CHAPTER 8

EFFECT OF THE DISTANCE FROM WATER ON THE POPULATION STRUCTURE AND UTILISATION OF *ADANSONIA DIGITATA* AND *STERCULIA ROGERSII* IN THE KRUGER NATIONAL PARK

INTRODUCTION

The increased elephant damage to trees near water is well known (Ben-Shahar 1993). During the wet season, elephants tend to be widely dispersed, but concentrate near permanent water during the dry season. Increases in elephant density around the water result in increased pressure on the vegetation (Swanepoel & Swanepoel 1986).

In the Kruger National Park, this trend was established during early research projects on the utilisation of vegetation by elephant (Van Wyk & Fairall 1969). During winter, elephant in the far north of the Kruger National Park concentrate around the river systems, as areas without permanent water are unsuitable as winter range for them. Because of this, they exhibit highly destructive behaviour in the areas surrounding permanent water (Van Wyk & Fairall 1969).

This section of the study was therefore to determine if any relationship exists between the amount of utilisation of *Sterculia rogersii* and *Adansonia digitata* and their distance from the perennial rivers.

METHODS

The position of all sampled trees was recorded relative to the starting point of the transect. It was thus possible to isolate trees which were growing more than 10 km from the Limpopo and Luvuvhu Rivers, and other permanent water sources (Group 1). The

population structure and utilisation data from these trees were then compared with data from trees growing within a 10 km distance from permanent water (Group 2).

RESULTS

Adansonia digitata

The size class distribution of baobabs growing within 10 km of permanent water (Group 2) is significantly different from that of baobabs growing further from water (Group 1); (Fig. 23); (Kolmogorov-Smirnov two-sample test, $D_{max} = 0.12$; $P < 0.005$). In Group 2, the smallest size class is best represented, with generally decreasing proportions into the larger size classes. Trees with a girth of 1 to 2 m are, however, most common in Group 1, while very few trees have a girth of 3 to 5 m.

The two populations have been compared using the depth of utilisation scale and the differences are highly significant (Kolmogorov-Smirnov two-sample test, $D_{max} = 0.17$; $P < 0.001$). More than half (55 %) of trees further than 10 km from water are unutilised, but only 37 % of baobabs within closer proximity to water have not been foraged on (difference of proportions of unutilised trees $z = 5.42$; $P < 0.001$); (Fig. 24). Although only a few trees close to water have been severely damaged, no trees more than 10 km from these water sources showed signs of Type III or IV damage.

The damage scores of the two groups of baobabs have also been calculated, and show that trees closer to water have been more heavily utilised than trees further away. The damage score of baobabs close to the water sources (15.57) is substantially greater than the damage score of baobabs further away (9.66); (difference of proportions $z = -5.90$; $P < 0.001$).

Sterculia rogersii

The size class distribution of *Sterculia rogersii* trees is also very different in the two groups (Kolmogorov-Smirnov two-sample test, $D_{max} = 0.22$; $P < 0.001$). The smaller size classes

