CHAPTER 1

GENERAL INTRODUCTION

The establishment of the Maputo Elephant Reserve (MER) in southern Mozambique in 1932 stemmed from the need to protect the local African elephant (*Loxodonta africana* (Blumenbach, 1797)) population from destruction by man. However, the introduction of species such as the white rhino (*Diceros bicornis bicornis* (Linnaeus, 1758) during the early 1970's marked a change in attitude of protecting elephants, to one of conserving biota typical of the region.

At present the department of conservation, Direcção Nacional de Áreas de Conservação (DINAC) still considers the protection of elephants a conservation priority. As a consequence, the Department of Biological Sciences (DCB) of the University of Eduardo Mondlane established an ecological research program in cooperation with the department of forestry and wildlife, Direcção Nacional de Florestas e Fauna Bravia (DNFFB) some four years ago. Though this program contributed greatly to our knowledge on the biota of the MER, we still have very little information on the interactions between plants and animals occurring in the MER.

As part of the post-war development of southern Mozambique the local government authorized the Blanchard Project as a venture into developing a profitable ecotourism industry. In 2000, the government also sanctioned investigations into the inclusion of the Maputo Elephant Reserve in the Lubombo Transfrontier Conservation Area. The development of both these programs requires information about the consequences such developments will have for the biota of the region, and more specifically for the African elephant, which in this region is considered a flagship species for conservation.

The Blanchard Project started with the introduction of waterbuck (*Kobus ellipsiprimnus* Ogilby, 1833) and kudu (*Tragelaphus strepsiceros* Pallas, 1766) into the MER and with the construction of an electric fence all along the 26 km western border of the Reserve. This project came to an end in 1998 and further developments are in the hands of those negotiating the renewal of the concession.

The development of a Transfrontier Conservation Area (TFCA) in the region aims at restoring the Maputo plains elephant population by reuniting the elephants of MER and Tembe Elephant Park through the so-called Futi Corridor into a single

population. The simulation of the consequences of the establishment of such a TFCA for both the region and for the elephant populations depend on fundamental information on the following:

1) the population ecology of the fragments of elephant populations of the region,
2) the interaction between elephants and their habitats, and
3) the socio-economic status of local people and their interaction with elephants.

The present study is directed at the elephant population of the MER and where possible the Futi Corridor. It focuses on the interactions between elephants and their habitats.

Earlier studies on the elephants of the Maputo Elephant Reserve focused on their diet through fecal analysis (Correia 1995, Mafuca 1996), distribution and habitat choice using fecal counts (Ntumi 1997), and crop damage and movement patterns through satellite tracking (Ntumi 1997). This population comprises only some 200 individuals over an area of 800km^2, an estimate that may negatively impact on the viability of the population (Frankel & Soulé 1981). The negative attitude of the local communities towards elephants as a consequence of crop damage (see de Boer & Baquete 1998, de Boer & Ntumi 2001, Soto *et al.* 2001) also may influence the elephant population. However, the protection of these elephants and the associated increase in their numbers without factors limiting their numbers within the confinement of the MER may have negative implications for the sand forests unique to this part of the world.

One of the ways of seasonally reducing local pressure on the vegetation would be to re-establish traditional movement patterns between the MER and the Tembe Elephant Park through the Futi Corridor. Such a periodic release of disruption may provide opportunity for the development of a dynamic and sustained interaction between elephants and their food plants.

The study centers on the use of space, habitat and vegetation by elephants in southern Mozambique and provides some of the information that will be required to simulate the consequences of the establishment of a TFCA in the region.

Habitat preference by elephant depends on vegetation type, quality and the vegetation type coverage (Laws 1970a; 1970b, Laws *et al.* 1975, Leuthold & Sale 1973, Sukumar 1990, van Wijngaarden 1985). It also is affected by water quality,

availability and distribution (Weir 1972, Williamson 1975) and by human activities such as agricultural development and poaching (Sukumar 1989, Barnes *et al.* 1997, Deodatus & Lipiya 1991, Deodatus & Sefu 1992, Tchamba 1996).

The factors influencing elephant distribution in the MER have been speculated to include vegetation quality and biomass (Tello 1973, Correia 1995, Mafuca 1996, Osborn 1996, Ntumi 1997), water availability and salinity (Ntumi 1997), vegetation cover (Tello 1973, Ntumi 1997), and the avoidance of poachers (Ntumi 1997, de Boer *et al.* 2000).

