

State of the Antarctic Ecosystem (AntEco)

Programme Summary

Biological diversity is the sum of all those organisms that dictate how ecosystems function, and underpins the life-support system of our planet. This programme has been designed to focus on patterns of biodiversity across terrestrial, limnological, glacial and marine environments within the Antarctic, sub-Antarctic and Southern Ocean regions, to provide the scientific knowledge on biodiversity that can be also used for conservation and management. Under the framework of EBA, initiatives such as CAML, SCAR-MarBIN, ANTABIF have demonstrated how internationally coordinated research can rapidly advance knowledge of the state of Antarctic ecosystems. These have improved our understanding of key elements of Antarctic biodiversity, its linkage with global biodiversity and aspects of its phylogenetic and biogeographic history, and highlighted the importance of cross-disciplinary links with the oceanographic, glaciological and climate communities in particular.

The new challenges are to further the knowledge on past processes that formed the current biodiversity and patterns therein, and use this to develop scenarios of its future state through interdisciplinary approaches. To do so we will promote the use of innovative technologies, on scales from the latest molecular analyses to remote sensing, that have already been shown to provide the means for synthesis and integration across the entire region over scales and at resolutions that until now have not been possible.

Programme goals

In essence we propose to explain what biodiversity is there, how it got there, why it is there, what threatens it, and also provide recommendations for its management and conservation.

Key scientific questions:

- How do we explain the origin, current distribution and abundance of biodiversity?
- How has Antarctic biodiversity responded to past change and what does this tell us about its capacity to respond to future change?
- What are the threats and what are the implications for the maintenance of biodiversity?

We will address this by:

- Biodiversity census and sustained observing technologies (building on the CAML legacy and extending into the non-marine environment), database population
- Modelling and prediction of biodiversity-environment interactions, pattern analyses and bioregionalisation
- Application of cutting edge remote sensing and other technological innovations, hand in hand with straightforward, repeatable baseline surveys to secure long-term monitoring of the environment and diversity
- Inferring species adaptation, radiations and extinctions by the integration latest molecular approaches with glaciological, geological and climate modelling
- Integrating with the geological record and palaeoecology
- Integrating with climate modelling and increasing climate and environmental modelling resolution – making it biologically relevant.

This programme will place a high priority on communication and linkages with other SCAR standing scientific groups, in particular with relevant areas of palaeoecology, oceanography, glaciology, soil science, permafrost, geochemistry, geosciences, and climatology. It will also involve important synergies with the 'AntETR' programme, and will provide the basis for up-scaling the results of AntETR process-oriented studies in local ecosystems to larger geographical scales. The programme

will take into account exceptional and little-known habitats, such as subglacial environments, seamounts, vents, and special characteristics such as uniqueness, endemism and refugia.

The programme will inform the ATS parties, the CEP and other stakeholders (e.g. IPCC, Inter-governmental Science-Policy Platform for Biodiversity and Ecosystem Services (IPBES)) about trajectories of change, threats to biodiversity, and environmental management and stewardship in Antarctica. Contemporary threats include global change, introduction of non-native species, direct human impacts, together with their effects on the structure and function of communities, and the continuity of ecosystem services.

Why now?

Physical and biological measurements of the Earth's system now confirm that some climate-related processes are already outside the range of recent natural variability, and that several global processes are exhibiting a marked amplification in polar regions. The IPCC AR4 WGII Polar Regions chapter recognized the need for "detection and projection of changes in terrestrial, freshwater and marine Arctic and Antarctic biodiversity", and additionally highlighted was the lack of an assessment report for the Antarctic. Now is the time to assess what the state of the Antarctic ecosystem is and how it responded to past change, so that we can predict future ecosystem dynamics.

Implementation

Following approval at the 2010 SCAR Delegates meeting, a PPG will be established and a full proposal draft will be submitted to the SCAR Executive in 2011 for external review. The AntEco PPG will be made up of 6-8 members, including at least one former member of the EBA steering committee. We will ensure that the makeup of the PPG provides representative expertise in terrestrial, marine and freshwater biodiversity, on scales from molecular through to whole ecosystems and remote sensing. CONMAP will be approached to ensure logistical feasibility. Funding will be for the PPG and will be used for the PPG to meet and develop the full proposal

Stakeholder links, other programmes

This programme will link to current SCAR Programmes – ACE, AGCS, SALE, EBA (and their successors), other Antarctic initiatives such as ACCE, CCAMLR, COML, ANTABIF, and inform stakeholders in the ATS and CEP. The programme is outward looking with targeted stakeholders including IPCC, SOOS, IPBES, ICED, and PAGES. More broadly it aims to provide government agencies and policy makers with the scientific information required to make decisions on biodiversity issues in line with DIVERSITAS, IPBES and the CBD, which seeks to address all threats to biodiversity and ecosystem services, including threats from climate change, through scientific assessments, the development of tools, incentives and processes and the transfer of technologies.

