

# Responses to reviewer comments

## EDITOR

Dear Prof. Koh,

Thank you for considering our paper and securing the two reviews. These have been very helpful in improving the manuscript. We are encouraged by both reviewers' support of the paper but recognise the need to improve several aspects. As recommended, we have revised the paper. We have taken the main comments in relation to the paper to be the need to:

- 1) explain more clearly how conflicting ideas were dealt with;
- 2) explain more clearly how the regenerative systems framing was used to shape H3;
- 3) discuss in more detail how the results of our study could be put into practice;
- 4) compare our Three Horizons process to other applications of the framework and discuss what can be learned from our case;
- 5) improve clarity for a wider audience around the Yorkshire context and UK- or Yorkshire-specific organisations, initiatives and designations;
- 6) increase the focus on food waste throughout the paper.

Substantive changes we have made to the article in response to these issues include:

- 1) added text to our Methods and Discussion about conflicting ideas in our results and how they were dealt with;
- 2) added text to our Ontological framing section clarifying how the regenerative systems framing was used;
- 3) added text to our Discussion clarifying how we would expect the results of our study to be used to inform practice, and added a new data availability statement with information on accessing more detailed Three Horizons results;
- 4) added a paragraph to the Discussion about our methodological takeaways from our Three Horizons process and how it compares to other examples;
- 5) expanded text in the Introduction about the Yorkshire context, added a new figure illustrating land use in Yorkshire, and gone through the entire paper adding detail to explain mentions of specific organisations, initiatives and designations;
- 6) with validation from participants, added new ideas in our Three Horizons results about food waste and how to tackle it.

We explain these and other specific changes (e.g. in response to the reviewers' minor comments) in this document. Some other changes of note, unrelated to the reviewers' comments, are the addition of a number of co-authors who were involved in the Three Horizons processes but failed to respond in time to initial co-authorship invitations. We have also improved the correspondence between Table 4 and the main text and improved clarity on some of the points around regenerative farming.

We have numbered distinct reviewer points. The authors' responses to comments are presented in purple. Modified or added text in the manuscript is presented in **bold**. For references, see full revised manuscript. Note that due to Paperpile updates there may be some discrepancies in the precise superscript numbers reported here and in the main manuscript. Line numbers correspond to the revised manuscript without changes highlighted, unless otherwise stated.

## REVIEWER 1

1. I really enjoyed reading this manuscript. It is an interesting account of a very impressive implementation of the three horizons planning. Congratulations to the authors for pulling that off. While overall I think it is an excellent contribution, I'd like to raise a few things, that probably can be addressed through minor changes.

We thank the reviewer for the positive feedback.

2. One of the benefits of three horizons planning is that it is very open to the integration of different perspectives and priorities. At least in theory, the values expressed for horizon three can be conflictive and there can be different and maybe alternative narratives of how to work towards. In practice, the workshop process would provide space and time for discussing different viewpoints and values and to carve out a shared understanding of what constitutes H3 (e.g. through having a wide range of actors mixed discussion groups). From the manuscript, I do not get a good feeling of how well this integration worked. The workshop process was rather elaborated with multiple events partly with stakeholders, partly only with the core or extended researcher team, often split up for the different themes and part of the data was collected through a survey (i.e. not through a group process, although the results were discussed in a later workshop). I would expect quite some disagreements and tensions when it comes to farming types or food choices. While three horizons planning is not conflict resolution method, I would still like to see if there were tensions, disagreements, conflicts, that did not enter the the jointly agreed results. This is particularly relevant, as the manuscript appears to be streamlined for the aim of establishing a regenerative system, which seems it was introduced by the researchers into the process. Maybe I misinterpreted this, but I found myself even wondering, if a backcasting approach wouldn't have created similar results as the end point appears somewhat predefined.

We agree with the reviewer's view of the role and value of the Three Horizons process. They have correctly picked up that 3H is not a conflict resolution process per se, even though it does provide many opportunities for integrating diverse perspectives and values. Also, as correctly identified by the reviewer, a number of contentious issues certainly arose in the process. Some of this was highlighted in the original submission (e.g. lines 363-371). However, in light of the reviewer's comment we have significantly modified the Discussion, highlighting three key dilemmas/tensions and explaining the potential limitations of our process. The new text (lines 455-480) now reads as follows (new additions in bold):

