



**Queensland University of Technology**  
**submission to the**  
**Joint Standing Committee on the National Capital and External Territories**  
**inquiry into the importance of Antarctica to Australia’s national interests**

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**Introduction**

Australia needs a strong Antarctic science presence. The nation has a long history of influence and leadership in Antarctica: we are an original signatory to the Antarctic Treaty; Antarctic exploration and innovation are core to our national identity. Australia is a global leader in Antarctic science, conservation science, data science, and technological innovation. Recent scientific advances uniting these fields has set a foundation for Australia to deliver strongly into Antarctic science – the currency of the Antarctic Treaty System. Australia’s legitimacy and authority on the continent and in its surrounding waters is entirely a function of the seriousness of our commitment to Antarctic science. This inquiry is therefore an exciting opportunity to forefront and consolidate Australia’s leading scientific role at the south pole.

QUT is a partner in the *Australian Research Council* Special Research Initiative ‘Securing Antarctica’s Environmental Future’. At QUT, we apply our expertise in data science, robotics, conservation ecology, and decision science to address policy-relevant questions about Antarctic

ecosystems, governance, and protection. Our research is spearheaded by ARC Fellows, Fellows of the Australian Academy of Science, board members of national organisations, science-to-government experts, and field-leading researchers. Through the Special Research Initiative, QUT works with the Australian Antarctic Division, other university partners (Monash University, University of Adelaide, University of Wollongong, James Cook University, and University of Sydney), other government partners (ANSTO, Geoscience Australia, and the Bureau of Meteorology) and museums (South Australian and Western Australian) in a national consortium driving Antarctic research excellence. The ARC-funded SRI program is an exemplary demonstration of flourishing relationships between universities and the AAD.

Diversity delivers better outcomes when solving multifaceted, complex problems like Antarctic environmental protection - diversity of expertise and experience, across multiple institutions and disciplines. Australia must draw the best talent to leverage the greatest expertise, capability, and capacity, no matter where this talent is based. Ongoing, structured collaboration between universities and the AAD enables innovative and creative science. Universities allow for blue-sky, riskier, explorative, cutting-edge research that can embrace the unknown, while mission-directed government research is typically applied and sustained, bringing deep subject-matter expertise, delivering to policy, informing management, and tapping into geopolitical insights. Universities are boosting AAD research with access to new infrastructure, new funding sources, expanded and diverse workforce, and expertise. Benefits to universities from AAD include increased logistic and operational support, expert domain knowledge, and insight to government priorities. This triangulated approach – with a carefully constituted university consortium working in concert with and complementing agency objectives – is the best model to extract full value from Australia’s distributed Antarctic science capability.

## **1. Importance of upholding the principles of the Antarctic Treaty System for Australia’s national interest**

### **Maintaining Antarctica as a place dedicated to peace and science**

Australia’s territorial claim, the largest of all nations, brings a commitment to the international community to maintain the principles of the Antarctic Treaty System (ATS). It is in Australia’s national interests to maintain and demonstrate leadership in this environmental and geopolitical stewardship. The ATS, and Australia’s prominence within it, affords visibility and influence over Antarctic governance and on-continent activities. If Antarctica were a country it would be one of our nearest neighbours; Antarctic waters form the southern boundary of our nation. If the ATS were to collapse, our near southern neighbour would have no governance over military, mining, and science activities, and could become exposed to exploitation, unregulated occupation, unrestrained pollution and potentially catastrophic loss of biodiversity and environmental integrity. Australia would lose visibility and influence, and would be more exposed than nearly any other nation to potential detrimental effects. It is vastly in our national interest to prevent the development of a wild west to our south; and the explicit and public continuation of our serious Antarctic science effort is the way to preserve and further develop the beneficial ATS governance arrangements.

In addition to our own national interest – for the strategic reasons discussed under this term of reference as well as the intrinsic scientific reasons discussed below under the other terms of reference – it is also in global best-interests to maintain an effective Antarctic Treaty System. Antarctica is non-militarised, has no sovereign states, is largely absent of commercial interest, and continually demonstrates 60+ years of successful international diplomacy of global relationships and stability. Antarctic governance is a model of international relations, negotiations, and collaborative policy-setting. This example instils confidence for emerging and future multinational treaties, e.g. United Nations Biodiversity of Areas Beyond National Jurisdiction (BBNJ) Treaty for the high seas. In Antarctica, when need arises (e.g., when an icebreaker is stuck in the ice or personnel require medical evacuation), countries work together to aid each other, *quid pro quo*. The Antarctic Treaty

Consultative Meetings enable open discussion about domestic and global issues that may stymie the success of Antarctic science (e.g., pollution, wars, trade sanctions), putting pressure on global leadership on issues tangential to Antarctica.

International Antarctic diplomacy is unique, with a historical disinterest in global geopolitical turmoil. The Antarctic Treaty System prioritises peace, science, collaboration and transparency, despite tensions in diplomatic relationships in other contexts. Benefits to Australia of a functioning ATS include global stability, strengthened bilateral diplomatic relationships, a framework for a multi-national approach to scientific discovery, and lessons about conflict resolution and collaboration relevant to other international diplomatic systems.

