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Localised climate change defines ant communities in human-modified tropical landscapes

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Tropical ectotherms, such as insects, are expected to be particularly sensitive to climate change as they may already live close to their upper thermal tolerances. In tropical forest landscapes microclimates are buffered by the tree canopy, and temperatures can be rapidly altered following logging and land-use change, which removes trees and allows sunlight to penetrate towards the forest floor. This represents a powerful and understudied form of localised climate change, which could have implications for tropical forest insects, such as ants, and the functions they perform.

While it has been suggested for some time that altered microclimates - arising because of human disturbance - lead to changes in the composition of ants and other insects, the empirical evidence for this is lacking. Our paper addresses this knowledge gap, by drawing together fine scale data on microclimates, ant communities and organismal physiologies to show that localised climate change defines the structure and activity of ant communities. This is the first such study to clearly demonstrate this effect in disturbed topical forest landscapes.

Our research shows that the observed changes to ant communities between primary forests, logged forests and oil palm plantations can be explained by a relationship between the local temperature and the physiology of the ant genera. Ants with high thermal tolerances have higher abundance and increased functional activity in modified, hotter habitats than in unmodified, cooler habitats; and conversely ants with low thermal tolerance have lower abundance and decreased functional activity in modified, hotter habitats than in unmodified, cooler habitats.

These findings show that localised climate change effects brought about by human activity are already leaving their mark on communities of abundant and functionally powerful tropical organisms. This improves our understanding of how these globally important ecosystems may function in a warmer future.