Chapter 2 Coastal dune forest in context

The study area (between Richards Bay town and the Umfolozi River mouth) and the mining process are described in the methods sections of each of the following chapters (3 to 6). A map of the mining lease is available in Chapter 6 (Figure 6-1). To avoid repetition I limit this chapter to a characterisation of coastal dune forest and its historic and current threats.

Characterisation of Coastal dune forest

Broadly, there are two types of forest in South Africa, Afrotemperate Forests (also referred to as Afromontane Forest) and Indian Ocean Coastal Belt Forests, with an intermediate (in terms of species composition and geography) coastal scarp forest situated between the two groups (Lawes et al. 2004). Forests occur along the southern and eastern seaboard of South Africa and extend a short distance in to the interior across the Great Escarpment, mountain ranges, and coastal plains (Mucina et al. 2006). Approximately 7 % of South Africa's land surface is climatically suitable for the development of forests, however forests comprise as little as 0.1 to 0.56 % (Mucina et al. 2006). Forests are generally fragmented and patches are very small (<100 hectares; Midgley et al. 1997). The threats to these forest patches include timber extraction, fuel-wood extraction, over-exploitation of plants and animals for food and traditional medicines, clearance for agriculture, clearance for housing, commercial plantations and mining (Lawes et al. 2004; Mucina et al. 2006). Therefore, an understanding of forest regeneration after disturbances is imperative to conserve and restore the disproportionate levels of biological diversity housed within South African forests (Lawes et al. 2004).

Coastal dune forest falls within the Indian Ocean Coastal Belt biome, which is one of the nine biomes in South Africa recognised by Rutherford et al. (2006). The biome covers the eastern seaboard of the Indian Ocean between the northern half of the Eastern Cape Province and extends through the KwaZulu-Natal Province northwards into Mozambique (Mucina et al. 2006). Burgess et al. (1998) suggest that coastal dune forest forms the southern most example of East African Tropical Coastal Forest, which extends along the Mozambican, Tanzanian, Kenyan and Southern Sudanese coast, although in east Africa, the forests generally have a larger inland extent than that seen in South Africa.

The Indian Ocean Coastal Belt formed in relatively recent (geological) times after the last glacial maximum (Lawes 1990). Sand dunes were formed from deposits left by the regression of the Indian Ocean during the last glacial period (8000-10000 years ago), and subsequently climatic forces (strong winds and arid periods) shaped the dunes in to their present day parabolic shape (Tinley 1985; von Maltitz et al. 2003).

The present-day climate is subtropical with rainfall occurring year-round but peaking in the summer months (southern hemisphere summer: November to February; see Figure 2-1). The temperature is hot and humid, the mean temperature between 2006 and 2009 was 23.79 ± 3.40 °C (mean ± standard deviation, n = 3 years) and peaked in February at 28.56 ± 0.72 °C (Figure 2-2). Thirteen of the last 18 years have been below the long-term mean rainfall (Figure 2-3).

Coastal dune forest is an eco-region within a biodiversity hotspot as it falls within the southern-most part of the Maputaland Centre of Endemism (van Wyk & Smith 2001; Küper et al. 2004). Endemism is rare within coastal dune forest itself, but a number of trees and birds do

reach their southern-most limit within this eco-region (von Maltitz et al. 2003; Gibbon 2006). The Conservation Research Unit (CERU) have only assessed patterns of endemism in the dung beetle community (Davis et al. 2003). However, this is a taxon that I do not assess (directly) in this thesis. Hamer & Slotow (2002) report that the millipede community exhibits endemism within the forests of northern KwaZulu-Natal although a list of these endemics is not given and therefore one should be cautious when making conclusions based on this.

