Seasonal Patterns of Floodplain Groundwater: The Roles of Climate and Riparian Transpiration

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Abstract. In semi-arid regions, the dynamics of drought are a major topic of concern for both water managers and scientists. Critical thresholds of hydrologic connectivity within dryland riverscapes are crossed when water levels decrease. For example, losing stream reaches will eventually become dry when lateral sub-surface outputs exceed upstream surface inputs over long enough periods of time. Below ground, falling water table levels can sever plant access to sub-surface water sources. In this study, we focused on controls of low water availability on time scales ranging from weeks to months. We conducted our study on the San Pedro River in southeastern Arizona. Along this unregulated river, a major driver of multi-month variability in floodplain groundwater is climate. On shorter timescales, however, transpiration governs rates of drops in floodplain groundwater. Based on diurnal groundwater fluctuations, mesquite (*Prosopis velutina*) appeared to have a greater impact on rate of groundwater decline than cottonwood (*Populus fremontii*). The larger stand size and deeper roots of mesquite are likely to have played a major role in this observed pattern. By mid-summer, groundwater levels were drawn below the rooting extent of streamside cottonwood. Vertical connectivity, however, was re-established upon the onset of the summer rainy season with full recovery of the affected trees; as well as a record of the seasonal drought event in the tree-rings. The implications of our observations are discussed in the context of climate change, groundwater pumping, and woody plant encroachment.