The manuscript contributes an innovative methodological contribution to a pressing topic: the integration of cross-scalar, interdisciplinary, modelling techniques and hence absolutely warrants publication. My background is in modelling in a more general sense and not in the specific model types employed in the research and as such I found the descriptive contextualisation's used to support the mathematical descriptions of the agent-based component particularly helpful. I do not have any detailed critiques of the methodology, rather, in my opinion, the biggest limitation of the manuscript is that the writing could benefit from substantial improvement. Another area that I feel needs attention is the results section discussing country level dynamics, which makes a number of claims that I feel are not currently adequately justified by presenting the underlying data.

We thank the reviewer for their positive words regarding the contribution of our paper to fill a pressing research gap, as well as for their assessment of the agent based model description's accessibility for a broader audience beyond the specific model type used. We agree with their two delineated areas of limitations, and suggest to (1) significantly revise and clarify language to make the text more concise and accessible, and (2) clarify what we can derive as results of this paper, and which limitations remain at this stage. This is connected to the adaptations we suggest to Reviewer one (emphasize purpose of the paper, type of results we propose ("substantial conclusions" section of Reviewer one's comments)).

With respect to the writing, I would say that key areas for improvement for the authors would be to: try to simplify sentences as much as possible, really consider the order of information being presented, and whether wording can be more concise or clear. A problem that occurs very frequently through-out is that many sentences are structured such that the key subject is placed in the final clause rather than leading the sentence, which is particularly problematic when many acronyms are being referred to in a single sentence. In addition, there are a substantial number of sentences with grammar or syntax errors and others for which the clarity could be improved by more appropriate word choice. There are also many statements for which citations should be provided where there are currently none.

Thank you; we will consider these suggestions by implementing: simplification of the text, foregrounding key information, shortening sentences, making text more concise, revising the use of acronyms (see response to reviewer 1; reduce number of acronyms to key terms), revise grammar/syntax, and word choice. We will also revise our use of citations and agree with the example sections pointed out below needing further citations.

I recognise that it is never helpful when reviewers simply point out flaws without providing suggestions for improvements, so in the technical corrections below I have provided detailed explanations and suggestions for corrections on a 'case by case' basis. I have done this for the majority of the manuscript, up until the end of the results, but given the extent of the issues it is too time-consuming for me to do it for the discussion as well.

Please don't be disheartned by my comments, your research is making a very important contribution and as such it is crucial that your readers be able to understand it as clearly as possible.

To quickly address the key review topics outlined by EGU:

We thank the reviewer for their overall positive assessment of these key topics and respond to the areas of improvement raised in detail below.

1. Does the paper address relevant scientific questions within the scope of ESD?: Yes
2. Does the paper present novel concepts, ideas, tools, or data?: Yes
3. Are substantial conclusions reached?: Yes, although some are perhaps overstated based on the results presented.
4. Are the scientific methods and assumptions valid and clearly outlined?: Yes
5. Are the results sufficient to support the interpretations and conclusions?: In some cases, I would suggest no, there are some interpretations that could benefit from better justification by the actual data underlying the results.

We propose to revise our framing of the results section to be more clear about our paper's aim and the type of results we contribute, which we agree is not clear throughout the paper (testing the model, exploring coevolutionary dynamics, tracing emergent adoption patterns back to the model set-up, instead of providing a model-based, realistic, data-driven, applied study).

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?: Yes
7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution?: There is a point in the results section where the manuscript starts to show results from another companion paper that is 'in prep'. As a reader, I was left confused as to where the two peices of research had diverged and what actually consititued one vs. the other. I think the manuscript would benefit from laying out in the methods section where is the clear division between the research being presented and the parallel research also pending publication.

We propose to clarify how this manuscript, and its companion paper, are connected and where they differ. The companion paper introduces the technical specifications and a selection of modeling approaches feasible with the novel copan:LPJmL modeling framework, while this InSEEDS manuscript provides a "deep-dive" introduction, theoretical embedding, and analysis of the first model developed using the copan:LPJmL framework.

8. Does the title clearly reflect the contents of the paper? Yes
9. Does the abstract provide a concise and complete summary? Yes
10. Is the overall presentation well structured and clear? Yes there are clear sections but I feel the overall structure could be improved, particularly some of the sub-sections in the results could do with clearer/more indicative titles.

We propose to revise the section / sub-section structure and titles to be more indicative. We also propose to revise the overall structure to provide a more easily accessible manuscript.

11. Is the language fluent and precise? No, as I have tried to highlight in a lot of my comments in technical corrections, there is a lot of problems with grammar, syntax and word choice through-out. There is also a tendency to use a few too many buzz words which are not well defined and sometimes applied inconsistently e.g. world-earth, co-evolutionary, etc.

In line with our reply to reviewer 1, we propose to more clearly define some of the key terms for this publication, like world-earth and co-evolutionary with regard to the literature they stem from, and why we think they are helpful in this context. We suggest doing this either in an introduction section, or in a separate glossary box/table of key terms.

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? As far as I can tell yes.
13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Yes, I have highlighted sections in the introduction and 'methods' section which I think are a little superfluous as they provide further justification/ background on dimensions of the research that are not really essential.

We suggest revising the manuscript to condense it, specifically the sections that were pointed out.

14. Are the number and quality of references appropriate? No, I have highlighted in the technical corrections many setences which require citations for which there are none provided.

We thank agree that these sections need more references. We suggest revising reference use throughout to assess where references are missing, and where they might be superfluous, to also address reviewer 1 asking us to reduce the number of references.

15. Is the amount and quality of supplementary material appropriate? Yes

Technical corrections:

To avoid confusion with line numbering between versions, for each point I have quoted sections/sentences that have issues and then tried to explain the problem and make suggestions for improvements.

We thank the reviewer for their detailed and absolutely helpful suggestions. We appreciate every one of them. We propose revising all sections regarding the language and reference-addition suggestions made to make the paper more accessible, and implementing all language suggestions. As we propose to do so with all language and reference suggestions made, below, we only provide point-by-point replies to the suggestions that go beyond these two dimensions.

Abstract:

•   'Transgression' from a grammatical perspective is fine but in common parlance it does carry quite a normative connotation (i.e. that the act is morally wrong). Perhaps better to use a more objective term e.g. 'bypassing' or 'exceeding'.

We suggest using a more neutral term.

•   "tipping dynamics": If word limit allows then perhaps tipping point dynamics would be "clearer.

•   "are strongly context-dependent.»: This feels a little vague because you have introduced what the context (geographical?) of the study is. If there sufficient space in the abstract it would be nice if this was clear.

We suggest clarifying these dimensions in the abstract.

Introduction:

•   "Co-evolutionary dynamics between humans and the Earth system are the central characteristic of the Anthropocene, a new epoch in the evolution of the Earth system (Schellnhuber, 1999; Crutzen, 2002; Steffen et al., 2011). Agricultural systems are a prominent example of the co-evolutionary interactions in World-Earth Systems (Meyfroidt et al., 2022)." The intro introduces a lot of terminology overall so I think it would be good to be selective where possible. Why use 'Earth System' in one sentence and then 'World-Earth System' in the next? In fact, is World-Earth System a typo because I cannot find the phrase in the Meyfroidt et al. citation?

We suggest re-writing the introduction, including a clear definition of central terminology to avoid sentences being overloaded with jargon that is not accessible for a broad audience.

•   "The green revolution is a specifically stark example this process in the 1950s and 1960s, it intensified land use and agriculture, enabling global population growth and prosperity.": Typo, should be 'example of', also grammatically it would be more accurate to say 'it led to' or 'it resulted in' because the green revolution itself did not directly intensify land use rather it was the process which enabled it. Finally it would be appropriate to use a citation for this statement.

We agree with their suggestion to correct this sentence.

•   "As a result, the intensification of agricultural practices contributes significantly to environmental degradation (Pretty et al., 2018; Benton and Bailey, 2019)." The lack of a clear tense makes this sentence read a little strange, I think it would be good to either say 'has contributed' or 'continues to contribute to'.

