

Review of LULUCF Data Hub

General Comments

The LULUCF Data Hub represents a significant and timely international collaboration. By aligning the JRC, GCB, and WRI datasets, the authors provide a vital benchmark for climate reporting and capacity development. To ensure this product meets the high standards of *Earth System Science Data (ESSD)*, the following suggestions are put forward to improve the transparency, nomenclature, and international integration of this work.

Nomenclature and Transparency of the JRC NGHGI Dataset

- A. While the JRC NGHGI dataset component is central to the Hub, its current presentation as "National GHG Inventory data" is somewhat misleading. As the manuscript notes, and as it is made clear by the metadata in the Zenodo version, this dataset involves significant data interpolation and interpretation, well beyond the original UNFCCC country submissions.
- B. Summarizing the gap-filled totals of the "NGHGI country data", as done in the manuscript in Tab. 2 and 3, provides a skewed impression of the current state of official country reporting to UNFCCC. Specifically, while official country data for LULUCF form a near complete set, the underlying forest data officially reported to UNFCCC by countries are significantly sparser than communicated in the manuscript.

Recommendations A: Name of dataset and data flags

1. Rename NGHGI, the key component of the LULUCF Hub, to more accurately reflect its nature (e.g., "JRC Gap-filled NGHGI");
2. Provide easy-to-read flags. For instance, the authors may consider adopting the international SDMX flags already in use by FAOSTAT emissions dataset, e.g. flagging 'X' the official UNFCCC country data and 'I' the JRC imputations.

Recommendations B: Improve description of country coverage

3. Add details regarding the 184 unique countries (plus the EU) with LULUCF country data (Tab. 3). It would be useful to clarify that the number of official country data varies year by year before gap-filling. Even for a specific year with lots of data like 2020, the reader should be informed that of the 184 countries with LULUCF emissions/removals country

data, only ~100 had official UNFCCC data for forest variables collectively, and specifically: ~95 countries have data for emissions/removals on forest land; ~70 have data for deforestation emissions; ~90 have data on forest land area; and ~70 have data on deforestation area. Only 65 countries provide the four variables consistently. While the gap-filled dataset is useful to provide global consistent numbers, what is the impact of such massive gap-filling, considering that the JRC NGHGI dataset is being used as a reference for assessing more complete sets. It seems unlikely that the basic information on specific forest subcategories in the gap-filled set can go beyond the one contained in the smaller, incomplete subset of official data.

4. In relation to the partial coverage of forest data, the authors may want to better qualify the information summarized in Tab. 2. Specifically, of the 197 countries included in the table, it would be useful to clarify that the 91 reporting forest land area to UNFCCC cover only ~3 Mha, whereas all 197 report forest land area to FAO that totals 4.1 Gha. To this end, the numbers provided in Tab. 2 for forest area (4.4 Gha) and managed forest area (3.7 Gha)—both generated using FAO forest land area to gap-fill missing information—require better explanation, in particular the former provides a total forest area that is larger than FAO's. The confusion also points to the need by the authors to work closely with FAO to clarify any misunderstanding in underlying area statistics.

Conceptual Boundaries and Uncertainty

A. Managed land

The discussion regarding "managed vs. unmanaged" land, and the related discussion on what is an anthropogenic emission/removal, is theoretically sound but perhaps overemphasized relative to the picture emerging from the very UNFCCC data being used. The latter show that most countries, when reporting to UNFCCC, effectively treat their entire forest land area as managed, and in many cases even report larger, not smaller forest areas than to FAO. Thus most countries reporting to UNFCCC already consider anthropogenic all the emissions/removals on their total forest land area.

Recommendations: Add nuance to the managed vs. total forest land area issue

5. Requalify the discussion in the text on managed land to further expand on the information relayed in Tab. 2, i.e., that the NGHGI data show that it is an issue limited to 9 countries. In fact it is a handful of these (Brazil, Canada, USA), that report managed areas that are smaller than the FAO total area, driving the difference with FAO in global

estimates of managed vs. total (~-400 Mha). This suggests that the fact the difference between world total and managed forest area is driven by ~three countries should be regarded as a numerical issue, one to be treated ad-hoc, rather than the basis for the global implementation of area correction factors to be applied to models in all countries. I realize that this issue is possibly solved by the decision tree used in the manuscript.

6. Importantly, the authors may want to usefully comment on the similar but opposite dynamic, whereas many countries report forest land area to UNFCCC that is larger than the total forest land area reported to FAO. As in the previous case, although this is by far a longer list than countries reporting managed areas smaller than total area, in the end this difference is also driven by a handful of countries (China, Russia, Namibia and Mexico), which alone add about 300 Mha to the world total forest land area in FAOSTAT. Countries may report to UNFCCC additional forest areas, not classified by FAO as forest land but rather as “other wooded land”. Incidentally, the gap amount noted herein bridges the 4.4 Gha in Tab. 2 with the FAO 4.1 Gha total, suggesting again the need by the authors to clarify these numbers, in possible communication with FAO.

A. Uncertainty and significance of country comparisons

The $\pm 50\%$ uncertainty in the LULUCF data populating the LULUCF Hub implies that the quantitative differences often discussed in the manuscript for individual countries should be regarded as qualitative, providing useful insights into specific regional patterns that may inform national and international data quality improvement programs. Apart from large patterns emerging in a handful of countries however, the comparisons of model estimates to NGHGI data presented in the manuscript appear to be within margins of "random noise," i.e., showing large groups of countries whose global totals tend to either over- or under-estimate the NGHGI reference by equal amounts.

Recommendations: Pay attention to 95% CI and statistical significance

7. Include explicit quantification of underlying uncertainty in results used for comparing country data to highlight level of statistical significance, focusing on qualitative explanations of important data quality issues rather than numerical analyses in cases where statistical significance is low.

Integration of FAO and Global Partnership Context

Given the Hub’s goal of being an international reference, the absence in the manuscript of FAO/FRA relevant data collection and dissemination processes is a notable omission. FAO holds the primary international mandate for forest statistics through the FRA process and its FAOSTAT emissions database, covering LULUCF extensively with FAO estimates while providing in parallel UNFCCC country data for comparison. This dataset is widely used in IPCC assessments and routinely consulted by national inventory compilers—is a logical inclusion or, at minimum, a necessary point of comparison for the Hub.

Recommendations: Explore collaborative options

11. The authors may consider inclusion of the FAOSTAT dataset in the Hub or provide a technical justification for its exclusion. Acknowledging the synergy between JRC and FAO data would strengthen the manuscript’s standing within the UN-level reporting framework, considering that FAO activity data and emission estimates already are integral part of IPCC recommendations to countries
 12. To truly serve as a basis for improving the accuracy of country estimates within a structured capacity development program, the Hub would benefit from a formal pathway for collaboration with FAO as the UN Organization mandated to work with member states on forest data. I encourage the authors to add a section in their conclusion regarding future steps for such expanded institutional partnerships.
-