S. Sitch et al., 2024 "Trends and Drivers of Terrestrial Sources and Sinks of Carbon Dioxide: An overview of the TRENDY Project" (Global Biogeochemical Cycles, https://doi.org/10.1029/2024GB008102)

Science Question

How can we quantify and attribute land carbon dynamics to underlying processes at global and regional scales, contributing bottom-up estimates to Global Carbon Budget (GCB) and RECCAP-2?

Analysis

- Land-Use Harmonization 2 dataset (LUH2) – a global dataset of historical and future land-use that is a required component of the TRENDY protocol and has contributed annually-updated land-use forcing data to GCB for 10 years. Uses Landsat data on forest area change.
- An international ensemble of around 20 Dynamic Global Vegetation Models (DGVMs) quantifies land biophysical exchange processes and biogeochemistry cycles. EDv3.0 model – an ecosystem demography model developed in CMS20-Hurtt has participated from 2023 onwards. EDv3.0 uses GEDI and ICESat-2 data and uses all gross transitions of LUH2.

Results

- Improved estimates of LU emissions in Brazil and Indonesia via use of MapBiomas data (Fig 1)
- Models simulate a contemporary net land sink of 1.7 ± 0.6 PgC/yr, with large opposing effects of CO2 fertilization and land-use change
- Despite the largest gross fluxes being in the tropics, the largest net land-atmosphere exchange is simulated in the extratropical regions (Fig 2)

Significance

- TRENDY provides annual updates of human land use and the the natural land sink, for global stock takes, for GCB, and the protocol is now used by National GHG Center land models.
- This works contributes to CMS20-Hurtt as well as upcoming CMIP7 datasets and simulations.

Acknowledgements

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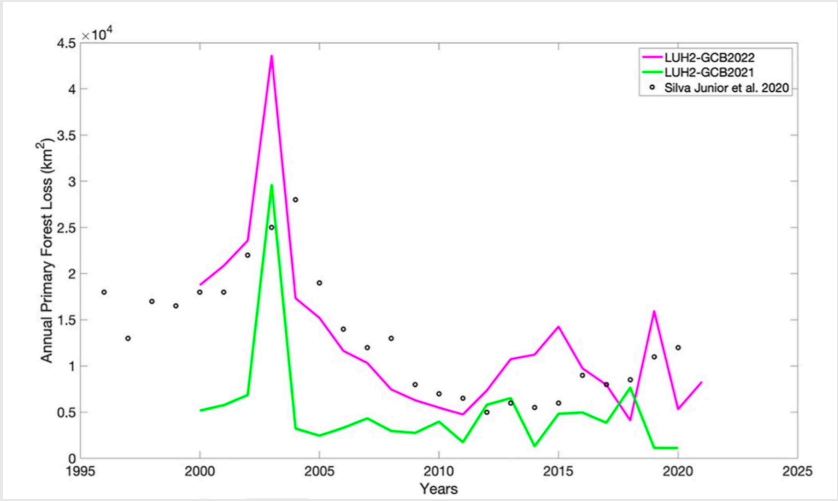

Figure 1: LUH for GCB2022 showed improved estimates of forest loss in Amazonian Brazil, when compared with satellite data and previous LUH2 versions.

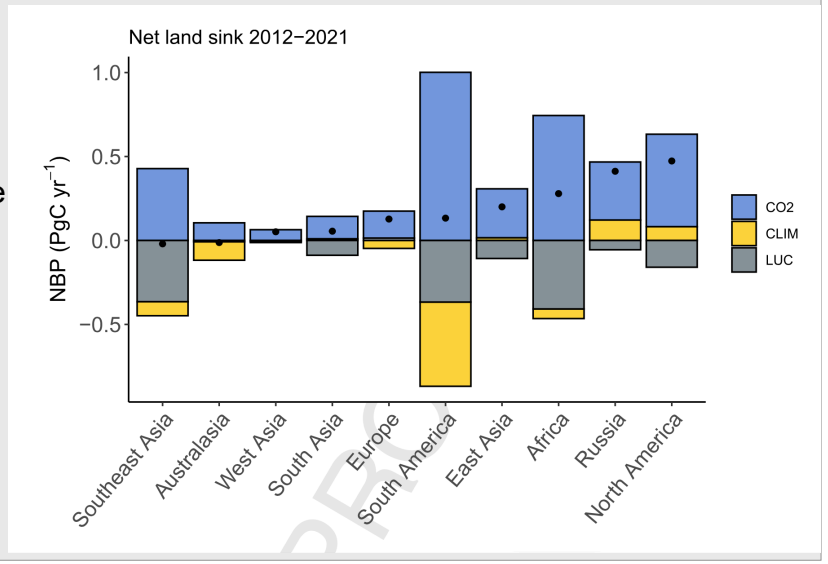

Figure 2: Regional mean net land-atmosphere exchange (symbols) for 2012-2021, with process attribution (bars).