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Biogeosciences Discussions

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

Anonymous Referee #1

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This paper addresses a topic of broad interest to both scientists and those involved in carbon conservation schemes. The paper is for the most part well written with appropriate analysis but I have several concerns which may preclude publication in a high quality journal such as Biogeosciences. My foremost concern is the restricted size of both the primary and secondary data sets. A limited number of literature sources are consulted, while one of the sites (Danau Sentarum) may not be broadly representative of other coastal/sub-coastal lowland peatlands in SE Asia (see below). I believe the authors should be encouraged to present a more comprehensive and better researched piece of analysis using a larger data set more likely to be representative of tropical peatlands. Determination of bulk density (Bd) is the principle methodology used in this paper, yet very few actual Bd values are presented, thus the research is somewhat abstract and, on the basis of the data currently presented, unverifiable. At the very least,

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a table is required that presents the average values and other key statistics like range for each of the 3 regions (Danau Sentarum, Sabangau, Berbak), and of the literature sources, as a function of depth. The same table is also needed for carbon content. In its present form, it is impossible to judge if the numbers presented are supported by other studies.

Specific comments p.7053,l.1 "... converting peat forest to industrial plantations (a dominant land use transition of tropical peatlands in Indonesia; Koh et al., 2011) Comment: Miettienen et al 2012 provides a more recent and accurate measure of peat land conversion to industrial plantations.

p.7053,l.2 "...occur from initial burning to clear land. During the unusually severe fire season of 1997, drought conditions prompted opportunistic and uncontrolled burning which eventually affected over 2 Mha of wetland ecosystems throughout Indonesia, resulting in C losses commensurate with the 1.5 PgC average annual flux from global land use change from 1990–2005 (Taconni, 2003; Le Qu′ er ′e et al., 2009; Page et al., 2002; Langmann and Heil, 2004). Comment: if fire emissions are discussed, it should be made clear that fires have occurred in many (most) subsequent years, not just in 1997. These sources indicate a larger area of burnt peatland than 2 Mha.

p.7053,l.13 "... Posa et al. (2011) suggested that only about 37% of Southeast Asia's initial 182 541 km2 of peat swamp forests remain, and Miettinen and Liew (2010b) estimated that half of the peat swamp forest area mapped in peninsular Malaysia, Borneo and Sumatra in 1990 had been converted to other land uses by 2008, implying large scale C emissions from land use change." Comment: Posa did not carry out the primary research to arrive at these figures, but mostly used data from various papers by Miettinen et al. and others. It would be better to refer to the original source of such numbers, not to other papers that loosely interpret these sources. Miettinen et al's various papers show that of this 37% of remaining forest, only a small part still has intact canopy. Miettinen et al 2012 provides the most recent and complete picture.

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p.7055,l.12. “Original data included in this study . . . including four sites at Danau Sentarum National Park (W. Kalimantan Province), four sites at Sabangau Natural Laboratory for Peat Swamp Forest (NLPSF; C. Kalimantan Province), and two sites at Berbak National Park (Jambi Province, Sumatra). At each of these sites three to six peat cores were extracted from 10m diameter subplots established along 250m transects using a Russian peat sampler (Jowsey, 1966).” Comment: the amount of original data used in the analysis is actually rather small: 3 areas with 2-4 sites each, with 3-6 replicate cores each, along very short transects (given that peatland domes may extend over distances greater than 20 km with peat thickness often over 10m and occasionally up to 20m). A total of less than 50 cores, with a regional spread that does not in fact include the single area that has the largest peat extent, which is Riau. This is not necessarily a terminal problem, but it is a limitation that should be made clear.

p.7055, l.19. Did the transects cross the peat dome – i.e. what was their orientation to the slope of the dome? How was a distance of 250 m decided upon? As commented above, these domes can be v. extensive. Likewise, peat cores with depths 1.9 to 4.2 m from the Sebangau site may not be representative across the full range of peat thickness at this site (max. thickness > 12 m). Some comment on this should be made.

p.7056,l.3. It is a bit worrying to see that by far the most samples were derived from Danau Sentarum (434 vs 174 for Sabangau/Berbak combined), as this is a highly atypical peatland area being inland and far older than the other (coastal) peatlands in Sumatra and Kalimantan. This casts some doubt on the representativeness of the results; again this fact should be acknowledged.

p.7056,l.3. It should be indicated that Bd values as determined from vertical peat cores collected using a peat corer can be subject to errors, as this method A) compresses the peat (increasing sample Bd; this is especially a problem in peat with high wood content as is the norm in SE Asia) and B) carries the risk of retrieving incomplete samples with air/water pockets (decreasing sample Bd). The method of taking horizontal samples from open soil pits is in that sense preferable (although more laborious, and requiring

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pumping where water tables are high) (see Hooijer et al. 2012). It should be described how these error sources were dealt with and (since they are to some extent inevitable) how they are thought to influence the final result.

p.7060,l.8. "Current estimates of tropical peat C stocks and fluxes often rely on assumed default values for Bd (usually around 0.1g cm−3), " Comment: in fact, many sources indicate that the Bd values for undisturbed peat, and also in some disturbed areas, are below 0.1 g cm−3. See numerous old IPB publications, or the Andriesse 1988 FAO review, or for recent examples the Page et al 2011 (Global Change Biol) and Hooijer et al 2012 paper in Biogeosciences.

p.7060,l.8. "(Ballhorn et al., 2009; Jaenicke et al., 2008; Murdiyarso et al., 2010; Page et al., 2002, 2004, 2011). Comment: most of these references do not report original data (Page et al., 2004 is an exception), and only Page et al. 2011 specifically deals with peat characteristics. This is a strange feature throughout this paper: it relies quite a lot on indirect sources, rarely on original sources or on reviews that are truly relevant. Improving the breadth of the referencing could really improve this paper. Acknowledging the difference between primary and secondarily derived data would also be informative to readers who may not know the literature in detail.

p.7060,l.19: The vertical auger method is advocated here as the primary tool for deriving Bd values, whereas it is widely known to be sub-optimal and sometimes very inaccurate (see earlier comments above). I would suggest that the alternative more reliable method of open pit sampling is also given as an alternative.

p.7065, Table 1: There are far more Bd data in other papers, many of which are referenced in Page et al 2011, and most recently in the Biogeosciences paper by Hooijer et al 2012. I would suggest including at least the latter, as it alone in fact presents results for double the amount of data presented in this analysis.

p.7068, Figure 1: These figures present Bd in kg m-3, whereas the text refers to g cm-3. This is confusing.

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Interactive comment on Biogeosciences Discuss., 9, 7049, 2012.