•   "The result is the transgression of multiple planetary boundaries (PBs) – critical

processes that sustain Earth System stability and resilience – such as biosphere integrity, land-system change, freshwater use or biogeochemical flows (Campbell et al., 2017; Richardson et al., 2023)." Same problem as the previous sentence, i.e. the tense is not clear, and in this case it is even more important because the boundary has either been crossed or not. Also, similar point to the usage in the abstract, 'transgression' is perhaps too weighted a term.

We will revise our use of tense throughout the manuscript.

• "Soil degradation is among the most significant problems, as it entails a loss of soil nutrients and soil organic matter (SOM), followed by decrease in the soil's water retention and infiltration capabilities.» For flow, make the link to the previous topic explicit, i.e. 'In this respect, soil degradation…' this is advisable because otherwise 'problems' is too vague on it's own.

• "With increasing climate change and global warming, pressure from rising water consumption in the form of evapotranspiration and extreme weather events such as droughts and heat waves are also increasingly affecting agroecosystems,» : The usage of 'water consumption' reads slightly strangely here as the examples that follow are natural processes, especially evapotranspiration, whereas 'consumption' really implies a subject (i.e. humans).

We agree that it is a non-ideal word choice in this list of natural processes. We propose to revise this list to clearly distinguish between natural and social/human-induced processes.

• "Given the critical reliance of societies on food and other ecosystem services provided by agricultural systems, a systemic transformation is imperative to ensure agricultural productivity while maintaining or re-establishing the ecological resilience of these systems (Benton and Bailey, 2019).» Needs some form of qualification i.e. to ensure continued agricultural productivity' or 'to prevent further declines in…'

• "Most RA scholars and practitioners agree on soil health as»: Similar to above, this would benefit added qualification i.e. 'agree that the maintenance/improvement of soil health is…'

• "While the inclusion of livestock is often practised in RA," 'Inclusion' doesn't quite fit correctly in combination with 'practised', better to be more specific i.e. 'livestock farming' or 'rearing of livestock'. But for the flow of the whole sentence it would be better to switch the subjects i.e. While RA typically involves livestock farming it also is also applicable to…'

• "Soil health has repercussions on multiple scales and is often regarded as a key leverage point for planetary health (Montgomery et al., 2024).» This sentence feels very out of place with the preceding and subsequent sentences, it would fit much better when the importance of soil health is introduced in the previous paragraph.

We suggest we revise the placement of this sentence.

• "Some scholars and practitioners explicitly include human, social, and societal dimensions in their definition of RA. Muller (2020) embeds RA within a broader paradigm he

calls"regenerative development", which comprises societal dimensions like politics and economy," The wording here reads slightly off, the first sentence implies these elements are 'included in' the definition but then example instead situates RA within something broader (i.e. RA exists within regenerative development), which is in a sense the opposite.

We thank the reviewer for this sharp observation and propose to revise our definition-dimensions of regenerative agriculture and its connection to other fields such as "regenerative development".

• "While some dimensions, most prominently ecological, of RA practices are well-researched (LaCanne and Lundgren, 2018; Lal, 2020; Kassam et al., 2022),» Better flow to move the subject to the first clause, i.e. 'While some dimensions of RA practices, most…'

• "the question of how transitions towards such systems can unfold is largely under-researched,» but what is the system in question? So far you have referred to RA practices which is not a system in itself, do you mean a system where RA is widely practiced/adopted?

Thanks for pointing out this indeed unclear sentence. We propose to better define what we refer to ("such systems") and use more precise wording.

• "There are several outstanding research questions, aimed at understanding how such transitions might unfold, including: What could adoption and therefore spreading dynamics of RA look like given different social structures or learning processes? Can social tipping points be reached in those transition processes, such that positive feedbacks lead to widespread and self-reinforcing adoption? How can resilient agricultural land systems be achieved globally—and how might the process of adoption differ across locations?

We propose to make the following changes in this paragraph:

Overall, I find this paragraph too vague, as it uses too-many terms for which the definition is contentious or unclear and the authors don't provide their own perspectives:

We propose to provide a clear definition for the terms used (e.g., social tipping points, resilient agricultural systems) in the introduction (text, box, or table glossary).

o First and foremost, if these are 'outstanding' questions it implies that they have been established by someone, but there are no citations for each or all of them?

We propose to use the term "key" instead, as our use of "outstanding" was indeed confusing.

o 'spreading dynamics' is from my knowledge not a established term in the literature but it's also not clear enough as a standalone phrase I think better phrasing overall would something like: 'How might the adoption of RA differ with respect to variations in social structures or learning processes'.

We agree that the term "adoption" is better suited here and will reduce the use of jargon like "spreading dynamics" (network science) which is less accessible to a broad audience.

o 'Social tipping points' would require a citation.

We agree that this point, as well as the other question dimensions raised, need further citations.

o   What explicitly are 'transition processes' in this context ? The overall process of transitioning from conventional Ag. To RA or something smaller scale?

o   How is 'transition' different from 'adoption' when both are used in the same sentence?

Regarding the two points above: we agree that it is important to clarify language here and propose adding these terms to the glossary, and generally reducing the terminology used. We also suggest revising the manuscript for their consistent use.

o   "How can resilient agricultural land systems be achieved globally—and how might the process of adoption differ across locations" Is a resilient agricultural land system one that specifically requires RA? If so you need to make this statement clear, also the 2nd clause feels redundant in light of the earlier statement regarding adoption dynamics.

We agree that this statement needs clarification and propose (a) the addition of the terms "resilient agricultural system" (and its relation to RA) to the glossary, and (b) the removal of the second clause to avoid redundancy.

•   "The afore-mentioned research questions cannot be addressed by existing modelling approaches due to divergent model purposes and lenses.» This is a crucial piece of argumentation and hence requires citations, also 'lenses' could be more specific, are you referring to models only focusing on specific or limited dimensions of socio-cultural-environmental systems?

We thank the reviewer for pointing out this indeed central but rather "hidden" piece of our argumentation. We suggest adding references and more clearly putting forward our envisioned contribution with this novel modeling approach, which we perceive as complementary to existing up-to planetary approaches that often focus on economic dimensions of social-ecological systems. This connects to our points made in the reply to reviewer one on "**Novel Concepts, Ideas, Tools, or Data**" -- there is ample evidence for the importance of certain socio-psychological dimensions we include (norms, attitudes, learning, …) for farmer decision-making (e.g., see meta-analysis of Swart et al., 2023), which are, so far, underrepresented/non-existent in previous up-to planetary scale modeling approaches. However, we deem capturing these dimensions as crucial for answering research questions that complement what we can learn from "classic scenario-optimization approaches (e.g., how many people can we feed under climate scenario x") and instead zoom in on a process-based, endogenous understanding of human behaviour.

•   "Social-ecological, for example agent-based modelling approaches, capturing human behaviour and social dynamics in nuanced ways, are often limited in their range of applicability and, in many cases, applied to single case studies": Several small problems with grammar. Move the subject for improved clarity; 'Socio-ecological modelling approaches, for example, agent-based models..' But also the 2nd clause is not grammatically correct, my suggestion would be: 'while capable of representing nuanced human behaviour and social

dynamics, are often limited in their applicability beyond the specific case studies they are parametized/developed for.'

• "Albeit larger-, up-to-global scale modelling approaches, like integrated assessment models that aim to include human dynamics in their analyses, exist, their understanding of "the human" is limited. Their macroeconomic optimization approaches rest on the rational actor paradigm and omit scientific findings about alternative motivations and drivers in human decision-making (Browning et al., 1999; Hodgson, 2012; Otto et al., 2020).» The start of this sentence is problematic because the fact that it follows immediately from the discussion of agent-based models, and the use of 'albeit' implies that you are suggesting that IAMs are examples of agent-based models which is not wholly correct(some are, some aren't). Instead, you need to make it clear that IAMs are another paradigm of socio-ecological model, typically operating at a larger scale (the phrase of 'up-to-global' is quite clunky) but this requires a simplification of decision-making. This would make the sentence read much clearer.