Ntumi (1997) discussed the consequences of high densities of elephants for the sand forests of MER. Correia (1995) and Mafuca (1996) showed that plants of these sand forests are important sources of food for the elephant. However, Tello (1973), suggested that elephants here focused their year round activities on the floodplain of the MER, only seeking refuge in the sand forests when disturbed by poachers while moving between the Maputo River and the South African border. However, habitat preferences apparently have changed and elephants now spend most of their time in the sand forests (Mafuca 1996, Ntumi 1997).

Habitat fragmentation is one of the most important factors affecting wildlife in the southern parts of Mozambique (Pardal 1996). The agricultural settlements along the Futi River may lead to an increase in man-elephant conflict. This development started 10 to 15 years ago and Ostrosky & Matthews (1995) noted large-scale development schemes near Manhoca, some 6km north of the international boundary. Here some 16 000 hectares were cleared for agriculture purposes and large areas were subdivided and fenced for cattle ranching (Hatton *et al.* 1995, Ostrosky & Matthews 1995).

The Maputo Elephant Reserve[1]

The study was conducted in the Maputo Elephant Reserve (MER) and in the adjoining Futi Corridor. The 800km^2 MER is situated in southern Mozambique (26°25'S, 32°45'E, Fig. 1). Hot, rainy summers (October-March) and colder, drier winters (April-September) characterize the climate. Annual rainfall varies from 690 to 1000mm (Grossman & Loforte 1994). The soils are mainly sandy with some more

fertile, alluvial soils around the Futi and Maputo Rivers. Several, sometimes saline lakes can be found in the area. Geomorphologicaly, the area comprises unconsolidated quaternary to recent sediments, mostly sands (dunes, sandy plains with heavier textured soils), and *mananga* and alluvial soils (Massinga & Hatton 1996). White (1983), cited by Massinga & Hatton (1996) considered this area part of the Tongoland-Pondoland regional mosaic (TPRM). The high and unique biodiversity of the area is increasingly considered as of special scientific conservation and economic value. Van Wyk (1994) described this area as the Maputaland Center for Plant Endemism. Based on a modification of the descriptions of Tello (1973), Haandrikman (1998) and Vriesendorp (1998), de Boer *et al.* (2000) distinguished the following six plant communities (see also Fig. 2):

Mangroves, which border the Maputo bay and surround the deltas of the Maputo River and Bembe canal, mainly comprise *Avicennia marina* and *Rhizophora mucronata* trees.

Dune vegetation which mainly consists of pioneer plants (e.g. *Scaevola plumieri, Ipomoea pes-caprae, Canavalia rosea* with dune thicket and coastal dune forest (*Diospyros rotundifolia, Mimusops caffra* and *Sideroxylon inerme, Cyperus compactus, Monanthotaxis caffra.*

Grass plains are dominated by *Themeda triandra, Vernonia glabra, Cynodon dactylon, Sporobolus virginicus, Salacia kraussii and Dactylotenium aegyptium.* Parts of the grasslands are inundated during the rainy season.

Forests dominated *by Ochna natalitia, Mimusops caffra, Euclea natalensis, Psydrax locuples, Afzelia quanzensis, Dialium schlecterii.*

Woodlands are relatively open areas dominated by species such as *Strychnos madagascariensis, Strychnos spinosa, Dichrostachys cinerea, Garcinia livingstonei, Vangueria infausta, Syzigium cordatum, Sclerocarya birrea, Afzelia quanzensis, Terminalia sericea* (Massinga & Hatton 1996, Vriesendorp 1998).

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[1] The proper name is Reserva Especial de Maputo. It was created in 1932 specially to protect elephants. Further, the conservation objectives have been improved, using the elephants as a flagship to conserve

Riverine vegetation along the seasonal Futi River comprises reed-beds dominated by *Phragmites australis*, *Juncus kraussii* and *Cyperus compactus*, sometimes fringed by patches of riverine forest of *Ficus sycomorus*, *Syzygium cordatum* and *Kigelia africana, Helichrysum kraussii, Panicum maximum.*

Different herbivore species have been recorded in the past (Tello 1973). However, during the civil war, most of them were decimated through poaching. Reedbuck (*Redunca arundinum*), red duiker (*Cephalophus natalensis*), suni (*Neotragus moschatus*), common duiker (*Sylvicapra grimmia*), hippopotamus (*Hippopotamus amphibius*), bushpig (*Potamochoerus porcus*) and crocodile (*Crocodilus niloticus*) can still be found in the MER and the Futi Corridor.