'Second, **significant** efforts were made in our work to honour diverse views **and include diverse goals and values, and identify systemic action. Yet the process we undertook did not provide the time and space for detailed work that would be needed to creatively address some of the key dilemmas and tensions involved.** This included **three key aspects: power, innovation, and trade-offs of farming practices and different diets. Clearly, there are dilemmas around the 'power' embedded in the Yorkshire food system, like that held by a handful of large enterprises, such as supermarkets that hold many elements of the current system in place.** While **the dominance of supermarkets helps to support distribution of food to a large population at low cost due to economies of scale,** it can constrain transformation. **Our Three Horizons findings also revealed a tension between more bottom-up forms of innovation and change and notions of disrupting monopolies in the food system (e.g. in action domain 1, 'Enhance supply chain connectivity and innovation'), and the desire to 'get big players on board' for more system-wide impact (e.g. in action domain 2, 'Scale environmentally beneficial farming').** The trade-offs of different farming practices and different

**diets must also be further explored to fully understand their impacts on wider ecosystem services.** For example, the meat and dairy industry holds significant social, economic and cultural power [64], yet much of its conventional practice will also need to be challenged **and downscaled or modified** if society is to move towards genuinely regenerative futures [65–67]. **The issue is also not straightforward: while there is a growing social movement to reduce meat consumption, integrating livestock is one of the main principles of the regenerative agriculture movement, with farmyard manures key to adding carbon back into the soil and thus helping to restore soil health [17,18,68], and claims that livestock in some regenerative farming systems are carbon-negative [68]. However, livestock are also major contributors to methane emissions [69] and can cause water quality decline [70]. These issues have created tensions between regenerative farmers and the vegan movement, for instance [71].** Thus, while our work began to open up discussion about some of these issues, **and set an ambitious overarching direction that had high levels of consensus,** much more extensive effort will be needed to **find creative ways of working with** dilemmas and power imbalances.’

We have also added a sentence to the Method (lines 771-773) clarifying our approach to dealing with conflicts or dilemmas:

**‘Throughout the 3H process, if tensions or contradictions arose between participants’ offerings, these were noted by the facilitators and retained in the final results if there was no objection from participants, rather than fully resolved.’**

We also point the reviewer towards lines 768-771, which explain the ‘streamlining’ in our approach:

‘Although the process of ‘distilling’ information throughout the subsystem and integration work inevitably lost some nuance, 3H aims to cohere and distil complexity into something meaningful and motivating that broadly guides action and stimulates critical reflexivity, rather than capture every detail, which would quickly become overwhelming [21,63].’

We wish to emphasise that the regenerative systems framing was used as a broad sensitising concept rather than prescribing what H3 should look like (i.e. creating a predefined endpoint). We used it to push ambition, but allowed participants to co-create their own interpretation of what a future regenerative Yorkshire food system would look like. We have added to the ‘Ontological framing’ section of the Materials and methods to clarify this (lines 573-577):

**‘Framing the future, transformed system, as being a regenerative one provides a powerful concept, aiming to drive ambition, imagination and transformation. We worked with this regenerative framing whilst allowing participants to co-create their own interpretation of what a future regenerative Yorkshire food system would look like.’**

3. The manuscript mentions H2+ and H2- innovations, but doesn’t explain how these were included in the analysis/workshop process. Was it part of the workshops? And if yes, what were the results? This is particularly relevant for a system that currently is characterised by very powerful actors and strong feedback mechanisms.

We thank the reviewer for spotting this. We have clarified in the Method section that the focus was on identifying H2+ actions in Workshop 2, not just H2 actions per se. I.e. the participants were encouraged to focus on transformative/disruptive kinds of action rather than more marginal or incremental kinds of change that risk capture by H1. The H2 results thus correspond to H2+ actions, as understood by the participants. The corresponding section (lines 726-727) now reads:

‘Workshop 2 focused on understanding the contrast between the present and envisioned future, and **identifying** the H2+ actions needed to support the transformation.’

4. While the process and the results are pretty well described, I am still left wondering how an actual transformation could now be put into practice. What could be the next steps? Is there any roadmap for action or anything comparable? Is there any stakeholder commitment? The key actions that have been synthesized (e.g. in Tab. 4) are pretty general, which is suitable for a publication, but might be a bit too unspecific for any real world activity. Is there any process of how more detailed results are to be available for the public or how it is going to put into practice? The discussion shortly mentions a newly established commission (L342-345), but that seem fairly little given the ambitious goal of transforming the food system of all Yorkshire.

