

Natural ecosystems, water and climate: Re-thinking and embracing nature's complexity for climate stabilization

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The replacement of primary terrestrial ecosystems by industrial biocomplexes – pastures, agricultural land, and industrial forests – over the past two centuries has globally simplified the genetic information underlying the climate-regulating functions of terrestrial biota. These include biotic regulation of atmospheric moisture transport and cloud cover – two major uncertainties in climate projections. This human-induced simplification of biota–climate interactions likely disrupts the climate system, as the complex stabilizing feedbacks evolved in natural, self-sustaining ecosystems over millions of years are no longer in place to maintain environmental stability.

Climate sensitivity to rising atmospheric CO₂ may therefore depend on the state of the biosphere, with more natural, intact ecosystems contributing to reduced sensitivity. The environmental stability provided by these systems supports economic planning and protects long-term investments. Conversely, tipping points in ecosystem degradation – especially those involving atmospheric circulation – can trigger abrupt shifts in the climate response to CO₂ accumulation. Extracting less, not more, from forests will thus help stabilize both climate and society.

As the unprecedented and unpredicted global heat continues to challenge climate science, the field stands at a crossroads – with a rare opportunity to shift toward a more biosphere-oriented approach. International and interdisciplinary collaboration needs unifying ideas. Recognizing natural ecosystems as climate stabilizers could be one.

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