State of the Antarctic Ecosystem

Implementation Plan (2013)

1. Introduction

Biological diversity is the sum of all organisms in a system. These organisms collectively determine how ecosystems function and underpin the life-support system of our planet (1). The SCAR-Biology Programme - State of the Antarctic Ecosystem (AntEco) has been designed to focus on past and present patterns of biodiversity across all environments within the Antarctic, sub-Antarctic and Southern Ocean regions. The broad objectives of the programme are to increase the scientific knowledge of biodiversity, from genes to ecosystems that, coupled with increased knowledge of species biology, can be used for the conservation and management of Antarctic ecosystems.

Relatively recent initiatives such as CAML, biodiversity.aq and EBA have demonstrated how internationally coordinated research can rapidly advance knowledge of the state of Antarctic ecosystems (2, 3, 4). Such initiatives have improved our understanding of the biogeographical affinities of Antarctic biodiversity in space and time and further highlighted the importance of cross-disciplinary links with the oceanographic, geological, glaciological and climate research communities (5, 6, 7).

Through the development and maintenance of an international research network, AntEco aims to inform our understanding of current biodiversity and patterns therein, to distinguish the impact of present processes from historical signals, and to use this knowledge to develop scenarios of its future state through interdisciplinary approaches. To do so we will promote the use of both established and innovative technologies, on scales from the latest molecular analyses to remote sensing, that will provide the means for synthesis and integration across the entire region over physical and temporal scales and resolutions that until now have not been possible. While the scope of research activities supported will be broad, research priorities will be directed towards science that is policy relevant and assists in guiding management and conservation in the region.

AntEco is structured into five research sectors, each with a sector leader:

1. Spatial Ecology (Huw Griffiths, British Antarctic Survey, UK)
2. Molecular Ecology and Evolution (Jan Strugnell, Latrobe University, Australia)
3. Ecoinformatics and Systems Biology (Alison Murray, Desert Research Institute, USA)
4. Paleoecology (Dominic Hodgson, British Antarctic Survey, UK)
5. Impacts, trends and conservation (Annick Wilmotte, University Liège, Belgium).

Research will not be carried out in isolation within these sectors. Multidisciplinary approaches are a key guiding principle within AntEco, with collaborations encouraged not only between research sectors, but also more broadly across SCAR Research Programmes and other relevant SCAR Standing Committees and Expert Groups.

The AntEco Executive is comprised of the Chief Officer (Dr. Aleks Terauds), Deputy Chief Officer (Prof. Don Cowan), Secretary (Dr. Anton Van de Putte), Prof. Pete Convey and the research sector leaders (Appendix 1). The remainder of the Steering Group is comprised of leading researchers that together, represent a broad range of countries and disciplines (Appendix 2).

2. Deliverables, Timeline and Milestones ~ 3-5 pages.

2.1 The Programme

Milestones and deliverables of AntEco will be structured around three overarching inter-disciplinary questions:

1. How has Antarctic biodiversity evolved in response to past environmental change and what does this tell us about its capacity to respond to future changes?

2. What are the systematic and environmental geographic features of Antarctic biodiversity, and what mechanisms underpin the current distribution and abundance of biodiversity?

3. Given the evolved geographic distribution of diversity and forecast threats, what conservation actions are required for the preservation of biodiversity, and mitigation of, and adaptation to, change?

Aligned with these overarching questions, are the priority objectives of each research sector:

Spatial ecology
- Develop bio-physical models and provide insights into the relationship between organisms (both native and non-native) and their environment,
- Identify biodiversity hotspots, glacial refugia and vulnerable areas,
- Use biodiversity values to support spatial conservation planning decisions

Molecular ecology and evolution
- Increase understanding of the molecular evolutionary history of Antarctic and Southern Ocean biota,
- Implement established and 3rd generation sequencing techniques for exploring micro and macroevolutionary processes,
- Develop autecological studies which enhance our understanding of individual species' functional roles,
- Determine how climatic, oceanographic and tectonic changes have shaped evolution

Ecoinformatics and systems biology
- Initiate and undertake large scale data syntheses
- Identify and increase understanding of emergent properties
- Use hypotheses driven research to understand the ecological roles of microbes in Antarctic ecosystems

Paleoecology
- Determine late Quaternary and Holocene changes in biodiversity and identify which environmental factors are significantly related to these changes
- Use ancient DNA and bimolecular archaeological studies to elucidate past genetic diversity and paleoenvironments
- Examine the history of glaciation and its impact on biodiversity

