

Interactive comment on “A cost-efficient method to assess carbon stocks in tropical peat soil” by M. W. Warren et al.

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Authors' comments to referee #2:

The reviewer raises good points of discussion to be considered for the final version of the paper. The main recurring questions pertain to how this method can be used to estimate C stock change, (thereby CO₂-e emissions), at what Tier, and how this method compares with subsidence methods such as suggested by Hooijer et al. (2012).

Using a higher tier stock change approach to assess CO₂-e emissions from peatlands for national greenhouse gas inventories or application to REDD type projects requires: 1) Net volume of peat lost from LULUCF (including fire and heterotrophic oxidation), and 2) Carbon density of the peat lost from LULUCF. This study presents a low cost

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method to estimate the latter, and estimates of peat volume losses are still necessary for emissions calculations. The C density estimates derived by the method presented in our study could greatly expand national and regional datasets for determination of default values and increase the accuracy of IPCC Tier 2 methodologies, and could also be used for Tier 3 methodologies if the assumption of C content >40% is validated for a subset of peat samples for the peatland area of interest. Furthermore, the method presented here can be used to calculate C density from existing bulk density data for studies which did not include direct measurements of peat C content. An expanded dataset of regional or national C density values for peatlands would contribute to the accurate estimation (and quantified uncertainty) of emission factors needed to calculate CO₂-e emissions at lower tiers when combined with default values of carbon volume losses from LULUCF activities.

While our study introduces a method to easily estimate C density and belowground C stock in peatlands, Hooijer et al. 2012 focus on estimating C losses from the oxidation component of subsidence. In their study, peat volume losses from oxidation are estimated by measuring subsidence rates and changes in bulk density, where increases in bulk density would indicate soil compaction and consolidation. Hooijer et al. 2012 calculate C density of oxidized peat by multiplying bulk density measurements by a default value for C content of 55%, from Suhardojo and Widjaja-Adhi (1977). Although the method used and variation of C content values from Suhardojo and Widjaja-Adhi (1977) are not presented, it is likely that %C determination was from a semi-quantitative method such as loss on ignition (LOI) or Walkley-Black wet combustion. These methods are measures of organic matter (not %C) and known to be less accurate and precise than direct C analysis with an induction furnace C analyzer. We suggest the method presented here could improve estimates of C density over a standard default value, particularly when site specific values are not available. It would be interesting to recalculate the C losses estimated by Hooijer et al. (2012) from subsidence using bulk density measurements and the method presented here for comparison.

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To summarize, the equation we suggest for calculating carbon density from bulk density is a tool to determine one factor that is needed for CO₂-e emission estimates using a stock change approach, and would be applicable to any stock change method including estimates of the oxidation component of subsidence or peat losses from burn scars. Peat volume loss estimates are still needed to estimate CO₂-e emissions, and can be accomplished using several alternative techniques. Our study demonstrates that C stocks can be accurately predicted from bulk density data using a general equation, and does not consider stock changes from LULUCF.

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