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Reviews and syntheses: An empirical spatiotemporal description of the global surface–atmosphere carbon fluxes: opportunities and data limitations

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S1: Wood harvest and spatial redistribution methods

A global gridded (1-degree) wood harvest dataset was developed for GEOCARBON (http://www.geocarbon.net/) that included updated reporting of land-use statistics and sub-national scale data where available (Fig. S1). Annual wood harvest statistics for circa 2005-2010 were collected using a combination of data from National Forest Inventory (NFI) and from statistics reported to the UN-FAO Forest Resources Assessment (FRA) 2010. Details are provided in Table S1 regarding those countries where NFI data were used, including actual reporting years, national or sub-national statistics and supporting documentation. For the remaining countries, the wood harvest statistics were reported at the national level using the FAO-FRA, and were sometimes from reporting years prior to year 2000. We split the data to roundwood and fuelwood categories, using FAO-FRA for fuelwood harvest statistics when they were not included in the NFI (all countries in Table 1, except the USA and Canada). Total annual global wood harvest volume was 3,076 million m^3 for this time period, and assuming a global average wood density of 0.55 t m^{-3} (http://www.fao.org/docrep/w4095e/w4095e06.htm) and carbon content 50% of biomass, the annual wood harvest volume was equal to 0.89 Pg C.

The database was then spatially downscaled to a 1 km gridded product by assuming wood harvest was homogeneously distributed across the forested area of each political unit (i.e., national or sub-national boundaries), where forest area was determined from the 1 km Global Land Cover 2000 (GLC2000) dataset (European Commission, Joint Research Centre, 2003, http://www-gem.jrc.it/glc2000). Only the GLC2000 forest categories (Class 1, 2, 4, 5, 6) were used to calculate forest area per political unit for roundwood, whereas for fuelwood, the shrub categories were included (Classes 9, 10, 11, 12) as these were important for downscaling data in savanna-dominated regions. Global forest area using the GLC2000 was approximately 3.4 Mkm^2 and consistent with the FAO-FRA inventory statistics (McAllum et al. 2004) and the fuelwood harvest area was 5.6 Mkm^2. The data were then aggregated to 1-degree spatial resolution by summing the wood harvest for each 1 km grid cell within the larger grid. The dataset is similar to that produced by the Global Land use Model (Hurtt et al. 2006) who vary there

wood density by biomass expansion factor from 0.225 gC m^{-3} to 0.325 gC m^{-3}, whereas here we derive a fixed 0.275 gC m^{-3} value. Hurtt et al. (2006) estimate approximately a 1 PgC wood harvest flux.

A simple consumption-based model, to laterally transport wood harvest to sites of consumption (Ciais et al. 2008), was also developed. We based the model roughly on the definitions of Peters et al. (2012) accounting for fluxes of 'apparent consumption' and ignoring processing related losses. The redistribution of wood harvest was based on first estimating country-level wood use from import and export statistics from FAOSTAT (http://faostat3.fao.org) and then using the Gridded Population of the World version 4 dataset (GPWv4) to calculate per capita wood consumption. Country-level wood use was determined as, consumption = production + imports – exports, and then the per-capita consumption estimated as the summed country level wood consumption divided by total country-level population (using national boundaries from the Global Administrative Dataset version 2.8). These per-capita consumption rates were then multiplied by the 1-degree GPWv4 dataset to calculate gridded total wood consumption, which (reaggregated to the country level) was equivalent to the net production, import and export statistics from FAOSTAT. Lastly, we rescaled the FAOSTAT per-pixel wood consumption product to match the global sum of our wood harvest product by first calculating the fractional consumption of global wood harvest for each pixel (i.e., per-pixel wood harvest divided by the global wood harvest from the FAOSTAT approach), and then multiplying the per-pixel fractional consumption grid by the new global wood harvest product. The final redistribution of wood harvest was thus consistent with the original total global wood harvest estimate of 0.89 PgC, and took into account per-capita consumption rates and population density. The spatial distribution of wood harvest versus consumption is visualized in Fig. S2.

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Table S1: Sources of NFI data used for roundwood harvest.

Country	Scale	Year	Source
Austria	Lander	2005,2011	http://bfw.ac.at
Australia	State	2005,2011	http://www.daff.gov.au/a
Brazil	State	2005,2011	http://www.sidra.ibge.gov.br
Canada	State	2005,2011	Canadian Forest Service
Czech Republic	Regional	2005,2011	http://www.czso.cz/
Estonia	Regional	2005,2011	http://www.rmk.ee/for-a/forest
Finland	Regional	2005,2011	http://metla.fi
France	Department	2005,2011	http://ifn.fr
Germany	Lander	2005,2011	http://berichte.bmelv-statistik.de/
Norway	Regional	2005,2011	http://ssb.no
Sweden	Regional	2005,2011	http://slu.se
Switzerland	Canton	2005,2011	http://www.lfi.ch/resultate/regionen-en.php
USA	County	2005, 2011	US-Forest Service / TPO data
UK	Regional	2005,2011	http://www.forestry.gov.uk/
Rest of World	National	2005	http://fao.org

Figure S1: Political units for which wood harvest statistics were reported.

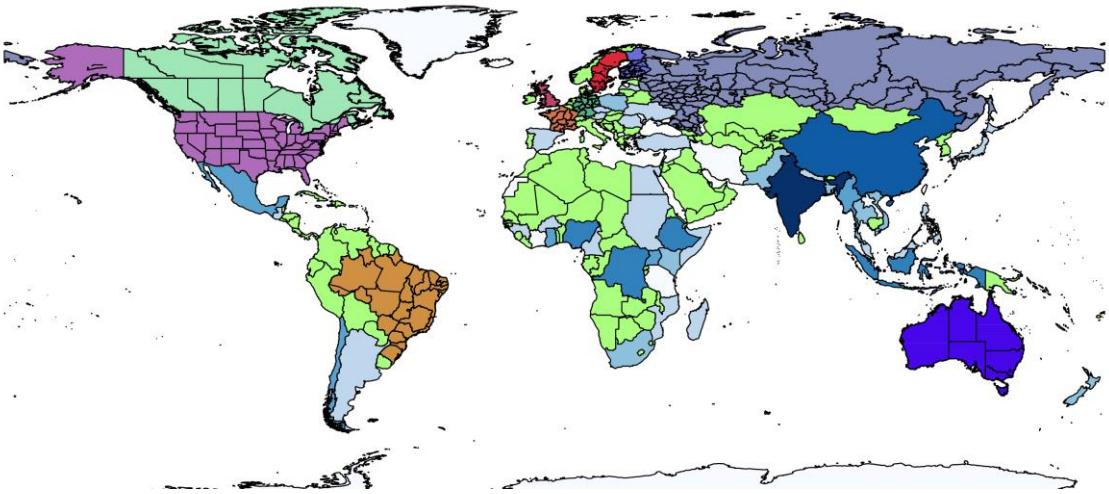

Figure S2: Difference between harvested and consumed wood (in m^3).