QUANTIFYING IN-STREAM NITRATE REACTION RATES USING CONTINUOUSLY-COLLECTED WATER QUALITY DATA

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High frequency in situ nitrate data from three streams of varying hydrologic condition, land use, and watershed size were used to quantify the mass loading of nitrate to streams from two sources – groundwater discharge and event flow – at a daily time step for one year. These estimated loadings were used to quantify temporally-variable in-stream nitrate processing rates. Nitrate in groundwater discharge was identified as contributing approximately 70 percent of the total nitrate load to a large river and small agricultural stream, compared with 45 percent to a small urban stream. The greatest in-stream losses of nitrate occurred during the summer and fall months, with net in-stream losses of up to 70 percent of total nitrate load in the large river, 60 percent in the agricultural stream, and 50 percent in the urban stream. Stream discharge and nitrate concentrations were inversely correlated with nitrate loss rates; whereas temperature and photosynthetically active radiation were positively correlated with loss. This study demonstrates a new approach for interpreting high frequency nitrate data that may be applied in other stream ecosystems to quantify temporal variability in nitrate source loading and rates of in-stream processing. These source and rate estimates can in turn be used to improve predictive models of nitrate transport and potentially inform efforts to reduce nutrient loads to streams and coastal environments.

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