



**WP** **10**  
Agenda Item: 2.3.3  
Person Responsible: Don Cowan

**EXCOM 2013**  
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# **State of the Antarctic Ecosystem (AntEco)**



## Executive Summary

**Title:** State of the Antarctic Ecosystem (AntEco)

**Introduction/ Background:** Biological diversity is the sum of all organisms that determine how ecosystems function, and underpins the life-support system of our planet. AntEco will be focusing on past and present patterns of biodiversity in the Antarctic, sub-Antarctic and Southern Ocean regions, to enhance scientific knowledge on biodiversity that, when coupled with increased knowledge of species biology, can be used for the conservation and management of Antarctic ecosystems. The new challenges are to distinguish the impact of present processes from historical signals, and to develop scenarios of potential future states through interdisciplinary approaches. Key scientific questions include:

- How has Antarctic biodiversity evolved in response to past environmental change and what does this tell us about its capacity to respond to future change?
- What are the systematic and environmental geographic features of Antarctic biodiversity, and what mechanisms underpin the current distribution and abundance of biodiversity?
- Given the evolved geographic distribution of diversity and forecast threats, what conservation actions are required for mitigation of, and adaptation to, change?

The principal role of AntEco is to promote the use of established and innovative technologies in research and collaborations that will enable the synthesis and integration of biological, physical and temporal data at different resolutions in order to better understand the nature of Antarctic ecosystems.

**Important Issues or Factors:** AntEco is newly formed in 2013, and will develop its operational structure throughout this year.

**Recommendations/Actions and Justification:** To function effectively, it is important that both the existence and the purposes of the AntEco SRP are rapidly and widely communicated across the global Antarctic scientific community. AntEco therefore requests the assistance of SCAR and its instruments in establishing a comprehensive database of national Antarctic programs and contacts.

**Expected Benefits/Outcomes:** The following are projected outcomes of AntEco activities:

- Potential linkages between SRPs
- Publications (research publications and reviews)
- Preparation of relevant strategy and advisory documents
- Population of relevant databases with spatially significant population datasets
- Presentations at appropriate scholarly meetings, workshops and conferences
- Training and graduation of post graduate students (MSc and PhD)
- Presentations at public (non-scientific) forums
- Establishment of new public interaction sites (web pages etc.)
- Media activities

**Partners:** AntEco activities will interface closely with new SCAR-sponsored programs (such as AnT-ERA, PAIS and AntClim21) and with existing peripheral SCAR programs (such as CCAMLR and ICED) [see Appendix 1]. AntEco activities will also provide valuable inputs to a range of international databases such as biodiversity.aq (incorporating SCAR-MarBIN and ANTABIF), SCAR Antarctic Biodiversity Database and Barcode of Life Database. At the research level, AntEco activities (workshops, etc.) are expected to stimulate collaborations and partnerships between international research groups. Such collaborations will naturally evolve through mutual interests, complementary and unique skills, coordinated logistics, and other synergistic drivers of research linkages.

**Budget Implications:** Estimated SCAR funding required over the total program lifetime (in US\$):  
\$160, 000 over 8 years = \$20, 000 per year

## State of the Antarctic Ecosystem

### 1. Rationale for the Programme

In recent geological history the Antarctic has been experiencing rapid, unprecedented change, making it critically important to assess the state of the Antarctic ecosystem. These assessments will enable us to predict future trajectories of change and inform best practice environmental management in the region.

Such assessments are particularly important in the context of the growing threats facing the Antarctic continent. These threats come from various sources and many have the potential to fundamentally change elements of Antarctic biology.

Firstly, the dramatic global changes in climatic conditions, particularly affecting Western Antarctica and the Arctic Peninsula, have the capacity to induce massive long-term changes in biological communities. By obtaining present day baseline data and elucidating how historical changes have affected biological communities in the past, we can gain a better understanding of the consequences of these changes.

Secondly, the rapid rise in direct human impacts on small but important areas of the continent, from the ever-increasing activities of the national operators and the ecotourism industry, represents a real threat to biodiversity. Physical impacts/disturbances and chemical contamination are causes of great anxiety in already sensitive Antarctic ecosystems.

Research programs designed to assess, monitor and quantify such threats are fundamental tools in establishing viable management and control strategies. Furthermore, integrated and collaborative research under the auspices of these programs will be much more effectively translated into policy through bodies like the Committee for Environmental Protection.

