Peer Community In Ecology

Disentangling effects of large herbivores on litter decomposition

Sébastien Barot *based on peer reviews by 2 anonymous reviewers*

Simon Chollet, Morgane Maillard, Juliane Schorghuber, Sue Grayston, Jean-Louis Martin (2019) Deer slow down litter decomposition by reducing litter quality in a temperate forest. Missing preprint_server, ver. Missing article_version, peer-reviewed and recommended by Peer Community in Ecology. 10.1101/690032

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Aboveground – belowground interactions is a fascinating field that has developed in ecology since about 20 years [1]. This field has been very fruitful as measured by the numerous articles published but also by the particular role it has played in the development of soil ecology. While soil ecology has for a long time developed partially independently from "general ecology" [2], the field of aboveground – belowground interactions has shown that all ecological interactions occurring within the soil are likely to impact plant growth and plant physiology because they have their roots within the soil. In turns, this should impact the aerial system of plants (higher or lower biomasses, changes in leaf quality…), which should cascade on the aboveground food web. Conversely, all ecological interactions occurring aboveground likely impact plant growth, which should cascade to their root systems, and thus to the soil functioning and the soil food web (through changes in the emission of exudates or inputs of dead roots…). Basically, plants are linking the belowground and aboveground worlds because, as terrestrial primary producers, they need to have (1) leaves to capture CO2 and exploit light and (2) roots to absorb water and mineral nutrients. The article I presently recommend [3] tackles this general issue through the prism of the impact of large herbivores on the decomposition of leaf litter. This issue is a relatively old one [4, 5] but still deserves efforts because there have been relatively few studies on the subject and because the issue is relatively complex due to the diversity of mechanisms involved and the difficulty to disentangle them. I recommend this article because the authors have cleverly taken advantage of a "natural" long-term experiment, i.e. three islands with contrasted deer densities, to test whether these large mammals are able to impact leaf litter decomposition and whether they are able to do so through changes in litter quality (because they browse the vegetation) or through changes in soil characteristics (either physical or chemical characteristics or the composition of the decomposer community). They have found that deer decrease litter decomposition, mainly through a decrease in litter quality (increase in its C:N ratio). I particularly appreciate

the combination of statistics achieved to test the different hypotheses and the fair and in-depth discussion of the results. I have to confess that I have two small regrets with this work. First, all replications are implemented within the same three islands, so that it cannot be fully excluded that measured effects should not be attributed to any other possible difference between the three islands. I am fairly sure this is not the case (at least because the three islands have the same environments) but I hope that future studies or meta-analyses will be able analyse independent deer density treatments. Second, as a soil ecologist, I am eager to see results on the decomposer communities, both microorganisms and macrofauna, of the three islands.

References:

[1] Hooper, D. U., Bignell, D. E., Brown, V. K., Brussard, L., Dangerfield, J. M., Wall, D. H. and Wolters, V. (2000). Interactions between Aboveground and Belowground Biodiversity in Terrestrial Ecosystems: Patterns, Mechanisms, and Feedbacks. BioScience, 50(12), 1049-1061. doi: [10.1641/0006-3568(2000)050[1049:ibaabb]2.0.co;2](https://dx.doi.org/10.1641/0006-3568(2000)050[1049:ibaabb]2.0.co;2)

[2] Barot, S., Blouin, M., Fontaine, S., Jouquet, P., Lata, J.-C., and Mathieu, J. (2007). A Tale of Four Stories: Soil Ecology, Theory, Evolution and the Publication System. PLOS ONE, 2(11), e1248. doi: [10.1371/journal.pone.0001248](https://dx.doi.org/10.1371/journal.pone.0001248)

[3] Chollet S., Maillard M., Schörghuber J., Grayston S. and Martin J.-L. (2019). Deer slow down litter decomposition by reducing litter quality in a temperate forest. bioRxiv, 690032, ver. 3 peer-reviewed and recommended by PCI Ecology. doi: [10.1101/690032](https://dx.doi.org/10.1101/690032)

[4] Wardle, D. A., Barker, G. M., Yeates, G. W., Bonner, K. I., and Ghani, A. (2001). Introduced browsing mammals in New Zealand natural forests: aboveground and belowground consequences. Ecological Monographs, 71(4), 587-614. doi: [10.1890/0012-9615(2001)071[0587:ibminz]2.0.co;2](https://dx.doi.org/10.1890/0012-9615(2001)071[0587:ibminz]2.0.co;2)

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Reviews

Evaluation round #1

DOI or URL of the preprint: https://doi.org/10.1101/690032

Authors' reply, 30 September 2019

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Decision by Sébastien Barot, posted 02 September 2019

Interesting manuscipt requiring clarifications

After reading carefully your manuscript and the reviewers' comments I concur with them to think that the manuscript is interesting and timely but that some improvements and explanations are required before its formal recommendation.

In particular, I have had difficulties to fully understand the design of the second experiment. I think this is because the “formula” line 186-187 is confusing to me (I do not manage to find the same number of litter bags by plot). Similarly it is not fully clear to me whether the feces and leaf litter are in the same bags or not. Moreover, the hypotheses behind this experiment are not clear to me and are not fully explained. As mentioned by the reviewer, the feces are likely to have an overall low impact on the overall litter dynamics due to the relative abundance of feces and tree litter?

I have also some questions about the statistics. Somehow, I am missing ANOVA tables, with comprehensive stat results (for experiment 1, effect of litter source, decomposition place and all interactions). The effect of the mesh size is nearly never mentioned. In some cases, it is even not clear whether it has been tested. The figures mention post-hoc tests but I am not sure the ”name of this test” is ever mentioned. I am confident that the method to test for the home field advantage is suitable, but slightly more explanations should be given on this method (why not testing the interaction between provenance and decomposition location and testing the hypothesis using the suitable contrast?). Fig. 1 describes the plant communities, but could the differences ben tested using a “between analysis”?

As the reviewers, I find the use of “ C and N loss” confusing. Indeed, these are losses from the litter bags but not necessarily from the ecosystem. Ideally, to describe the impact of herbivores on soil and ecosystem functioning it would be important to assess the proportion of the C and N removed from the litter bags that is still in the soil and the proportion that is in the atmosphere (OK I know this is very difficult to achieve).

Reviewed by anonymous reviewer 1, 02 September 2019

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Reviewed by anonymous reviewer 2, 07 August 2019

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