### **Expanded presence through innovations in remote monitoring technology**

Remote monitoring (e.g. via uncrewed drones) untethers Australia's scientific footprint from stations, especially with improvements to drone technology (longer flights, broader coverage, and new sensors). This broadens our presence on the continent, and reinforces Australia's position as an Antarctic leader. Antarctica is a vast continent with an extremely harsh environment, requiring bespoke innovations to drone technology and data processing.

Better data – more frequent, wider-ranging, with better accuracy – enables better science and science-informed policy. Data from remote sensing is critical for Antarctic science as it enables access to remote, inaccessible, and untouched locations. Remote sensing in Antarctica provides us with a whole new understanding of the Antarctic landscape, its values, and extent. It helps us to understand the current environment and enables us to determine the extent of human activity in the region. Beyond Antarctica, benefits from remote monitoring innovations will deliver into Australia's broader needs for low-impact monitoring – e.g. monitoring other World Heritage Areas like the Great Barrier Reef, remote central Australia, and offshore islands.

Universities, and particularly QUT, play a crucial role in the technological innovations needed to create remote technology hardware that can operate in Antarctica and other similarly harsh environments like deep ocean, Mars and the Moon. New advanced technologies and associated data-processing techniques boost Australian Antarctic Division's monitoring abilities, reporting requirements, and the ecological, hydrological, and glaciological science that benefit from improved data.

### **Understanding the Antarctic Treaty System and our place in it**

The Antarctic Treaty is a complex multinational geopolitical system of 56 countries. To support Australia's objectives, and the persistence of the Treaty System, we need to study and understand this unique governance structure. A deep understanding of how nations interact in the ATS can also offer opportunities to understand and frame broader geopolitical relationships and events. This is particularly important in the context of other multinational treaties Australia is involved in (e.g. BBNJ and UN).

University research led by mathematicians, social scientists, and law scholars is generating new knowledge about the speed, efficacy, and political structure of the ATS. Understanding the Antarctic governance system and how it is evolving helps Australia to position our domestic Antarctic actions and policy positions. This work boosts Australian Antarctic Division's policy branch and the policy-relevance of all Australian Antarctic science.

## **2. Conserving and protecting the unique biodiversity and environment of Antarctica for Australia's national interests**

### **Conservation planning for protected areas in Antarctica**

Australia's territorial claim covers 42% of the Antarctic continent. Our strong relationship with this region of East Antarctica means we have a responsibility to protect its unique and fragile

biodiversity. Australians value Antarctica as a wilderness. No one wants species to go extinct – especially not species that live in or depend upon Antarctica or any Australian territory. The Australian public values Antarctic wildlife and Antarctic wilderness; its protection is therefore in the interests of the nation. Wildlife protected under Australia's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (committing us to their protection and management) forage and travel annually in Antarctic waters (e.g., blue whales, wandering albatross) while others arrive in summer to breed on land (e.g., southern elephant seals, giant petrels).

Despite its geographic isolation and the umbrella of the Antarctic Treaty System, Antarctic biodiversity and environments are still at risk. Currently under the Antarctic Treaty System, protection for Antarctic species and environments is inadequate, unrepresentative, and at risk. There is a need and international political appetite to expand the protected areas of Antarctica – this should be done in a systematic, transparent, and defensible way. Australia is a global leader in environmental protection and evidence-based protected area planning and management. Further, we are global leaders in conservation research, designing the methods needed to execute planning for the best possible outcomes, particularly in complex and changing systems.

Collaborative research between universities and the AAD is building an understanding of Antarctic biodiversity. QUT leads research in how to effectively gather data, how best to analyse data about wildlife that comes from different sources, how to integrate multiple data to design representative protected areas and how that data can form a strong foundation of evidence to plan large-scale protection of Antarctic biodiversity. In collaboration with AAD, QUT scientists are working to determine how best to use remote technologies in Antarctica in order to reduce the impact of research on species and environments.

### **3. Antarctic science's role in developing a better understanding of global environmental and climate science**

#### **A natural laboratory to understand species' responses to environment**

Antarctic biodiversity represents life at the limit – of temperature, environment, isolation, and geographic range. Antarctic species have evolved and adapted to survive in the most inhospitable condition on Earth. This includes Antarctic-specific species, but also those that occur in other places in the world in vastly different conditions. Antarctica is a natural laboratory for studying how environment and climate influence species survival and the evolution of life. Nowhere else on Earth can we study these processes in the absence of confounding human impacts such as agriculture, land clearance, pollution, and exploitation. There is an unrivalled purity and simplicity to Antarctica and its biodiversity.

