

AFI7/05

MICROBIAL DIVERSITY IN ANTARCTIC SOILS

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Objectives

The aim of this project is to improve knowledge of Antarctic microbial diversity and its relationship with ecosystem functioning. This will be achieved by:

- Assessing the diversity of the microbial communities using molecular, structural and functional approaches in soils on a latitudinal gradient from 54-74°S
- Investigating the flow of carbon from isotopically-enriched substrates (plant materials and model compounds) into and through the soil microbial communities at selected sites along the latitudinal gradient and determining whether it differs between soils of differing diversity
- Determining the effect of experimental manipulations of temperature and liquid water content of the soils to simulate expected climate change scenarios on the diversity and functioning of the soil microbial communities at selected sites along the latitudinal gradient
- Developing models for investigating the dynamics of nutrient flow and energy flow in microbial communities in relation to both the environmental and biological conditions.

Field work 2007/08

Soil samples along the Antarctic Peninsula

Soils were sampled from multiple locations at more than 30 sites covering 20 degrees of latitude (54-74°S) along the Antarctic peninsula. All samples were immediately frozen at -80°C to enable active microbial communities to be investigated using RNA-based methods. This collection is the most comprehensive of its kind. The RRS James Clark Ross visited South Georgia, Bird Island and Signy Island. Soil samples were collected at all three sites. These samples represent the most northerly sites in a collection spanning the entire peninsula. HMS Endurance facilitated access to a further 30 sites between 62-74°S. The vast majority of these sites were extremely remote and demanded navigation through uncharted waters and helicopter support (Figs 1 and 2).



Fig. 1. Lynx Mk. 3 from HMS Endurance circling a remote and otherwise inaccessible Antarctic Island

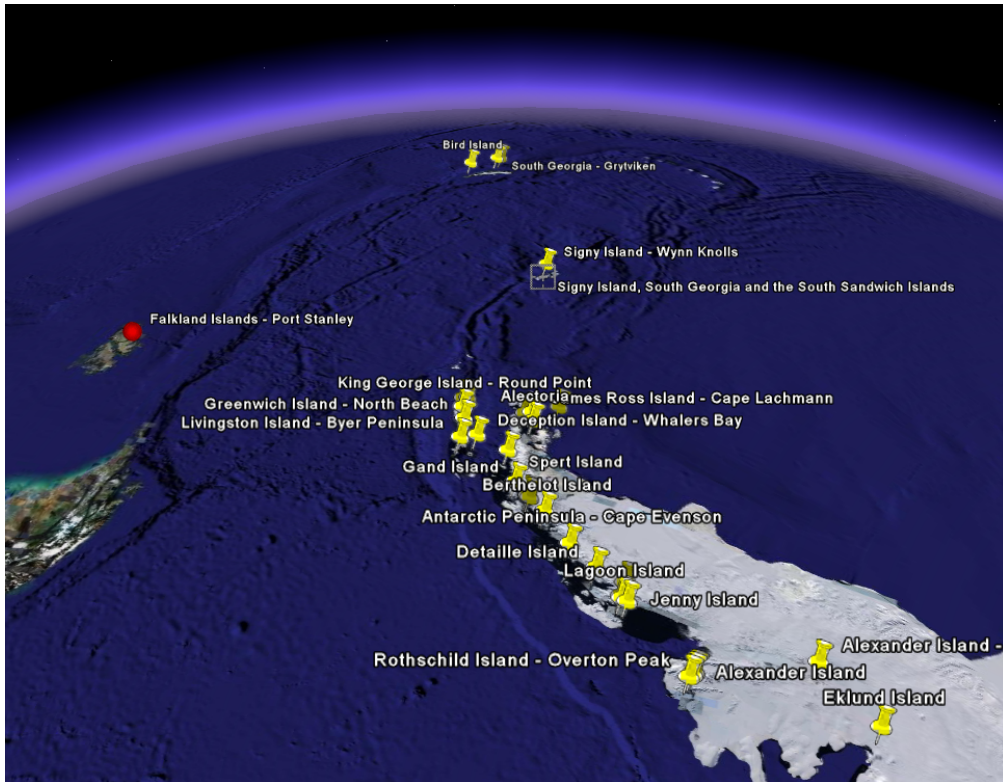


Fig. 2. Locations of the sampling sites (not all are shown).

Field experiments

To determine how the diversity and functioning of the soil community is affected by changes in organic resource supply and environmental conditions, field experiments were established at two of the sites (Signy Island and Mars Oasis; Fig 3) along the transect. The experiments comprised temperature and moisture manipulation (ambient and elevated in both cases), and nutrient amendment in the form of glucose (carbon supplement), glycine (C and N supplement) and Tryptic Soy Broth (a growth medium containing all nutrients required for microbial growth). At each of the sites used for field experimentation, there are 64 (2 temperatures x 2 moistures x 4 resource additions [including control] x 4 independent replicates) plots, each of 1 x 1 m that will need to be visited in the 2008/09 field season. The temperature manipulation was achieved using open top chambers (OTCs) of International Tundra Experiment (ITEX) design. ITEX OTCs increase soil surface temperatures by approximately 1-2°C to provide a realistic projection of changes in Maritime Antarctic soils by 2100. Moisture manipulation was achieved by irrigating with deionised water.

Establishing the field experiments was very demanding work and would not have been achieved without the help of Phil Coates (Signy Island GA), Adam Clark (Mars Oasis GA) and Dickie Hall (terrestrial biologist). Thank you very much for you efforts!



Fig. 3. Field experiment at Mars Oasis, Alexander Island.