GHG balance in drained organic forest soils – data revisited

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Aim, materials and methods

Our aim is to produce a synthesis on GHG emissions from drained organic forest soils in the Nordic and Baltic countries[(*)]. We collected GHG flux estimates from IPCC-eligible peer reviewed literature. When needed, the data was appended with site- and site-type specific data for completing the annual soil net GHG balance for CO_2, NH_4 and N_2O. Duplicate estimates based on same monitoring data and estimates from experimentally modified sites were not included. The data were classified based on climate zone, nutrient status, land-use history, and stand stocking (FAO class includes sites with too low stocking for production forestry). Here we compare the annual flux estimates in these data with the default emission factors presented in the IPCC 2014 assessment on wetlands.

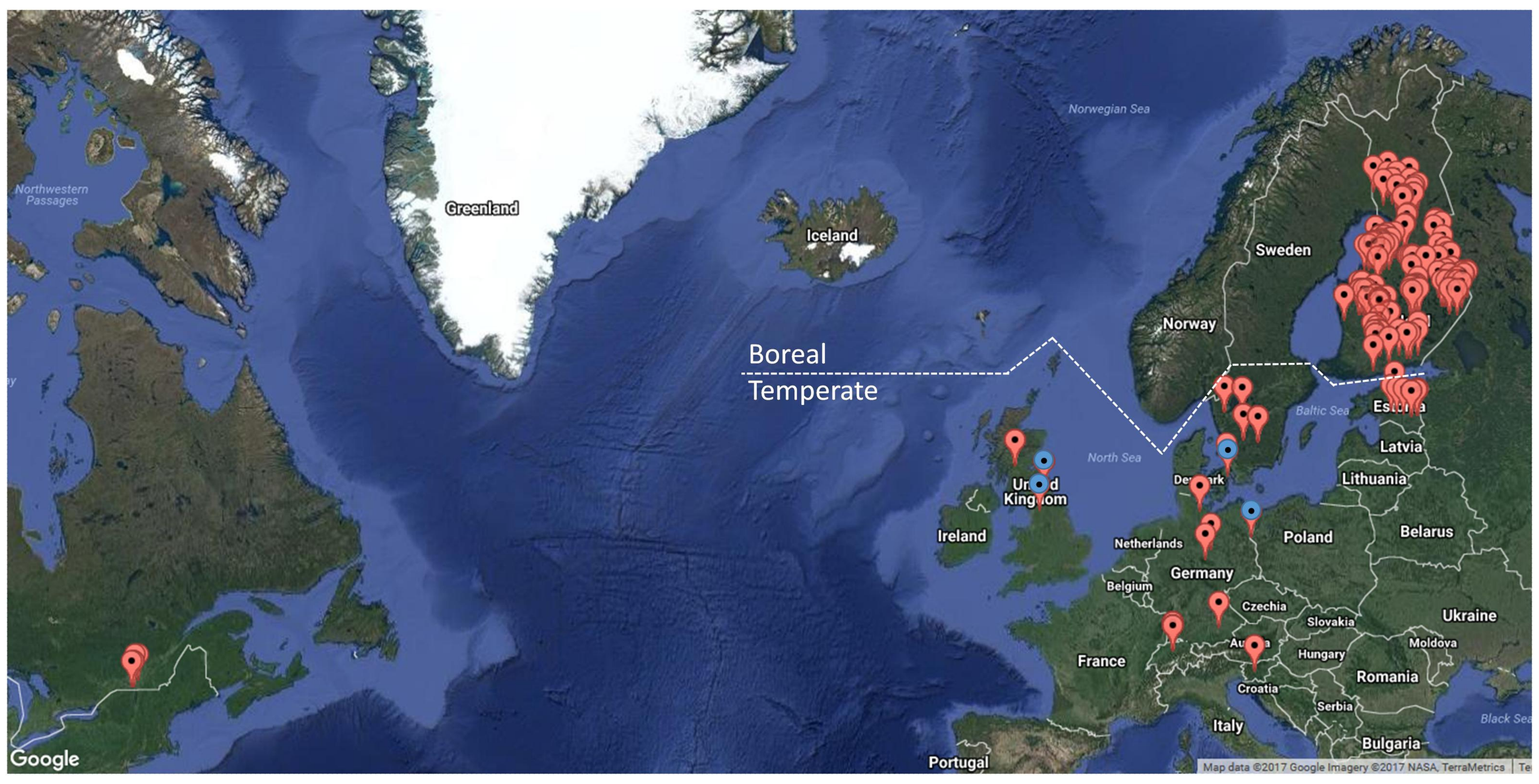
Annual CO_2, CH_4 and N_2O fluxes

Our database includes 197 CO_2, 205 CH_4 and 183 N_2O annual flux estimates. Most of the data were from boreal peatlands in Finland (**Map**). Data from temperate region were limited but included also 18 GHG estimates from other organic soil types (gleysols). Annual flux estimates in the data were largely within the range presented in the IPCC 2014 but some differences also occurred (**Fig. 1 & 2**). The increase in data amount allows added classification possibilities based on soil characteristics and site origin compared to the analysis in IPCC 2014.

Especially the count of CO_2 flux data was notably increased. This increase resulted largely from inclusion of closed-chamber monitoring flux estimates. Because most of such data describe a specific part of the ecosystem C fluxes, they had to be appended with other site- or site-type specific data (e.g., above- and belowground litter deposition and turnover rates, root respiration rate), and in some cases also annualisation of seasonal fluxes was needed. Datasets providing CO_2 fluxes on annual basis (eddy covariance and chamber data) and as longer-term flux averages (soil inventory data) were compared and the flux estimates were found to quite similar, even though there was clearly more variation in the estimates based on soil inventory (**Fig. 3**).

Gaps in knowledge and reporting

More detailed site description (e.g., tree species composition, stand volume or basal area, basic soil characteristics) in reporting would enable more efficient data use in modelling aiming at higher Tier levels in GHG emission accounting. Lack of data from the temperate zone is obvious.



Map. Monitoring sites on organic drained forest soil (red=peat, blue=gleysol) providing seasonal and annual CO_2, CH_4 and N_2O flux estimates in boreal and temperate regions.

