The impact of the African elephant on *Acacia elatior* trees in Samburu National Reserve, Kenya

A study carried out for Save the Elephants
http://www.save-the-elephants.org/index.htm

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Introduction

Elephants have been shown to have a substantial influence on vegetation structure in a diverse range of woodland habitats. They have the ability to alter the size distribution of tree populations through the actions of debarking, browsing and felling, which can carry important ecological implications. Studies spanning the last forty years have demonstrated that the impact of elephants on vegetation is dependent on a number of factors, such as tree species and elephant density. By the end of the 1980's a large body of evidence suggested that high elephant densities were associated with a decline in tree populations. However, more recent studies have shown the relationship to be less clear cut. For example, it has been shown that elephant-induced mortality of *Acacia tortilis* trees actually facilitated regeneration by thinning out the canopy layer.

Given the complex nature of elephant-vegetation interactions and the fact that elephant numbers may be on the increase in protected areas, it is important to predict the effects of elephants on different tree species. Therefore, long term monitoring of individual species is required in order to establish the precise relationship between elephants and their habitats, and to guide management decisions.

The damage that elephants can cause to trees may be classified into three main categories: browsing, debarking and felling. Browsing is easily recognised by a characteristically frayed appearance at the end of twigs and small branches (Figure 1). Debarking describes the action of tusking and stripping away the inner and outer layers of bark (Figure 2). The removal of these layers is potentially lethal since they not only protect the tree

but also are involved in nutrient transport. Elephants also have the strength required to fell trees, which may be done in order to access branches that were out of reach.

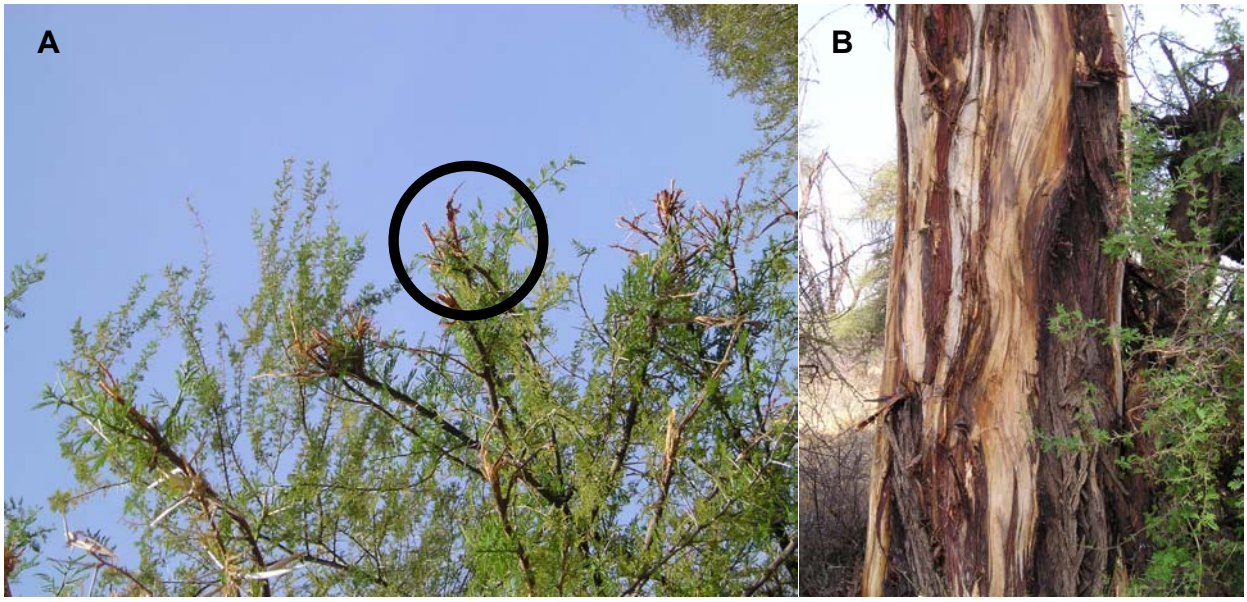

Figure 1. A, browsed *Acacia elatior* twig (shown in black ring). **B**, Debarked *A.elatior* trunk, the paler areas are exposed sapwood where the bark has been removed.

