

Utility of Geospatial Techniques in Delineating Groundwater-Dependent Ecosystems in Arid Environments

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Abstract : Identifying and delineating groundwater-dependent ecosystems (GDEs) is critical to the well understanding of the GDEs spatial distribution as well as groundwater allocation. However, this information is inadequately understood due to limited available data for the most area of concerns. Thus, this study aims to address this gap using remotely sensed, analytical hierarchy process (AHP) and in-situ data to identify and delineate GDEs in Khakea-Bray Transboundary Aquifer. Our study developed GDEs index, which integrates seven explanatory variables, namely, Normalized Difference Vegetation Index (NDVI), Modified Normalized Difference Water Index (MNDWI), Land-use and landcover (LULC), slope, Topographic Wetness Index (TWI), flow accumulation and curvature. The GDEs map was delineated using the weighted overlay tool in ArcGIS environments. The map was spatially classified into two classes, namely, GDEs and Non-GDEs. The results showed that only 1,34 % (721,91 km²) of the area is characterised by GDEs. Finally, groundwater level (GWL) data was used for validation through correlation analysis. Our results indicated that: 1) GDEs are concentrated at the northern, central, and south-western part of our study area, and 2) the validation results showed that GDEs classes do not overlap with GWL located in the 22 boreholes found in the given area. However, the results show a possible delineation of GDEs in the study area using remote sensing and GIS techniques along with AHP. The results of this study further contribute to identifying and delineating priority areas where appropriate water conservation programs, as well as strategies for sustainable groundwater development, can be implemented.

Keywords : analytical hierarchy process (AHP), explanatory variables, groundwater-dependent ecosystems (GDEs), khakea-bray transboundary aquifer, sentinel-2

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