• "with a closed social-ecological feedback loop» This is too specific to be clear for lay readers, even for myself with an appropriate scientific background, I am not confident exactly what you mean by 'closed'?

We suggest we better explain what we refer to with the "closed loop" language, and which scientific community/stream this stems from.

• "proof-of-concept models towards more complex, integrated models," I think 'integrated' is not a good choice of adjective here because you have already established that a defining characteristic of these models is that they ideally integrate multiple systems so how is this a contrast to 'proof of concept' versions of these models, as surely to be considered successful proofs of concept these models would already be integrated?

We agree with the reviewer's sharp and correct observation (they should all be integrated) and suggest adjusting the wording in our explanation of the "spectrum of modeling approaches" we perceive, and where we would place this InSEEDS model version.

• "which also consider biophysical preconditions and decision-making in a process-based manner.» A bit too vague, what is a process-based manner in this context?

We suggest defining how we understand process-based in this model. For our biophysical process-based subcomponent, LPJmL, this is well-defined, but the term has to be laid out for the agent-based component.

Here, we do not use an intertemporal optimisation approach but are processed based in the manner that we aim to understand and model the socio-cultural processes. This is connected to the inherent property of ABMs reflecting the endogenous representation of agents, decision-making, and their interaction with social and biophysical environments, as opposed to representing "the social" through approaches like the use of static SSP scenarios or economic optimization.

•   "A model built in the copan:CORE modelling framework consists of entities that interact with each other via processes (Donges et al., 2020).» Minor grammar correction with respect to 'framework' wording should be 'according to' or 'with' rather than 'in'.

•   "that integrates agent-based model components for socio-cultural and social-ecological

dynamics.» Minor grammar correction should be 'to represent' or similar instead of 'for'.

•   "This way, InSEEDS is able to model the human-land system more holistically than prior efforts,» Grammar, 'this way' is not quite correct, consider: 'In this sense…'

•   "allows to capture» Grammar: this formulation requires a subject i.e. 'allows users…' or to make it neutral rephrase too: 'offers the possibility to capture…'

•   "up-to global» Try to be consistent, earlier you use "up-to-global" (different punctuation) but also "up-to-planetary" (what is the difference?).

We will streamline the use of these terms (pick "up-to planetary"), and streamline hyphenation.

•   "Investigating the adoption of regenerative land management practices is particularly worthwhile due to its potential to increase Earth system resilience. Given the central role of land system management in the global change dynamics of the Anthropocene (Steffen et al., 2011; Campbell et al., 2017), the InSEEDS model allows for the embedding of land(scape) regeneration within planetary and Earth system stewardship (Chapin et al., 2011; Steffen et al., 2018; Rockstrom et al., 2024).» In my opinion, this justification is a little superfluous, you make the point earlier regarding the importance of regenerative practices and overall the relevance/importance of the InSEEDs model is already clear to me as a reader. Given that the introduction is quite lengthy already and I have suggested points where it could be clearer, I would suggest perhaps removing these sentences to make more space.

We agree that the introduction needs significant shortening. We will revise this section especially.

•   "The InSEEDS model captures interactions between social, ecological, and socio-cultural processes,» Through-out the manuscript I think there are some cases where terms are applied in perhaps a slightly inconsistent manner. For example, in this sentence, can social processes be considered meaningfully distinct from socio-cultural processes? and what about socio-ecological processes, which is another term that is used several times in the introduction? Perhaps, you could improve clarity if you were to more deliberately 'set your terms' in the introduction, for example by stating something along the lines of: 'agricultural systems are subject to/shaped by interacting social, cultural and ecological processes and henceforth for simplicity we refer to these as X.' This could help avoid some of the inconsistent application of terms and simultaneously allow you to be more concise.

In line with previous suggestions, propose to revise the whole manuscript for the consistent use of terminology.

• "and the feedback mechanisms that close the loop between ecological outcomes and social adaptation." I have made a similar comment on the understandability of this phrase above, but linguistically 'close the loop' doesn't quite make sense in this context as the feedback mechanisms are themselves the loop (i.e. in their absence there would be no loop) and hence they cannot be said to 'close' the loop.

As mentioned above, we suggest re-phrasing this sentence, and linguistically adapting it to make it more understandable. We aim to express that our approach closes the loop between ecological and social dynamics by introducing feedback mechanisms between these two dimensions.

• "the latter is a central cornerstone of many RA operations worldwide. Firstly, 'operations' is not so fitting a term here as it implies a more organised and deliberative activity whereas many real-world examples/applications of RA are likely quite informal and bottom-up in nature. Also grammatically the ': the latter is a' is not quite correct. To address both I would suggest: ': with the latter being a cornerstone of many examples of the application of RA globally'.

• Figure 1: Generally I find it clear and helpful, a small suggestion is that the social cultural taxon contains "no residue cover" but this is meant to represent the alternative to conservation tillage which according to the preceding text is 'conventional farming' right? If so, better to be consistent and have that in the figure too. Also, you include some acronyms in the figure (e.g. for the taxons) but not for others such as CT, CY and CF, this would make the link to the text more explicit. Finally, if you think of the concept that a figure should be understandable in the absence of it's caption, then it would be good if there was a logo/label for InSEEDS in the figure itself.

We agree that the terminology of the different practices between text and figure should be aligned. We also agree with the suggestion to remove certain acronyms in the figure (CT, CY and CF) to make it more accessible without the reference to the text. Sadly, we are still in the process of designing a logo and have no version we can share in this figure yet.

• "The combination of different soil conserving tillage systems like no till, in-row subsoiling or strip till, with residues left on the field that cover more than 30% of soil surface can be summarised under the term CT (SARE, 2020)." I would suggest reversing sentence structure for clarity, i.e. 'We consider CT to include the combination of…'

• "Conservation Agriculture approaches, like CT, have been proposed as a fundamental cornerstone of RA systems (Kassam, 2023; Kassam and Kassam, 2024).» For me, this sentence is unnecessary as this point has been made in the introduction already.

• "Conservation 134 Agriculture approaches, like CT, have been proposed as a fundamental cornerstone of RA systems (Kassam, 2023; Kassam and Kassam, 2024). The InSEEDS model, prospectively, is designed to investigate transitions to RA systems that comprise a diverse set of land-use management practices that go beyond CT. We chose CT

as our first representative RA practice based on the observation that, as a single practice, it can be regarded as one of the options with the widest potential for adoption and positive outcome on ecological indicators (Wang et al., 2006; Liang et al., 2025). In the following, we use the terms CT and RA interchangeably, and elaborate on their connection in Discussion Section (5).» I recognise that the manuscript is not strictly following an IMRD structure but the paragraphs that proceed this in the section very much read like conventional methods section text (i.e. objective presentation of model details). As such, this section then feels somewhat disconnected because it is returning to a more conceptual level/justification statements. For example, as a reader you have already made it clear to me why CT is important, I don't need any further justification yet why you chose to implement this first vs. other RA practices within inSEEDS. It is good content, but I think it would be better placed in the discussion.

We agree that the placement of this paragraph should be revised.

• "Nevertheless, Herzfeld et al. (2021) also showed that CT does not necessarily lead to an increase in SOC, a pattern that has been shown by Karstens et al. (2020).» because you are juxtaposing this example with the previous sentence it would be good if it was clear whether Herzfeld et al.'s result is from a real-world context or whether it was also generated from LPJmL? Also, for grammar/semantic correctness the last clause should be 'a finding that was also observed by Kartstens…' (finding not pattern because the example you are discussing can not said to be a pattern).

• "Slow responses of SOC levels to short-term agricultural management changes might play another role in the limited effects of CT practices in modelling studies." Needs citations even if they are just the same studies as discussed as above.

• "Understanding and modelling the social dynamics of the adoption and spread of agricultural practices in farmer networks is a multi-disciplinary endeavour.» Citations needed.

• "The social feedback loop is characterised by agents observing the social norms present among their neighbours.» But what are some examples of 'social norms' in the context of your research? It would be good to give the reader some more insight here.

