

**Dear Editor,**

**As you will see below we have made the majority of changes requested by the reviewers for this second revision. For clarity in this second revision, I accepted all the track changes from the first revision so that only those pertaining to the second revision remain in the document.**

**We thank the reviewers for their time and trouble.**

**First reviewer (Kao) comments:**

Response to all comments are below in **red**, we have also accepted the vast majority of the in text corrections made by the reviewer.

Comment L32: subject to?

**Changed as suggested**

Comment L71: spatial scales?

**The wrong word was used, should have been “rates”. Sentence changed to “at rates rarely encountered over evolutionary time scales”**

Comment L322: Does not quite work in context – i.e. the leap between rigidity of behaviour in regards to farming practice as related to reintroduction of carnivores, to animal genetics in new conditions is a big one. Is there a closer analogy that can be used?

**We did not find better examples but have modified the text to make clear that these are only examples: “For wild animals, one example is how human habits of farming landscape may evolve in response to recolonization by wild animal species like large carnivores, a question for which some straightforward solutions may exist (Kuijper et al. 2019). In farming, an example of rigidity of human behavior is the, continued use of inappropriate animal genetics”**

Comment L325: it isn't clear what is meant by 'durability' here

**Changed “durability” to “sustainability”**

Comment L356: Not sure what is meant here by 'opposing'. Do you mean that land sharing and sparing have opposing effects? How so?

**The word “opposing” is a left-over frenchism in the text, it has been replaced by “ranging from”**

Comment L368: High dependence of the livestock, of the consumers, or both?

Inserted “livestock” to clarify

Comment L388: I found this difficult to read

We agree! and have adjusted the text to “The governance mode of Natura 2000 brings together land users and civil society in decision making. it also includes both animal scientists and animal ecologists on its scientific committees, valuing their role in providing evidence through qualitative and quantitative evaluation of benefits, i.e. finding the balance between provisioning services to local farming systems, and markets, and conservation services to the society (McCauley, 2008, Morán-Ordóñez et al., 2013).”

Comment L400: This is a strong statement – is there a reference to support it?

Yes, added (e.g. McCauley, 2008).

Comment L415: I think you mention earlier that there is a difference between selection for specific traits, and adaptation across many traits to specific environments. Given this difference, what are the limits to what you can learn across the two subjects?

Whilst we agree that there are differences between intensively selected animals and those that are under natural selection we do not see that these markedly change the underlying mechanisms. Indeed, one could convincingly argue the opposite that “evolutionarily derived” adaptation mechanisms have shown themselves to be surprisingly resilient in the face of artificial selection. Therefore, we do not see the need to modify the text to take into account this comment. It is not that the question is uninteresting but it is an example of an issue that would require considerable discussion to do it justice, creating a much longer and somewhat unbalanced paper.

Comment L432: Not sure what is being distinguished here. It could for example be argued that bioinformatics is a form of specialised statistics. Also what is ‘biological’ – do you mean knowledge of underlying processes to go with metrics?

Have clarified as requested, changing the sentence to: “Building an integrated phenotyping (Headon, 2013) that sorts the mechanisms underlying adaptability in order of importance now needs to combine biological knowledge of the processes involved, bioinformatics, and statistical knowledge.”

Comment L498: This seems obvious – i.e. it must be possible to restore things – its really a question of how much effort is required is it not? Or if you mean something different please clarify

Not necessarily, “restoring things” is not always possible if an ecosystem has changed beyond a tipping point. Accordingly, we have added “, at least when the ecosystem has not been pushed beyond a tipping point.”

Comment L509: Is this setting up comparisons or a 'what can be learned' – if the latter, isn't this something that has been known? How much is science

The text added here was included in response to a previous comment by the reviewers to “translate what your argument really means in animal production”. As requested, it is more along the lines of what is currently being developed about animal diversity in livestock farming systems. Accordingly we've made no changes.

