BA03

# CCAMBIO

# Climate Change and Antarctic Microbial Biodiversity

DURATION OF THE PROJECT
01/05/2012 – 31/07/2016

BUDGET
999.259€

KEYWORDS
Climatic changes, microbial diversity, next generation sequencing, metagenomics, geographic distribution, Antarctica

## CONTEXT

The Belgian CCAMBIO project, financed by BELSPO, aims to study the diversity, biogeographic zoning, evolutionary history, and genomic make-up of lacustrine microbial mat communities in the Antarctic Realm (AR) in order to assess their resilience and local and regional responses to global change. It participates to the international initiatives coordinated by the SCAR programmes 'Antarctic Ecosystems: Adaptations, Thresholds and Resilience (AntERA)' and 'State of the Antarctic Ecosystem (AntEco)'. Thanks to the better knowledge of the microbial diversity, the factors governing its distribution and the impacts of climate change, CCAMBIO will contribute to the establishment of new protected areas and an improved integrated management of Antarctic biotopes.

## PROJECT DESCRIPTION

### Objectives

The specific objectives are:

1. To extend existing sample collections by field campaigns to the understudied sub-Antarctic and Maritime Antarctic islands
2. To quantify the degree and nature of microbial bio-regionalisation in the AR using in-depth inventories of microbial biodiversity (cyanobacteria, selected groups of bacteria, and protists).
3. To test evolutionary hypotheses on the origin, diversification rate and range dynamics of selected taxa.
4. To study the overall genomic make-up and biochemical properties of a microbial mat community along a depth gradient to assess the contribution of the different taxonomic/functional groups to the functioning of the consortium in response to changes in the light climate.
5. To explore the potential of microorganisms and functional genes/groups as early warning indicators for global change through modelling the distribution of focal taxa and functional groups in response to climate and environmental change.

### Methodology

CCAMBIO will use a combination of techniques:

1) Biomass partitioning among the groups of photosynthetic microorganisms will be done by high performance liquid chromatography of photosynthetic pigments (PAE). In depth analyses of microbial community composition using 454 next generation tagged-sequencing analysis of the 16S or 18S ribosomal RNA genes for cyanobacteria, bacteria and micro-eukaryotes as well as ITS regions for cyanobacteria (CIP, PAE, LMG, RBINS) will be carried out.
2) For a selection of taxa, we will develop multi-gene molecular phylogenies to study their evolutionary history within the Antarctic Realm (AR). The importance of adaptive radiations and local population differentiation will be assessed (CIP, PAE, LMG).
3) Functional data will be obtained by a metagenomic inventory and metatranscriptome analysis along a depth gradient, in parallel with a measure of the photosynthetic activity by PAM (Pulse-Amplitude Modulated) fluorometry. This will inform us about the contribution of the different taxonomic/functional groups to the functioning of the consortium in function of changes in depth and light intensity (CIP, PAE, LMG).
4) The biodiversity and functional genomic data will be used to develop climate and environmental envelopes for key taxa and functional groups and to define bioregions and identify areas with an unusual diversity or harbouring a relict flora. Spatial models to predict the distribution of taxa and functional groups under different scenarios of climate change will be developed (CIP, PAE, LMG, BOT, RBINS, BAS).

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### INTERACTION BETWEEN THE DIFFERENT PARTNERS

Each partner has a specific experience with the diversity and evolution of particular microbial groups. Additional samplings will mainly be carried out by partner BOT. The experiments will be carried out by the 3 first partners and RBINS will participate for the bioinformatic analysis (MARS module of the portal 'Biodiversity.aq'). The statistical analysis and spatial models will be done by all and be centralized by PAE.

### LINK INTERNATIONAL PROGRAMMES

CCAMBIO participates to the international initiatives coordinated by the SCAR programmes 'Antarctic Ecosystems: Adaptations, Thresholds and Resilience (AntERA)' and 'State of the Antarctic Ecosystem (AntEco)'. With the members of the follow-up committee, it aims to build a consortium to study the metagenomics and metatranscriptomics of microbial communities in Polar regions.

### EXPECTED RESULTS AND/OR PRODUCTS

- A website (www.ccambio.ulg.ac.be).
- Publications in high quality scientific journals with referees.
- A workshop on the use of NGS methods in microbial ecology (http://www.cip.ulg.ac.be/workshopCCAMBIO/).
- A sample and DNA database
- New characterized strains in the BCCM public collections
- Publication of biodiversity data in an open access data system, valorised, and presented at various meeting and workshops attended by specialists in the field and the general public. This will involve the organisation of (technical) workshops, the training of junior scientists and students and disseminationthrough the media.
- A spatial model to predict the distribution of microbial taxa in different climate change scenarios. The datasets and models will be useful as support to environmental policies in Antarctica.
- A conclusion workshop.

### PARTNERS

**Dr. Annick Wilmotte**, (**CIP), University of Liège**: Coordinator and specialist of the cyanobacterial diversity
**Prof. Wim Vyverman**, (**PAE), University of Gent**: Specialist of the protist diversity and ecological modeling analyses
**Prof. Anne Willems, (LMG), University of Gent:** Specialist of the bacterial diversity
**Dr Bart Van De Vijver (BOT)**, **National Botanic Garden of Belgium**: Specialist of diatom diversity
**Dr. Anton Van de Putte (RBINS), Royal Belgian Institute of Natural Sciences:** Project manager of the portal 'Biodiversity.aq' for the deposit and analyses of Antarctic biodiversity datasets
**Dr Pete Convey (BAS), British Antarctic Survey**: Specialist of the polar biodiversity and ecology

### CONTACT INFORMATION


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**Follow-up Committee**

For the complete and most up-to-date composition of the Follow-up Committee, please consult our Federal Research Actions Database (FEDRA) by visiting
http://www.belspo.be/fedra


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