

REVIEWERS COMMENTS AND RESPONSES OF THE AUTHORS

Authors (blue text):

Thanks very much to both reviewers for their comments. We have made substantial revisions to the text, particularly the methods and conclusions sections, which we hope resolve the issues raised. The comments of each reviewer are responded to individually below (blue text). We are also glad to say that the article in which the conceptual framework is fully described has now been accepted for publication in Environmental Science and Policy, with online publication expected in the coming days, and that as a result this will be available to readers of the current article (if it were published). We have attached a copy of the pre-proof version of the ES&P article (in confidence until its formal publication) for the reviewers' convenience, given its importance to fully understanding the study presented here. We apologize for the fact that this was not available earlier.

NB: Line numbers in the following responses refer to the version of the revised manuscript with track changes shown and without authors' details

Reviewer # 1:

Short summary of the aim of the paper, its main findings and conclusions

The article presents the comparison between Wales and Uruguay at the level of “knowledge exchange” (KE) that are carried out by extension services in each country, with the aim of reducing greenhouse gas emissions (GHG) in grassland systems. For this, it uses the background, conceptual framework and categories presented in (Kipling, Taft, et al. 2019a) and (Kipling, Taft, et al. Under review). The conclusion indicates that a renewed research focus on agricultural extension systems is needed to more effectively apply KE resources to meet sectoral GHG emissions targets.

The main topic of the article fits in with the specific issue of Landbauforschung.

General comments on strength and weakness

The article presents a good idea when trying to characterize the information needs and involvement of farmers with agricultural extension services for GHG mitigation. However, it shows several methodological weaknesses:

A) the used methodology was developed in Wales without being validated in Uruguay. The categories used would not necessarily be appropriate in Uruguay without farmer's validation due to differences in context (economic, political, cultural, religious, environmental, geographic, etc.).

The (now published) article referred to above includes details of how the general relevance of the framework was tested against the challenges to change and types of solution defined in an OECD review of global challenges to implementing climate friendly farming (Wreford et al 2017: Overcoming barriers to the adoption of climate-friendly practices in agriculture, OECD Food, Agriculture and Fisheries Papers OECD, Paris). Our earlier 2019 article on challenges to change also included validation of the challenge categories against the challenges identified by Wreford et al (2017). The framework accommodated the challenges and solutions identified in the review, indicating its general validity beyond its Welsh origins (i.e., specific challenges obviously vary between countries, regions, systems etc., but the broad *types* of challenge and solution appear to be generally applicable). Our article does not seek to make inferences about the specific challenges (or potential solutions) to change in farming in Uruguay. This we would see as a next step (see new Fig 1 in revised manuscript). Here, we are analyzing the KE methods used in the two countries to reveal and highlight which types of challenge they could (in theory/*a priori*) address. So, for example, this study uses the conceptual framework to highlight what types of challenge a farmer exchange is likely to address, and what its

limits might be. Future analysis of the challenges on the ground will then show if this method is likely to be effective, given its characteristics as described in this study. We have revised the methods section of the paper to clarify this logic and included a new Fig. 1 which puts the current study in the context of previous and future work (revised manuscript, methods section).

B) It is not specified how the information was performed.

Methods now clarified to address this and other points (revised text methods section)

C) It assumes a homogeneity in the form of agricultural production of both countries that is not real, at least it should be mentioned something about this aspect. While the focus on GHG is shared, other dimensions of the sustainability of agricultural systems are not mentioned. There is a high environmental risk in considering a single dimension individually, e.g. the carbon footprint in feed lot is smaller than extensive livestock on pastures in “Campos” ecosystem, however, the rest of the sustainability indicators are environmentally negative (pollution of rivers, animal welfare, smell, etc.). These aspects should be even mentioned.

We completely agree with the reviewer on the need for holistic approaches to environmental issues. We have tried to bring that out more in the revised text (see response to detailed comments on the article by Garibaldi et al below and also additions to revised manuscript lines 133-136) but were specifically asked for this special edition to focus on GHG mitigation, and had to keep to a specific number of references, leaving little scope for citations relating to general context. We do not seek to say that the agriculture in these two very different countries is homogenous but to say – here are two countries with agricultural sectors based to a large extent on extensive pasture based livestock production in very different environments and contexts. We hope the revised manuscript brings these things out better in the general changes made to the text and specifically in clarifications made between lines 128 and 158. As mentioned in answer to other comments, the focus of this paper was in fact on the KE methods used, rather than the agricultural systems themselves, which is the reason for not going into more depth on the conditions in each country but focusing instead on theory/practice of KE. We hope the reviewer accepts the clarifications on this in the methods section, in the context of the limitations of space/remit for this special edition.

