

Guest Editorial

Long-term studies: lessons from Byers Peninsula

Long-term data show that the western portion of the Antarctic Peninsula is one of the most rapidly warming regions on Earth. Clearly these temperature changes not only affect the terrestrial and freshwater ecosystems but also facilitate biological invasions through milder climatic conditions and increased human movements. This issue of *Antarctic Science* illustrates how individual national programmes, supporting international and transdisciplinary initiatives, can contribute to a better understanding of the state of Antarctic terrestrial/freshwater ecosystems, and how they are responding to environmental changes. This long-term, interdisciplinary approach at Byers Peninsula, Livingston Island, organized by the Spanish national programme, complements other long-term ecological monitoring such as the McMurdo Dry Valleys Long-Term Ecological Research (MCM-LTER) at $\sim 78^{\circ}\text{S}$ in East Antarctica. Both these sites have yielded information about long-term trends in how terrestrial ecosystems respond to changing climatic variables, and provide important information about the nature and sensitivity to climatic changes in these very different locations. The investigations at Byers serve as an excellent model for how individual national programmes can not only make significant contributions to documenting change, but also provide an important pan-Antarctic understanding when these data are compared to other long-term datasets.

Baseline data like those from Byers are essential to understand and confirm the changes and observations. As we speak, our climatology, meteorology and glaciology colleagues are continually monitoring change in the Antarctic using dedicated instrumentation and remote sensing technologies. We know from the meteorological records that changes in mean temperatures are occurring at numerous locations around Antarctica. GRACE satellite data provides information on ice mass loss from around the continent. Yet how are the terrestrial and freshwater ecosystems responding to these changes? With the exception of Byers and Taylor Valley we really do not know. The Byers approach of co-ordinating a long-term, interdisciplinary approach on the relationships between climate change and ecosystem response is an excellent one that might be used as an example at other polar locations. This approach is needed not just where we know temperatures are increasing and cryosphere is being lost, but also where baseline information needs to be gathered before changes occur. Clearly the terrestrial ecosystems in the Peninsula region are changing rapidly, but are there other regions on the continent undergoing change as well? What is needed now are more ecological observations tied to the ongoing local and regional geophysical data. Initially such an observational network could be built on current capabilities and infrastructure, scientific collaborations and individual national programmes without very significant additional investments, and coordinated through the Scientific Committee of Antarctic Research (SCAR). This proved effective for the Regional Sensitivity to Climate change in Antarctic Terrestrial and Limnetic Systems (RiSCC) programme which inspired parts of the present work. This could be accomplished by modest resources and effort on baseline setups that will feed more expensive science in the future.

Our oceanographic colleagues have recognized the importance of continuing data collection across the Southern Ocean through the Southern Ocean Observing System (SOOS) and the US LTER program has long demonstrated how valuable such baseline data can be. We Antarctic ecologists should have a more proactive vision of a future where we have a truly inclusive pan-Antarctic terrestrial observatory platform to detect the impacts of anthropogenic change in either ecological structure or function, quantify long-range derived pollution, and monitor the introduction of invasive species. Without this, ten years from now those interested in the future of Antarctica will be asking us how the Antarctic terrestrial ecosystems have responded to climate warming and we still will be unable to answer the question.

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