The Relationship between Groundwater, Landuse, and Demography in Dakhla Oasis, Egypt

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Abstract:

Understanding of the continuous dynamic relationship between water availability and land use/land cover change (LUCC) is an essential step in urban development planning. This is particularly crucial in dryland environments, where water and fertile soil are very limited and nonrenewable. Dakhla Oasis is located in the heart of the Western Desert of Egypt, 190 km to the west of Kharga Oasis, and is the oasis furthest from the main settlements of Egypt. Dakhla Oasis contains highly fertile lands and is rich in groundwater. It supports a relatively high population compared to Kharga Oasis with about 100,000 inhabitants. Groundwater is the only water source for irrigation and domestic use. The economy of Dakhla depends on several industries including agriculture, handicrafts and tourism. This paper presents the main results of an interdisciplinary research project in Dakhla Oasis with special emphasis on Rashda Village within the Oasis. The study is a model investigation of groundwater resources, land use/land cover and their link with demographic characteristics. One 1972 Landsat Multispectral Scanner System image, two 1984 Landsat Thematic Mapper images and Six 2011 SPOT4 satellite images were used for LUCC detection. In addition, a detailed database of groundwater extraction from 1960 to 2005 was available. Supervised image classification and visual interpretation were integrated to achieve more accurate LUCC maps. The results show that the study area has undergone very severe land cover changes with significant increases in urban settlements and in agricultural land. Local aquifer recharge and recovery fails to compensate for artificial groundwater extraction. The overall discharge increased between 1976 and 2006 by 54% to 62%, in different areas. This was associated with increases in population ranging from 8.5% to 150% in the same period. If extraction continues at current rates, pumping with current technology will become uneconomical in the next 90 years.

Keywords:

Remote Sensing, groundwater resources, land use, Rashda Village, Dakhla Oasis

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