

## **Ant mosaics in Bornean primary rain forest high canopy depend on spatial scale, time of day, and sampling method**

### **ABSTRACT**

Background. Competitive interactions in biological communities can be thought of as giving rise to “assembly rules” that dictate the species that are able to co-exist. Ant communities in tropical canopies often display a particular pattern, an “ant mosaic”, in which competition between dominant ant species results in a patchwork of mutually exclusive territories. Although ant mosaics have been well-documented in plantation landscapes, their presence in pristine tropical forests remained contentious until recently. Here we assess presence of ant mosaics in a hitherto under-investigated forest stratum, the emergent trees of the high canopy in primary tropical rain forest, and explore how the strength of any ant mosaics is affected by spatial scale, time of day, and sampling method. Methods. To test whether these factors might impact the detection of ant mosaics in pristine habitats, we sampled ant communities from emergent trees, which rise above the highest canopy layers in lowland dipterocarp rain forests in North Borneo (38.8– 60.2 m), using both baiting and insecticide fogging. Critically, we restricted sampling to only the canopy of each focal tree. For baiting, we carried out sampling during both the day and the night. We used null models of species co-occurrence to assess patterns of segregation at within-tree and between-tree scales. Results. The numerically dominant ant species on the emergent trees sampled formed a diverse community, with differences in the identity of dominant species between times of day and sampling methods. Between trees, we found patterns of ant species segregation consistent with the existence of ant mosaics using both methods. Within trees, fogged ants were segregated, while baited ants were segregated only at night. Discussion. We conclude that ant mosaics are present within the emergent trees of the high canopy of tropical rain forest in Malaysian Borneo, and that sampling technique, spatial scale, and time of day interact to determine observed patterns of segregation. Restricting sampling to only emergent trees reveals segregatory patterns not observed in ground-based studies, confirming previous observations of stronger segregation with increasing height in the canopy.