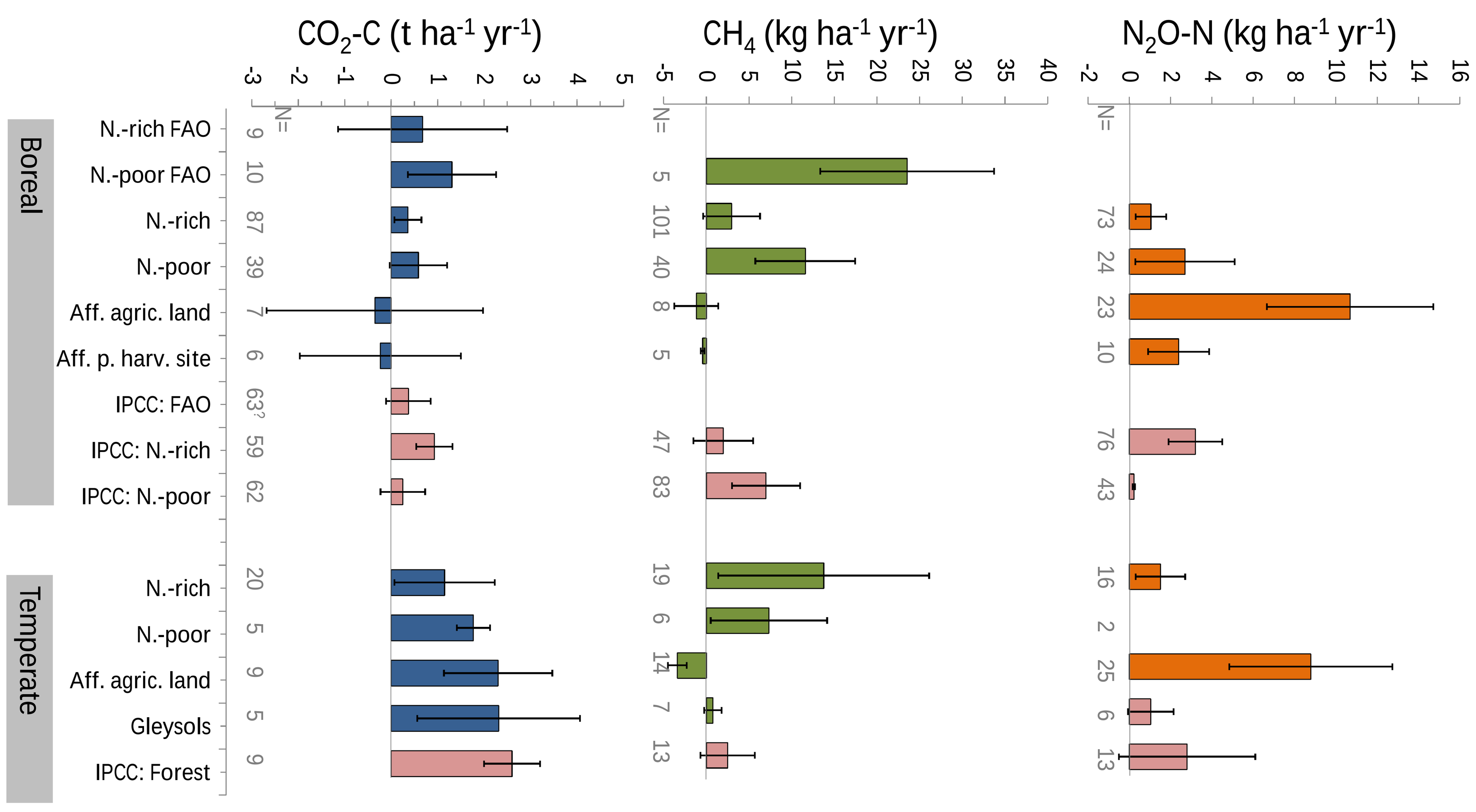


Fig. 1. Soil net GHG balances in drained organic forest soil classes based on revisited peer reviewed data and on IPCC 2014 assessment.

