EGU24-1645, updated on 10 May 2024
https://doi.org/10.5194/egusphere-egu24-1645
EGU General Assembly 2024

Spatial analysis of CDR implications for global biodiversity refugia

Ruben Prütz[1,2,3], Joeri Rogelj[3,4,5], Sabine Fuss[1,2], Jeff Price[6], Nicole Forstenhäusler[6], Rachel Warren[6], Andrey Lessa Derci Augustynczik[5], Petr Havlík[5], and Florian Kraxner[5]

[1]Geography Department, Humboldt University of Berlin, Germany (ruben.maximilian.pruetz@geo.hu-berlin.de)
[2]Mercator Research Institute on Global Commons and Climate Change (MCC), Germany
[3]Grantham Institute for Climate Change and the Environment, Imperial College London, United Kingdom
[4]Centre for Environmental Policy, Imperial College London, United Kingdom
[5]International Institute for Applied Systems Analysis (IIASA), Austria
[6]Tyndall Centre for Climate Change Research, University of East Anglia, United Kingdom

Background: Due to ongoing delays in deep global emission reductions, and as more and more countries set national net-zero CO_2 targets, carbon dioxide removal (CDR) is continuously gaining importance and attention. Virtually all Paris-aligned AR6 mitigation pathways imply gigatonne-scale CO_2 removal even before mid-century, with further upscaling thereafter. Integrated assessment models, used to explore the solution space, currently primarily rely on removals via bioenergy with carbon capture and storage (BECCS) and afforestation, which require massive amounts of land to meet scenario-implied removal scales. This substantial land demand is expected to have severe consequences for biodiversity, which could limit the sustainable scaling potential of these CDR options. Meanwhile, depending on the mode of implementation, afforestation could theoretically benefit habitat conservation in some cases, easing the immense pressure on biodiversity due to ongoing global warming and deforestation.

Objective: By combining spatially-resolved data on biodiversity refugia with spatial time series data from the Global Biosphere Management Model (GLOBIOM) on bioenergy crop plantations and afforestation under different mitigation scenarios, we estimate and compare land use and warming-related pressure on remaining global biodiversity refugia. We compare different biodiversity recovery assumptions after peak warming, consider the land use pressure of ongoing deforestation, and explore additional warming-related refugia loss when excluding CDR from scenarios.

Preliminary results: We show how scenarios with more ambitious temperature outcomes result in higher land use-related pressure on remaining biodiversity refugia areas as more land-intensive CDR is implied in such pathways. Meanwhile, more decisive climate action, including more CDR, substantially reduces the warming-related loss of remaining biodiversity refugia areas. The underlying biodiversity recovery assumptions strongly impact the degree of warming-related refugia loss with considerably less influence on land use-related implications. Generally, the perceived trends are stronger towards 2100 compared to mid-century.