

## REVIEWERS COMMENTS AND RESPONSES OF THE AUTHORS

### Editor Landbauforschung

As we fortunately came to the same conclusion of the value of the manuscript, we will accept your manuscript, subject to minor revision. Please take into account the reviewers' recommendations and write a short response to each of the comments. Please follow strictly the instructions for authors. The revised version of your manuscript will be evaluated again by the Chief editor and, if necessary, by the reviewers.

I can inform you about a change we have undertaken here in the meantime: It is possible to give up to 20 references now with a position paper. This is in response to frequent comments of reviewers of our new format 'position papers' we faced in the last weeks. We hadn't expected this and I would encourage you to re-include more references, as you already did in the first version we commented.

Please carefully check and consider the comment of Reviewer # 1 to L 99.

Also I must inform you that the line numbers Reviewer # 2 referred to seem to be tangled up. Please check if you can reassign the comments and whether our assignments are correct.

### Reviewer # 1:

#### Summary and specific issue

This position paper reviews the state of the art knowledge of paludiculture on rewetted peat soils around the world. It is timely does a comprehensive job in putting together the general information about the experimental and demonstration sites in terms of crops tested, the range of water level (very important), with current and event potential areas of production. The review concludes on what is required to move this to the next level of implementation and large scale land use.

The topic fits into the specific issue as given :, „**Exploration and mitigation of greenhouse gas emissions in ruminant and grassland systems**“, since paludiculture will provide a land use change away from intensive grazing system where animals are likely not to feature and fertilization will be reduced while restoring the ecosystem services of grassland: Carbon and biodiversity.

## General comments on strength and weaknesses and possible improvement

The paper is concise and well written. The main weakness is that it is not properly references in many places. As a position paper, each argument should be backed up carefully.

**We added more references now, as this is also allowed now by the journal.**

This is lacking especially when discussing the carbon and blue crediting systems (L31 and L48).

**In L31 we already referred to the text below (Chapter 3). In Chapter 3 we added references about carbon and blue crediting systems now and explained that blue crediting systems are not widely known yet and still in the developing stage: “In so-called blue crediting schemes, farmers could be paid for These these water management related ecosystem services could form a basis for blue crediting schemes as well (Bohlen et al., 2009; Grygoruk et al., 2013). However, these schemes are still in the developing stage.”**

And also re blue crediting, reference to other legislation (e.g. Water Framework Directive) is critical, as it is mentions that the ‘polluter pays principle’ is applied.

**We referred to the WFD now and added a reference (Correljé et al., 2007).**

Also a general comment is that the conclusions contain more information that is not presented/discussed in the text (L99-101 for example).

**We added this sentence to Chapter 3: “Next to that, every hectare of drained peatland that is converted to paludiculture prevents climate mitigation actions on 10-100 ha of mineral soils for food production, which would have led to a lower productivity (e.g. less fertilizers).” Also we shortened the sentence in the conclusion: “Small areas of drained peatlands converted to climate mitigation optimized paludiculture prevent climate mitigation actions on 10-100 times larger areas of mineral soils for food production.”**

I would also like to see a line stating that the first ideal ‘option’ is to rewet peat soils and adapt management to allow for natural colonisation with peatland plants to return to a C sequestering system as well as all the suite of ecosystem services where carbon sequestration through non-harvesting of biomass but rewetting of peat soils and natural management may also be an option in the future given the increased C.

**We added this sentence to the Introduction to state what the ideal situation is after rewetting of peat soils: “The ideal situation would be a natural colonisation with peat forming plants after rewetting and return to a carbon sequestering system without harvesting, but often the productive function cannot be given up and paludiculture, the productive use of wet and rewetted peatlands, should be considered.”**

The final general point is the issue of ‘climate proofing’ this land use which hasn’t been addressed (e.g. how do we keep the WTL within the limits during drought events?). Overall a final conclusion should refer to the need to do a Life Cycle Analysis of this land use and associated products.

**We added this information to this sentence in Chapter 5: “Pilot projects are very important to further develop management and harvesting techniques, obtain robust data on environmental benefits (including Life Cycle Analyses (LCA) of land use and associated products), and create markets for products.” To the last conclusion we added the phrase: “and the generation of LCAs”.**

Detailed comments; see suggestions below

L15 ‘Peatlands *utilised for* paludiculture’

**We changed this now into “peatlands used for paludiculture”.**

L17 ‘minimal groundwater level’ should read ‘minimum annual/seasonal groundwater level’. If this is indeed the meaning; but if the meaning is to do with an objective /to aim for then minimal is ok.

**Indeed, this has to do with the objective to preserve the peat and keep a minimal groundwater level, so we did not change this.**

L25: ‘larger scale i.e. farms’ (I don’t think there is a ‘higher scale’ than farms?)

**These larger scale projects are not always on farms, because there are also research projects on land that is managed by nature organizations or water authorities for example. At least in the Netherlands.**

L26 ‘protein source *or* as raw...’

**We changed this.**

L33 ‘rapidly emitted as CH<sub>4</sub> and CO<sub>2</sub>’.

**We changed this.**

L44 ‘Guidelines for low emissions’ is this CH<sub>4</sub> and CO<sub>2</sub>? Or only methane?

**Both, so we now changed “low emissions” into “low GHG emissions”.**

L48 Blue crediting systems requires some references to back up this argument. Even the term is not widely known yet so this needs to be explained.

