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Supplement of

Carbon fluxes from land 2000–2020: bringing clarity to countries' reporting

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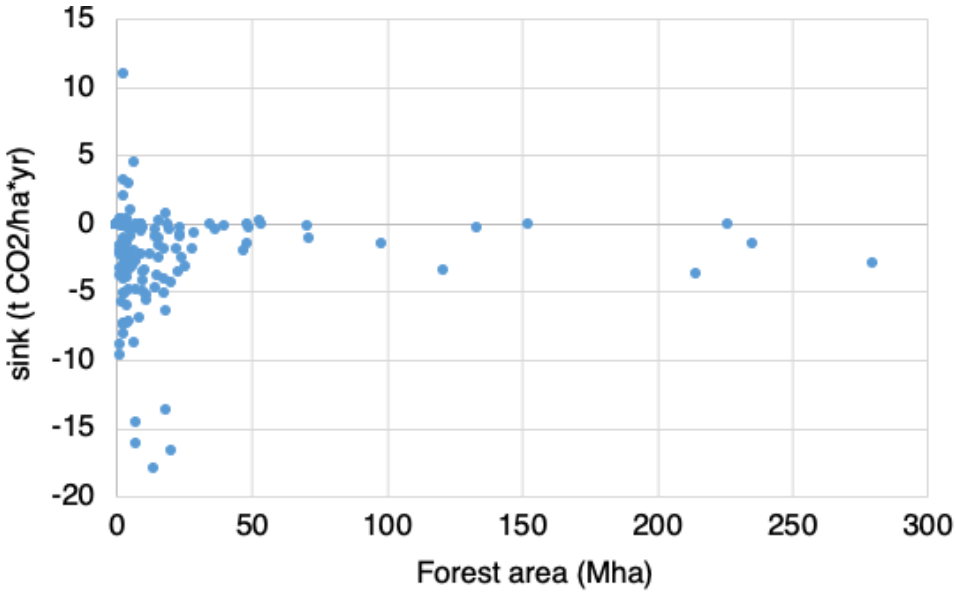
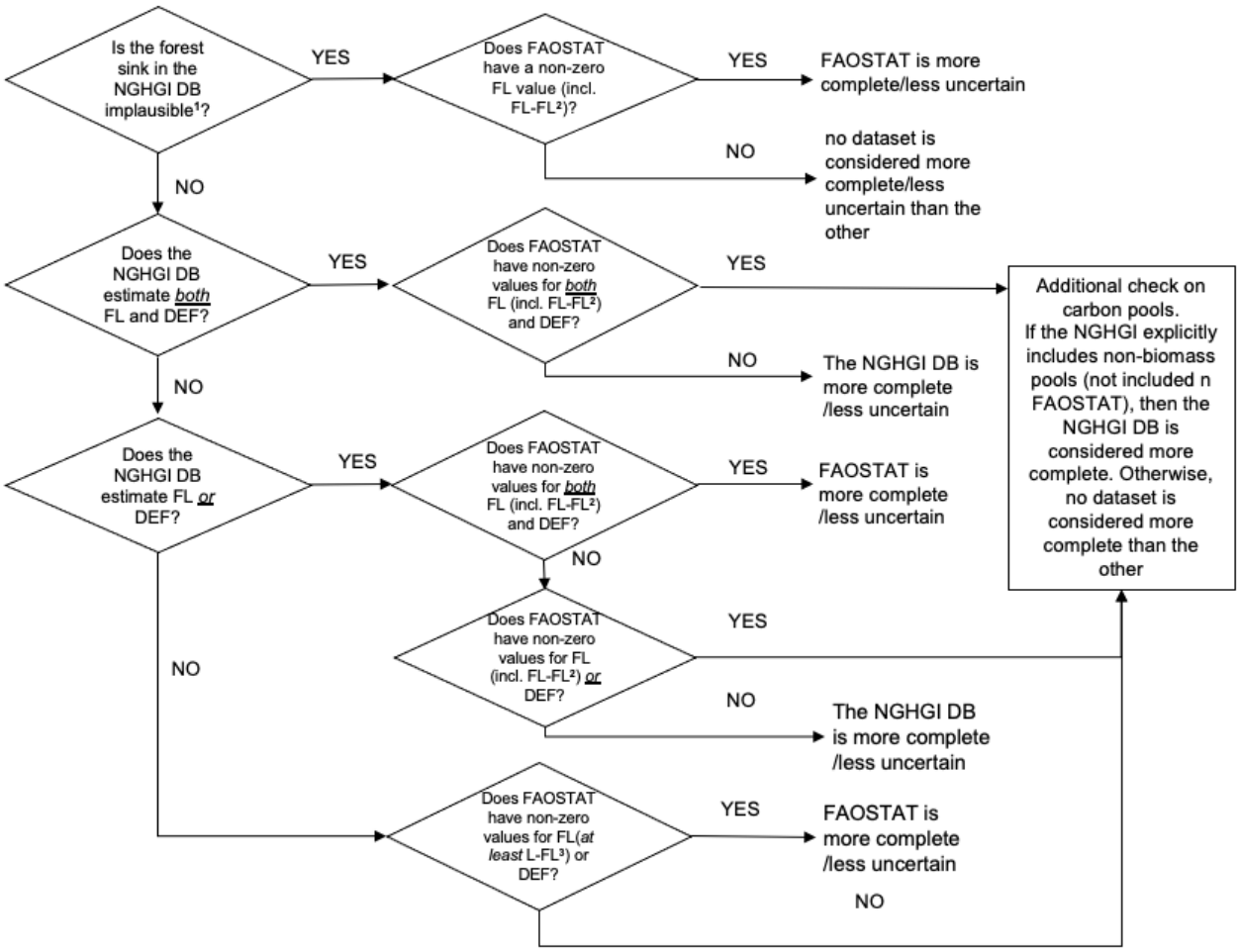
Data from this study are openly available via the Zenodo portal (Grassi G, Federici S, Abad Viñas R, Korosuo A, Rossi S (version March 2022). LULUCF data based on National GHG inventories (NGHGI DB), at https://doi.org/10.5281/zenodo.7190601.

