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Biodiversity helps grassland resist extreme weather

Using data from 46 experiments on grassland plant diversity, an international team of researchers has shown that high biodiversity increases the resistance of such ecosystems to a wide range of climate events (drought, heatwaves, extreme rainfall). These findings call into question studies usually carried out in ecology, in which measurements of ecosystem stability are partly based on their ability to return to normal following a disturbance, rather than on their capacity to resist such a disturbance. Michel Loreau of the CNRS Experimental Ecology Station in Moulis took part in this work, published on October 14, 2015 in *Nature*.

The role played by biodiversity in the ability of ecosystems to continue functioning during extreme weather events, which are increasingly frequent as a result of climate change, remains poorly understood. Several surveys have suggested that highly diverse plant communities are more resistant than species-poor ones, changing less from their normal state during periods of drought — and recovering more rapidly afterwards. However, these findings have not been subsequently confirmed. In this new study, the researchers therefore used data from 46 experiments on grassland plant diversity in order to test the hypothesis of a positive effect of biodiversity on the resistance and resilience of ecosystems to various climate events, from drought to extreme rainfall.

Analysis of the data shows that biodiversity does indeed increase the resistance of grassland primary productivity[1] for a broad range of climate events, whether wet or dry, moderate or extreme, and brief or prolonged. Across all the studies and weather conditions taken into consideration, it turned out that the productivity of low-diversity plant communities (i.e. only including one or two species) changed by about 50% from its normal level during a climate event, whereas that of high-diversity communities (including 16 – 32 species) only differed by around 25%. On the other hand, ecosystem productivity had either regained or exceeded its normal level a year after a climate event, regardless of plant diversity, showing that biodiversity has no effect on ecosystem resilience, at least on annual timescales.

These findings therefore suggest that biodiversity stabilizes the productivity of ecosystems and their related services[2] essentially by increasing their resistance to climate events. As a result, current human-induced environmental changes, which cause biodiversity loss, seem likely to impact the stability of ecosystems by altering their resistance to climate events.

[1] Primary productivity designates the increase in plant biomass per year.
[2] The human benefits of good ecosystem functioning, such as pollination by bees, bumblebees, butterflies and birds.

Until now, theoretical ecological studies on the response of ecosystems to various perturbations have focused on the resilience of such ecosystems. However, since biodiversity does not affect the ability of grassland to return to normal following a disturbance, an entirely new field of research now opens up to theorists: how does biodiversity enhance ecosystem resistance? What kind of biodiversity should be protected in order to ensure the stability of ecosystem functioning?

Reference

Biodiversity increases the resistance of ecosystem productivity to climate extremes
Forest Isbell et al. *Nature*, October 14, 2015. DOI: 10.1038/nature15374

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