Technical developments in molecular biology over the past few decades have facilitated the investigation and understanding of species origins, history, trajectories and diversity. With the recent advances in high throughput “next generation” DNA sequence analysis, the opportunities to comprehensively assess species diversity and community structures are unparalleled. Coinciding with these technological and analytical advances is the perception that genetic diversity is a resource, not only for progress in biotechnology, but also for understanding fundamental aspects of species interactions and adaptations.

In the marine realm there has been a significant increase in biodiversity knowledge due to initiatives like CAML and databases like SCAR-MarBIN are becoming useful tools assessing biodiversity and identifying areas that are vulnerable and unique. However for most of the Southern Ocean’s nearshore and benthic environments the level of data availability is far from satisfactory and continues to limit analyses. Our knowledge of terrestrial biodiversity is also far from comprehensive, except on small localised scales, and preliminary analyses undertaken by SCAR have shown that there are no biodiversity records for a significant percentage of ice-free Antarctica (Terauds and Chown 2010).

The refinement and development of appropriate frameworks to categorise and assess biodiversity on and around the Antarctic continent is a key element in ensuring on-going conservation of the region.

Given the recent completion of the preliminary SCAR analyses of the Environmental Domains, and the bioregional analyses that followed (Terauds et al 2012), everything is in place for AntEco to facilitate, coordinate and ensure the future progress of this research.

These frameworks can then be used in conjunction with Antarctic biodiversity data and characteristics (i.e., dispersal mechanisms, genetic variability, rarity, vulnerability etc.) to assess the current set of protected areas and enable informed choices regarding new protected areas that are required.

## **2. Interim Executive Committee**

Don Cowan, U. Pretoria, RSA (Chief Officer)

Aleks Terauds, AAD, AU (Assistant Officer)

Peter Convey, BAS, UK (Assistant Officer)

## **3. Implementation Plan, Outputs and Deliverables**

### **3.1 Background**

The SRP is divided into three interlinked themes: a) Evolved patterns, b) Spatial patterns, and c) Governance, mitigation and adaptation. A high priority will be placed on forming and strengthening linkages across the SCAR standing scientific groups (oceanography, glaciology, soil science, permafrost, geochemistry, geosciences, and climatology) through links with AntClim 21. It will also involve important synergies with the physiological limits and tipping points identified by AnT-ERA and interface with future SCAR programmes.

Key scientific questions:

- How has Antarctic biodiversity evolved in response to past environmental change and what does this tell us about its capacity to respond to future change?
- What are the systematic-and environmental-geographic features of Antarctic biodiversity, and what mechanisms underpin the current distribution and abundance of biodiversity?
- Given the evolved geographic distribution of diversity and forecast threats, what conservation actions are required for mitigation of, and adaptation to, change?

### **3.2 Implementation Plan**

*Formation of a Steering Committee:*

At the date of submission, the Executive Committee comprises a Chief Officer with two assistant officers.

Chief Officer: Professor Don Cowan, Director, Genomics Research Institute, University of Pretoria, RSA

Don Cowan is the Director of both the Genomics Research Institute and the Centre for Microbial Ecology and Genomics at the University of Pretoria, South Africa. He has been actively involved in Antarctic research since 1999. He has published over 220 research papers, reviews and book chapters, and is one of South Africa's cohort of A-rated scientists.

Assistant Officer: Dr Aleks Terauds, Senior Research Scientist, Australian Antarctic Division, Hobart, Australia

Assistant Officer: Dr Peter Convey, Individual Merit Scientist, British Antarctic Survey, Cambridge, UK

Other international Antarctic researchers who have either been approached or who have expressed interest in participating in the Steering Committee are:

Dr Jan Strugnell, La Trobe University, Australia  
 Dr Alison Murray, Desert Research Institute, Nevada, USA  
 Prof Ian Hogg, University of Waikato, NZ  
 Dr Claudio Gonzalez-Wevar, Universidad de Chile, Santiago, Chile

It is intended that the composition of the committee be structured in order to provide effective coverage of the different core biomes (marine, terrestrial), fields and technologies relevant to Antarctic ecological research, and will be established at the planned AntEco consortium meeting at the SCAR Biology Symposium in Barcelona (July 2013). A proposed organisational structure for AntEco is shown in Attachment A.

