Warming versus land-intensive mitigation impact on biodiversity refugia across climate policy scenarios

Ruben Prütz[1,2,3], Joeri Rogelj[3,4,5], Jeff Price[6], Rachel Warren[6], Nicole Forstenhäusler[6], Yazhen Wu[5], Andrey Lessa Derci Augustynczik[5], Michael Wögerer[5], Tamás Krisztin[5], Petr Havlík[5], Florian Kraxner[5], Stefan Frank[5], Tomoko Hasegawa[7], Jonathan Doelman[8,9], Vassilis Daioglou[8,9], and Sabine Fuss[1,2]

[1]Potsdam Institute for Climate Impact Research, Germany
[2]Geography Department, Humboldt-Universität zu Berlin, Germany
[3]Grantham Institute for Climate Change and the Environment, Imperial College London, UK
[4]Centre for Environmental Policy, Imperial College London, UK
[5]International Institute for Applied Systems Analysis, Austria
[6]Tyndall Centre for Climate Change Research, University of East Anglia, UK
[7]Research Organization of Science and Technology, Ritsumeikan University, Japan
[8]PBL Netherlands Environmental Assessment Agency, The Netherlands
[9]Copernicus Institute of Sustainable Development, Utrecht University, The Netherlands

EGU25-9028

Background. "Biodiversity loss will continue to escalate with every increment of global warming." "Afforestation or bioenergy can compound risks to biodiversity." [IPCC]

Aim. Analysis of warming-related and mitigation-related (afforestation and bioenergy) climate refugia implications across mitigation scenarios

Datasets

We spatially combine existing datasets:

Refugia maps

Climate suitability maps for 135,000 species (plants, fungi, vertebrates, and invertebrates) for 1-4.5 °C.

Land use maps

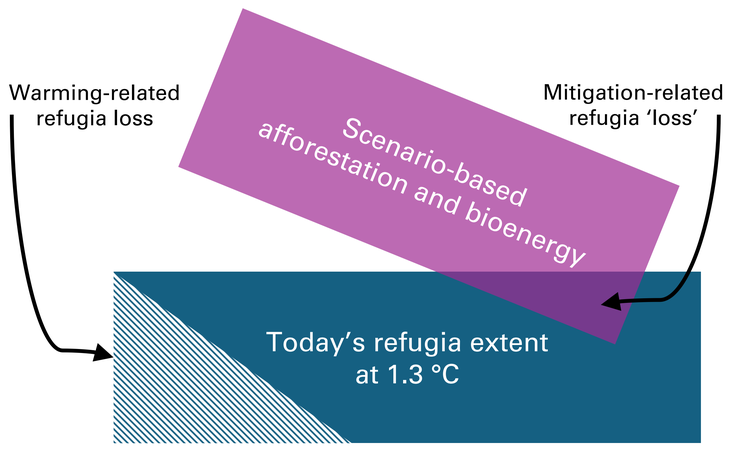
Afforestation and bioenergy maps for four scenarios and models: AIM, GCAM, GLOBIOM, and IMAGE.

Scenario warming

Warming levels for four scenarios: 1.5 °C (RCP1.9), below 2 °C (RCP2.6), above 2 °C (RCP3.4), and Current Policies (RCP4.5).

