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Ecological restoration of groundwater-dependent vegetation in the arid Ejina Delta: evidences from satellite evapotranspiration

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The ecological water conveyance project (EWCP) in the Ejina delta, a typical hyper-arid area of China, aimed to restore degraded phreatophytic ecosystems. We assessed the degree of ecosystem recovery using as an ecohydrological indicator a ratio between actual and potential evapotranspiration derived from MODIS since the beginning of the project in 2001. The selected indicator was the Temperature Vegetation Dryness Index (TVDI) which was validated with Eddy covariance (EC) data confirming its applicability to monitor groundwater dependent vegetation.

The spatial analyses of the evapotranspiration ratio show drying trends (2000-2015) which are stronger and also cover larger extensions than the wetting trends. Thus, the condition of key riparian areas relying mostly on surface water improved since the project began. However, groundwater dependent ecosystems located in lower river Xihe reaches present drying trends. It seems that despite of the runoff supplemented by the EWCP project, there is nowadays more inequality in the access to water by groundwater dependent ecosystems in the Ejina Delta.

The study shows that energy-evaporation indices, relying on radiometric satellite temperature like the TVDI, can detect degradation signals that otherwise might go undetected by NDVI analyses especially in arid regions, where vegetation indices are greatly affected by the soil background signals. Additionally, they can provide timely information to water managers on how much water to allocate for a sustainable restoration program.