We suggest to more explicitly state the types of social norm relevant for farmer decision-making (manifold, e.g., both injunctive and descriptive) to then specify which of these dimensions we represent in our model (descriptive social norms signalling the majority management practices in the agents' neighborhood).

• "It is formalised as follows: The TPB posits that human action is driven by behavioural expectations BE—a combination of perceived behavioural control PBC and behavioural intention BI:" The first part of the sentence before the colon is redundant especially because the preceding clause also ends in a colon.

• "Following the spatial structure of the LPJmL gridcells, farmers consider the 8 gridcells adjacent to their own land, i.e., their Moore Neighbourhood of range 1, as their neighbours» At the moment, the sentence structure is slightly confusing as the last clause reads like it is

missing a subject i.e. the neighbours... X… Better to invert the sentence structure and in simplify i.e. Within LPJmL, a given farmers neighbours are defined as…

• "These two components are weighted using ωAself andωAnbr respectively, and combined in the attitude-based evaluation of the agents'current land management success. Need to include the term 'respectively so that it is explicit which notation corresponds to which concept from the previous sentence.

• "There is strong evidence suggesting the influence of social norms, which may be related to geographical proximity (neighbouring farms) or membership in certain groups, associations, or communities of practice, on the adoption of farming practices (Brown et al., 2018; Swart et al., 2023). Minor grammar problems with 'suggesting' better to re-formulate: There is strong evidence that social norms …. , can influence the adoption of farming practices.

• "the norm component's contribution to the BE,and thus to a potential strategy switch, is larger compared to a case when only a slight majority (e.g., 5 out of 8 neighbours) practice CF» The 'BE' needs a clear subject (i.e. the farmer's), reformulate: 'The contribution of the norm components to a respective farmer's BE and thus…'

• "The smaller the PBC value, the more inertia is introduced, which significantly reduces the likelihood of behavioural change.» But the inertia is not 'introduced' as the prior sentence is referring to it being set for different AFTs correct? If so better to just say 'there is greater inertia'.

We suggest clarifying this sentence. The reviewer correctly observes that the initial PBC value is set for the AFTs after initialization, but it is adjusted in different ways during simulation dynamics (after an agent switches management practice, their PBC value is reduced, which introduces more inertia and makes near-future switches less likely).

• "It serves as an approach to develop generic agent types to simulate up to global social-ecological, behavioural land-use ABMs. AFTs are based on the primary characteristics of roles (such as farmer, forester, or extensionist agent) and cognitive as well as behavioural processes (such as attitude formation, learning, imitation).» Both sentences require citations.

• "The distinction of different farmer AFTs is rooted in the notions that (a) land-use priorities and decision-making vary among different farmers (e.g., with respect to climate zones, socio-cultural environments, farm sizes and purposes, etc.) (Edwards-Jones, 2006; Singh et al., 2016), and consequently (b) transition pathways for those different farmers will be distinct (Maybery et al., 2005; Stringer et al., 2020). See red text for suggested improvements, particularly with regards to 'groups' in the last clause you have not explicitly established who these groups are i.e. you previously state farmers but not that they are grouped.

We suggest clarifying which groups we refer to (e.g., farmer associations).

• "Many different farmer typologies exist (Burton and Wilson, 2006; Malek et al., 2019;

Bartkowski et al., 2022).» Be specific, are you referring to modelling here? Because otherwise this statement is self-evident given the previous sentence.

We suggest explicitly referring to empirically-derived typologies that stand for themselves ("intrinsic value" of synthesizing knowledge), but can also be used for modeling studies.

• "investing in soil health can support the provision of stable yields in the longer run.» Citation needed.

• "This farmer type, additionally, was found to be "less concerned than other groups by problems, showing their enthusiasm for conservation agriculture" (Casagrande et al.,2016, p. 293).» Following on from the comment above, it is not clear in this sentence whether you are discussing a real-world farmer typology or a typology employed in modelling?

See comment above.

• "This conviction to improve soil quality can be mapped to (1) the emphasis on their own attitude and values as compared to the social norm, and (2) the relative importance of SOC as compared to CY parameters in our pioneer AFT.» Be more specific, yes of course it 'can' be mapped in this way but is this how you actually realised it? If yes, then say so.

Yes, that's what we did, so we propose to clarify this.

• "Comparing the two learning processes and the resulting attitude sub-components, Anbr is given more importance and thus a higher ωAnbr in the case of pioneers.» Again, this is a small issue of the ordering of information in the sentence, the preceding sentence ends by bringing the focus to the pioneer AFT, and this sentence is describing the characteristic/configuration of the pioneers and hence it would be clearer to begin the sentence with the pioneer as the main subject and then describe the characteristic in relation to them.

• "In contrast to mere normative pressure, they are expected to be considerably influenced by social learning opportunities, and learn from their neighbours' successes and failures using a different management strategy to compare their performance with their own. Several issues:

o   Citation needed

o   'In contrast to mere normative pressure' is not grammatically/syntactically correct because there is no subject or action. Reformulate along the lines of 'Rather than being solely influenced by normative pressure…'

o   'using' is unclear who is using and also 'to compare their performance' is redundant because you already say 'successes and failures', better to simply say 'successes and failures in applying different management strategies to their own'

We agree that the sentence structure creates confusion. We were referring to the neighbors using different strategies. We propose to remove redundancy and clarify the comparison

• "high belief about being capable of putting their intentions into practice.» Grammar issue with 'about', should read: High belief in their capability to put their intentions into practice'

• "With regard to non-farmer-specific strands of literature, this combination of AFT attributes can also be connected to the concepts of "innovators" and "early adopters" (Rogers, 1962) and"trendsetters" (Bicchieri and Funcke, 2018). Social science research shows that certain sub-groups or individuals tend to abandon predominant descriptive social norms and spearhead change, well before a descriptive norm tipping point is reached." From my perspective you have provided ample other justification for the characteristics of the pioneer AFT and these sentences don't substantially add to this. Given how long the manuscript is in general, I would recommend dropping these sentences.

We would be happy to cut this section to shorten the manuscript.

• "traditionalist AFT would be more reluctant to adopt a novel management practice that is not well-established yet.» This sentence is confusing terms, the "traditionalist AFT" does not exist in reality, traditionalist farmers do but you are referring here to the conceptualisation of the traditionalist AFT in the abstract. Hence, it is not correct to say 'would be more reluctant' as this cannot be verified Instead, it should read, 'should, in theory, be more reluctant…'

Yes, we are referring to the conceptualization of the traditionalist AFT in our manuscript. We propose clarifying as suggested.

• "For each cell, the type of agent is determined probabilistically using a Bernoulli trial with the aforementioned probabilities for a cell being assigned a pioneer (S) or traditionalist (1−S) AFT.» The wording is quite awkward and it took me multiple readings to understand the sentence, the problem is 'aforementioned' which is not typically used when the probabilities you are referring to are in the first clause of the sentence (vs. being in a preceding sentence). Inverting the sentence content would make its meaning clearer: 'The values of S and 1-S are used to determine the assignment of AFTs for each cell in the model state space by applying them as probabilities within cell-by-cell Bernoulli trials.

• "Most of the exact parameter values needed to calculate the decision making, i.e., the weights of N or A, cannot be based on quantitative empirical data, yet, due to a lack of such datasets for the parametrisation of the human component in World-Earth models (Arneth et al., 2014). Again, quite awkward wording makes the sentence hard to understand as 'yet' is often used in this manner to introduce a juxtaposition but here you mean it in a temporal sense. Reformulate: 'While it would be theoretically possible to base parameter values for

decision making on empirical data, such data is not yet available…'

• "Some of the parameters, like SOC and CY , attitude_own_land and attitude_neighbors, and norm and attitude, are weighted in relation to each other on the basis of the qualitative differentiation between AFTs: while the precise weights' parameter values are not derived from quantitative empirical data, their parameter ranges (e.g., own attitudes are weighted higher than social norms in the pioneer AFT as compared to the traditionalist AFT) are based on qualitative AFT differences that can be found in the literature (see Chapter 2.2).» Several problems:

o   Firstly, it is supposed to be a run on sentence from the preceding one but the sentence does not begin with an appropriate connective ephrase? i.e. you just said that the empirical data is not available yet, hence I would expect the next sentence to clearly state: The alternative to using empirical data is…

This captures what we intend to say well.

o   Secondly, the sentence is very long and the use of both a colon as well as a parenthetical section in the subsequent clause makes it hard to understand.

