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EMPLOYING MODERN TECHNIQUES IN STUDYING SOIL AND WATER RESOURCES IN SELECTED AREA OF NORTH WESTERN COASTAL REGIONS, EGYPT

By

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5-SUMMARY AND CONCLUSIONS

The objective of this work is to study the land and water resources for selected area in the North Western Coastal Zone of Egypt for sustainable agricultural development.

This study included following:

1- Identification of the geomorphic units in the study area by using the digital elevation model, planet image and ground truth data.
2- Studying the pedological characteristics (morphology, physical, chemical and classification) of the study area.
3- Using a qualitative approach to land evaluation developed in this study following principles and guidelines of **FAO (1983).**
4- Generating basins and sub basins area by the integration of RS/GIS technologies through geostatistical analysis and hydrological model.
5- The study aimed also to predict annual peak flow and runoff water volume, as well as for the 20, 10, 5, 3, and 2year return periods.

The study area is extending from Minqar Alousran at the east to Beer Qaaem at the west, Marsa Matrouh at the north to Jable Khaled at the south. The total studied area is about 345563.52 Fadden.

Ninety eight (98) soil profiles were selected representing the geomorphic units. One hundred and ninety-one (191) soil samples, were collected, morphologically descried and subjected to soil physical and chemical analyses.

The GIS approach was used to assessment land evaluation according their suitability for different agricultural use.

Hydrological characteristics (e.g. flow direction, flow accumulation, watersheds and stream orders) for the study area and El-Harak Basin (as case study) were extracted from DEM by using the Arc

hydro and hydrology tools in ArcGIS. The morphometric characteristics (e.g. area, basin slope, basin length, maximum stream length, perimeter, shape factor and sinuosity factor) were obtained by using WMS software. The HEC-1 model in WMS software was used to simulate the rainfall-runoff process as it occurs in an actual river basin.

Four main geomorphic units were identified namely: Coastal Plain (10.98%), Northern Plateau (29.38%), Southern Plateau (43.32%) and Lybian Plateau (10.80%).

The results could be summarized as follows:

- The soils ranged from very shallow to very deep (15 to 135 cm depth). The dominant soil texture is between sandy clay loam to sand and loamy sand. These soils are moderately to extremely calcareous have $CaCO_3$ 5.5 up to 42.41 %. The gypsum content is generally low. These soils have low to high bulk density (1.21 to 1.68 g/cm^3). The total porosity ranged from 36.66 to 54.34%. Hydraulic conductivity values of these soils are moderately high to high (0.79 to 14.03 cm/hour). Field capacity, wilting point and available water values in the soil were varying between 9.82 and 38.8 %, between 3.30 and 18.35 % and between 4.94 and 20.84 %, respectively.
- These soils are slightly to strongly alkaline with pH 7.56 to 8.82 and varied from non to strongly saline soils with EC 0.63 to 72.19 dS/m. CEC varies between 3.54 and 29.53 cmol/kg soil. These soils have slightly sodicity. The OM is very low.
- The studied soils in the geomorphic units are classified according to **soil survey staff (2014)** as follow: Lithic Haplocalcids, Typic Haplocalcids, Typic Torriorthents, Gypsic Aquisalids, Typic Calcigypsids, Lithic Torriorthents and Oxyaquic Torripsamments.

•Land evaluation for the studied soils was carried out according their suitability: for annual rainfed (field crops), for drip irrigation vegetables and for drip irrigation trees.

•Land suitability for annual rainfed (field crops) indicated that, the most of studied soil 62.47 % were (NS) for this agricultural use. The marginally suitable (S3) soils covered 25.33 % followed by the moderately suitable area (S2) that has only 2.30 %.

•Land suitability for drip irrigation vegetables indicated that, the most of studied soil 51.26 % were (S3) for this agricultural use. The not suitable (NS) soils covered 34.08 % followed by the moderately suitable area (S2) that has only 4.67 %.

•Land suitability for drip irrigation tree showed that, the most of studied soil 83.75 % were (NS) for this agricultural use. The marginally suitable (S3) soils covered 4.10 % followed by the moderately suitable area (S2) that has only 2.25 %.

Water resources and harvesting:

•The study area contains 17 basins, those basins areas are ranged between 23.95 km^2 and 422.4 km^2.The main basins in the study area are El-Qassaba (164 km^2), El-Hraka (178.31 km^2), El-Zaraka (422.43 km^2), El-Qalaleeb (66.9 km^2), El-Naghamish (93.64 km^2), El-Khair (101.28 km^2) and El-Nodia (145.52 km^2).

•The Curve Number (CN) of the study basin depending on the land use / land cover and the hydrologic soil groups. Its average values are 73.67 for El-Hraka basin. The annual runoff water volumes are 10583.29 m^3. However, the annual infiltration volumes are 8195.01m^3.

•The peak flow of the 20 year return period flash flood is 29.24m^3/s for the study basin, while the value for the 10 year return period flash flood is 17.98 m^3/s. The peak flow for the 5 year return period reaches 9.50

m^3/s for the 3 year return period peak flow is 3.78 m^3/s, while the 2 year return period peak flow is 0.75 m^3/s.

•The runoff volume of the 20 year return-period is 2777883.3 m^3, while for the 10 year return period is 1713298.9 m^3. The Runoff volume for the 5 year return-period reaches 906578.6m^3; and for the 3 year return period runoff volume is 359883m^3, while the 2 year return period is 69989.4 m^3 for the study basin.

Conclusions and Recommendations:

1. Using modern irrigation systems and the reduction of irrigation periods to avoid the soil crust formation caused by the calcareous soil.
2. According to results, drip irrigation system for vegetables showed to be more suitable than drip irrigation system for trees and Rainfed annual (field crops) in the studied area. As a result, the drip irrigation in arid and semi-arid regions appeared to be the most appropriate irrigation and ensures the sustainable use of the land for irrigation agriculture.
3. The results of study evidence the successful employment of a new methodology based on WMS, HEC-1, and DEM which lead to a good estimation of surface runoff.
4. Using advanced water harvesting techniques for growing crops or for rehabilitation and development of rangelands, where rainfall is inadequate for rainfed agriculture and irrigation water is lacking. The stony dams construct across the drainage basins, and man- made underground storage cisterns or galleries for collected the surface runoff, whereas the surface runoff remainder is going into the sea.
5. The integrated methodology of this study could be considered as a ready module for applying at different locations and represents a significant participatory management tool for rainfed agriculture in Egypt.