

Invertebrate activity data from an experiment in Malaysian Borneo, 2014-16 [HMTF]
(2017) Griffiths, H.M., Ashton, L.A., Walker, A.E., Hasan, R., Evans, T., Eggleton, P., Parr, C.L.

Overview of data

The "AntMonitoringData.csv" document is a time series dataset of ant abundance at bait monitoring cards, recorded every two weeks for over two years from December 2014 to March 2017. The "NonAntInvertebrate.csv" document is a time series dataset of non-ant invertebrate abundance at bait monitoring cards, recorded every two weeks for two years from December 2014 to December 2016. The "PercentageBaitRemovedData.csv" document is the amount of food resource removed from experimental plots when ants or vertebrates were prevented from accessing the resource. It was collected in September and October 2016.

Experimental design/Sampling regime

This study was carried out within an area of lowland, old growth dipterocarp rainforest in the Maliau Basin Conservation Area, Sabah, Malaysia (4° 44' 35" to 55" N and 116° 58' 10" to 30" E; mean annual rainfall 2838 mm ± 93 mm). In October 2014, we established eight experimental plots within a 42-ha area, each measuring 50 x 50 m, with an additional buffer zone of 15 m surrounding treatment plots; sampling was confined to the central 50 x 50 m on treatment plots. Four plots were allocated as control and four as ant suppression plots, each separated by at least 100 m. We applied two poison bait types to the ant suppression plots: Synergy Pro® (active ingredients: hydramethylnon and pyriproxyfen) and a custom bait, which consisted of Whiskas® cat food soaked in a sugar solution (60g/L sugar in water) containing Imidacloprid at a concentration of 110ppm. To maintain the ant suppression treatment, while avoiding the application of excessive amounts of insecticides, we applied an integrated pest management approach.

Data Collection Methods

"AntMonitoringData.csv" and "NonAntInvertebrate.csv" methods: Ant and non-ant invertebrate activity were assessed every two weeks using monitoring baits. On two, 50 m transects in the centre of the plots, we placed 0.3g Whiskas® cat food onto 20, 5 x 5 cm laminated cards, each separated by 5 m. These were left undisturbed for one hour, after which they were checked and the numbers of ants and non-ant invertebrates was recorded. It was not possible to accurately count the exact numbers of ants in the field, so instead,

following Parr *et al.* (2016) we estimated numbers using a ranked 1-6 scale (0 = 0 ants; 1 = 1 ant; 2 = 2-5 ants; 3 = 6-10 ants; 4 = 11-20 ants; 5 = 21-50 ants; 6 = >50 ants). Non-ant invertebrates were visually categorised to major group and abundance recorded: wasp (Hymenoptera), cricket (Orthoptera), fly (Diptera), springtail (Collembola), beetle (Coleoptera), cockroach (Blattodea), spider (Araneae) and harvestman (Opiliones).

“PercentageBaitRemovedData.csv” methods: During September and October 2016, we established 30 bait removal stations (15 open and 15 caged) within the core 50 x 50 m sampling area of each experimental plot. At each station, food resources were placed in an open petri-dish (6 cm width; 1.5 cm depth) either directly onto the forest floor (open treatment) or within a 20 x 20 x 20 cm metal mesh cage (caged treatment: Appendix S2 for photograph examples of caged and open treatments). The mesh-size (1 x 1 cm) of the cages ensured no vertebrates could access the baits within the caged treatment, but did not inhibit the access of the majority of invertebrates. Three bait types were used: 3.05g (\pm 0.02g) of dried carbohydrate bait (biscuit); 3.04g (\pm 0.02g) of dried seed bait (sunflower seed); and 1.08g (\pm 0.01g) of dried protein bait (fish; a smaller amount of protein bait was used because it was less dense and thus occupied a larger volume than the other bait types). The bait types were selected to mimic the foraging resources available in the natural system such as sugar rich fruits and nectar, seeds and dead animal bodies and therefore attract as wide a diversity of foraging organisms as possible. We therefore used food resources that were carbohydrate, protein, or seed, and importantly, selected resources that we could easily measure the amount removed. Using bait assays in this way is a standard approach in ant ecology (e.g. Fayle *et al.* 2011; Kaspari *et al.* 2012; Houadria *et al.* 2016). Baits were dried at 50°C for 2 days to a constant mass (assessed using a Ohaus™ balance, 0.01g precision) before placement in the field. Resource removal stations were separated by 5 m and each bait type (carbohydrate/seed/biscuit) x treatment (caged/open) was randomly placed on three, 50 m transects. Each transect was separated by 10 m. In each plot, bait type was replicated five times per treatment (total baits, n = 30 per plot) and this was repeated temporally on 2 different days (total n = 60 per plot, total n = 480. Both caged and open treatments were put onto the forest floor between 09:00 and 11:00 and protected from the rain by a plastic cover. After 24 hours all baits were collected, transported to the laboratory, dried again at 50°C to constant mass and weighed.

We collected these data, we quantified the contribution of ants, other invertebrates and vertebrates to assess the roles that the different groups play in ecosystem function, and the capacity for functional redundancy within and between these groups.

A L Walker and F Hasan were responsible for data collection; H M Griffiths, L A Ashton, P Eggleton and C L Parr were responsible for interpretation.

Bearded pigs (*Sus barbatus*) destroyed a total of 103 bait stations; these were removed from the dataset.

Details of data structure

Three comma separated values files are supplied, as described below:

Nature and Units of recorded values:

Colum headings - AntMonitoringData.csv

- Date: The date that the monitoring was carried out.
- Plot: The experimental plot that the data were collected from.
- Treatment: The experimental treatment that was applied to the plot, A = ant suppression plot; C = Control.
- Score: The score used to estimate the numbers of ants observed on the bait cards (0 = 0 ants; 1 = 1 ant; 2 = 2-5 ants; 3 = 6-10 ants; 4 = 11-20 ants; 5 = 21-50 ants; 6 = >50 ants).

Colum headings – NonAntInvertebrateData.csv

- Date: The date that the monitoring was carried out.
- Plot: The experimental plot that the data were collected from.
- Treatment: The experimental treatment that was applied to the plot, A = ant suppression plot; C = Control.
- Wasp, Cricket, Fly, Springtail, Beetle, Cockroach, Spider, Harvestman: The numbers of each of these organisms that were observed at the monitoring bait cards.
- Sum: The total number of non-ant invertebrates observed at the bait cards.

Colum headings – PercentagebaitRemoved.csv

- Date put out: The date that the bait was placed in the field
- Date collected: The date that the bait was collected from the field
- rep: The replicate number of the bait
- plot: The experimental plot that the data were collected from.
- plot treat: The experimental treatment that was applied to the plot, A = ant suppression plot; C = Control.
- bait: the type of bait that was placed in the field

- cage_treat: whether or not the bait was placed inside a cage (vertebrate exclusion) or was open, placed directly onto the forest floor.
- start_weight: the dry weight of the bait that was placed in the forest
- end_weight: the dry weight of the bait that was removed from the forest
- perc_gone: the percentage of bait that was removed during the 24 hours in the field.