We suggest splitting the sentence.

o   'weights' parameter values' doesn't make sense grammatically and I can't make a suggestion because I don't clearly understand the difference between the weights and parameter ranges?

This is indeed a confusing expression of ours. What we intended to say is that the weights associated with different variable values (e.g., the weight an agent places on social norm) are not quantitatively derived from data. We suggest revising the sentence, also with regard to the use of the term parameter (here, it should be variable).

• "The following global simulation runs were performed for the sensitivity analysis and result generation: (1) The base run using the standard parametrisation laid out in Table 1.» This sentence is contradicting an earlier sentence in the section above: "The default values highlighted in Figure 3 and Table 1 are selected as a result of the sensitivity analysis shown in figure 4.1.» The first sentence (in the manuscript) suggests the parameter values were derived from the SA but the other sentence suggests exactly the opposite i.e. these were the values applied at the start of the SA. Which was it?

We agree that it doesn't become clear from the current version that the default values were chosen as a result of the SA. We suggest adapting the section to make this clearer.

- "This is run is the foundation for the results presented in section" Grammar error

- "are obtained and used from Ostberg et al. (2023)' Redundant wording.

- "Starting in the year 2023, LPJmL ceases to run as a stand-alone model, and is bidirectionally coupled with the ABM component through the copan:LPJmL framework." Awkward wording: 'ceases to run' implies some internal error or change in the model or some outside circumstance when in reality it just that you introduced the bi-directional coupling at this point, also you need to be clear you are talking about simulation time and not reality. Being more specific and using simpler langaugse would improve clarity: 'From the year 2023 in the simulations we introduced the bi-directional coupling of…'

- "The integration of LPJmL as an environmental (ENV) and an ABM as a socio-cultural and socio-metabolic (CUL & MET) component yields the InSEEDS model." 'yields' is not appropriate because it implies that InSEEDS somehow arose autonomously from this process of coupling whereas in fact you designed this coupling to represent InSEEDs.

We agree that yield misrepresents our model-building process. We suggest to clarify the sentence as proposed.

- I am not so familiar with the EGU formatting but as I have said previously the whole manuscript is very long and as such I feel like the detailed explanation of the sensitivity analysis method would be better placed as an appendix. You have a lot of concepts and model processes to relay while trying to keep the readers attention and for me, while it is obviously technically important, the sensitivity analysis is not central to the main message of the work.

While we agree that the manuscript needs substantial shortening, we think that it would be difficult to move the sensitivity analysis to the appendix given the manuscript's focus. As suggested above, we propose to emphasize that the main contribution of this paper is to introduce, test and analyse a model and present a structurally validated version of this model. We agree that moving the sensitivity analysis to the appendix would be appropriate for other types of manuscripts, e.g., more content-focused application studies. For this manuscript and its focus, we deem the results from the SA to be too central to move the SA to the appendix. We still take your point on manuscript length seriously and propose condensing other, less central dimensions of the manuscript, e.g., the detailed background sections on transitions and transformations in the introduction, the two-fold introduction of AFTs in Chapter 2, and generally the extensive background provided in the model description section.

- "Given the qualitative approach to parametrising the AFTs sketched in subsection 3.1, the subsequently presented results of the sensitivity analysis should be understood as demonstrating the dynamical interplay of the underlying parameters in order to validate the

overall model behaviour and explore different model pathways, instead of quantitative insights based on a precise real-world model parametrisation." Several issues:

o   The sentence is overly long and complex, try to be much more simple and direct in your wording: 'given that the model parametisation was qualitative the purpose of SA in this context is not intended to be consolidative (i.e. to identify objectively correct parameter values) but instead it is intended as an explorative process to validate overall model behaviour and demonstrate the dynamics it produces.' What would also be important would be to cite some sources who have also applied sensitivity analysis for a similar purpose.

o   'sketched' is a strange turn of phrase because it literally implies drawing something which is not true it was written, so better to say 'outlined'.

o   'dynamical interplay': There is a very subtle difference in meaning between dynamic and dynamical, bit in short say dynamical interplay is incorrect

because dynamical already encompasses the notion of interplay. On there hand 'dynamic interplay' would be correct.

•   "To achieve this, a sensitivity analysis (SA) was conducted." Why is this following the preceding sentence, because in it you have stated that you did SA?

We agree that it is confusing and suggest removing this to reduce redundancy.

•   "were kept in the base run configuration" Be more specific, i.e. 'used the values of' because 'kept in' almost implies they were each within a range.

Results:

•   "results, to then introduce findings» Grammar: needs to be 'before then introducing' rather than 'to' in order to be correct.

•   "The InSEEDS model system» Stay consistent with terminology: earlier you refer to the "InSEEDS model" but a "model system", as used here, is a subtly different thing.

We suggest to indeed stick to the term "InSEEDS model" consistently throughout the manuscript.

•   "Its results for different parametrisation sets, as explained in Figure 3 and Table 2, are shown in the following." Several problems:

o   The figures do not "explain" the results they show or detail them.

o   What is 'the following'? there needs to be a subject here i.e. 'in the subsequent paragraph'

o   Again this is an example of a sentence that could benefit from being re-ordered: 'Figure 3 and Table 2 detail the results of testing different parametrisation sets.' This is simpler and

more concise and also as a reader I don't need to know that you are going to explain these results to me, instead you can just do it.

These are very helpful points and we believe implementing them will improve clarity.

o   OK but after reading the sentence that follows are these actually 'results' or are they simply the values that were used for testing? There is a difference.

Yes, that is true, this sentence might be misinterpreted. "Results" refers to the subject of the sentence before, the InSEEDS model. What we introduce in this subchapter are the sensitivity analysis *results* of the different values we tested in the SA. We propose to clarify this difference.

•   'The effect of the pairwise variation of the named parameters on both biophysical (i.e., SOC and CY) and social (i.e., spreading extend of RA practices) variables is shown in Figure 4.' This sentence follows too abruptly form the previous, the juxtaposition needs to be clearer i.e. Figure 3 and table show the values tested and Figure 4 shows the implications of these values in terms of the biophysical and social outputs variables of the model.

We suggest clarifying the sentence flow according to their suggestion.

•   "We can observe that the variation of the norms and attitude weights (green) has the strongest impact on the simulation results– varying this weight produces the most significant difference in simulation results, especially considering the distinction ofrun intention_0 on the one side, and run intention_2 to intention_4 on the other side." OK, you have started a new paragraph here and hence you need to be specific what figure you are referring too especially because in the last paragraph you have referred to two different figures.

We agree that the reference to the figure should be made explicitly.

•   "yield the maximum share of RA practitioners,» Be careful, it is not the 'maximum' rather it is the 'greatest observed share' because testing other values could have led to greater shares, i.e. the maximum remains theoretical.

Thanks for raising this difference and we agree with their suggestion to correct the statement.

•   "Figure 3. TPB weights (ω) that have been shifted along equal intervals within realistic ranges. There are 3 sets with each two ω for each different level of the TPB equation: (1) the variation of attitude and norm as the sub-components of behavioural intention (green), (2) the variation of social learning and learning from one's own land as the sub-components of attitude (pink), and (3) the variation of soil and yield as factors in both learning processes (blue). ω intervals are highlighted for traditionalists (solid bard) as well as for pioneers (hatched bars)."

We and agree that several adjustments should be made to figure 3 to make it more accessible. We noticed that central elements of the figure were altered during the last edits,

which we didn't catch. We thank the reviewer for their attentive comments and will answer point-by-point below. Reviewer 1 raised similar points, and I will therefore re-iterate some of the point-by-point suggestions we made to address them in our replies to Reviewer 1.

o   Overall, the whole caption is quite confusing, I don't understand what the values in the circles represent are the sets? If so why are there 4 for some and 3 for others. Also why use 'level of the TPB equation' these are not levels they are components or terms in the equation? It would be helpful to start from the highest level of organisation i.e. Figure 3 contains three sub-plots for each of the components of the TPB equations, within these each of the weights of the respective sub-components were varied in X sets for each of the Agent Functional types.

