

Reconciling land use CO₂ fluxes: Efforts done so far (1)

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We're lost: can you tell me where we are?

You are at Latitude ABC and Longitude XYZ, at 100 m above sea level.

You must be a scientist. We asked you a simple question, you gave us too complex information and we're still lost.

And you must be a policymaker. We gave you an accurate answer, but you don't understand and blame us

> Modified from : Creating common purpose the integration of science and policy in Canada's Public Service, Canadian Centre fo Management Development, 2002

Global Carbon budget (2013–2022)



LULUCF in national inventories: GHG flux from managed lands

Approach to **reconcile the gap**: <u>add</u> the CO₂ sink considered 'natural' (estimated by Dynamic Global Vegetation Models) to the anthropogenic forest flux by Bookkeeping models.

This way, Bookkeeping models' results are adjusted to NGHGIs' definition

Approx. numbers from Friedlingstein et al 2023; Grassi et al. 2023



Navigation system: Car dashboard: National GHG inventories **Global models** 1 See 70 Km *Navigation system:* Car dashboard: left in the tank Distance until selected **Global models** National GHG inventories destination: 70 Miles Driver. Do you want to switch 70 Km Policy left in the tank from Miles to Km ? yes no maker Driver. Policy maker

"Translating" Global models' results to make them more comparable with GHG inventories is a pragmatic short-term fix to ensure a more accurate assessment of the collective country climate progress under the Paris Agreement.

This has been done bot for the historical period and for future emission scenarios



Reconciliation of *historical* data

Harmonising the land-use flux estimates of global models and national inventories for 2000–2020

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Blueprint for comparing anthropogenic land-use fluxes at various levels





Where these results stands in the Global C budget?

(averages 2000-2020)



Reconciliation of *future emission scenarios*

nature climate change

FOCUS ARTICLES

() Check to

Critical adjustment of land mitigation pathways for assessing countries' climate progress

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emissions they need to achieve, the urgency of action and the concept of net zero.

Conclusions and possible next steps

The main reason of the LULUCF gap between countries and global models is understood and can be largely reconciled.

A lot of work is still to be done:

- Countries → greater transparency on data/methods, greater completeness of estimates, definitions/area of managed lands, more clarity of LULUCF within climate targets
- Global models → better representation of land use areas and management, consistency between anthropogenic and natural fluxes, results disaggregated to be comparable to countries, etc..

Next steps: further increase comparability, operationalize the comparison, assess and communicate the implications (remaining carbon budget, net zero)



All roads to Paris pass through forests. Attention not to get lost among the trees.



ADDITIONAL REFERENCES

Carbon Brief - simple descriptions of the issue

- 2018: https://www.carbonbrief.org/guest-post-credible-tracking-of-land-use-emissions-under-the-paris-agreement/
- 2021: https://www.carbonbrief.org/guest-post-a-rosetta-stone-for-bringing-land-mitigation-pathways-into-line

2023: https://www.carbonbrief.org/guest-post-why-resolving-how-land-emissions-are-counted-is-critical-for-tracking-climate-progress/

Scientific literature: key papers

- Grassi et al. (2018) Reconciling global-model estimates and country reporting of anthropogenic forest CO2 sinks. *Nature Climate Change*, 8, pp 914–920.
- Grassi et al. (2021) Critical adjustment of land mitigation pathways for assessing countries' climate progress. *Nature Climate Change*, 11, pp. 425–434.
- Schwingshackl et al. (2022) Differences in land-based mitigation estimates reconciled by separating natural and land-use CO2 fluxes at the country level. One Earth 5, 1367–1376
- Grassi et al. (2023) Harmonising the land-use flux estimates of global models and national inventories for 2000–2020. *Earth Syst. Sci. Data* 15, 1093–1114.
- Friedlingstein et al. (2023) The Global Carbon Budget 2023. Earth Syst. Sci. Data, 15, 5301–5369
- Nabuurs et al. (2023) Reporting carbon fluxes from unmanaged forest. *Nature Communications* Earth & Environment volume 4, 337
- Gidden et al. (2023) Aligning climate scenarios to emissions inventories shifts global benchmarks. Nature, https://doi.org/10.1038/s41586-023-06724-y
- Jones and Askew (2023) Emissions scenarios and targets aligned to meet climate goals. *Nature* 624, 46-48 (2023)

Other related papers

- Heinrich et al. (2023) Mind the gap: reconciling tropical forest carbon flux estimates from earth observation and national reporting requires transparency Carbon Balance and Management volume 18, 22
- Nyawira et al. (2024) Pantropical CO2 emissions and removals for the AFOLU sector in the period 1990–2018 *Mitig Adapt Strateg Glob Change* (2024) 29:13
- Obermeier et al. (2024) Country-level estimates of gross and net carbon fluxes from LULUCF. Earth Syst. Sci. Data 16, 605–645, 2024

IPCC reports and side events

- IPCC 2006 Guidelines. Vol 4, Ch. 1. https://www.ipcc-nggip.iges.or.jp/public/2006gl/
- IPCC expert meeting report (2009) Revisiting the Use of Managed Land as a Proxy for Estimating National Anthropogenic Emissions and Removals https://www.ipcc-nggip.iges.or.jp/public/mtdocs/pdfiles/0905_MLP_Report.pdf
- IPCC 2019 Refinement. Vol 4, Ch. 1 and Ch 2. https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html
- IPCC side event at COP27 (2022) Estimating GHG Emissions: Reconciling Different Approaches. <u>https://apps.ipcc.ch/outreach/programme.php?q=81&e=5</u>.