Subject: Decision on Conservation Biology 22-265
From: Mark Burgman <onbehalfof@manuscriptcentral.com>
Date: 22-08-12, 01:43
To: richard.schuster@glel.carleton.ca
CC: fjarrad@conbio.org, jadrew@esf.edu, richard.schuster@glel.carleton.ca, Rachel.Buxton@colostate.edu, jeffrey.hanson@uqconnect.edu.au, allisonbinley@cmail.carleton.ca, jpittman@uwaterloo.ca, v.tulloch@ubc.ca, fal42@cornell.edu, proehrdanz@conservation.org, p.h.verburg@vu.nl, arodewald@cornell.edu, ScottD.Wilson@ec.gc.ca, h.possingham@uq.edu.au, josephbennett@cunet.carleton.ca

12-Aug-2022

Dear Mr. Schuster,

Thank you for submitting your manuscript "Protected area planning to conserve biodiversity in an uncertain world" (22-265) to Conservation Biology. I have received two thorough, constructive reviews. The full set of comments is pasted below.

The reviewers approve of the focus of this work. However, they also raise a number of important issues regarding the framing of the study and several of the assumptions underlying the analyses. On the basis of the reviews and recommendation, I invite you to respond to the comments and submit a substantially revised manuscript for potential publication in Conservation Biology.

Important
Your revision must be in Word format and not exceed word limits given in Instructions to Authors, regardless of the length of the original submission or whether reviewers have asked for more detail.

Precede editor and reviewer comments with “Comment:” and precede your explanation relative to that comment with “Response:” Color and fonts other than ScholarOne’s default will not show.

To submit your revised manuscript, log into your Author Center at https://mc.manuscriptcentral.com/conbio Your manuscript is listed under "Manuscripts with Decisions." Under "Actions," click on "Create a Revision." Your manuscript number has been appended to indicate that this is a revision. Please DO NOT upload your revised manuscript as a new submission.

In the space provided or as a separate Word document, please include a detailed, point-by-point response to the comments of the handling editor and reviewers. Describe the changes you made to the original manuscript and, if applicable, explain why you did not address certain comments. If you have a Cover Letter, upload it as a separate document.

Wiley Editing Services Available to All Authors
Should you be interested, Wiley Editing Services offers expert help with manuscript, language, and format editing, along with other article preparation services. You can learn more about this service option at www.wileyauthors.com/eeo/preparation. You can also check out Wiley’s collection of free article preparation resources for general guidance about writing and preparing your manuscript at www.wileyauthors.com/eeo/prepresources.

This journal offers a number of license options for published papers; information about this is available here: https://authorservices.wiley.com/author-resources/Journal-Authors/licensing/index.html. The submitting author has confirmed that all co-authors have the necessary rights to grant in the submission, including in light of each co-author’s funder policies. If any author’s funder has a policy that restricts which kinds of license they can sign, for example if the funder is a member of Coalition S, please make sure the submitting author is aware.

Rapid turnarounds are in the best interest of the authors, journal, and our mission-oriented discipline. Therefore, I expect your revised manuscript to be submitted within six weeks. If you cannot submit your revision within six weeks, please contact me as soon as possible to discuss the possibility of extending the turnaround time. If the revision is not submitted on time and I do not hear from you, we may have to consider your manuscript as a new submission.

If the manuscript ultimately is provisionally accepted, our senior editor, Ellen Main, will undertake a thorough revision of style, format, and English grammar. But in the interest of decreasing cumulative turnaround times, please read and follow our style guide for authors (attached). Additionally, you will see many fewer edits on your paper after provisional acceptance if you follow the specifications in the style guide carefully, including matters of voice, tense, and use and definition of terms.

Thank you for submitting your manuscript to Conservation Biology. I look forward to receiving your revision.

Sincerely,
Mark Burgman,
Conservation Biology

REVIEWER COMMENTS

Reviewer: 1
Comments to the Author

I found this study comprehensive, sound, and relevant for biodiversity conservation globally. First, this study considered large numbers of vertebrate species which included mammals, birds, reptiles, and amphibians. Most of spatial prioritization studies focused on mammals, but the authors in this study considered large number of species comprising multiple taxonomic classes. Second, it focused on optimizing conservation area networks by considering not only the ecological values, but also the three risks, i.e. governance, climate change, and land use intensification, which will make the resulting priority areas are more likely to be successful in a long-term instead of just using biodiversity features as the prioritization goals. Therefore, I see the merit in this work. Moreover, the manuscript is well-written and concise, the method is reproducible, and the results are coherent.

