Is Tropical Biodiversity Disproportionately Sensitive to Human Pressures?

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Background

The sensitivity of species to human pressures is expected to vary across the world

There are a number of reasons to expect tropical biodiversity to be most sensitive:

→ Species in the tropics are more specialist, in terms of climatic niches [MacArthur, 1972, *Geographical Ecology*], diets [Forister et al., 2015, *PNAS*] and habitats [Salisbury et al., 2012, *Ecol Letts*]

→ Species in the tropics tend to be closer to their climatic niche limits [Sunday et al., 2014, *PNAS*]

→ Tropical regions have a much shorter history of human impacts, so the most sensitive species are often still present [Balmford, 1996, *TREE*]

→ Tropical species have smaller geographical ranges [Stevens, 1989, *Am Nat*] and slower pace of life [Wiersma et al., 2007, PNAS], characteristics associated with higher sensitivity [Newbold et al., 2013, *PRSB*; 2018, *PLoS Biol*]

→ Tropical climates are less variable seasonally and interannually, so species may be less tolerant of environmental changes [Janzen, 1967, *Am Nat*]

Key Findings

We find that tropical biodiversity consistently responds more negatively to human pressures than non-tropical biodiversity

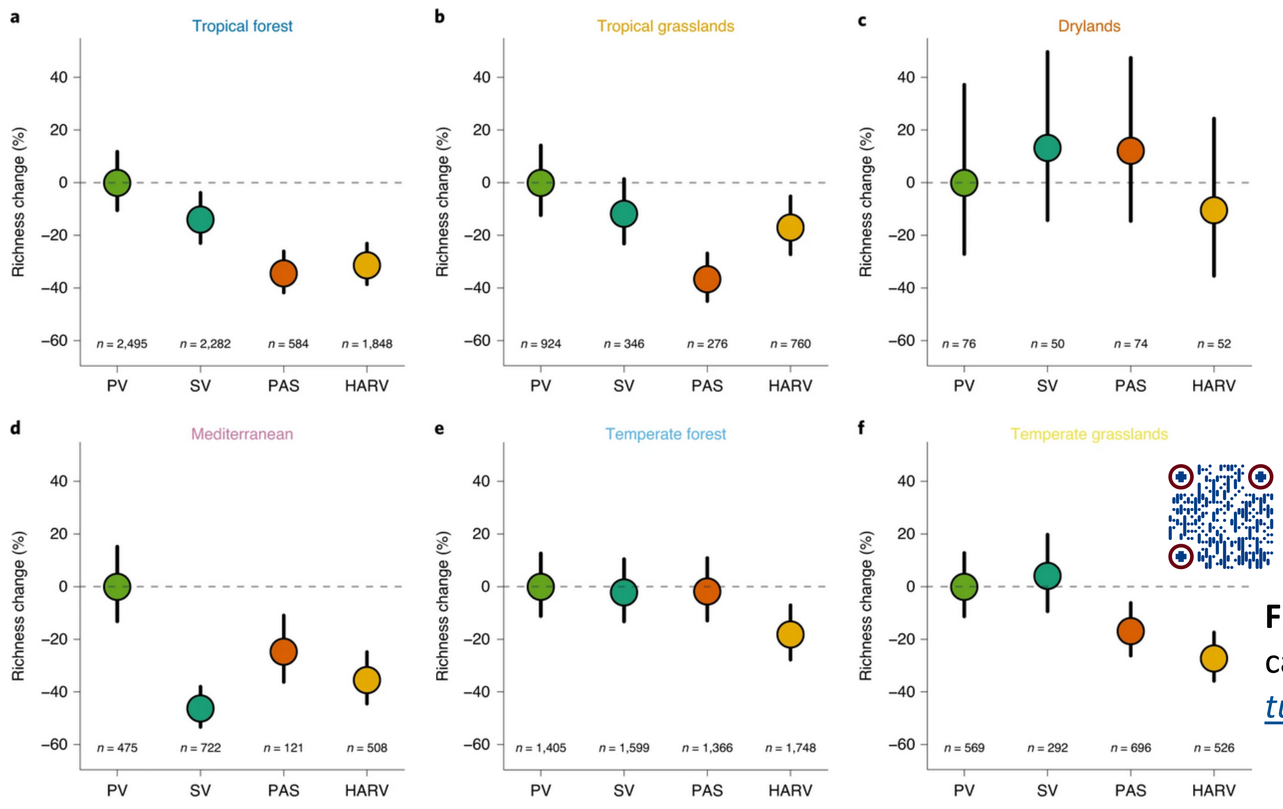

Figure 1. Tropical and Mediterranean biodiversity responds most negatively to human land use. PV = Primary vegetation; SV = Secondary vegetation; PAS = Pasture (livestock grazing); HARV = Croplands and tree plantations. Newbold et al. (2020). *Nature Ecology & Evolution*

