Chapter 2

Study area

The study area is situated at the southern end of the Mozambique Coastal Plains. This area, now known as Maputaland, includes the Matutuine District of the Maputo Province in southern Mozambique and the northern part of the KwaZulu-Natal Province of South Africa. Geographically, the area stretches from the Lebombo Mountains in the west, the Indian Ocean in the east, the Bay of Maputo in the north and Lake St. Lucia in the south. The two conservation areas of interest include the Maputo Elephant Reserve (MER) (26°25'S, 32°45'E) and the associated Futi River Corridor (FC) in southern Mozambique, and the Tembe Elephant Park (TEP) (27°01'S 32°24'E) in South Africa (Fig. 2.1).

The MER was established in 1932 and covers some 800 km^2 under legislative protection of National Directorate for Conservation Areas (DNAC). Ezemvelo KwaZulu Natal Wildlife (EKZN), a provincial department, has the managing mandate for the TEP. The Park was proclaimed in 1983 and then fenced along its western, southern and eastern boundaries to prevent direct contact with people living on the South African side (Sandwith 1997). At 300 km^2, TEP covers an area less than half of MER. In 1989, the northern boundary with southern Mozambique was fenced off.

Some 17 people per km^2 (www.demarcation.org.za) reside mainly south and southeast of TEP, with no people living inside the Park. This differs from MER, where people remained after its proclamation (de Boer & Baquete 1998), and where they concentrate mostly in the southern and southeastern regions of the Reserve.