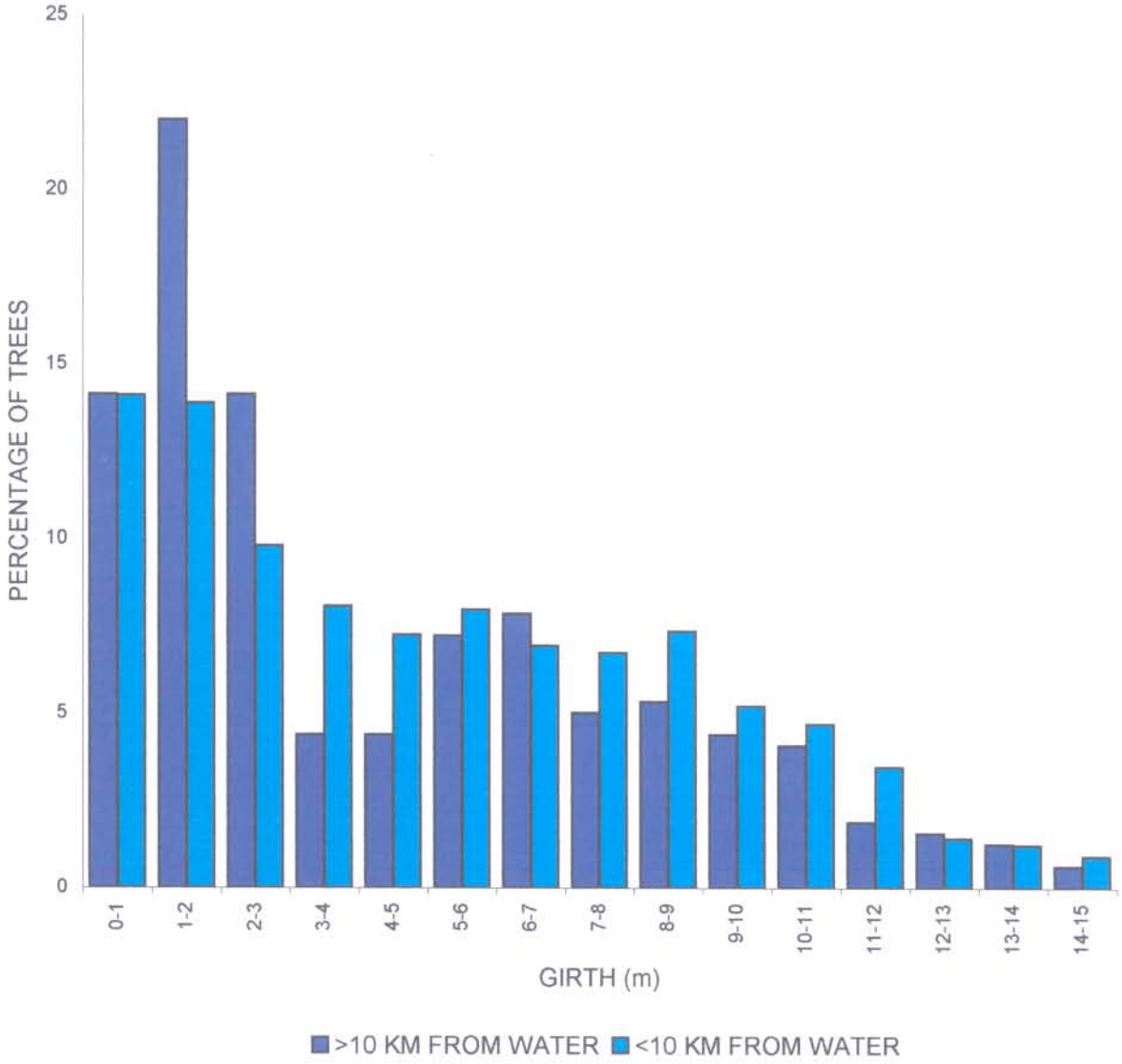
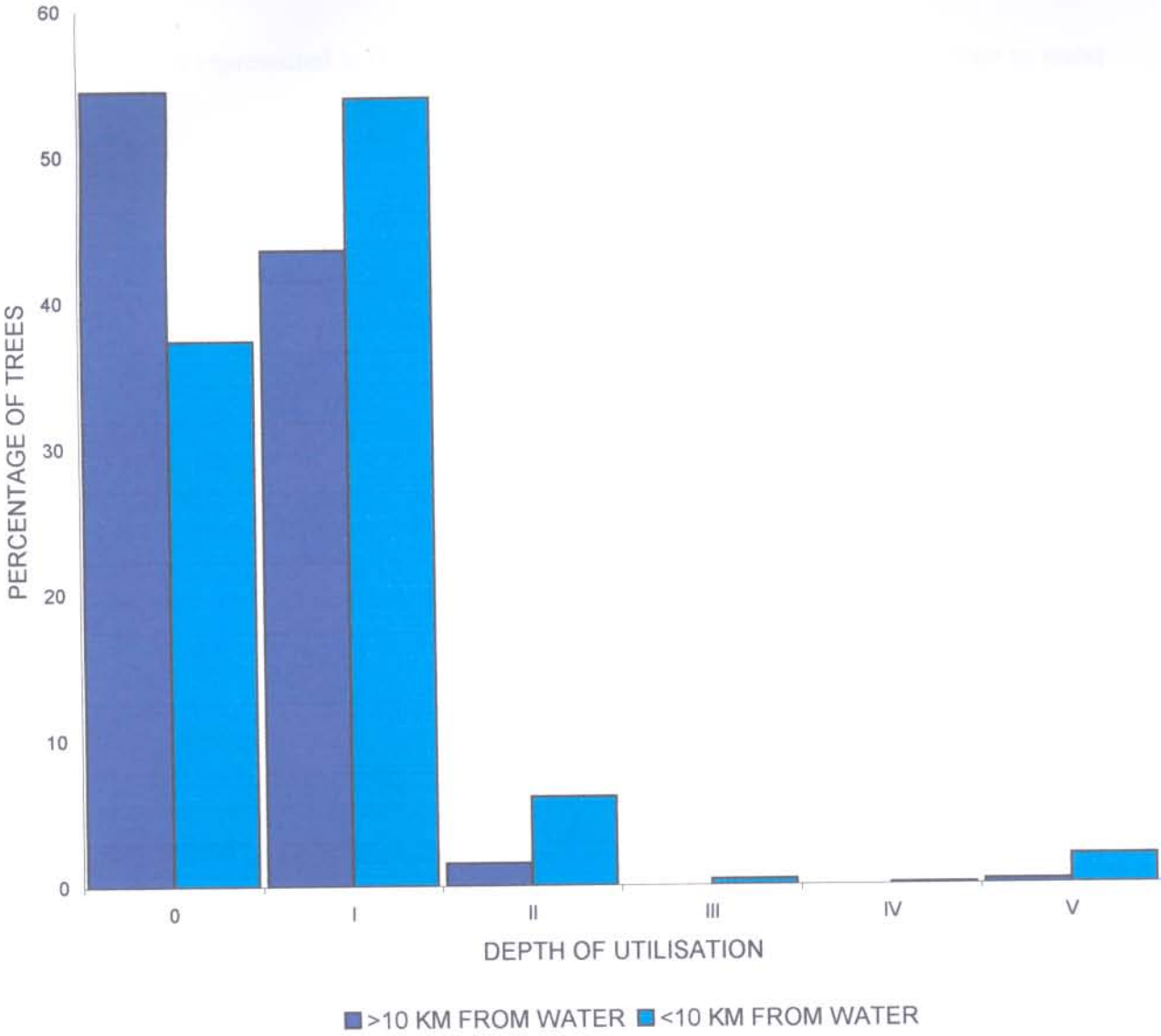


