

Loss of pollinator diversity consistently reduces reproductive success for wild and cultivated plants

Corresponding Author: Ms Maddi Artamendi

Attachments originally included by the reviewers as part of their assessment can be found at the end of this file.

Version 0:

Decision Letter:

16th January 2024

Dear Dr Artamendi,

Thank you for your enquiry about submitting your manuscript "Loss of pollinator diversity consistently reduces reproductive success for both wild plants and crops globally" to Nature Ecology & Evolution. We would be happy to receive a full version to further consider. However, I'm sure you'll understand that we cannot make a firm decision about whether to send the paper out to review until we have carefully read the full paper (and appropriate background literature).

In order to submit your complete manuscript to Nature Ecology & Evolution, please use the link below:

Link Redacted

If you have any questions, please feel free to contact me.

[redacted]

Version 1:

Decision Letter:

3rd April 2024

*Please ensure you delete the link to your author homepage in this e-mail if you wish to forward it to your co-authors.

Dear Dr Artamendi,

Your Article, "Loss of pollinator diversity consistently reduces reproductive success for both wild plants and crops globally" has now been seen by 3 reviewers. You will see from their comments copied below that while they find your work of considerable potential interest, they have raised quite substantial concerns that must be addressed. In light of these comments, we cannot accept the manuscript for publication, but would be very interested in considering a revised version that addresses these serious concerns.

We hope you will find the reviewers' comments useful as you decide how to proceed. If you wish to submit a substantially revised manuscript, please bear in mind that we will be reluctant to approach the reviewers again in the absence of major revisions.

If you choose to revise your manuscript taking into account all reviewer and editor comments, please highlight all changes in the manuscript text file.

We are committed to providing a fair and constructive peer-review process. Please do not hesitate to contact us if there are specific requests from the reviewers that you believe are technically impossible or unlikely to yield a meaningful outcome.

If revising your manuscript:

* Include a "Response to reviewers" document detailing, point-by-point, how you addressed each referee comment. If no action was taken to address a point, you must provide a compelling argument. This response will be sent back to the referees along with the revised manuscript.

* If you have not done so already we suggest that you begin to revise your manuscript so that it conforms to our Article format instructions at <http://www.nature.com/natecolevol/info/final-submission>. Refer also to any guidelines provided in this letter.

* Include a revised version of any required reporting checklist. It will be available to referees (and, potentially, statisticians) to aid in their evaluation if the manuscript goes back for peer review. A revised checklist is essential for re-review of the paper.

Please use the link below to submit a revised paper:

Link Redacted

Note: This URL links to your confidential home page and associated information about manuscripts you may have submitted, or that you are reviewing for us. If you wish to forward this email to co-authors, please delete the link to your homepage.

If you wish to submit a suitably revised manuscript we would hope to receive it within 6 months. If you cannot send it within this time, please let us know. We will be happy to consider your revision so long as nothing similar has been accepted for publication at Nature Ecology & Evolution or published elsewhere.

Nature Ecology & Evolution is committed to improving transparency in authorship. As part of our efforts in this direction, we are now requesting that all authors identified as 'corresponding author' on published papers create and link their Open Researcher and Contributor Identifier (ORCID) with their account on the Manuscript Tracking System (MTS), prior to acceptance. This applies to primary research papers only. ORCID helps the scientific community achieve unambiguous attribution of all scholarly contributions. You can create and link your ORCID from the home page of the MTS by clicking on 'Modify my Springer Nature account'. For more information please visit www.springernature.com/orcid.

Please do not hesitate to contact me if you have any questions or would like to discuss the required revisions further.

Thank you for the opportunity to review your work.

[redacted]

Reviewer comments:

Reviewer #1 (Remarks to the Author):

In this manuscript, the authors carry out a global meta-analysis to determine how loss of pollinator diversity, as opposed to total loss of pollinator, affects the reproductive success of plants. The authors also run a number of multilevel meta-analyses to elucidate which moderators, namely crop/wild, outcome measure, compatibility and pollinator type explain the heterogeneity across studies.