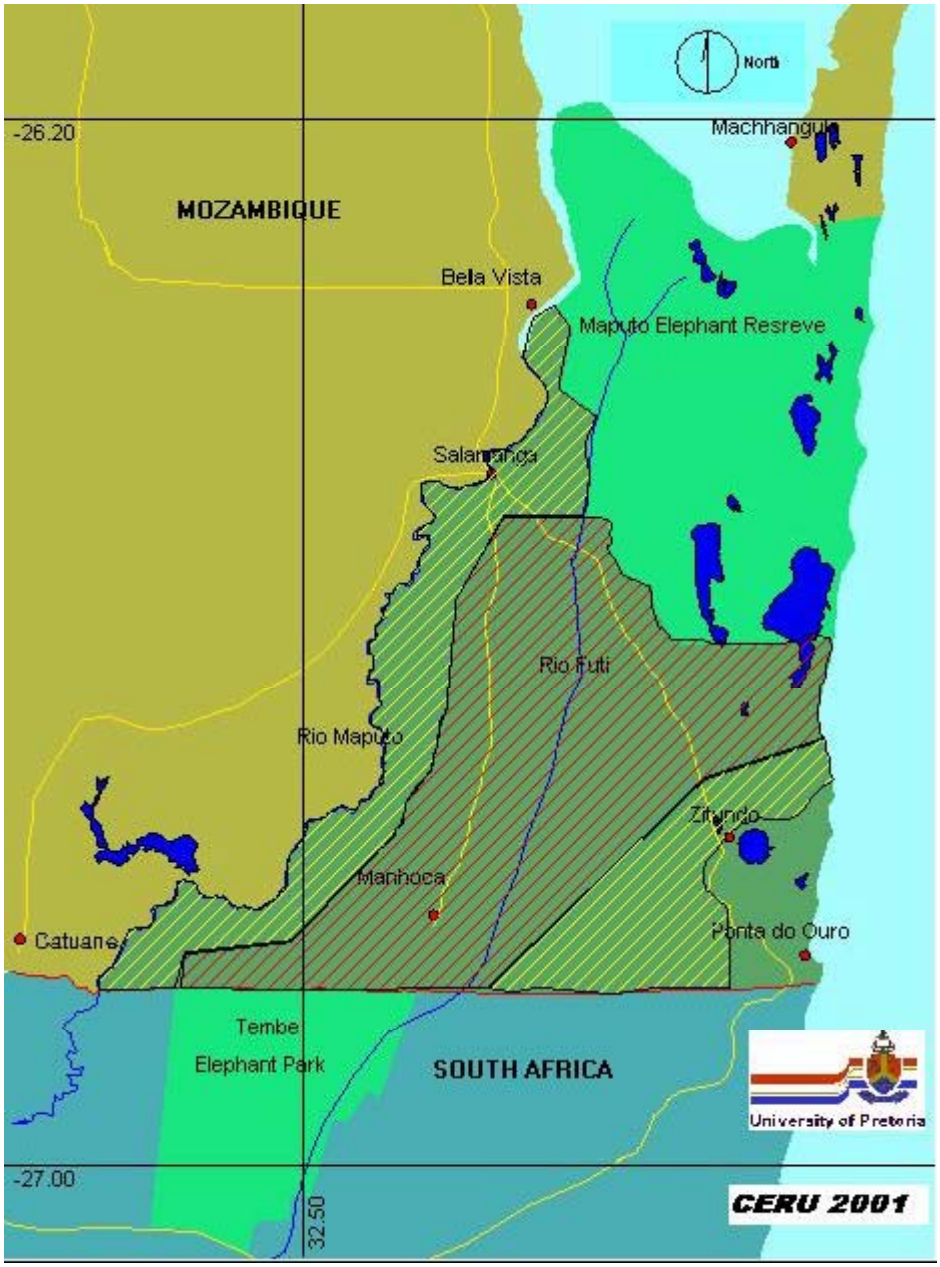

Fig. 2.1 Maputaland extends across the South African and Mozambican border. The Maputo Elephant Reserve and the Futi River are situated in southern Mozambique and Tembe Elephant Park in South Africa. The hatched area indicates the potential Futi corridor. This 40 km long strip used to link the two conservation areas before fencing the Tembe Elephant Park effectively divided this singular ecological entity in Maputaland.

The Physical Environment

The Mozambican coastal plains are covered in deep aeolian sands deposited during the quaternary period between 3 million and 10,000 years ago (Maud & Botha 2000), Geologically, this is one of the youngest landscapes in southern Africa and the soils are highly permeable, heavily leached and nutrient poor (Pollet *et al*. 1995). Along the riverine floodplains however, alluvial soils occur, with higher clay and base content (Myre 1964; Pollet *et al*. 1995). These areas are rich in organic matter. The nutrient-poor soils also alternate with clay-rich duplex soils that formed between sand dune ridges (Matthews *et al*. 2001).

The coastal plains consist of relict, north south running longitudinal dunes that extend from southern Mozambique into TEP and its surroundings. The main drainage lines consist of the Maputo and Futi Rivers, both which run in a south-north direction. The Maputo River drains in a large estuary in Maputo Bay. The Futi River originates just south of TEP, flows through the Park just inside the eastern perimeter (known here as the Muzi Swamps), and ends in the MER where it flows into a delta system. Seasonal pans occur along the Muzi Swamp, as well as between the dune ridges where either clay or duplex soil types are exposed. Other sources of surface water include several fresh water and saline lakes and marshes scattered throughout the study area.

The climate of Maputaland is sub-tropical, with hot wet summers and warm dry winters (van Wyk & Smith 2000). Humidity is high and evaporation exceeds precipitation for all months except in December, January and February (Schulze 1997). Winds are generally light with little seasonal variation in velocity. Gale force winds are recorded for the region (Pollet *et al*. 1995) and tropical cyclones are sometimes accompanied by destructive winds. No temperature data is available for

southern Mozambique or TEP. The nearest reliable source is the Mbazwana Airstrip (27º28'S 32º35'E) situated 60 km southeast of TEP. Here, temperature records show that, for the duration of the study period (2001 to 2003), the monthly mean (±SD) temperature (°C) ranged from 10.6 ± 1.76 to 21.7 ± 2.35 for the daily minimum and 23.6 ± 3.22 to 31.5 ± 3.78 for the daily maximum respectively.