Fig. 23: Size class distribution of *Adansonia digitata* in the Kruger National Park in relation to the distance from permanent water.



0: TREE UNDAMAGED.
I: TREE SLIGHTLY SCARRED.
II: TREE RINGBARKED, BUT DAMAGE SUPERFICIAL.
III: TREE DEEPLY SCARRED.
IV: TREE SHAPE RADICALLY ALTERED BY UTILISATION.
V: TREE DEAD.

Fig. 24: Depth of utilisation of *Adansonia digitata* in the Kruger National Park in relation to the distance from permanent water.

are all better represented in the sample of trees further away from water than close to water (Fig. 25).

Utilisation of *Sterculia rogersii* trees is also greater near to water (Fig. 26). The distribution of the two populations on the depth of utilisation scale is significantly different (Kolmogorov-Smirnov two-sample test, $D_{max} = 0.19$; $P < 0.001$), as are the damage scores (difference of proportions $z = -2.93$; $P < 0.005$). *Sterculia rogersii* trees within 10 km of permanent water have a damage score of 26.74, compared with a score of 22.19 for trees further away. The proportion of unutilised trees close to water is 12.06 %, compared with 31.34 % of trees further away (difference of proportions of the percent unutilised $z = 6.89$; $P < 0.001$).

DISCUSSION

To assess elephant utilisation, Swanepoel (1993) compared trees 20-30 km away from water with those closer to it. The study area in the Kruger National Park is bordered on two sides by perennial rivers. As a result of this, most areas are within a distance of 20-30 km from permanent water. In the Kruger National Park, vegetation utilisation becomes fatuous at a distance of more than 10 km from water. This smaller distance (10 km) was therefore chosen for this study, but was considered sufficient enough to yield significant results. Utilisation of both *Adansonia digitata* and *Sterculia rogersii* was far greater close to the river systems and waterholes than away from them.

In Mana Pools National Park, Zimbabwe, damage inflicted on baobab trees away from perennial water has been found to be significantly lower than damage inflicted on trees closer to water (Swanepoel 1993). It has also been found that the mortality of baobab trees near the Zambezi River is considerably higher than that of trees 20-30 km from perennial water.

In the Kruger Park, Van Wyk and Fairall (1969) have found that the utilisation of woody plants by elephant is inversely proportional to distance from water as well as the state of the

