



Surface and Groundwater Contribution in Conveying with High Crop Water Demand in Indus Basin

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The water resources of the Indus Basin, Pakistan are mostly exploited, however the demand for water is on a permanent rise due to population growth and associated urbanization and industrialization process. Owing to rapidly increasing population, the available surface water resources are not able to cope up with people's needs. The cropping intensities and cropping patterns have changed for meeting the increased demand of food and fiber in the Indus Basin of Pakistan. Cumulative effect of all sources water i.e rainfall, irrigation and groundwater resulted in the high cropping intensities in the Basin. Presently rainfall, surface irrigation and river supplies have been unsuccessful to convene irrigation water requirements in most areas. Such conditions due to high cropping intensities in water scarce areas have diverted pressure on groundwater, which has inconsistent potential across the Indus Basin both in terms of quality and quantity. Farmers are over exploiting the groundwater to meet the high crop water demand in addition to surface water supplies.

The number of private tubewells has increased more than four-fold in the last 25 years. This increasing trend of tubewell installation in the basin, along with the uncontrolled groundwater abstraction has started showing aquifer stress in most of the areas. In some parts, especially along the tail of canal systems, water levels are showing a steady rate of decline and hence - the mining of aquifer storage. Fresh groundwater areas have higher tubewell density as compared to saline groundwater zones. Even in fresh groundwater areas, uncontrolled groundwater abstraction has shown sign of groundwater quality deterioration. Under such aquifer stress conditions, there is a need to understand groundwater usage for sustainable irrigated agriculture on long term basis.

In this paper the contribution of groundwater in the irrigated agriculture of Lower Chenb Canal (LCC) East, Punjab, Pakistan is explored using a nodal network approach and water balance. Also, crop water demands, rainfall, and surface water are calculated to estimate the groundwater abstraction in different districts of Lower Chenb Canal East to understand its usage patterns in year 2008-09. Crop water demand has been estimated using SAM-ET (spatial algorithm for mapping evapotranspiration) algorithm which is based on surface energy balance. Landsat 5 TM satellite images are used to estimate actual crop water demand and the results are compared with Penman Monteith method. The irrigation supplies are calculated from real time data collected by Project Monitoring and Implementation Unit (PMIU), Punjab Irrigation Department. The PMIU envisaged for efficient and optimal canal operations oriented towards equity and transparency.

Initial results from nodal network water balance model also provide the spatial variation in crop water demand for each node in LCC East. This work is also aimed at evaluating surface water availability and the assessment of spatial distribution of groundwater abstractions by considering the present crop water demand.