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Impact of deficit rainfall coupled with high groundwater exploitation on water quality in semi-arid region of Karnataka

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ABSTRACT

A study was conducted in a semi-arid watershed spread over 442 ha located in Chitradurga district, Karnataka with a view to assess the impact of deficit rainfall coupled with high groundwater exploitation on water quality. A total of nineteen (ten and nine from upper and lower portions of the watershed, respectively) bore wells were selected, and samples were collected during the pre-monsoon seasons of 2011 and 2014. Results indicate that the groundwater is alkaline in nature with an average pH of 8.70, and average electrical conductivity of 1.28 dS m^{-1} . The general order of abundance in respect of cations is $\text{Mg}^{2+} > \text{Na}^+ > \text{Ca}^{2+} > \text{K}^+$, and in respect of anions is $\text{HCO}_3^- > \text{Cl}^- > \text{SO}_4^{2-}$. Cations were observed to be higher in the upper portion of the watershed as compared to the lower portion. Increased individual ion concentration of individual ions such as Na^+ (77%), Mg^{2+} (61%) and HCO_3^- (100%) in 2014 compared to 2011 can be explained in terms of the three consecutive low rainfall years coupled with higher groundwater abstraction. The dominant hydro chemical facies of the groundwater in the watershed are $\text{Mg-HCO}_3\text{-Cl}$ and $\text{Na-HCO}_3\text{-Cl}$. During 2014, 21% of the samples were in the 'high salt hazard' zone, while the groundwater in 50% of the watershed indicates a potential alkalinity hazard expressed as residual sodium carbonate. These values indicate that the water should be used with caution for irrigation during years of low rainfall in order to prevent the soils from becoming salt-affected and reducing crop yields.