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**The influence of savannah elephants on vegetation:
a case study in the Tembe Elephant Park, South Africa**

by

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Submitted in partial fulfilment of the requirements
for the degree of
Doctor of Philosophy (Zoology)

in the

Faculty of Natural and Agricultural Sciences
University of Pretoria
Pretoria

February 2006

The influence of savannah elephants on vegetation: a case study in the Tembe Elephant Park, South Africa

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Abstract

Most elephants in South Africa live in enclosed areas such as the Tembe Elephant Park in Maputaland. The Park also protects sand forest. This can create a conflict of interest as elephants may influence species typical of these forests. To assess the effects that elephants may have for vegetation, I compare variables of similar plant communities inside and outside the Park. I then compared the space and landscape utilization of elephants living in the Park with those of free-ranging elephants living in southern Mozambique. In the final analyses, I used meta-analytical methods to interpret my findings.

Woody seedlings showed no measurable response to tree canopies that elephants have altered, but the response of grasses and woody saplings depended on the landscape type. In closed woodlands, elephants generated gaps in the canopy layer

that increased structural heterogeneity. These gaps favoured the establishment of grasses, and along with herbivory, may have been responsible for reduced occurrence of woody saplings. In the open woodlands, elephants and frequent hot fires in the Park apparently homogenised this landscape. In this case, altered tree canopies reduced grass and woody sapling presence.

The species compositions of sand forests, closed woodlands and open woodlands between inside and outside the Park differed. However, tree and shrub densities, their abundance-incidence and rank-abundance relationships were similar for a given landscape inside and outside the Park. Ecological events operating at larger scales, such as seed dispersal and droughts, mask the influence elephant have for these community variables.

Elephants in the Park had smaller home ranges than free-ranging elephants living in southern Mozambique. The size of these home ranges were however, similar to that predicted by rainfall, as suggested by my analysis of data collected across southern Africa. The elephants that roamed freely in southern Mozambique prefer closed woodlands throughout the year. However, elephants confined to the Park avoided reed beds (with natural surface water) in the dry season and showed no landscape preference in the wet season.

My meta-analysis on the effects of elephants on other taxa included 230 peer-reviewed studies. These were published over a 40-year period and included information from 74 sites. From only those studies used in the effect size calculations, when conducted over a period of less than 5 years show a negative impact while those conducted over longer periods show a neutral effect. Site-specific differences, such as rainfall, may also influence the effect elephants have for plants. Twenty of the 230 studies shared more than 50% of all citations. The majority (16 of the 20) claimed that

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elephants had a negative influence for plants. This is in contrast with the findings of all studies included in the analysis – half of these concluded a positive effect and the other half a negative effect. In short, elephants do not decrease the diversity of other species present in the system, despite their adverse effects for individual trees. Elephants affect ecosystems at small scales. Providing an opportunity for elephants presently living in Tembe Elephant Park to disperse across their former ranges may negate negative influences on sensitive vegetation in the Park.

Acknowledgements

First, I would like to thank Rudi van Aarde. Thank you for your trust, support and patience in me over the last number of years. A few sentences cannot express my appreciation for the faith you have shown in me and in believing that I will be able to complete this work. In addition, I value your shaping my thoughts on conservation, ecological restoration and management philosophy. Your interpretation of these topics, all very close to my heart, will influence my future career. Weereens – Baie Dankie Rudi.

Secondly, Neil Fairall, for your input right at the beginning of the project. Your ideas and thoughts were instrumental in formulating the beginning of this study. It is after all you that asked the very first day of us going to Tembe “if I think that elephants breaking a tree is having an overall negative effect on the environment?” The meta-analysis finally answers that question. I would also like to thank other external academic tutors, especially Stuart Pimm, for teaching me the art of science, and sharing his appreciation and enthusiasm of life in general.

As with all fieldwork – many people assisted directly and indirectly in collecting the data. First, Derrick Tembe, your eyes and ears, and amazing sense of direction, always made sure that we got back safely each day. Also thank you for your hard work in the field, your effort extended beyond the call of duty. In addition, I thank DG Erasmus for coming out the last couple of months to keep me company in Tembe, and to help me finishing the data collection in the sand forests.

I am in great debt to my fellow colleagues, by names Robert Morley, Sam Ferreira, Tim Jackson, Theo Wassenaar, Anouska Kinahan, Adrian Schrader and Johan Fourie. Thank you for sharing and exchanging ideas, proofreading my

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manuscripts, giving advice and moral support and spending countless hours encouraging me to finish.

Last, but not least, my family and all my other friends, both old and new, for you confidence in me, and understanding through these testing times.

Disclaimer

The present dissertation includes four paper manuscripts, prepared for submission to different scientific peer-reviewed journals. Styles and formatting of these chapters follow the respective journal requirements. This results in some duplication in study site description and methods between chapters. Chapters 1, 2, 7 and the Appendices follow the format requirements for the *Journal of Ecology*. I compiled a single Reference list for Chapters 1, 2 and 7 and follows directly after the Synthesis. I hereby declare all the work to be my own and that I have acknowledged all those that helped me and contributed in producing this dissertation.

Robert AR Guldemond

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