Ant and termite assemblages along a tropical forest disturbance gradient in Sabah, Malaysia: potential changes in ecosystem function with diversity loss

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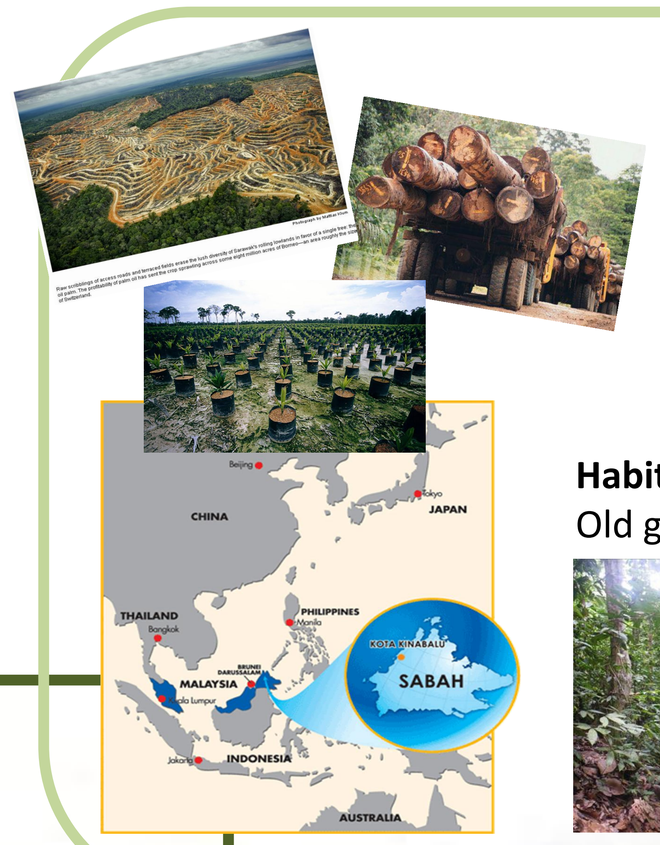
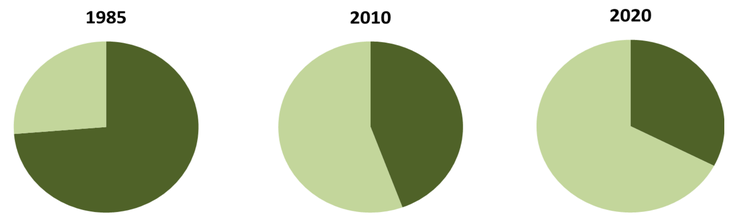
Background

Borneo is a 'hotspot' – highly diverse but hugely threatened, with over 250000 ha of forest logged each year in Malaysia alone (1). Secondary forest and oil palm are increasing across landscapes, but their value for biodiversity is largely unknown.

Ants and termites dominate tropical ecosystems and are fundamental to ecosystem services such as decomposition, nutrient cycling and carbon processing.



Forest cover in Borneo: Past and future
Dark green = forested; Light green = deforested
(Adapted from WWF 2005, mongabay.com)



Habitat disturbance gradient:

Old growth | Secondary logged | Oil palm plantation

Questions

What are the effects of habitat disturbance on biodiversity and ecosystem function?