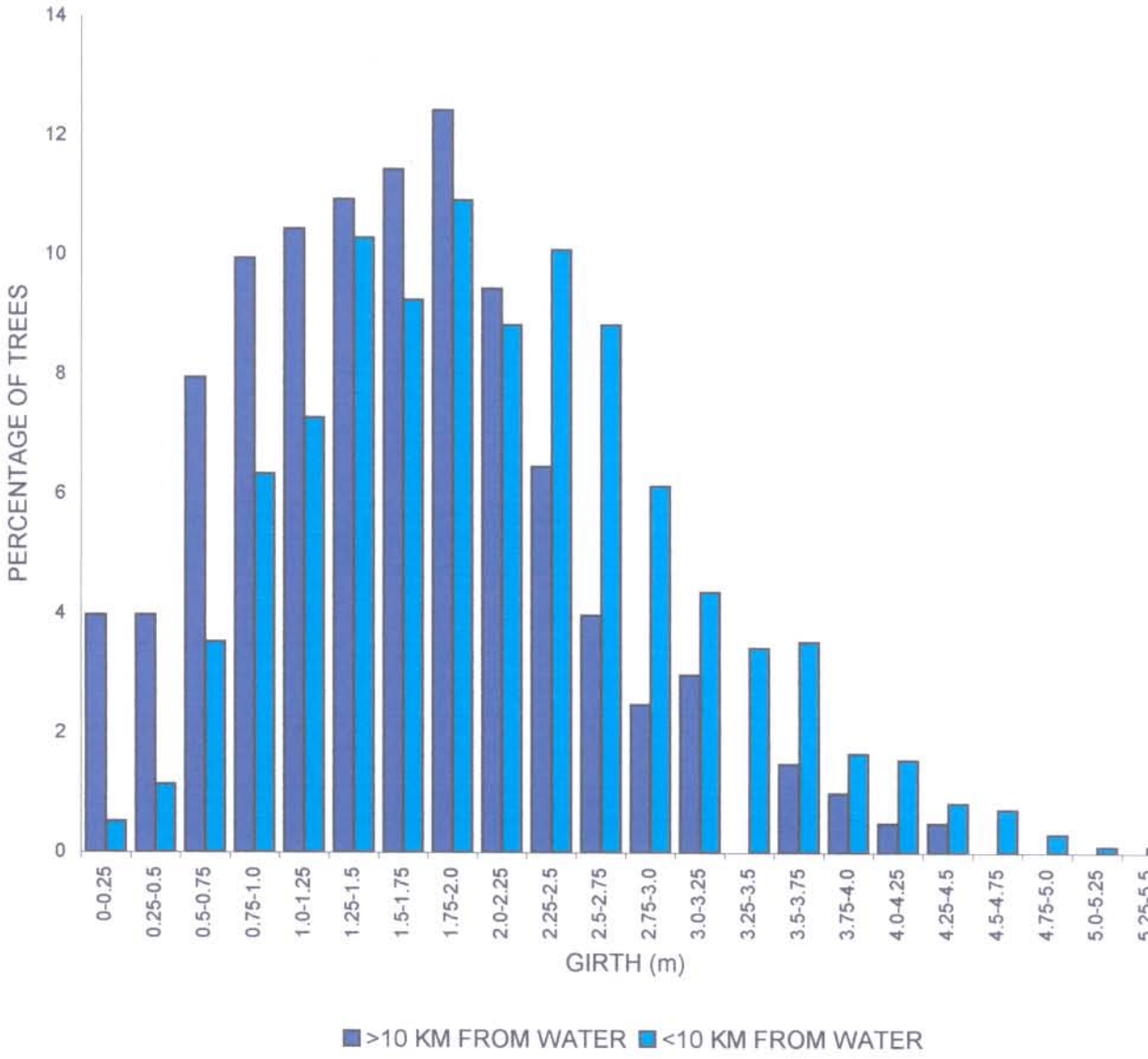
