Review PCI Ecology

Large herbivores strongly slow down litter decomposition in temperate forests by Chollet et al.

Using a 1-yr long litterbag transplant experiment in three islands of the Haida Gwaii archipelago capturing a range of deer density/history, this paper addresses the question of top-down controls of large herbivores on ecosystems, and more specifically whether and how much deer density/presence affects litter decomposition directly and/or indirectly in temperate forests. The main result of this work is that deer population density affects C and N loss from litter decomposition primarily through plant community changes, and secondary by changing abiotic soil conditions and decomposers community ability, or through feces deposition. I particularly appreciated the demonstration of the key role of the soil macrofauna in changing the HFA results.

Yet, as they are presented in the ms, **the results do not fully or clearly support all the conclusions**. As you will see in my detailed comments underneath, I first worry that the **sampling design might be limiting** the reach of the conclusions with **only one sampling event** after one year of decomposition. Second, the **standard litter** used in Exp.#2 was probably not adequately chosen. Third, the patchiness of the dung/urine might explain why they had no effect on global decomposer ability, but this questions the **sampling intensity** (# of litter bags deployed) and its capacity to capture the microclimatic, topographic and biochemical heterogeneity of these browsed islands (strong and intermediate).

Finally, even if the data is there, **the message and the conclusions are still blurred by too many inaccuracies**. Underneath, I tried to identify them and give suggestions to solve these. For instance, one issue comes from the confusion throughout the ms about "litter quality" which refers at least to two different variables (CWM litter C:N and litter quality calculated using the Decomposer Ability Regression Test proposed by Keiser et al. (2014)).

I recommend revisions.

TITLE

"strongly" sounds a little vague, I would recommend to be more specific or to remove it.

"Temperate forests" sounds global while the study only took place in 3 islands in BC.

ABSTRACT

L32 What does "latter" stand s for? Changing decomposer communities?

L33 Specify that this is C and N loss from litter decomposition

INTRODUCTION

This section is well written, based on recent literature and is convincing.

L74-88 : You introduce the concepts of ability, litter quality and HFA, I suggest you mention the Keiser et al. paper as it is pivotal in your demonstration.

L89-94 This section deserves to be elaborated. There are many direct and indirect (including through vegetation changes) herbivory effects on soil microbial communities and functioning, and it is unclear what you mean by "development and functioning of decomposers communities".

L106 Do we have information on how Sitka black-tailed deer diet and homeostasis compare to other ungulates? This could help to extrapolate the results.

L119 I am **not sure "mechanisms" were actually assessed** in this study or please cite which mechanisms were actually measured.

L123 Although the objectives are clearly stated **hypothesis are missing** here unless it is ok with PCI Ecology specifications.

M & M

L153 It would be useful to see this data (at least in Supp Mat.) and how species were distributed in PF groups as in Fig.1A.

L157 Unclear. 33 plant species were collected on each island or total? What are the main species? Are they all covering more than 5% of each plot area as mentioned L168?

Because the experiment takes place in a forest I assume woody species are included in the litter bags, and that raises the question of the **proportion of hard vs. soft litter material** in each plot/litter bag? In other words did you control for the twigs quantity which might influence decomposition rates a lot?

Did you control for soil (C, N, and mass) contamination of the litter bags? And how?

L176-177 I suggest to group this sentence with the ones L188-190.

L188 **Only one sampling time? So we have no idea of the dynamic of the decomposition process and the decay curve cannot be describes with confidence, neither the decomposition rate constant k can be estimated adequately. To me, <u>this is a major limitation of this work</u>. If not, then you should argue in the manuscript why this is fine. Usually, 3 to 6 collections by season are needed during the first year of decomposition.**

L191 In this section there is no mention of litter mass loss measurement.

L198 You need to explain why you measure C and N on small mesh bags only.

L206-214 If I am correct it means n=1 composite sample for pH, OM depth and C/N for each plot. I assume this the reason why no linear regression was tested with this data set.

L217 You mean "(CWM) <u>initial</u> litter C:N ratio"

RESULTS

L251 At it stands, it is impossible to get a grasp of the diversity change (shrub, bryophytes or else) between "deer herbivory" plots with Fig.1A alone. Could you add a table in the Sup.Mat. ?

L254 You mean the <u>initial CWM litter</u> CN ratio right?

Fig.1A vs. Fig 1B: so although plant species composition differed with deer browsing level, the CWM litter quality (C:N) was no different.

L256-258 Nope, Soil pH does not significantly decrease according to Fig. 1D.

L274-275 How did you calculate the 12% and 30%?

L281 Are these 5% significant? And how did you calculate that figure?

Fig.2 and Fig. S2: It would really help the reader if all panels (Ability, Litter Quality) had a different letter than HFA. I suggest A, B, C, D and E, F, G, H.

