science of The Total Environment*.

The results indicate that 31% of the natural vegetation in the Mediterranean likely depends on groundwater. A biome-wise map of pGDV is important for prioritizing areas with detailed identification of actual GDV and biodiversity conservation.

Vegetation that relies on groundwater for its health and survival often forms biodiversity hotspots, provides critical habitat and sustains human livelihoods and ecosystem services.

However, there is a lack of harmonized biome-wise mapping of the distribution and extent of pGDV in the Mediterranean. To address this challenge, we integrated global geodata on groundwater-vegetation interaction, soil, topography, land cover and hydrogeology with a simple index. Our index allows the detection of areas with suitable conditions to hold pGDV where vegetation behavior also indicates groundwater use.

The Mediterranean map reveals that regions with high pGDV are distributed throughout the entire biome. We also see an increased occurrence in coastal lowlands and in riverine landscapes. These areas indicate precipitation-independent high vitality and evapotranspiration of natural vegetation in low permeable valleys or on low slopes where water accumulates and the groundwater table is shallow while soil properties allow infiltration.

More potentially groundwater-dependent vegetation was found in coastal lowlands and riverine landscapes. Credit: L. El-Hokayem

We were surprised that the proportion of high pGDV (31%) was lower than estimated in a recent global meta-analysis (50%). However, only one tenth of the catchments in the biome have an area share of high pGDV above 50%. These catchments may be prioritized for further analysis of GDV. We tested the plausibility of our results against known GDV locations in Italy and California and found good agreement.

Reliable identification of GDV requires big data and high computational power when applied on a large scale. Using the pGDV index, regional authorities or researchers can select regions of interest where the

proportion of pGDV is high and detailed analysis is required.

The index is initially designed for the Mediterranean biome, but is ideally adaptable to other semi-arid climates. With minor adjustments to the geodata and the vegetation characteristics, the concept could also be transferred to temperate or tropical regions.

More information: Léonard El-Hokayem et al, Mapping potentially groundwater-dependent vegetation in the Mediterranean biome using global geodata targeting site conditions and vegetation characteristics, *Science of The Total Environment* (2023). DOI: 10.1016/j.scitotenv.2023.166397

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