Two rainfall stations recorded rainfall for the region. For southern Mozambique, we used the data collected at Changalane (26º17'S 32º11'E), which is the nearest station in southern Mozambique, and for TEP at the Park's headquarters (27º01'S 32º24'E). Rainfall patterns for the sites were similar for the duration of recording period. Southern Mozambique (1980 – 2002) received a mean (±SD) amount of 757 ± 226 mm and TEP (1959 – 2002) received 748 ± 388 mm annually (Figs. 2.2a & d). The coefficient of variation for the region is high, and ranged between 25 – 30 % (Schulze 1997). The cumulative rainfall surplus/deficit (see Dunham *et al*. 2004) for both TEP and southern Mozambique followed similar patterns, and the entire region experienced a dry period before the study, and higher than average rainfall during the time of field data collection (Figs. 2.2b & e). Rain may fall throughout the year but peaks during summer with a trough in winter (Figs. 2.2c & f). Months that contributed to less than 5% of the annual rainfall range from May until September, and this is consequently considered as the dry season. The wet season (October to April) for both TEP and southern Mozambique contributed more than 80% of the annual rainfall.

The Biological Components

The region between the Maputo, the capital of Mozambique, and Lake St. Lucia in

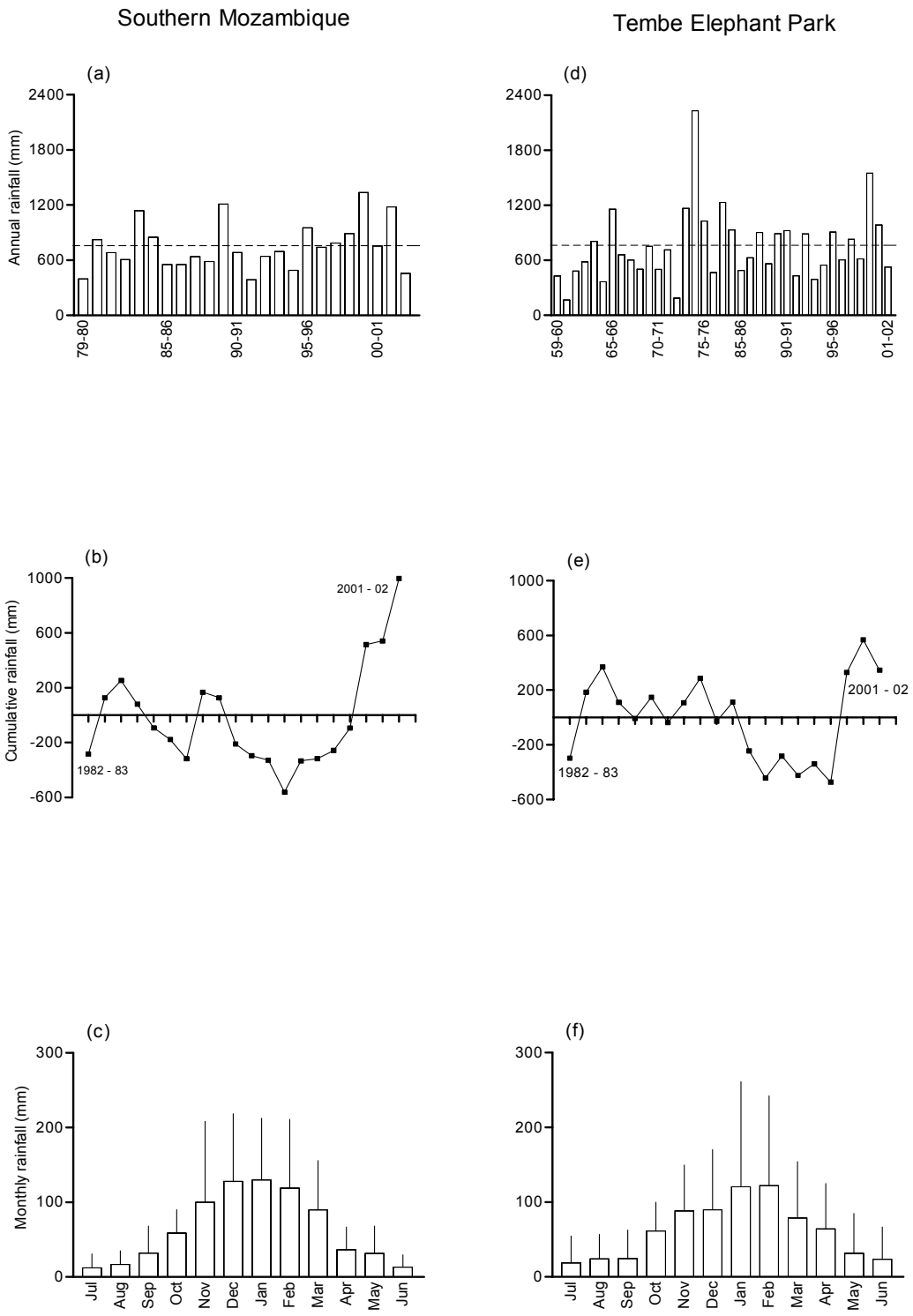

Fig 2.2 Rainfall variables for southern Mozambique and Tembe Elephant Park including (a & d) mean annual rainfall (calculated from the 1982/83 to 2001/02 season) (b & e) cumulative surplus/deficit rainfall and (c & f) mean (±SD) monthly rainfall.

South Africa represents the southern limit of the central African tropics and the northern limit of the southern African temperate forests (van Wyk 1996). This transitional zone supports plant and animal species from both the tropics and the temperate coastal regions (Moll & White 1978; Spector 2002). Van Wyk (1996) recognises this region separately as the Maputaland Centre (MC), due to high levels of diversity and endemism.

Recently Conservation International included this region into the Maputaland Pondoland-Albany Biodiversity Hotspot (www.biodiversityhotspots.org), one of 39 such regions around the world. The Maputaland regional contribution to this hotspot includes more than 2,500 species of vascular plants, 102 mammalian species/sub species and 472 bird species (Parker & de Boer 2000; Davis *et al.* 1994). Four of the bird species are endemic and 43 subspecies are either endemic or near endemic (Davis *et al.* 1994), now also recognised by BirdLife International as the Southeast African Endemic Bird Area. The region further supports a rich herpeto-fauna, with 112 species/subspecies of reptiles, 23 of which are endemic (Bruton & Haacke 1980) and 45 frog species, three of which are endemic (Poynton 1980). Some 67 species of fresh water fish occur here, of which 12 are endemic to Maputaland (Skelton 2001).