Detailed comments by line

Line 11: please see Garibaldi, L, et al. Farming Approaches for Greater Biodiversity, Livelihoods, and Food Security. Trends in Ecology & Evolution, January 2017, Vol. 32, No. 1

Thanks for sharing this very relevant article which we have now cited in the text (with apologies to the journal editor for going further over our reference limit!) (revised manuscript lines 37-40)

Line 108: check the climate information

Climate information double checked in cited FAO report: pp 172 of source ‘The Campos has a subtropical climate, very warm but with frosts in winter. It is humid, often with moisture surplus in autumn and spring but moderate deficits in summer’. However, the source later says that there are only 1-6 frosts per year, and we have therefore amended the text to emphasize this. We have also replaced ‘average rainfall’ with ‘annual rainfall’ for clarity, and added the detail about the fluctuation in conditions which is discussed on page 171 of the source report. Finally, we have revised the text on rainfall peaks, as the spring peak, although mentioned in the report, does not fit with local knowledge of the area(revised manuscript lines 119-120).

Lines 113-114: Do you consider variations of more than three million cows as fairly steady (see 1990)?

Thanks for spotting this mistake, text altered, revised manuscript lines 126-128)

Lines 149-152: Categories of analysis may change, even using the same method.

Method section now clarified to address this

Lines 154-157: Sources of information are cited but it is not clear what information was specifically used and how it was systematized. It is not clear which region of Wales or Uruguay they refer to. It is not possible to generalize when there is proven heterogeneity between different production systems (e.g. owners / lessees, size of farms, region, grazing management and use of supplementation, etc.). But the most important are the differences in context that have not been taken into account (economic, political, institutional, cultural, religious, etc.) for a valid comparison.

We hope our significant clarification and revision in the methods section addresses this concern, including clarification and added detail in the text on the case study countries (revised manuscript lines 128-136 and 142-158).

Line 169: It is not appropriate to use a document that has not completed the peer review, especially if it contains a methodological basis.

We are glad (relieved!) to say that this article has now been accepted for publication and will be available online shortly. Should the work presented here be accepted for publication, we will complete the reference information accordingly at proof

Line 238: Without considering these differences, the work done does not have enough validity. We hope that the clarification of the text in general and the methods in particular addresses this issue and indicates the validity of the study

Conclusions

The conclusions should be reviewed according to the methodological weaknesses noted above.

We hope the improvements made to the paper with the help of the two reviewers address this point, including changes to the wording of the conclusion for clarity.

References

It would be desirable to add part of the extensive international literature on social learning and on the dimensions of sustainability in agricultural systems.

We were asked by the editors to reduce the number of references when we submitted an earlier version of the article (it is already well above their limit for an article). This has limited our capacity to cite every study we would have liked to. However, we hope the fact that the key underpinning article is now available, links this study to the body of work on social learning much more firmly. We were also asked to focus the article very specifically on GHG mitigation but we strongly agree with both reviewers that these issues need to be treated holistically and have added a reference and text emphasizing that requirement (revised manuscript lines 37-40)

Recommendation

The categories that arise from farmers must be obtained experimentally in Uruguay. This implies that the article must be reformulated, or directly rejected.

We have now (we hoped) clarified this issue in the text (methods section). The presented study focused on making an inventory of KE methods used in each country. It then used the conceptual framework developed previously to analyze what sorts of challenge those methods could be expected to address *a priori*, and in what way. So, for example sharing information in a newsletter primarily addresses Knowledge limitations, but if there are barriers of Interest around the topic presented it will not be read, etc. So, this was an initial desk based study to establish what, in theory, the KE methods applied in the two countries can do and how they work. The next step is to undertake the study the reviewer suggests – to go to the farmers and other stakeholders in Uruguay and ask them what kinds of challenge they actually face, and what types of solution they think are needed. Putting the two parts

together (the desk based assessment of the KE methods and an understanding of what challenges actually exist), would then allow KE practitioners to see whether the methods they are using fit with the challenges on the ground, and the ways people want those challenges to be solved. Defining what the methods can do, and how, is the first step to reaching that point. We have now included in the methods a new Figure 1 which we hope clearly shows the logic and context of the presented study.