In general, coastal dune forest is rich in plant species (Mucina et al. 2006) and has a canopy of 12 – 16 m (Ferreira & van Aarde 2000; Wassenaar et al. 2005). There are several distinct vertical strata and well developed understory that is between 0.2 m and 2 m high (Ferreira & van Aarde 1999; Wassenaar et al. 2005). Over the last 18 years of research CERU have identified 103 species of tree (woody plants >1.7 m high), 60 species of herbaceous plant, 88 species of birds and 21 species of millipedes in the undisturbed Sokhulu Forest and the contiguous Mapelane Nature Reserve that serve as "reference" or "benchmark" sites for the present study. Some additional species have been recorded in surveys that have taken place further north in the iSimangaliso Wetland Park (formally The Greater St Lucia Wetlands World Heritage site; see Redi et al. 2005), to the south of Richards Bay Town, adjacent to the Richards Bay Nature Reserve, as well as in the Umlalazi Nature Reserve (CERU unpublished data). I have only included plots surveyed in the Sokhulu Forest and Mapelane Nature Reserve for the calculation of species number and the characterisation of common species (below) for three reasons: these sites are the closest in geographical distance to the rehabilitating sites; are not separated by physical barriers (the Umfolozi River to the north and Mhlatuze River to the South); and have been repeatedly surveyed for all taxa unlike the other dune forest sites.

Previous published work has highlighted typical or dominant species found in mature coastal dune forest (for example, van Aarde et al. 1996; Kritzinger & van Aarde 1998; Ferreira & van Aarde 1999; Wassenaar et al. 2005). However, since these papers were published CERU has amassed further data on the community composition of mature coastal dune forest in our study region. Therefore, in order to characterise the species composition of the coastal dune forest community I have calculated the mean abundance of each species across all survey plots and identified those species that cumulatively make up the four quartiles of abundance. "Very common" species account for >75 % of mean cumulative abundance, "common species" account for 50 – 74 %, "rare species" account for 25 – 49 % of cumulative abundance, whereas "very rare" species account for <25 %. In the tables below (Table 2-1 to Table 2-4) I have assigned all recorded and identified species in each taxa one of these four criteria.

From Tables 2-1 to 2-4, one can describe the most typical species in the Sokhulu Forest and Mapelane Nature Reserve as those species contributing more than 50 % to mean total abundance per survey unit (very common and common species as defined above). The most dominant species in the tree community include the understorey trees *Dracaena aletriformis* and *Psychotria capensis*, as well as the subcanopy and canopy species *Diospyros natalensis*, *Erythroxylum emarginatum, Teclea gerrardii, Drypetes natalensis, Euclea racemosa subsp. sinuata, Deinbollia oblongifolia, Peddiea africana* and *Chionanthus peglerae*. Common species in the herbaceous plant community include the patchily distributed *Isoglossa woodii*, which is characteristic of coastal dune forest throughout the study region and further to the north as well (Ferreira & van Aarde 1999; Griffiths et al. 2007). Other herbaceous species include *Asparagus falcatus, Laportea peduncularis* and *Pupalia lappacea*. The climber *Pyrenacantha scandens* is

also a common species in mature coastal dune forest. Common bird species include Yellow-bellied Greenbul (*Chlorocichla falviventris*), Green-backed Camaroptera (*Camaroptera brachyura*), Collared Sunbird (*Hedydipna collaris*), Yellow-breasted Apalis (*Apalis flavida*), Dark-backed Weaver (*Ploceus bicolour*), Terrestrial Brownbul (*Phyllastrephus terrestris*), Black-backed Puffback (*Dryoscopus cubla*), Eastern Olive Sunbird (*Cyanomitra olivacea*) and the Yellow-rumped Tinkerbird (*Pogoniulus bilineatus*). Finally, the most common millipedes are *Centrobolus fulgidus* and *C. richardii*.

It is important to note that these species although dominant may not be specific to mature coastal dune forest as they are found throughout the region and can tolerate a wide variety of habitats including grasslands, woodlands and mature forest. For example, the millipede species C. *fulgidus* and *C. richardii* are present in all but the very youngest (< 6 years old) rehabilitating dune forest as well as dominating mature stages (Grayling et al. 2001; Redi et al. 2005). In order to determine the species that characterise a coastal dune forest one may also need to know which species are exclusive to mature coastal dune forest. These species include, for trees, *Chionanthus foveolatus*, *Pavetta natalensis*, *Acalypha glabrata*, *Ficus lutea*, *Allophylus africanus*, *Cassipourea malosana*, *Olea woodiana*, *Tecomaria capensis*, *Ficus polita*, *Pisonia aculeata*, *Drypetes reticulata*, *Ficus sycomorus*, *Tarenna pavettoides*, *Keetia gueinzii*, *Manilkara discolor*, *Tarenna junodii*, *Artabotrys monteiroae*, *Chionanthus battiscombei*, *Hymenocardia ulmoides*, *Ephippiocarpa orientalis* and four currently unknown species awaiting identification.