This is indeed an interesting approach and a timely question to investigate given that loss of diversity provides a more realistic scenario than a total loss of pollinators.

However, the manuscript as it stands, does not provide in my opinion enough clarity to understand how the data was collected and analysed, and consequently how some of the inferences were made.

In particular the methods section requires more details to be provided and more clarity. For example, I did not find it easy to assess what type of manipulative studies were included, what were the experimental designs of both manipulative and observational studies.

The statistical analysis itself seems robust, but more clarity is needed on the moderators extracted, on the choice of models and how lack of study independence was dealt with.

Furthermore, It is essential especially for a global analysis, but generally for any meta-analysis to include a grey literature search and wherever possible a search in a language other than English. This is not reported in the current manuscript.

Below I give further details on the areas of concern.

It may be that once the methodology used is clarified, the concerns on the inferences made are dissipated, but I recommend these concerns to be addressed before this manuscript can be put forward for publication.

Methods

The methods section needs to be integrated with additional information to make it completely replicable. There are areas that require more clarity to both improve replicability and clarify/justify decisions made. My main areas of concern are:

L332 inclusion criteria 4) compare plant reproductive success in situations in which pollinator diversity differed; how were the differences in pollinator diversity measured in the studies included? Experimental manipulation, observation, both? More details should be provided in the methods section on the different experimental design encountered. It is important here to expand on what is meant by this, what experimental designs are included.

L363-368 here the authors describe what was used as treatment/control to calculate the effect size, mentioning “lower” and “higher” pollinator diversity treatments. But these treatments have not been described yet in the manuscript,

It is not entirely clear to me how the non-independence of observations was addressed. L384 mentions terms being either crossed or nested as random factors. Which one is which? How were factors nested to account for multiple effect sizes from the same study? Because judging by L389-390 there was no nesting in the final model.

The authors may have used a perfectly sensible method, but it is not entirely clear from the manuscript and needs clarification.

L394-407 This section is hard to follow. It is not clear if the moderators mentioned in L398-403 were used as moderators in the analysis, extracted from studies or just observed as being employed by the studies.

L395 list the moderators here, it is not clear from the methods exactly what moderators were used.

L404-405 here is the first time in the methods that there is an indication of what manipulative experiments were included. I believe this should be stated earlier in the section to increase clarity on study selection and overall. Also, it is necessary to describe what observational studies were included, what the experimental design was for these studies (observational and mesocosm which are only mentioned in the results and figures) and what was used to calculate the effect size in this case i.e. what comparison was used.

L407 needs to clarify what moderators, and are they the same for each subset?

Results

The results report analysis on the effect of climatic zone, though this is not mentioned in the original questions at the end of the introduction L66-69

L141 there needs to be more clarity on how this inference is made. My understanding is that the authors looked at the following manipulations: vertebrate or invertebrate, diurnal or nocturnal and wild or managed.

The inference that the negative effect is greater for invertebrates than for vertebrate seems to be based on the diurnal/nocturnal manipulation (the authors refer to fig 6A although I think it should be 6B) though invertebrate nocturnal pollinators (e.g. moths) may have been present? If that was not the case, was it confirmed in the studies?

In Fig 6B what manipulation was used for the invertebrate exclusion? Wouldn't that be total exclusion? Or does it include the observational studies? Clarify

This may be based on robust decisions and analysis but it does not transpire easily from the manuscript as it is. More details need to be provided on the methodology to aid understanding of the analysis inferences.

Discussion

L219- 225 Gazzera et al used total exclusion, to my knowledge they did not look at pollinator diversity.