Collaboration between AAD and university science allows broader lessons to be drawn from Antarctic-specific work. Learning about life in Antarctica informs and shapes our knowledge of other systems including Australia itself. By quantifying how climate and environment drive species in the simple Antarctic system, we better understand how species rely on key features of the environment. This understanding then transfers to an Australian context. For example, measuring these key biology fundamentals in Antarctica, where we have simple ecosystems and an absence of bushfire, drought, and land-clearing, enables us to better predict how Australian biodiversity will respond to climate change in the future.

#### **Understanding invasive species by learning about Antarctica**

Invasive species are a global problem, particularly in the isolated island nation of Australia, where the introduction of invasive species like cats has proven to be a catastrophic change to long-established ecosystems. Antarctica and its islands present a unique opportunity to understand how invasive species arrive, which ones establish, and how they interact with native species. For example, research into the introduction of weeds, cats, rats, and mice into Australia's sub-Antarctic Macquarie and Heard Islands illuminates how invasive species expand into and catastrophically

damage pristine ecosystems. Australia executed an extensive invasive species eradication campaign on Macquarie Island, from which we learned how to eradicate multiple invasive species. QUT-led research on these invaded Antarctic systems, their management, and their subsequent recovery has created a knowledge base for eradicating invasive species in other Australian island ecosystems (e.g., Dirk Hartog, Lord Howe, Christmas, Norfolk, and Kangaroo Islands). Novel, non-invasive remote sensing techniques for monitoring the response of native species (some EPBC-listed) have been developed in these regions and are now informing the management of post-eradication ecosystems in Australia and beyond.

Antarctic biosecurity is an unrivalled global, multi-sectoral, collaborative effort. Research into biosecurity practices, protocols, risks, and successes in Antarctica provide incredibly valuable insights for biosecurity transferable to other systems. In collaboration with the AAD, QUT performs research on biosecurity, identifying how species are transported, and what type of species get through management and become invasive due to their unique traits. Australia is a leader in Antarctic and domestic biosecurity, with benefits across many sectors from biosecurity innovations.

#### **4. Antarctic science contributing to Australia's economic and social development**

##### **Antarctic digital sovereignty**

Australia asserts digital sovereignty over Antarctica when we maintain the authority to govern, manage, and use Antarctic data specific to Australia's needs. This is implemented by Australia owning and governing a complete data pipeline, including collection, storage, access and analysis, which underpins decision-making, and is embedded in policy. True digital sovereignty would minimise Australia's reliance on any other nation's Antarctic science programs for digital or data needs. Our data would be held in the Australian Antarctic Data Centre (based at AAD) and be easily accessible to enable rapid response to emerging policy and management concerns. Digital sovereignty would allow maximum use of valuable data (leveraging greater outcomes of existing data), and enable data-driven decisions about Australia's activities in Antarctica, and more broadly (e.g. fishery management and global climate science). It would also provide greater insights and data-informed decision capability regarding continental activities outside Australia's own range and remit.

Australian universities – particularly QUT – house significant expertise in data science. Collaborative university structures like the *Australian Data Science Network* and the *QUT Centre for Data Science* have the expertise and freedom to develop new analytic approaches that may be bespoke, or general and broad-ranging in their application. Universities with large data science teams are positioned for rapid processing and analysis of data as it arises, as well as novel and emergent approaches on data mining and data integration. For example, a new biodiversity database produced by AAD is already being analysed at QUT and used to inform decision analysis. This demonstrates the strong relationship between AAD, QUT and other institutions across the university research sector, allowing for rapid response to emerging data arising from AAD.

##### **Co-benefits of Australia's Antarctic technology and data innovation**

Much of the science and innovation Australia develops for Antarctica is not necessarily Antarctic-specific – especially those emerging from the university sector. These innovations and findings represent a significant additional windfall gain from undertaking Antarctic science, as they have wide-ranging benefits to other ecosystems, contexts, and sectors of the Australian economy. By advancing data science and robotics, university research is driving innovation that is motivated by Antarctic science through deep collaboration with AAD, while also having many non-Antarctic collateral benefits. Advanced drones, novel sensors, analytical techniques for understanding remotely-sensed data, and data integration methods being developed at QUT are all applicable across the Australian economy, society, and environment. Australia's economy benefits from innovation via the new technologies and methods themselves (e.g. commercialisation in other contexts) and the use of those innovations to improve Australian society.

### **Broad-reaching benefits from Antarctic ecosystems**

The conservation of Antarctic biodiversity has far reaching benefits beyond Antarctica, and is best achieved by university and government science acting in concert. Migratory species are encompassed within this area protection, many of which are critical to Australia's ecosystems and are deeply valued by the Australian public. For example, marine ecosystems around the world, including Australian fisheries, rely upon Antarctic krill; humpback whales, which contribute to Australian tourism industries, spend part of their lifecycle in the Southern Ocean to feed annually before returning to Australian waters. At a whole-ecosystem level, Antarctica is the last true wilderness on the globe. In the Anthropocene epoch, when human impacts are far-reaching and easily observed, people want to believe that there is still true wilderness somewhere in the world.