There is no roadmap for action per se or direct stakeholder commitment out of the workshop participants – the aim of our process was to identify overall domains of action. However, some of the workshop participants have since been elected as FixOurFood Commissioners, and the Commission aims to use the action domains to focus and frame its work. Our research also influenced the establishment of an experimental regenerative farming trial on the University of Leeds farm. We have added to a section in the Discussion (lines 417-428) that we hope clarifies the influence our study has already had, and how we expect the results of our study to be used in policy and action:

‘A good starting point **for effective cohering** has been the establishment of a new high-profile commission – the FixOurFood Commission [55] – to help drive transformation. The Commission was established as a direct result of this research and involves influential food system actors tasked with building momentum for large-scale food system change in Yorkshire. **The six action domains provide a strategic focus for the Commission’s work. A second outcome from our research, driven particularly by action domains 2 and 4, has been the installation of a co-designed regenerative farming trial and demonstration platform at the University of Leeds farm, with involvement of a large network of stakeholders, to provide data and evidence informing how to transition to a regenerative farming system [56]. Our work should also directly inform: the ongoing development of regional-scale food strategies, e.g. by North Yorkshire Council [57]; investment priorities of Yorkshire’s mayoral combined authorities (MCAs), including the newly created York and North Yorkshire MCA; and the research priorities of the FixOurFood program more generally [21] as it enters its final year.**’

We have also added a new ‘Data availability’ statement clarifying where more detailed 3H results can be accessed (lines 827-831):

‘**More detailed Three Horizons results can be found in FixOurFood’s freely accessible subsystem reports [95–97]. Original material (post-it notes etc.) is stored on a number of murals in FixOurFood’s Mural (<https://www.mural.co/>) account. Data are available from [fixourfood@york.ac.uk](mailto:fixourfood@york.ac.uk) or the University of York Open Research team ([lib-open-research@york.ac.uk](mailto:lib-open-research@york.ac.uk)) for researchers who meet the criteria for access to confidential data.**’

5. The discussion is strongly focused on the actual results and the case study. Given that some of the authors have extensive experience in applying the three horizons methods, it would be interesting to see a little reflection on what we can learn from this for other applications of the method or how this case was similar or different to previous experiences or even published examples. The discussion of power (from L361) goes into this direction, but still feels a bit vague and general.

We have added two new paragraphs in the Discussion in light of this comment from the reviewer (lines 482-507):

**‘Reflecting on our Three Horizons process in light of other applications of this framework, what stands out is our unusually extensive, iterative, multi-step and multi-actor application that integrated results from across multiple food subsystems and considered how action could be systemically cohered. Our approach aligns with recommendations for more second-order, adaptive and reflexive approaches in co-creative research and transformation contexts [72–74], as well as incorporating diverse forms of knowledge in food system transformation research [54,75].**

**From this approach, we learnt a number of lessons as facilitators. Firstly, the process required high levels of coordination, as well as considerable commitment of time and effort from participants. We found that online platforms, notably Mural (<https://www.mural.co/>) – although many other similar platforms exist – were helpful for collaboratively engaging with large groups of people (e.g. populating Three Horizons maps), especially given the shift to online workshops during the COVID-19 pandemic. However, it was not always easy for participants who were not used to online meeting forums and collaborative platforms, and poor internet connections particularly for those joining from rural locations impacted their ability to contribute and follow the workshops. Secondly, the process reinforced to us that Three Horizons is an orienting tool: whilst it provides many opportunities for detailed analysis, what participants valued most was that it helped them to work through complexity and distill information down to core messages and narratives. Since applying Three Horizons in this way, we have focused on how food system actors can reinforce one another in service of more regenerative dynamics. While it was outside the scope of our project, there are ways of practicing Three Horizons that focus more on specific, named actors (e.g. organizations, businesses and initiatives) and thus enable even more action-oriented use of the Three Horizons results (e.g. in ‘ambition loops’ to cohere reinforcing action between government policy, business, and civil society [76]) and encourage more direct commitments to action from participants. Nonetheless, our results still provide useful overarching themes, and are being used to strategically orient the work of organizations such as the FixOurFood Commission.’**

6. L203: Please spell out or explain what Defra is.

We thank the reviewer for spotting this potentially unclear acronym. We have now spelled this out (UK Department for Environment, Food & Rural Affairs).

## **REVIEWER 2**

7. This is an interesting paper on a topic that requires sound and pertinent information and evidence to make much-needed change. The aims are clearly in focus and align with research gaps and needs. The work as presented is accurately written and reads very well; not all papers are as readable and engaging. There are some aspects of the paper that merit revision, primarily to enhance the robustness and value of the study and to ensure broad appeal to an international readership.

We thank the reviewer for the positive feedback.