L223 where is this data in the manuscript? The figure showing effect sizes by biomes seems to include all pollinators. The authors found a strong negative effect when nocturnal pollinators are excluded and states that most of those studies excluded bats, in line with this the results seem to confirm previous findings that the most affected plants were bat pollinated

L226 Again, were the studies included in the nocturnal/diurnal analysis clear about there not being any invertebrate pollinators, either diurnal or nocturnal? Or were there caging experiments? this should be clarified

Referencing

Some references are oddly placed in the middle of a statement, or they do not back up the statement where they are cited.

Examples below:

L46 citation 5, this article looks at how loss of biological diversity will alter ecosystem functioning, though a citation here should support why looking at species diversity would support to understand that relationship (biodiversity-ecosystem functioning) beyond experimental conditions

L29 “valuable sources of medicine or construction materials” this statement is used in Ratto et al. 2018 but this paper is not the original source. Refer to Ratto et al. for the original source for this.

L53 citation 19 explores the delivery of Ecosystem services by pollinators and does not focus on managed pollinators

Minor comments

L8-11 review this sentence, I believe the “is needed” at the end is not needed (no pun intended!)

L15 remove “a”

L31 I would rephrase this slightly, how is the decline “despite” their importance

L44-47 but it is my understanding that you indeed looked at experimental conditions?

L391 judging by what was said in L363-368 lower pollinator diversity was the treatment, hence showing the effect?

L442 biased. Undefined?

L177-179 unclear, sounds unfinished, perhaps rephrase

In the search string, I wonder why the authors chose to include only seed set and fruit set? Even though other outcome measures were included

Supplementary information

Provide a list of the studies included in the meta-analysis

I hope my review provides useful recommendations and look forward to seeing a revised version.

Fabrizia Ratto

Reviewer #2 (Remarks to the Author):

The manuscript, "Loss of pollinator diversity consistently reduces reproductive success for both wild plants and crops globally", applies a global meta-analysis to quantify the effects of declining pollinator diversity on plant reproductive success. I found the paper to be well-written and thorough and do not have any major concerns. I think this is an important topic and this is a timely study to evaluate these effects. I expect it will be well-cited.

Minor comments:

Line 11: There is a typo in this sentence. I think just delete the "is needed" at the end

Line 12: If possible it would be nice to include the measures of plant reproductive success (fruit weight, fruit set, seed set) in the abstract

Line 177-179: This is a sentence fragment, so revise

Line 208: "fewer" rather than "less", I think

Line 212: "self-compatible" rather than just "compatible" I think

Line 215-216: I suggest rephrasing this sentence: "but being self-compatible does not preclude that the presence of flower visitors is positive."

Line 261-262: There is a phrasing issue in this sentence, rephrase: "in some cases, due to an excess of pollen in the stigmas brought by subsequent honeybee visits can prevent pollen tube development, given the existence of a generally saturating relationship between pollinator visitation rate and fruit set"

Line 296-297: Not entirely sure what this sentence means

Line 297: Superfluous comma

Line 442: superfluous "undefined" at the end of the sentence

Reviewer #3 (Remarks to the Author):

The manuscript "Loss of pollinator diversity consistently reduces reproductive success for both wild plants and crops globally" provides much needed insights into the relationship between diversity and ecosystem function, by assessing the link between pollinator diversity and plant reproductive success. The meta-analysis thereby reveals how the decrease of pollinator diversity influences the reproductive success of wild and cultivated plants across the globe. The study thereby finds a significant impact of the reduction in pollinator diversity on plant reproductive success. This effect was found to be higher for wild pollinators and plants than for managed and cultivated species. These patterns appear to hold independently of the geographic origin of the included studies.

While the premises of the study and the results are interesting, I find that the various sections of the manuscript require a substantial revision. I think that with these revisions the manuscript could be of interest to a broader audience. In many ways the study builds on the meta-analysis published by Woodcock et al. (2019), but provides a broader view, incorporating wild plants. However, in many instances the manuscript misses certain critical details, for example it is never made clear how pollinator diversity has been measured in the studies considered, or how strong the changes in pollinator diversity are and what the difference is in the decrease of wild vs managed pollinators (some aspects are mentioned in the methods, but it would already be helpful to know the amplitude of the change). The cited literature is further incomplete and quite often papers are erroneously cited (see my detailed comments below). I also found that the discussions often read more as detailed results, missing a more in depth assessment of the ecological meaning of the studies finding. The limitations of the study were discussed, but have received more detailed attention. However, I do find that the study addresses an important knowledge gap, and hope that with some significant alterations it will be deemed acceptable for publication.

