

Seedlings face uphill battle with climate change

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Research explored how warming will alter tree establishment at and above the tree line. Credit: US Department of Energy

Scientists found that certain species of trees will not rapidly advance uphill as global temperatures rise. In other words, subalpine forests will not follow the climate up the mountain. Using field experiments in the Rocky Mountains, scientists tested how two types of emerging tree seedlings responded to artificial warming and watering at three locations. They found that Engelmann spruce may not move to higher elevations as temperatures rise. Further, the spruce may die off at lower elevations. Its overall range could shrink. The hardy limber pine may advance upward, but likely at the same slow pace as in today's climate.

There is little understanding of climate constraints on seedlings, which are the future of the forest. The unexpected results indicate that warming reduces the odds of seedlings establishing or provides no net benefit. Past genetic adaptation to local conditions may also hinder upslope tree advances, a finding counter to current theory.

Climate warming is expected to promote upslope shifts in forests. However, researchers working with common gardens sown with seeds collected from two different elevations and subjected to climate manipulations, using infrared heaters and manual watering, indicate that warming and local genotype may constrain tree seedling recruitment above the current treeline.

Negative effects of [warming](#) in forest, treeline, and alpine sites were partly offset by watering, suggesting growing season moisture may limit establishment of future subalpine forests. Greater [climate](#) sensitivity of Engelmann spruce compared with limber pine portends potential contraction in the elevational range of Engelmann spruce and changes in the composition of high-elevation Rocky Mountain forests. The greater availability of poorer quality seed at the upper [forest](#) edge could further slow upslope shifts.

More information: Lara M. Kueppers et al. Warming and provenance

limit tree recruitment across and beyond the elevation range of subalpine forest, *Global Change Biology* (2016). [DOI: 10.1111/gcb.13561](https://doi.org/10.1111/gcb.13561)

Provided by US Department of Energy

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