FIGURES



Supplementary figure 1. Sink per unit of area in forest land, compared to the total managed forest area. Each dot is a country, and only countries with forest area >1 Mha are displayed. Sink values greater than -10 tCO_2/ha*yr are considered "implausible" in this study. To help readability, the x-axis is displayed only up to 300 Mha. This does not allow displaying Russia, which has about 700 Mha of managed forest and a sink of about -1 tCO_2/ha*yr.

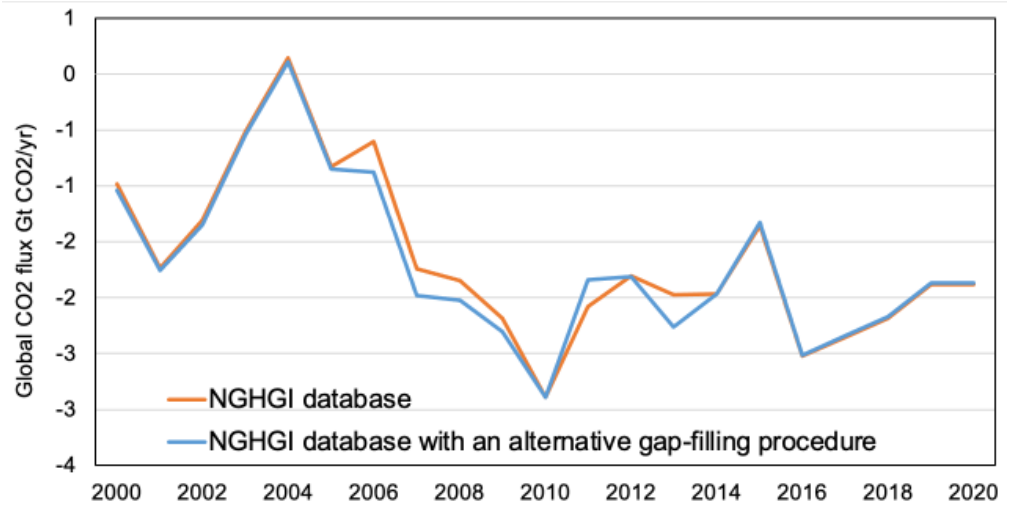


1. When the forest sink is greater than 10 tCO2/ha*yr over >1Mha.

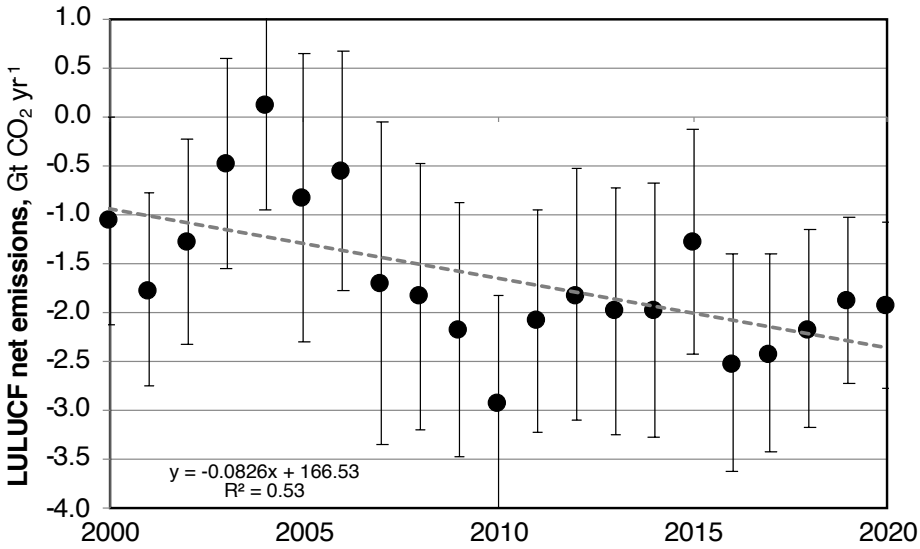
2. FAOSTAT does not distinguish FL-FL from land converted to forest (L-FL). Here, we performed an additional analysis based on the original country reports to FRA (FAO, 2020): if the country report includes a constant value of carbon stock/ha over time, then it is assumed that FL-FL is zero and that any value computed by FAOSTAT for FL comes from L-FL only.

3. When a value for FL is reported in FAOSTAT but the C stock/ha in the country report to FRA is constant.

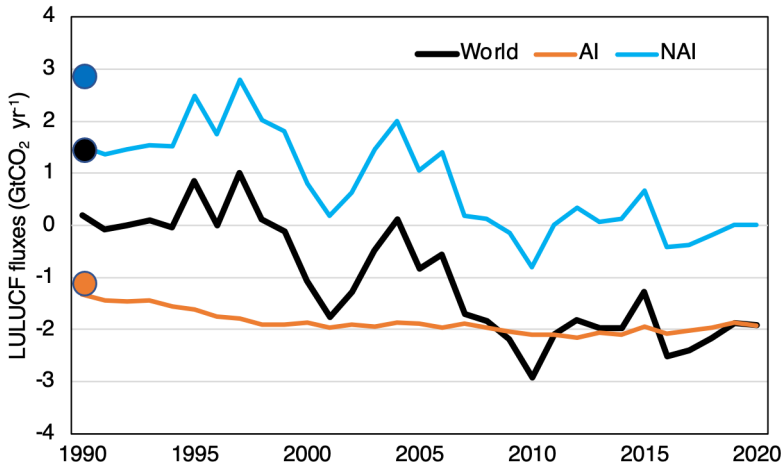
Supplementary figure 2. Decision tree to assess the completeness/uncertainty of carbon fluxes by each NAI countries for Forest land (FL) and Deforestation (DEF), in the NGHGI DB and in FAOSTAT. While the assessment above is essentially on completeness (with the exception on the first step on the plausibility of NGHGIs), according to the IPCC (2006) *lack of completeness* is a source of *uncertainty*; hence, here we speak of "completeness/uncertainty".