Reviewer # 2:

Aim of the paper

By comparing Uruguay and Whales, the main goal of the article is to evaluate the utility of a framework and knowledge exchange methods in regard to climate change mitigation, specifically greenhouse gas emissions in agriculture. The article generally describe how specific institutions and actors are operating, highlighting the main differences and commonalities between the two case studies.

General comments

Introduction: The main research questions need to be more specific beyond barriers and strategies. This would need to be justified by specific literature on either barriers or strategies (or both) based on similar scenarios.

The focus of the paper is not on the barriers of change that exist on the ground in the two case study areas, but instead on the KE methods which advisors in each area use (e.g., newsletters, discussion groups etc.): what sorts of challenge they can address (*a priori*) and how they work (level and approach). For example, what kinds of challenges (practical limitations, knowledge limitations etc.) can group discussions address, and how can they address them? This knowledge sets up future research with farmers and other stakeholders in Uruguay about what challenges they actually face and what types of solutions they think should be implemented. When that is known, the analysis of the KE methods being used (presented here) can be compared with the challenges on the ground, to see if the methods are well aligned to the issues faced, or whether other methods need to be applied, or a different mix of methods. See revised methods for fuller description, and especially the new Figure 1 which shows the context and logic for the presented study. We apologize that these important aspects were not more clearly defined in our first draft.

The justification for the selection of the case studies need to be further explained. It is stated there are differences between these countries but one of the research questions explore whether and which differences are. Further description of Whales' and Uruguay's experiences and description of actors involved are needed to frame the justification and theoretical/practical relevance of the study.

We have made revisions to increase the detail on agriculture in Uruguay and to justify the relevance or Uruguay and Wales as the focus of a study on agricultural KE methods for climate change mitigation (revised manuscript lines 128-136 and 142-158). We have also tried to clarify the research questions and make general changes to the methods section, which we hope show that the study is focused on the nature of the KE methods used in both countries, rather than on the actual challenges faced by / experiences of stakeholders on the ground in each country. See revisions to methods and new Fig. 1 which we hope more fully and clearly explain these points and address these concerns.

Methods: Number of participants/ characteristics /, etc. are needed.

Methods section has been substantially revised for clarity and content and we hope now addresses the reviewer's concerns here and below

It is not clear whether grounded theory or existing framework/s facilitated the categories analyzed in the following sections. Please, clarify this in the method section. Additionally, it is not clear what data is considered to evaluate the experiences of both case studies. For this, it would be important to include more primary data from the participants (e.g., from surveys, interviews, focus groups, etc.).

Methods section altered to clarify these points as requested

General comments on findings and conclusions: The comparison of these two case studies could potentially reveal interesting findings that could be used and/or considered by scholars and practitioners working on climate change mitigation in agriculture. The use of the conceptual framework needs more justification based on deeper theoretical arguments (I suggest to look at the literature on agri-environmental governance from geographers, sociologists, and political scientists to explore critical aspects (e.g. power, organizational aspects, creation of assemblages, etc.) beyond instrumental differences and commonalities between the two case studies). While the practical implications of this study are quite clear, the current instrumental analysis of the framework proposed by the author/s is problematic, giving its lack of sufficient theoretical justification and needs.

The source article for the method has now been accepted for publication in *Environmental Science and Policy* and will be published online in the next few days. We agree with both reviewers that it was unfortunate that this was not available at the time of their initial reviews. So, the basis of the conceptual framework and how it was arrived at is now available to readers. We have attached a pre-proof copy of this cited article for the reviewers' convenience. In addition to the discussion of the challenges to change in the other article referred to in the text (Kipling et al 2019, Challenges to implementing greenhouse gas mitigation measures in livestock agriculture), we hope this new information allays the reviewer's concerns about the framework, where it has come from and how it fits with existing theory. We would have liked to have added a further appendix or more text/references to the current article to cover these aspects in more depth, but are restricted by journal limits on word count and number of references (which we have already technically exceeded!)

Perhaps, professional editing would enhance the overall quality of communication as well.

