

Interactive comment on “Soil properties impacting denitrifier community size, structure, and activity in New Zealand dairy-grazed pasture” by Neha Jha et al.

Anonymous Referee #1

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Comments

Scientific significance: Does the manuscript represent a substantial contribution to scientific progress within the scope of Biogeosciences (substantial new concepts, ideas, methods, or data)?

The paper content falls within the scope of BG. The objective was to gain insight into relationship between denitrifier community size, structure and activity. This was performed by analyzing genes: nirS, nirK and nosZ. Also denitrifier enzyme activity was analysed. 10 soils each sampled at 6 locations with 25 samples at two depths respectively, and pooled. All analysis was performed later at the laboratory. The study is motivated by N₂O emissions, since a potent greenhouse gas, and that complete

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denitrification to N₂ is better. The authors motivate the study by ‘denitrifier community structure is not always strongly correlated to soil or environmental parameters (Dandie et al., 2011; Enwall et al., 15 2010; Philippot et al., 2009) indicating that our understanding of the factors controlling the diversity and function of denitrifying communities is still inadequate.’ In contrast Graham et al. (2016 *Frontiers in Microbiology*) concludes environmental variables are the strongest predictors of process rates, however that microbial data was the next important explanation factors. So what is the hen and the egg? Many new molecular methods have been developed over the last decennia, opening possibilities to study the microbial life in soils. The impression is that the availability of a method designed this study. Results and conclusions are vague.

Scientific quality: Are the scientific approach and applied methods valid? Are the results discussed in an appropriate and balanced way (consideration of related work, including appropriate references)?

The authors are familiar with molecular and microbial genetic and process studies, which were applied here. However one can ask what can the denitrifier community structure tell on the N₂O emission size? A DEA assay gives a hint in combination with nosZ genes. But contrasting results were found, where soil of group had low DEA and low nosZ (Fig 4), so what to expect? And soil group 2 high in nosZ where DEA was the highest, does that hint low N₂O in spite of high process rate? It is not possible to guess that N₂O may be emitted from a soil. This is not discussed in the paper. However N₂O emission size was not the main aim of the study, but the study was motivated by it. The motivation of the study is vague (see above), and the objective told in the abstract ‘to gain insight to relationships between . . . structure and activity’. What was the insight gained? Ten soils were compared, but one soil (n=1?) is treated as a group of soils (group 2), however many samples at one site. This could be questioned? References to papers describing methods are not appropriate, since the methods are not found there. The Discussion section resembles a Result section however there are references after each paragraph.

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Presentation quality: Are the scientific results and conclusions presented in a clear, concise, and well-structured way (number and quality of figures/tables, appropriate use of English language)?

The authors could have better worked the text through. Sometimes the text is difficult to follow. The overall structure is OK, however the content of the discussion could couple more to other work.

Specific comments

P2 L34 This hypothesis is not very visible through the paper. Management practices altering environment conditions at the different soils could not be found.

P3 L6 'Population therefore' something lacking, difficult to read. L17-20 This section describing soil sampling is messy, difficult to read, some things are lacking like only one soil depth here but two depths later on. L23 Standard protocols refers to Morales et al. (2015), but I could not find these methods referred to in this reference. L28 Refers to Morales also for DEA, not in that paper. I have to say I have not checked all references given in the manuscript.

P4 L25 Why was the 10 soils investigated described so sparsely?

P5 L32 Two soils (n=2) compose one group. Enough?

P6 L2 More so for group 2 consisting only one soil.

P7 L12 two orders of magnitude? Only one as I can see.

Many vague and not very clear statements and conclusions, based on one or two soils follows.

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