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Xiyan Xu, PhD

Professor, Institute of Atmospheric Physics of Chinese Academy of Sciences, Beijing, China

Harnessing terrestrial ecosystems to combat climate change: challenges and opportunities

The terrestrial biosphere is currently a net carbon sink and absorbs 25-30% of fossil fuel carbon emissions annually. However, the large carbon storage and carbon sink of the terrestrial ecosystems are affected by climate change and disturbances from human activities, leading to uncertainties in evaluating their potential for climate change mitigation. In the northern high latitude, where climate warming has been much faster than in the rest of the world, we found a large reduction in terrestrial carbon sink because warming increases soil carbon decomposition and wildfire biomass burning. The increased carbon emission cannot be offset by enhanced vegetation carbon sequestration. In the tropics, the ecosystems are more shaped by human activities, e.g., deforestation for agricultural expansion. Deforestation accompanied with intentional ignition not only causes carbon loss, but results in a drier and warmer regional climate, which in turn accelerates forest degradation and carbon loss. Sustainable land use and management practices provide opportunities to combat climate change. Natural and seminatural vegetation with conservation practices has higher amount of foliage in the canopy, and can effectively cool the land surface temperature and thus buffering the effects of climate change. The demonstration that conservation can significantly contribute to climate mitigation and adaptation also highlights the need to tackle the biodiversity and climate crises simultaneously.