Products and deliverables

- A major deliverable will be a State of the Antarctic Ecosystem Report, analogous to the recent ACCE, but concentrating on biological aspects.
- There will be significant progress with database population and integration (e.g. MarBIN, RiSCC, ANTABIF), formulation of new databases (Terrestrial 'CAML' including ICEMATE, genetic and barcoding metadatabase) and GIS products (visualising bioregionalisation). Where possible these will be integrated with global databases such as GEO BON.
- The programme will provide recommendations towards the CEP's 5-year plan e.g. prediction of distribution and biodiversity changes (vulnerable species and systems), ship-borne tourism, Marine Protected Areas, ASPAs, and CCAMLR.
- The creation of an Expert Group concerned with human impacts and invasive species in collaboration with the AntETR programme.
- Provide new data for glaciological and geological and other SCAR SRPs

- The creation of the Biological Material Repository
- The promotion of workshops on specific aspects of biodiversity and taxonomy

Outreach and capacity building

We will facilitate a kick off workshop to bring the various disciplines together with the aim of producing an initial high-impact synthesis paper to lay the foundation of the programme. We will maintain a continued representation in the mainstream scientific literature, and foster meaningful interdisciplinary interaction. Later in the programme we will hold an international workshop on the State of the Antarctic Ecosystem and from this produce a 'State of the Antarctic Ecosystem' report which will be provided to SCAR, CEP and IPCC as a final outcome of the programme.

In addition, the programme will encourage its member projects to engage in outreach activities via their local communities, and maintain a website that includes resources suitable for teachers and school students. We will also make press releases associated with the programme to ensure that the critical issues on the state of the Antarctic environment remain in the public domain, and of political importance.

The programme will build capacity within the Antarctic community by populating databases and encouraging collaboration to increase the use of new tools. We will provide guidelines and training for undertaking time series measurements for the biological domain to ensure compatibility with Arctic programmes. We will also foster the development of the next generation of Antarctic scientists by linking with APECS, ensuring that a member of APECS is on the steering committee and encouraging early career researchers to attend programme workshops and meetings.

List of Acronyms

ACE – Antarctic Climate Evolution, SCAR Programme
 ACCE - Antarctic Climate Change and the Environment, report published by SCAR
 AGCS – Antarctica in the Global Climate System, SCAR Programme
 ANTABIF – SCAR Antarctic Biodiversity Information Facility
 'AntETR'- Antarctic Ecosystem Thresholds and Resilience, SCAR Programme proposal
 APECS – Antarctic Polar Early Career Scientists
 ASPAs – Antarcti Specially Protected Areas
 ATS – Antarctic Treaty System
 CAML - Census of Antarctic Marine Life
 CCAMLR - Commission for Conservation of Antarctic Marine Living Resources
 CBD - Convention on Biological Diversity
 CEP – Committee for Environmental Protection
 COML – Census of Marine Life
 DIVERSITAS – an international programme of biodiversity science
 EBA – Evolution and Biodiversity of Antarctica, SCAR Programme
 GEO BON – Group on Earth Observations – Biodiversity Observation Network
 ICED, a Integrating Climate and Ecosystem Dynamics in the Southern Ocean
 'ICEMATE' – Impacts and Change in East Antarctic Marine and Terrestrial Ecosystems
 IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
 IPCC – Intergovernmental Panel on Climate Change
 MarBIN - SCAR Marine Biodiversity Information Network
 PAGES –Past Global Changes programme
 PPG – Programme Planning Group
 RiSCC – Regional Sensitivity to Climate Change in Antarctic Terrestrial and Limnetic Ecosystems SCAR Programme
 SALE – Subglacial Antarctic Lake Environments, SCAR Programme
 SOOS – Southern Ocean Observing System