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Biogeosciences Discussions

Interactive comment on "Biogeochemical plant site conditions in stream valleys after winter flooding: a phytometer approach" *by* V. Beumer et al.

Anonymous Referee #1

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General comments

In their very interesting and well structured MS, the authors show the outcome of a nicely designed experimental test of the effects of 8 weeks of flooding at 15 degr C on post flooding soil conditions, for a number of selected soil types differing in land use history and related soil characteristics. Interestingly, they combine direct biogeochemical measurements in soil pore water with a phytometer approach, providing them with a biological test for possible changes in the concentrations of nutrients and potentially toxic compounds. In addition, they discuss the use of phytometers in biogeochemical research.

In my opinion, both these topics address questions which are not only relevant for more fundamental understanding of flooding on biogeochemical processes, but also for nature conservation. Therefore, I feel that this MS which is well within the scope of BG.

Rather than in the use of phytometers itself, the novelty of the MS lies in the fact that the authors are studying the post flooding conditions in spring, instead of the changes during flooding , which are ecologically highly relevant as they define the initial conditions of vegetation development. In addition, they show possible positive effects by eutrophication and possible negative effects by soil toxins, depending on the receptor choice (phytometer species).

However, the first issue that puzzled me is the choice of 15 degr C as a temperature for winter flooding. This has unquestionably had a strong effect on soil biogeochemistry, including the rates of decomposition, oxygen consumption and mineralization of NPK and concomitant accumulation of the compounds discussed. This has to be explained.

In addition, strong conclusions on the nature of nutrient limitation are at least partly based on phytometer nutrient stoichiometry, whereas it has been shown by Güsewell & Koerselman (2002), cited by the authors, that the threshold values defined for whole vegetation are not suitable to gain insight into the nature of nutrient limitation of separate species. I feel that this would weaken some of the conclusions in the discussion, and that it needs additional explanation.

Finally, the possible role of pH changes in the semi-natural sites during flooding on biogeochemical processes, nutrient availability and plant growth should be included in the discussion. For ASN, there was a strong difference in pH after flooding, which could have influenced different processes as explained below.

Specific comments

P5203, Title: include 'soil core' in the title (e.g. 'a soil core-phytometer approach' or 'a phytometer approach using soil cores', to indicate that the phytometers have not been used in the field.

P5204, Abstr L10-11: 'The growth conditions changed in opposite directions'. Please make this statement more explicit with respect to the species and the direction of the observed changes.

P5204, Abstr: Include a short statement on possible limitations for the extrapolation to natural vegetation, or indicate that you will address this issue in the MS.

P5207, Intro L21: explain the term ammonification, as it has been used in literature for both mineralization of organic N to ammonium and (less appropriately) for DNRA (dissimilatory nitrate reduction to ammonium). If decomposition rates are affected, concentrations of other nutrients may also change.

P5208, M&M L6: From which depth were the cores collected (top layer?), and what was done with the standing vegetation?

P5208, M&M L7: (see general remarks), explain the rationale for using this high temperature. According to me, this is not an average winter temperature. In that case, a flooding period in spring is simulated, which changes the topic of the MS. Higher T generates higher process rates and higher responses than during an actual winter flooding event. This has implications for nutrient levels, including those of potentially toxic ammonium. An explanation is needed.

P5209, M&M L14 and 21: on which surface water and groundwater samples have these concentrations been based?

P5209, M&M L 26: Were the seedlings (one week after germination) planted on the soil cores directly after flooding? Was there a difference in water content during the first week(s), as a result of the flooding pretreatment? This could interfere with germination rates and growth rates.

P5210, M&M L5: Methods for bio-available soil nutrients (Table 1) are lacking.

P5210, M&M L6-10: (see general remarks) these threshold ratios have been defined for entire vegetation, not for individual species. Please comment on this, and modify text accordingly.

P5210, M&M L14: equal: has this been checked by comparison?

P5210, M&M L18: provide reference for methods and equipment.

P5211, Res L12: In addition, the low pH could explain higher P-availability.

P5211, Res L 14: survival %s have not been tested statistically and variation is not included in the table, so it is very difficult to interpret table 2. Please provide statistics. There is only a strong difference for Lythrum on ASN, which could most probably be explained by the strong difference in pH (3.9 for control, which is very uncommon for Lythrum) at the beginning. Please comment on this.

P5213, Res L7: I don't understand this phrase, as P concentrations were not significantly decreased for SN or increased for A soils. See also technical corrections.

P5213, Res L24: K concentration is only lower for FA, not for A1 and A2. Please change the ext accordingly.

P5215, Res L12: time is repeated for the same units, so officially a repeated design should be used, but this seems not very relevant for the outcome here.

P5216, Res L5: Ca was not higher for all soils. Change the text accordingly.

P5216, Res L8-9: Indicate how you know that sulphate reduction took place (decreased levels?) and how you know that sulphides had been oxidized (measured?).

P5216, Disc L20: include pH effects as a possible factor for ASN. Please explain if the higher pH had no direct (adverse) effects on Anthoxanthum growth (field ranges?).

P5216, Disc L22: explain how the last possibility could be ruled out (other macronutrients, micronutrients).

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P5217, Disc L15: For ASN, the biomass was much lower for the pre-flooded treatment, K concentration was much higher and both N/K and P/K ratios were much lower. These effects were much stronger than for SN1 and SN2. If K became more available after flooding and N/P ratios stayed equal, could there be a relative decrease in N and P availability?

K concentration in the flooding water was 14.9 mg/l, which is much higher than the control value. What was the contribution of the flood water composition to the observed differences?

It is concluded that winter flooding did not affect biomass of Anthoxanthum strongly, but this is not true for ASN. In fact, the significance seems to be entirely generated by this soil type, which could implicate that the low pH and the difference in pH between treatments may also be involved (see above). Please include this in the discussion, with respect to possible toxic effects (see also below: toxicity).

P5217, Disc 18: Can it be ruled out that pre-flooding led to higher water contents at the beginning, influencing Lythrum growth?

P5217, Disc L27: 'which was confirmed by...': this statement is not clear to me, please rephrase.

P5218, Disc L20: ammonium is mainly toxic at low pH and not at circum-neutral pH (as explained by Lucassen et al. 2003, cited by the authors), which could be included in the discussion about the strong effects on ASN biomass (as the pre-flooded soils still showed lower pH than other soils).

P5219, Disc L5: In addition, Ca concentrations are low which strongly increase Al toxicity effects at equal concentrations.

P5219, Disc L20: It seems to me that growth rates of this eutrophic species are too low on the semi-natural sites to use this species as a phytometer to assess soil changes related to hydrology. Please comment on this, and include this in your discussion.

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Interactive Comment

P5220, Disc L13: omit Fe since you ruled this factor out in your discussion.

P5221, Disc L20: why only for groundwater exfiltration or rain water accumulation? You used brook water quality? Please include the possible role of water quality in this discussion.

P5221, Disc L22: shortly mention the other two.

P 5224, Table 1: provide reference for vegetation types. Why is bio-available K not included in the table?

Technical corrections

P5213, L9: Fig 2c instead of 3c.

P5215, L20: change ’is’ to ’was’.

P5216, L9: change ’were’ to ’had been’.

Interactive comment on Biogeosciences Discuss., 5, 5203, 2008.