Peer Community In Ecology

Amphibians under scrutiny - When human-dominated landscape mosaics are not in full compliance with their ecological requirements

Sandrine Charles *based on peer reviews by* ***Peter Vermeiren*** *and 1 anonymous reviewer*

Matutini Florence, Jacques Baudry, Marie-Josée Fortin, Guillaume Pain, Joséphine Pithon (2022) Conservation networks do not match the ecological requirements of amphibians. bioRxiv, ver. 3, peer-reviewed and recommended by Peer Community in Ecology.
https://doi.org/10.1101/2022.07.18.500425

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Among vertebrates, amphibians are one of the most diverse groups with more than 7,000 known species. Amphibians occupy various ecosystems, including forests, wetlands, and freshwater habitats. Amphibians are known to be highly sensitive to changes in their environment, particularly to water quality and habitat degradation, so that monitoring abundance of amphibian populations can provide early warning signs of ecosystem disturbances that may also affect other organisms including humans (Bishop et al., 2012). Accordingly, efforts in habitat preservation and sustainable land and water management are necessary to safeguard amphibian populations.

In this context, Matutini et al. (2023) compared ecological requirements of amphibian species with the quality of agricultural landscape mosaics. Doing so, they identified critical gaps in existing conservation tools that include protected areas, green infrastructures, and inventoried sites. Matutini et al. (2023) focused on nine amphibian species in the Pays-de-la-Loire region where the landscape has been fashioned over the years by human activities. Three of the chosen amphibian species are living in a dense hedgerow mosaic landscape, while five others are more generalists.

Matutini et al. (2023) established multi-species habitat suitability maps, together with their levels of confidence, by combining single species maps with a probabilistic stacking method at 500-m resolution. From these maps, habitats were classified in five categories, from not suitable to highly suitable. Then, the circuit theory

was used to map the potential connections between each highly suitable patch at the regional scale. Finally, comparing suitability maps with existing conservation tools, Matutini et al. (2023) were able to assess their coverage and efficiency.

Whatever their species status (endangered or not), Matutini et al. (2023) highlighted some discrepancies between the ecological requirements of amphibians in terms of habitat quality and the conservation tools of the landscape mosaic within which they are evolving. More specifically, Matutini et al. (2023) found that protected areas and inventoried sites covered only a small proportion of highly suitable habitats, while green infrastructures covered around 50% of the potential habitat for amphibian species. Such a lack of coverage and efficiency of protected areas brings to light that geographical sites with amphibian conservation challenges are known but not protected. Regarding the landscape fragmentation, Matutini et al. (2023) found that generalist amphibian species have a more homogeneous distribution of suitable habitats at the regional scale. They also identified two bottlenecks between two areas of suitable habitats, a situation that could prove critical to amphibian movements if amphibians were forced to change habitats to global change.

In conclusion, Matutini et al. (2023) bring convincing arguments in support of land-use species-conservation planning based on a better consideration of human-dominated landscape mosaics in full compliance with ecological requirements of the species that inhabit the regions concerned.

References:

Bishop, P.J., Angulo, A., Lewis, J.P., Moore, R.D., Rabb, G.B., Moreno, G., 2012. The Amphibian Extinction Crisis - what will it take to put the action into the Amphibian Conservation Action Plan? Sapiens - Surveys and Perspectives Integrating Environment and Society 5, 1–16. http://journals.openedition.org/sapiens/1406

Matutini, F., Baudry, J., Fortin, M.-J., Pain, G., Pithon, J., 2023. Conservation networks do not match ecological requirements of amphibians. bioRxiv, ver. 3 peer-reviewed and recommended by Peer Community in Ecology. https://doi.org/10.1101/2022.07.18.500425

Reviews

Evaluation round #2

DOI or URL of the preprint: https://doi.org/10.1101/2022.07.18.500425
Version of the preprint: 2

Authors' reply, 29 May 2023

Dear edito,

We have made the requested minor changes. We also added a sentence in the introduction to make it more fluid.

Best regards

Florence Matutini

Decision by Sandrine Charles, posted 19 May 2023, validated 21 May 2023

A few more minor adjustments

Dear authors,

I am ready to recommend your paper, but I would like you considered a few more minor adjustements.

As far as I know, abbreviation are invariable, so please change ”PAs” in ”PA” all along your manuscript.

Please provides supplementary files in PDF format, and please take care about havinf all tables on sigle pages (i.e., no page break in the middle of a table).

Line 353, the reference from ”Lee Yaw” has a special character between ”Lee” and ”Yaw” that should be removed.

Figure 1 and 3 are of low resolution; if possible, please increase the image quality.

Table 4 is also of low visual quality; would it be possible to improve this?

Thanks in adavance for considering these suggestions, while I am preparing my recommendation.

Sandrine Charles

Reviewed by anonymous reviewer 1, 14 April 2023

When I first read the manuscript, I had difficulty assessing whether the analyses reported in this article were realistic from an ecological point of view and could really be used in the field of conservation biology. The modifications and clarifications added by the authors have significantly improved the manuscript, particularly on the method used (appendix 1 and text) and on the classification of protected areas.

I am less convinced by the way the friction coefficients are calculated by group. Nevertheless, the authors assume that this is a first study and that these results should not be over-interpreted. The discussion allows us to place this work in a broader context. All of the minor comments have been considered.

Reviewed by Peter Vermeiren, 24 April 2023

Dear authors and editor,

I read over the revised manuscript and the responses provided. The authors have done a lot of work in carefully addressing each of the comments, including further analyses and supplementary materials. These revisions have addressed all my comments and questions. I have no further comments.