We propose to adapt and extend the figure description to address those points: Circles represent the exact parameter weights chosen in the given experiment, the x-axis represents the weight range from 0 to 1, the numbers in the circle indicate the connection of the parameter combination to the run (e.g., looking at the green group varying attitudes and norms, as the subcomponents of behavioral intention: the thickly circled default run that has the number "1" in the circle corresponds to the run "intention_1" in figure 4. In this run, figure 3 shows that the parameter weights for social norm are set to 0.4 and attitudes to 0.6 for traditionalist, and 0.2 (norm) vs 0.8 (attitude) for pioneer AFTs).

There are different numbers of circles/experiments that we conducted for the following reason: All variations in weights were conducted with 0.2 steps, and the inclusion of one parameter of the combinations that was set to 0. For variation in weights of attitudes/norms and own land/neighbor learning, we conducted 5 runs (experiments 0-4) each -- a difference of 0.2 between AFTs given the other conditions above yielded 5 runs. As the ecological weights differed with a magnitude of 0.4 between AFTs, only 4 runs (experiments 0-3) were possible.

The figure also shows wrong values for "weight own land" and "weight social learning", which we want to correct.

We agree and suggest ordering the three groups of TPB component by their hierarchy in the decision-making model: top layer: variation of behavioral intention sub-components (norm vs attitude, green), middle layer: variation of attitude sub-components (learning from own land vs. social learning, pink), lower layer: variation of ecological sub-components (yield vs. soil, as inputs for the learning processes, blue).

o   Also, the description of what the blue bars represent in the figure caption does not align with the labelling in the figure itself, i.e. in the figure you use 'ecolog. Performance'. Rather than say in the caption 'in both learning processes' which is superfluous instead you need to be explicit that you are referring to the soil and yield and the 'ecolog. Performance factors'.

We agree that the current phrasing is confusing. By mentioning the fact that the ecological sub-components hierarchically serve as input for the learning processes, and the learning process in turn as input for the attitudes, we wanted to specify the nested relation between these three groups of TPB. Our current phrasing, however, rather creates confusion, which

• Figure 3 comments:

o   As a reader I don't fully grasp why the colours breaks are where they are and what they represent. Are they simply mean to represent a gradient between high and low values, if so why is a gradient not used? If they are supposed to demarcate sets, I don't understand why the caption says there are three sets when there are four breaks?

o   the x-axis label 'agent parameter sensitivity shifts' firstly should be below the figure with the actual axis values otherwise it could be confused with being a plot/sub-plot title but also the wording is strange are these are not shifts these are simply values (i.e. not representing a change)?

o   For the sub-plot labels in the right, it would be more readable if they weren't rotated, perhaps if they were displayed running horizontally from the top left corner of each respective box?

• "Figure 4. Global analysis of the impacts that parameter variations have on different model variables after a simulation run (year 2100). The parameter values of the depicted runs can be mapped to the colour scheme introduced in Figure ??. The blue runs depict a variation of the weighting of SOC and CY in the learning sub-components of attitude formation. The darker the blue, the higher CY , as opposed to

SOC, is weighted in the ecological evaluations performed by the farmers. The pink runs depict a variation of the weights attributed to social learning, and the observation of the agents' own land, which together form the attitude component. The darker the pink, the higher social learning, as opposed to the evaluation of the agent's own land, is weighted. The green runs depict a variation of the weights of social norm and attitude, which, taken together, form the agents' behavioural intention. The darker the green, the higher social norms, as opposed to the farmers' own attitude, is weighted."

o   First sentence, be more concise and precise in wording: 'the impacts of parameter variations on model outputs variables at the end of the simulation time (2100)'

o   Don't refer to the lines primarily as 'runs' this is unclear for the reader. You should explicitly make the connection but from then on refer to them as what they physically are in the figure (lines): 'The horizontal lines each represent specific runs, with the colour of the line mapping to the parameter values of the run as presented in figure 3.'

o   "The darker the blue, the higher CY , as opposed to SOC, is weighted in the ecological evaluations performed by the farmers" Grammar correction: 'the greater CY is weighted in farmers ecological evaluations as oppose to SOC.

•   "With parameter configurations placing only minimal emphasis on social norms, the attitude component, that considers the evaluation of ecological performance through social learning and the observation of one's own land, is dominant in the decision-making function.» Unclear meaning, do you mean 'within the parameter configurations that placed only minimal emphasis on social norms'? Also the whole sentence eis too long. It would be better to split into two with the explanation of what the attitude component represents, currently the 2nd clause, moved to a 2nd sentence. The most important thing is the result so bring this to the forefront.

•   "The weighing of social learning and observing and learning from the dynamics present at the agent's own land, which together form the attitude sub-component, has the second largest influence on model dynamics (attitude_0-4).» Again, invert the sentence to increase clarity: The factor that had the second largest impact on model dynamics was….'

•   "Regarding ecological outcomes, the difference is less pronounced, with 2% higher SOC and CY levels of scenario (a) as compared to (b)." A and B should not in parentheses in this sentence, you have defined them previously.

•   "All three indicators (adoption of CT, levels of SOC and CY) increase steadily with the share of pioneers.» To vague, you have just been discussing results under each scenario in a comparative way but this sentence doesn't make it clear which if any you are referring too? If it is across both scenarios then you need to be specific i.e. 'Regardless of the scenario…'

We suggest implementing all above suggestions on Figure 4. We reply to the suggestions below in more detail.

•   "The adoption of CT or CF practices, and therefore, the spatiotemporally resolved spreading dynamics of these practices can be analysed and illustrated from cell to up-to-planetary scales » Several problems:

o   The sentence is wordy but this just makes it more cofnsuing: What is resolved about these dynamics? Do you simply mean the spatial and temporal dynamics of the spread of these practices. Why are you deliberately separating adoption from spreading in the sentence?

In line with previous suggestions, we propose to clearly introduce and define the different terms (adoption, spreading, transition…) for them to not create confusion when applied together, and revise the text to create consistency in their application. We agree with the observation that "resolved" is not necessary.

o   What is the proof that this statement is true? Your results haven't shown it yet and there is no citation?

This sentence is intended to be an introduction to the results section that lays out an analysis on cell, national, and planetary scales. The statement is true because the model allows for simulations of CT/CF adoption on a global grid. These results can be looked at at these different scales (one can either look at a single cell, or aggregate to the country level, or consider all cells at a global level), but it does not make any further claims than that.

o   Firstly, 'cells' is a specifically biological term, but it is confusing because you are referring to raster or grid cells as they are realized in the model. However, it is also confusing because raster cells can be at any resolution and hence the comparison with global is meaningless because one is an abstraction and one is a real scale?

As we build on the LPJmL grid cell for our spatial model setup, we rely on their standard 0.5° grid cell resolution. It seems that we haven't specified this before, which correctly leads to a lack of spatial reference point to assess the grid cell size in the current manuscript version. We suggest to clarify this.

•   "– companion paper to this publication –« Too short: 'which should be considered as a companion paper…'

•   "focuses on possibilities of global spreading analyses." But again how is spreading different from adoption? and also the wording is unclear and clashes with the previous sentence. You have already made the claim (albeit unsupported) that analyses of global scale adoption are possible but now you are saying that they are investigating the possibility of this, why would they investigate the possibility if we know it is possible already?

To address this comment and others before, we suggest a clear introduction of terminology to delineate the terms. We also propose to clarify how our different levels of analysis emerge: We have results on a global grid cell level, and the analysis of the country (and global) levels are just aggregated of the local level dynamics (individual grid cells). Considering different levels of aggregation allows for the analysis of different dimensions of the results.

