

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

Anonymous Referee #6

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General Comments

In this paper, Krüger et al report the results of a study investigating the depth profile of various biogeochemical markers in peatlands. These markers are examined for their suitability in determining both qualitatively and quantitatively the level of peatland degradation. This paper is clearly appropriate for Biogeoscience, providing a useful assessment of the varying degrees to which stable isotopes, bulk density, C/N ratios, radiocarbon age, and ash content can be used to assess peatland health in the past and present. I believe the paper is suitable for publication, provided the authors address the issues brought up in the review process.

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The authors may wish to consider rearranging the Results and Discussion section so that section 3.7 (radiocarbon age) appears before the other sections. This would allow them to make explicit linkages between peat age and the other biogeochemical markers. For example, in section 3.5, there is an inference of drainage activities owing to the enhanced ash content in the NW site between 10 and 60 cm. If the radiocarbon ages were presented earlier, this presumed drainage period could be linked to an actual date, and discussed in the context of the historical record.

In some places, the units were a little different than elsewhere in the literature. For example, p2L24 (and others) use $\text{t C ha}^{-1}\text{a}^{-1}$. Consider using kg or Mg, and yr instead of a. This may be a convention for Biogeoscience, though.

When the authors reference GHG emissions, it is a little unclear whether this refers to just CO_2 emissions from the soil or to a fuller assemblage of GHGs including methane, N_2O , etc. For example, on P5 it discusses "Current GHG flux measurements", but then presents the actual fluxes in terms of NEP, which implies CO_2 fluxes only. Be clear about the types of emissions you are describing; if it's CO_2 flux measurements, say that so readers don't assume methane/ N_2O were also being measured.

It might be helpful to have a concluding sentence in the abstract guiding readers as to which biogeochemical markers, based on this study, seem most useful for determining peatland degradation. Based on your results, it seems like ash content, in combination with radiocarbon age, presents a much clearer picture than either of the stable isotope profiles (especially nitrogen.)

In several places (P8L20, P10L12, P12L29) there is reference to the "upper centimeter" of the soil. Does that actually refer to the soil sample from 0–1 cm, or is it meant to convey soils in the upper horizon? Whichever it is, it needs to be made more explicit; i.e., "In the top 1 cm of the soil" or "From 0–10 cm).

The paper could benefit from a close editing for English usage; there were some issues of clarity throughout the paper. I have noted some of them in the "Specific Comments"

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section.

Specific Comments

P1L16 "lose carbon to the"

P1L25 based on your results, the enhanced $\delta^{15}\text{N}$ is due to both decomposition and fertilizer application (in the GI case); the fertilizer application should be mentioned here as well.

P1L27 ... "This indicates that not only the managed..." It is a little unclear which marker is being described here. It could be read as just the ash marker (from previous sentence), or the whole panel of biogeochemical markers. If you are meaning to refer to the ash content only, saying "These ash profiles, not only in the managed grasslands but in the natural wetlands, indicate that all the sites were influenced by anthropogenic activities either currently in the past, most likely through drainage."

P2L3-5 "...we calculated carbon loss from these sites in retrograde" reads a little awkwardly. Perhaps you could explicitly state the time frame for which you calculated C loss.

P2L21 "GHGs from organic soils comprise 5.1% of Germany's national total emissions"

P2L23-28 Keep units consistent! Either use C or CO_2 to trace emissions so readers don't have to scale on the fly.

P3L3 "almost constant with depth"

P3L7 "show a slight decrease in $\delta^{13}\text{C}$ with depth"

P3L21 I don't understand the "(wet) oxic soils" formulation. Is it different if the oxic soils are dry? Is this an important distinction to be made?

P3L29-30 Rather than "wider" C/N ratios, use "larger". Substitute "smaller" for

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"narrower". I think this is a more common way to express these ratios; check for other occurrences later in the text.

P4L3 "aa" can be deleted

P4L14 "weather"whether

P4L28 remove comma: "The study area is located in Lower Saxony"

P4L29 remove quotes around peatland name

P5L7 "when conservation area" "when a conservation area"

P5L13-25 Here you present a bunch of information on your 3 sites. It would be good if you could keep the sites in the same order throughout. Here you present GE before GI when talking about cut/fertilizer schedule, GI before GE when talking about drainage, and GI, GE, then NW when talking about carbon balances. It will be easier for readers to keep track of the differences between the sites if they are presented the same way each time.

P5L23-25 Either give the actual NEP values for all 3 or for none; here you give the exact values for GI but no numbers for GE or NWP.

P4L23 "The Net ecosystem" "The net ecosystem"

P9L6-7 A more in depth explanation of how the different slopes point to different peat loss rates might be helpful. I understand how the overall pattern of $\delta^{13}\text{C}$ indicates relative levels of degradation, but it's harder to link the slopes to peat loss.

P9L7 "Below this point" - clarify. Below which depth?

P9L14 "decrease in the upper" "decrease with depth in the upper"

P9L20 delete "rather"

P10L14 "Organic fertilizer may be" "Organic fertilizer may also be"

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P10L23 "C/N ratios are narrow" "C/N ratios are smaller"

P10L26 you could add that these typical values indicate lower levels of microbial activity.

P10L30 "as well as the C/N ratio" "as well as decreasing the C/N ratio"

P11L28 Include all sites in the first sentence: Carbon losses as induced by drainage are highest at GI and lowest at NW, as estimated by the combined bulk density and ash content method."

P11L30 "higher current GHG emissions" "higher measured GHG emissions". Also, make sure that GHG emissions is correct; do you really mean CO₂emissions?

P12L7 "nowadays a C sink" "nowadays is a C sink"

P12L22 check GHG vs CO₂ flux

Table 2: Is the $\delta^{15}\text{N}$ vs $\delta^{13}\text{C}$ column really necessary?

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