In Samburu National Reserve, my preliminary observations in 2000 suggested that *Acacia elatior* was the tree species most affected by elephant damage. The severity of damage to *A.elatior* raised concerns that the population could be undergoing a rapid decline. This has been established as a critical issue for formulating management plans (Samburu National Reserve General Management Plan, 2004). These observations were supported by a total survey of the riverine vegetation carried out in 2003-4 which showed that over 50% of *A.elatior* had trunk or bark damage caused by elephants, making them the riverine component suffering from the highest level of damage. In addition, the survey found *A.elatior* to be the dominant riverine species, comprising 50% of a total 40,000 shrubs and trees. These findings, having established the extent of damage to *A.elatior*, highlight the importance of monitoring the rate of change in damage and tree mortality.

Aim

The main objective of this study was to revisit four permanent vegetation plots that had been set up in 2000 in order to quantify the impact of elephants on the population structure of *A*.elatior.

Study Area

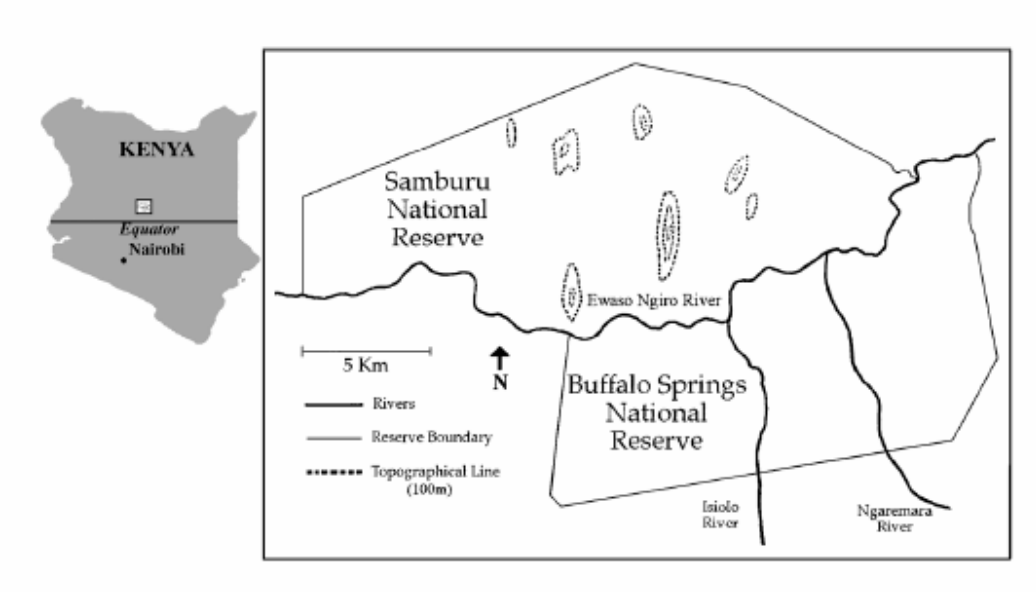

Figure 3. Map of the Samburu and Buffalo Springs National Reserves.

The Samburu National Reserve is approximately 165 km^2 and is located on the northern bank of the Ewaso Ngiro River (Figure 3). The semi-arid landscape is characterised by rocky, steep-sided hills and temporary watercourses.

The elephant population utilising Samburu National Reserve is free-ranging and comprises of at least 767 known individuals. The growth rate of the population, through natural increase, is estimated at 4.6% per annum. The numbers present in the reserve at any one time fluctuate seasonally, with the highest elephant densities observed during the dry season.

Methodology

The vegetation plots were situated along the northern bank of the Ewaso Nyiro River. They measured 50m width parallel to the river and 100m length stretching back away from the river.