4.2.1 National scale

•   "Here, we want to dive further into more nuanced dimensions of the co-evolutionary dynamics, which can more easily be observed by zooming into results on smaller spatial scales." But what is co-evolving? You haven't made this clear yet? The models within the framework of the adoption of different practices? Also 'zooming in' is too colloquial, it would

be clearer to say: 'exploring results at a finer spatial resolution'. But more importantly is it actually a finer scale that is most important here or is it also exploring contrasts in dynamics from different locations at a finer spatial scale?

We, again, suggest a clearer definition of what we mean with the term "co-evolutionary": the coevolution of social and ecological dimensions of the model through bidirectional feedback loops between the two. We agree to adjust framing and remove "zooming in". We believe that these points are connected: the analysis on a finer spatial scale allows us to trace contrasts in dynamics from different locations. We suggest clarifying this aspect.

• "Applying a default parametrisation (Table 1), the coupled model interactions with focus on the main variables, behaviour, SOC and CY are shown for three different countries, as extracts of the global simulation (Breier et al., in prep) in Figure 5." Again, think carefully about the order of information, reducing unnecessary words and adding relevant details (i.e. the country names) to make the sentence clearer: 'Figure 5 shows the results of behaviour, SOC and CY for three different countries, Paraguay, Spain and South Africa. These results come from InSEEDS simulations under default parameter values: (Table 1), performed as part of Breier et al. (in prep).

• "The chosen countries, respectively, showcase interesting model dynamics.» Firstly grammar: 'respectively' is incorrect in this usage but more importantly a golden rule in academic writing is to never just describe your results as 'interesting' without any further clarification. Just be specific, what is interesting about them? Is it just that each country shows distinctly different dynamics from the each other? More importantly why were these countries chosen? Was it specifically because they showed distinct dynamics as compared to others?

We agree that we should specify why these countries were chosen, which, just as the reviewer suggests, were their distinct dynamics, and, connected with that, the fact that they illustrated diverse spatial and temporal patterns of adoption (e.g., adoption of CT that seems to spread regionally, vs. adoption of CT that happens in an area where all neighbors practice CF).

• "Figure 5 (a) shows the farming behaviour from 2022 to 2100. The most lightly coloured cells represent those that have not changed their management since year 2022. Figure 5 (b) and (c) show the ecological impacts the behaviour has on SOC and CY , respectively." You need to be more specific about the nature of the sub-plots. 'Each sub-plot contains maps showing dynamics at a grid cell level for each of the countries' but then what is the spatial resolution because this is not in the figure caption either?

As suggested before, we propose to specify the spatial resolution of 0.5 degree grid cells.

• "In some areas, the importance of local networks and connections for adoption and spreading becomes evident. In these cases, one can observe "seeds" of new management practices that spread to adjacent cells, and sometimes evolve into a new shared management cell cluster, over the simulation period. Here, the principal of local spreading comes into play, which is influenced both by social norm and social learning dynamics: the local descriptive social norm encourages the adoption of locally» My problem with this

section is that it the result is self-evident, i.e. we know we should see these dynamics because this is exactly how the processes in the model are encoded and hence what we should expect. But more importantly you have framed this section as being about interesting dynamics and the differences between countries but this is not saying anything in that direction?

We thank the reviewer for their constructive criticism of the "expectedness" of our results. While it is true that, in theory, social norm and social learning dynamics are relevant for all agents, we only see spatially-connected adoption dynamics in certain regions, and not in others. It is, therefore, not self-evident that practices spread locally (sometimes they do, sometimes they don't), because several other factors also play a role in the (non)adoption of a practice. Regionally different ecological conditions have an impact on the agents' evaluation of the practices. As also pointed out in the results, we can observe several cases where an agent adopts a novel practice (e.g., RA) on their grid cell that is surrounded by neighbors practicing the other management approach (e.g., CF). These different possible dynamics of adopting a novel management practices, that arise in the different regions when looking at them at country-level spatial scale, are precisely what interests us to trace the interplay of different factors in the process of adopting a novel practice even further on the cell level.

We propose to adapt this paragraph to hopefully clarify these points.

• "as well as South Africa (close to Bloemfontein)," and "(close to Corumba)," and "on the Balearic Islands," None of the maps contain place names or locator maps and you cannot expect readers to know specific locations in a selection of countries without these. Either add these elements to the figures or rely on alternative geographical descriptors, although even saying 'in the north' etc. is flawed because the maps lack a north arrow and scale bar.

We agree that the information is currently lacking. We propose to refer to the places using alternative geographical descriptions (rely on the rectangles), and, in the caption, specify that all maps are pointing to the north, and again, referring to the 0.5° resolution to specify spatial scale.

• "Without neighbours practising different management to learn from, or local social norms to exert pressure, a switch in decision-making can solely arise from a dissatisfaction with the agent's own ecological performance.» This a logical explanation for the observed results but are you only inferring this or can this actually be validated by the underlying data from the model? If so, I think it would be important to take the explanation one step further i.e. why is it these specific locales that trends in ecological performance are driving this effect i.e. is it a knock/on effect of climate change driven impacts on performance indicators which then prompts this change in behaviour?

Connected to the second-to-last point, these types of observation on the national level (i.e., a farmer in a cell surrounded by conventional farmers adopts conservation tillage) are precisely what motivates us to dissect different possible reasons/interplays of factors for adoption, in the analysis of the cell level. While we currently don't consider this exact example (a switch in decision-making without neighboring cells practicing different

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• "In the analysis of simulation results, it becomes evident that model behaviour differs significantly across different world regions and their respective conditions.» Significantly is a very loaded word in scientific writing, you have not formally assessed the significance of the differences better to use a synonym such as 'substantially'

We propose to use "substantially".

• "in the evaluation of the biophysical performance (de)merits that a certain management practice entails." I am sorry but this doesn't make sense grammatically with the use of 'de(merits)' be clearer and talks about 'benefits or drawbacks' but also you need to re-structure the sentence for it to make sense.

We suggest to re-structure the sentence: "In the ecological realm, distinct biophysical conditions in the different geographical areas play a central role in the evaluation of the biophysical benefits and drawbacks of a certain management practice."

• "While, on a global average, we can observe that CT, as compared to CF, has a positive effect on SOC and CY , the biophysical, and thus also social-ecological dynamics differ considerably between and within countries:" Ok multiple problems here:

We thank the reviewer for the points raised on this sentence and reply to the non-language-related ones below

o   Firstly, 'on a global average' doesn't make sense grammatically but also more importantly you have not shown that you have calculated an average value. Be more specific: While at a global level…'

o   Secondly, the comparison is not logical because you are neither stating what the directionality of the relationship is or being clear that the relationship is different for CF? i.e. you need to either say that CT has a greater positive effect than CF or that CT has a positive effect whereas CF has a negative effect. At the moment as a reader I don't know what the relationship is?

This is an important point and we suggest revising this section to be specific about the relationship.

o   Then for the last clause of the sentence, it needs to be clear that the biophysical and socio-ecological dynamics are the factors that are driving differences in SOC and CY because at the moment the use of just a comma to join the clauses does not imply this.

We propose to make this relationship clearer.

o   But more importantly for the last clause why are you repeating this? The whole broader section has been framed from the start that there are differences in drivers between countries and thus repeating this again is not adding anything?

We agree that this last clause is redundant. We suggest removing it.

•   "Nevertheless, especially in Paraguay, very different dynamics can be observed:» Again don't repeat, you have said at the start of the paragraph that there are differences just say how Paraguay is different.

We agree to remove redundancy here.

•   "As pointed out in Chapter 2.1, the biophysical model behaviour in Paraguay can be explained by land-use change legacy effects also described in Herzfeld et al. (2021).» This sentence is misleading because nowher ein section 2.1 do you specifically talk about this being the situation in Paraguay which the sentence is implying.

Thanks for catching that, indeed, we fail to mention legacy effects in Chapter 2.1. While we lay out different dimensions from the Herzfeld publication here, we missed legacy effects. As these are very specific to the Paraguayan example, we propose removing the reference to Chapter 2.1 and introducing them here.

But even more crucially I don't think you are actually presenting another evidence to make this leap? How can you definitely say that this result stems from land-legacy effects and not any of the other variables in the model? You are not showing us any of the input data that confirms this assertion?