Please find below my detailed comments:

Abstract

L11: Remove "is needed".

L11: Remove "to reveal a" and replace with "revealing a"

L15: Remove "a"

L16: "crops; reducing wild pollinator species diversity has therefore a more.....effect....."

Introduction

L24: The citation provided here seems inappropriate or at the very least insufficient. There are several reviews and papers summarizing the reproductive strategies of flowering plants and their evolution which should be cited. Also, the study which is cited is focused on the response of plant reproduction to habitat fragmentation and does not seem appropriate to support the statement made in this phrase.

L27: add after "benefit" "at least to some..."

L33: One of the studies cited is focused exclusively on Britain, while the study by Reverté et al. does not seem appropriate here. Other relevant studies are missing for example the studies by Hallmann, van Klink, etc.----albeit these report effects rather than their causes. Also study 7 does not seem to be appropriately cited here.

L37: A single citation does not entirely support the generality of this statement (even if it is a meta-analysis, or in this case especially so, as for this meta-analysis the studies have been probably selected based on criteria including complete pollinator exclusion), furthermore the cited paper is exclusively focused on crops.

L39: Study 15 is inappropriately cited, they do not seem to have tested the complete loss of pollinator diversity, but the impact of functional diversity.

General comment: The introduction does not discuss the different ways pollinator diversity can be assessed, nor the way pollinator diversity is actually linked to reproductive success of plants.

L41: Citations are insufficient and not quite appropriate for the point made (i.e. the study cited is focused on Britain alone, while the sentence generalizes beyond this geographic scope). While the cited study should be included, the citations should be expanded, consider van Klink et al., etc.

L44: Very vague sentence, which I feel is not that straightforward to follow. Is it meant to imply that the article is focused only on the impact of pollinator diversity decline from here on, rather than on abundance and diversity? In this case there is a need to better explain why? Also, I do not completely follow why focusing on pollinator diversity would provide an opportunity to go beyond experimental conditions and what do you mean by experimental conditions?

L47: This requires more explanation, why is this relevant, what is meant by species selection effects (not all readers may be familiar with these terms), also I do not think that this topic is ever addressed in the discussion, which is why I think it may not be relevant to the manuscript (or it needs to be made clearer why it is relevant).

L49: I do not think that the relevance of this sentence is clear for a wider audience, what system specific mechanisms have you presented at this point, so as to make the transition to other system specific mechanisms? This whole paragraph seems out of place and fragmented, I am not sure what its scope is. I suggest to revise it.

L52: a) Some terms appear inconsistent to the scope of the paper. The focus is on reproductive success/pollination as a function, I think introducing ecosystem-functioning, a much broader term is not ideal as pollination is just one aspect of ecosystem functioning. I suggest keep to reproductive success.

b) Inspired by this sentence, but generally applies: I feel that more information is needed on what has been shown in previous studies and how the present study builds on these. For example, little is presented on what is known about the link between pollinator diversity and plant reproductive success.

L54: What other approaches are there? Also there needs to be a description/definition provided of what these methods actually are....are experimental approaches solely exclusion experiments or are there other approaches, and what exactly have observational studies observed? You mention in the methods mesocosm experiments, but they are not introduced. How do these methods differ, what do they have in common, would one expect different outcomes from different methods? If so, why, etc.