Impacts, trends and conservation
- Provide the CEP with the tools it requires to properly manage and preserve the Antarctic environment
- Increase understanding of mitigation and management of threats from species transfer
- Promote evidence-based protected area designation ensuring comprehensive, adequate and representative protection

2.2 Deliverables

I. Primary publications in peer-reviewed journals

Publications in peer-reviewed journals will form the primary deliverable of the programme, again with a focus on the above overarching research questions and priority objectives. AntEco will encourage and support collaborations across disciplines and groups, with members of the Steering Group playing a key role in establishing and developing such collaborations. AntEco will aim to produce at least two publications in international peer reviewed journals for each Research Sector (or combination thereof) in each year of the programme, starting in 2014.

II. Major reports, including linkages to major SCAR activities

Members of AntEco Steering Group and their associated networks have strong links to the Antarctic Treaty System (ATS) through the Committee for Environmental Protection (CEP) and the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) as well as to the Southern Ocean Observing System (SOOS). These links will be developed and strengthened through the life of the Programme, and manifest through contribution to the submission of Working Papers, Information Papers and Background Papers to the CEP and Scientific Reports to CCAMLR. CEP contributions will be facilitated through the SCAR Standing Committee to the Antarctic Treaty System (SC-ATS) and through National Delegations as appropriate.

Several members of the AntEco Steering Group have also had, and will continue to have, direct input into the IPCC reports and associated publications and are also involved in the development of the structure and procedures of the new IPBES. Given the focus on patterns of biodiversity and the evolution of change, results from AntEco supported research will likely be exceptionally relevant to these groups in the future. AntEco members, including Steering Group members, are expected to play a significant role in the April 2014 SCAR Horizon Scan and associated outputs.

III. Other reports and grey literature

Although publications in peer-reviewed journals and major reports to international bodies (as described above) will form the majority of AntEco outputs, other reports and grey literature will be prepared as required. These might take the form of policy-ready summary documents or emerging issues syntheses for initiatives such as the Antarctic Environments Portal. Other examples include reports to National Programs, government bodies or Institutions and data papers that contain information on species distribution.

IV. Workshops and other key meetings

A number of workshops will be held each year under the auspices of AntEco. These will typically be associated with major SCAR conferences such as SCAR Open Science Conference and Biology Symposia. AntEco workshops will typically have a well-defined objective and associated output(s).

In 2014 one major and one minor workshop (both by invitation) are planned to be held just prior to the Auckland Open Science Conference:

a) From mammals to microbes: environmental drivers of biodiversity at different spatial scales in Antarctic ecosystems (~ 30 participants)

b) Non-native species eradications in Antarctica (<10 participants).

In each following year of the Programme, members of the Steering Group will develop submissions on workshop topics and these will be supported based on the level of community interest and relevance to AntEco objectives. A limited amount of travel support will be offered through a mini-grant system to some workshop participants, particularly those who are less well resourced.

AntEco will also assist in planning for, and participating in, cross-programme workshops. In particular, discussions will be held with AnT-ERA and AntClim to develop ideas that might be most effectively addressed in a bilateral or multilateral workshop setting.

In addition to workshops, AntEco will organise and convene sessions at each SCAR Conference that are aligned with the research Sectors. For example, five AntEco sessions are currently confirmed for the 2014 SCAR OSC (sessions 24-29 http://www.scar2014.com/programme/2014-scar-open-science-conference-sessions/)

V. Capacity building and education activities

In addition to several early career researchers already appointed to the Steering Group of AntEco, other key members have well-established networks of younger scientists and students. These networks will be used to ensure that the emerging cohorts of up-and-coming scientists are not only aware of, but also excited by the research priorities of AntEco and the opportunities that are available through collaborations within the AntEco network. These linkages will be further developed through regular updates and cross-linkage meetings with the Association of Polar Early Career Scientists (APECS).

Through these developed and established networks, early career scientists and students will also make an important contribution to AntEco outputs, in particular publications in peer-reviewed literature. Furthermore, AntEco has supported and will continue to support SCAR fellowship winners by providing links to relevant research programs and researchers.

A mailing list has been established for AntEco allowing the rapid dissemination of relevant information to the broader research community. This list is managed through SCAR and overseen by the Chief Officer.

