

Biogeosciences Discuss., referee comment RC2  
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## Comment on bg-2021-11

Anonymous Referee #2

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Referee comment on "Cycling and retention of nitrogen in European beech (*Fagus sylvatica* L.) ecosystems under elevated fructification frequency" by Rainer Brumme et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-11-RC2>, 2021

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I find the submission by Brumme et al. to be an interesting study, well-written and relatively thorough with valuable contribution to the literature on N cycling in beech forests under increased frequency of masts. I recommend the paper to be accepted for publication Biogeoscience after the identified conceptual and technical issues are carefully addressed.

### General comments

Although the study described the importance of litterfall on N cycling (L47-49), the specific effect of fructification frequency was only briefly mentioned (L72-75), and I recommend explaining it in more detail. In the introduction, more emphasis should be given on the reason behind the increased fructification frequency and its implication for N cycling in beech forest ecosystems with better connection to the research question to be answered, and this should be started in the abstract. In the results, showing the temporal pattern of mast frequency (result in thus those from literature) and exploring its relationships with some factors such as N deposition pattern would be interesting.

The <sup>15</sup>N-labelled leaf litter exchange experiment should be explained in depth, and the calculation of the <sup>15</sup>N-labelled litter N recovery in soil needs to be shown. It was not explained why the retention of <sup>15</sup>N labelled litter N in plant (aboveground and belowground biomass) was not quantified. Were roots present in the soil samples? If so, the <sup>15</sup>N recovery in the root should be presented.

It would have been more interesting to see how retention of <sup>15</sup>N-labelled litter N differs from that of deposited N, which can be explained by presenting and/o discussing the results in this study with other <sup>15</sup>N-labelling studies.

## Specific comments

L19-20: This part misses a logical connection between changes in fructification and its implication for N cycling that needs investigation.

L23-25: retention of litter N should come later when discussing N retention.

L35: Consider adding a concluding statement about the important implication of this study.

L38-39: the effect of N deposition is presented as things of the past in this paragraph. Better to discuss it as a general issue that has been observed in past, still happening, and is expected to happen in the future using the right tense.

L45-46: fragmented sentence; not well connected to the preceding one.

L50-51: provide (a) reference (s).

L71-72: Is it the effect on the amount of fruit produced?

L85-86: Although, the sites used in this study are Level II plots, results from Level I plots from previous studies were also discussed in the result (e.g., line 250). Thus, I suggest giving brief introduction of the Level I and II plots in Europe here.

L99: Are the slope (precipitation) at the experimental sites small enough to exclude N losses from the plot through surface runoff in the N balance?

L133-142: Why is it called 'net' gaseous exchange and how was it estimated(L133)? Have you measured gaseous N uptake too? The N flux data should be moved to the result section.

L155-159: I am less supportive of this part. Where were those 300 seeds obtained from? Since the litterfall were collected from 1998-2008 for the three Bavarian sites, how the number of years without mast and mast year were presented as 22 and 11, respectively?

L171-172: It is not clear why 'the soil columns were cut into slices'. Or are you saying the soil cores were divided into layers?

L175: This sentence about the <sup>15</sup>N labelling experiment should come earlier as part of the above paragraph. I suggest revising this whole section 2.2 with more orderly description of 1) experimental design/establishment and then discuss, 2) sampling, and 3) Laboratory analyses.

L182-183: Does that mean your data did not fulfill the normal distribution? If that is the case, have you tried some sort of data transformation?

L192: Should not it be 'foliar nutrient'? The term 'N cycling' obviously represents a far more complex interaction processes and pools that are not presented under this section.

L221-230: The subtitle should reflect the data presented, not the method. What does the '15N excess' (L222) represent? How did you calculate it? The 15N excess, to my understanding, is the changes in 15N content of soil pools following the addition of 15 labelled litter N. I also wonder how the 15N recovery (Table 5) was calculated? The 15N excess (‰) and 15N recovery (%) should clearly and separately presented. This should be explained in section 2.2.1.

L252: Which time reference is being referred to as 'in the past' since all the discussion so far indicated that mast frequencies has been increased.

Line259-260: Can you provide the temporal changes in mast production for the European beech forests? This will be useful to explore possible correlation between the temporal changes in mast frequencies and some possible global change factors (e.g., N deposition, as mentioned in the next paragraph).