General comment: I am missing an introduction of the relevance of how pollinator diversity is measured on the estimation of reproductive success...at the very least taxonomic vs functional diversity, various ways to calculate diversity (richness, Shannon, Simpson, or their Hill number equivalents, etc.). Does the way we measure diversity have the potential to impact the way we understand the impact of pollinator diversity on plant reproductive success? Also, what would make one expect geographic differences in the impact of pollinator loss on plant reproduction? I am not saying that there is no pattern to be expected, I would just like to see the introduction better setting up the aims/hypotheses of this study.

L61: This is what I was looking for above in terms of defining what an experimental vs observational study is. This should be placed further up in the introduction; add definition/explanation on mesocosm experiments.

L64: Until now you have always talked about plant reproductive success, now you switch to fitness. I would keep the terminology consistent, and use reproductive success. It may also be good to discuss the different ways plant reproductive success can be measured and make clear whether or not you also included studies on pollination success rather than reproductive success (based on your search terms you used both, but these two terms do not mean the same exact thing).

L66: I don't think that the intro sets these questions up sufficiently: in particular questions ii) and iii). Why would one expect a difference between wild plants and cops, what has previous research shown? Also how is reproductive success measured in the literature and why would the way RS is measured impact the results of the study? The same for the compatibility system (mentioned for the first time here in the questions, but never introduced), the same with the type of pollinator excluded...why is this a relevant question? There is nothing in the introduction to set this up.

Results

L73: Please define how you defined a region and why you pooled countries into regions?

L77: This means that even though more studies were conducted in Europe, these were studies with fewer observations? Might this not be an effect of the size of a country/region? It may also help to define what an observation is in this context?

L81: Replace "closely" with "intensively".

L91: How does this correlate to how species rich a family is?

L91: I am rather surprised that the Orchidaceae are represented with such a low number of studies. This brings me to a further point, the specialization of plants for particular pollinators is not considered. This is a crucial point, as for more specialized plant species a far smaller decline in pollinator diversity may have a greater impact than on generalized plant species. I think this aspect warrants inclusion or at least discussion. And/or it warrants mentioning to what extent the species included in the study were generalized or specialized (albeit, I acknowledge that there is a gradient of specialization). It may be interesting to also

consider how well certain plant families are represented relative to their diversity.

Further, what were the pollinator groups considered? Did the studies included tend to focus on a broad range of local pollinators or did they focus on particular groups?

L96: Field exclusion studies = I would also like to know more about how these studies were conducted, what were the similarities and differences, what pollinators were excluded, etc.

L99: Pollinator diversity: how did you/the articles you included define diversity? As richness, Shannon, Simpson? Taxonomic and/or functional?

L100: I would also like to know how you combined potentially different ways to measure reproductive success and what were the different reproductive success metrics included? Could the diversity measure impact the results?

L100: Consider specifying what model you used (I know it is described in the Method section, but it would be helpful to included here as well).

L108: Replace "slightly" with "marginally".

L111: I would introduce the fact that you did consider different ways to measure reproductive success sooner (I know it is difficult, as the methods are at the very end of the paper, but it would make your approach clearer). Also, in your search term string you included pollination success, but this appears not to be reported....an explanation would help.

L113: Maybe a valid discussion point: the relationship between reproductive success and actual effects on population sizes, etc....in orchids for example many specialized species (sexually deceptive species in particular) have extremely low reproductive success under the best of circumstances, BUT one fruit/seed capsule produces thousands of seeds, so they trade in quantity of fruits for quality/quantity of seeds. I wonder if this is the case in other plant species and whether it impacts the way we think about reproductive success.

L118: Mesocosm studies: This needs to be explained to a broader audience, what are these studies? It would really help to add a definition of the type of studies included under experimental and observational studies.

L122: I don't recall a discussion about why mesocosm studies have such high effect sizes?

L128: What is the relationship between the plants most affected and the amount of data available for each family?

L137: I am a bit hesitant about the way results which are not stat. significant are reported, because the framing suggests that there is a hierarchy, but statistically there is no difference between seed set, etc. I would rephrase this.

L146: The taxonomic groupings are a bit haphazard, consider grouping by order or other taxonomically meaningful category (and maybe mention if particular genera/families have received particular attention).

