A Model for Estimating Dynamic Discharge of Shallow Groundwater Nitrate into Rivers Using STELLA

Pollution of the Lower St. Johns River (LSJR), Florida with excess nutrients from point and non-point sources due to groundwater discharge, surface runoff, and atmospheric deposition are a major environmental concern. While the surface runoff and atmospheric deposition of the excess nutrients into the LSJR have been received great attentions, the mechanisms by which the nutrients enter the LSJR through shallow groundwater discharge have not yet been thoroughly quantified. Knowledge of this phenomenon is crucial to understanding the eutrophication of the LSJR. In this study, a dynamic model for shallow groundwater nitrate discharge into the LSJR was developed using the STELLA modeling software. The structure of the model consisted of time-dependent simultaneous discharge (or recharge) of water and nitrate from shallow aquifers into rivers, which was driven by water head gradients between river stage and groundwater level as well as controlled by the nitrate removal pathways in the aquatic ecosystem. The model was calibrated using field measurements and applied to predict the dynamic discharge of shallow groundwater nitrate into a tributary of the LSJR in septic lands. This study suggests that the result model was a useful tool for estimating shallow groundwater nitrate discharge into rivers.