

Review of Ouyang, S. et al.:

Variations in soil carbon, nitrogen, phosphorus and stoichiometry along forest succession in southern China

General comments (overall quality)

The authors present an inventory of the soil C, N and P concentrations, storage and the soil C:N:P stoichiometry of three different forest types in southern China. The main study question is whether/how forest succession, as represented by the three forest types, influences soil C, N and P in different soil depths. Although offering a good overview of soil C, N and P in the studied forests, the manuscript suffers from a lack of novelty and thoroughness. There are plenty of analyses of C, N and P in the mineral soil of forest ecosystems and the authors fail to point out why their study is still needed. The missing reasoning for the choice of the study topic and the lack of hypotheses (only general study aims are given) is reflected in a rather aimless discussion and the conclusions get very little support from the main body of text. The methods section does not provide all information needed to reproduce the study and the results part is sloppy. Figures and tables are frequently cited wrong. Many questions are left open, as seen in the comments below.

Before any publication, I suggest a strong revision of the manuscript because by now it is imprecise and without focus.

Specific comments (individual scientific questions)

Abstract

- Please specify the results section by presenting numbers (e.g. percentages, r values) instead of just stating that something significantly increased/ decreased/ correlated.
- You should end with a real conclusion. Point out why the influence of forest succession should be recognized/ how your results can be connected to forest ecology.

Introduction

Please restructure the introduction focusing on your topic "forest succession". It contains too much general knowledge and leaves too many questions about your topic. The relevance of "succession" should be clear from the first paragraph on, and the introduction should culminate in your hypotheses. I strongly suggest to dismiss the general "study aims" and implement real hypotheses because these are the core of any scientific work and likely will help to give structure to the discussion.

- Shorten and move (or delete) first paragraph (too general and no focus on study topic)
- The second paragraph seems to be a much better start for me, but it should be expanded.
 - Why does forest succession improve soil C sequestration?
 - How are N and P behaving controversial during forest succession?
- The third paragraph indicates a knowledge gap (soil stoichiometry of forests in southern China)
 - Why does it need to be closed?
 - What are the expected benefits for forest management or soil research?
 - What was learned from similar analyses you cite for northern China?
- Fourth paragraph: please use hypotheses instead of "aims".
 - Aim (1): What patterns do you expect?
 - Aim (2): It is very difficult and speculative to assess the nutrient limitations of a forest without considering the vegetation (e.g. concentrations in leaves, biomass production etc.)

Aim (3): This comes as a surprise. Why do you need to look at these parameters? They were not introduced before. If they are important, you should draw the readers' attention towards them in the introduction.

Materials and methods

- Your choice of abbreviations for the forest types (PM-LG, CA, LG-CG) is not obvious for most readers. To use the corresponding stage of succession for each forest ("early", "middle" or "late" as in Table 2) would improve the readability of your manuscript.
- The description of the three forest types of section 2.2 should be implemented in section 2.1 because it is still site description.
- It is not clear to me how you took soil samples and determined bulk density. Please clarify the second paragraph in section 2.2. When was the sampling (year and season)?
- How was the data for stand factors (Shannon index, tree species number, ...) and topography derived? There is no information on this in your methods section.
- What are the hypotheses behind your statistical tests? How did you choose the input of your multivariate models?
- Did you only analyze the differences between succession stages per depth or also in between the depths you sampled at each stage? From your figures I guessed it was the first, but the results section left me with doubts (see below).

Results

You frequently refer wrongly to tables and figures, please check all the references. Table 3 is not referred to at all. Be precise and avoid vague statements (e.g. avoid stating two parameters differ significantly, but without telling how).

- 3.1: You start with a very unspecific statement, referring to a table (I think you mean Table 1, not 2?) not related to the following topic. I suggest using Table 1 as additional information, not for starting paragraphs in your results (same in 3.2, 3.3)
- 3.2: This paragraph refers to Fig. 3, not Fig.2
- 3.3: Are your ratios molar or mass based? This could already be stated in the methods section and should also be included in your table/figure captions.

You refer to Fig. 2, not Fig.3 here.

Did you test for significant differences of stoichiometric ratios between the different depths of each forest? It reads like this, but there is only one sentence spent on the ANOVAs in your methods section. Did you take into account that the different depths are not independent of each other? Either you need to specify the explanation of your statistics or you cannot derive statistical comparisons between different depths - I would like more information on what you did there.

- 3.4: To me, the space taken by Table 4 and 5 is in no relation to its explanatory power. Would it be an option to give those as supplementary material? What about Table 3? Please explain the use of this table or remove it, if it is not needed.

Discussion

It is very hard to recognize the authors' train of thought, both in single sections and in the discussion as a whole. The focus on "forest succession" is often lost and there are many jumps between topics. Moreover, there is very little actual discussion, mostly results are just compared to the literature,

which is only part of the job. All in all, no coherent story is told here and I could not understand what the given results actually mean in the context of forest succession.

Therefore, I recommend to completely rewrite the discussion. Including hypotheses may help improving both structure and content.

Again, please check all your table and figure references, many are wrong.

- 4.1: What is STN and STP in comparison to TN and TP? These abbreviations were not introduced.

First paragraph:

I expected to read how forest type and soil depth affected SOC, TN and TP but there was no specific information given. This paragraph is very vague. It would be sound to start with a very short, pointed summary of the results this section refers to.

p. 6, l. 7ff.: Microorganisms are mainly performing litter decomposition and mineralization, and they are not mineralizing soil but organic matter. Further, how does the soil fauna come into play here? Please clarify this starting statement.

p. 8, l. 4: Did the trend decrease? Increase? Please be precise.

