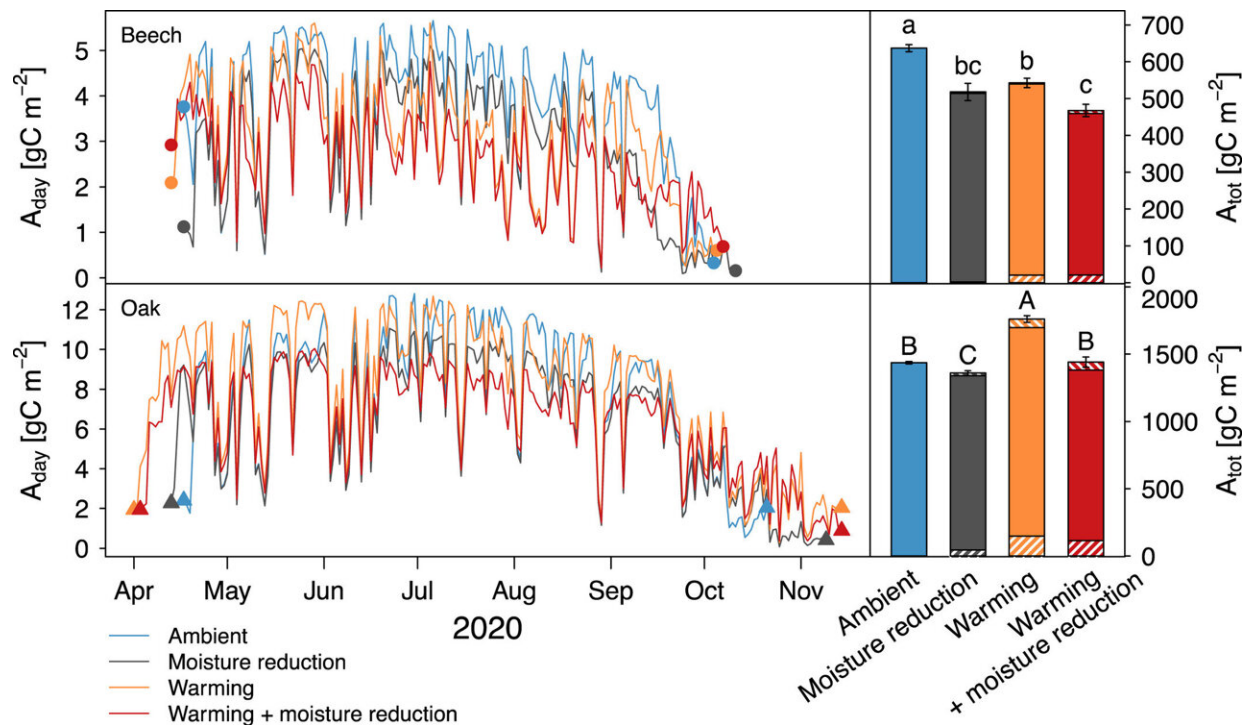


Resilience of tree species tested under global warming conditions

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Mean simulated daily carbon uptake (A_{day} , $n = 4$ chambers per treatment and species) of European beech and pubescent oak growing under control, warming, moisture reduction and warming + moisture reduction conditions during the growing season of 2020 and their respective annual carbon uptake (A_{tot}). The surplus of carbon uptake in warming, moisture reduction and warming + moisture reduction treatments before the leaf-out and after senescence of ambient trees are shown with right and left dash, respectively. Significant differences between treatments are indicated with capital (pubescent oak) and small (European beech) letters (Tukey's HSD post-hoc test, $\alpha = 0.05$). Credit: *Journal of Ecology* (2022). DOI: 10.1111/1365-2745.13892

As trees grow, they absorb ever greater amounts of CO₂ from the atmosphere. Consequently, the health of trees both determines climate and is determined by it. During heat waves and droughts, trees stop growing and almost entirely stop absorbing carbon. And because carbon is responsible for the increase in extreme weather events, the result is a vicious circle. Certain tree species, however, are largely able to compensate this effect: milder springs promote earlier "leafing out," which lengthens the period of growth during which trees metabolize CO₂.

A team of researchers supported by the SNSF compared the resilience of two species: common beech and pubescent oak. Common beech is ubiquitous in Swiss forests. Pubescent oak is less common in Switzerland, but becomes more abundant the closer to the Mediterranean you go. Not surprisingly, the more southern of the two species benefits more from higher temperatures. At 5 degrees Celsius above the current average temperature, pubescent oak buds a month in advance and leaf fall occurs a few days later. This extended vegetation period is enough to compensate dormant periods during summer heatwaves and droughts. In fact, the oaks grow as much and take up as much CO₂ as under current climatic conditions.

Bad times for beech

Common beech is less resilient. Still at a [temperature increase](#) of 5 degrees Celsius, beech begins to bud just a few days early. Ultimately, under hotter conditions the trees languish and absorb less [carbon](#) from the atmosphere, exacerbating climate change. These observations show that beech trees will inevitably suffer from warming, says Charlotte Grossiord, lead author of the study published in the *Journal of Ecology* and a professor at EPF Lausanne. On the other hand, more

Mediterranean species could have an advantage in Switzerland. "Our work aims at helping forest managers consider which species to favor," says Grossiord. "We continue to plant beech, the signature species of Swiss forests, but it may not be the best investment for the future."

In reaching their conclusions, researchers at EPF Lausanne and at the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL) grew both [tree species](#) in climate-controlled greenhouses at a WSL site. Sixteen hexagonal chambers were equipped with heaters to mimic various climatic conditions. The team subjected one group of [trees](#) to higher temperatures, a second to summer drought and a third to both conditions. A fourth control group, exposed to current climatic conditions, served as a reference. For two years, the researchers measured a series of parameters from the seasonal cycle to height and diameter growth, as well as photosynthetic activity and leaf surface.

As a next step, Grossiord would like to study the resilience of other species. "We started with oak and beech because we have a lot of information about them. But many Swiss species are interesting, especially softwoods."

More information: Charlotte Grossiord et al, Warming may extend tree growing seasons and compensate for reduced carbon uptake during dry periods, *Journal of Ecology* (2022). [DOI: 10.1111/1365-2745.13892](https://doi.org/10.1111/1365-2745.13892)

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