Comment L523: But in a livestock herd, is what being mitigated really about economic loss? If so, its not so clear to me how the arguments are analogous

What we were trying to indicate is that having a diversity of individuals can contribute to the resilience of the livestock system. We have thus added “ and thereby increase the resilience of the system”” to clarify this

Comment L563: There could be limits to the extent to which this works though, if the entire system is undergoing massive change, so might be worth mentioning the extent of mitigation that is being implied.

We agree with this point but have absolutely no data or studies to allow us to make an estimate. No change made.

Comment L572: factor?

Changed “entry” to “entry point”

Comment L620: This interjection is slightly jarring, since the context does not make it clear why mathematical models are more useful here than in other parts of the paper – I would argue there are lots of places where mathematical models are helpful, not just here – if there is something more specific then it would be worth expanding though

Entirely agree with the reviewer and have thus changed the sentence to read “This issue of accessing latent variables from multiple proxies is the focus of much research using signal processing methods, and will be extremely useful for quantifying the ultimate consequences of.....”

Comment L681: Do you mean a higher demand, because of the lower price?

Inserted “demand” to rectify as suggested.

Comment L719: Commented [KR21]: Rare to use this term these days (in English anyways)

Changed to “epizootic diseases”

Comment L729: This needs a bit more explanation – why highlight this in particular here since it’s a very general point that respecting cultural practices is going to be an issue.

Agree that there is no need to highlight “respecting cultural practices” at this point. Given that explaining the phrase sufficiently would considerably extend the text for no real gain, we have chosen to delete “Beyond respectful cultural practices”.

Comment L800: This needs clarification – why do slight changes in the evaluated metrics make a big difference?

The slight refers to the difference in impacts not the changes in the evaluated metrics. Nonetheless, have modified the sentence “These results, largely to do with a better understanding of GHG physics, come from another community” to clarify.

### **Second reviewer comments:**

Line 152 “For example, because genotypes can perform differently...” I appreciate the authors’ revision to add explanations about why it is important to understand how populations respond to new artificial selection pressures. While I understand what the authors are trying to mean, the added texts are slightly confusing/redundant and I suggest a re-organisation between Line 149 and 171. These discussions argue, I believe, the importance of understanding on the inter-relationship between ‘changing environment’, ‘selection pressure’, and ‘population response’. In my view, it would be much easier to follow arguments in Line 149 – 171 if this objective of discussion is clearly highlighted in the beginning (e.g. around Line 149 before “Understanding how populations respond to...”). Currently, different reasonings go parallelly in the text (e.g. Line 159, 161, 167), which makes it hard to understand this whole paragraph.

As requested, we have modified the text beginning at L149 by changing that sentence to: ‘Understanding how populations respond to these new selective pressures, which means understanding the inter-relationships between rates of environmental change and the selection pressure this exerts on animal populations, is a key issue in applied evolution and conservation’. We have also deleted one sentence lower down to improve flow (“In terms of animal ecology, understanding how the environment affects selection pressures will be key to understanding potential adaptive responses.”)

Line 617 “In that sense, several points discussed in this article may be...” The authors’ efforts to add specific examples on how one or more of discussed points in this paper are related to avian/swine flu are appreciated. Nevertheless, while Line 553 – 616 are entirely specific to Influenza, Line 617 and onwards are very general. This mismatch makes it less convincing why the marriage between animal production and ecology is important. Perhaps the way to overcome is to make discussions from Line 617 more specific to Influenza. I agree with the idea that the use of new technologies for monitoring animal contacts, adapting livestock managements, and increasing genetic diversities are helpful in tackling avian/swine flu. Immune priming is also an interesting topic. Therefore, it would be very nice to explain how each of these topics could potentially facilitate controlling influenza. For instance, how does animal diversity help system resilience in terms of minimising the impact of

Influenza? Maybe you could also deepen discussions around employing new technologies, say, for wild bird migrations? Or what kind of livestock management do we need to minimise the impact of Influenza?

We have carefully re-read this section in the light of the reviewers comment. We do not really see the problem of a mismatch that the reviewer points out, and we cannot see how to make the transition from a specific example to the more general case – which was a request of the previous review of this manuscript – without considerably increasing the size of this section. As this would seriously imbalance the overall paper we have made no change.