I have two main comments:
1. There have been multiple studies about global spatial conservation prioritization with different scenarios, but I have not seen how this global target should be translated into country-level implementation strategies. While I understand this is not the main focus of the paper, it would be more relevant to conservation managers if the authors suggest clearer recommendations on how countries should increase the protected area size in their countries. A more challenging recommendation is how to get the leaders of the countries and their respective governmental institutions to be willing to increase protected areas in their countries and who should be doing that? NGOs, universities, the government, the CBD? The number of global scale analysis on conservation priorities keeps growing, but there is also a considerable gap between global-level target and implementable country-level conservation efforts. Another thing that may make the results of this study more relatable to conservation practitioners is how much increase in protected area size broken down for each country to meet the “no regret” scenario and the 15 risk scenarios.

2. There are two climate risk metrics considered by the authors: the velocity of climate change and the exposure to extreme events. The authors have acknowledged that the spatial distribution of the two metrics were very different, and hence provide alternative priority area mapping in the Supplementary Materials. I think that both metrics are important to biodiversity and I am wondering if the authors have considered to combine both metric to represent climate change risk in one map by scaling each metric and adding the

values. I think it is justifiable as the governance risk also consisted of several indicators. I suggest the authors to include both metrics for climate risk and re-run the analysis or provide more elaboration on why these two metrics cannot be combined and why one metric is chosen over another.

Other minor comments and questions:
- Line 50: Put the opening bracket after Brooks et al.
- Line 53-57: What does “habitat associations” here indicate: the suitable habitat only or suitable and marginal? And did it also consider the different types of “Major Importance”? Please elaborate in the text.
- Line 74: Why was 10x10 km resolution for protected areas used if the biodiversity raster resolution was 1x1 km?
- Line 123-124: Did the 16 scenarios also include a null model? If so, then “all possible combinations of risk categories” totalled 15, which were later compared to a null scenario. Please rephrase.
- Line 127: Related to previous comment, if the 10 x 10 km resolution was used for processing all data, why the biodiversity features and ESA land cover to represent species’ habitat were processed at 1 km resolution? Were the habitat suitability rasters then aggregated from 1 x 1 km to 10 x 10 km? If so, how were they aggregated?
- Lines 165-172: Why did these numbers of species not include reptiles?
- Line 176: Would the sensitivity analyses be included in the Supplementary Information?
- Like 183-185: Another interesting point to present and discuss is how much additional areas from existing protected area network are needed to meet the risk scenarios? Because although a little additional area of 1.6% is needed to take into account of conservation risks compared to only targeting ecological values, the more challenging effort to do is to add more protected areas to the existing ones by creating new ones or expanding existing ones, as shown on Figure 1 and 2. Please also add this on the abstract.
- Line 189-191: I am not sure if the same 8.5 million km2 refer to comparisons among the 15 risk scenarios OR between null scenario and 15 risk scenarios because the “no regret” area is mentioned in this sentence. Please rephrase to clarify and define the meaning of “no regret” area. And how were these countries (Canada, Kenya, Peru) were selected? A glimpse at Figure S4 seems to show that not much priority areas in Canada, but much more in Central American countries, South and mainland South East Asian countries, and Madagascar. As an addition, the regional areas could also be mentioned other than the individual countries.
- Figure 1: The color for priority areas in the legend appears brown, but purple on the map.
- Figure 4: Annotate country names on the map.
- Supplementary materials Table S2: the example of 5 countries used different notations (N = null, G = governance, L = land use, C=climate) than the one in Google Drive folder (A, S, L, C?) for the 15 prioritization scenarios.

Reviewer: 2
Comments to the Author

Thank you for the opportunity to provide feedback on this interesting article. I have detailed below my impressions and shared some comments and suggestions for improvement. I think there is value in the article, but I also think that some limitations of the data must be acknowledged to avoid the risk of readers using this analysis inappropriately. These limitations are an inevitable trade-off when dealing with ~ 30.000 species, but on-the-ground recommendations should be provided with much caution given well-known biases in range maps (even when adjusted as done here).

General comments
Wording: I found the title a bit misleading, in the sense that referring so broadly to uncertainty made me think right away to uncertainty in the predicted distribution of species, another concept that has been poorly investigated in conservation planning. Perhaps something similar to “Protected area planning to conserve biodiversity in world of

uncertain climate, land use, and governance" might be easier to connect the reader with the topic discussed in the paper. Also regarding wording – the "null scenario" is really not a null model in the traditional sense of a model generated with randomization, but rather a "no cost" scenario. I was a bit confused by this terminology, particularly in figure 4.

Introduction: I found the introduction clear and well written, perhaps a bit short. I don't think it is necessary expanding this section, but if the authors think it might be a relevant addition, they could provide details on how incorporating uncertainty has improved conservation planning outcomes (line 28), or cases where not accounting for uncertainty has resulted in negative consequences.

