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

by

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The influence of savannah elephants on vegetation: a case study
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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 citings. The majority (16 of the 20) claimed that
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.
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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.

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