VI. New data and/or meta-data

The development of good data curation and propagation practices is a primary objective of AntEco. Authors of AntEco-supported products will be encouraged to provide both metadata and new data into existing repositories, in particular biodiversity.aq and the SCAR Biodiversity Database. AntEco Secretary (Anton Van de Putte) currently holds a key position in biodiversity.aq, and will play an important role in facilitating data transfer between AntEco products and biodiversity.aq. Chief Officer (Aleks Terauds) has strong links to the SCAR Biodiversity Database, originally an EBA initiative, which is currently housed at the Australian Antarctic Data Centre. Ensuring that there is minimal overlap and better linkages between biodiversity.aq and the SCAR Biodiversity Database will also be a priority that will be facilitated by these AntEco members. Another key developing data repository is the microbial Antarctic Resource System (MARS) database (AntEco contacts – Alison Murray and Anton Van de Putte) which will also be integrated with biodiversity.aq.

AntEco also supports the Antarctic Genetic Archive (AntEco contact - Craig Cary). AGAr is a tool to link all biodiversity research being conducted in Antarctica, by housing a DNA archive. Once collected, this will enable researchers from all countries to gain access to valuable DNA samples without the necessity of going to the remote locations. This will enhance biodiversity research worldwide by making data collection more efficient, and

reduce the overall environmental impact on the pristine and fragile Antarctic environment. This continent scale biodiversity archive will be the first of its kind in the world. The archive has the capacity to hold 1 million DNA samples and can be contributed to by any scientists working in Antarctica. Once established, the archive will be available to the research community across the world.

VII. Brochures and other PR material

An AntEco presentation has been prepared and is available for download at: http://www.scar.org/researchgroups/progplanning/AntEco_Presentation_2013.pdf. AntEco Steering Group members and members of the SCAR Executive have already used this presentation to promote AntEco to National Programs and at international conferences/workshops. A poster summarising the aims and priorities of AntEco is currently being prepared and should be completed by mid-2014. Other public relations material will be prepared as necessary in response to emerging events and where appropriate in discussion with the SCAR Development Council (chaired by Peter Convey).

There is a strong feeling in the Steering Group that a bi-annual newsletter would be a useful tool in promoting the work that is being undertaken by members of the AntEco research network. Discussions are currently underway as to how this might be achieved, with the first newsletter planned for mid-late 2014.

VIII. Linkages to other international programmes and activities

AntEco Steering Group members and their research networks have well-established links with other SRPs and more broadly across the SCAR network and wider research community. Embedded cross-linkages of AntEco Steering Group members within other SCAR groups include:

Aleks Terauds (SC-ATS, SCAR Biodiversity Database), Don Cowan (Ant-ERA), Anton Van de Putte (SC-ADM, EG-ABI, biodiversity.aq), Alison Murray (EG-ABI), Mary-Anne Lea (EG-BAM), Julian Gutt (Ant-ERA); Peter Convey (Development Council; Advisory Group on Antarctic Climate Change and the Environment; Cross Linkages Group; LS-SSG); Craig Cary (ICTAR); Annick Wilmotte (LS-SSG, Belgium delegation to CEP); Angelika Brandt (LS-SSG, SOOS).

These linkages will ensure that AntEco will progress research that is consistent with SCARs Strategic Plan. As the two SCAR Biology Research Programmes, maintaining and developing links between AntEco and Ant-ERA are recognised as particularly important; however, AntEco members also have well-established research relationships with AntClim and PAIS.

Many AntEco members are also leading or key investigators in a range of international research programmes or institutions and have access to wide research networks that will also facilitate international engagement. AntEco also recognises the importance of interacting with groups like Council of Managers of National Antarctic Programs (COMNAP), and will continue to build on existing relationships with this group.

Long-term monitoring is seen as an integral part of the AntEco Programme and therefore linkages with the established Southern Ocean Observing System (SOOS) and the developing Antarctic Nearshore and Terrestrial Observing System (ANTOS) will be maintained and encouraged. Steering Group members also have existing research collaborations with the Southern Ocean Research Partnership (SORP).

