Warm gravel gathers more moss


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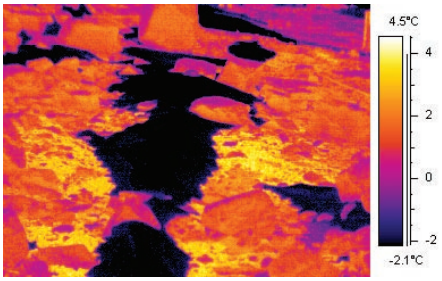

Unlike most plants, some mosses are well adapted to the extreme cold, dry climate of Antarctica. They can survive long periods in a frozen or dried-out state. However, they need access to liquid water to grow. When air temperatures are near freezing point, it is therefore important to know if mosses and their immediate environment are colder or warmer than air, and whether they can access melt-water from ice or snow.

To identify the conditions that allow mosses to grow, and to predict how they may respond to possible climate cooling or warming, we need to know the actual temperatures at which mosses function. These temperatures may differ markedly from those recorded by weather stations.

At Mawson and Casey in early 2005, we used thermal imaging – using an infra-red camera – to assess and record surface temperatures in the Antarctic landscape. We found that loose gravel was usually warmer (up to two degrees) than solid rock surfaces (which have a larger thermal mass and take longer to warm up in the sunlight). Moss cushions and turfs, in turn, were up to two degrees warmer than gravel. Thus, gravel not only provides an easier substrate for mosses to cling to and take up nutrients, but also gives moss cushions a thermal advantage.

In a related experiment we looked at the effect of water on different moss species after cold, dry periods. Small dehydrated samples of moss cushions of two local species at Mawson – the Antarctic endemic *Coscinodon lawianus* and the cosmopolitan *Bryum pseudotriquetrum* – were brought back to Canberra and re-wetted at cool temperatures. At the end of the Antarctic summer it takes *Bryum* one to two days to regain its capacity for photosynthesis after rehydration. In contrast, *Coscinodon* achieves the same in two hours. Thus, changes to the frequency of freezing and thawing, or drying and re-wetting cycles, as a result of climate change, could determine which species does better in Mawson's harsh environment.

In the next phase of the project we aim to determine how often water is available to Antarctic mosses, how long these 'moist' periods last, and how these 'windows of opportunity' are used by the plants for growth.

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Above right: The false-colour thermal image of moss growing at Mawson (original image at top) shows that snow has the lowest temperature – about -2.1°C – followed by rocks and boulders and then gravel beds. Moss turfs clinging to the gravel are even warmer, at a steamy 3-4°C.

Above left: Professor Marilyn Ball and PhD student Danielle Medek, from the Australian National University, record a thermal image of a moss turf at Casey.

Southern Ocean Atlas

CRAIG MACAULAY

Contributor to the Southern Ocean Atlas, John Church, from CSIRO and the Antarctic Climate and Ecosystems Cooperative Research Centre, presents a copy of the atlas to Professor Michael Stoddart, Chief Scientist of the Australian Antarctic Division (AAD). The atlas will be keenly reviewed during the AAD's marine science voyage (BROKE-West) in January 2006.

When the *Aurora Australis* departed Hobart on her first voyage of the season in October, she took a 'road map' to the inhospitable Southern Ocean. The 225-page Southern Ocean Atlas is the first of four atlases in a series that also covers the Pacific, Atlantic and Indian oceans. The atlases were produced as part of the World Ocean Circulation Experiment (1990-2002) that aimed to establish the role of the oceans in the Earth's climate and to obtain a baseline dataset against which future change could be assessed. About 30 nations, including Australia, participated in the programme, using ships to make physical and chemical observations and employing moored and drifting instrumentation. Satellites were used for global observations. Funding of Australia's commitment to the programme was made through CSIRO, the Bureau of Meteorology, the Antarctic Climate and Ecosystems Cooperative Research Centre, the Australian Antarctic Division and the Federal Government's science and environment agencies. Printing and international scientific distribution of the series has been partially funded by energy explorer BP. For details see <http://www.woce.org/atlas_webpage/>.