Effects of Water Residence Time on Nitrate Removal in Flow-Regulated Backwater Lakes of the UMR Flood Plain

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We examined in 2004 nitrate retention in five backwater lakes that are connected to the UMR via flow-controlled culverts. Nitrate loading and water residence time varied inversely as a function of culvert flow. Unlike engineered wetlands, we could not maximize source water nitrate concentration to increase loading. Under these constraints, maximum nitrate mass removal (~ 42%) coincided with a water residence time of ~2 days. Removal decreased as flow and lake flushing rate increased. Hypothetical adjustments in flow and water residence time resulted in a 22% estimated load reduction. However, estimated removal could improve by 50%, due to increased contact time. Our results indicate that water residence time needs to be considered in connectivity design issues in order to maximize nitrate removal in backwater systems. This design goal is more difficult to achieve for natural backwater systems given the more complex interrelationships between flow, load, morphology, and water residence time.