

Drought imperils carbon sequestration in European forests

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Forests play a critical part in mitigating climate change due to their ability to absorb CO₂ from the atmosphere. However, many European forests removed less CO₂ from the atmosphere during the extremely hot

and dry summer of 2022, according to a new European study. The findings suggest that plans to compensate for CO₂ emissions through forests may have to be amended.

Europe aims to be CO₂ neutral in 2050, and forests are frequently considered one of the ways to achieve this goal. Previous research showed that forests sequester less CO₂ during extreme dry spells, which will likely occur more frequently in the future climate. For the first time, a team of scientists studied the impact the [extreme heat](#) and drought of 2022 had on forests throughout Europe. [The findings](#) were published in *Nature Communications*.

More CO₂ in many European forests

The team used an extensive [European network of measurements of the carbon cycle](#). These show that European forests absorbed significantly less CO₂ in 2022. Ph.D. candidate Auke van der Woude, lead author of the study, says, "The readings are taken in the forests, using equipment capable of determining the amount of CO₂ that the [forest](#) absorbs at a very local level. We also saw higher than normal atmospheric CO₂ concentrations in many locations in the summer of 2022."

Analysis of precipitation and evaporation show that the drought area in 2022 was about the same size as in 2018, but more located in the south of Europe. Model calculations suggest that the impact of the droughts in 2018 and 2022 were comparable: a reduction in CO₂ absorption of some 60 TgC (units used to indicate the concentration of carbon in the atmosphere). That is more than the Netherlands emits in an entire year and is added to the 750 TgC in annual emissions produced by the EU.

Droughts in rapid succession

The European drought of 2022 was the second long dry spell after 2018.

Van der Woude says, "The rapid succession of droughts such as these shows that extreme drought is no longer that extreme." Moreover, the summer of 2023 was above average in temperature.

Carbon cycle professor Wouter Peters states, "Our study shows that the current plans to compensate CO₂ emissions through extra large-scale absorption by forests may be unrealistic." These plans are based on the assumption that European forests are capable of sequestering extra CO₂, but if they fail to do so in periods of drought, these plans may have to be amended."

French forests suffer greatest impact

One of the areas most gravely affected by the [drought](#) of 2022 is Les Landes, located in south-western France. Trees in this region stopped absorbing CO₂ altogether in that summer, even during the daytime, which is when most of the photosynthesis in the leaves takes place. Researchers had not seen a similar standstill of CO₂ absorption in their readings before. Additionally, many wildfires occurred in the region. Although these caused damage and other issues, the researchers concluded that the fires played only a small role in the extra CO₂ emissions.

Trees absorb CO₂ in their leaves. This happens through tiny channels called "stomata." These stomata not only absorb CO₂ but also evaporate water. To avoid losing too much water, plants can close their stomata. By doing so, less water will evaporate from the leaves, but less CO₂ will be absorbed as well. The reduced uptake of CO₂ by trees during droughts is thus a result of a survival strategy.

More information: Auke M. van der Woude et al, Temperature extremes of 2022 reduced carbon uptake by forests in Europe, *Nature Communications* (2023). [DOI: 10.1038/s41467-023-41851-0](https://doi.org/10.1038/s41467-023-41851-0)

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