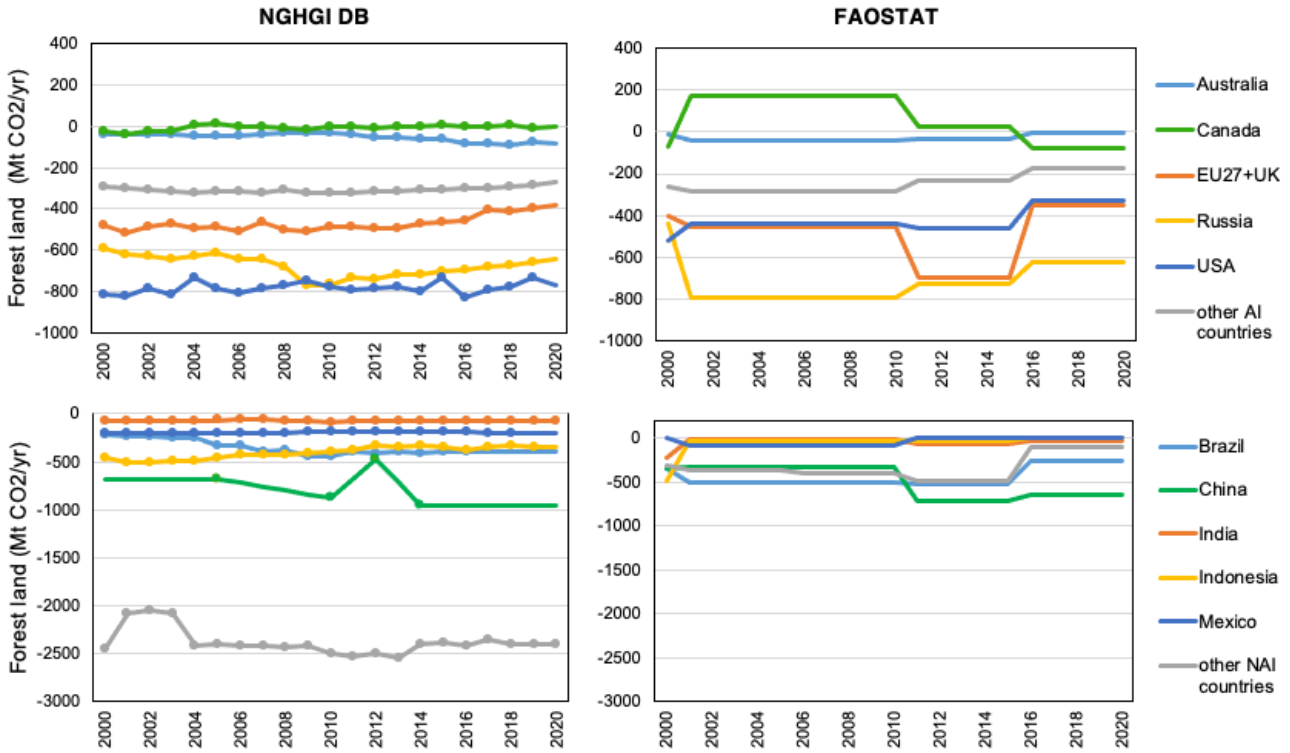
Supplementary figure 3. Comparison of two gap-filling procedures: linear interpolation between two data points (the NGHGI database presented in this study, orange line) and interpolation between two data done taking the most recent data to fill the missing years (NGHGI database with an alternative gap-filling procedures, blue line). In both cases, extrapolation backward (from 2000) and forward (until 2020) is done using the single closest available data. See methods for details.



Supplementary figure 4. Estimates of uncertainty (at 95% confidence interval) for global LULUCF net emissions from 2000 to 2020, based on information collected in the NGHGIs (Grassi et al. 2017, complemented by expert judgement) and then aggreged at global level using IPCC equations (see methods), along with the linear trend and its equation.

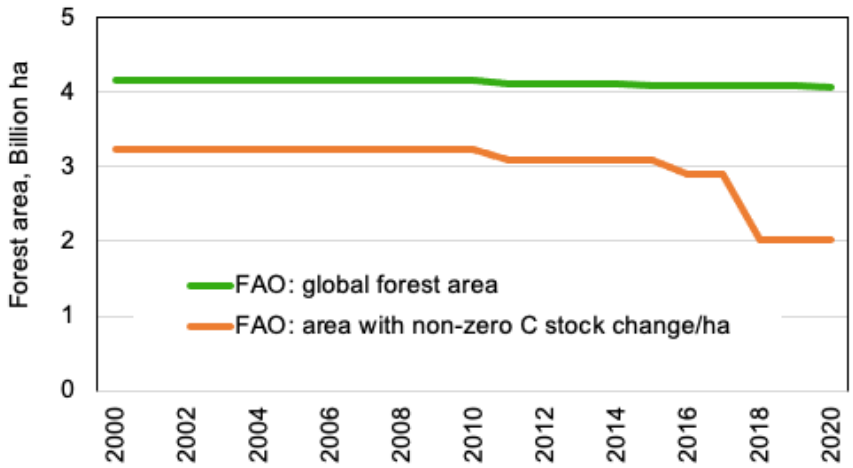


Supplementary figure 5. Trends of emissions from LULUCF from 1990 to 2020 in the NGHGI DB. For 1990-1999, data include all Annex I countries, plus data from the 10 most important non-Annex I countries (in terms of CO_2 fluxes) for which data are available (Argentina, Brazil, China, Colombia, Gabon, India, Indonesia, Malaysia, Mexico, Namibia). For the other non-Annex I countries, the value from 2000 was extrapolated backward until 1990. Therefore, for non-Annex I countries, data pre-2000 are less complete and more uncertain than data post-2000. Peak in emissions reflect years with high deforestation (e.g., 1995 and 2004 in Brazil) or fire activity (e.g., 1997, 2006 and 2015 in Indonesia). Conversely, the FAOSTAT LULUCF data are available over the entire period 1990-2020. The colored circles indicate the FAOSTAT LULUCF values for 1990.