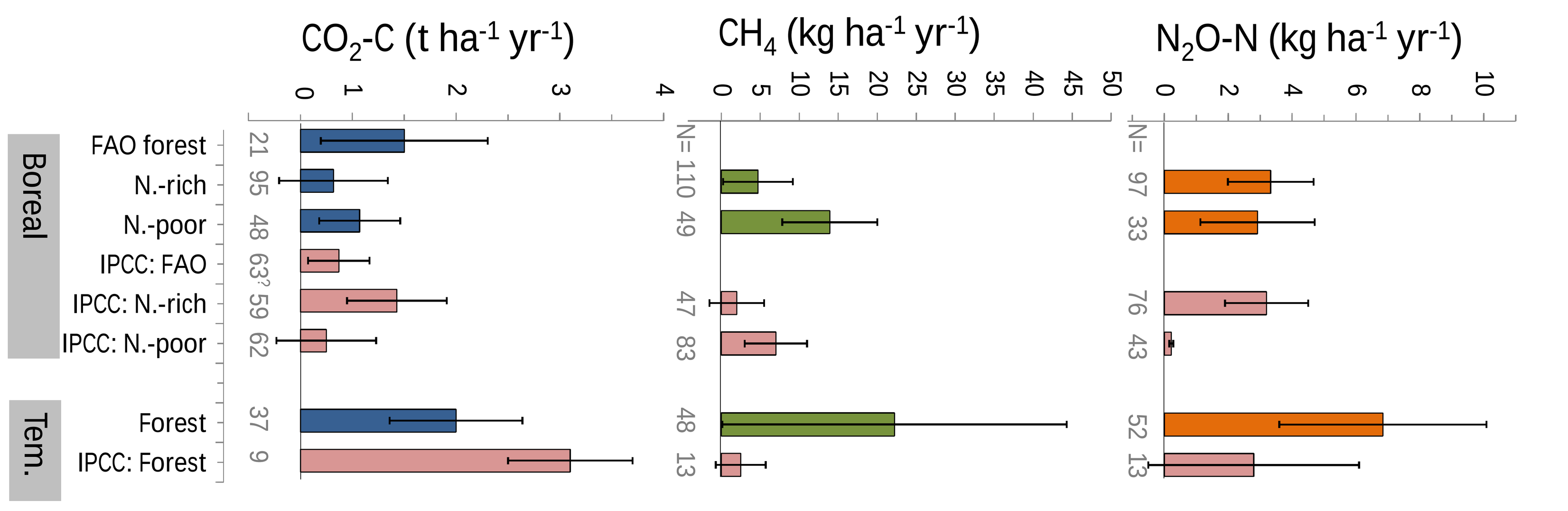


Fig. 2. Soil net GHG balances in drained organic forest soil classes based on revisited peer reviewed data and on IPCC 2014 assessment presented by formally comparable groups.

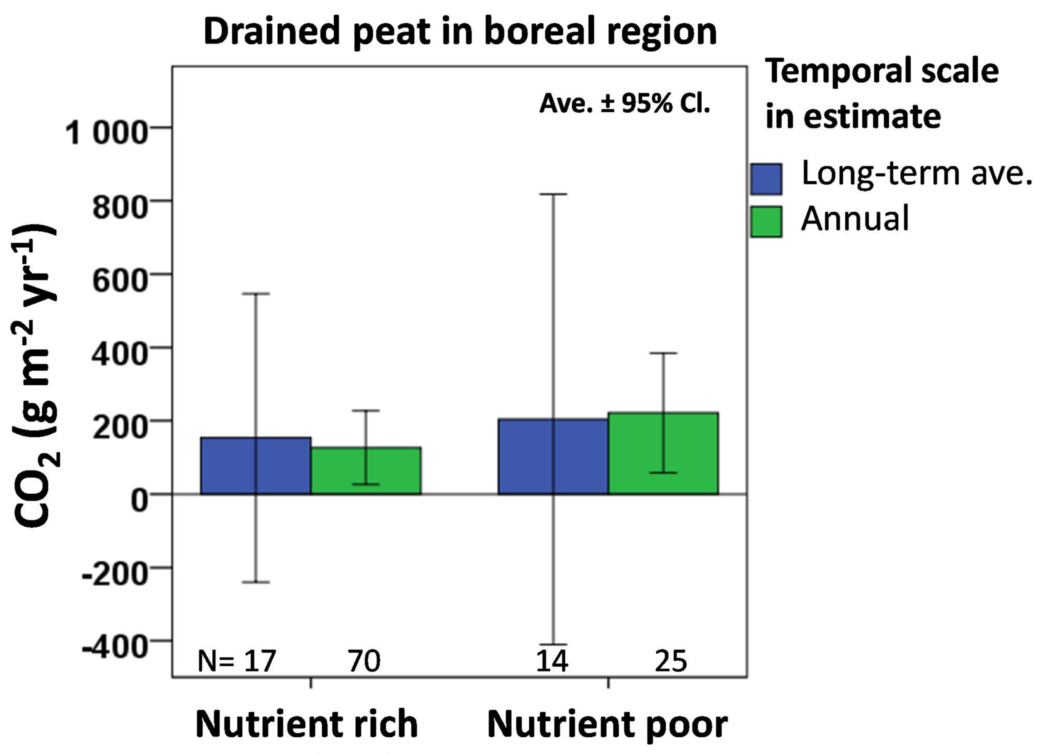


Fig. 3. Comparison between annual soil net CO_2 exchange estimates derived from long-term averages (peat inventory methods, e.g. subsidence method) and from annual estimates (eddy covariance and chamber methods) for drained forest soils.

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