#### *Proposed Operational Program:*

- 2013 Formation of the AntEco full steering committee: establishment of key sectors, goals and activities: AntEco steering group meeting and open workshop at the Biology Symposium, Barcelona.
- 2013/14 Establishment of an international member database and network; Workshop/symposium at the SCAR Open Science Conference
- 2015 First full AntEco report on international membership, activities and outputs
- 2016 Joint AnT-ERA - AntEco - AntClim21 Syntheses-workshop at the XXXIV SCAR and Open Science Conference (see AntETR report)
- 2017 [activities to be established]
- 2018 Second full AntEco report on international membership, activities and outputs
- 2019 [activities to be established]
- 2020 Final full AntEco report on international membership, activities and outputs: Final AntEco Symposium, SCAR Open Science Conference

### **3.3 Outputs and Deliverables**

#### *3.3.1 Management and Reporting:*

The most effective approach to coordinate the objectives and outcomes of AntEco would be to initiate and maintain communication between dispersed research groups. Coordination and communication should be effectively managed by a Steering Committee, where the committee members represent all sectors of AntEco's scientific interests. Conferences and workshops hosted by SCAR (SCAR Open Science Conferences, SCAR Biology Symposia, ISAES) will provide opportunities for cross-disciplinary communication and reporting on the progress and future plans of Ant-Eco.

#### *3.3.2 Data management plan:*

The most appropriate mechanisms for data management will be the use of existing conventions and infrastructures, e.g. ANTABIF, Polar Information Commons, NCIMB and GenBank. However, it will be necessary for AntEco to establish and maintain a meta-information structure to assist researchers to access the relevant datasets, considering the rapid rate at which data are expected to be acquired.

#### *3.3.3 Capacity building, education and training plan:*

AntEco's capacity building and education efforts will focus on the integration of researchers and scientists in the early stages of their careers into the SCAR community in order to maintain the progressive training of new generations of polar researchers. A section of the potential up-and-coming AntEco website may be dedicated to cater for and inspire young scientists, and promote career and development opportunities.

#### **3.3.4 Tangible outputs**

Within the stated remit of the AntEco program (to drive and enhance international research activities in the broad field of Antarctic ecosystems and ecology), the following represent tangible and quantifiable outputs from the AntEco program:

- Establishment of an international 'membership' database

- Development of formal linkages between SRPs
- A record of publications (research publications and reviews) from AntEco members
- Preparation of relevant strategy and advisory documents
- Population of relevant databases with spatially significant population datasets
- Presentations at appropriate scholarly meetings, workshops and conferences
- Training and graduation of postgraduate students (MSc and PhD)
- Presentations at public (non-scientific) forums
- Establishment of new public interaction sites (web pages etc.)
- Media activities

**4. Milestones and Future Plans:**

During the initiation and implementation stages, AntEco will be focused on establishing its internal management and operational structure and on spreading awareness of the existence of AntEco and the aims and interests of the SRP to the international Antarctic community.

By late 2014 AntEco will start to deliver its first research outputs and publications and start making scientific contributions to databases and websites. A steady flow of these research outputs can be expected over the duration of the AntEco SRP. AntEco will utilise opportunities presented by SCAR to host symposia and workshops (e.g., the 2014 SCAR OSC in Auckland, the 12th International Symposium on Antarctic Earth Science in 2015, and the XXXIV SCAR and Open Science conference in 2016).

As a final milestone AntEco will report on the progress made during the course of the SRP, with reference to the contributions of Ant-Eco to Antarctic research development, research outputs, student training and development, cross disciplinary activities etc.

The key activities (both continuous and periodic) of AntEco can be visualized as follows:

Period	2013	2014	2015	2016	2017	2018	2019	2020
Organisation of AntEco steering committee								
Formation of key research and subject sectors								
Establishing an AntEco membership database of national and international organisations and laboratories								
Organisation of AntEco workshops and symposia								
Leveraging of additional operational funding								
Student training and development								
Published research outputs								
Stimulating contributions to databases and websites								
AntEco reports								

## 5. Budgetary Implications

All research (field and laboratory) activities falling within the remit of the AntEco program will be funded through National Antarctic and other funding programmes. The primary role of AntEco is therefore to stimulate, motivate, coordinate and disseminate. SCAR funding, through its support for the activities of the proposed Steering Committee (including workshops etc.) will effectively leverage an international Antarctic research budget which will be several orders of magnitude greater.

It is envisaged that annual \$20,000 SCAR budget to AntEco will be used for the following purposes:

- Employment of part-time secretarial/administrative assistance for the Chief Officer
- Contributions to the travel and subsistence costs of Steering Committee members to attend AntEco workshops and symposia
- Contributions to the travel and subsistence costs of Steering Committee members to present AntEco 'concept' papers at national and international Antarctic research workshops and symposia
- Depending on financial constraints, it may be possible to support a limited number of 'early career' bursaries for attendance (and presentation) at SCAR AntEco symposia or other appropriate fora.

Appendix 1: Interactions between Ant-Eco and other SCAR research programmes

