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# Pest damage in mixed forests: disentangling the effects of neighbour identity, host density and host apparency at different spatial scales

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## Abstract

Mixed forests are thought to be less prone to pest insect damage than monocultures. This may result from reduced host availability (i.e. density effect) or from non-host trees reducing host apparency (i.e. associational resistance). Associational and density effects are often confounded in mixed forests. We aimed to disentangle their relative importance on attacks of pine trees by a specialist pest, the pine processionary moth (PPM, *Thaumetopoea pityocampa*).

We assessed pine infestation by PPM by counting the number of winter nests for four consecutive years along an experimental gradient of tree species diversity.

The composition of tree species assemblages determined the balance between associational resistance and density effects. The rate of PPM attacks decreased with pine density, especially in mixtures with slow growing species, corresponding to a dilution effect. The presence of fast growing species counterbalanced the effects of pine density by providing associational resistance via reduced pine apparency, whenever fast growing species were planted within pine plots or in adjacent plots.

After four years, the overall effect of tree diversity shifted from less to more damage in mixtures as compared to monocultures. This likely resulted associational resistance tending to fade with time as pines became taller than all other associated species, making density effects preeminent.

Our findings suggest that mixing tree species to trigger resistance to pest insects requires taking into account the relative growth rate of associated species together with the relative proportion of focal and associated species, both within and between stands.

**Keywords:** associational resistance, biodiversity, insect herbivory, resource dilution hypothesis, *Thaumetopoea pityocampa*, TreeDivNet, tree growth

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