Study shows how plants influence Europe's climate

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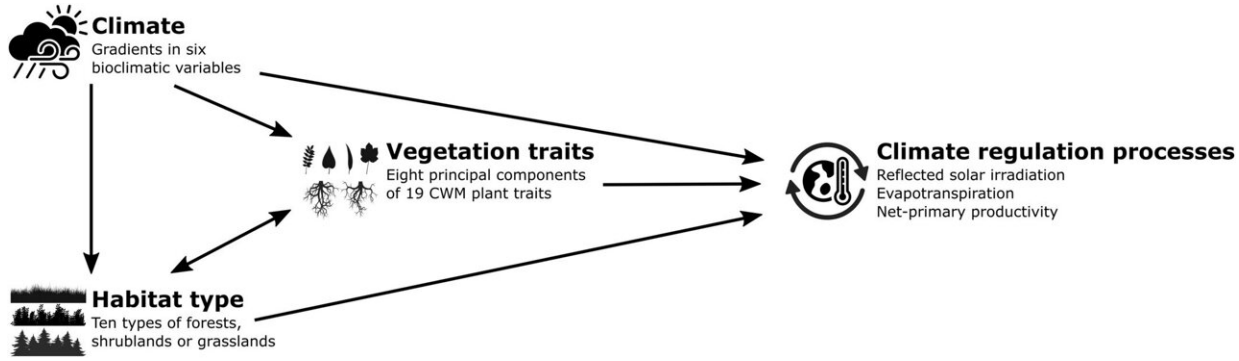

Framework depicting the assumed effects of the functional composition of plant communities on climate regulation processes, accounting for the effects of climate and habitat type. Credit: *Global Change Biology* (2024). DOI: 10.1111/gcb.17189

The climate regulates plant growth and yet the climate is also influenced by plants. A study by Martin Luther University Halle-Wittenberg (MLU), which was published in the journal *Global Change Biology*, has found that ecosystems can have a strong impact on Europe's climate depending on their plant mix.

The researchers combined satellite data with around 50,000 vegetation records from across Europe. A good 5% of regional climate regulation can be explained by local plant diversity. The analysis also shows that the effects depend on many other factors. Plants are able to influence the climate by reflecting sunlight, or cool their surroundings through evaporation.

"There is an extremely complex relationship between plants and the climate. At the one hand, the climate considerably influences plant growth as well as a plant's properties, such as how high it grows, how thick its leaves are, and how deep its roots go. At the other hand, plants influence climatic conditions in many different ways," explains Dr. Stephan Kambach, a research associate in the Department of Geobotany at MLU. For example, if plants reflect a lot of sunlight, less heat accumulates at that location. Plants also evaporate water, which cools their surroundings. In addition, plants bind large amounts of the greenhouse gas carbon dioxide.

However, according to Kambach, little was previously known about the extent to which the various functional traits of plants, such as the properties of its leaves and roots, affect climate. To close this knowledge gap, an international team led by MLU combined regional satellite data with local surveys of plants and plant traits at almost 50,000 locations in Europe.

"It was important for us to combine areas from very different habitats. Our data therefore includes information about coniferous, deciduous and evergreen deciduous forests, as well as various shrublands and open countryside formations," explains Professor Helge Bruelheide, the senior author of the study and head of the Department of Geobotany at MLU.

"We show that a significant proportion of the observed climate-regulating processes are explained by differences in the functional traits

of local plants. Therefore, it depends greatly on which plants grow in which numbers in an ecosystem," continues Kambach.

However, the effects differed greatly between individual ecosystems, for example between evergreen coniferous and evergreen deciduous forests. "We were nevertheless able to prove that a higher plant cover reflects less sunlight and that larger leaves are associated with higher levels of evaporation and more carbon sequestration," the biologist explains.

The study is a key result of the European research project "FeedBaCks," which is investigating the feedback mechanisms between biodiversity and climate and their consequences for humans. It is coordinated by the University of Zurich.

"Our study also provides important points of departure for nature conservation and politics. The potential impact and feedback effects of biodiversity should be taken into account when developing measures for mitigating climate change," concludes Helge Bruelheide.

More information: Stephan Kambach et al, Climate regulation processes are linked to the functional composition of plant communities in European forests, shrublands, and grasslands, *Global Change Biology* (2024). DOI: 10.1111/gcb.17189

Provided by Martin Luther University Halle-Wittenberg