

Interactive comment on “Continental drivers of ammonium and nitrate in Australian soil under different land uses” by Juhwan Lee et al.

Anonymous Referee #1

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Overview

In this study the authors use a cubist model to decipher the soil parameters influential to mineral nitrogen (NH_4^+ , NO_3^-) in Australian soils under different land-uses. The scientific question is valid and the data approach taken is state-of-the-art, so that the manuscript certainly falls within the scope of SOIL. However, the presentation and interpretation of the data lacks depth and specificity and needs significant revision before it can be accepted for publication.

Comments

Abstract

L5-6: It is unclear what the agricultural region and non-agricultural regions are. This

is a large problem for the paper, because samples taken from within the agricultural region may actually be from natural environments, or vice-verse.

L9: Normally NH_4^+ introduces H^+ into the soil and therefore affects pH, not the other way around.

L11: what is the 'other' ecological region?

Introduction

P2, L1: Definition of mineral N?

P2, L6: I think it is the mineral N application, not continuous cropping per se, that leads to increased N emissions.

P2, L13: Mention some numbers/a range of expected mineral N values in soil.

P2L19-24: there are also studies showing that mineral N fertilizer can promote turnover of (and deplete) SOC (e.g. Shahbaz et al, LDD, 2017 or Neff et al., Nature, 2002).

P2, L34: Is biodiversity an ecosystem function? I would think it is an ecological indicator or even property, not a function.

Materials and methods

P3, L15-16: What is a unique environmental condition?

P3, L16-17: How was sampling performed? The text about no further samples being resourced is confusing.

P3 L17-22: 'Spatial distribution. . . at different times of year'. This section isn't methodology, it appears a combination of introductory remarks and discussion. Delete or move to the appropriate sections.

P4 L8-10: It is unclear whether samples from the 'agricultural region' really came from agriculturally used sites or were just located in what the authors appear to have defined to be a region dominated by agricultural use. Looking at the map, there are vast tracts

of land that have been defined as the agricultural production region which I would have thought are natural (e.g. nearly all the national parks in the great dividing range). How did you define these 'agricultural' and 'non-agricultural' regions? I am uneasy about such a broad sweeping definition being used to cover a continent (albeit a 'small' continent). If the samples are only from the agricultural region, does this mean that they were definitely taken from an agricultural land-use? This is a critical point concerning all the results.

P4, L13: briefly mention the depths again. Or state 'two sampling depths' or similar.

P4 L14, L20: I would have thought that a tree-based model such as cubist does not require log-transformation or the assumption of normality.

P4 L20, L23: Which 'selected' soil properties? A table with all the predictors used in the models would be nice.

P4 L27: A brief explanation of number of committees and nearest neighbours parameters would be helpful.

P4 L29: I dislike this use of the term relative importance. Your results show that several variable have a relative importance of 100 % in the same model. This implies that total importance is > 100 %. Relative importance in other models is frequently based upon influence of the predictor on model accuracy/goodness-of-fit, not solely on its inclusion in the model. Perhaps just use 'importance'?

Results

P5 L13: 'regional patterns' I do not think this is an appropriate use of 'regional'. Normally, a region is an area which is spatially defined because it is smaller and belongs together (e.g. Gippsland, the Hunter Valley, The West Australian Wheat belt). Looking at Figure 1, both the ecological and the agricultural production regions cover disjoint areas which have completely different climates, geology, vegetation among other things. I do not feel comfortable clumping these 'regions' together unless the samples in the

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regions are really defined by land-use, in which case you should refer to land-use categories, not regions.

P5 L15: 'or the median of' - rephrase.

P5 L19: 'significant regional difference' - be specific.

P5 L21-22: Do you mean that NH₄ and NO₃ differed between land-uses?

P5 L23-24: 'relatively natural environments' - What specific land-uses or environments are you referring to?

P5 L24-25: But the table does show e.g. significantly higher NH₄ in 'habitat/species management'. Make sure the text fits the results you present.

P5 L30: Which soil properties, what were the effects? Be specific. P6 L1: Once again 'soil properties'. This is too vague as to be meaningful., Be specific.

P6 L28-31: This is discussion, not results.

Discussion

P7 L9: 'may suggest' - or just suggests? No need to be so hesitant to make a statement.

P7 L14-15: Now you are talking about land-uses, not regions. Please be consistent. What about the effects of different climate and geology. These have a massive influence on soil forming factors, as well as vegetation. I would have thought that these factors could be accounted for in models. Even if they haven't, they should be given some thought in the discussion.

P7 L16: This seems to be presentation of new results in the discussion section.

P7 L18-19: This is the crux of the issue with this paper - it is unclear how you defined agricultural vs. ecological regions, so you are not really comparing land-use effects. In fact, it remains unclear to me what you are comparing, given the very large areas covered

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by the 'agricultural' and 'ecological' regions, which cover vastly differing climates and site environments.

P7 L26: What is a soil disturbance level?

P8 L18: I find this explanation for the lack of climate consideration inadequate. You can easily download at least broad climate data from the BOM and could have considered this in the models. You have clumped sites from Tasmania together with sites from far-north QLD, which have vastly differing climates. Even something as broad as a Köppen climate classification may have been considered in your models, if you do not have access to something more specific.

P8 L30: Sequentially?

P8 L31: Do not give examples. You should discuss the actual results.

P9 L4: Do not give one example, discuss your findings.

P9 L5: The model explained variance was much lower for NH₄⁺ in the agricultural soil, potentially indicating that you have not included all the driving factors in your models.

P9 L5-10: Which effects - specifically state what you think the relationship is? See comment above on relationship between pH and NH₄⁺. Make sure you discuss your results, not just reiterate them.

P9 L10-13: 'Was affected by' - this is too vague. Be specific. What was the relationship? Positive or negative? Are you sure this is causation, or is it merely covariance. . . ?

P9 L24-25: What about the error arising from a lack of consideration of other factors driving soil processes (climate, geology, topography. . .)?

P10 L9: Where is land-use intensity presented?

Conclusions

I do not think you actually looked at land use and management in depth (except the

results presented in Table 1, which for NH₄ appear insignificant across the broad categories). You defined agricultural and ecological zones, but the way this was done is unclear.

P10 L34 (35?): For me, your results do not indicate regionally explicit soil controls, but I find your definition of these regions problematic.

P11 L 4: 'it was probably due to' What are you referring to with it?

P11 L5: which complex biophysical properties?

Tables and Figures

Figure 1: Throughout the manuscript you contrast the agricultural region with the ecological region, but the map shows three regions 'intensive agricultural and plantation production', 'production from relatively natural environments' 'other ecological region'. It is unclear how you have defined your regions.

Figure 2: I think a box-whisker plot would be much better here.

Supplementary Figure 1: You state on P4 L27 that the number of committees was set to one to avoid complex models. Why does the y-axis show up to 20 committees? The caption mentions grey bars, but there do not appear to be any. Supplementary Figure 2: You state on P4 L27 that the number of committees was set to one to avoid complex models. Why does the y-axis show up to 20 committees?

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