Land-use patterns in watershed influence denitrification process in stream sediment

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Land-use patterns can affect various nutrient cycles in stream ecosystems, but little information is available on their effects on denitrification processes at the watershed scale. In the presented study, we investigated the controlling factors of denitrification rates within streams of the Han River Basin, Korea with different land-use patterns in order to enhance the effectiveness of water resource management strategies. Ten small watersheds were classified into three land-use patterns (forested, agricultural and urban) using satellite images and a geographic information system technique, and *in-situ* denitrification rates were determined using an acetylene blocking method. Additionally, sediment samples were collected from each stream to analyze denitrifier communities (T-RFLP) and abundances (real time qPCR) targeting *nirS* and *nosZ* genes. *In-situ* denitrification rates were found to be in the order of agricultural streams (289.6 mg N_2O-N m^{-2} d^{-1}) > urban streams (157.0 mg N_2O-N m^{-2} d^{-1}) > forested streams (41.9 mg N_2O-N m^{-2} d^{-1}). The quantity of *nirS* genes was the highest but that of *nosZ* genes was the lowest in agricultural streams. In contrast, genetic diversity of denitrifying genes was not affected by watershed land-use patterns, but exhibited stream-dependent patterns. While land-use pattern is the most prominent evaluator for the denitrification rates at a landscape scale, other factors such as clay content, DOC and temperature are as important at a local scale.

Keywords: Denitrification, Land use patterns, Microbial communities, Stream

