Biogeosciences Discuss., 11, C7762–C7765, 2015
www.biogeosciences-discuss.net/11/C7762/2015/

Biogeosciences
Discussions
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Interactive comment on "Biogeochemical indicators of peatland degradation – a case study of a temperate bog in northern Germany" *by* J. P. Krüger et al.

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Received and published: 3 January 2015

BG review Journal: BG Title: Biogeochemical indicators of peatland degradation – a case study of a temperate bog in Northern Germany Author(s): J. P. Krüger et al. MS No.: bg-2014-492 MS Type: Research Article

Review by: Wladimir Bleuten

General comments The article present an interesting attempt to define decomposition of peat in three different land unit types by radio isotopes of N and C and classical methods (ash content, C/N, Bulk Density, 14C). The results of the different methods have been compared and combined in order to find clues for determination of peat

decomposition rates related to land use.

The "semi-natural" type (NW), according to the vegetation composition obviously has been degraded. The question rise if the top"soil" of this NW type can be compared to the grassland types, which both are drained heavily. There is no information about the application level of manure, fertilizer and or lime, nothing mentioned about cattle grazing (and dropping) yes or no. Liming, if occurred, will strongly influence the Carbon and ash content of the top layers and therefore effect the conclusions from the analyses.

The location of the cores and the surrounding drainage system development over time could be found in Leifeld et al. (BGD-11-12341-2014 Supplement: Fig S1). It should have been much better if this Figure was included in this paper (I could not find/open any supplement of the article).

Specific comments Definition of catotelm as used in this paper is missing. What is the top of the soil: top moss heads, top of acrotelm? That is important for interpretation of decomposition: in acrotelm always rather high. No C-concentration data are presented, only ash content Depth in Table 1 is missing: regressions refer to different depths? It is not clear which peat layer(s) of the NW cores are used as reference peat

Technical corrections P3: 6-7 Alternatively, under anaerobic conditions with anaerobic decomposition the depth profile may show a slight decrease with depth because of an relative enrichment of 13C depleted lignin Not clear what is meant here. Maybe better use instead of "alternatively": "However," And what is "13C depleted lignin" ? 12-13 Together, peatland drainage induces a change from a uniform δ13C depth profile to increasing δ13C values with depth. That is valid for catotelm layers, not for acrotelm. 25-27 In intensively managed ecosystems, the application of mineral and/or organic fertilizer, with their different isotopic signals, could additionally alter the stable nitrogen isotope signature in soil Also by droppings from cattle and by atmospheric deposition N balance will be influenced, the latter not only in intensively used peatland. 29-31 Little decomposed peat has wider C/N ratios, reflecting the former plant material, whereas

the ratio becomes narrower in strongly decomposed peat owing to a preferential loss of C over N during microbial decomposition. “wider” and “narrower”: low and high? Expected is depletion of N by microbial decomposition and therefore increase of C/N ratio. P 5 11-12 .. vegetation is dominated by cross-leaved heath (Erica tetralix L.), flat-topped bog moss 11 (Sphagnum fallax Klinggr.), and common cotton grass (Eriophorum angustifolium Honck.). On p10:1 Calluna vulgaris is mentioned to be one of the dominant species. Typically, the presence of heather points at some drainage. Where were the cores taken? 16 (GI type) ..fertilized with mineral fertilizer and manure. What about cattles droppings, liming? 16-17 GI is drained with pipes as well as drainage ditches whereas GE is only drained by ditches Depth of drainage?, depths of ditches? Distances of drains and ditches to the core sites? 18 At the NW site, the water table was around the soil surface What is meant with “around”? Needs specification. 28-29 . . .three peat cores per site were collected in the Ahlen-Falkenberger peatland at NW, GE and GI (n=3). No details of the core sites location properties. Is it expected that the 3 land unit types are homogenous spatially? P6 13-14 The material remaining after heating is defined as the ash content of the sample. The presence of lime (naturally and or applied for agriculture) is included in Carbon content? Results of Organic Matter or Carbon content and of Bulk Density are not presented in this article which is an omission. P7 5-7 we assume that the ash content in the catotelm is not affected by drainage and ash from the oxidized peat remains at the site and accumulates in the upper layer. The ash content of the catotelm of each individual core is taken as a reference value Not clear what is meant here with “catotelm”. Usually it is dedicated to the permanently saturated peatlayers of pristine bogs. In the bogs described here the lower water table is -40 to -80 cm below the “soil”surface, which means that at least part of the original catotelm fall dry as a result of artificial drainage. What is meant with the “upper layer”? Is that catotelm? Or top of catotelm? It is advisable to avoid the usage of the term catotelm for this study.

P8: 20-25, p9: 4-5 The interesting differences in d13C increase with depth between the grasslands and the NW type is related to drainage even in the NW site. However, in

the (limited) description of the site the water level is said to be “near the surface”. The top layers of the NW site differ substantially to the grassland sites, but this cannot be verified as the article does not give details of the core. Most probably, the top layers of the NW site consists of fresh organic material (acrotelm thickness can be up to 40 cm). In contrary, the top layers of the grasslands consists of already partly decomposed peat (see 14C ages in Fig 2). In Table 1 the regressions coefficients and slopes between the core sites are compared but for the NW site to a depth of ca. -0.5 m and for the GE and GI sites ca. -0.3 m (depth of -25 0/oo, deducted from fig 1).

P9: 20 – p10:20 (3.2 Stable nitrogen isotopes) Here, also the differences between NM and grassland sites are described solely from the analyses. The peat material, in particular of the upper layers are different between NW and grassland sites, which influence the value of the conclusions.

P11 (3.5 Ash content and bulk density) 15-16 (Fig. 4). Bulk density increases at this depth and is higher compared to deeper parts of the profiles and 18-19 We interpret this accumulation as being the result of drainage activities in the vicinity of NW during formation of these peat layers There is no information about the presence of charcoal within the peat as indicators of fires at or near the core sites. Fires may explain the peaks in ash content about ca 1880 and ca 1780 (estimated from Fig 4). Also by deposition of mineral soil material spread from arable land by wind may explain the peaks. The conclusion that any increase in ash content result from drainage can be doubtful. 20-21 At both grassland sites, ash content (Fig. 4) and bulk density (Fig. S1) increase strongly in the upper centimeters Could not find Fig S1

Interactive comment on Biogeosciences Discuss., 11, 16825, 2014.