L152: Plants: If these are different plants then what this result shows is plants adapted to nocturnal pollinators are more pollinator dependent, right?

L159: Cacti: In which case your result illustrates the high degree of specialization for bats in cacti....correct?

L164: What is the relationship between crop and wild plants within the assessed families? Particularly for families such as Fabaceae and Rosaceae?

L171: Would you have sufficient data to extract shared plants, so as to see whether the results hold when comparing the effect of wild and managed pollinators on the same plants?

DISCUSSION

L176: I might have added this comment before, but what was the magnitude of decline in pollinator species diversity across studies?

L177: This sentence needs rephrasing: "With pollinator species diversity expected to decline....., a further significant effect on the reproduction of various plant species is to be expected...."

L180: I don't think I have seen information about the degree of this reduction across the studies?

L182: It would be interesting to add to what extent the degree of pollinator diversity reduction accounted for in the studies relates to that predicted by various broader studies (i.e., van Klink et al.).

L188: I find these discussions point insufficient, the fact that wild plant seems to be more affected merits a deeper discussion.

L190: I would discuss this finding in relation to resource limitation in more depth.

L199: This paragraph reads more like results, that discussion.

L212: compatible replace with self-compatible

L212: Unclear what exactly is meant here, I would actually like to read more about the mechanisms through which pollinator diversity impacts plant reproductive success.

L218: Yes, but your results seem to indicate that this does not really happen....

L221: Ok. But what about wild plants, considering for example that specialization is higher in some regions of the world, one could expect a difference in the response to pollinator diversity changes. But this may depend of course on the plants studied. I would appreciate a deeper discussion on wild plants.

L222-225: Sentence needs rephrasing and possibly splitting to make its meaning clearer.

L226: Considering that this is basically only based on Cacti, I think this too broad of a statement. It basically denotes that Cacti are more specialized/pollinator dependent than other plants investigated.

L232: I would say that you can only make this comparison if you look at the same plant species, not if you compare a bat vs a bird pollinated species. Plant species have different pollen to ovule ratios, so a bird may be perfectly effective in pollinating a plant adapted to it.

L239: Citation: This is the wrong citation!!! These estimates vary quite a bit between studies, but in any case, you should cite the appropriate studies here, not one on syrphids.

L245: But you kind of do at the start of the paragraph.

L248: Delete "one or two".

L250: (mostly solitary bees): This suggests that most studies incorporated were focused on wild bees, this is not mentioned in the methods/results section.

L285: functional diversity: As you did not assess functional diversity you can't really make this point.

L292. Sentence seems disconnected from the rest of the text, and I don't really understand what is meant (a diverse assemblage of bee species is not associated with a particular trait). Furthermore, the link to functional traits is not given, as you did not assess functional diversity.

L294: How did you measure complementarity? If you assume it is correlated to pollinator diversity then you need to discuss and cite the studies which show this. And rephrase the sentence, as it suggests that your results provide evidence of functional complementarity.

L296: Unclear sentence, what do you mean by selection effects?

L302: First: The sentence needs revising and shortening/splitting.

Second: This is quite a crucial aspect which needs to be more prominently addressed.

L304: This sentence also needs clarification relative to the exclusion experiments...how many species were actually included, how large was the gradient of pollinator diversity (of the included species) between studies? That data should be available, or?

L306: It may be more valuable if you could make a concrete suggestion on how to fill this gap in our knowledge in the future, rather than this rather general phrase.

Methodology

L331: I suggest adding to this section a description of diversity measures, reproductive success measures, pollinator groups included, etc.

L331: "assess the impact of a reduction in the diversity of any pollinator taxon,...." A taxon can be a species, in which case the sentence does not make sense, as there can't be a decrease in species diversity of a species. I suggest to revise, maybe simply to "...a reduction in the taxonomic/species diversity of pollinators".