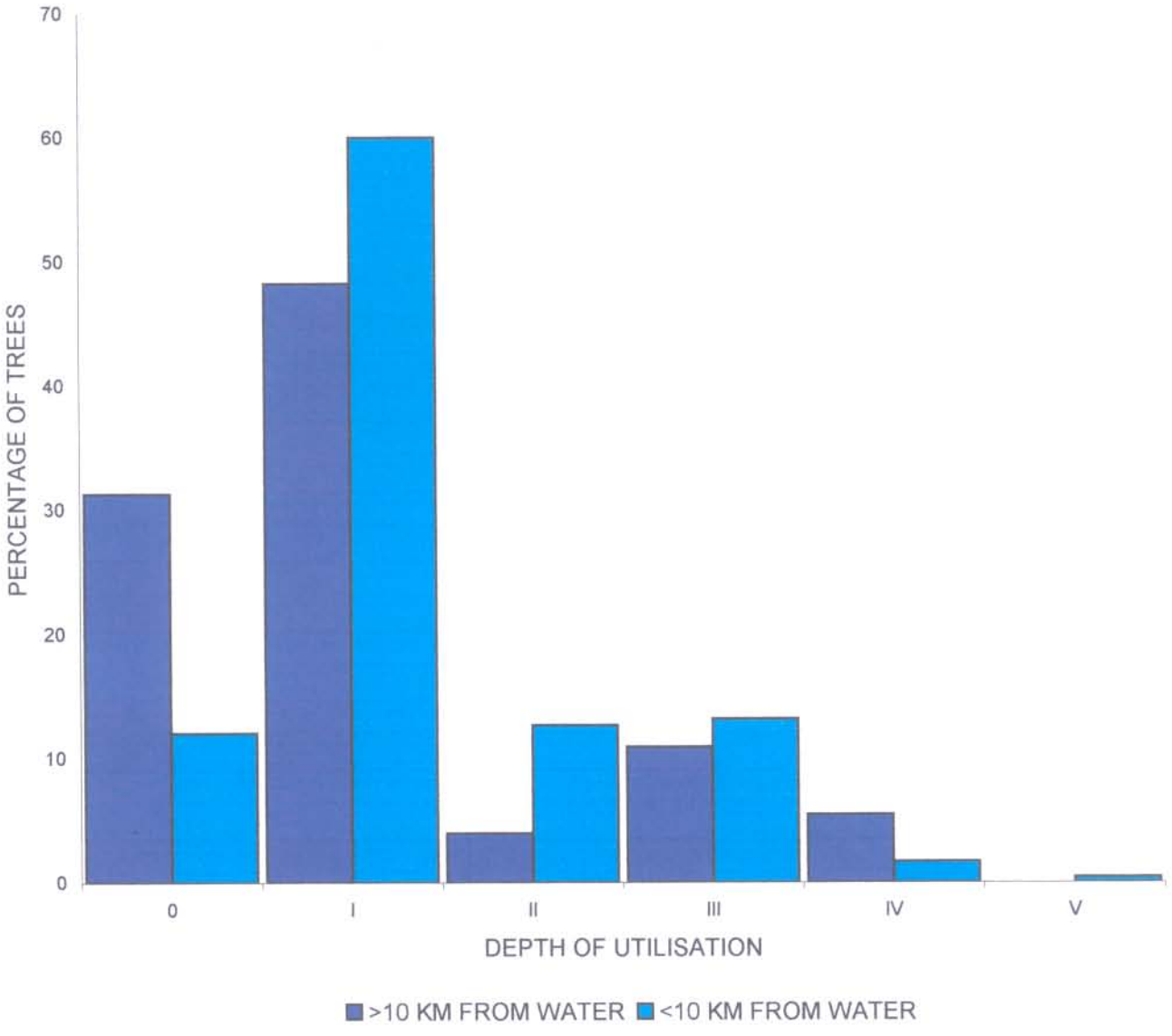


