

# Biodiversity of Termites

## Patterns in termite species richness in Central Australian mulga.

Melinda Hillery is a Ph.D. student with Macquarie University's Key Centre for Biodiversity and Bioresources, based at CSIRO Sustainable Ecosystems in Alice Springs, NT. She started in March 1998, and plans to complete in early 2001.



One of the things I love about the arid zone is the amazing patterns in the landscape. The people who have lived in and looked after this country for at least the past ten thousand years (Walpiri, Arrente, Pitinjatjarra and Luritja to name a few) have made these patterns famous through their art, teaching us about this important aspect of the desert.

Patterns can be found at every scale, from the rippled surface of a sand dune covered by the tracks of mammals, reptiles, birds and insects that have visited overnight, to the birds-eye view gained from the aeroplane as you fly in to Alice Springs. Looking at the MacDonnell Ranges you can see

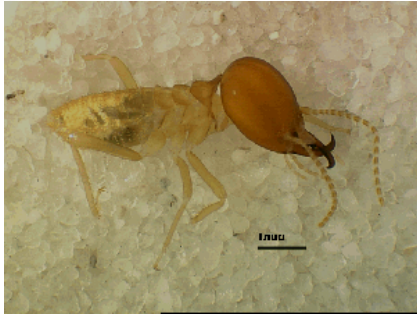
pieces of the earth's crust broken and forced up, exposing the layers of ancient geological history. Folds and faults ripple across the landscape as though some great hand has reached down in front of you and stretched the desert surface like plastic.



Pattern and scale have become important aspects of my PhD work on the termite species of Central Australian mulga woodlands. Termites are thought to play a key role in the movement of water and nutrients, in an environment where both of these are scarce. Termites tend to concentrate water and nutrients in parts of the landscape where they are very active. In order to understand how this works for a landscape as a whole, I set out to understand patterns in the way that termite species occur in the environment at different scales in space and time.

I am doing this by:

1. The development of a model to explain patterns in termite species richness with resource distributions at three levels of nested spatial scale. Combining the results of early fieldwork with information from the broad literature of island biogeography, I have developed a model that aims to explain how species richness for a particular area is constructed in a patterned environment from species richness at finer scales.
2. Testing of this model by measurement of termite species richness with resource distribution across spatial scale.
3. Development of the model for variation in resource



availability through short periods of time and testing of the model following a large rainfall event in early 2000. Fine scale patterns in termite species richness are being monitored every three months for the one year.

4. Experimental manipulation testing the effect of two components of habitat diversity on termite activity and species richness.

5. Considering the case of large scales of time and space by looking at distributions of termite species richness on the Australia continent using data available in the termite atlas (Watson and Abbey 1993). This includes the examination of historical influences on species richness including source pools of termites and changes in the environment in evolutionary time within Australia, and the nature of particular phylogenetic lines of termites which have radiated into the Australian arid zone.

How my work links to other work at CSIRO Sustainable Ecosystems, and Macquarie University:

One focus of the research group at CSIRO Sustainable Ecosystems in Alice Springs is on the 'resilience' of landscapes. Gary Bastin has been looking at the contribution of 'patchiness' to landscape resilience though the use of remotely sensed data, whilst Craig James and Graham Griffin are working towards a project that will identify landscapes with biodiversity that is less resilient to disturbance.

I have come at the same problem (biodiversity loss) from a different angle. Although my model aims to explain the species richness of a

single group of species in a single landscape, it is not a new model, but a synthesis of ideas in the literature that pertain to many organisms and landscapes. The emphasis of the model on variance in resource availability across scale in space and time allows it to feed in to landscape scale studies of biodiversity and disturbance. Disturbance, for example, can be described in terms of the changes that it makes to resource availability in space and time. In measuring resource availability I have also made use of some of the aerial videography and digital analysis methods developed by Gary and others in the lab. Mark Stafford Smith and Graham Griffin are my supervisors at CSIRO.

Mark Dangerfield is my supervisor at Macquarie University. He has worked on the role that the termite *Macrotermes michelseni* plays in shaping the landscape in the Okavango Delta in Botswana.



Current work at the Key Centre for Biodiversity and Bioresources that is in concert with my PhD is the investigation of broadscale patterns in biodiversity at Sturt National Park in western NSW, and the development of the BioTrack system for the processing and analysis of projects where data is in the form of large numbers of biological specimens like invertebrates or microbes.

#### Further reading:

##### Australian termites:

Abensperg-Traun, M. and D. Steven (1996). Termite tactics: adapting to a land of change. *Ecos* 89: 31-35.  
 Watson, J. A. L. (1982). Distribution, biology and speciation of the Australian harvester termites, *Drepanotermes* (Isoptera: Termitinae). *Evolution of the Flora and Fauna of Arid Australia*. W. Barker and P. Greenslade. Frewville South Australia, Peacock Publications: 263-265.

##### Termites generally:

Abe, T., D. E. Bignell, et al., Eds. (in press). *Termites: Evolution, Sociality, Symbiosis, Ecology*. Dordrecht, Kluwer Academic Publishers.

Dangerfield, J. M., T. S. McCarthy, et al. (1998). The mound-building termite *Macrotermes michaelseni* as an ecosystem engineer. *Journal of Tropical Ecology* 14: 507-520.

Whitford, W. G., Y. Steinberger, et al. (1982). Contributions of subterranean termites to the 'economy' of Chihuahuan Desert ecosystems. *Oecologia* 55: 298-302.

**Australian arid zone:**

Morton, S. R. (1993). Determinants of diversity in animal communities of arid Australia. *Species Diversity in Ecological Communities: Historical and Geographical Perspectives*. R. E. Ricklefs and D. Schluter. Chicago, USA, University of Chicago Press: 159-169.  
Stafford Smith, D. M. and S. R. Morton (1990). A framework for the ecology of arid Australia. *Journal of Arid Environments* 18: 255-278.

**Pattern and scale and species diversity:**

Levin, S. A. (1992). The Problem of Pattern and Scale in Ecology. *Ecology* 73: 1943-1967.  
Ricklefs, R. E. and D. Schluter, Eds. (1993). *Species Diversity in Ecological Communities*. Chicago, University of Chicago



For more Information contact:

Communication Officer  
CSIRO Centre for Arid Zone Research  
CSIRO Sustainable Ecosystems  
PO Box 2111, Alice Springs, NT 0871  
Ph: (08) 8950 7100  
Fax: (08) 8950 7187  
Karen.eva-stirk@csiro.au

