



Climate change has a big impact on low-diversity ecosystems

New research suggests that climate change-induced species decline, in low-diversity ecosystems, could be more detrimental to ecosystem functioning than species decline in temperate regions, where diversity levels are high.

Low-diversity ecosystems, such as deserts, cover large areas of Earth's surface, however, few biodiversity studies have examined the impacts of climate change in these areas. In high-diversity ecosystems, several species are thought to perform the same functional role, which suggests that the loss of individual species might not affect the overall functioning of an ecosystem. This so called functional redundancy does not exist in ecosystems where the initial levels of diversity are low, such as polar deserts.

Soil ecosystems found in the polar deserts of Antarctica, host simple food webs, with minimal species diversity. As such they can be used as a model to evaluate the contribution of individual soil species to ecosystem functioning and the impacts of climate change-induced species decline, in low diversity ecosystems.

At two locations in the Taylor Valley, Antarctica, researchers have demonstrated that a single species of the soil-dwelling nematode, *Scottinema lindsayae*, plays a significant role in carbon cycling. Nematodes are a type of worm, typically just 50 µm in diameter and 1 mm in length. They assimilate carbon into the soil when they feed on plants and other microorganisms in the soil.

Between 1993 and 2005, there was a 65 per cent reduction in the abundance of *S. lindsayae*, which the researchers ascribe to regional climate change. Nematodes survive extreme climate conditions by entering into a dry, dormant phase. When the temperatures warm they become active and reproduce. Recent cooling in the Taylor Valley meant that there were fewer days above 0°C, which limited reproduction opportunities within the 218 day life-span of this worm.

Researchers stated that the 65 per cent reduction in nematode population was associated with a 32 per cent loss of function in carbon cycling. They also suggested that further declines in the nematode population could elicit increasingly large changes in carbon cycling capabilities.

Small changes in temperature (warming or cooling) can have significant influences over soil communities. In Antarctic ecosystems where species diversity and hence functional redundancy is low, ecosystem functioning is dependent on a few 'keystone' species. Loss of these species will have a major effect on food web dynamics and the carbon cycle.

Future work will need to investigate carbon cycling in these soils and how the ecosystem as a whole responds to species decline. This work is fundamental to predicting the response of Antarctic ecosystems to climate change.

Source: Barret J.E., Virginia R.A., Wall D.H. and Adams, B.J. (2008). Decline in a dominant invertebrate species contributes to altered carbon cycling in a low-diversity soil ecosystem. *Global Change Biology*. 14: 1734-1744.

Contact: jebarre@vt.edu

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