Localised climate change defines ant communities in humanmodified tropical landscapes

ABSTRACT

1. Logging and habitat conversion create hotter microclimates in tropical forest landscapes, representing a powerful form of localised anthropogenic climate change. It is widely believed that these emergent conditions are responsible for driving changes in communities of organisms found in modified tropical forests, although the empirical evidence base for this is lacking.

2. Here we investigated how interactions between the physiological traits of genera and the environmental temperatures they experience lead to functional and compositional changes in communities of ants, a key organism in tropical forest ecosystems.

3. We found that the abundance and activity of ant genera along a gradient of forest disturbance in Sabah, Malaysian Borneo, was defined by an interaction between their thermal tolerance (CTmax) and environmental temperature. In more disturbed, warmer habitats, genera with high CTmax had increased relative abundance and functional activity, and those with low CTmax had decreased relative abundance and functional activity.

4. This interaction determined abundance changes between primary and logged forest that differed in daily maximum temperature by a modest 1.1°C, and strengthened as the change in microclimate increased with disturbance. Between habitats that differed by 5.6°C (primary forest to oil palm) and 4.5°C (logged forest to oil palm), a 1°C difference in CTmax among genera led to a 23% and 16% change inrelative abundance, and a 22% and 17% difference in functional activity. CTmax was negatively correlated with body size and trophic position, with ants becoming significantly smaller and less predatory as microclimate temperatures increased.

5. Our results provide evidence to support the widely held, but never directly tested, assumption that physiological tolerances underpin the influence of disturbanceinduced microclimate change on the abundance and function of invertebrates in tropical landscapes.