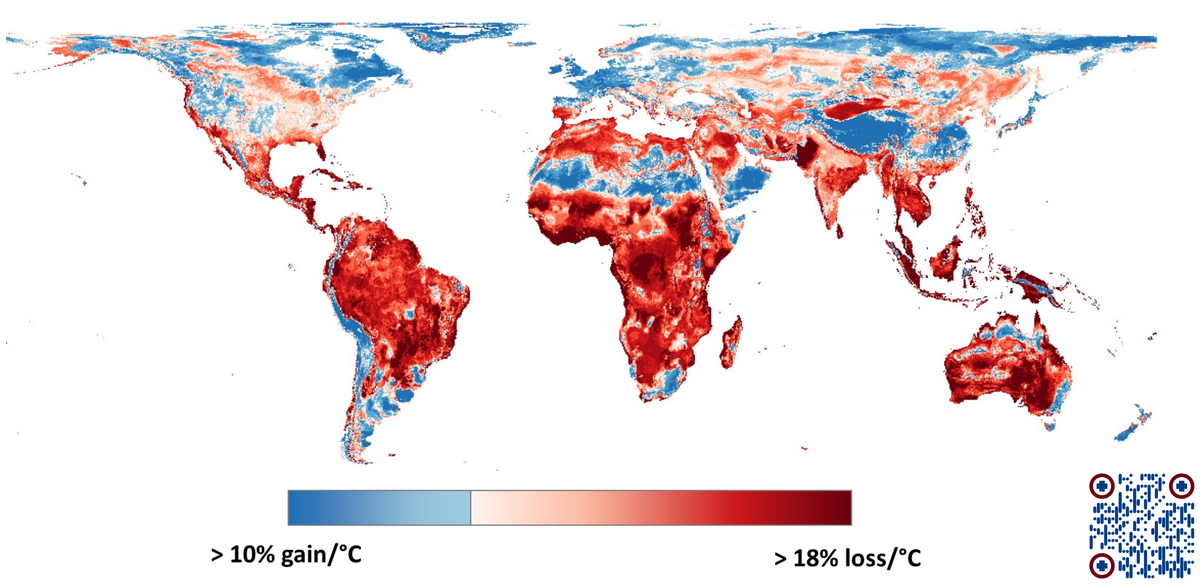

Figure 2. Each degree of temperature increase from climate change is projected to cause the greatest % loss of species from tropical areas. Newbold et al. (2020). *Nature Ecology & Evolution*

Figure 3. The interaction of rapid historical temperature increase (standardized temperature anomaly) and high-intensity agriculture is associated with the lowest levels of insect biodiversity, with reductions of > 50% in the tropics. Outhwaite et al. (2022). *Nature*

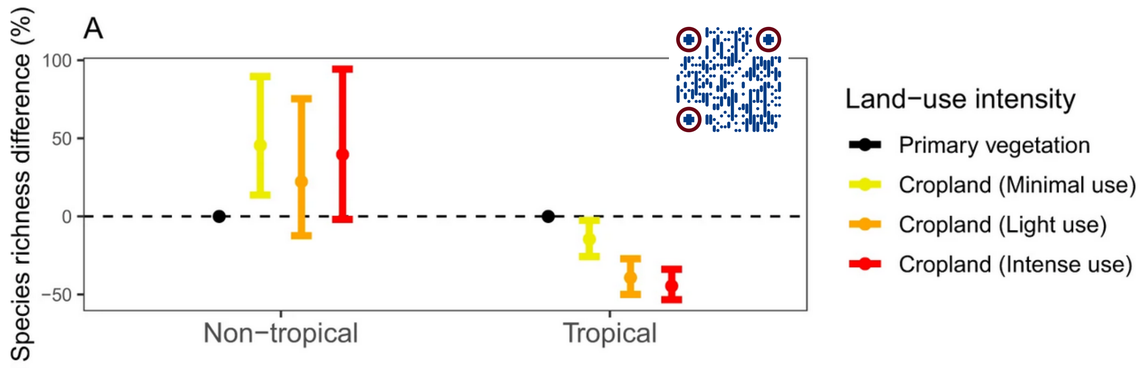

Figure 4. Pollinator biodiversity is reduced in high-intensity cropland, but only in tropical regions. Millard et al. (2021). *Nature Communications*

Implications

We urgently need further study of biodiversity responses in tropical regions

Tropical areas are poorly represented in many biodiversity databases and studies [Meyer et al., 2015, *Nat Comms*]

Most species are located within the tropics [Orme et al., 2005, *Nature*]

The ecology of many tropical species remains poorly understood, while many remain undescribed [Hortal et al., 2015, *AREES*]

These areas will experience profound climate change soonest [Mora et al., 2013, *Nature*] and will be the destination for much future agricultural expansion [Hurtt et al., 2020, *Geosci Model Dev*]

Biodiversity models and projections need to account for the differential sensitivity of biodiversity in different regions

Online poster: