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Use of SWAT for assessing the effect of Land Use Changes in southern Tunisia

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Rainfed farming in Tunisia has been supported by water-harvesting techniques since antiquity. In the arid regions of the country, considerable investments are being made in maintaining the traditional water-harvesting systems and in introducing new ones. To assess the long term effects of the intensification of these water-harvesting works on the water balance components, the GIS-based watershed model SWAT (Soil Water Assessment Tool) was applied in a 350-km^2 watershed in southern Tunisia. The model was previously adapted and evaluated for these specific arid Mediterranean environments. Besides the traditional land-use of the early 1990s (SC1), two other scenarios were considered. Scenario 2 included the installation of diversions and water-harvesting dikes to expand the olive production on the plains along the foot hills (*tabias*) and the construction of gabion recharge check dams in the main *wadis*, while scenario 3 (SC3) was similar to SC2 but with a partial silting up of these recharge structures.

The average precipitation over the watershed for a historical 30-year rainfall record (1973-2003) was 184 mm. For the traditional land use (SC1), the water balance components (expressed as a percentage of the precipitation) were distributed as follows: 80.1% evapotranspiration, 13.2% percolation from soils, 4.4% transmission losses from the *wadi* bed, and 2.2% outflow to the salt flat (*sabkhah*) along the coast. The intensification of the water-harvesting works (SC2) increased the evapotranspiration component to 82.0% and percolation to 15.4%. The recharge from the *wadis* was

reduced to 2.3%; this included both transmission losses (1.7%) and seepage from the check dams (0.6%). The watershed did no longer produce any outflow in both SC2 and SC3. Scenario 3 only resulted in a small reduction of the seepage losses, from 0.6 to 0.5%. Clearly, the model results indicated that the expansion of olive water-harvesting systems on the relatively shallow soils in the plain (from 2.4 to 8.8 thousand ha), did not only increase the productive water use in the watershed but also resulted in an increase in potential groundwater recharge. However, these olive system also reduced the runoff to the *wadis*, thereby reducing the impact of the newly established check dams on groundwater recharge.