The influence of lateral hydrologic connectivity on ecosystem metabolism in an active beaver meadow

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Abstract. The strength of lateral hydrologic connectivity (surface and subsurface exchange of water and associated materials) between a river and its floodplain is an important control on nutrient and organic matter processing dynamics in riparian wetlands. However, environmental engineers have largely ignored the role of hydrologic connectivity in providing essential ecosystem services, and constructed wetlands are commonly built using compacted clay and periphery berms that result in less groundwater and surface water exchange than observed in natural wetlands. In our study, we use the open-channel diurnal dissolved oxygen change method to calculate ecosystem metabolism metrics (gross primary production, ecosystem respiration, and net ecosystem productivity) in an active beaver meadow riparian wetland and an upstream confined reach in Rocky Mountain National Park, CO. We show how changing flow regimes from late spring snowmelt (high connectivity) to autumn/winter baseflow (low connectivity) influence nutrient and organic matter processing rates for the beaver meadow and confined systems, as well as for two beaver meadow floodplain waterbodies; a side channel and a pond. Results from our research indicate that ecosystem metabolism rates are maximized at intermediate levels of discharge for the active beaver meadow and are consistently low for the upstream confined system, which exhibits less variation than the meadow in lateral hydrologic connectivity through time. Our study suggests that beaver meadow metabolism rates are maximized at the optimization of high floodplain waterbody processing rates and sufficient connectivity of those waterbodies with the main channel; emphasizing the importance of incorporating connectivity in wetland mitigation practices that seek to enhance water quality at the catchment scale.