The elephant population estimate for MER and FC ranged from 80 to 350 individuals over the past 30 years (Morley 2005). The most recent estimate yielded 204 individuals (Ntumi 2002), increasing at about 3 percent per year (Morley 2005). The elephant numbers in TEP was relatively low (< 50 individuals) prior to erecting fences around TEP in 1989, but has since increased to 179 (95% CI = 136 – 233) for 2001 at 4.6 ± 0.06 percent per year (Morley 2005). These estimates yield a density of 0.25 and 0.59 elephants per km^2 for MER and TEP respectively.

Maputaland falls within the northern most part of the Tongaland–Pondoland Regional Mosaic, one of the main African phytochoria described by White (1983). The landscape of Maputaland is heterogeneous, and may be described using different classifying criteria (e.g. Moll & White 1978; Acocks 1988; Granger 1998). For instance, de Boer *et al*. (2000) recognises six plant communities within the MER and Matthews, *et al*. (2001) distinguished eight physiognomic vegetation types for TEP. The study area is however situated in the savanna biome (Westfall & Rutherford 1994), characterised by the coexistence of trees and grasses.

I define the landscape of the study area based on the structure of trees and shrubs (adapted from Edwards 1983). Such structures reflect on function since it relates to the physiological needs of elephants (e.g. Laws *et al*. 1970; Kinahan *et al*. in review). I used the classifications by de Boer *et al*. (2000) and Matthews *et al*. (2001) to verify the four broad landscape types (based on the landscape map constructed by Fairall & van Aarde (2004), using a cloud free partial scene ID 167-79 of 30 August 1999, Fig. 2.3). These included forests (mainly sand forest, and some swamp- and coastal dune forests), the open and closed woodlands and reed beds. Sand forests are very dense and a dry semi-deciduous forest type (van Wyk 1996). The closed woodlands are characterised by a closed and layered canopy with very dense undergrowth. Sparsely spaced mature trees and prominent grass sward dominate the open woodlands. The reed beds (dominated by *Phragmites australis* (Cav.) Steud) are associated with the Muzi Swamp in TEP, the FC and other surface water bodies in MER.

