SCAR's Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica

Background

This Scientific Committee on Antarctic Research (SCAR) Code of Conduct (CoC) provides guidance for scientists undertaking terrestrial scientific field research in Antarctica. Reference was made to the need for this CoC during CEP IX (CEP IX Final Report; para. 132). A CoC was approved by the XXX SCAR Delegates Meeting in Moscow July 2008. SCAR presented the CoC to the CEP XII (2009) as IP 4. A further review of the CoC was coordinated by SCAR in 2017, through experts and the broader SCAR community, and the revised version submitted for consideration at CEP XX (WP 18). Further consultation was carried out in the 2017/18 intersessional period, including with COMNAP.

This CoC has its origins in the 2006 CEP discussions on avoiding the introduction of propagules[1] of non-native species. Since those discussions, the CoC has been broadened to provide guidance to design and conduct terrestrial scientific field research in a way that minimises environmental impacts, including, but not limited to, the transfer of non-native species.

Introduction

Antarctica contains many unique geological, paleontological, glaciological, and biological features. This landscape and its biological communities often have limited natural ability to recover from disturbance. Many features could be easily and irreversibly damaged. This CoC provides recommendations on how scientists and associated personnel can undertake scientific field activities while protecting the Antarctic environment for future generations, as well as not compromising future scientific research. These protocols ensure that human presence will have as little impact as possible. All personnel undertaking scientific research in Antarctica should be familiar with this CoC and field activities in Antarctica should be designed to have as little environmental impact as possible.

The Protocol on Environmental Protection to the Antarctic Treaty (also known as the Madrid Protocol or Environmental Protocol) provides a basis for environmental protection and management in the Antarctic. Climate change and increasing pressure from human activities suggest that comprehensive guidelines are needed to protect the unique features of Antarctica. This CoC complements the relevant sections of the Protocol and provides guidance for researchers conducting land-based field research (including, but not limited to - limnological, terrestrial, coastal/littoral, glaciological, biological, paleontological, sociological, historical, archaeological, climatological and geological research). A 'field' activity is defined here as any scientific activity, and the logistics to support this activity, which is conducted in the natural environment, irrespective of its duration.

All countries with researchers that undertake terrestrial field research in Antarctica are encouraged to include this CoC within their operational procedures and to ensure that personnel undertaking or supporting scientific field research follow this CoC.

It is recommended that this CoC be followed by all personnel undertaking scientific research to the maximum extent possible and as long as it does not affect the safety of the expedition.

General Guidelines

Antarctic scientists potentially have a higher likelihood of carrying non-native propagules to Antarctic [and sub-Antarctic] ecosystems than other Antarctic travellers because their field of study often takes them to alpine or northern polar habitats. Moreover, Antarctic scientists also move between the Antarctic

[1] Propagule: means of propagation, *eg*, seed, spore, egg, live insect (including microbes in non-sterile soil)

Conservation Biogeographic Regions (ACBRs)[2,3,4] which can differ substantially in biodiversity and geodiversity. In the process of conducting research within these habitats, Antarctic scientists can inadvertently entrain propagules and/or soil on clothing, equipment and equipment cases. If these items are then taken to the Antarctic, or among ACBRs, and they have not been cleaned/sterilised to remove or kill the propagules, an opportunity to transfer such material to and around Antarctica is created. Equipment should be properly cleaned before it enters the Antarctic, or moves between regions within Antarctica.

The implications of human transfer of taxa between locations can range from the modification of the genetic structure of populations to changes in local biodiversity and subsequent effects on community dynamics. Human transfer may involve species (or their propagules) from sites outside Antarctica, and such species would in most cases be considered non-native. However, given the differences between regions, intra-regional transfer of indigenous species also needs to be minimised. Such accidental movement of indigenous biota could compromise scientific studies of molecular adaptation, regional evolution and biogeography and reduce the inherent value that Antarctica offers as a system with very limited anthropogenic influence.

Before going into the field

Report planned activities to the appropriate national authority as thoroughly as possible and well in advance, in order to allow an assessment of the environmental impact that may be caused on the field site(s) visited, as required by Annex I to the Protocol on Environmental Protection to the Antarctic Treaty.

Prior to conducting any scientific activity, it is essential to consider and clearly define the scope of the planned activity, including its area, duration, and intensity.

Be aware of the cumulative impacts of the activity, both by itself and in combination with other activities within the region. Consider lower impact alternatives to the activity and re-use of existing facilities wherever possible.

In order to minimise environmental impacts of field activities:

i. Choose sites as close as possible to research stations and use existing pathways.
ii. Limit the number of visitors to field sites to the people required to carry out the fieldwork.
iii. Where possible avoid areas that are especially vulnerable to disturbance such as vegetated areas, breeding sites, patterned ground, and water bodies.
iv. Re-use existing sites wherever possible.
v. Consider the capacity required to prevent and respond promptly and effectively to any environmental accident or incident.

Everything taken into the field must be cleaned before being taken into the field, and returned to the main station for proper cleaning, where it is feasible and safe to do so.