Fig. 25: Size class distribution of *Sterculia rogersii* in the Kruger National Park in relation to the distance from permanent water.



0: TREE UNDAMAGED.
I: TREE LIGHTLY BROWSED.
II: TREE WITH BRANCHES REMOVED BY BROWSING.
III: TREE WITH SOME STEMS BROKEN OFF.
IV: TREE WITH ALL STEMS BROKEN OFF.
V: TREE DEAD OR UPROOTED.

Fig. 26: Depth of utilisation of *Sterculia rogersii* in the Kruger National Park in relation to the distance from permanent water.

grass cover. The number of trees which died from causes other than elephant utilisation, however, shows an increase with distance from water which has been attributed to the fact that elephants remove some plants in the areas near water which would have died anyway.

This increase in utilisation close to water can be attributed to the distribution patterns of animals relative to water. A number of animals concentrate in the areas surrounding water. These include impala (*Aepyceros melampus*), zebra (*Equus burchelli*), blue wildebeest (*Connochaetes taurinus*) and buffalo (*Syncerus caffer*). Even during the winter months in the Kruger National Park, impala will usually only venture up to 2.2 km from water, zebras 7.2 km, blue wildebeest 7.4 km, and buffalo 7.8 km from water (Trollope 1990).

Although the distribution pattern of elephants is seasonal, during the dry season, they concentrate near permanent water points (Ben-Shahar 1993; Swanepoel & Swanepoel 1986; Van Wyk & Fairall 1969). During the August (dry season) of their study in the Kruger National Park, Van Wyk and Fairall (1969) found that all the larger elephant herds were either in the vicinity of the larger watercourses which had permanent waterholes or along perennial rivers. Only bachelor bulls, either solitary or in small herds were in areas where the water supply was meagre. Greater pressure on the vegetation surrounding permanent water results from this seasonal distribution patterns of elephants.

Swanepoel (1993) found that elephant feeding on baobabs occurred during the dry season, becoming more intense as the season progressed and then stopping abruptly with the first rains of the new season. This behavioural pattern of elephants, can further explain the increased utilisation of baobabs near water. During the dry season, when elephants feed on baobabs, the herds are in the vicinity of the water, and baobabs close to water are therefore utilised. With the onset of the rains, when the elephants move away from the rivers, they have ceased feeding on baobabs, with the result that the trees at a distance from water are not utilised to the same extent.

During dry periods, and especially drought years, the browsing by other large herbivores such as kudu and eland, causes considerable damage to fleshy stemmed plants such as

Sesamothamnus lugardii and *Sterculia rogersii*. Species other than elephant may therefore also be responsible for the increase in pressure on vegetation close to water.