

Interactive comment on “Lacustrine wetland in an agricultural catchment: nitrogen removal and related biogeochemical processes” by R. Balestrini et al.

Anonymous Referee #2

Received and published: 31 October 2007

The rationale for the study is sound and it is the spatio-temporal dynamics of N movement and transformations through the study region that make this paper of interest. I agree with the authors claims that there is a paucity of studies examining denitrification and diffuse N pollution, especially in shallow groundwater systems. The study design is reasonable, although I'm sure that the statistical pedants will find fault, and the difficulties and data gaps arising from the lack of flow are almost inevitable. I was pleased to see that QA aspects of the analytical chemistry were properly described.

The most informative part of this paper for me was the relationship displayed between

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nitrate and alkalinity. The authors point this out and correctly state that it is not frequently investigated. The very dramatic nitrate gradients in the shallow groundwater are also most interesting.

Comments:

Change title to 'wetlands'; or 'A lacustrine wetland...'

MUST change Cl to Cl⁻, SO₄ to SO₄²⁻, NO₂-N to NO₂⁻-N etc. The uncharged species used in the text either do not exist (HCO₃, SO₄) or would be highly reactive radicals (Cl) or gases (NO₂).

I don't understand the statement that modern agricultural practices contribute to catchment nitrogen losses (page 3502, line 25). Does this mean more N is exported in waterways? There is more N removal by denitrification than would occur for other land uses?

I dispute the logic in the statement that denitrification provides suitable conditions for denitrifying bacteria to persist (page 3503, line 17). Surely it is the other way around given the ubiquity of bacteria capable of undertaking denitrification?

If denitrification is an anaerobic process, then how can it be occurring when DO concentrations range between 0.5 to 3.3 mg L⁻¹? Need to discuss anoxic microsites more fully and provide literature references for this. Does the fact that no measurements < 0.5 mg O₂ L⁻¹ were recorded indicate a problem with the method for measuring these concentrations? (i.e. a small amount of O₂ contamination into the samples prior to or during measurement)

I totally disagree with the statement on page 3511, line 17 that alkalinity increases continued due to iron or manganese reduction. These two reduction processes occur at much higher redox potentials than sulphate reduction. Hence Fe(III) and Mn(IV) reduction would be (largely) complete before sulphate reduction commences.

I take minor exception to the statement that N₂O is a final product of denitrification. No

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it's not!; N₂ is. You can argue that the penultimate product is a final product, but that is semantics.

There was no consideration given to whether other nitrogen transformations (especially dissimilatory nitrate reduction to ammonia) may be occurring. Even if no definitive statements can be made, it should be noted that nitrification and denitrification (and assimilation) are not the only N transformations possible. Another interesting question is the efficiency of the final stage of denitrification (N₂O to N₂) due to the role of the former in global warming.

Given the likely interdependency of variables, was there any consideration given to performing a Principle Components Analysis (cf MDS) to tease out the dominant factors explaining denitrification in this study.

The English in the paper is generally satisfactory although careful copy editing will be required as there are numerous small errors in word use and grammar. I'm not commenting on these.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 4, 3501, 2007.

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