L332: Wouldn't it have been a good control to assess whether and to what extent plant reproductive success changes even if pollinator diversity does not? To what extent may the patterns you observed be determined by other factors than pollinator diversity changes?

L336: Please define which measures you included.

General comment: I am missing a point on how diversity was measured, what indices were used? Did you use the same index throughout or did you include studies with different measures of pollinator diversity?

General comment: What was the decrease in diversity observed for wild vs managed pollinators? There are really few managed pollinators vs wild ones, so couldn't your results be impacted by a lack of variation in the diversity of managed pollinators vs wild pollinators?

L355: How did you deal with multi-year studies?

L365: Why not the other way round? so that a positive value indicates that a higher diversity increased reproductive success, that would seem more intuitive.

L395: Can you define what these variables actually are? It would make it easier for a reader to follow your approach.

L398: I am not sure what you define as main reproductive success, is it the overall reproductive success?

L401: Classification of lost pollinators? I do not completely understand what is meant here.

L441: I would suggest adding an explanation for this value.

L442: Delete "undefined".

L455: I suggest adding an explanation of what this means/the relevance of this finding.

L456: The paragraph on plant traits: how did this aspect enter your results and discussion?

Figure 2: Some of the colours are difficult to distinguish, in particular the colours for Others and Rubiaceae and Cucurbitaceae, the same with the dark yellow colours.

Figure 5: I do not recall you discussing the partially self-compatible group in the text?

Figure S1: The Figure appears to be at very low resolution, please upload a better quality image.

Figure S2: As above.

Figure S4: As above.

Version 2:

Decision Letter:

22nd July 2024

Dear Dr. Artamendi,

Thank you for submitting your revised manuscript "Loss of pollinator diversity consistently reduces reproductive success for wild and cultivated plants" (NATECOLEVOL-24010125B). It has now been seen again by the original reviewers and their comments are below. The reviewers find that the paper has improved in revision, and therefore we'll be happy in principle to publish it in Nature Ecology & Evolution, pending minor revisions to satisfy the reviewers' final requests and to comply with our editorial and formatting guidelines.

If the current version of your manuscript is in a PDF format, please email us a copy of the file in an editable format (Microsoft Word or LaTeX)-- we can not proceed with PDFs at this stage.

We are now performing detailed checks on your paper and will send you a checklist detailing our editorial and formatting requirements in about a week. Please do not upload the final materials and make any revisions until you receive this additional information from us.

Thank you again for your interest in Nature Ecology & Evolution. Please do not hesitate to contact me if you have any questions.

[redacted]

Reviewer #1 (Remarks to the Author):

I believe the authors have addressed mine and other reviews' comments thoroughly and provided sensible edits and/or sound reasons for their choices. The manuscript is clearer and more robust and I would now recommend it for publication.

I enjoyed reviewing it and believe it will be well received and cited.

Fabrizia Ratto

Reviewer #2 (Remarks to the Author):

Sorry for the late response. The authors did not offer a tracked changes version of the manuscript so it was difficult to see all the changes made. As far as I can tell, the authors addressed my concerns and those of the other reviewers.

Reviewer #3 (Remarks to the Author):

Dear authors,

Thank you for addressing my comments and for the thoughtful responses. I find that the revised manuscript has now dealt with all the points I had raised and I am looking forward to seeing it published.
Please find attached the manuscript with just a few minor comments.

All the best,

Version 3:

Decision Letter:

16th September 2024

Dear Dr Artamendi,

We are pleased to inform you that your Article entitled "Loss of pollinator diversity consistently reduces reproductive success for wild and cultivated plants", has now been accepted for publication in *Nature Ecology & Evolution*.

Over the next few weeks, your paper will be copyedited to ensure that it conforms to *Nature Ecology and Evolution* style. Once your paper is typeset, you will receive an email with a link to choose the appropriate publishing options for your paper and our Author Services team will be in touch regarding any additional information that may be required

After the grant of rights is completed, you will receive a link to your electronic proof via email with a request to make any corrections within 48 hours. If, when you receive your proof, you cannot meet this deadline, please inform us at rjsproduction@springernature.com immediately.

