Peer Community In Ecology

Complex but positive diversity - ecosystem functioning relationships in Riparian tropical forests

Werner Ulrich *based on peer reviews by 2 anonymous reviewers*

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Many ecological drivers can impact ecosystem functionality and multifunctionality, with the latter describing the joint impact of different functions on ecosystem performance and services. It is now generally accepted that taxonomically richer ecosystems are better able to sustain high aggregate functionality measures, like energy transfer, productivity or carbon storage (Buzhdygan 2020, Naeem et al. 2009), and different ecosystem services (Marselle et al. 2021) than those that are less rich. Antonini et al. (2022) analysed an impressive dataset on animal and plant richness of tropical riparian forests and abundances, together with data on key soil parameters. Their work highlights the importance of biodiversity on functioning, while accounting for a manifold of potentially covarying drivers. Although the key result might not come as a surprise, it is a useful contribution to the diversity - ecosystem functioning topic, because it is underpinned with data from tropical habitats. To date, most analyses have focused on temperate habitats, using data often obtained from controlled experiments.

The paper also highlights that diversity–functioning relationships are complicated. Drivers of functionality vary from site to site and each measure of functioning, including parameters as demonstrated here, can be influenced by very different sets of predictors, often associated with taxonomic and trait diversity. Single

correlative comparisons of certain aspects of diversity and functionality might therefore return very different results. Antonini et al. (2022) show that, in general, using 22 predictors of functional diversity, varying predictor subsets were positively associated with soil functioning. Correlational analyses alone cannot resolve the question of causal link. Future studies should therefore focus on inferring precise mechanisms behind the observed relationships, and the environmental constraints on predictor subset composition and strength.

References:

Antonini Y, Beirão MV, Costa FV, Azevedo CS, Wojakowski MM, Kozovits AR, Pires MRS, Sousa HC de, Messias MCTB, Fujaco MA, Leite MGP, Vidigal JP, Monteiro GF, Dirzo R (2022) Riparian forest restoration as sources of biodiversity and ecosystem functions in anthropogenic landscapes. bioRxiv, 2021.09.08.459375, ver. 3 peer-reviewed and recommended by Peer Community in Ecology. https://doi.org/10.1101/2021.09.08.459375

Buzhdygan OY, Meyer ST, Weisser WW, Eisenhauer N, Ebeling A, Borrett SR, Buchmann N, Cortois R, De Deyn GB, de Kroon H, Gleixner G, Hertzog LR, Hines J, Lange M, Mommer L, Ravenek J, Scherber C, Scherer-Lorenzen M, Scheu S, Schmid B, Steinauer K, Strecker T, Tietjen B, Vogel A, Weigelt A, Petermann JS (2020) Biodiversity increases multitrophic energy use efficiency, flow and storage in grasslands. Nature Ecology & Evolution, 4, 393–405. https://doi.org/10.1038/s41559-020-1123-8

Marselle MR, Hartig T, Cox DTC, de Bell S, Knapp S, Lindley S, Triguero-Mas M, Böhning-Gaese K, Braubach M, Cook PA, de Vries S, Heintz-Buschart A, Hofmann M, Irvine KN, Kabisch N, Kolek F, Kraemer R, Markevych I, Martens D, Müller R, Nieuwenhuijsen M, Potts JM, Stadler J, Walton S, Warber SL, Bonn A (2021) Pathways linking biodiversity to human health: A conceptual framework. Environment International, 150, 106420. https://doi.org/10.1016/j.envint.2021.106420

Naeem S, Bunker DE, Hector A, Loreau M, Perrings C (Eds.) (2009) Biodiversity, Ecosystem Functioning, and Human Wellbeing: An Ecological and Economic Perspective. Oxford University Press, Oxford. https://doi.org/10.1093/acprof:oso/9780199547951.001.0001

Reviews

Evaluation round #2

DOI or URL of the preprint: https://doi.org/10.1101/2021.09.08.459375
Version of the preprint: 2