We are observing different effects in the social-ecological dynamics. On the LPJmL-side, this model behavior is described in Herzfeld et al. 2021 and matches the underlying dynamics and a legacy effect in slowly responding soil carbon pools is generally plausible. We will adjust the text to not focus on the actual trend, which is independent of the simulated management decisions, but on the differences in this trend compared to the simulation with static management.

•   "Some cells in the centre of Paraguay even show missing data points regarding SOC values.» The use of 'even' implies that the missing data points are resulting from the land use legacies but why is this logically coherent from a causal perspective? I can think of lots of other reasons why there may be missing data points, you need to demonstrate the logic here.

We agree that "even" is inappropriately used here; we did not mean to make a causal inference from legacy effects to missing data points. We will remove this word.

• "In addition to ecological heterogeneity, social heterogeneity greatly influences model dynamics. The initial share of the two AFTs has been shown to largely impact simulation dynamics and model results. A systematic comparison of different initial AFT shares, for example, shows that the global mean behaviour change differs by up to 60 % between scenarios with only traditionalist, or only pioneer AFTs." You are mixing tenses (shown and shows). This is a bigger problem through-out the results section, ideally you should be talking about the results of the experiment in the past tense.

We suggest implementing their suggestion of using the past tense for experiment results to eliminate tense discrepancies.

• "Figure 5. InSEEDS simulation of year 2100 for selected countries Paraguay, Spain and South Africa. a shows the age of the applied management (CF/CT) and behaviour change since start of the coupled simulation (2022) –the lighter the shade, the more recent the adoption. b shows the annual change rate of the top soil carbon layer (20 cm), and c the change of the CY since 2022. Adoption of a novel practice that isn't driven by the local social network are marked in pink, illustrations of local spreading processes are marked in purple, and the distinct ecologically heterogeneous conditions are marked in red.»

o   Applied management cannot have an 'age' needs to read along the lines of 'duration since adoption of the management'.

o   Figure captions must stand-alone hence don't use an abbreviation in the caption but the full term in the figure: CY vs. crop yield. Also not grammatically correct to say 'of the crop yield' because yield is itself a dimension, needs to be either 'in crop yield' or 'of the crop yield value'.

o   'are marked in pink'need to be more specific because you have pink in one of your colour schemes as well: 'are highlighted by overlaid pink squares'

o   'Illustrations of' word choice these are not illustrations of they are again 'highlighting' the phenomenon.

We suggest implementing the propositions made on Figure 5 above.

o   There are no red marked areas in the figure?

We removed the red marked areas because we felt like these were too much in terms of colours used, but forgot to adjust the caption accordingly. We suggest removing this from the caption.

• Figure 5 comments:

o   It's very boring for me to say this because it is the standard critique of most map-based figures but you do need to include a scale bar and north arrow as part of the figure. I don't always believe this is necessary for figures which are meant to be slightly more abstracted

like this, however the fact you are comparing three different countries does make it necessary in my opinion.

This information is indeed lacking for the figure. We propose to add this information to the figure caption: based on the grid cell foundation of the figures, which have a uniform 0.5° size, all three countries are displayed at the same spatial resolution. We would prefer not to add this type of information to the figure itself, for the reason that the reviewer mentions: as they are (a) rather abstracted and (b) already contain a lot of information, we believe that including these information within the figure might not be (a) necessary, and (b) might overbear the figure and distract from the content we intend to focus on/convey. Our maps adhere to journal standards (https://www.earth-system-dynamics.net/submission.html#mapsaerials) and we hope that the suggested edits will be sufficient.

o   More importantly, I don't remember being told what is the spatial resolution of the rasters being used in the figure or the outputs of these InSEEDs simulations?

See comments above: 0.5°

o   Why for Paraquay does your map using a bounding box that extends beyond the country borders when you are not doing this for the other countries?

The country-level results are derived from global simulations. The bounding lines in the Paraguay map occur where edge-bordering grid cells are classified as land. In contrast, Spain and South Africa are largely surrounded by water, so no bounding lines appear at those map edges. Where their borders adjoin land, similar bounding lines are present.

o   As mentioned in the comment above it is not helpful to refer to specific in-country locations in the text when the maps do not show readers where these are. Either include points for the locations or don't make reference to them.

We agree that our current reference system (using in-country location names) is not helpful. We propose to solely use the square marked areas to refer to specific in-country locations.

o   The coloured squares used to highlight the areas displaying certain tendencies are OK visually but the figure could be improved by including 'zoomed in' inset maps of these locations. The main point you are trying to make with this figure is these specific dynamics and hence you wan to draw the readers attention as much as possible, inset maps would help to do this.

We also perceive some problems with our illustration, e.g., while the pink and purple squares were chosen to be as colorblind friendly as possible, given the already many colours used in the graphic, we received the feedback that they are difficult to distinguish for non colour blind viewers. This is why we suggest talking to a professional graphic design person to jointly hash out how this whole figure, and especially the highlighted areas, could be made more visually accessible, and discuss several ideas (such as differently dashed boxes instead of more colours).

o   I don-t think the areas highlighted showing adoption of alternative practices in the Parauay or South/Africa are actually good examples of this_ The assertion is that this is meant to be a change in practice irrespective of the neighbouring cells but in both pink squares in these maps there are neighbouring cells with the same practices so how is this the case or am I missing something?

We agree that not all boxes are placed well to illustrate this point. We suggest removing the southern pink box in the South African plot, as this is indeed confusing. Furthermore, we suggest adapting the text to better explain why social influence cannot play a role in the case the reviewer points out (neighboring cells with the same practice exist): As the switch to CT, e.g., in the Spanish Pink box, has occurred in the same year, this cannot have occurred because of social influence.

4.2.2   Local/cell scale

•   "On the level of one cell, we can observe further dynamics related to different dimensions of the decision-making function, like norms and attitude." It feels strange to framing the discussion in terms of cells without knowing what spatial extent these represent? Although in reality that is not essentially because you are referring to the dynamics with respect to these as single entities or 'units' within the model. I think it would be good to focus at this level of abstraction rather than saying cells which muddles up the spatial dimensions and siting of these.

We suggest adapting the framing to clarify that it is the "single entity" / agents' dimension we're analyzing in this plot (in addition to clarifying that a grid cell has a 0.5° spatial dimension, translating to 55x55km at the equator, 55x<55km elsewhere). We referred to the cell as the whole results section is built up to zoom in from information we can gain from planetary, via national, to the smallest possible spatial scale, but we agree that it is confusing not to also explicitly refer to the agent dimension.

•   "The cells were chosen for several reasons: (1) they exhibit particularly interesting, and distinct mechanisms leading up to the switch of the farmer management practice, (2) they are located at the Balearic Islands (see the marked islands on Figure 5), and their particular properties as island cells limit the influences acting on them, and thus makes them more easily traceable." Ok you have said how you have picked cells, but as a reader I still don't understand what cells you are referring to, i.e. are these cells you are going to discuss in more detail, cells that are depicted in another figure? The sentence assumes the reader has a prior knowledge of the cells in question.

We agree that the sentence structure does not clarify that we are about to introduce two specific cells and their dynamics. We propose to adapt the sentence structure to make this more explicit.

•   "The runs stem from experiments» The same as the point above exactly what runs are you referring to here? The reader has no prior reference in this section?

In the next sentence, we specify that the single-cell / single-agent level results we introduce here stem from a specific run from the SA experiments we conducted (intention_0). The simulations in this section are based on the intention_0 run parametrisation from the sensitivity analysis (see lightest green configuration in Figure 3). We propose to change the phrasing of the two sentences such that it becomes clear what the underlying data points for these figures are.

• "parametrisation yields» yields implies that it has produced these values, this is not correct, you have set the values as they are.

We suggest replacing this term.

Literature

Swart, R., Levers, C., Davis, J. T., & Verburg, P. H. (2023). Meta-analyses reveal the importance of socio-psychological factors for farmers' adoption of sustainable agricultural practices. One Earth, 6(12), 1771-1783.