L291 Not a word on the Litter Quality diagram for N Loss?

L306 Specify "<u>Litter</u> carbon and nitrogen loss…" "…to the <u>initial</u> C:N ratio…"

L307-308: "…<u>litter</u> C:N CWM…"

L319-322: You mean Fig. S2A and S2C (not Table S2).

L322-323: Please refer to Fig. S2B

L325: Is it really FigS2D here? I would use Fig. S2C instead. Again how did you calculate the 25% decrease? Not a word on Litter quality diagrams?

L329-330 **How 31% and 47% compare to 24% and 32% respectively on L447? I am lost.**

L332-335: You mean <u>significantly.</u> I suggest you replace p= 7.89e^{-08} by p<0.001 here and in the whole paper.

L337: Fig S3 **B**

L338: Fig. S**3D. Is it significant/true for all islands? Based on the error bars, it seems to me that there is not much improvement at least for Strong and Intermediate**.

DISCUSSION

L350. What about Bryant et al. 1989, Du Toit 2003, Fornara & du Toit 2007, 2008…?

L353. Could you add references of some review papers for instance to support this statement?

L356. But on Fig. 1B there are no CWN **initial** litter C:N differences between islands which suggest no initial litter quality differences due to herbivores.

L359 This sentence is really confusing. **Where are these % coming from?** Is it from Fig.2B and D (because you talk about litter quality, and C and N loss)?

L361. Based on Fig. 3, there is no much initial litter quality (C:N based) control on litter C loss (<10%).

L365 or from L373 to 383. Again, **I am not convinced there is such a "dramatic" change in litter quality (CWM C:N based) when looking at Fig.1**. Yet, from L379 to L383, litter quality is the one on

Fig. 2B and D and indeed shows significant differences between browsing treatments. My interpretation is that browsing indeed changes plant community composition but not CWM litter C:N (Fig. 1). Therefore, it suggests that the browsing effect that you observe on litter decomposition might be related to other litter traits such as lignin or polyphenol contents, or any other litter quality parameters that you suggest in the discussion but are missing in your study. **You should make this crystal clear for the reader to limit any confusion, maybe by referring to the figure in the discussion.**

L389 decomposability and decomposition are different things. Here you measured decomposition.

L392-395 As you say, the intermediate treatment CWM initial litter C:N was not different than the others on Fig. 1B. I like the suggestion that N mineralization was limited in intermediate treatment by the highest initial CWM litter C:N. I wonder also **how much the increased patchiness of the browsing/pooing effects mentioned L454 in the intermediate treatment (compared to no or strong browsing) could participate to this apparent heterogeneity in C:N and N mineralization**.

L400 Specify you mean "litter quality" from Keiser et al. 2014.

L403 Based on Fig 2B I agree with this statement. Yet, I wonder if the 5% difference mentioned L281 are related to it or not?

L408 pH is not different among the treatments (see Fig. 1D).

L408-412 You could use some references here to support your explanation on F:B /vegetation change/deer browsing relationships. So, Ca and Mg litter contents would be nice to measure as possible explanatory litter traits of deer browsing effect on decomposition.

L421 **is this statement supported by Fig. 4D? If so, it is necessary to add statistics on the inter-treatment effect (e.g. between sites difference).**

I am not totally convinced by the experiment #2 . You used *P. sitchensis* as a standard litter but you showed that coniferous were selected/favored by deer browsing, so one could expect that Intermediate and Strong decomposer communities are also selected to decompose this litter.

There is also the question on how to relate data/results from pure litter (Exp.#2) vs. litter mixture (Exp#1)?

L423-424 …inclusion of the …fauna <u>during</u> litter decomposition affected litter <u>mass loss</u> at the community …". **You did not calculate/show decomposition rates (k values)**, and Fig. S2 shows only % mass loss after one year of decomposition.

L426 Could you elaborate on these negative effect(s)? What mechanisms? Direct or indirect?

L435 Fig.**S3B** not S2

 L445-446 I would use "larger proportion of N" rather than "more nitrogen". **Even though dung and urine are probably more N concentrated than litter, litter quantities are way higher than dung and urine deposits, which implies that there is probably more N released by litter at the ecosystem/Island scale.**

L447 These figures do not match with the ones L329-330.

L449-50 Ability? Is it related to Fig.4C and D, or Fig. 2B and C ?

L452 "Changes" in what direction?

L453-457 Although I agree that the patchiness of the dung/urine distribution might explain the absence of high quality litter deposit effects on global decomposer ability, **I wonder how much this statement questions the sampling intensity (# of litter bags deployed) and its capacity to capture the microclimatic, topographic and biochemical heterogeneity of these browsed islands.**