Little information exists on the ecology of elephants of the MER. Population estimates for the past 30 years ranged from 80 to 350 individuals (see Table 1). Most of these seem to be educated guestimates rather than estimates with known levels of precision and accuracy .

Elephants use to move between the MER and the Tembe Elephant Park (Tello 1973, Hall-Martin 1988, Ostrosky & Matthews 1995). According to Hall-Martin (1988), the Tembe Elephant Park consists predominantly of leached sands of low fertility and the quality of the forage for elephants is generally poor. During their south-north-south movements elephants preferred the flood plain grassland and marsh habitat between the lower reaches of the Muzi River (called the Futi River in Mozambique) and the flood plain of the Maputo River. This area has relatively fertile alluvial soils, which provide better quality food (Gouveia & Azevedo (1955) cited by Hall-Martin 1988). Thus, the elephants may have been crossing the northern border of the Tembe Elephant Park into southern Mozambique to obtain higher quality food sources on the alluvial soils of the flood plains (Gouveia & Azevedo 1955, cited by Hall-Martin 1988).

The range of the elephant groups living in the MER (see Ntumi 1997) apparently have not changed much since Tello (1973) when they used the area from Futi River to the so-called "elephant plains" (now called Chango's plains) (DNFFB 1997). The elephant population of the MER appears to be on the increase (van Aarde

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the biological diversity.

& Fairall 2001), probably in response to the efficient protection they are receiving within the limits of the MER.

Most of the people of the southern Mozambique region live along the western side of the MER between the towns of Bela Vista and Salamanga and in the vicinity of Zitundo to the south (see Fig. 1). Some people (around 500 individuals) live in a few settlements around the main lakes within the MER and apparently depend on resources collected within the MER.

The 26km of electric fence erected as part of the Blanchard Project along the western boundary of the MER gave rise to a lot of conflict with people living close to the MER, thereby increasing the negative perception that the local population already had of conservation (de Boer & Ntumi 2001).