3. References

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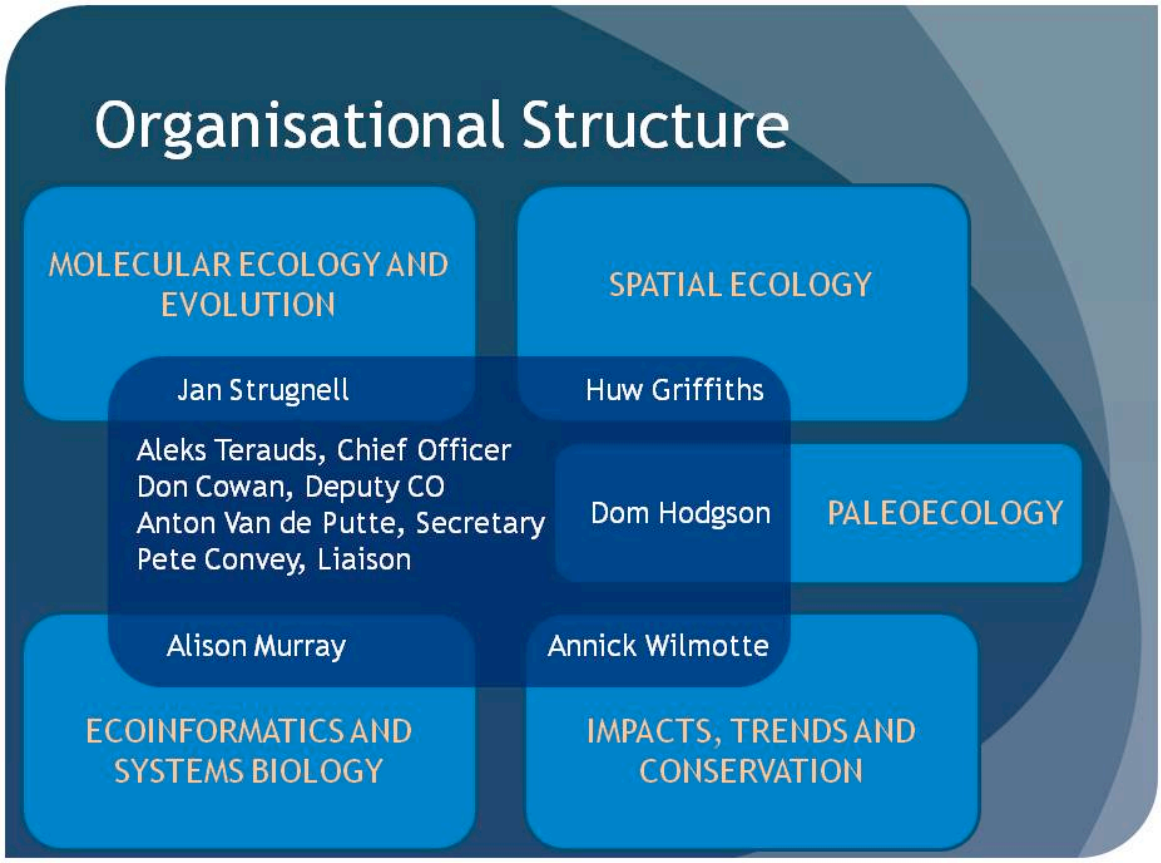
4. Appendices and References

Appendix 1 – Organisational Structure



Appendix 2 – Steering Group members

Name	Affiliation	Country	Main field of interest
Aleks Terauds	AAD	AUS	Terrestrial ecology
Don Cowan	U. Pretoria	RSA	Terrestrial microbial ecology
Pete Convey	BAS	UK	General biology
Angelika Brandt	U. Hamburg	DE	Marine biology
Alison Murray	DRI	USA	Marine microbiology
Annick Wilmotte	U. Liège	BEL	Microbiology, human impacts
Craig Cary	U. Waikato	NZ	Terrestrial microbiology
Guido di Prisco	U. Naples	IT	Marine biology
Jan Strugnell	La Trobe	AUS	Marine biology
Claudio Gonzales-Wevar	U. Chile	CHI	Marine biology
Dom Hodgson	BAS	UK	Terrestrial paleoreconstr.
Huw Griffiths	BAS	UK	Marine biology
Anton van de Putte	RBINS	BEL	Marine biology
Stefano Schiaparelli	U. Genoa	IT	Marine ecology
Mary-Ann Lea	IMAS, U Tas	AUS	Marine ecology
Conxita Avila	U. Barcelona	ESP	Marine biology
Julian Gutt	A. W. Inst.	DE	Linkage with Ant-ERA