Watershed-scale modeling of riparian biogeochemistry: a hydrologic connectivity framework

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Abstract. The effects of climate change on floodplains and riparian zones in the Western United States could be significant. Snowmelt-dominated rivers in this region have shown trends to earlier peak flows over the 20th century, with anticipated changes including increased winter flows, lower growing season flows, and earlier peak flows as regional temperatures increase and mountain snowpack is reduced. Despite the pressing need to understand how these ecosystems may change in future climate, models of hydroclimatic change impacts to riparian zones remain largely conceptual. In particular, little research has evaluated how hydroclimatic change may influence riparian zone processes affecting phosphorus and nitrogen loading to streams, and what may be the combined result of these direct and indirect effects of climate change to stream water quality. To model these impacts integrated across entire watersheds, an appropriate modeling framework must accurately represent lateral and longitudinal variations in hydrologic connectivity and its role as a driver of biogeochemical cycling in riparian zones. Here we propose a conceptual model and outline a modeling approach to address these needs. This approach embeds a process-based biogeochemical riparian model within a linked semi-distributed watershed model and groundwater flow and transport model framework.