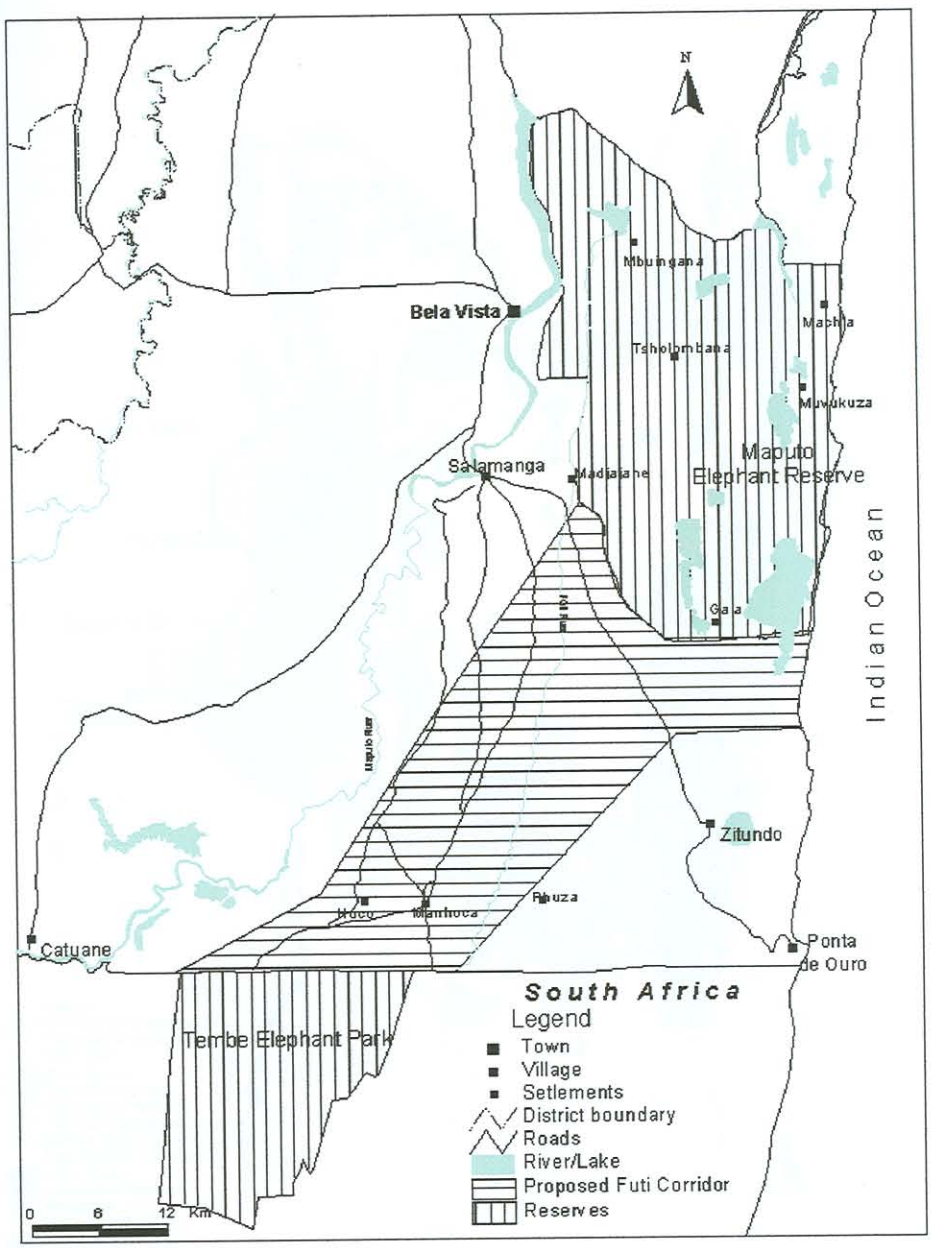

Figure 1: The location of boundaries of the Maputo Elephant Reserve in southern Mozambique. See details of the map in Figure 2.