Authors' reply, 29 March 2022

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Decision by Werner Ulrich, posted 28 February 2022

Major revision

Dear dr Anonini

Thank you for your revised version. I see that you have addressed the comments of the referees. I think the paper is interesting and deserves publication. However, I had difficulties to tarck your changes in the text. It is not enough to simply write ok as an answer to the comments of a referee. It is not the the task of a referee

to compare sentence by sentence the privious and the revised text. I also expected to see the text changes marked or, at least, to give precise line numbers were hanges occurred. In a number of cases I was not able to track your changes. I also missed tables and figures attached. I asked the previous referee to comment on your revision and recommend a major revision.

I wondered about your LASSO regression. Standard would be an ACI model selection that allows for model comparisons. LASSO is inevitably subjective due to the predefined cut off value.

Evaluation round #1

DOI or URL of the preprint: https://doi.org/10.1101/2021.09.08.459375
Version of the preprint: 1

Authors' reply, 23 February 2022

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Decision by Werner Ulrich, posted 06 November 2021

Major revision

Dear authors

I have now received two detailed and highly relevant reviews of your submission. Both referees see much value in your work and highlight the quality of the data set. However, both also point to several shortcomings. These regard particulalry the methods section where important information is missing. I agree with thereferees and encourage your to reshape the emthods. I also agree with the referees that the introduction and particulalry the discussion sections are too long and not sufficiently focused.

Both referees make detailed comments and give advice to revise your submissing. Therefore I recommend major revision of this overall interesting piece

Thank you for submitting to PCI Ecology.

Kind regards

Werner Ulrich

Reviewed by anonymous reviewer 1, 18 October 2021

Download the review

Reviewed by anonymous reviewer 2, 28 October 2021

In this contribution, Antonini and colleagues explore the multifunctionality of restored riparian forests in tropical systems following a chronosequence of restoration. They find that the restoration of taxonomic and functional diversity enhance ecosystem multifunctionality measured as litter decomposition, soild fertility and associated metrics. Because biodiversity was the main predictor of multiple ecosystem functions, the main message of the paper is biodiversity restoration is needed to recover ecosystem multifunctionality after restoration.

Overall, I found the main aim of the paper interesting. Little is known of tropical forests compared to other forest systems in contrasted climatic conditions such as temperate or mediteranean forests, and even less is known for the case of restoration efforts in tropical systems. The amount of work done during the sampling procedure with almost 60,000 individuals identified during a single year of sampling is incredible, and speaks

of the high levels of diversity in the system. I found however the article difficult to follow in the methodological part. The authors refer to the appendix in critical points of the sampling methodology, which as I said makes the paper difficult to follow. Moreover, there were many biodiversity compartments measured which are not clear their role for driving different functions. For instance, the role of mammals and tree species in driving soil fertility is clear, as well as, the effect of some invertebrates on driving biomass production. Yet, which is the role of some particular groups such as wasps in driving several functions was less clear and the authors unfortunately do not provide detailed explanations or suggestions that mechanistically link diversity (taxonomic, functional, or phylogenetic) to multifunctionality.

In that sense, given the high number of predictor I think is wise the regular approach the authors did to select those particular variables important to drive different functions, yet some if these effects I think they are not direct but rather indirect through other processes the authors perhaps did not measure. I miss here a structural equation model have observed and latent variables explaining the direct and indirect paths by which multifunctionality is driven by diversity.

Finally, I think the discussion is excesively long with 12 pages. It is unclear to me which is the main message the authors want to give to the reader. I think it would benefit from a more oriented and focused discussion. For instance, it could be explained why particular taxonomic groups have an overwhealming effect on multi-functionality. Another possibility could be to discuss synergies and trade-offs in multiple functions driven by different components of the biodiversity measured.

In sum, the study is very nice showing the importance of complementary aspects of biodiversity to promote multifunctionality in restored ecosystems, but the message is still not well given, which makes the contribution a bit convoluted.