Short-lived plant species are more climate-sensitive

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Plant species with short generation times are more sensitive to climate change than those with long generation times. This is one of the findings of a synthesis study by researchers from the German Center for

Integrative Biodiversity Research (iDiv), the Martin Luther University Halle-Wittenberg (MLU) and the Helmholtz-Center for Environmental Research (UFZ). The international team comprehensively compiled worldwide available data, mostly from Europe and North America, to address the question of how plant populations react to climate change. The study, published in *Nature Communications*, shows that plant characteristics such as generation time can predict how sensitive species are to changing climates. This has important implications for predicting which plant species need the most conservation attention regarding climate change.

Climate change is considered to be one of the greatest threats to plant species diversity. To set the right priorities in nature conservation policy, it is crucial to know which regions of the world and which types of species are particularly threatened by climate change.

As part of the iDiv synthesis center sDiv, which brings together international experts in workshops, a working group compiled all long-term studies on plants that quantify population growth rate. They assessed how the climate factors during those years of study, in particular precipitation and temperature, influenced population growth rate. Afterwards, they tested how features of the plant species, such as the length of a generation, influence how responsive the plant population growth rates were to climate variation in the past.

"We were able to show that generation duration is a useful indicator value for a species' susceptibility to climate change," said first author Dr. Aldo Compagnoni, a postdoctoral researcher at iDiv and MLU. For example, the scientists found that especially plants with short lifespans, such as those that only live a few years on average, suffered from climate extremes much worse than long-lived species. The analyses also showed that the main limiting factor of climate change is not the temperature increase itself. On average, precipitation had a three times

greater impact on plant populations than temperature.

"This work helps us identify which species might be climate-vulnerable, even if we have limited information about those species," says last author Prof Tiffany Knight from iDiv, MLU and UFZ. "For example, while we have long-term population data for a small subset of plant species on Earth, we can estimate the approximate generation duration for most plant species. This is an important first step towards determining species' vulnerability to climate change at a global scale."

However, there are important data gaps that limit the ability to make general predictions on a global scale. The researchers found appropriate long-term datasets only for 62 of the 350,000 plant species on Earth, and the vast majority of these were species occurring in temperate zones of the USA and Western Europe. Apart from a few tree and shrub species, the data set included only grasses and herbs. To be able to make reliable predictions about the consequences of climate change for all regions of the world and all known species, new population ecology research is needed on woody plant species and on plants in the tropics, the researchers conclude.

More information: Aldo Compagnoni et al, Herbaceous perennial plants with short generation time have stronger responses to climate anomalies than those with longer generation time, *Nature Communications* (2021). DOI: 10.1038/s41467-021-21977-9

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