

## Shrub growth decreases as winter temperatures fluctuate up

May 20 2014, by Doree Armstrong

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This is a disc cut from the root collar of shrub *Dracophyllum* on Campbell Island, New Zealand. Credit: David Hollander.

Many have assumed that warmer winters as a result of climate change would increase the growth of trees and shrubs because the growing season would be longer. But shrubs achieve less yearly growth when cold winter temperatures are interrupted by temperatures warm enough to trigger growth.

"When [winter temperatures](#) fluctuate between being cold and warm enough for growth, plants deplete their resources trying to photosynthesize and end the winter with fewer reserves than they initially had. In the summer they have to play catch up," said Melanie Harsch, a University of Washington postdoctoral researcher in biology and applied mathematics. She is lead author of a paper on the subject recently published in *PLOS ONE*.

The roots are especially sensitive to temperature fluctuations, Harsch said. Warming winters result in higher root respiration, which uses up carbon reserves as plants make and release oxygen, leading to less carbon available during the regular growing season.

Harsch and her colleagues studied two species of shrubs on Campbell Island, an uninhabited UNESCO World Heritage site in the southwest Pacific Ocean about 375 miles south of New Zealand's mainland. They studied two large shrubs, *Dracophyllum longifolium* and *Dracophyllum scoparium*, which are evergreen broadleaf species that can grow up to about 15 feet tall and live up to 240 years.



The shrub *Dracophyllum* covers Campbell Island, New Zealand. Credit: Janet Wilmshurst.

Researchers found that while warmer, drier winters helped seedlings get established, it adversely affected growth of older plants.

"For growth to occur you need sufficient precipitation and temperature and nutrients. Growth should only happen during the summer on Campbell Island when temperatures are above 5 degrees Celsius," Harsch said. Five degrees C is about 40 F. "On Campbell Island most winters are cool and below this 5 degrees Celsius, so the plants are not active. The plants we studied are evergreen and there is little snow cover, so they are sensitive to changes in temperature."

In this study, researchers cut out discs, called "cookies," from just above the shrubs' root collar, and measured the width between each ring to determine growth. They found that plant growth decreased as winter temperatures went up.

"On Campbell Island the snow is ephemeral, so the plants usually are not covered," Harsch said. "If we're going to see an effect in changing winter conditions, we're going to see it at Campbell Island decades before we see it at, say, Mt. Rainier, where there is a lot of snow and winters are colder."

Harsch said plants in areas like Campbell Island may eventually adjust to warmer winters, but the transition period will be tough as temperatures bounce above and below what plants need to stay dormant, causing the plants to draw down their resources.

"It may eventually be warm enough in the winters so that plants can

photosynthesize and grow year round, like they do in the tropics," she said. "It's this transition part that [plants](#) are not adapted for."

Harsch plans to do a follow-up study that would measure the microbes and carbon reserves in the soil, and manipulate snow packs to see how it affects establishment and growth.

"How much of this can our tree species withstand?" Harsch said. "Will summer growth eventually compensate for these hard winters, or is this some sort of extra stressor on trees that will be one more nail in the coffin? If you think of all the different factors of increasing vulnerability in climate change, is this really significant? We just don't know."

**More information:** Paper: [www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0093241](http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0093241)

Provided by University of Washington

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