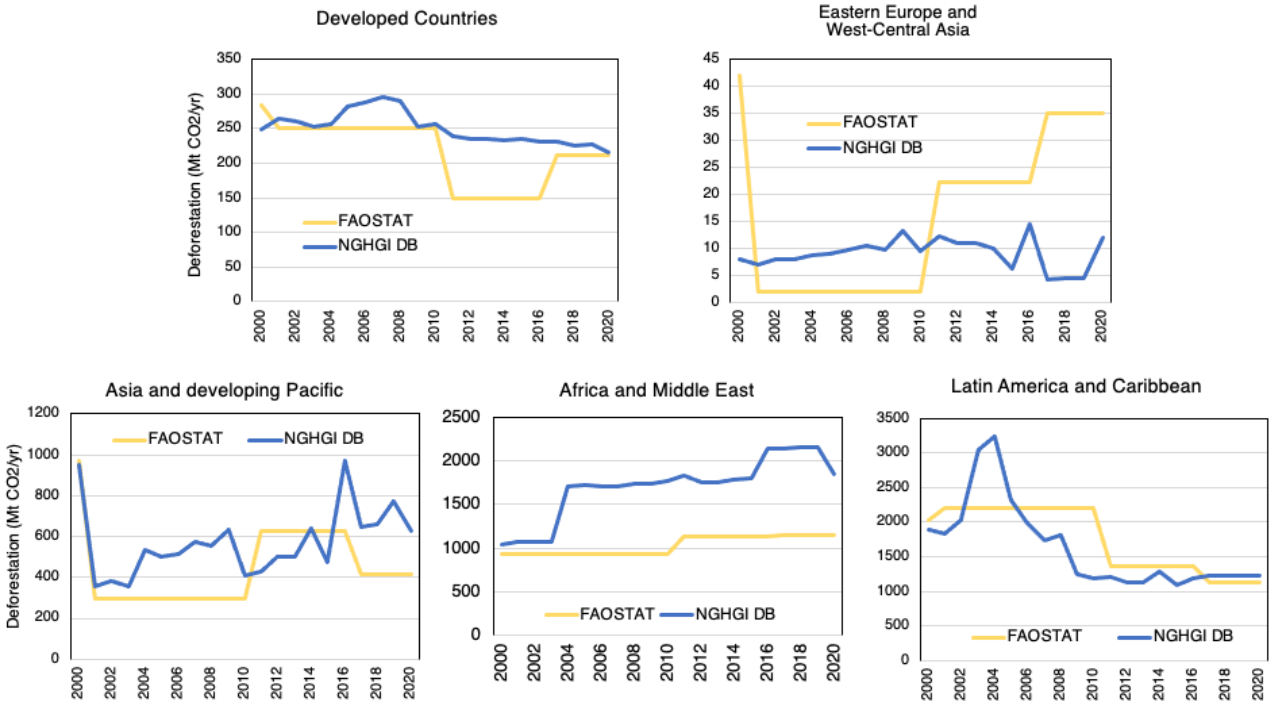


Supplementary figure 6. Trends of emissions from deforestation in the NGHGI DB and in FAOSTAT, for the top five AI countries (above) and the top five NAI countries (below). The higher sink in EU27+UK for the period 2011-2015 is largely due to a highly unplausible increase of carbon stock reported by Romania to FRA 2020, upon which FAOSTAT estimated a net sink of -285 $MtCO_2$/yr.

Supplementary figure 7. Trends of the values of C stock density (tC/ ha) from country reports to FRA 2020, for the top five AI countries (above, with Finland taken as example for the EU) and the top five NAI countries (below).



Supplementary figure 8. Trends of the global forest area from country reports to FRA 2020 (green line) and the forest area for which countries report to FRA a non-zero change in C stock (orange line).



Supplementary figure 9. Trends of emissions from deforestation in the NGHGI DB and in FAOSTAT, for five global regions.