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## Powerline easements: ecological impacts and effects on small mammal movement

Tanya C. Strevens  
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**Powerline easements: ecological impacts and effects on small  
mammal movement.**

**A thesis submitted in fulfillment of the requirements for  
the award of the degree**

**DOCTOR OF PHILOSOPHY**

**from the**

**UNIVERSITY OF WOLLONGONG**

**by**

**Tanya C. Strevens BA Mod. (Hons)**

**SCHOOL OF BIOLOGICAL SCIENCES**

**2007**

## **Certification**

I, Tanya Strevens, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the School of Biological Sciences, at The University of Wollongong is wholly my own work. It does not include any material published by another person without due reference within the text. The fieldwork presented in this thesis was performed by the author, except where acknowledged. Similarly, all photographs were taken by the author, except where acknowledged. The document has not been submitted for qualifications at any other academic institution.

Tanya Strevens

25<sup>th</sup> January 2007

*“It seems to me that the natural world is the greatest source of excitement; the greatest source of visual beauty; the greatest source of intellectual interest. It is the greatest source of so much in life that makes life worth living.”*

~ Sir David Attenborough

*Antechinus stuartii*

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## Abstract

Habitat loss and fragmentation are recognised as the two primary threats to biological diversity worldwide. Powerline easements are linear habitat features that occur in all land tenures, including national parks. Where they occur in areas of natural vegetation, the vegetation is periodically mowed to maintain short grassy conditions. This creates a stark discontinuity with the natural vegetation in the area.

With the creation of powerline easements comes the simultaneous generation of large tracts of ‘edge habitat’ at the boundary between the easement and natural vegetation. In these regions, ecological processes and abiotic conditions can vary considerably from those in the bushland interior, with potentially negative effects on biodiversity. It is important, therefore, to understand the magnitude of the effects of powerline easements. By generating a series of scenarios using GIS, I explored this in a 5,735km<sup>2</sup> region of New South Wales that is rich in conservation reserves but highly fragmented by linear anthropogenic features. While the area of habitat replaced by powerline easements was not great (0.57% of all habitat in the study area), the total area of habitat likely to be ecologically affected by these features is very extensive, up to 14,070ha. Powerlines make a substantial contribution to the subdivision of native bushland in this study area.

Linear features, such as powerline easements, can inhibit the movement of small mammals. Isolated populations are more vulnerable to extinction as a result of environmental stochasticity (e.g. bushfire, disease), and are also liable to loss of genetic diversity. To quantify the barrier effect posed to small mammals by powerline easements, I conducted a mark-recapture study at four sites over a 2-year period. This revealed an extremely low rate of easement crossing by the two common small mammal species, *Rattus fuscipes* and *Antechinus stuartii*, even where vegetation in the linear opening had grown tall and dense. There was some evidence to suggest that when animals did cross from one side of the easement to the other, it tended to be when vegetation was denser. There were generally very few captures of animals in the easements themselves, even where numbers were substantial in the adjacent forest. This suggested that competitive exclusion did not explain the infrequent easement crossings.

However, one site in which easement vegetation was well-established, individuals were captured relatively regularly in the easement.

As a first step in developing a strategy to mitigate the barrier effect observed, I sought a better understanding of the habitat preferences and movement behaviour of my study species. Using the spool-and-line technique, I followed the paths of spooled animals through the habitat and, at intervals, scored the vegetation in the immediate vicinity of the spool trail. I compared these results to availability of these habitat features in the habitat in order to quantify preferences of the two species for particular microhabitats. *Rattus fuscipes* responded positively to logs and to higher densities of shrub cover. A preference for areas with higher densities of shrub cover was also identified. *Antechinus stuartii* exhibited a significant association with leaf litter, and preferential use of larger logs and trunks.

Based on the knowledge of these habitat preferences, I constructed two habitat corridors in the easement at each of the four study sites. These ‘linkages’ were composed of rows of logs and branches that linked the natural vegetation on the two sides of the easement. After initial experimentation with straight linkages, I incorporated kinks to test more effectively whether spooled animals would follow the course of these structures to the shelter of the adjacent habitat or would ignore the favoured habitat characteristics provided in the linkages.

*Antechinus stuartii* used the linkages more than *R. fuscipes*; they were less inclined to move away from it and into the easement. While some *R. fuscipes* individuals did use the linkages either partially or entirely, others strayed from them into the open easement. They strayed significantly further when shrub vegetation in the linkage was dense. *Rattus fuscipes* was less likely to leave the linkages when they were straight than when there were kinks incorporated into them. The level of ground vegetation had little effect on the distance that *R. fuscipes* moved away from the linkages following release.

The path taken by animals released on linkages, as well as in the open easement was described using a measure of ‘tortuosity’; the numbers of angles in each of four size classes per unit distance. It was then possible to compare the nature of the movement

paths of animals in the open easement, on the habitat linkages, and in the adjacent habitat. Overall, the greatest number of turns per metre was made in the open easement, with fewest in the forest habitat. For both *R. fuscipes* and *A. stuartii*, the trend was for more of the smallest angles in the open than the habitat, and more large angles in the habitat. I found no significant difference between the open easement and the linkage in terms of the proportions of turns in each angle category for either species.

Finally, I carried out a series of translocations of *R. fuscipes* and *A. stuartii* to test whether easement crossing could be induced in individuals that usually showed no evidence of inclination to travel into the easement. Selection of habitat characteristics and the tortuosity of the movement path were recorded. More than half of the individuals translocated to the opposite side of the easement returned to their side of origin in 1-5 days. Others may have returned after trapping was concluded or were simply not recaptured during the trapping session. Thus, animals can and will cross the powerline easements. Translocated animals exhibited a more tortuous movement path than animals in familiar habitat, which may be related to searching behaviour as the animal investigates its new environment, perhaps selecting a travel path for the return journey to its home range.

Powerlines are a little-studied source of habitat fragmentation, despite the widespread nature of their distribution. Given the barrier effect that has been demonstrated in this study and the potential ecological consequences of this and also of edge effects, these habitat features deserve greater attention. While corridors may in some situations mitigate the barrier effect for native animal species, linkages across powerline easements constructed in this study had little impact on the number of easement crossing events. This suggests that our understanding of what characteristics of natural habitats need to be incorporated into corridors to make them more suitable is insufficient. Closer examination of the factors that influence the movement behaviour of small mammals in a variety of habitat situations will provide useful insights into how management actions could be improved.

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