



Improving land-use carbon emission estimates in Indonesia

Brasika et al. (2025), “Uncertainties in carbon emissions from land use and land cover change in Indonesia”, Biogeosciences. <https://doi.org/10.5194/bg-22-3547-2025>



Science Questions

- How can we assess the sources of uncertainties in estimates of land-use carbon emissions in Indonesia (which is a significant contributor to global land-use emissions)?
- What are the fundamental differences in land-use forcing datasets for Indonesia?

Analysis

Compare 3 land-use forcing datasets using a single DGVM, and a DGVM-ensemble

- Land-Use Harmonization 2, for Global Carbon Budget 2022 (LUH2-GCB2022), is a global dataset of annual land-use change (850-2022). Uses national FAO data, Landsat forest area changes, and MapBiomass products for regions of importance for the carbon budget.
- MapBiomass utilizes Landsat images to generate 30m maps of agricultural area for Brazil, other S. American countries, and now includes specific characteristics relevant to Indonesia. MB1 spans years 200 to 2019, whereas MB2 covers 2000-2022 with additional agricultural categories.

Results

- Indonesian cropland area increased between 10 and 20 Mha from 2000 to 2022, with LUH2-GCB2022 having the highest overall increase across all 3 land-use datasets
- Mean annual land-use emissions computed in JULES-ES ranged from 0.06 ± 0.01 PgC/yr (from MB2) to 0.11 ± 0.03 PgC/yr (from LUH2-GCB2022)
- Land-use emissions across multiple DGVMs using MB1 ranged from -0.04 to 0.35 PgC/yr with a mean of 0.12 ± 0.02 PgC/yr

Significance

Land-use and related emissions have multiple sources of uncertainty. The newer LUH2-GCB2023 used MapBiomass data for Indonesia for improved land-use forcing that couples long-term, global-scale data needs with national details from recent satellite observations.

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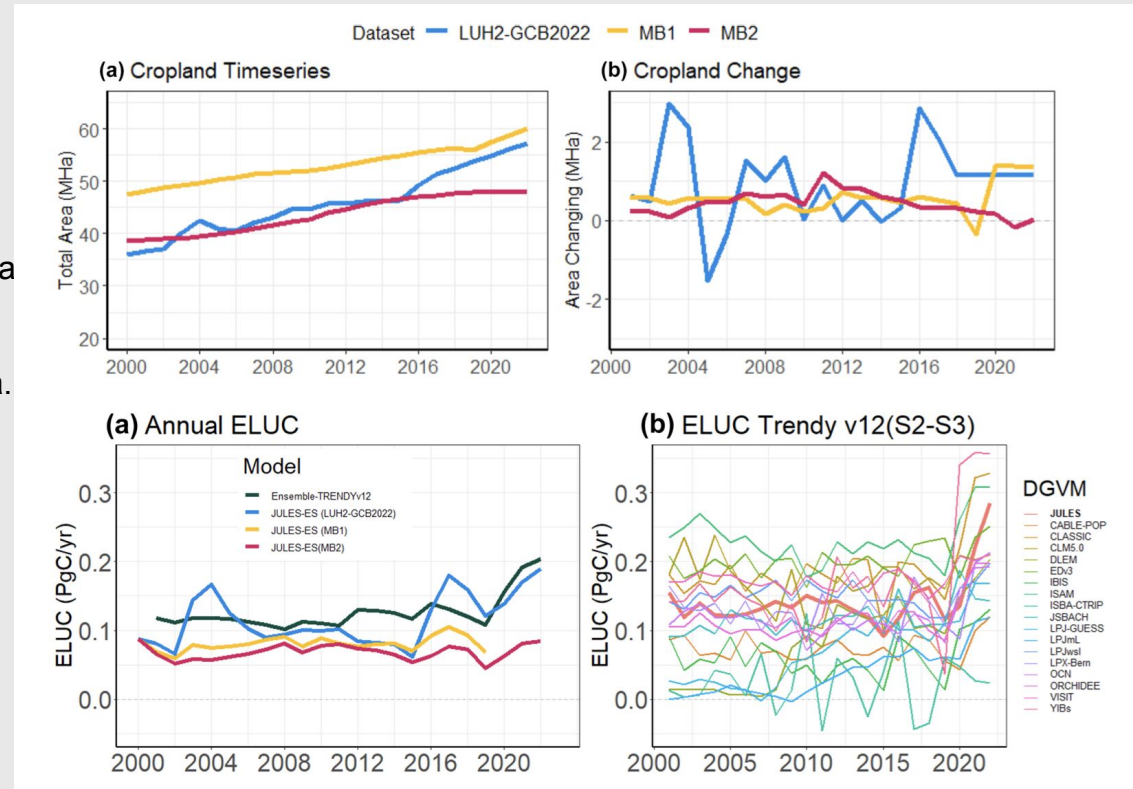


Figure 1

Top: time-series of Indonesian cropland area (left) and cropland area change (right) for 3 land-use forcing datasets.

Bottom: time-series of Indonesian land-use emissions (ELUC) from JULES-ES forced by 3 land-use datasets (left) and for multiple DGVMs forced with the MB1 dataset (right).