

**Developing spatial model to assess agro-ecological zones for sustainable agriculture development in MENA region: case study Northern Western Coast, Egypt.**

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**Abstract**

The development of Agro-Ecological Zones (AEZs) is a vital step in sustainable agricultural development. This study proposes a quantitative method for developing the AEZs and land suitability for Wadi El-Grawla, North-Western Coastal Region (NWCR), Egypt. Hundreds of surface soil samples and twenty soil profiles covering the variations in the study area were collected; then, the inverse distance weighted (IDW) interpolation technique was utilized to produce representative maps for different soil characteristics. Moreover, a digital elevation model (DEM) was generated from topographic maps to calculate various land surface factors such as slope, curvature, and relief density. In addition to benefiting from Sentinel-2 imagery in the separation process of different landform units with a classification accuracy of about 87%. Two soil orders were identified in the study area, namely, Aridisols and Entisols. Chemical analysis of soil samples revealed that soil pH range from 7.14 to 8.6. Total soluble salt changes widely from one location to another. Calcium carbonate (CaCO<sub>3</sub>) has a wide range of 3.5–31.5%. Organic matter (OM) ranges between 0.04 and 1.55%. A weighted overlay of obtained thematic maps resulted in three management zones in the Wadi El-Grawla area. Zone-1 represents the best location, with an area of about 2359.3 ha. At the same time, the regions of the area of zone-2 and zone-3 are 2526.4 ha and 1346.8 ha, respectively. Finally, suitability maps were produced for the most strategic crops cultivated in Wadi El-Grawla. The most suitable classes were S2 and S3 for all studied crops. The obtained results will support the decision-makers to put various development plans according to the conditions of the study area.