

I found this a very interesting paper to read. The general subject area is a very useful one and the advocacy for cross-disciplinary integration and learning is important. While I think the context could be generalised to include other disciplinary areas (this is already alluded to in different areas) there is considerable merit to considering in particular the relationship between livestock production and animal ecology as a specific interaction. I also like the discussions of each of the individual sections.

However, the relationship between the broader philosophical sections aims of the paper on the intersection between animal production and animal ecology, and the individual sections could use some further development, and the specific examples they choose do not in my view, fully develop the ideas being proposed.

Thus while the overall aim of unification is a very good one, in practice the scientific alliances they propose are considerably less ambitious than is embedded in the title and the broader discussion. A specific point that I think could be expanded upon is that, while there is some attention paid to the 'human factor' the role of social sciences and economics could be included in a more integrated way. Also, I get more of a sense in the paper of how animal production science can learn from animal ecology. I get less on how animal ecology learns from production, though the importance of considering wildlife and livestock at the same time is clear throughout the paper.

More specific comments follow:

Line 28/29: This is a relatively limited list of the impacts of the species and of course the central purposes from an anthropocentric viewpoint about food production and animal products. Otoh, the role of wildlife species is also much broader. The list of course is only an example, but perhaps a broader range or how they relate to all of agricultural systems, ecosystem services, and ecological conservation. These are brought in later, but it would be useful to allude to them here.

Line 37 In terms of animal diversity, it isn't clear at this point whether within species or between-species is being considered. Later it becomes clear that it is both, however it would be useful to also make it clear here at first discussion.

Line 42. It is not clear to mean at this point what is meant by 'elementary' cycles – does it mean 'fundamental'. If this is a discipline-specific terminology, given the inter-disciplinary thrust of the paper, it would be worth defining.

Line 75 – should that be 1.43m species?

Line 97 onwards. The discussion of natural vs. artificial selection is a good one, highlighting the different aims of the two types of activity. However, it becomes less clear how this dichotomy feeds into the broader questions of the subject of the paper. The discussion seems quite specific, without strong ties to those broader questions and themes. I think this could be done better by bringing it closer to the section on viability, which I think addresses similar issues but with some of those broader implications and putting the two in proximity would make those broader arguments clearer.

Line 119. I'm not familiar with the Darwin argument about why domestication leads to an increase in diversity. Is this because the domesticated variants developed independently across different communities led to a diversity in breeds? In any case, it would be helpful to have further clarification here.

Line 119-120. Of course the number of species we farm is also being reduced (or at least, that the biomass of particular domesticated species is becoming proportionately larger compared to others). It could be argued that this is a different form of 'artificial selection' at a higher scale. Also, while the point regarding within-species and indeed within-breed diversity reduction is a good one, it isn't clear how this is occurring. For example, it could be that the range of traits that are valued commercially is becoming more limited over time, especially as large producers start to dominate, and the role of

supermarket chains in setting requirements becomes ever more important (in the UK at least). However, it could be that we are simply better at artificial selection, without the underlying aims themselves having changed – i.e. we've always aimed for the same traits but improved and more widespread knowledge means that we've narrowed down to a relatively limited number of breeds to do it with. Both of these arguments are I think consistent with what is discussed in lines 112-116 and there could be others. It would be helpful for the authors to expand on what the drivers are.

Line 123 onwards and especially from line 126. I think this might be the point where the argument about the relationship between animal science and animal ecology is being made. I.e. understanding the importance of fitness has led to fundamental conceptual improvements in how we approach artificial selection. This is hinted at in line 126, but a deeper discussion is merited, as I am left with a sense of 'what', but not a good understanding of 'why'.

Line 129 onwards. The link between 'living with environmental change' and humans as the evolutionary force is not entirely clear to me here. Very true that both natural populations and livestock will need to respond (or be managed) to respond to these changes. It is less clear that this is achieved by synthetic understanding generated between disciplines – is there direct evidence or a strong direct line of reasoning to suggest this? Does it mean, for example, that improvements in general population fitness is a better way to handle these changes, than increased intensity of trait selection for example (therefore requiring better knowledge of ecological factors), or does it mean that, because the ability of humans to select for traits is such a strong effect, that we can more or less breed our way out of the problem by selecting for appropriate traits if we do it efficiently enough (requiring more and better livestock breeding genetics knowledge, i.e. within the context of production)? Or possibly something else.