**We added references about blue crediting systems now and explained that blue crediting systems are not widely known yet and still in the developing stage: “In so-called blue crediting schemes, farmers could be paid for These these water management related ecosystem services could form a basis for blue crediting schemes as well (Bohlen et al., 2009; Grygoruk et al., 2013). However, these schemes are still in the developing stage.”**

L50 the title includes ‘upscaling’ which is not addressed there but in paragraph 5 mostly.

**We changed the title into “Pilot projects” now, because that better describes the content of this paragraph.**

L51 ‘demonstrations’ instead of ‘implementations’.

**We agree and changed this into “demonstration sites”.**

L51 ‘farm-scale and **beyond**’ sounds like Buzz Lightyear ; what exactly is beyond the farm scale?

**We removed “and beyond”.**

L51 ‘spread over several countries’ sounds like the sites are crossing borders... rephrase showing that these pilots and demonstrations have already been implemented in various countries.

**We changed “spread over several countries” in “in various countries”.**

L73 Reference to the Water Framework Directive to back up the blue crediting would be judicious

**We referred to the WFD now and added a reference (Correljé et al., 2007).**

L86 expect reference here to back up this last statement

**We added a reference here (Runhaar, 2017).**

L87 what kind of further steps is referred to here?

**We explained this now by stating: “Further steps in implementing paludiculture...”**

L88 replace ‘insight’ with ‘robust data’ and add ‘management and harvesting’ in front of cropping techniques or else it may refer to ‘cultivation’ which I understand is not permitted.

**According to this remark, we changed this sentence into: “Pilot projects are very important to further develop management and harvesting techniques, obtain robust data on environmental benefits, and create markets for products.”**

L99 This conclusion should be discussed back in the main text.

**We added this sentence to Chapter 3: “Next to that, every hectare of drained peatland that is converted to paludiculture prevents climate mitigation actions on 10-100 ha of mineral soils for food production, which would have led to a lower productivity (e.g. less fertilizers).” Also we shortened the sentence in the conclusion: “Small areas of drained peatlands converted to climate mitigation optimized paludiculture prevent climate mitigation actions on 10-100 times larger areas of mineral soils for food production.”**

L102 ‘economically sustainable’ is not what ‘sustainable’ means since it relies on 4 pillars which includes ‘economics’. So here it should be economically ‘viable’.

**We changed this.**

L113 add ‘wet’ in front of peatland agriculture.

**We changed this.** Table 1: would be good to include the references (maybe numbers) into this table to quickly check where the figures come from. I am curious where the ‘potential areas’ come from (hence the need for references) but I’m unsure these are in those references; if not how were they inferred?

**It is not possible to give all references used for making this table (as we did in the first version of this manuscript), because we would need more than 20 references. So we now added this text to the table caption: “Figures based on references in Wichtmann et al. (2016) and Geurts and Fritz (2018).”**

#### General comments and Recommendation

- As mentioned above, some conclusions are justified and supported by the reviewing text.
- Table 1 would benefit from cross-checking with appropriate references.
- Title is matching the scope and the specific issue of Landbauforschung.
- Recommendation: minor revisions needed

#### **Reviewer # 2:**

##### General comments

This manuscript deals with possible ecosystem services of rewetted peat soils which will remain in agricultural use.

The manuscript is well written, and gives a good overview of ecosystem services after rewetting of former (drainage based) agricultural use. Table 1, in particular, presents a nice overview of current research and experiences of the subject.

I think the manuscript is very up to date and valuable for readers that would like a short overview of the subject.

I recommend publication of the manuscript with minor revision needed.

### Detailed comments

Page 1, line 19. ((Editor: probable L 16-17)) This is an important message, but I would like some reference here because it is quite essential that the readers can find more info on this claim.

**We added a reference here (Geurts & Fritz, 2018).**

Page 1, line 20. ((Editor: probable L 18)) I suggest to use the word *implies* instead of *means*.

**We changed this.**

Page 1, line 35. ((Editor: probable L 32)) I suggest to use the word *prolong* instead of *increase*.

**We changed this.**

Page 2, 50. ((Editor: probable L 46)) I suggest to skip the words *can serve to* and also the word associated word *to (reduce)* in lines 50 and 51 (*to increase*).

**We skipped these words now.**

Page 2, lines 58 and 59. ((Editor: probable L 54 and L 55))The message is more or less repeated. I suggest to skip the reference Gunther et al 2015 and add Jurasinski et al 2016 to line 59.

**We removed this sentence: “Peat moss, reed and alder are examples of peat forming paludicrops that thrive at -10 cm.” and added “peat moss, reed and alder” to the previous sentence (as an example of peat forming paludicrops). We also added the reference of Jurasinski et al. 2016 to this sentence and skipped the reference of Wichtmann et al. 2016, as the reference of Gunther et al. 2015 is not present there. We also added Schäfer and Joosten (2005) and Günther et al. (2017) as a reference for the peat forming crops alder and peat moss.**

Page 2, line 65. ((Editor: probable L 60)) I feel it would be informative to mention a few exotic species that could become invasive after use in paludiculture.

**We now mentioned wild rice, rice, giant reed, and miscanthus as examples.**

Page 3, line 114. ((Editor: probable L 109)) I suggest to add the word *in potential* before the word possible, since it is not always possible. I think it would be better to skip this conclusion in line 113 and line 114, because no data is presented in the manuscript that paludiculture can produce a comparable biomass yield as conventional agriculture. If this conclusion would remain here, then please present references in page 1 (under paludicrops).

**We added “in potential” to this sentence. We also added this sentence and references to the section “Paludicrops”: “In potential, biomass yields of 15-30 t dm/ha are possible (Heinz, 2012; Köbbing et al., 2013; Grosshans, 2014), which is comparable with conventional crops.”**