Methods: My main concern on this article is on how conservation features, the distribution of species, have been represented in analysis. Starting by rasterizing species ranges at a 1-km grain ignores a very well known problem in the literature on range maps, since stacking range maps overestimates local biodiversity at grains larger than tens (if not hundreds) of kilometers (e.g., Hurlbert and Jetz 2007 in PNAS; https://www.pnas.org/doi/10.1073/pnas.0704469104). I realize that there is an additional step of including land cover categories and elevation as additional filters in the analysis, but I personally still feel like the reliability of these surfaces at a 1-km resolution might be limited. Even aggregation to the majority rule of 0.3 km ESA land cover is complicated, in the sense that many metapopulations can persist in landscapes with broken habitat remnants (e.g., tens of cells with 40% forest in an agricultural matrix would be considered agriculture, but could indeed support many species). I do recognize the effort of performing this analysis on thousands of vertebrate species, and I do not think that this aspect invalidates the general point the authors make, but it is worth clarifying and discussing more in the manuscript. For instance, the authors could describe how these limitations of the method might bias the spatial patterns in their results. On a side note, one easy test of the map reliability could be testing for the correlation between your range-based maps and other products, like e-Bird maps based on models calibrated with empirical data.

I don't think you reported explicitly the planning unit side, which (if I understood properly) is 100 km2. I wonder why in figure 4 there are much coarser cells?

Discussion: I think you need to caution the readers from taking the results of your analysis as a guideline for on-the-ground conservation. I do believe you make a good point that risk including international dynamics must be incorporated into conservation efforts, and that the cost of accounting for uncertainties is relatively low. However, I also think that your analysis only scratches the surfaces in terms of really accounting for uncertainty. Other important sources of uncertainty are the predicted distributions of species (which might have a much larger effect on your increases in areas) and especially the choice of your measures of risk. You do acknowledge that changing climate velocity affects the inference, but those effects are compound and I think it is an overstatement that your analysis resolves this can of worms and that only minor gains are sufficient to resolve the problem. That said, I do think it makes valuable points on the need to start accounting for these sources of uncertainty.

Also, I do think that an increase of 1.6% on average over 21% of the planet is not that a negligible of an increase, so I personally don't agree with one of the messages of the paper that we "just need" an additional 1.6%. This is about 7% more than what would be needed without accounting for the cost of uncertainty, and an area larger than many European countries. But this is a matter of opinions, I understand why you stated that 1.6% of the planet surface isn't that much overall. I raise this point knowing that ultimately it will be up to the authors and the editors to decide whether this view is justifiable.

Detailed comments
Line 23-24: great point.
Line 58-59: please report where the species' elevational level was extracted from.
Line 70: please report the size of the buffers adopted.
Line 74: was every 10-km cell containing a protected area considered as "protected"? This will have a substantial effect and different effects across space, e.g., PAs in Europe are

often smaller than 100 km2, whereas in Africa they are often much larger. In this case, Europe will seem to be more protected than it actually is, for instance. I would suggest discussing somewhere in the paper this pitfall.
Line 103: perhaps the first comma is a typo?
Line 134: please refer to table S1, so that it is easier to figure out right away which scenarios you compared.
Line 122-180: I found the description of the conservation planning analysis clear. I am not familiar with lexicography, so I am not qualified to review the specific details of the methods employed, but I am familiar with the specifics of the conservation planning exercise and I thought the authors did a good job in explaining those.
Line 182: In my opinion, 1.6% more land protected on average is not a small area overall. It is also 7.5% more than the null scenario estimates.
Line 191: are you sure that Canada includes much of the “no regrets” areas? Figure 2 seems to have not many cells based on visual inspection. Mexico, for instance, seems to have more cells.
Line 197-207: these examples are great, but are based on the assumption that your adjusted range maps capture well the distribution of species. I would suggest adding a disclaimer that, for these specific cases, more detailed studies should be used to confirm your findings (e.g., based on species distribution models). The risk I foresee is directing international policy based on data that is, in my opinion, not compelling to make these sorts of decisions.
Line 213: Again, 1.6% might seem small but is 7.5% more than your “species-only model” and an area larger than most European countries. I am not debating that it would be worth adding this area to mitigate risks, but I think it is a substantial investment.
Line 224-226: great point.
You acknowledge the sensitivity of your analysis to the choice of metrics of risk in governance, climate, and land use. I think, given that the metrics were selected quite arbitrarily, you should stress that 1.6% more land protected to account for risk is a measure limited to your “cost space”, and likely an underestimation. Truly accounting for uncertainty, e.g., having multiple cost surface for each risk factor AND a metric of uncertainty on the distribution of species would be a much more difficult task, will likely result in larger requirements of additional protected land.
Fig. 1: I don’t understand this figure. Which scenario(s) does it illustrate? All risks together? If yes, in which order? Or is it a combination of multiple scenarios?
Fig. 4: why is the resolution (grain) in the bottom row coarser than the grain of your conservation planning analysis?

As there is no attached R script, I cannot provide feedback in the software development associated with the manuscript.

Attachments:

* Author-Style-Guide-mar22.docx 53.9 KB