Due to the importance of these deadlines, we ask you please us know now whether you will be difficult to contact over the next month. If this is the case, we ask you provide us with the contact information (email, phone and fax) of someone who will be able to check the proofs on your behalf, and who will be available to address any last-minute problems. Once your paper has been scheduled for online publication, the Nature press office will be in touch to confirm the details.

Acceptance of your manuscript is conditional on all authors' agreement with our publication policies (see www.nature.com/authors/policies/index.html). In particular your manuscript must not be published elsewhere and there must be no announcement of the work to any media outlet until the publication date (the day on which it is uploaded onto our web site).

Please note that *Nature Ecology & Evolution* is a Transformative Journal (TJ). Authors may publish their research with us through the traditional subscription access route or make their paper immediately open access through payment of an article-processing charge (APC). Authors will not be required to make a final decision about access to their article until it has been accepted. [Find out more about Transformative Journals](https://www.springernature.com/gp/open-research/transformative-journals)

Authors may need to take specific actions to achieve [compliance](https://www.springernature.com/gp/open-research/funding/policy-compliance-faqs) with funder and institutional open access mandates. If your research is supported by a funder that requires immediate open access (e.g. according to [Plan S principles](https://www.springernature.com/gp/open-research/plan-s-compliance)) then you should select the gold OA route, and we will direct you to the compliant route where possible. For authors selecting the subscription publication route, the journal's standard licensing terms will need to be accepted, including [self-archiving-and-license-to-publish](https://www.nature.com/nature-portfolio/editorial-policies/self-archiving-and-license-to-publish). Those licensing terms will supersede any other terms that the author or any third party may assert apply to any version of the manuscript.

In approximately 10 business days you will receive an email with a link to choose the appropriate publishing options for your paper and our Author Services team will be in touch regarding any additional information that may be required.

If you have any questions about our publishing options, costs, Open Access requirements, or our legal forms, please contact ASJournals@springernature.com

An online order form for reprints of your paper is available at <https://www.nature.com/reprints/author-reprints.html>. All co-authors, authors' institutions and authors' funding agencies can order reprints using the form appropriate to their geographical region.

We welcome the submission of potential cover material (including a short caption of around 40 words) related to your manuscript; suggestions should be sent to *Nature Ecology & Evolution* as electronic files (the image should be 300 dpi at 210 x

297 mm in either TIFF or JPEG format). Please note that such pictures should be selected more for their aesthetic appeal than for their scientific content, and that colour images work better than black and white or grayscale images. Please do not try to design a cover with the Nature Ecology & Evolution logo etc., and please do not submit composites of images related to your work. I am sure you will understand that we cannot make any promise as to whether any of your suggestions might be selected for the cover of the journal.

You can now use a single sign-on for all your accounts, view the status of all your manuscript submissions and reviews, access usage statistics for your published articles and download a record of your refereeing activity for the Nature journals.

To assist our authors in disseminating their research to the broader community, our SharedIt initiative provides you with a unique shareable link that will allow anyone (with or without a subscription) to read the published article. Recipients of the link with a subscription will also be able to download and print the PDF.

You can generate the link yourself when you receive your article DOI by entering it here: http://authors.springernature.com/share<a>.

[redacted]

P.S. Click on the following link if you would like to recommend Nature Ecology & Evolution to your librarian
<http://www.nature.com/subscriptions/recommend.html#forms>

** Visit the Springer Nature Editorial and Publishing website at www.springernature.com/editorial-and-publishing-jobs for more information about our career opportunities. If you have any questions please click here.

Open Access This Peer Review File is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

In cases where reviewers are anonymous, credit should be given to 'Anonymous Referee' and the source.

The images or other third party material in this Peer Review File are included in the article's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

To view a copy of this license, visit <https://creativecommons.org/licenses/by/4.0/>