## Nitrogen cycling in desert soil: a significant and neglected component of the global N cycle

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**Project description:** Hot and cold deserts cover about one third of the Earth's land surface. Although temperatures differ significantly between hot and cold deserts, they both receive low annual rainfall, and are considered ecologically marginal and highly sensitive to climatic changes. Despite their apparent barrenness and limited nutrient status, deserts play a significant role in global biogeochemical cycling of nitrogen (N) and carbon (C) and are estimated to store over 30% of the global soil organic C reserve. Additionally, desert soils have been found to contain ~90% organic N (e.g. Michaelides et al., 2012) and have been shown to contribute as much as 30% of the total global gaseous N emissions. However, little is known about the potential impact of climatic changes on biogeochemical cycling of N and C in desert soils, particularly changes in temperature and atmospheric $CO_2$ levels, and whether hot and cold deserts will have a similar or different response to these changes.

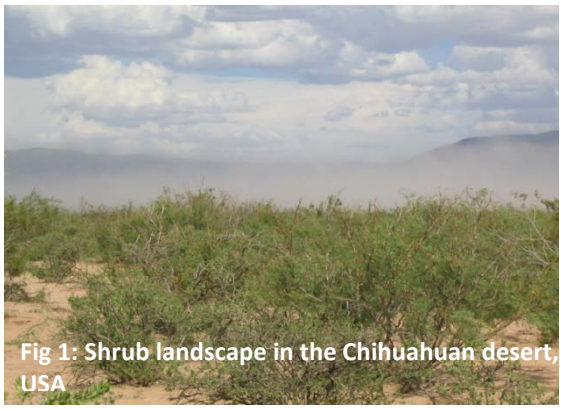
Fig 1: Shrub landscape in the Chihuahuan desert, USA

This project aims to quantify N cycling in desert soils and to assess the potential impact of climatic perturbations on this cycle for both hot and cold desert ecosystems. Specifically, the student will carry out novel laboratory-based experiments in which $^{15}N$ labelled substrates will be used to elucidate the microbial fixation of N and its subsequent distribution into the organic and inorganic phases of soils. Experiments will also be carried out in which the N cycle in soil will be assessed in response to perturbations of climatic characteristics (i.e. temperature, $CO_2$, water availability and N-deposition) imposed on desert soils. Soils will be sampled from the Chihuahuan desert, New Mexico, USA (Fig 1) and from recently deglaciated forefields of glaciers in Svalbard (Fig 2). This highly interdisciplinary approach, combining soil, microbial and biogeochemical techniques, will for the first time allow a quantitative assessment of the N dynamics in deserts and the impact that climate change will have on global biogeochemical cycling and ecosystem change in hot and cold deserts.

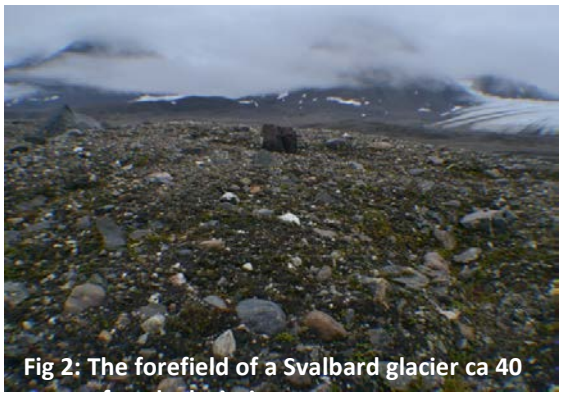
Fig 2: The forefield of a Svalbard glacier ca 40

Telling, J., A. M. Anesio, M. Tranter, T. Irvine-Fynn, A. Hodson, C. Butler, and J. Wadham (2011), Nitrogen fixation on Arctic glaciers, Svalbard, *Journal of Geophysical Research* 116, G03039.

Michaelides, K., Lister, D., Wainwright, J. and Parsons, A.J. (2012) Linking runoff and erosion dynamics to nutrient fluxes in a degrading dryland landscape. *Journal of Geophysical Research-Biogeosciences* 117, G00N15, doi:10.1029/2012JG002071.