Also, as mentioned in the general comments, this seems mostly be about how animal production science learns from ecology – are there arguments in the other direction?

Line 162 onwards. The European example seems to be a good one, but as previously, the text supplies the 'what', but does not illuminate me on how the scientific communities are interacting and why. Other examples, if they exist, would also be welcome, particularly where they might highlight different approaches.

Line 165. This is a welcome mention of societal considerations. My view would be that it should be given a greater and earlier prominence in the paper.

Line 170 onwards. This section is a good discussion of how wildlife and livestock must respond to a variety of viability risks, and how the measures of risk differ between the two. It also discusses how the two interact but I think could go deeper on this – in particular what the trade-offs and synergies are between the goals of production, and the goals of wildlife management. Also, where it is considerably less clear is where the communities and their approaches would benefit from each other.

Line 171. Ecosystem services are hinted at, but not discussed explicitly (or at least the term and its implications are not discussed). It might be worth doing so here given the traction the terminology seems to have (I note that it is mentioned later, but w/o definition).

Line 212 onwards. The discussion of rigidity of behavior in both human and animal populations is interesting, but I am not convinced by the arguments here of how they are related except in the broadest sense.

Line 228. The co-viability analysis sounds interesting but more detail is needed here to understand what the analysis aims to do.

Line 232 onwards. I think this is a really interesting discussion. It does seem to be closely related to the discussion of artificial vs. natural selection (line 97 onwards) on several points, but the fact that it is

separated by several sections means that it is harder to see these links. I would suggest reorganizing so that they are discussed more coherently.

Line 257. Its not clear with the term 'big data' is relevant here. Its generally held that it refers to data that are exceptional in terms of all of volume, velocity (i.e. rapid accumulation but importantly the importance of rapid analysis and decision-making) and variability (i.e. data complexity).

Line 257. I think it should read 'that are concomitantly'

Line 293 onwards. This addresses resilience at a species by species level, but I think could be expanded by addressing the question of how the interactive network amongst species may shift as a whole - i.e. not so much whether or not a single species can be replaced by another (or groups) but where a reconfiguration of the entire system is possible that maintains sufficient resemblance to the previous system so as to allow it to be recognizably similar. In essence, can we define 'functional units' within ecosystems that could be re-arranged within themselves, w/o disturbing the larger whole (functional analogues?)

Line 303. First mention of 'ecosystem services' – as noted in an earlier comment, this could be expanded upon, and defined earlier.

Line 347. This is a useful point to be making and I think could be expanded upon – for example, this seems like an area where there is likely to be much to be learned from game theory – i.e. can we identify 'strategic complements' where positive actions reinforce the adoption of those actions.

Line 363 onwards. While I can see this is an area of important interest, this section has a very different tone and direction to the previous sections - those were largely conceptual, this seems largely practical - the transition jars a bit.

Line 414 onwards. The two examples are useful but seem somewhat limited in scope. They don't really address the breadth of discussion of the entire paper. I realise that this may be difficult to do as such broadly comprehensive examples may not exist. A possible approach might be to create some sort of table or matrix which lists the different foci discussed here, with examples that pertain to one or more of them (preferably ones that cut across multiple foci) with some brief discussions in the text.

In regards to the avian flu example, it does capture some important points, however much of the paper is about how stresses in our systems are becoming greater and create greater problems. Its not clear to me that avian flu is a particularly good example of this. Possibly a better one would be to discuss the current problem of African swine fever. The illustrates the problem of increasing wild boar populations across Europe, the role of a particularly climate dependent tick in transmission, and the interactions between wildlife and livestock. It's also a massive global problem.

I am less able to comment on the second example. It has broader implications, but it isn't clear here to me how this is about animal ecology learning from animal production – its more about animal production bringing in other disciplines to solve a particular (albeit very large) problem. As before, the synergistic element seems to be missing. As a minor point,, this report (and paper mentioned therein) might be useful here: <https://www.oxfordmartin.ox.ac.uk/downloads/reports/Climate-metrics-for-ruminant-livestock.pdf>

