Climate change stunting growth of century-old Antarctic moss shoots

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One hundred years ago, two teams of explorers raced to be the first to reach the South Pole. Roald Engelbregt Gravning Amundsen reached the South Pole on December 14, 1911.

Thirty-three days later on 17 January 1912 the Terra Nova Expedition led by Robert Falcon Scott arrived at the Pole in second place. At the same time in East Antarctica, the Australasian Antarctic Expedition led by Douglas Mawson was searching for the South Magnetic Pole.

On their expeditions for King and country, Scott and Mawson carried out some of the first scientific studies in Antarctica. Scott's ill-fated expedition found fossils of Gondwanaland trees showing that Antarctica was once covered in lush forests.

Even today, we tend to think of Antarctica as the last untouched wilderness preserved from human impact by International Treaty. However, despite its remoteness and vastness it is still affected by anthropogenic climate change.

A paper to appear in the January issue of Global Change Biology shows how the dominant plants in Antarctica have been affected by modern climate change. In a handful of coastal Antarctic 'oases' void of permanent ice cover, lush moss beds grow during the short summer season from December to February using melt water from streams and lakes. Up until now, measuring the seasonal growth rate of these plants has been extremely difficult and hence it was impossible to assess the

impact of our changing climate.

This research, conducted by a team of environmental scientists from the University of Wollongong (UOW) and nuclear physicists from the Australian Nuclear Science and Technology Organisation (ANSTO), shows how the increased concentration of radiocarbon in the atmosphere resulting from nuclear weapons testing (mostly in the late 1950s and early 1960s, called the 'the bomb spike') can be used to accurately date the age of the moss shoots along their stems in a similar way to tree-rings.

Professor Sharon Robinson from UOW's Institute for Conservation Biology and Environmental Management (School of Biological Sciences) said the team found that that most of the plants were growing 50 years ago when nuclear testing was at its peak.

In some species the peak of the radiocarbon bomb spike was found just 15 mm from the top of the 50 mm shoot suggesting that these plants may be more than 100 years old.

'Accurate dating along the moss stem allows us to determine the very slow growth rates of these mosses (ranging from 0.2 to 3.5 mm per year). Remarkably, these plants were already growing during the heroic age of Antarctic exploration. In terms of age these mosses are effectively the old growth forests of Antarctica -- in miniature," Professor Robinson said.

Although increased temperature and precipitation in the polar regions due to climate change are predicted to increase growth rates, the scientists found that at some sites growth rates have declined since the 1980s. They suggest that this is likely due to moss beds drying out, which appears to be caused by increased wind speeds around Antarctica that are linked to the Antarctic ozone hole.

In the 100 years since the start of scientific research in Antarctica, contamination of Earth's atmosphere with increased radioactivity due to nuclear weapons testing has led to radiocarbon labelling of Antarctic plants.

"This has allowed scientists to show that climate change has made the driest continent on Earth an even harsher environment for plant life," Professor Robinson said.

More information: The paper is published in *Global Change Biology* by: Clarke, L. J., Robinson, S. A., Hua, Q., Ayre, D. J. and Fink, D. (2011), "Radiocarbon bomb spike reveals biological effects of Antarctic climate change". Global Change Biology. Wiley-Blackwell, October 2011, DOI: 10.1111/j.1365-2486.2011.02560.x

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