The following information was recorded for each tree, both in 2000 and 2004:

- GPS (Global Positioning System) location
- Trunk circumference
- Tree height
- Damage level
- Damage type
- Extent of debarking (if present)

Results and Discussion

In 2000, a total of 188 living trees were recorded in the plots, this figure had dropped to 114 trees by 2004, giving a mortality rate of approximately 10% *per annum*. The highest mortality rates were seen in trees that were debarked (Figure 4) and the greater the extent of debarking, the greater the probability of mortality.

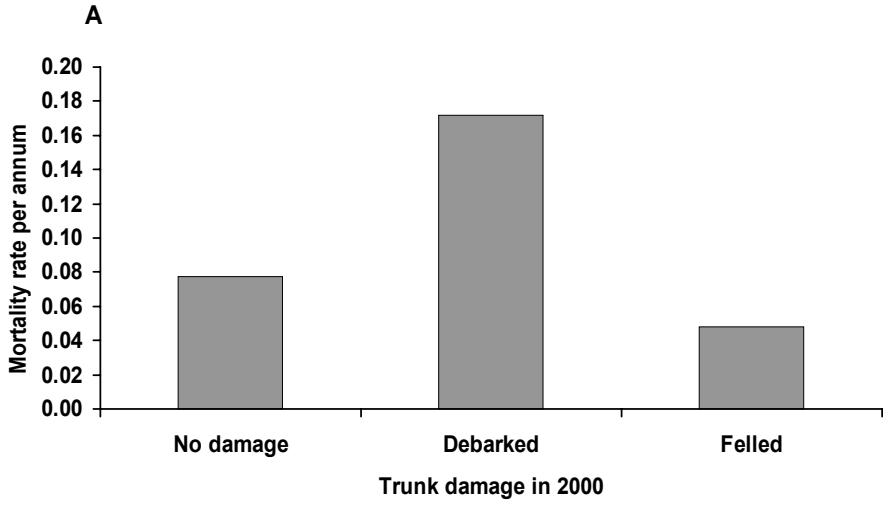

Figure 4. Tree mortality rates for different damage classes. Note, 'no damage' does not exclude browsed trees.

It was found that trees in the larger size classes tended to be debarked, whereas the smaller trees were browsed. Trees that were heavily browsed were found to be extremely bushy around the trunk and were rarely debarked (Figure 5). Taken together, and in conjunction with field observations, these results suggested that the bushiness induced by browsing may afford some protection to the tree.

Figure 5. Bushy *A.elatior*, note the trunk is obscured.

Very low levels of regeneration were seen: a total of only four new trees were recruited into the plots during the four year study period. Such a low regeneration rate is particularly worrying when taking into consideration the high mortality rates of this riverine population. Together they suggest that the *A.elatior* may be in decline and that the concerns raised by the Samburu County Council are justified. There are a number of possible interpretations of the results of this study. It may be that regeneration is being suppressed in some way. Alternatively, regeneration may be episodic, dependent, for example, on annual variations in rainfall.

Two distinct 'stand structures' of trees were identified in this study. Trees were either bushy or tall with few low branches, the latter typically characterised by higher levels of debarking and mortality. It is interesting to speculate whether the bushy state of the trees is

merely a transitional phase or whether it is one of two alternative fates depending on how the elephants feed. Crucially, it seems the *way* in which the elephants are utilising the trees is key in determining the probability of mortality, rather that elephant damage *per se*. Felling appeared to have little impact, and indeed browsing may even have a positive effect a tree's chance of survival by protecting it from debarking. This study found that debarking was the most important factor in determining whether a tree survived or died.

The population will not be sustainable if it continues to decline at its current rate. Some measures have been taken to dull the impact of elephants on *A.elatior*. Chicken wire has been wrapped around the trunks of a small sample of trees which prevents elephants from stripping off the bark, however this method is not completely infallible. It has also been shown that installing bee hives deters elephants from the trees. It remains to be seen whether these strategies will cause the elephants of Samburu to increase damage levels elsewhere.

Acknowledgements

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