

Buffer system implementation with increases infiltration and nitrate retention capacity – A case study from Brittany, France

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A mixed surface and sub-surface flow riparian zone in Brittany (France), which is mainly fed by water from drainage ditches, was monitored for nitrate retention over three years from 2005 to 2007. Results show high time-averaged nitrate retention of >90 % for sub-surface and ~70 % for surface passage. However, no retention could be detected during major rain events, which reduced the overall (flow-averaged) retention to ~40 %. Based on the findings, higher nitrate retention can be reached by increasing (i) the water residence time in buffer systems, (ii) the fraction of subsurface passage or (iii) denitrification rates in the system.

(i) is only feasible if (active) buffer volume is enlarged, which may be difficult in practice. In the case of Brittany an enlargement can also be reached by extending buffer systems into existing drainage ditches. (ii) is of particular importance in areas with low soil permeability. In such areas, addition of gravel or sand beds can be considered. Regarding (iii), denitrification turns maximal under anaerobic conditions if sufficient carbon sources are available. In straw- and bark-filled column experiments we found high nitrate retention rates of >99 % and ~40 %, respectively, during a comparably low residence time of ~5 hours. As a result, the addition of external carbon sources to buffer systems is suggested.

Currently, several pilot sites are constructed in the Ic watershed in Brittany attempting to take into account points (i) to (iii). For the following four buffer types, monitoring will start in February 2010:

- Two short drainage ditches, filled with carbon sources
- One drainage ditch and one riparian wetland, each filled with a gravel filter, and optional upstream addition of carbon sources
- One riparian surface wetland with optional upstream addition of carbon sources