8. Readers may not be familiar with details appertaining to the study and its setting. A fuller profile of Yorkshire as a study area would help in this regard, with some commentary on Yorkshire in broader context: how does this region map onto the aims and methods of the study (i.e. in terms of suitability for the experimental design etc.) and is Yorkshire representative of or different to other regions in the UK and/or elsewhere? This latter aspect is, for me, particularly

important in terms of if and how outcomes of the study can be generalised. There are also some references to organisations and initiatives that require further details. There are several instances (I can't list them all here), but examples include active networks in Yorkshire (lines 177-179) and visioning tools (lines 356-358) - these are named and their broad aims/purpose are stated, but a few words to set out how e.g. "opportunities for scaling and learning" are provided would give fuller and more meaningful context. Similarly, international readers will not necessarily be familiar with Defra and ELM (lines 203-204), or the role and purpose of UK National Parks and AONBs (lines 219-221).

We thank the reviewer for spotting these issues. We have now expanded the section in the Introduction about Yorkshire to provide more context about its relevance and suitability for the study. The section (lines 117-128) now reads:

**'The work focuses on the food system of the extensive 15,420 km<sup>2</sup> Yorkshire and Humber region (hereafter abbreviated to 'Yorkshire') in the UK, with a human population of around 5.5 million. Yorkshire has a diversity of soils, land cover and farming systems (Fig 1), extends across urban and rural environments (Fig 1), and contains the highest concentration of food and drink businesses in the UK [21]. Yorkshire is also a hotbed of food system innovation, as highlighted by a number of recent local food strategies and action plans [23–26], and its networks of innovative farmers and food and drink businesses, such as Yorkshire Agricultural Society's Farmer Scientist Network [27], Grow Yorkshire [28] and Deliciously Yorkshire [29]. Yorkshire's food system also shares many challenges with other food systems, such as high rates of food insecurity [30]. These features make Yorkshire a useful case for establishing lessons about regional-scale food system change and well-suited to participatory processes drawing on a diversity of innovative actors, and explains the county's selection as the focus of the FixOurFood research program [21].'**

We have also added a new figure (Fig 1) illustrating land use in Yorkshire.

We mentioned similarities between Yorkshire and other areas of the UK in the Discussion in our initial submission (see lines 320-322 and 326-330). However, we have added a statement in the Discussion of our resubmission (lines 431-437) clarifying what aspects of our findings we suspect would be most applicable to other areas of the UK:

**'We suspect that transforming food systems elsewhere in the UK will require a similar combination of producer-led, consumer-led, top-down and bottom-up change, building on pre-existing momentum, and cohering, integration and cooperation, to that highlighted by our study. Moreover, the recent disruption to international food supply chains from climate change [46] and geopolitical crises such as the Russo-Ukrainian War [47] will surely focus attention across the wider UK on efforts for greater food self-sufficiency (the UK currently imports around half of its food [48]), which arose as a key topic in our Yorkshire-focused work.'**

We have attempted to locate any instances where organisations and initiatives are mentioned with insufficient details. We have added detail to the section at lines 219-225:

**'Inspiring alternative food and innovation networks were pointed out as already active in Yorkshire, such as Food Circle York (a social enterprise bringing together a community of customers and organic and regenerative farmers, growers and producers, with twice-weekly markets in York) [29] and Yorkshire Agricultural Society's Future Farmers (a platform for innovative farmers, vets and industry supporters in Yorkshire that runs conferences and other large-scale events, workshops, mentoring schemes and industry visits) [30], providing opportunities to learn from, replicate and scale up innovative practice, and share ideas and skills.'**



We have added detail to the section about visioning tools (lines 447-451):

‘Use of visioning tools like the Regenerative Lens **(which aims to encourage ambition and alignment to regenerative system concepts in futures practice)** [13] or Seeds of Good Anthropocenes **(which aims to create optimistic, realistic visions of the future based on identifying and growing ‘seeds’ of pre-existing exemplars of innovative ways of thinking and living)** [48]’

We have spelled out the Defra acronym and added some detail about carbon credits, although we feel that the information provided about ELM is sufficient for the purposes of the paper. Future Farmers are explained earlier on in the paper (lines 222-224). Lines 247-254 now read:

‘In addition to creating stronger market incentives (e.g. action domain 1), it also requires institutionalising long-term commitments to scaling up ‘horizontally’ via city and regional-scale councils, partnerships and networks (e.g. Future Farmers [30]) and ‘vertically’ via national-scale policy working with **the UK Department for Environment, Food & Rural Affairs (Defra)** to ensure an integrated land use strategy and that **agricultural** subsidy schemes such as Environmental Land Management (ELM) and carbon credits **(a system for financing carbon offsetting via land management that reduces, avoids, or removes carbon emissions)** genuinely provide sufficient support.’

