

Landscape features

Impact: Nutrient leaching and run-off

Reference 35

Mayer, PM; Reynolds, SK; McCutchen, MD; Canfield, TJ 2007 Meta-analysis of nitrogen removal in riparian buffers
JOURNAL OF ENVIRONMENTAL QUALITY, 36, 1172-1180. 10.2134/jeq2006.0462

Background and objective

Riparian buffers, the vegetated region adjacent to streams and wetlands, are thought to be effective at intercepting and reducing nitrogen loads entering water bodies. Riparian buffer width is thought to be positively related to nitrogen removal effectiveness by influencing nitrogen retention or removal. The purpose of this article is to identify trends in the relations between nitrogen removal capacity and buffer width, as well as hydrological flow path and vegetative cover, extracted from peer-reviewed studies containing empirical data on buffer effectiveness.

Search strategy and selection criteria

The authors employed database search engines (e.g., Cambridge Abstracts, Google Scholar, etc.) and existing bibliographies (e.g., Correll, 2003) to locate riparian buffer zone literature. We used search terms singly or combination including: riparian, buffer, width, filter strip, vegetated filters, nitrogen. 1) Papers that did not relate nitrogen removal to buffer width were not included in the results; 2) Data presented in proceedings and other non-peer reviewed sources were not included in our meta-analysis.

Data and analysis

The authors analyzed effectiveness (percentage nitrogen removal and nitrate removal per unit length) among buffer factor groups (width category, flow path, and vegetation type) using non-parametric tests because the dependent variables were not normally distributed (Shapiro–Wilk test for normality, $P < 0.001$). All analyses and model fitting were performed with Systat 11.0, Sigma Stat 3.1, and SigmaPlot 9.0 software.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
45	Landscapes with N antropogenic inputs	Riparian buffers	Riparian buffers influent	Metric: N removal; Effect size: Ratio of the considered metrics in the intervention to the considered metrics in the control	56%

Results

- Overall, buffers were effective at removing large proportions of the nitrogen from water flowing through riparian zones (mean % +- standard error [SE]: 67.5 +- 4.0, N = 88).
- NA

- NA
- NA
- NA

Factors influencing effect sizes

- Buffer width : Effectiveness was not related to buffer width when analyzing buffers within width categories (P < 0.5, Table 1), suggesting that any effect of buffer width on nitrogen removal occurs only after buffer size reaches a width threshold. Nitrogen removal effectiveness of buffers .50 m wide was greater than that of buffers 0 to 25 m, whereas effectiveness of buffers 26 to 50 m did not differ from the other categories.
- Water flow path : Nitrogen removal effectiveness also differed by flow pattern. Subsurface removal of nitrogen was much more efficient than surface removal.
- Buffer vegetation type : Overall nitrogen removal effectiveness did not vary by buffer vegetation type suggesting that all buffers were equally effective at removing nitrogen.

Conclusion

Riparian buffers of various types are effective at reducing nitrogen in riparian zones, especially nitrogen flowing in the subsurface.