Shallow groundwater recharge and residence time in two separate flood plains along an aridity gradient in South Queensland, Australia

Dioni Cendón, Associate Professor Bryce F.J. KELLY, Dr Josh LARSEN, Stuart HANKIN, Dr Cath HUGHES, Dr Karina MEREDITH, Dr Suzanne HOLLINS, Charlotte IVERACH ANSTO

Fertile floodplains in headwater Darling-Murray catchments like the Condamine have endured profound physiographic changes over the last ~150 years, including the onset of intensive agriculture and groundwater abstraction since the 1960s. This has placed groundwater within alluvial aquifers under stress, raising allocation concerns and triggering salinity problems in some areas. Approximately 1,000 km west, across a decreasing rainfall gradient (659 mm/yr at Dalby to 198 mm/yr at Ballera), the Cooper Ck floodplain (near Ballera) is still in pristine condition and provides an ideal example of arid zone hydrological processes. This study compares groundwater from two alluvial systems with an emphasis on understanding groundwater recharge processes under various climatic conditions. Groundwater was collected from the Condamine alluvium in 2014 from 30 irrigation and monitoring wells. Groundwater was collected from the Cooper Ck alluvium between 2008 and 2011, from piezometers installed along a transect between major waterholes. All bores were sampled for major, minor/trace elements, water stable isotopes (δ 180 and δ 2H), δ 13C in dissolved inorganic carbon, 3H, 14C and sulfate isotopes (δ 34S δ 18O) in selected samples for both study areas. The groundwater dataset was complemented with available long term rainfall data. Both locations showed that groundwater had depleted isotopic signatures consistent with recharge associated with large floods. Also in both locations groundwater defined well-correlated evaporation lines (R2>0.95), consistent with mixing with other sources. Groundwater near main channels contained 3H and 14C consistent with modern recharge, however, in the Cooper Ck modern recharge appeared restricted to areas like channel confluences. This study has implications for understanding how to sustainably use groundwater resources and the role of floods in recharging floodplain aquifers. Comparing the two sites provides a snapshot of how the Condamine could respond to increased aridity.