AWRA 2011 ANNUAL WATER RESOURCES CONFERENCE
Albuquerque, New Mexico
November 7-10, 2011

CHARACTERIZING WATER LEVEL FLUCTUATIONS AND SHALLOW AQUIFER RECHARGE FROM IRRIGATION IN A SEMI-ARID IRRIGATED VALLEY

Carlos G. Ochoa*, Alexander G. Fernald, Steven J. Guldan, Manoj K. Shukla, Vincent C. Tidwell

ABSTRACT: An important amount of aquifer replenishment in arid and semi-arid regions may come from percolation of irrigated landscapes. Proper quantification of groundwater recharge is important for a better understanding of the capacity of the aquifer for providing groundwater supply. However, calculating aquifer recharge is one of the most difficult tasks when assessing groundwater resources. Objectives of this study conducted in an agricultural valley of northern New Mexico are: 1) At the field scale, determine and compare shallow aquifer recharge by the water balance (WBM) and the water table fluctuation (WTFM) methods, and 2) At the valley scale, characterize temporal and spatial variability of water table fluctuations in response to direct and localized aquifer recharge. A combination of water budget components and piezometric level data collected were used to calculate aquifer recharge at the field scale (≤ 1 ha). Higher estimates of aquifer recharge were obtained by the WBM than by WTFM. For individual irrigation applications, aquifer recharge values ranged from 0 to 369 mm when using the WBM and from 0 to 230 mm when using the WTFM. At the valley scale (~ 10 km2), aquifer recharge was estimated by the water table fluctuation method and water table fluctuations were evaluated at different well locations during three years (2007 through 2009). In general, valley-scale aquifer recharge remained relatively constant, at about 700 mm yr^{-1}, in all three years. A seasonal water table rise was observed in response to canal seepage and irrigation percolation during all three years. Canal seepage contributions to water table were clearly identified by changes in water head and electrical conductivity measured in one well located near the Alcalde main irrigation canal. Time of water table response to onset irrigation season varied across well locations, wells located near the river generally responded first, then near-canal and irrigated land wells, followed by dryland location wells. Peak water table rise ranged from 0.26 m (near-river) to 0.41 m (irrigated land). Study results add to the understanding of the mechanisms of shallow aquifer recharge and the interactions between surface water and groundwater in an agricultural valley of northern New Mexico.

* Research Assistant Professor, NMSU, PO Box 30003, msc 3I, Las Cruces, NM 88003 USA, Phone: 575-646-5558, Fax: 575-646-5441, Email: carochoa@nmsu.edu