Second paragraph:

You state that litter and root input cause SOC and TN increases in late stages of succession, but explained only the root part. How is the litter affected?

Third paragraph:

This all comes a bit too short, you should give more details on the fate of P. The second sentence is not conclusive.

Fourth paragraph: To me, decreasing C and N concentrations with increasing soil depth occur as a well known phenomenon.

l. 19ff.: Again, did you really test depth related differences and, if so, how?

l. 24ff. In the next to last sentence you try to bridge the depth-related results and forest succession, but this does not come clear to me. How is TP in different soil depths related to succession?

l.25ff. (p.8-9): Yes, TP will be rock derived (or do you know about P fertilization in the studied forests?), but how does available P come into play here? Please clarify this statement, by now it does not explain anything.

- 4.2. :

First paragraph:

This is too much a list of literature references and too little discussion.

l. 4: Your starting sentence is again very vague. How does succession influence the ratios?

l. 5: What do "improved" ratios mean? Why do you present the highest ratios here?

Second paragraph:

What is your point here? I recognize C:N:P ratios as topic, but I do not get what you want to say about them - They are lower than elsewhere? They are stable? They determine soil processes?

l. 11: Referring to homeostatic stoichiometry of organisms and soils there are better general references. For example, you could cite Sterner & Elser, 2002 (Ecological stoichiometry: The biology of elements from molecules to the biosphere), Cleveland & Liptzin 2007 (C:N:P stoichiometry in soil: is there a "Redfield ratio" for the microbial biomass) or McGroddy et al.

2004 (Scaling of C:N:P stoichiometry in forests worldwide [...]), which is only a small choice of many more studies.

I. 12: What are the “key ecosystem characteristics”?

Third paragraph:

You switch to TP all of a sudden, leaving the discussion of the C:N ratios a stub. What is the effect of forest succession on C:N ratios? And what does that mean for the soil?

The discussion of C:P and N:P ratios is frayed and aimless. What do you want to say?

Fourth paragraph:

I. 10: I disagree with this statement. Your dataset shows quite some variation between the C:N:P ratios of forest types. Can you relate this to the results of your statistical analyses?

- 4.3:

The title of the section is imprecise, “factors” is a very vague term. Could you find a title describing the following more accurately?

How is the analysis of all these parameters connected to your topic “forest succession”?

To me it seems that the sum of parameters you include here prevented you from carefully considering and discussing each parameter on its own. Still, I am not sure whether this is a major point of this study.

Conclusions

- How can you differentiate the influence of forest succession and other soil/forest characteristics on the variability of SOC, TN and TP? Isn't it obvious to expect the elemental composition of soils to vary due to site-specific conditions? This conclusion seems quite superficial for me.

- The third sentence does not make sense, there is something wrong with the ratios you list. Did you mean “C:N ratios” in the second half of the sentence?

- I think it is inappropriate to speculate about the nutrient limitation of forests in a study that did not in the least consider the vegetation, e.g. as in foliar nutrient contents, growth, etc.

- Your discussion includes nothing about sustainable forest management. In what way are your results useful? What are the implications for forest management? This conclusion has no support from the manuscript.

- What about all your depth-related analyses? This major part of your analyses should be regarded in the conclusions.

Tables/Figures

- The caption of Figure 2 is given for Figure 3 (Molar or mass based ratios?)

- Figure 3 has no caption.

- Figures 1-3: What is the 0-30 cm depth? A mean value calculated from the other three depths? A 0-30 cm bulk sample? This needs explanation in the methods.

- Table 2: Mass based or molar ratios? Please use “C:N:P ratios” or “C:N:P stoichiometry” instead of just “C:N:P”

- Table 3: This correlation is neither explained in the statistics section nor referred to in the results. What type of correlation analysis is this?

- Table 4: Again, what is the “0-30 cm layer”? How was this data derived?

- Table 5: Same question as to Table 4.

Technical corrections (typos etc.)

Using non-breaking space with units and statistical numbers will prevent awkward formatting. Here are some cases throughout the text where that happened (e.g. p. 6, l.2, l.18, p. 7, l. 2).

Materials and Methods

Section 2.3: Please add references for the SOC, TN and TP determination.

Section 2.4, l. 3: *ith*

Section 2.4, l. 6: replace “layer” by “depth”

Section 2.5, l. 12: introduce the abbreviation “DBH”

Results

Section 3.1, (p. 6), l. 5: “TP concentrations appeared to decrease.” --> This is your results section - do not speculate. Please specify or skip.

Section 3.3, l. 20: please correct: [...] ratios of all three depths

Section 3.3, l. 23: please correct: (Fig. 2A)

Section 3.3 (p. 7), l. 5: replace “layer” by “depth”

Section 3.4, l. 13: replace “while” by “whereas”

Discussion

p.8, l. 3: (Table 1)

p8, l. 5: (Fig. 1 and Fig. 3)

p. 8, l. 6: please shorten: [...], in agreement with other studies (Your references).

p.8, l.20: Figure reference again wrong

p.8, l.24: delete “layers”

p. 8, l. 24: Figure reference wrong

p.9, l. 5: missing full stop

p.9, l.5, 6: It is more common to give only one decimal place for stoichiometric ratios.

p. 9, l. 8: C:N:P ratios

p. 9, l. 21: You do not have a Fig. 4.

p. 10, l. 18: delete first “and”, no comma before second “and”

p. 10, l. 22: “following”

p. 11, l. 19: “significantly”

Tables 4/5: pH, not PH