Precautions should be taken to avoid introduction of non-native species, or of chemical contamination, and transfer of materials between sites:

i. Ensure that all equipment and clothing, including footwear, is thoroughly cleaned.
ii. Avoid taking unnecessary packaging and materials into the field. Note that several products used for packaging are prohibited in Antarctica, such as polystyrene beads or chips.

Once in the field

Particular care should be taken in areas with sensitive biological, geological, paleontological, historical, archaeological and geomorphological features such as bird and seal colonies, roosting areas, vegetated areas, freshwater lakes and ponds, sand dunes, screes, fluvial terraces, fossil beds, fragile or vulnerable landforms

[2] Terauds A, Chown SL, Morgan F, Peat HJ, Watts DJ, Keys H, Convey P & Bergstrom DM (2012) Conservation biogeography of the Antarctic. *Diversity and Distributions* 18:726-741.
[3] Terauds A & Lee JR (2016) Antarctic biogeography revisited: updating the Antarctic Conservation Biogeographic Regions. *Diversity and Distributions* 22:836-840.
[4] Resolution 6 (2012) - ATCM XXXV Hobart; Resolution 3 (2017) - ATCM XL Beijing

(*eg*, patterned ground, unconsolidated or poorly consolidated sediments, biological soil crusts, weathering pits, water-saturated soils during summer melt periods, etc.), ice core pyramids and ventifacts.

Avoid unnecessary disturbance of Antarctic flora and fauna. Avoid areas where wildlife is easily disturbed, especially during the breeding season.

When taking samples (*ie*, geological, paleontological, biological, ice, etc.) take as small a sample as possible to minimise environmental impacts. Only take samples in accordance with the Environmental Impact Assessment undertaken for the activity and, where appropriate, any permits issued by an appropriate national authority.

The location of any spill, camp site, soil pit, drilling site, sampling site, experimental site, or any other disturbance should be recorded (preferably using a GPS), and reported to the appropriate national authority, for the benefit of future researchers.

Minimise impacts when moving around in the environment:

i. Stay on established trails where available.
ii. Avoid walking on vegetated areas, streambeds, lake margins, and delicate rock, landforms and soil formations.
iii. Restrict ground vehicle usage to snow and ice surfaces, or designated tracks, wherever possible.
iv. Where feasible, use recognized helicopter landing sites and ensure that markers for helicopter pads are clearly visible from the air.
v. Minimise the disturbance to wildlife by following the ATCM guidelines for operations of aircraft near concentrations of birds[5].
vi. Restore any disturbances caused by activities, as long as such restoration does not cause any further environmental impacts.
vii. Algae and invertebrates live beneath stones. Moving rocks and stones should therefore be minimised to the extent required for the work being undertaken.
viii. Do not build cairns.

Management of scientific field sites

Minimise environmental impacts of field sites:

i. Make sites no larger than needed for the proposed scientific activities.
ii. Keep sites tidy during use.
iii. Avoid activities which could result in the dispersal of foreign materials into the environment. In particular, avoid the use of spray paint, wooden post markers, etc., and, where feasible, conduct activities such as sawing or unpacking inside a tent or hut.
iv. Secure equipment from being blown away or stolen by inquisitive birds (*eg*, skuas, penguins).
v. Wherever possible, all precautionary measures should be taken to ensure collection and removal of human waste and grey water.

When the work is complete, restore sites as far as feasible without creating further environmental impact. Remember that sites may require subsequent monitoring to comply with the Protocol for Environmental Protection to the Antarctic Treaty.

As it is important to prevent the introduction of foreign materials and contaminants into the environment:

i. Avoid materials liable to shatter at low temperatures, *eg*, polyethylene-based plastics.
ii. Take care when handling fuel, chemicals and isotopes (stable or radioactive) to avoid spills or unintentional release into the environment. Consider the recommendations in the CEP Clean-up Manual[6].
iii. Store and handle fuel and chemicals using appropriate containers.

[5] ATCM Resolution 2 (2004) Antarctic Treaty Consultative Meeting XXVII – Cape Town.
[6] Committee for Environmental Protection Clean-up Manual (http://www.ats.aq/documents/recatt/att540_e.pdf)

iv. Use drip trays where possible when handling fuels or other liquids and take special care when handling fuel in high winds.

Report any environmental accident or incident to the appropriate national authority.

If equipment is planned to be installed in the field in the longer term:

i. Ensure an Environmental Impact Assessment is undertaken prior to any installation, as required by Annex I to the Protocol for Environmental Protection to the Antarctic Treaty.

ii. Clearly identify any equipment by country, name of the principal investigator and year of installation, and state the duration of the deployment.

iii. Make sure installations can be retrieved and removed when no longer required, unless it is impractical, or would result in a higher environmental impact, or have been identified as useful for long-term monitoring and/or research.

Do not displace materials or collect samples of any kind, except in accordance with the associated Environmental Impact Assessment and any required permits.

When undertaking research with live animals, consider the legal requirements of national authorities and those set out in *SCAR's Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica*.