With the help of both reviewers' comments we hope that the changes we have made to the text have succeeded in improving the quality of communication

Detailed comments by line

1. Please, modify the title by alluding to the needs or main findings of the study. It could also say: 'two case studies' or a comparison between (not 'in').

We have clarified the title and we hope that, along with the extensive revision of the text, the reviewer feels that the two are more clearly aligned (revised manuscript lines 1-2)

16. "The aims were," please, use other words such as the: "the main goals of this study are..."

Changed as suggested (revised manuscript line 15)

18. 20. Comas are missing

Altered as suggested (revised manuscript line 18)

44. Please, clarify what you mean by: "Despite this direction of travel,"

Text altered for clarity (revised manuscript, line 51)

44-49. This sentence is too long and confusing. It could be simplified by having two sentences.

Sentence split as requested (revised manuscript lines 51-56)

59. Please, clarify what you mean by "working in a developing world context."

Text simplified (revised manuscript line 66)

68. it should say "the main goal of this study..."

Altered, but text now reads 'the main goal of the current study' to avoid ambiguity with the previous sentence (writing 'this study' made it seem as if we were referring to the study described in the previous sentence) (revised manuscript lines 75-76)

70. "contrasting countries (Wales, in the global north, and Uruguay in the global south)": the geographic location of the countries is not enough to claim "contrasting" contexts. More information should be added such as socioeconomic situation of agriculture, farmers, etc. Uruguay is considered a "middle-class" country which may imply that have similar indicators than Whales. Agriculture in Uruguay is pretty advanced in several sectors.

Although these socio-economic aspects are not the focus of the current study, we fully appreciate the reviewer's concern that they should be properly represented. We hope the alterations to the methods correct the lack of socio-economic information and highlight more clearly that there are both differences and similarities between the countries (revised manuscript lines 128-136 and 142-158) (we also hope the editor is understanding about the need for the additional references)

135. In this case authors shouldn't be in parentheses.

In revised manuscript this part has been altered

144-149. Awkward sentence. Please, re-write it.

Re-written as requested (revised manuscript lines 122-127)

Diagrams and tables look fine and clear.

Recommendation:

The article needs major revisions.

We hope the changes made address the reviewers' concerns

REVISED VERSION

Editor/Chief Editor Landbauforschung to Reviewers

In addition to the revised text and rebuttal to your comments you find the meanwhile accepted manuscript Kipling et al. (2019a). The authors have send it to us to underpin their methodological approach. **In this case we disclose the double-blind review process to you as the author was already obvious by referring to this publication in the text.**

(Kipling RP, Taft HE, Chadwick D, Styles D, Moorby JM (2019a) Implementation solutions for greenhouse gas mitigation measures in livestock agriculture: A framework for coherent strategy. Environ Sci Policy 101:232–244, [doi:10.1016/j.envsci.2019.08.015](https://doi.org/10.1016/j.envsci.2019.08.015))

Responses to reviewers and editor (blue text)

We thank the reviewers and editor for their further comments and their work to support our improvement of our article. Please see our responses to the remaining issues below, and tracked/commented in the attached text.

Reviewer # 1:

I have reviewed the new version of the article and see the authors made an effort with the requested changes. According to your the Editors comments, I consider that authors have met the contextual and

scientific requirements now better, and I can follow their line of arguments. Attached Below ((changes by Editor)) is a better description of Uruguayan climate as a suggestion for the authors:

Specific comments by line

In yellow, the suggestion of replacement of lines 116-120:

Uruguay lies within the South American Campos, an ecological region of grasslands splashed by trees and shrubs.

Uruguay's climate is temperate, moderate and rainy. Temperature of the coldest month is between -3 ° and 18 °C, and temperature of the warmest month exceeds 22 °C. Precipitation shows high interannual variability, with an annual total that reaches 1300 mm in the north of the country. According to the Koeppen climate classification, Uruguay is classified in the "Cfa" category (Bidegain and Caffera, 1997)

(Clima del Uruguay https://www.rau.edu.uy/uruguay/geografia/Uy_c-info.htm)

... production systems (extensive grassland-based beef and sheep production) and agricultural issues (low productivity resulting from poor nutrient value and digestibility of grasses due to edaphic...