Best regards

Peter

Evaluation round #1

DOI or URL of the preprint: https://doi.org/10.1101/2022.07.18.500425

Version of the preprint: 1

Authors’ reply, 08 March 2023

Dear editor,

Please find the attached letter.

Sorry for the delay for the resubmission.

Best regards

Florence Matutini

Download author’s reply

Decision by Sandrine Charles, posted 12 December 2022, validated 12 December 2022

Major revisions

Dear authors,

First of all, I am sorry for the delay in handling your manuscript and providing you with a first recommendation. After waiting too much time for a third review, we decided to base our decision on the two we received in due time. From these two reviews, I suggest you revise your manuscript to account for reviewer's comments; they are relevant and constructive and should allow you to improve your first version. Please provide your revised manuscript together with a point-by-point answer sheet for each reviewers. Please also highlight in your revised manuscript the changes you will have made.

Best regards, Sandrine

Reviewed by Peter Vermeiren, 24 October 2022

Thank you for the opportunity to review this manuscript. This work builds on previous species distribution models for 9 amphibians, by combining them into multi-species suitability maps. Connectivity among highly suitable habitats is then assessed, as well as overlap with existing protected areas and green infrastructure. The manuscript addresses a very relevant issue via a clear and well-structured methodological approach. The introduction and discussion also place the work and its limitations into a broader context. I enjoyed reading this manuscript.

One question that came up with me is that a selection of nine species of amphibians were investigated. Nevertheless, there are many more amphibians. The manuscript mentions amphibians in general when discussing the results. It would be worthwhile to discuss the relevance/transferability of the results to amphibians in general. How representative are the results for other amphibians. (I saw that some correlation between the multi-species suitability maps and independent data on amphibian species richness was made, perhaps this is a result that can be discussed a bit more in this context).

A second issue that I wondered about is how sensitive the results are to the suitability classification scheme. For example, highly suitable are those areas with a score > 80%. Would the results look very different if you used a different threshold, e.g. 75 or 85%?

Apart from that I only have very minor suggestions, regarding clarification:

L. 176 – 179: This sentence is rather hard to understand. Please explain in more detail what is meant with "the ecological context of our region" and how/why this leads you to aggregate the 100m pixels into 500m pixels. Also, please briefly explain why the maximum suitability was taken, wouldn't this overestimate the suitability?

L. 185: It is not clear to me how the R2 value was calculate with 500 iterations. (What differs between the iterations?)

L. 195: I think the correct English should read "suitability index above 80%". "Up to" would be everything below 80%. Please check.

L. 217 - 219: This sentence is unclear. With "studied region" you mean the whole Pays-de-la-Loire region? Do you mean that resistance values were randomly chosen in this buffer strip in case you did not have land-cover data (and thus could not calculate resistance values)?

Fig 2. A minor suggestion: It would be quite easy to divide the multi-species suitability index by the number of species summed over, in order to have suitability indices that are always on the same scale (0-1) for easy and quick comparison among the graphs.

L. 318: Obtained instead of obtain, and highlights instead of highlight

Reviewed by anonymous reviewer 1, 14 November 2022

This manuscript "Conservation networks do not match ecological requirements of amphibians" is relevant in the domain of the conservation biology. The writing and logic in the manuscript were easy to follow and the

results are interesting. However, I think the manuscript lacks details about the methodology to determine their real ecologic significance. I have several major comments.

Firstly, what sort of detection and survey method was used in this study? The authors worked on 9 amphibian species that have very different ecological preferences and constraints. Therefore, it is important to specify in the materials and methods how the data concerning the presence of the species in the different sites were acquired. I understand that the data are issued from participatory sciences and expert knowledge. But, even if the authors refer to already published articles, it is necessary to specify if the survey was done randomly or only on sites favourable to amphibians. Was it a daytime survey, a nighttime survey, a net survey? What is the probability of detection of each species with this method? have you adapted the survey effort to the probability of detection for each of the 9 species studied?

Secondly, how is the coefficient of friction calculated for the different species? Is the friction coefficient per habitat depending on the species considered? Indeed, for example, the friction coefficient of an habitat for animals that move on the ground (bufo spinosus) is very different from that, for the same habitat, for animals that move in trees (Hyla arborea)?

Finally, I do not know the IUCN classification of protection areas. Nevertheless, I am really surprised by the authors' choice to include ENS and PNR in the protection area. What are the specific regulatory protection measures for amphibians in these areas? To my knowledge, none. Do the ENS of this study have specific regulations?

Why are the Natura 2000 areas that have a regulatory status in group 3? (lines 152-162 ; Table 2).

Minor comments:

Line 72: In this study, the authors consider only the green infrastructures. Nowhere is mentioned the blue infrastructures which are particularly important for amphibians (tadpoles but also adults). In conservation policies, green and blue infrastructures are often associated. (Line 83) Does the term "wetlands" refer to the blue part of green infrastructures? Did the authors take ditches into account in their study? Ditches are very important for the movement of amphibians.

Line 86: I disagree that charismatic species are poorly representative of species-habitat relationships. In many case, charismatic species are considered as umbrella species that are important in terms of protection.

Line 98-102: I am not sure that in Western Europe, traditional hedgerows landscapes have a high density of ponds. This is true in the western of France but it is probably not the general case in Europe.

Line 110: Amphibian skin is permeable and not impermeable

Line 156: I do not understand what the authors mean line156-157 (For two types of Pas, site boundaries were not available.)

Line 248-256: Does this mean that 1% of the amphibian habitat in the study area is in Group 1, or does it mean that only 1% of the amphibian habitat is in Group 1?

The article would be improved if species-specific data were included in the results so that interspecific variability in results could be assessed.

Although the study focuses on the importance of PAs and GI to amphibians, biodiversity is not just about these species. The authors could comment this point in the discussion.

Download the review