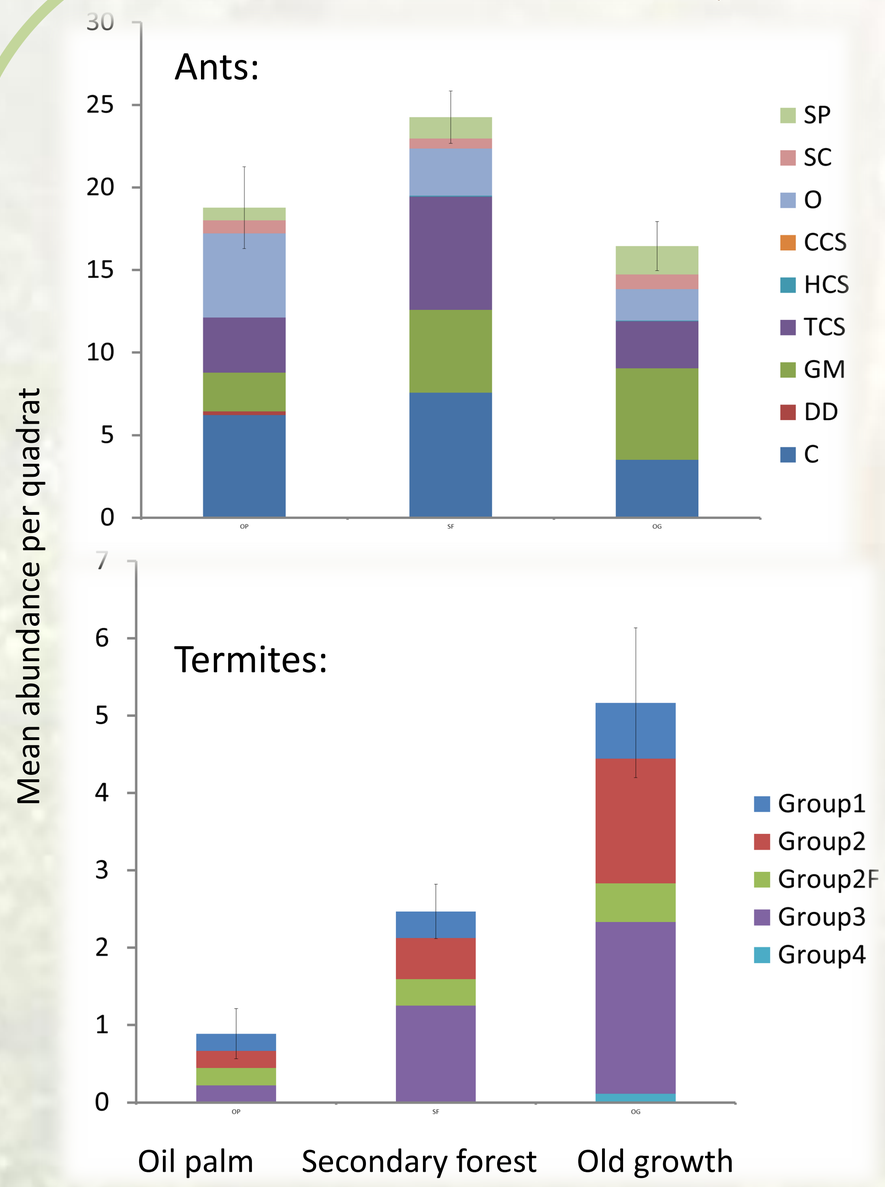
Specifically…

How does habitat disturbance affect ant and termite functional groups?

Methods

- Ants and termites were sampled from dead wood and soil in quadrats at 59 old growth, logged secondary forest and oil palm sites.
- At each quadrat environmental variables were measured to characterise soil type, vegetation, exposure and forest quality.
- Ants and termites were classified to genus and to functional group (2,3).
- Number of occurrences per quadrat was used as a measure of abundance.

Results

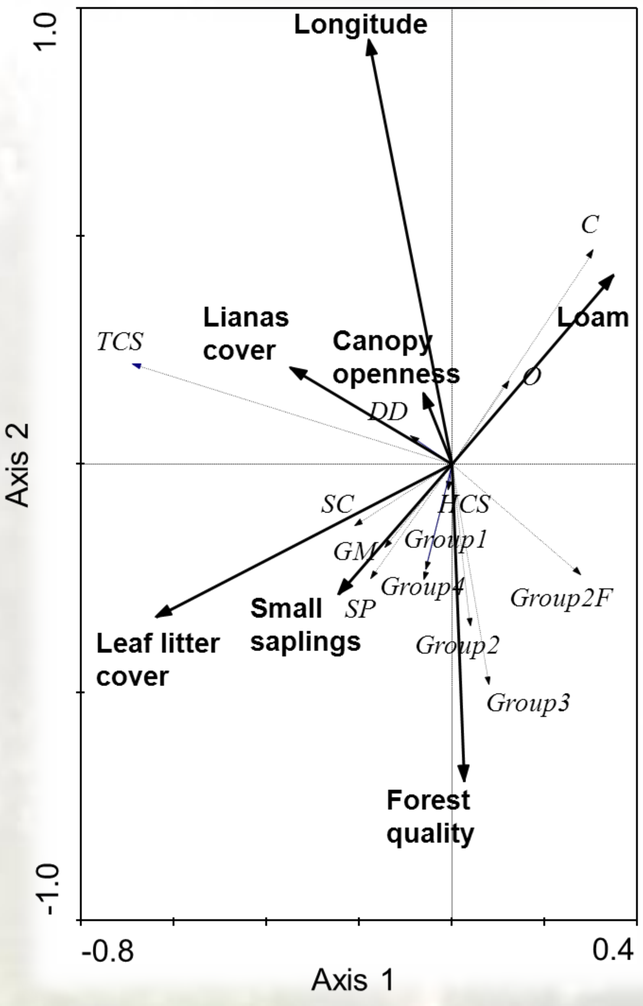


Bar graphs (left):

- Termite abundance declined strongly with disturbance.
- Group 4 soil feeders were only found in old growth forest, whilst more sclerotised wood-feeders (Group 1) were better adapted to living in oil palm.
- Ants were less affected by disturbance than termites but there were changes in relative abundance of functional groups along the disturbance gradient.
- DD ants were only found in oil palm whilst GM ants were much more abundant in old growth forest.

Community ordination analysis (right):

- Termite assemblages were strongly structured by disturbance.
- Ant assemblages were less strongly affected by disturbance and ants were much more variable in their responses to environmental conditions.



Ant functional groups based on behaviour, dominance and feeding strategy: **DD**- dominant Dolichoderinae; **SC**- subordinate Camponotini; **TCS**- tropical climate specialists; **HCS**- hot climate specialists; **C**- cryptic species; **O**- opportunists; **GM**- generalised Myrmicines; **SP**- specialist predators (2).
Termite functional groups based on feeding strategy: Group 1- feed on dead wood and grass; **Group 2-** grass, dead wood and leaf litter; **Group 2F-** grass, dead wood and leaf litter with the help of fungal symbionts; **Group 3-** organic rich upper soil layers; **Group 4-** 'true soil feeders'- organically poor soil (3).

Conclusions and implications

- Ant and termite functional group assemblages shifted with habitat disturbance and variation in environmental conditions.
- Given the importance of ants and termites in tropical forest ecosystems , these shifts are likely to alter ecosystem functions, with unknown consequences for biodiversity.

References
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Sabah map taken from http://www.bitfkk.com.my/entry.cfm. Oil palm nursery picture taken from http://climatelab.org/Impacts_of_Biofuels. Oil palm aerial view taken from http://ngm.nationalgeographic.com/2008/11/borneo/klum-photography. Logging picture taken from www.life.com. Ant pictures taken from www.dphotojournal.com and www.petsfoto.com. Termite picture taken from www.authenticpest.com.au.

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