Thanks for these suggested changes to the text, which we have now included in the attached revised manuscript, along with the reference cited (revised text lines 111-116)

Reviewer # 2:

I read the article. It looks much better. The authors addressed all the comments and suggestions I made. However, I agree with you the editor ((changes by Editor)) on the structural improvements the article still needs. I think after improving these aspects it could be suitable for publication in your journal.

Specific comments by line

There is something important to be fixed:

Page 4- line 111: the authors describe Uruguay as a country with "few trees..." they should mention the importance of forestry (eucalyptus) for pulp mill, which is now the most important industry of the country (it displaced livestock production as the most important export in 2009).

To correct this we have added a reference highlighting the importance of Eucalyptus and pine plantations in Uruguay (commented in revised text, lines 126-128)

Chief Editor Landbauforschung

Suggestions for further improvements in structure and text flow

I've read your interesting article several times and must say, it is still hard to follow the story line. Therefore I suggest to include some structural elements:

Line 158 to 162: The elements of your framework should be placed in a list with bullet points as you did in the appendix, like this

From these views the following components of the conceptual framework were derived and will be used for categorisation in the following:

Four challenge categories (Kipling, Taft, et al. 2019b)

- Practical Limitations

- Knowledge Limitations
- Cognitive Limitations
- Interests

Three Levels of change at which solutions may operate (Kipling, Taft, et al. 2019a)

- Work Around
- Overcome
- Alter

Three Approaches to change they may take

- Accommodate
- Control
- Empower

(see Appendix 1 for detailed summary).

[Changes made as suggested and this whole section simplified \(revised text section 2.2\)](#)

Line 158: In the text you define special terms that are new to the reader: like 'challenge categories'. But in figure 1 and also in line 200 you use the term 'challenge types'. This was confusing to me. Please check if you use consistent terminology also for important terms you readdress throughout the study.

[All instances of challenge type / types of challenge etc. have had 'type\(s\)' replaced with 'categories' and we have checked terminology more generally.](#)

Line 177: Please include the abbreviation (FC) behind Farming Connect as you used this abbreviation throughout the text.

[Abbreviation added as requested](#)

Line 188: Please insert some keywords to explain what is exactly meant by 'grounded theory approach' as the reader needs support in understanding what exactly was done. Obviously the themes and categories used here (line 189) are not the same mentioned below (Line 191-193) in connection with the framework. This leaves confusion.

[Throughout, we have altered the themes/categories terminology for the KE methods analysis to classes and types to avoid the confusion mentioned. We have also added some explanatory words on grounded theory \(revised manuscript lines 193-195\)](#)

Line 191-193: You wrote here: "Finally, the conceptual framework described above was used to qualitatively assess KE methods in terms of i) potential barriers to initial engagement, ii) types of challenge to implementing mitigation measures they could address iii) their potential mode of operation iv) their potential impact on non-target stakeholder groups."

These points are part of the structure and can be found in the headlines below.

I recommend to exactly use the same terminology here and in the headlines used in the following to increase the recognition value.

It could look like this:

Finally, the conceptual framework described above was used to qualitatively assess KE methods. For this the following aspects were analysed i) potential barriers to initial engagement, ii) types of challenge to implementing mitigation measures they could address iii) their potential mode of operation iv) their potential impact on non-target stakeholder groups. These four points are the headlines and structure the 'Results and discussion' part of the current study.

But

The headline in line 213 should be the same as i)

The headline in line 276 is not listed above

The headline in 318 should be the same as ii)

There is no headline for iii)

The headline in 352 should be the same as iv)

The headline in line 394 is not listed above.

So I'm arguing in the direction that you should try to give a clear structure here on the things that will follow to give guidance for the complex text. Please think about suitable terminology and improving the recognition value.

We have adjusted the headings and the description of the aspects to be analysed as requested (revised manuscript 191-207) and tried to adjust text to improve clarity throughout

One final comment: Please check again all options to shorten the text and to follow a clear self-defined guideline from the beginning on. Maybe your co-authors can have a second fresh view on the text which is generally fine.

We have made some adjustments for clarity and to reduce the word count (although some of the detail requested by the reviewers slightly increased it in the first instance) – these changes are tracked/commented in the revised text.

Editor/Chief Editor Landbauforschung

Final accept after second revision

We are glad to inform you, that we accepted your article "Applying a conceptual framework for effective implementation of on-farm greenhouse gas mitigation: Evaluation of knowledge exchange methods in Wales and Uruguay" after your revisions in its current form.