

Dear PCI Ecology team,

We thank you and reviewers for constructive criticism on our manuscript “INSECT HERBIVORY ON URBAN TREES: COMPLEMENTARY EFFECTS OF TREE NEIGHBOURS AND PREDATION” and are pleased to return to you a revised and improved version.

We carefully responded to each comment from the revision. In the response letter below, we provide a detailed explanation of the changes made and each change is highlighted in blue font in the manuscript.

Sincerely yours,
Alex Stemmelen

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Ian Pearce

L60: Perhaps ‘study’, as ‘experiment’ tends to imply manipulations of some sort, which is not the case here.

We changed the text accordingly.

L90: What predatory arthropods attack these models? This would seem like quite a feat (and act of deception), and I am surprised that this happens. Do mammals, rodents, etc, attack the models?

It is hard to know exactly the identity of arthropods attacking these models. Previous studies described marks on the plasticine surface that are typical of spiders, ants and parasitoids wasps. Other studies found (*very rarely*) mark of attack by rodents and lizards (*Howe, Lövei, Nachman 2009; Ferrante et al. 2009*).

107: whom -> who

We changed the text accordingly.

L120 This also means that you cannot really interpret results based on one or the other of these factors (because you are explicitly saying that they measure the same thing), which is currently done in the discussion and abstract, which attributes herbivory to tree diversity and attack rates to tree density.

We agree. We changed the way we analyzed the data and used information theoretic approaches and model averaging to select the best model that would not include both tree density and tree diversity, as both hypotheses (effect of tree density or tree diversity on herbivory) seem plausible.

With only 5 tree species, it is unclear whether including it as a random effect (RE) makes more sense than a fixed effect. The typical cutoff is more like 15 in order to estimate variance of a RE. It probably makes little difference for the analysis though, as tree species seems to explain little variance anyhow.

Agreed, we chose to include tree species as a random factor because we were not primarily interested in the effect of the species of the focal tree on herbivory, and because the number of tree replicates was low and unbalanced across species. Yet we still wanted to know how much of the variation was explained by this parameter. We also agree that it would make little difference in the analysis and we kept it as a random factor for now.

In the intro, the resource concentration hypothesis is introduced. I think it could make sense to analyze the data with reference to the density of the same tree species within the neighborhood of the focal tree. (i.e. how many sugar maples were near to a focal sugar maple). We do not really know

the host breadth of insects causing damage in this study (or the feeding tendency of birds with reference to tree species), but it seems reasonable to think of the same tree species as a 'host' for an individual herbivore. There is some evidence for an effect of density of conspecifics in urban settings, such as with gall wasp diversity (Herrmann et al 2012 Landscape and Urban Planning), although that study was with some really specialized herbivores.

Agreed. We include the number of conspecific trees in a 20m radius around each tree as a fixed explanatory variable, but it turned out it was non informative.

I might recommend presenting the herbivory results before the predation rates results. The predation results are more interesting in general, but I think they become even more interesting when we see that herbivory varies in predictable ways.

We agree, we changed the results accordingly.

L177: The problem is that you say that you show in the methods that you cannot distinguish between these two things.

We took care of this issue by modifying the data analysis.

L187 and elsewhere. don't need Hervé's first name or initial.

We changed the text accordingly.

What is the evidence for how birds feed on herbivores of differing densities? This would be an alternate explanation to the causal predation -> (-) herbivory link. It could be that herbivore density -> (-) predators if birds are, say territorial and attack a lower percentage of herbivores when those herbivores are abundant. Is there any consensus as to how birds feed based on prey density?

This is a very interesting, yet unsolved question (to the best of our knowledge). We did not have prior information on real herbivore density in study sites so that we did not have any mean to tell whether we brought a significant amount of alternative (fake) prey or not. That would be a very interesting question to investigate. With such uncertainty, we carefully discussed the correlation between predation attempts on fake prey and herbivory.

It is interesting that there is little effect of tree identity in the study, particularly considering that tree architecture (Nell and Mooney studies) and defenses (Singer and Mooney studies) can modulate attack rates of caterpillars by birds.

We add a paragraph on this matter in the discussion.

Freerk Molleman

This is a useful contribution to the field. Especially the inclusion of predation data makes the study interesting. I am more interested in the community ecology than in the urban application.

The abstract starts with a long introduction about urban trees, while the introduction starts with the basic science to then go to urban trees, and the discussion doesn't deal with things that are different in urban environment such as pollution and temperature.

Why would there be a difference between abstract and introduction (intro approach better for me), and why would natural systems differ from urban one's. This is not explained. May be you can point out that parks and other urban trees are almost all planted so they are like common garden experiments ready for use by biologists. Notably, tree density is often low in parks. Then of course there is also a practical interest, but I doubt such considerations will often be used in urban planning and park design.

Indeed, the abstract was changed to be more similar to the introduction part. We added a part to the introduction where we mentioned some difference between natural system and urban one.

The study found that higher tree density was correlated with higher predation rates. This was the

most clear-cut effect, but did not make it to the title. High tree diversity and higher predation rates both correlated with less leaf damage. Perhaps there is a mechanistic link that higher tree diversity increases predation rate which decreases herbivory. Collinearity may be avoided by using residuals to tease this apart further?

Reviewer 1 also had remarks on the statistical approach we used to analyse the data. Following his suggestion, we added a new predictor in the models. The original effect of tree density on predation was no more informative in the updated modeling approach.

The title suggests that the study is about the neighbouring trees, but in fact it is about diversity in a 20m radius. This is a different matter. The finding may not be conclusive, but it is tantalizing. I suggest a further analysis. Identity of neighbouring trees may be important, especially the % of neighbouring trees that are of same species or of closely related species (congeners). Other studies have looked at neighbourhoods in this way. With this analysis, the title would become true.

We agree. We included the number of conspecific tree in a 20m radius around each focal tree as a fixed explanatory variable. The results did not change.

The authors made a methodological mistake that is not fatal, but does need to be mentioned in the discussion. It is wrong to expose dummies at the same spot for extended periods of time. Birds can quickly learn to avoid dummies this way. If dummies were observed intermittently, a decrease in attack rate over time would probably be evident. It is still possible to compare among trees in this set-up. The seasonal part is more difficult to interpret quantitatively.

Indeed, there was an effect of the season, with less predation during the second survey than during the first one, which could be attributed to the birds learning to avoid dummies. We mentioned it in the discussion part. However, dummy caterpillars were removed at the end of the first survey, and re-installed a couple of weeks later, partly by different field workers, on different branches. Although this does not completely solve the problem that birds may have learned that plasticine does not taste good, it kinds of attenuates the matter.

Denser tree cover also means more concentrated resources (insects) for insectivores. An expectable functional response seem to happen here: higher predation rate when trees are planted more densely. A similar functional response may explain predation rate in spring vs summer. Please look for other dummy studies that use longer time spans.

Was there an effect of tree species on predation rate? Species with more leaf damage may get higher predation rates. Please strengthen the discussion on these points.

We added a paragraph on this matter in the discussion.

Line 107: So leaves were photographs, scanned, collected for later assessment of damage?

Leaves were collected on the field and brought back to the lab the same day for visual damage assessment. They were neither scanned nor photographed.

Instead of 'target tree' I would use 'focal tree'.

We changed the text accordingly.