Title	**Mitigating agricultural greenhouse gas emissions by improved pH management of soils (MAGGE-pH)**
Project Timeframe	Sep 2017 – Jun 2020
Countries Involved	New Zealand (University of Otago, AgResearch) Denmark (Aarhus University) Finland (University of Helsinki) France (INRA) Germany (Thünen Institute) Ireland (National University of Ireland - Galway, Teagasc) Norway (Norwegian University of Life Sciences) Sweden (Swedish University of Agricultural University) UK (National Environmental Research Council)
Aims	To assess the potential of pH management in mitigating nitrous oxide emissions from pastoral soils, the repercussion of pH management on productivity, and to further understand the mechanisms controlling emissions under ruminant urine patches. Specific aims were: • To determine the effect of lime application on N_2O emissions in contrasting New Zealand pastoral soils using laboratory incubations; • To determine the effect of lime and soil pH on yield and nitrogen uptake in New Zealand pastoral soils using a field-based trial; and • To coordinate the molecular and microbiological analysis, which includes work performed in New Zealand and in partner countries.
Research Highlights	• Confirmed that pH is not a suitable mitigation strategy for N_2O emissions from animal urine patches. • Created a comprehensive database of genomes from urine patch organisms and will use this to provide insight into what happens *in situ* during the urine cascade. • Led to new initiatives to implement microbial characterization through novel sequencing approaches to international studies in partner countries (Ireland, Norway, Finland, and Denmark). • Findings will result in six or more peer-reviewed publications.
Future Work	• The genome database approach is being expanded to explore microbiomes across New Zealand agriculture as part of a proposed MBIE bid. • Individually assess physical, chemical, and biological contributions towards N_2O emissions while using a predictive framework that allows a detailed mechanism of emissions control to be developed.

	• Through a GRASS award, collaborations with partners in countries associated with the MAGGE-pH project will be established to outsource the approach and reproduce our genome collections across multiple countries to compare microbiomes in agriculture at a global scale.
Key Research Output(s)	<u>Journal article(s)</u> van der Weerden, T.J., Rutherford, A.J., de Klein, C.A.M., Ganasamurthy. S., Morales. S.E. (Under Review) Elevating soil pH does not reduce N_2O emissions from urine deposited onto pastoral soils. *Agriculture, Ecosystems and Environment.* Ganasamurthy, S., Rex, D., Samad, M.S., Richards, K.G., Lanigan, G.J., Grelet, G., Clough, T.J., Morales, S.E. (Under Review) Competition and community succession link N transformation and greenhouse gas emissions in urine patches. *Science of the Total Environment.* Ganasamurthy, S., Grau, M., van der Weerden, T.J., Rutherford, A.J., Vekic, T.T., Dorsch, P., Brennan, F., Morales, S.E. (In Prep.) Soil origin, edaphic factors and pH contribute to modulating microbiomes and N_2O emissions in soils. Ganasamurthy, S., van der Weerden, T.J., Rutherford, A.J., Morales, S.E. (In Prep.) Linking microbial successions, transcriptional response and N_2O emissions in N treated pasture soils. Ganasamurthy, S., Rex, D., Samad, M.S., Richards, K.G., Lanigan, G.J., Clough, T.J., Morales, S.E. (In Prep.) An open source collection of 1000 pasture soil metagenome-assembled genomes: insights into successions and metabolic potential of N_2O emission mediating microbes.