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Riparian Zone Hydrological Functioning in Glacial Till Valleys of the Midwest

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Identifying relationships between landscape hydrogeological setting, riparian hydrological functioning and riparian zone sensitivity to climate and water quality changes is critical in order to best use riparian zones as best management practices in the future. In this study, we investigate water table dynamics, water flow path and the relative importance of precipitation, deep groundwater and seep water as sources of water to a riparian zone in a deeply incised glacial till valley of the Midwest. Data indicate that water table fluctuations are strongly influenced by soil texture and to a lesser extend by upland sediment stratigraphy producing seeps near the slope bottom. The occurrence of till in the upland and at 1.7-2 m in the riparian zone contributes to maintaining flow parallel to the ground surface at this site. Lateral groundwater fluxes at this site with a steep topography in the upland (16%) and loam soil near the slope bottom are small (< 10 L/d/m) and intermittent. A shift in flowpath from a lateral direction to a down valley direction is observed in the summer despite the steep concave topography and the occurrence of seeps at the slope bottom. Principal component and discriminant analysis indicate that riparian water is most similar to seep water throughout the year and that deep groundwater originating from imbedded sand and gravel layer in the lower till unit is not a major source of water to riparian zones in this setting. Water quality data and the dependence of the riparian zone for recharge on seep water suggest that sites in this setting may be highly sensitive to changes in precipitation and water quality in the upland in the future. A conceptual framework describing the hydrological functioning of riparian zones on this setting is presented to generalize the finding of this study.