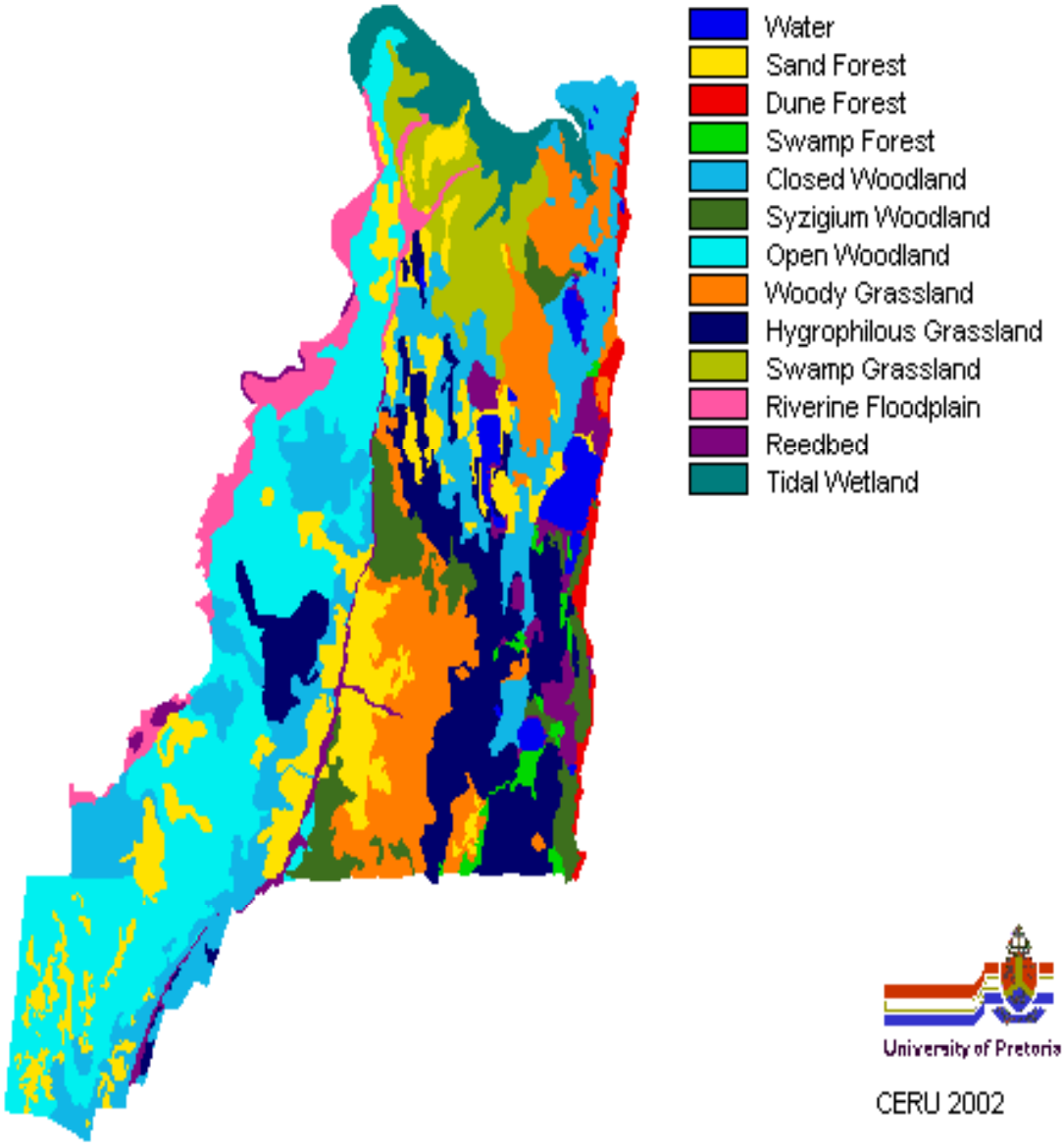

Fig 2.3 Landscape map of Tembe Elephant Park and southern Mozambique based on a supervised classification of a LANDSAT image of the area. Ground truthing of the landscapes was based on vegetation information from de Boer *et al*. (2000) and Matthews *et al*. (2001).