L191-294: In this part, texts about dry mass production, need to be either integrated into the rest of the discussion about litter N retention or be moved to section 4.1.

L305: What is the reason for humus degradation at the site? The negative  $\Delta S$  could be due to the high N leaching at the site (Table 6). The site also has low retention capacity for new N input (litter N). Explain the reason for the low N retention at this site and its implication.

L314-315: This sentence about N deposition effect on N retention comes between two sentences that explains effects of P availability.

L340-341: 'When comparing historic data with results from litterfall observations across Europe since the 1990s an increase in fructification frequency seems likely'. Is it not certain?

L341-343: Focus on N, which is the main topic of this study, not carbon and other undefined 'nutrient'.

L349-350: this confounding effect has not been explained in the discussion. In the context of the study sites, what is the main cause of the soil acidification? Are the study forests considered as N-saturated?

## Tables and Figures

Is it possible to reduce the number of tables (optional suggestion)? Can some of the data in the tables be presented in Figure?

Data should be presented with some measure of uncertainties; simple calculated SE would be nice.

Table 2: Present C, N, and P content for soil organic layer as you did for mineral soil? I would also be more logical to present the nutrient content before their stoichiometry.

Table 6: values in the last column are confusing as they show fraction of fraction. Moreover, the values (which I assume to show  $^{15}\text{N}$  recovery in Organic layer divided by total recovery) do not much that when calculated using the  $^{15}\text{N}$  recovery data in Table 5 for most sites (e.g., BBR).

Fig 5. The terms 'internal' and 'external' N cycle, as described here, is confusing, if not wrong. Commonly, internal N cycle in an ecosystem refers to N cycle between microbes, vegetation, and soil. The components in the schematic diagram and the direction of the arrows connecting them does not convey clear message. For example, all the DM and N in different litter type are not connected to the total litterfall. How are soil N pool, N deposition and N uptake are connected to other components in the diagram?

Few technical corrections /writing

L26: While there is no fundamental rules on this issue, generally, numbers from zero through to ten are written as words, and larger numbers are written as numerals. Being consistent is more important.

L25: Comma should be added after 'In these forests'. The proper use of comma needs to be carefully checked in the whole text (e.g., L78, L101, L147, L148, L168... and a lot more)

L32: Change 'about' to 'only about'

L75: use 'N' instead of 'nitrogen' as you indicated it in the first sentence in the introduction. Check other places (e.g., 279)

L80: change 'soil specific' to soil-specific'

L98: delete the first 'deposition' and 'from the atmosphere'

L108: It should be written as 'the BBR'. Check other places.

L27: write 'site specific' as 'site-specific'

L29: It should be 'inventories'.

L154: 'sites'. There was only one site at Rhineland-Palatinatehere (L87-88).

L161: Write 'light exposed' as light-exposed'

L167-168: while the purpose of the PVC is obviously to create the plots, this is not clearly stated.

L172: Change 'grinded' to 'ground'

L176: Change 'Numbers' to 'The number'

L181: It should be 'Statistical analysis'

L198: I think this section (2.4) is misplaced here. Should not it be at the end (after the main text)?

L199: Change 'each' to 'every'

L202: change 'amount' to 'the amount'

L203: Change 'Mean changes' to 'The mean changes'

L232: Change 'measured' to 'study'

L235: Change 'were' to 'was' and 'Mean' to 'The mean'

L272: Change 'nutrient rich' to 'nutrient-rich'

L295: Scientific names should be in italicized. Same issue in Table 1

L197: Change '2-years' to '2-year'

L309: Change 'high' to 'the high'

L325: Change 'base rich' to 'base-rich'

L334: 'that' is better' instead of 'which'

L347: delete the first 'N'

L350: delete 'still'

## Reference

The referencing style needs to be carefully checked. Few examples where correction is needed are:

DOI should be provided in consistent style (e.g., including URL.)

L433: Delete the date and month

L493: the journal abbreviation is not correct

## Figures and Tables

Texts fonts (e.g., types) in the figure are different from that in the main text

Figure pane labels are better be placed at the top left corner of each pane.

Fig 2 and 3: The year on the y-axis is not necessary.

Fig 4: Capitalization of words in the y-axis label