RESEARCH

ANTS AS BIO-INDICATORS OF DISTURBANCE IN URBAN BUSH – SUMMARY OF A CASE STUDY

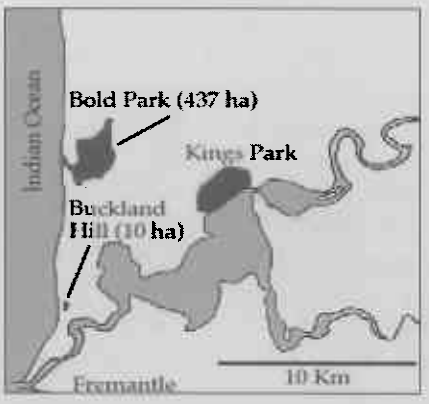
Pierre-Ulric Achour

NATURE enthusiasts spending some time in the field anywhere in Australia will undoubtedly have fascinating (yet sometimes painful) personal experience with ants.

Ants are recognized as numerically and ecologically dominant organisms in terrestrial ecosystems over a major portion of the planet. The group has probably been in this important position for over 50 million years! To date, over 300 genera and 15 000 species of ants have been described worldwide, and these numbers are still increasing as research continues. 103 genera and 1275 species and subspecies have been described in Australia alone. The biodiversity of the Formicidae family is a reflection of the incredible pattern of adaptive radiation which characterizes the group's evolutionary history.

Members of this large insect family occupy pivotal positions in many aspects of terrestrial ecology, and affect their physical and biotic environments profoundly. By facilitating the cycling of nutrients, interacting with flora and fauna and moderating physical conditions, ants promote the establishment and maintenance of complex plant communities and play a part in succession mechanisms and important ecosystem functions. Reciprocally, climate, vegetation and soil type are the main factors determining the composition of ant communities.

The Western Australian ant fauna is certainly very diverse, and most of the local ant species are of significant ecological or economic importance. The use of ants as bio-indicators dates from the mid 1970's, when it was proposed that exploring the structural composition of ant communities would yield valuable information on ecosystem health.



Location of the two study sites. (Illustration: P.- U. Achour)

Since then, the concept has proven itself relevant in monitoring the rehabilitation status of sites after many types of disturbances. These have included fire, grazing, mining and clearing.

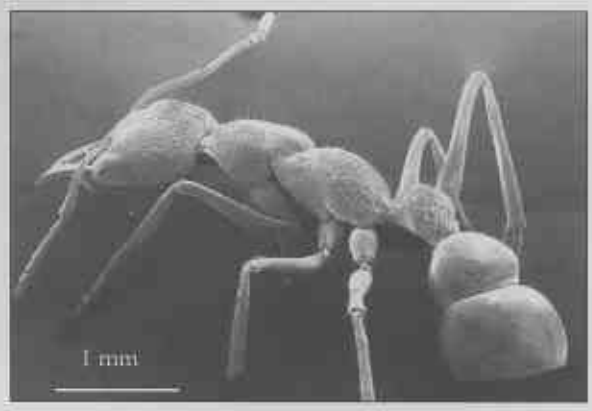
Previous studies examining the structure of ant communities around the Swan Coastal Plain have focused on non-developed areas. The remainder of this article shortly summarizes a study undertaken in 2002, around two suburban bushland areas in the Perth metropolitan area: Buckland Hill and Bold Park. The aim was to evaluate the rehabilitation success on Buckland Hill, using Bold Park as a reference site. The two sites, although of very different scale, share a similar geographic, topological and floristic background.

Buckland Hill (10 ha) was used as a limestone quarry and later as a military post during the Second World War. It is now a road-side public bushland area on the coastal reaches of Mosman Park's residential zone. Efforts to revegetate and protect the site have been sporadically implemented for over a decade by the local council.

Bold Park is the largest remnant coastal bushland in the Perth metropolitan area (437 ha). It is managed by the Botanic Gardens and Parks Authority as a protected A-class reserve. The area comprises important conservation, landscape and recreational opportunities. The park is comprised of many different plant communities, and has retained much of its original vegetation.

The initial expectations for this investigation were that the ant community structure would be significantly different between sites, and that variations in this structure would also be reflected in different vegetation assemblages within both sites.

Ant surveys were undertaken simultaneously along two transects (100m) on each site, during two seasons, to ensure a comprehensive coverage of the existing ant fauna. Collections were made along a poorly vegetated (disturbed) and highly vegetated transect line from each location, to determine the role of vegetation status on ant fauna



Electron Micrograph of Myrmecia urens, *a specialist predator. This native coastal 'Jumping Jack' is a close relative the larger 'Bull Ant'. It was found in Buckland Hill. (Photo: P.-U. Achour/E. Miller)*

continued on page 11

continued from page 10

composition. A vegetation survey was undertaken along each of the four transects, to quantify litter cover and vegetation density parameters.

Pitfall trapping and manual collection were the main collection methods for ants. The specimens were brought back to the Curtin University Entomology Laboratory and identified to species level.

Pitfall-trapped material, used for the quantitative analysis, comprised 4596 ants representing 60 species and 26 genera. Six additional species were collected manually. The results reveal a distinctly richer fauna on Bold Park (47 species) when compared with Buckland Hill (33 species). Site differences in composition were also very pronounced, with only 31.8% of all species being common to both sites. 45% of the species were limited to Bold Park, while only 21.7% were limited to Buckland Hill.

Ant richness for the transects was positively correlated with important edaphic and vegetation parameters such as litter cover and plant cover. This confirms the tight relationships existing between ants and their micro-habitats.

The two sites also differed in regards to the functional grouping of their ant communities. This model divides the ants into groups on the basis of their habitat or climatic preference, competitive dominance, foraging strategy or disturbance tolerance. For example, the abundance of dominant, opportunistic and generalised species along the most disturbed and barren transects (such as in Buckland Hill) was no surprise. On the other hand, cold climate specialists, cryptic species and specialist predators were better represented in Bold Park, and the well vegetated section of the Buckland Hill transect, where a greater range of environmental niches exist.

It was gratifying to discover that few of the exotic species which now dominate the ant fauna elsewhere in the Perth metropolitan area were present in the study sites. Two of these species were found in Buckland Hill (*Cardiocondyla nuda* and *Tapinoma melanocephalum*) and are unlikely to affect the persistence or return of native ants species where they occur. The third species, the infamous *Pheidole megacephala* (Big-headed or Coastal Brown ant), was found on the margins of Bold Park and should be monitored. The species poses an invasive threat, especially where severe disturbance such as clearing has been undertaken.

Overall, the study suggested that important differences exist between the ant fauna of the rehabilitated site and the more pristine reference site. The recovery of the original ant communities at Buckland Hill is modest, and the fauna has not yet regained its original richness or diversity, when using Bold Park as a point of reference. This parallels, to a certain extent, the different conservation status of the two areas and validates our stated expectations. It has also confirmed that ants reflect quite accurately the complexity and stability of their habitat, and are suitable indicators for assessing ecosystem health in the remnant vegetation around Perth. In the future, the results of long term studies of isolated urban bushlands could help shed some light on the role of linkage and scale of parks and reserves, in regards to re-colonisation and successional theories.

Pierre-Ulric Achour is an honors student in the Department of Environmental Biology at Curtin University of Technology. Prof. Jonathan Majer supervised the project and Dr. Brian Heterick provided invaluable help in identifying the specimens to species level. For further information contact Pierre-Ulric Achour at achourp@ses.curtin.edu.au