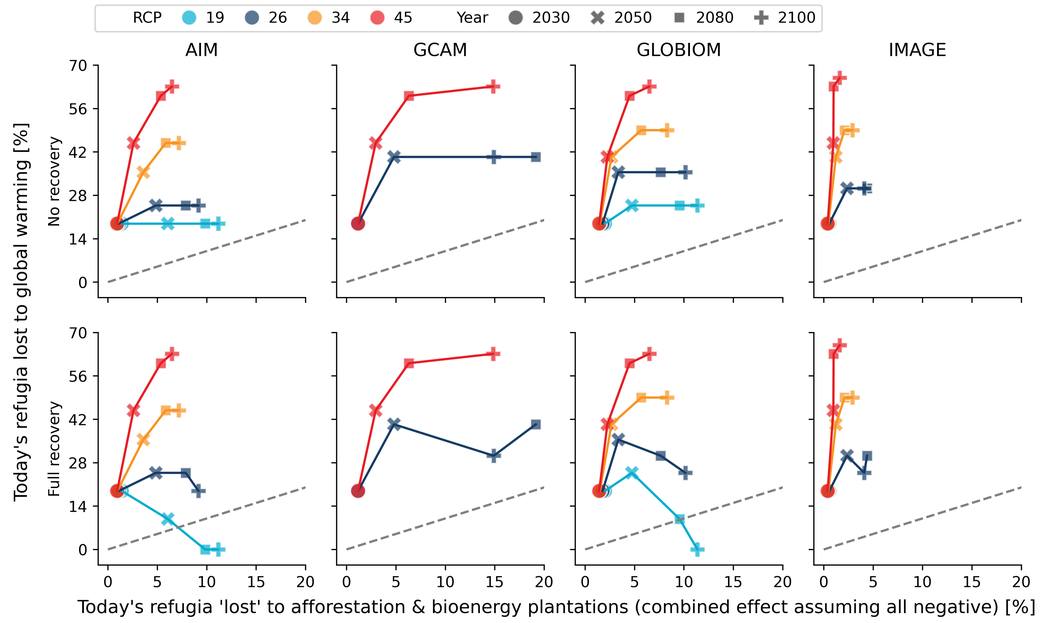
Workflow

We overlay refugia maps with scenario-based land use maps to assess refugia loss for different overshoot levels (temporary exceedance of 1.5 °C) and recovery assumptions.

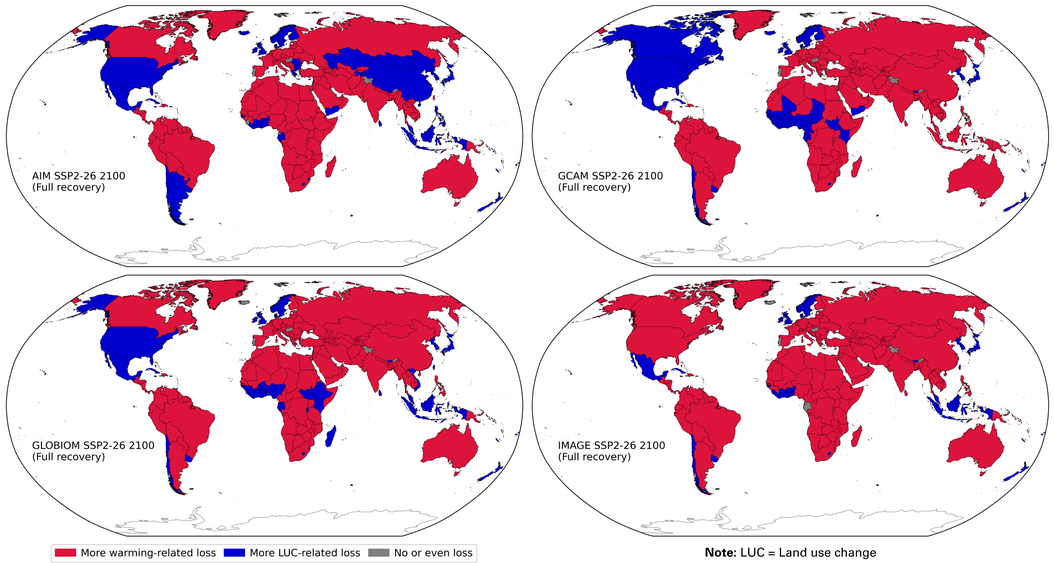


Insights. **1.** Warming-related refugia loss is larger than mitigation-related 'loss', assuming no recovery after peak warming. **2.** In some regions, mitigation-related refugia 'loss' is larger than warming-related loss. **3.** Land allocation within refugia at 1.5 °C is substantially larger after overshoot compared to before.

Warming-related refugia loss is larger than mitigation-related 'loss'



Model comparison allows to identify regional consensus



Land allocation within refugia at 1.5 °C is larger after overshoot