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PERSPECTIVE

How committed are we to monitoring human impacts in Antarctica?



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Under the Antarctic Treaty System, environmental monitoring is a legal obligation for signatory nations and an essential tool for managers attempting to minimize local human impacts, but is it given the importance it merits?

Antarctica is a vast frozen continent with an area around 1.5 times that of Europe (14 000 000 km²), but the majority of its terrestrial life is found on multiple outcrops or 'islands' of ice-free coastal ground, with a combined area of ~6000 km², equivalent to four times that of Greater London (Tin *et al* 2009). The biological communities of these ice-free terrestrial habitats are dominated by a small number of biological groups, primarily mosses, lichens, microinvertebrates and microorganisms. They include many endemic species, while birds and marine mammals use coastal areas as breeding sites (Chown and Convey 2007).

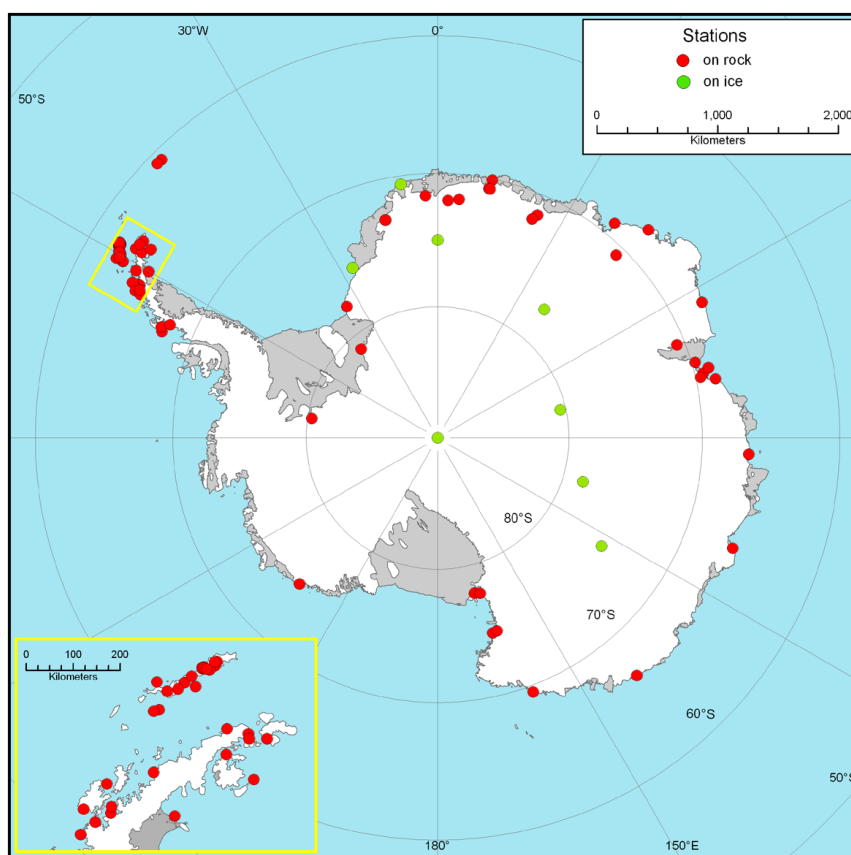


Figure 1. Map of the Antarctic Treaty area (south of latitude 60°S) showing the locations of year-round and seasonal stations built on rock or permanent ice (i.e. ice sheets or ice shelves). Data on station locations were taken from the Council of Managers of National Antarctic Programs website (COMNAP 2010). There is evidence to suggest that although these stations are registered on the COMNAP list, a number of stations are not regularly occupied or in use (see United Kingdom *et al* 2006, p9).

Since the influx of national scientific research programmes and infrastructure that accompanied the International Geophysical Year (1957–1958), Antarctica's habitats have been encroached upon increasingly by human activities. Over 120 research stations have been built (~75 currently operational) with the great majority located on ice-free coastal ground to allow ease of access by ship. (Headland 2009, COMNAP 2010). Construction of cargo and personnel landing and handling facilities, station buildings, airport infrastructure, roads and fuel storage areas have, to varying degrees, destroyed native vegetation and terrestrial fauna and displaced bird and marine mammals from breeding sites in their immediate environment. An early history of poor environmental management and waste disposal practices around many stations has left a legacy of fuel-contaminated ground and abandoned waste sites in adjacent marine and terrestrial environments (Tin *et al* 2009).