We have added detail to the references to National Parks and AONBs (which have more recently been rebranded by the UK government as National Landscapes) at lines 269-272:

‘Giving greater recognition to regenerative farming was also considered important, such as by designating ‘Areas of Outstanding Natural Farming’ in areas lacking existing protection (e.g. **outside National Parks and National Landscapes, which designate areas of ecological, aesthetic and cultural importance in the UK)**’

Lines 294-299:

‘Numerous initiatives doing this work to shift consumer mindsets already exist, such as TastEd **(which offers teachers support for taste education lessons that bring fresh fruit and vegetables into classrooms)** [39], Rethink Food **(which provides resources for schools to introduce holistic approaches to growing, cooking and learning about food)** [40], Farmer Time **(which connects schoolchildren to farmers via live online chats)** [41], and Open Farm Sunday **(an annual public open day for UK farms)** [42].’

Line 322-325:

‘A number of organizations are already working to support this action domain (e.g. to help farmers maximize the use of soil data, such as Soil Benchmark [43] **and Soilmentor [44], or Take a Bite Out Of Climate Change, which shares in accessible ways the scientific consensus about how food and agriculture contribute to climate change** [45])’

Finally, at lines 308-310:

‘such as through changing the **UK Groceries Supply Code of Practice (which sets out how retailers are expected to fairly manage their relationships with suppliers)** and food standards.’

9. As a default, I would usually expect to see some commentary on the role of food waste and its reduction; this is mentioned in passing (only three times) but efforts in this domain have potential to contribute much to a transition to "the desired future" (H3). Given recent estimates of food waste from UK household (see e.g. WRAP publications and UK government data) I suggest some commentary on food waste reduction in the context of the 3H model would be of merit.

The reviewer rightly points out that food waste is an under-represented issue in our findings. We have increased and strengthened mentions of food waste through the document, with validation from participants.

Row 4 in Table 1:

'This is apparent in schools, where food's social, environmental and nutritional importance is under-appreciated with school meals under-funded, food education insufficiently holistic, school food standards weakly enforced, **and high levels of food wastage.**'

Row 1 of Table 2:

'This is contributing to high resource circularity and self-sufficiency, with lower reliance on food imports **and less food waste.**'

Row 3 of Table 2:

**'Care and appreciation of food and its importance contributes to a zero-waste approach to food.'**

Lines 217-219:

**'As emergency responses to acute food insecurity, such supply chains and networks could redirect surplus and otherwise wasted food to food banks and other food access structures [29].'**

Lines 280-281 (and corresponding section in row 3 of Table 4):

'inspiring the public to lead a culture change in consumption and shifting emphasis to local, and seasonal, **and zero-waste**'

Lines 299-301 (and corresponding section in row 3 of Table 4):

**'Third, food retailers can support food waste reduction, e.g. by removing 'use by' date labelling and selling loose unpackaged fruit and vegetables (including 'wonky' produce), which additionally cuts packaging waste [30].'**

10. It is commendable that a high number of participants contribute to this study, but there is rather little commentary on the composition of the participant group. It would be helpful to the reader if more details could be provided here, particularly for the stakeholders, but, of course, with due regard for anonymity.

We point the reviewer toward Table S1 in the Supporting information, which provides information about the organisations represented in each subsystem. For data protection reasons we are not able to provide more information than this.



11. The role of import and export does not appear to feature here. Given the global trading of food - and the trading of food between regions of the UK - it would be useful and pertinent to include some commentary on this aspect: should or could the themes and proposals expressed in this study extend to consider more extensively "cross border" movements of food products?

This issue did in fact arise in our study, particularly in terms of the desire for greater self-sufficiency in the Yorkshire food system, although there was also a desire to share Yorkshire produce with the rest of the UK. These issues were mentioned in our initial submission at line 133, row 1 of Table 2 ('This is contributing to high resource circularity and self-sufficiency, with lower reliance on food imports'), and row 4 of Table 2 ('Yorkshire food is distinctive and desirable across the UK'). We have added a section in the Discussion about international supply chains and food self-sufficiency, however (lines 434-437):

**'Moreover, the recent disruption to international food supply chains from climate change [46] and geopolitical crises such as the Russo-Ukrainian War [47] will surely focus attention across the wider UK on efforts for greater food self-sufficiency (the UK currently imports around half of its food [48]), which arose as a key topic in our Yorkshire-focused work.'**

12. Alignment with journal requirements: the list of key words is somewhat long. The abstract and the "author summary" are identical; does this meet the journal's requirements?

We found that our abstract was already easily read by a more lay audience so did not feel a need to change many aspects. We will ensure that we align with the journal's requirements through discussion with the editors.