Summary

The elephant is one of the most important animals in African Wildlife Management, firstly because it is capable of modifying habitats, secondly because it is a major agent of damage to cultivation, and thirdly because it is a potential source of revenue through cropping. The latter also makes it a prime poaching target. The main problems caused by elephant concern changes in the physiognomy of the habitat with its consequences for the population itself and the diversity of plant and animal species in the conservation area. The Kasungu National Park suffers simultaneously from heavy illegal offtake and an elephant problem due to compression of elephant in the central part of the Park as a result of poaching activities and habitat preference. Heavy use of the woodland by elephant results in dense coppice regeneration which is thought to be an equilibrium phase of Brachystegia woodland. However, coppice phase woodland has itself less aesthetic appeal than mature woodland, the visibility of wildlife to tourists is effected adversely, while in addition it makes unsuitable habitat for several 'miombo' antelopes. The problem may be partly solved by upgrading the law enforcement capability of the Park, relaxing heavy use of woodland in the central area and simultaneously reducing elephant mortality in general. However, before a specific management policy can be pursued, sufficient technical information concerning numbers, occupance, reproductive capacity, mortality, movements and utilisation of the woodlands should be available. Nevertheless, the conclusions in this thesis do not dictate a specific management policy, but only provide a class of sound management options; such a policy decision must follow an evaluation in relation to the objectives of the National Park.

Elephant are usually counted from the air. However, in areas with dense woodland, uneven topography and/or uneven elephant distribution, aerial survey is felt to be of limited value. Kasungu National Park has areas with dense woodland and the distribution of elephant is usually clumped. Therefore it has been attempted to collect information on numbers and occupance by means of dropping counts. The first count in 1978 appeared to be an overestimate due to: i) elephant defaecating while walking and spreading the boli of one dropping over a considerable distance; ii) double counting of the same droppings by scouts counting next to each other and iii) underestimation of droppings of the youngest calves. To account for this overestimate the droppings count should be corrected by factor 1/2.1. Total
numbers of elephant present in 1978 were estimated by means of the dropping method as being 1189 ± 221 animals and by means of aerial survey as being 1000 ± 200 animals. The next step was to investigate the reproductive capacity of the population, using photogrammetric methods to determine the age-structure of individual elephants and family units. The overall age-structure appeared to be that of a young population with a high reproductive rate of 9.2 ± 1.8% per annum. The mean calving interval was about 3.3 years with an approximate age at onset of reproduction of 11.0 years. The reproductive rate had been increasing in the course of time, presumably due to a favourable food supply in the form of coppiced woodland. The mean annual mortality was estimated as 8.2 ± 0.7% and the population appeared to be static. The usual method to determine the age of an elephant in the field is by measuring its shoulder-height, using photogrammetric methods. However, it was found that when using the equations given by Laws et al. (1975) describing the relationship between age and shoulder-height for Uganda elephants, differences in growth between these elephants and the elephants measured in the present study may create artificial recruitment cycles in the age-structure of the population under study.

A recognition file was compiled during the study to collect information on movements of individually known elephants as to viability of Park boundaries and effects of illegal activity. None of the individually known elephants ever crossed the Park boundaries, while the size of the home range decreased in general over the period from 1978 to 1982, as a result of compression by illegal activity. Dry season home ranges of family units to be stable over longer period, while wet season home ranges were smaller and mostly situated along the Lingadzi river. The size of the home range was determined by the size of the family unit, although the social structure of the family units that made up a kingroup and determined the time spent with each other, also appeared to be of influence on the actual size. Dry season home ranges of bulls were only temporary, while during the wet season bulls ranged over a much wider area, mainly searching for receptive females. During the latter part of the dry season elephant movements were mainly determined by saltlicks and the remaining water-holes with a relatively high conductivity, away from the Lingadzi river. The elephant population occupied the smallest area during the dry season when they primarily fed on the coppiced phase woodland - which is a better food supply than mature woodland - of the central part of the Park. In this area which is subject to heavy browsing impact, utilisation by elephant was investigated for possible
oscillations of specific highly favoured tree species. Of 41 common species, 35 species were eaten, of which 13 species were selected. The destruction of trees by elephant appeared to be part of a feeding strategy that lead to increases of browse production of preferred height-classes of preferred species, improving the food availability for elephant during the dry season. Utilisation by elephant increased with an increasing tree density up to 300 trees/ha, where it remained constant. At higher densities the fraction of trees utilised decreased with an increasing tree density. Consequently trees of selected species had a better chance to mature as they occurred in relatively high ratios at these densities. It was argued that over extended periods, the species composition of *Brachystegia* woodlands, occupied by elephants, would show little or no change.

The chemical composition of leaf material was analysed and the utilisation of specific tree species appeared to be related with the protein and sodium content of the leaf material, whereas the crude fibre content was generally low in favoured species. In order to reduce heavy impact on the woodlands of the central part of the Park, different fire-treatments were suggested. Early dry season burning in combination with upgrading the law enforcement capability of the Park could be sufficient to solve the problem. In addition, it was suggested to manipulate elephant occupation by introducing artificial saltlicks and by opening up specific areas for illegal activity. Finally it is argued that the presence of several sub-populations of elephant that are out of phase with each other concerning interactions of trophic levels, reduces the chance of all sub-populations becoming extinct due to extraneous circumstances.