

15/09/2023

How long will plants keep rescuing us?



Anthropogenic fertilization of the Earth, with increasing concentrations of atmospheric CO₂ and nitrogen in-puts, has enhanced plant photosynthesis and carbon sinks of terrestrial ecosystems. Several signals now suggest, however, that this carbon-sink activity is slowing its rate of increase because of limitations of nutrients, water, and heat, among other factors.

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Current anthropogenic warming, as a result of greenhouse emissions, particularly carbon dioxide (CO₂), poses a very high risk to nature and human well-being. Up to now, this risk has been buffered by a key group of other species on the planet, terrestrial plants, which have assimilated almost a third of emissions, helping us avoid a much stronger and faster degree of warming.

In a new paper published in *One Earth* journal we raise the question of how long plants will continue to rescue us. Several signs suggest that this carbon sink activity could be declining in efficiency and slowing down its rate of increase. This decrease would be a consequence of limitations of nutrients, water, heat, fires, pollution and the reduction of the residence time of carbon in the vegetation.

If we focus on nutrient limitations, we must take into account that plant production requires more nutrients than carbon and nitrogen. Bioelements such as phosphorus, potassium, calcium, magnesium, molybdenum, manganese and zinc are necessary for cell structure and function, and therefore for plant growth. Thus, although the availability of carbon from rising

atmospheric carbon dioxide levels, and of nitrogen from various human-induced inputs to ecosystems, is continuously increasing. However, these increases are not paralleled by a similar increase in all these other bio-elements.

Many other limitations linked to climate change itself are also restricting the increase in carbon sinks, many other limitations are linked to climate change itself, which raises temperatures above the optimum and drives aridification of many regions. With all these conspiring factors, we can thus expect the pace of current carbon sinks to slow because of decreased efficiency.

This scenario calls for a reconsideration of IPCC (Intergovernmental Panel on Climate Change) climate projections toward a possible reduction in the mitigation capacity of the terrestrial biosphere even warmer conditions than currently projected and stronger impacts. If current models continue to ignore it, they may overestimate carbon sinks and mitigation potential and thus underestimate climate warming.

Currently, countries develop adaptation strategies that are largely fragmented, local, and incremental, with limited evidence of transformational adaptation and negligible evidence of risk reduction outcomes. Unfortunately, climate change is already here and it can become even stronger if mitigation actions are not fully successful. Climate projections must consider a biosphere dominated by warming and not by fertilization, only then countries will be able to develop better management adaptation strategies.

Josep Peñuelas, Rosa Casanovas

CREAF, Cerdanyola del Valles

CSIC, Global Ecology Unit CREAF-CSIC-UAB

josep.penuelas@uab.cat, rosa.casanovas@uab.cat

References

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