

Transforming a desert into a food basket: quantitative and qualitative effects of agricultural development on a unconsolidated brackish environment

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Abstract In semi-arid areas groundwater systems are frequently not sufficiently characterized hydrogeologically and long-term data records are generally not available. However, long-term time series are necessary to design future groundwater abstraction scenarios or to predict the influence of future climate change effects on groundwater resources. To overcome these problems, an integrated approach for the provision of a reliable database based on both hard quantitative and sparse and fuzzy data was taken and developed further. This developed integrated approach is demonstrated in the lowermost area of the Jordan Valley/Jordan. The Jordan Valley was rapidly transformed from a barely inhabited area into the “food basket” of Jordan. As a result, hundreds of shallow wells were drilled and large amounts of groundwater were abstracted, since groundwater is the major source for irrigation. Consequently groundwater quality decreased rapidly since the 1960s and signs of overpumping and an increase in soil salinity could clearly be seen. A numerical 3-D transient model integrating all important features of the hydrogeological system was developed and tested against stress periods depicted during the historical review of the test area (model period: 1955–2001). These stress periods include periods of intense rainfall, of drought, and of anthropogenic impacts, like building of storage dams and the influence of violent conflicts. Recommendations for future sustainable groundwater abstractions are given.

Key words stressed-aquifer system; unconsolidated aquifer; qualitative data; numerical modelling; Jordan Valley