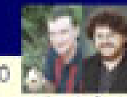
Bats in the Bunyas: Habitat Preferences of Microchiropteran Bats in the Bunya Mountains, Queensland

USQ AUSTRALIA
www.usq.edu.au/biophysci/

Nick Baker[1] and Andy Le Brocque

Department of Biological & Physical Sciences, University of Southern Queensland, Toowoomba, Qld 4350
1. *Present Address:* School of Animal Studies, University of Queensland, Gatton Campus, Qld. email: ncb@sas.uq.edu.au



Introduction

Microchiropteran bats are a significant component of Australia's mammalian fauna, consisting of around 25-30% of mammal fauna throughout Australia, and up to 42% in some areas of Queensland. They are recognized as important indictors of environmental disturbance and overall ecosystem health (e.g. Richards, 1991). However, relatively little is known about their ecology and habitat preferences.

The objective of this study was to examine the relative contributions of a wide range of environmental correlates to microchiropteran bat habitat preferences in the Bunya Mountains, south-east Queensland.

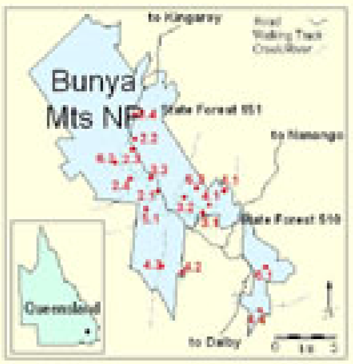


Fig. 1. Map of Bunya Mountains NP: (1) Low Altitude Araucarian Vine Forest; (2) Tall Open Forest; (3) High Altitude Araucarian Vine Forest; (4) Dry Tall Open Forest; (5) Semi-evergreen Vine Thicket; (6) Grassy Balds.

Study Area & Methods

- The Bunya Mountains National Park, south-east Queensland, contains 11 distinct vegetation types, including unique high-altitude grasslands ('grassy balds').
- Vegetation types chosen for sampling were: (1) Low Altitude Araucarian Vine Forest; (2) Tall Open Forest; (3) High Altitude Araucarian Vine Forest; (4) Dry Tall Open Forest; (5) Semi-evergreen Vine Thicket; and (6) Grassy Balds (Fig. 1).
- Harp traps were used to capture bats (Fig. 2), erected in 'flyways' within vegetation types. Each site was trapped for two consecutive nights in March-April, 2001.

Fig. 2. Harp trap positioned along a flyway in a high altitude Araucarian vine forest.

- Environmental variables, including geophysical variables (elevation, distance to water etc), disturbance history (grazing, fire etc, on a scale of 0-3), vegetation structure (FPC & density of stems in size classes), and roost variables (density of hollow-bearing trees & stags) were determined in a 20 x 20 m plot.
- Nocturnal insects, potential prey, were trapped after dusk using UV light traps for 2.5h at each site and specimens identified to Order and counted.
- Differences in richness, total captures and species abundances (standardised abundances per trap night) were tested using Kruskal-Wallis tests.
- Relationships between bat captures and habitat data (including insects) were examined by Redundancy Analysis (RDA) using CANOCO (ter Braak, 1992). RDA is an eigenanalysis method that attempts to show patterns in species data that can be best explained by the measured environmental variables.

Results & Discussion

- A total of 63 bats within 15 species (Table 1) were captured, with *Chalinolobus morio* (chocolate wattle bat), *Miniopeterus schreibersii* (large bent-wing), *Vespadelus vulturnus* (little forest bat) and *V. pumilus* (eastern forest bat) the most frequently captured. Capture of *Vespadelus baverstocki* (inland forest bat) and rare *Kerivoula papuensis* (golden-tipped bat) represent significant species range extensions.
- Bat species richness and total captures did not differ across vegetation types ($P>0.05$), while the abundance of *C. morio* was significantly higher in the dry tall open forest ($P<0.05$).

Results & Discussion (cont.)

- Redundancy Analysis (Fig. 3) shows the major grouping of samples, species and environmental variables, with the first two axes of RDA accounting for 30% of the variation in the data:

Table 1. Summary of species presence (by vegetation type).

