

**Termite responses to long term burning regimes in southern African
savannas: patterns, processes and conservation**

by

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I, Andrew Byron Davies declare that the
thesis/dissertation, which I hereby submit for the degree
M.Sc. Entomology at the University of Pretoria, is my own
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DATE: 23 June 2010

**Termite responses to long term burning regimes in southern African savannas:
patterns, processes and conservation**

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Abstract

Termites are considered to be major ecosystem engineers in tropical and sub-tropical environments, and fire in savanna systems is regarded as a major and necessary disturbance for the maintenance of biodiversity. However, most fire ecology studies have focused on vegetation dynamics with little attention given to other taxa, especially invertebrates. This thesis has addressed several aspects of savanna termite ecology. First, based on a review of studies examining the relationship between fire ecology and termites, I found that few broad conclusions can be made based on the published literature. Hence little is known on the interactions between termites and ecological processes such as fire. Leading on from this, several recommendations are provided in the thesis for future research to improve ecological understanding of savannas and the dynamics that structure these systems. Second, savanna termite responses to long-term burning regimes were investigated across four distinct savanna types along a rainfall gradient in South Africa using comprehensive sampling protocols. This was achieved using experimental burning plots which have been in place in the Kruger National Park (KNP) since 1954 as well as sites in Hluhluwe-iMfolozi Park. Termite communities were

found to differ significantly between these savannas with higher diversity at Pretoriuskop, a mesic savanna but not the wettest. Termite diversity was lowest at the most arid site (Mopani) but certain feeding groups peaked at Satara, a savanna with intermediate rainfall. Differences between these savannas are attributed to broad underlying changes in net primary productivity, temperature and soil type, with the role of mammalian herbivores also being considered. Seasonality was also examined and it was found that termite activity peaks in the wet and transitional seasons and is significantly lower in the dry season. Considering different fire regimes, termites, in general, were found to be highly resistant to burning, but assemblage composition was affected, this being more pronounced at the mesic savanna where fire has more effect on vegetation. These assemblage changes are linked to changes in vegetation structure caused by fire. Finally, termite ecology is often constrained by sampling difficulties and a lack of sampling protocols in savannas. A comparison of two often used sampling methods, baiting and active searching, was conducted across the savanna types studied. The efficiency of sampling method varied along the rainfall gradient and a single method was not the best for all savanna types. In mesic savannas, active searching (an often neglected sampling method in savannas) was most effective at sampling termite diversity while baiting was more effective in arid savannas, although this method is biased toward wood-feeding termites from feeding group II. Baiting also provides a better measure of termite activity than active searching. I demonstrate that termite communities differ significantly with savanna habitat and their responses to long-term burning regimes differ between these habitat types. Although termite communities were found to be quite resistant to burning, the degree of resistance differed with savanna type and management policies in protected areas and elsewhere need to take this into account when formulating conservation policies. Similarly, sampling methods differ in their efficiency at different sites which needs to be considered when designing sampling protocols in order to accurately reflect the biodiversity present.

Keywords: fire ecology, Hluhluwe-iMfolozi Park, invertebrates, Kruger National Park, long-term burning regimes, rainfall gradient, sampling protocols, savanna, seasonal differences, termites

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Disclaimer

Chapters 2, 3 and 4 of this thesis have been prepared for submission to different scientific journals. Therefore, styles and formats may vary between all chapters of this thesis and some overlap in content may occur throughout the thesis to secure publishable entities. For ease of reading, tables and figures have been placed on separate pages at the end of each chapter.

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