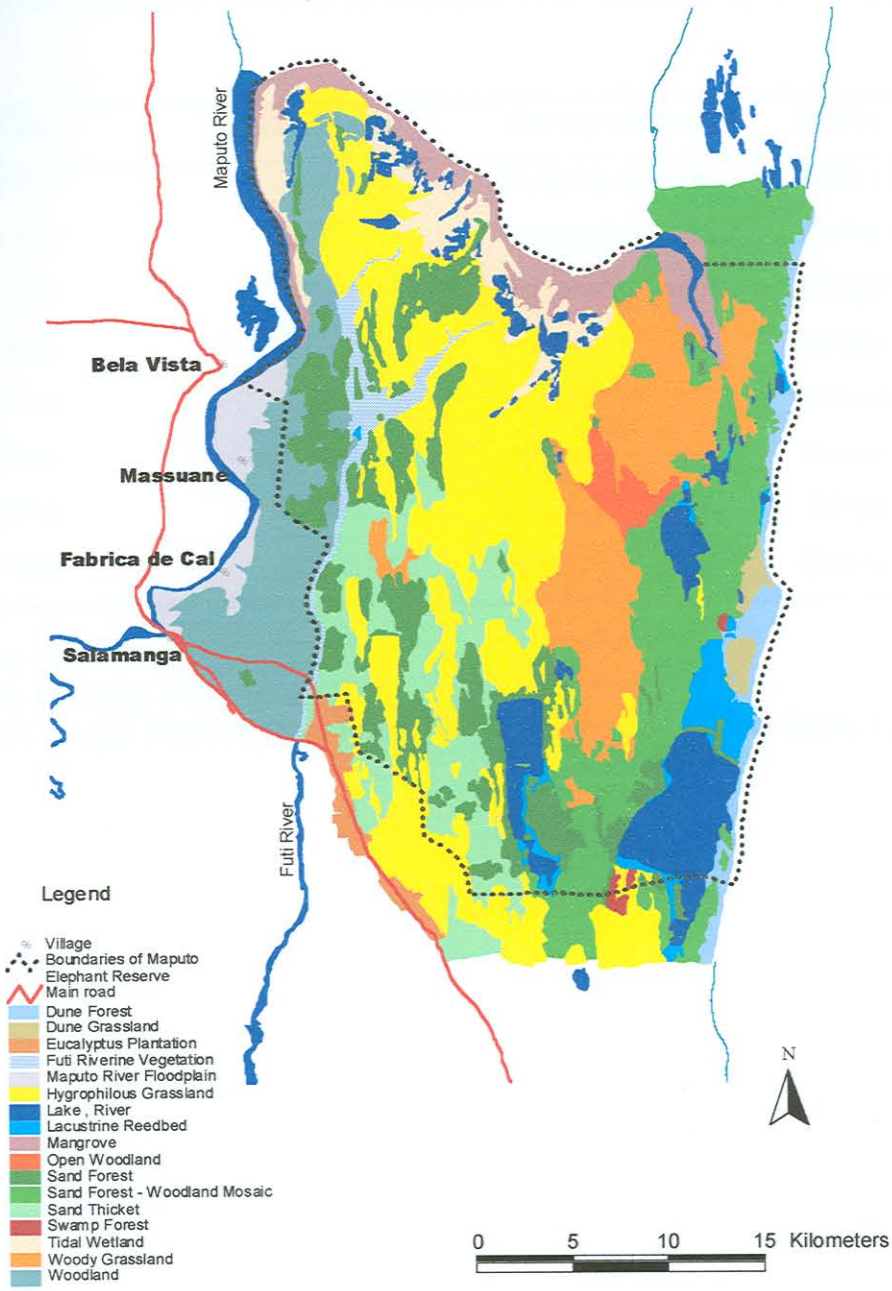

Figure 2: A vegetation map of Maputo Elephant Reserve based on a modification of a map produced by the Departamento de Ciências Biológicas (DCB 2000).

Table 1: The population estimates for elephants in the Maputo Elephant Reserve.

Year	Population size	Survey Method	Source
1970	350	Personal opinion	Tello (1973)
1972	269	Personal opinion	Tinley & Dutton (1972)[a]
1979	80	Personal opinion	Klingerhoefer (1987)
1995	137	Personal opinion	Davies (1995)[b]
1995	150	Personal opinion	Ostrosky & Matthews (199
1996	100-300	Personal opinion	Correia *et al.* (1996)
1998	180	Helicopter count	Whyte (pers. comm.)[1]
1999	205	Helicopter count	Current study

[a] Cited by Tello (1973)
[b] Cited by Ostrosky & Mathews (1995)
[1] I. Whyte, Kruger National Park, Private Bag X402, Skukuza 1350, South Africa.

The Futi Corridor

The Futi Corridor is part of the proposed Maputo TFCA (Transfrontier Conservation Area), situated in the southern-eastern part of the Maputo province (GEF 1996). It includes 2km on either side of the Futi River from Marco Viana (North of MER) up to the international border with South Africa (Oglethorpe 1997). Based on Landsat TM 1990-1991 imagery, field surveys and the interpretation of aerial photographs (Grossman & Loforte 1994; DINAGECA 1994; Hatton *et al.* 1995; Ostrosky & Matthews 1995; Haandrikman 1998) the following plant communities can be distinguished here:

Forests dominated by *Afzelia quanzensis, Mimusops caffra, Dialium schlechterii, Pteleopsis myrtifolia, Ptaeroxylon obliquum and Ochna barbosa.*

Grass plains are dominated by *Cymbopogon excavatus, Themeda triandra, Cynodon dactylon, Sporobolos virginicus* and *Phragmites australis, Dichrostachys cinerea, Strychnos madagascariensis, Strychnos spinosa* (Grossman & Loforte 1994, Hatton *et al.* 1995) and *Hyphaene coriacea* forms the woody component.

Woodlands dominated by *Afzelia quanzensis*, *Albizia adianthifolia* and *Sclerocarya birrea*, *Garcinia livingstonei*, *Terminalia sericea* and *Syzygium cordatum.*

Riverine vegetation comprises reedbeds dominated by *Phragmites ausatralis*, *Juncus kraussii* and *Cyperus compactus*, fringed by riverine forest of *Ficus sycomorus*, *Syzygium cordatum* and *Kigelia africana.*

People within the Corridor make a subsistence living through small-scale agriculture, hunting, and collection of fruit and roots for eating (Felgate 1986, GEF 1996). The main threat to indigenous biological resources in the areas is the uncontrolled poaching of wildlife and loss of habitat due to encroachment and conversion (GEF 1996). Ilala palm (*Hyphaene coriacea*) wine production is one means of earning cash income, particularly for the Ndlovo and Puza comunities. According to GEF (1996), poverty, and the lack of alternative sources of income is a significant factor in the area's natural resources use.

Agricultural production is estimated at US$200 per family per year, while forest products used annually were valued at US$118 (GEF 1996, Negrão (1996) cited by Massinga & Hatton 1996). The yearly consumption of medicinal plants totaled US$59 per family, while the consumption of animal protein amounted to US$118. The value of construction materials totaled US$50 (Negrão (1996) cited by Massinga & Hatton 1996).

AIMS

The present study is directed at determining if the type and/or state of vegetation and human activities are factors influencing the distribution, range use, habitat use and movement of elephants of the MER. The following objectives were formulated:

- To determine the range and habitat use of elephants of the MER and Futi Corridor.
- To relate range and habitat use to management implications for the MER and Futi Corridor elephant population.