	(1) Low altitude Araucarian Vine Forest	(2) Tall Open Forest	(3) High altitude Araucarian Vine Forest	(4) Dry Tall Open Forest	(5) Semi-evergreen Vine Thicket	(6) Grassy Balds
Chalinolobus morio	✓			✓	✓	
Vespadelus pumilus	✓		✓			
Miniopeterus australis	✓					
Miniopeterus schreibersii			✓			
Vespadelus vulturnus	✓	✓	✓		✓	
Kerivoula papuensis			✓			
Nyctophilus bifax			✓			
Chalinolobus nigrogriseus			✓			
Vespadelus regulus	✓					✓
Chalinolobus gouldii					✓	✓
Vespadelus troughtoni				✓		
Nyctophilus gouldi		✓			✓	
Scotorepens greyii					✓	
Vespadelus baverstocki					✓	
Nyctophilus geoffroyi					✓	

- the high altitude Aruacarian forest is highly variable (Fig. 3): Site 3.2 consisted of *M. schreibersii* and *V. regulus*, high densities of large trees and hollow-bearing large trees. Sites 3.1 & 3.2, consisted of *N. geofroyii* and *V. pumilus*, high elevation, distance to water, Diptera, litter cover & low densities of trees with hollows or loose bark.
- the semi-evergreen vine thicket (5.1) was characterised by *K. papuensis* and *C. morio* and high densities of large trees with hollows or loose bark, and density of trees.
- these variables also explained sites 1.1, 4.4, 6.1 and 6.3, representing a mixture of bat species and vegetation types at low elevation.
- some sites (2.1, 2.2, 2.3, 2.4, 3.4, 4.2, 4.3 & 6.2) showed little separation in species or environmental variables (Fig. 3).

The results suggest that the habitat preferences of bats are a combination of several environmental correlate types, rather than a single correlate. Overall, vegetation structural, roost and geophysical correlates better explained the patterns in species than prey correlates (nocturnal insects) for most bat species; however, further study is required to adequately test this hypothesis.

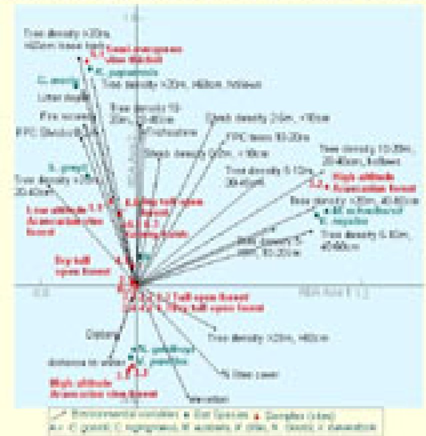


Fig. 3. Ordination of sample, species & environmental scores from first two axes of RDA (eigenvalues: axis 1 = 0.190; 2 = 0.111).

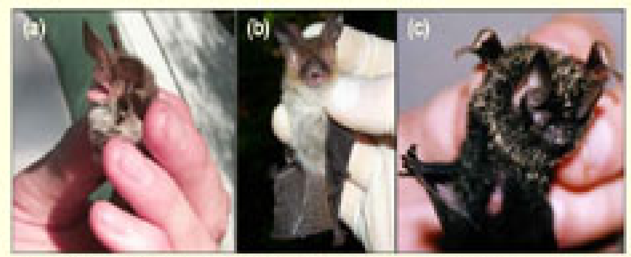


Fig. 4. **(a)** *Nyctophilus geoffroyi* restricted to semi-evergreen vine thickets; **(b)** *Nyctophilus bifax* and **(c)** the rare *Kerivoula papuensis* restricted to high altitude Araucarian vine forest in the Bunyas.

Conclusions

This research demonstrates vegetation structural, roost and geophysical correlates to better explain patterns in bat species than prey correlates in the Bunya Mountains. It is hypothesized that prey switching may be an important mechanism for many bat species, and that variables related to foraging ability and roost selection may play more important roles in determining microchiropteran bat habitat preferences.

References

Richards G.C. (1991) 'The conservation of forest bats in Australia: do we really know the problems and solutions' in, *Conservation of Australia's Forest Fauna* (D. Lunney ed.) Royal Zoological Society of NSW, Sydney. pp.81-90.

ter Braak C.J.F (1992) *CANOCO – A FORTRAN Program for Canonical Community Ordination.* Microcomputer Power, New York.