BRAIN-be
Belgian Research Action through Interdisciplinary Networks

MICROBIAN

Microbial diversity and functioning in the Sør Rondane Mountains, East Antarctica

DURATION
15/12/2016 - 15/03/2021

BUDGET
853 304 €

PROJECT DESCRIPTION

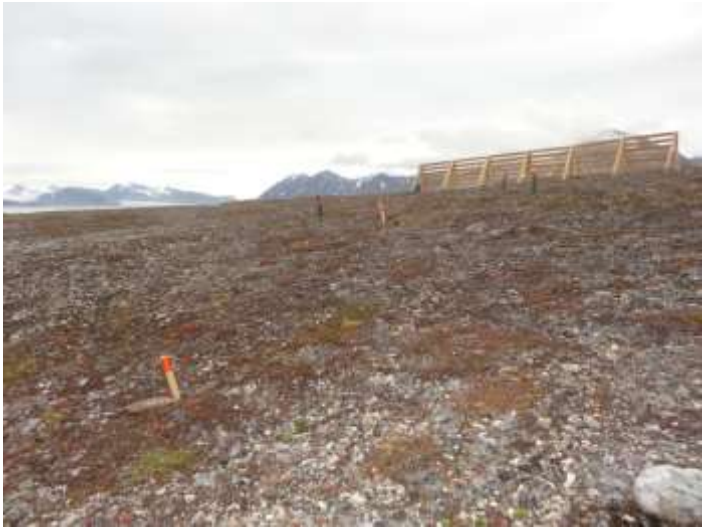
The scarce ice-free areas in Antarctica are among the most extreme terrestrial environments on Earth. Life in these places is dominated by microbes in strongly truncated foodwebs. Elucidating the factors that shape the biodiversity and the biogeochemical processes of these microbiomes, provides the scientific basis for habitat mapping and classification, for developing conservation strategies, for guiding long-term monitoring efforts and for predicting their possible response to future environmental changes. In this respect, inland nunataks in East Antarctica, like the Sør Rondane Mountains (SRM), are far less well-studied than those in more coastal locations and in the McMurdo Dry Valleys. This is surprising given their long-term exposure and their potential role as ice-free refugia during glacial maxima.

The SRM represent a c. 900 km² large nunatak, encompassing a large range of terrestrial habitats differing in geology and soil characteristics, exposure time and microclimatic conditions. The objectives of MICROBIAN are to (i) use a combination of remote sensing and close-range field observation techniques to map physical habitat characteristics and the presence/extent of microbial mat and biological crust communities around the Princess Elisabeth Station Antarctica, (ii) generate a comprehensive inventory of the taxonomic and functional diversity of microbial communities in these habitats, and cultivate and characterize (cyano)bacterial indicator taxa and deposit them as reference material in the BCCM collections, (iii) measure key ecosystem functions such as carbon and nutrient cycling in representative microbial communities, (iv) use mesocosm field experiments to mimic the possible effects of future climate change on the functional and taxonomic diversity of these microbial ecosystems, and (v) conduct field experiments to inform policy-makers in view of decision making regarding environmental protection and prevention measures to be taken to reduce the introduction of non-native species and to avoid cross-contamination between sites. MICROBIAN will provide a proof of concept to use high resolution satellite images for identifying regions of particular biological interest in East Antarctica and more broadly make a significant contribution to understanding Antarctic terrestrial microbial ecology.

Three field campaigns are organized guided by remote sensing based habitat mapping. Based on an existing Digital Elevation Model (DEM) developed in the Radarsat Antarctic Mapping Project, a regional climate model - the Antarctic Mesoscale Prediction System - and Landsat-8 imagery, first, regional climate conditions of ice-free nunataks and a coarse habitat classification are quantified. The spatial resolution of the DEM will be increased by analysing the slope, roughness and exposure of habitats using stereo Pléiades satellite images. In parallel, analysis of surface reflectance characteristics will be explored to guide further fine-mapping habitats. For a set of representative habitats, remote sensing will be complemented with in situ temperature and humidity data continuously recorded throughout the project. In parallel, microbial mat and soil crust communities will be fine-mapped using a high-resolution photomapping and drones. Microbial biodiversity of the different habitats will be studied using high throughput sequencing (amplicon sequencing and metagenomics), culturing and microscopy. During sampling, procedures will be set up to prevent cross-contamination between sites. Open Top Chambers and snow fences will be used to experimentally assess the effect of changes in temperature and snow cover extent and duration on the microbial communities. For amplicon sequencing, both universal and more specific primers will be used to analyse overall taxonomic composition, to target particular groups with a higher taxonomic resolution and to identify the presence of key functional genes. For a subset of sites, metagenomics will be used to more deeply analyse the taxonomic and functional attributes of their microbiomes, combined with in situ measurements of C and N fluxes. In addition, culturing approaches will target key taxa among bacteria and cyanobacteria in these sites. Characterised strains will be deposited in BCCM collections. Sequence and environmental data will be deposited in public databases and used to further develop the mARS module of the portal biodiversity.aq, an e-infrastructure that is part of EU-LifeWatch and supported by BELSPO (2015-2020).

MICROBIAN

Data analysis and integration will include high resolution spatial modelling of the (potential) distribution of microbial communities and key taxa and their biogeochemical activity. This will help identifying hotspots of biological activity based on the use of remote sensing information. The project will directly contribute to scientific questions addressed in the SCAR AntEco and AnT-ERA programs, which were also listed by the SCAR Horizon Scan. For the set-up of a long-term monitoring program we will closely interact with the ANTOS working group. The project results will provide significant policy support in the form of new information for the Non Native Species Manual of the Committee on Environmental Protection (CEP) of the Antarctic Treaty, for the characterization of Antarctic Special Protected Areas and for the design of their management plans that will be presented to the CEP and the Antarctic Treaty Committee Meeting.



CONTACT INFORMATION

Coordinator

Wim Vyverman
Universiteit Gent (UGent)
Laboratorium voor Protistologie en Aquatische Ecologie
Departement Biologie
wim.vyverman@ugent.be

Partners

Annick Wilmotte
Université de Liège (ULg)
Centre d'Ingénierie des Protéines
awilmotte@ulg.ac.be

Anne Willems
Universiteit Gent (UGent)
Laboratorium voor Microbiologie
Departement Biotechnologie en Microbiologie
Anne.Willems@UGent.be

Quinten Vanhellemont and Anton Van de Putte
Royal Belgian Institute of Natural Sciences (RBINS)
Operational Directorate Natural Environment
Remote sensing and ecosystem modelling team &
Biodiversity and Ecosystems Data and Information Centre
quinten.vanhellemont@naturalsciences.be
anton.vandeputte@naturalsciences.be

Bart Van de Vijver
Botanic Garden Meise
bart.vandevijver@plantentuinmeise.be

International Partners

Aleks Terauds
Australian Antarctic Division, Australia
aleks.terauds@aad.gov.au

Josef Elster
Centre for Polar Ecology
University of South Bohemia, Czech Republic
josef.elster@ibot.cas.cz

LINKS

http://www.microbian.ugent.be

BELGIAN SCIENCE POLICY OFFICE
Louizalaan 231 Avenue Louise • B-1050 Brussels
Tel. +32 (0)2 238 34 11
http://www.belspo.be/brain-be/ • Email : BRAIN-be@belspo.be

BR/165/A1/MICROBIAN