Field camps

Camping and scientific equipment should be cleaned before being brought into the Antarctic or before being transferred between sites.

Minimise the environmental footprint of field camps by:

i. Camping on permanent snow or glaciers where possible and only if safe to do so.

ii. Locating camps as far as feasible from lake margins, stream beds and associated fans, and vegetated areas, to avoid damage or contamination.

iii. Taking special care to ensure that no food or wastes are accessible to animals.

iv. Re-using campsites whenever possible.

v. Keeping camps tidy during use and restore, as far as is feasible and without causing any further environmental damage, after use.

vi. Using solar and wind power as much as possible to minimise fuel usage.

Ensure that equipment and supplies are properly secured at all times to avoid dispersion by high winds or helicopter downdrafts. Remember that in some locations high velocity katabatic winds can arrive suddenly and with little warning.

Remember that when working in an ASPA or ASMA, the area management plan may have additional requirements for field camps. Follow any conditions contained in the entry permit required for access to an ASPA. Visitor report forms[7] should be submitted to the appropriate national authority as soon as practicable.

Location-specific guidelines

Lakes and streams

Choose sampling equipment that is the least destructive to the aquatic or coastal environment. Sample carefully and avoid excessive and unnecessary sampling. Minimise cumulative impact if sampling repeatedly at a location over a long period or several field seasons. Use of dredges, trawls and box corers should be minimised.

Aquatic ecosystems in Antarctica are typically extremely poor in nutrients (except those with animal influence) and thus are sensitive to anthropogenic pollution. Measures should be put in place to minimise, as far as possible, release of human waste into the environment.

[7] See Appendix 2 of the Committee for Environmental Protection Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. Resolution 2 – ATCMXXXIV CEP XIV – Buenos Aires (2011)

Avoid walking in streams and lake beds or too close to their margins as this may disturb biota and affect bank stability and water flow patterns. When a crossing must be made, use designated crossing points if available, otherwise walk on rocks if possible.

Minimise the use of vehicles on lake ice if possible. If access to the water body is required for scientific research, use non-motorised boats whenever possible.

Ensure that all sampling equipment is tethered or otherwise secured and does not contaminate the water body.

Clean all sampling equipment before using it in another water body in order to avoid cross-contamination. Alternatively, use separate equipment at different sites.

Wherever possible use flumes, not weirs, when monitoring streams to minimise any potential impacts of the study.

To the maximum extent practicable, avoid the use of stable isotope tracers at the complete ecosystem level, but rather use them in closed vessels. Consider the use of naturally occurring tracers in experiments. Radioactive isotope tracers should only be used in closed vessels or in *ex-situ* experiments. No stable or radioactive isotope tracer waste should be disposed into ecosystems. Document all tracer use (location, type of tracer, amount) and report this information to the appropriate national authority.

To avoid introduction of contaminants or disturbance of the stratification of the water body and its sediments:

i. Do not swim or dive in lakes, unless it is required for scientific purposes.
ii. Remove all unwanted water and sediment materials from the site, even on permanently ice-covered lakes, rather than discharging them back into the lake.
iii. Ensure that nothing is left frozen into the lake ice that may ablate out.
iv. Consider using a remotely operated underwater vehicle (ROV) as a tool for underwater and under-ice research in lakes and coastal/littoral habitats.

Ice-free environments

Terrestrial vegetation includes very slow growing species and fragile growth forms. Damage by trampling may remain visible for years or even decades and further impact upon the many terrestrial invertebrate species that live in soils and feed on soil algae.

In high use areas, use existing trails where possible in order to avoid disturbing large areas of vegetation and/or soil or surface material. In lower use areas, consider whether trails or a dispersed pattern of travel would have least impact and implement accordingly. Local knowledge will often be a useful guide.

Clean all equipment and footwear, as far as is feasible, between sites to avoid transfer of soil and propagules among sites.

When sampling in vegetated areas, ensure that the site is restored as far as is feasible without causing any further environmental impact.

Limit the use of mechanical equipment for sample collection, whenever possible.

When sampling soil in desert areas, use groundsheets to contain excavated material to minimise the extent of damage to the desert pavement. Backfill soil pits and, as far as feasible, replace the desert pavement materials at the soil surface to restore the site appearance.

Do not disturb or remove rocks, minerals, fossils, meteorites or ventifacts unless it is necessary for the permitted research.

For specific guidance on undertaking scientific activities in terrestrial geothermally heated areas, please consult the *SCAR Code of Conduct for Activity within Terrestrial Geothermal Environments in Antarctica*.

Glaciers and ice fields

Remember that the use of water in hot water drills, and the use of other drilling fluids, could contaminate the isotopic and chemical record within the glacier ice.

Given that the hydrological systems under glaciers and ice sheets are connected to the wider environment and downstream contamination could occur, exercise caution when using chemical-based fluids to drill to the base of an ice sheet. Similar caution is necessary when drilling is made through ice shelves to ocean beneath. For further information on activities in subglacial environments, please consult *SCAR's Code of Conduct for the Exploration and Research of Subglacial Aquatic Environments*.