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Methodology to Analyse the actual and the future effect of water scarcity on the available water resources in Meguellil watershed

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Scarcity often has its roots in water shortage, and it is in the arid and semiarid regions affected by droughts and wide climate variability, combined with population growth and economic development, that the problems of water scarcity are most acute. The Merguellil watershed, situated in the center of Tunisia, represents exactly this state of fact where the agriculture is the main consumer with about 80% of the total water resources because of the continuous increase and intensification of irrigated area. The surface water can satisfy a very low portion of this demand; consequently, the groundwater is overexploited. The irrigation sector is divided into public and private. While the public irrigated areas are well known, the private ones are not sufficiently controlled mainly the water volumes pumped from the aquifer. Therefore, a sustainable management of all available water resources and meeting as much as possible all water demands, is crucial.

To analyze the actual and future water balance of the Merguellil watershed, and to identify critical trends and thresholds and effective solutions, a WEAP (Water Evaluation and Planning system) application has been developed. It utilizes a constrained optimization algorithm to allocate water among competing demands in a basin. The year 2009 is considered as the reference one which represents the basic definition of the water system as it currently exists, and forms the foundation of all scenarios analysis. Three scenarios were compared to the reference one. The first combines between the reduction of 10% in precipitation, as it is forseen by the regional climate model RCA (driven by ECHAM5) that provides statistic data of precipitation until 2050, and the increase of 2% per year in irrigated area in the kairouan plain deduced from the land use maps dating from 1991/1992 to 2009/2010 obtained by multi dates remote sensing data. The second scenario is the application of a deficit irrigation that respects the yield reduction related to each existing crop.

The third one tests the effect of the three hypotheses together on the water resources: reduction in precipitation, increase in irrigated area and deficit irrigation. Merguellil WEAP model demonstrates how different management options to face water shortage can be evaluated and compared for future climate, land use change and technology development scenarios.