Long-term soil phosphorus fertiliser implications for soil nitrogen cycling and GHG emissions.

Keywords: nitrous oxide, carbon, fungi, bacteria, nitrous oxide: dinitrogen ratio, stable isotopes, ^{15}N

Brief project outline: The student's scholarship will cover the candidate's stipend and scholar fees; the project will find consumable and analytical costs. Other funds for analyses and consumables will be provided by Lincoln University. The area in which the PhD candidate will be working on will be the nexus between soil nitrogen (N), carbon (C) and phosphorus (P). New Zealand soils have a long history of P application with application rates aimed at optimising pasture production. These P rates have not been assessed with respect to GHG emissions, especially N_2O. There are several hypotheses as to how long-term P application may affect N cycling in soils and thus N_2O emissions. For example, enhancing P alters microbial C supply and thus denitrification emissions, or P fertiliser overcomes microbial P deficiency and thus enhances nitrification. The PhD candidate's project would run in conjunction with an EJP funded trial that seeks to use ^{15}N tracing models to understand how long-term P fertiliser application affects GHG emissions and carbon use efficiency. The EJP project (ICONOCA) involves Clough and Morales as work package leaders and several European countries – most notably Ireland (TREAGASC) who lead the overall project. Lacking in this EJP project is a detailed examination of P and C interactive effects under conditions optimal for denitrification (a mechanism for removing N_2O in soil). The PhD candidate would use laboratory trials to examine how different C substrates, known to be exuded by plant roots (e.g., sugars, organic acids) affected total denitrification and N_2O emissions. This would also entail examining the fungal and bacterial community as it related to C form and P level. Soil P level is expected to alter fungal/bacterial microbial community composition and potentially the N_2O flux and N_2O:dinitrogen ratio. We will explore the implications of this using Winchmore soils (long-term P fertiliser trial) under fully denitrifying conditions.

Preferred candidate skills or experience:

- **Meet PhD entry requirements at Lincoln University**
  See: Entry requirement for Lincoln University and PhD House Rules – Lincoln University
- Ability to read and speak English to standard required New Zealand Universities
- Good laboratory skills, numerate
- Experience with stable isotope preferred
- Experience in microbiology preferred

Host institute(s) and location(s): Lincoln University, Lincoln (Christchurch)

Project leader(s)/research supervisor: Prof. Tim Clough, Associate Professor Sergio Morales.