Construction of research stations and other infrastructure fulfils two national objectives: (1) supporting geopolitical aspirations of claimant nations and (2) demonstrating a significant commitment to undertaking science in Antarctica, which is a prerequisite for attaining consultative status at the Antarctic Treaty Consultative Meeting. However, these objectives may not be supported equally, with little or no science performed routinely at some stations (United Kingdom *et al* 2006). In addition, co-ordination of science activities between nations—another aspiration under the Antarctic Treaty—is often lacking, leading to duplication of research between national programmes, and even that undertaken at nearby stations. In some cases, components of national research programmes lack any international, open or objective assessment of quality. Nevertheless, new nations continue to become involved in Antarctic affairs, and almost inevitably seek to establish their own infrastructure, while some established Treaty Parties continue to further expand their existing logistic and infrastructure footprints. Despite calls for nations to share existing infrastructure or reuse abandoned stations (ATCM 2006), new stations continue to be constructed on pristine sites, with the Antarctic terrestrial environment in particular coming under increased pressure.

The Protocol on Environmental Protection to the Antarctic Treaty (commonly known as the Environmental Protocol), which came into force in 1998, sets out common minimum standards for environmental management by all Antarctic Treaty Parties. Under the Protocol, it is mandatory to regularly monitor the environmental impacts caused by any new infrastructure that requires the completion of a Comprehensive Environmental Evaluation during the planning, as would be required for research stations or other large building projects. Ideally, monitoring should include assessment of levels of physical disruption of marine and terrestrial habitats, and should record levels of pollutants and also their impacts upon the full range of biological groups within local ecosystems. Biodiversity surveys should also be undertaken, in order that introduced non-native species can be identified at an early stage and eradicated (Hughes and Convey 2010).

But where can the scientific data describing national Antarctic programme impacts be found? Some nations have a good track record of publishing environmental monitoring data, but the large majority do not. With around 75 active stations, monitoring research should be well represented in the scientific literature, but data for most stations are not available. Furthermore, Antarctic Treaty signatory nations are required to supply details of their monitoring work through the Antarctic Treaty System's Electronic Information Exchange System (see www.ats.aq/e/ie.htm), yet only three out of 28 Treaty nations did so for 2008/2009.

In their recent synthesis paper, Kennicutt *et al* (2010) describe the results of a long-term monitoring programme at the United States' McMurdo Station, giving us a comprehensive picture of human impacts at this location. The high quality and breadth of this research makes it one of the best-documented

and longest-running monitoring programmes within Antarctica to date. Yet, why is this work so exceptional, when the USA have simply fulfilled their obligations under the Environmental Protocol? Monitoring programmes of this standard should be undertaken for all stations and large infrastructure. Factors preventing this may include (1) a lack of monitoring expertise or access to sophisticated techniques, particularly by smaller or less well-funded Antarctic programmes, and (2) the lack of importance or prestige attributed to 'routine' monitoring or survey programmes by science funding bodies, compared to other 'forefront' science areas.

With little formal international scrutiny other than occasional station inspections, a lack of enforcement mechanisms in place to penalize contravention of the provisions of the Antarctic Treaty and its related legal instruments, and a need to maintain good diplomatic relations between Antarctic Treaty Parties, nations are under little pressure to prioritize human impact monitoring. Despite the efforts of the Scientific Committee for Antarctic Research and COMNAP, most Antarctic nations still act individually, with little co-ordination of monitoring effort or use of standardized techniques. Close examination of the Environmental Protocol even casts some doubt over whether monitoring of infrastructure constructed before its implementation in 1998 is a formal obligation, although many would maintain that failure to do so would be contrary to the spirit of the Protocol.

While it can be hoped that most signatory nations take their Antarctic environmental responsibilities seriously, recent reports of poor environmental practice show that not all national programmes adhere fully to even the minimum requirements of the Environmental Protocol (Braun *et al* 2010). If basic environmental practice is poor, then standards of environmental monitoring may also be poor or non-existent. In stark contrast, researchers from Antarctic programmes who willingly disseminate their results through the scientific literature deserve credit as they allow other nations to learn from their efforts. Until all Antarctic Treaty nations engage with their monitoring obligations and develop together a co-ordinated continent-wide view of human impacts, Antarctica's environmental values will remain under threat of continued degradation and the principles of the Antarctic Treaty brought into disrepute.

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