

## ***Interactive comment on “Greenhouse gas emissions from river riparian wetlands: An example from the Inner Mongolia grassland region in China” by Xinyu Liu et al.***

### **Anonymous Referee #2**

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General comments. This paper addresses the spatial (longitudinal and horizontal transects) and temporal (wet and dry) variability of CO<sub>2</sub> CH<sub>4</sub> and N<sub>2</sub>O fluxes in degraded and non-degraded riparian wetlands and compares them to the adjacent grassland ecosystems. Principal differences in GHG fluxes between different ecosystem types is related to different biogeochemical production and consumption processes as controlled by above ground biomass, soil moisture content, soil temperature, and soil carbon and nitrogen stocks. Overall, riparian wetlands sites were hotspots of GHG fluxes linked to higher soil moisture and soil carbon stocks than the adjacent grassland sites. However, the degraded wetlands shifted to minor sources of CO<sub>2</sub> and sinks of CH<sub>4</sub> and N<sub>2</sub>O as the soil moisture, carbon stocks, and redox conditions changed. This shift

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may be significant in both local and regional GHG budgets when it comes to assessing the role of riparian wetlands to global warming and climate change. The paper may therefore be interesting for readers of biogeosciences as it offers some valuable details on the major controlling factors behind the shift in GHG source strengths between degraded and non-degraded riparian wetlands. However, some major flaws and information is missing in the M&M and results section that needs to be addressed to improve the manuscript quality (see specific comments). Statistical analysis should be more deepened and include a multiple variate analysis to explicitly show strengths of the individual controlling factors such as soil temperature and soil moisture content on GHG fluxes. The discussion needs to draw more on previous research by comparing similarities in findings to better support the discussion section. Particularly in terms of the biogeochemistry that may explain the spatial-temporal differences in the emissions from riparian wetlands.

Title Consider removing the word “river” as riparian wetlands already define wetlands on stream and riverbanks. Abstract Ln 13-15: Consider reversing the sentence to give details on the direct link between riparian wetlands and climate change. Introduction Ln 56: Remove the word “the” in “the nature. . . .” Ln 79: Remove the word “the” in “at the local. . . .” Materials and methods Ln 117: Replace “for” with “from” Ln 137: Consider replacing “the” with “a” in the reservoir bag. Ln 139: . . .and or or for the sampling times. If “and”, were they averaged for the day? It is a bit not clear now. Ln 141: . . .oven-dried. Ln 148: Figure 2, colors of the site labels are too difficult to see, consider using more contrasting colors. Ln 155: Indicate whether they are means and SD or SE in table caption. Ln 166: Missing section on what statistical tests were used for the analysis of the results.

Results Ln 169: Variations in SMC? Ln 169- 171: Confusing, consider revising the sentence to make it clearer. Ln 173: Cite the section in figure 3 to enable the reader follow easily the results section. Ln 180: Consider indicating on the graphs season information to make it less confusing. i.e add wet on top of the first two graphs and

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dry on the second pair of graphs. What are the error bars? Standard errors? Also throughout all the manuscript, consider using wet and dry instead of the months as it gives a more direct link to the hydrological conditions of the riparian wetlands. Ln 193: Not clearly seen in the graphs, maybe change the shapes of the points within the riparian region. Ln 196: Same comments as SMC on the visuals. LN 226: What statistical tests were used to show differences in the two seasons? This information is missing in the figure and in the text. Ln 247: Figure is stretched vertically. Check this for all figures to ensure the aspect ratio is maintained when adding them in the document.

Discussion Ln 282: The discussion includes results not shown in the results section. Consider shifting some of the results in the discussion to the results part of the manuscript. Ln 288: Indicate whether the correlation is positive or negative. Ln 292: Give more details on the mechanism that links SMC to CO<sub>2</sub> fluxes that the authors found, and how it links with your findings. Ln 296: How was this shown in the results? Seems rather speculative. Possibly give ranges based on other studies and link them with your study as shown in Table 1. Ln 308: You mean aerobic decomposition. Ln 311: Is this shown in the results section? Not clear what value of SMC indicates the saturation water content. Ln 313: More details on how the Niu et al 2017 study relates to your study. Ln 316: What mechanism links increased SMC to higher N<sub>2</sub>O fluxes? Currently the information is missing. Ln 330: Confusing as you say its important at the start of the paragraph. Ln 336: Consider replacing the growing season to either August or October. Currently it is not clear which season is the growing season for a reader not familiar with the region of study. Ln 364: Do soil nutrients mean SOC. Not clear at the moment. Ln 380: remove "the" in "the soil C:N. ...." Ln 381: TOC is also part of the C:N ratio. Elaborate more on the disentanglement between the two in the point you are making. Ln 384: But the statistics show the correlation with TOC is not significant. Ln 389: Elaborate more how this promotes N<sub>2</sub>O release. Ln 403: More description required for the table. For example if the values given are correlation coefficients and the type of correlation test used. Ln 417: Table 1 also shows higher C:N ratios in riparian

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soils. Ln 422: Elaborate more on the link between CO<sub>2</sub> concentrations and nitrification denitrification processes to make it clearer for the reader. Ln 432: use "and" instead of "but" as the latter indicates differences in the findings of the two studies. Is that the case? If yes, consider reversing the sentence to clearly bring it out. Ln 442: remove "the" in as the sources of. . . Ln 466: Was the soil carbon in the degraded wetlands lost through aerobic decomposition. Give more details on the mechanism. Conclusion Ln 486: Comparison of the source strengths of the three gases expressed as GWP not presented in the graphs. This may show more clearly that CO<sub>2</sub> contributed more than the other two GHG. Consider adding it.

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