Herbaceous species exclusively recorded in mature coastal dune forest sites include *Aneilema dregeanum*, *Chlorophytum comosum*, *Combretum kraussii*, *Cryptocarya woodii*,

Cussonia arenicola, *Eugenia woodii*, *Pavetta gerstneri*, *Pollichia campestris*, *Rawsonia lucida*, *Scadoxus membranaceus*, *Scolopia flanaganii*, *Solanaceae sp.*, *Sonchus sp.*, and 11 unconfirmed species. The birds exclusively found in mature coastal dune forest sites are Blackheaded Oriole (*Oriolus larvatus*), Bluebilled firefinch (*Lagonosticta rubricata*), Buffspotted Flufftail (*Sarothrura elegans*), Cape Wagtail (*Motacilla capensis*), Chorister Robin (*Cossypha dichroa*), Crested Barbet (*Trachyphonus vallantii*), Croaking Cisticola (*Cisticola natelensis*), Fantailed Flycatcher (*Myioparus plumbeus*), Fiscal Flycatcher (*Sigelus silens*), Grey Cuckooshrike (*Coracina caesia*), Greyheaded Bush Shrike (*Malaconotus blanchoti*), Olive Bush Shrike (*Telophorus olivaceus*), Orangebreasted Bush Shrike (*Telophorus sulfureopectus*), Pallid Flycatcher (*Bradornis pallidus*), Purplecrested Turaco (*Musophaga porphyreolopha*), Scimitarbilled Woodhoopoe (*Rhinopomastus cyanomelas*), Spotted Thrush (*Zoothera guttata*) and Threestreaked Tchagra (*Tchagra australis*). Finally, the millipede species include *Ulodesmus micramma zuluensis*, two unidentified members of the genus *Sphaerothrium*, and a further unidentified species.

A certain amount of caution is required in taking the above approach, as species may be present in rehabilitating sites but at low densities or in the edges of the site (where we do not survey) so are effectively undetectable. The bird species Narina Trogon (*Apaloderma narina*) has been seen in rehabilitating coastal dune forest sites but never recorded in a sampling plot. Without knowledge of species habitat requirements, it is difficult to draw many sound conclusions with regard to which species characterise coastal dune forest entirely. Assessing species typical in and species exclusive to mature coastal dune forest may only provide some insight.

Past and current threats to coastal dune forest

Coastal dune forest has a long history of human disturbance; iron-age man (around AD 400) may have influenced the regeneration dynamics of modern forests in the region by large-scale deforestation for agriculture and eventually for the production of charcoal to fuel the iron smelting process (West et al. 2000). The biggest impact probably coincided with the arrival of the Zulu people in the year 1670. The local clan, the Mbonambi, became well known as iron workers, due to the wealth of natural resources (iron ore and wood) in the area (Knight 1989).

In modern times as throughout history, impacts and threats stem from the increasing human population and their requirements for resources. The Province of KwaZulu-Natal has the second highest population in South Africa (10,650,000 people, which equates to 21.3 % of the total population; Statistics South Africa (2010)). In addition, it has high species richness and diversity (Fairbanks et al. 2001; Wessels et al. 2002) and encompasses 9351 km^2 (total area 17000 km^2) of the Maputaland centre of endemism (van Wyk & Smith 2001; Smith et al. 2006). The Maputaland centre of endemism forms a part of the Maputaland-Pondoland-Albany hotspot of biological diversity (Steenkamp et al. 2004). Where areas of high species richness coincide with areas of high human density, one expects conservation conflict (Balmford et al. 2001). This is particularly evident along the coastline of KwaZulu-Natal where large-scale habitat transformation has meant that less than 50 % of native vegetation remains (Wessels et al. 2002). In the large urban centres along the north coast (Durban and Richards Bay), the remaining natural vegetation is as little as 0 to 20 % (Wessels et al. 2002). Coastal dune forest historically, would have been the dominant vegetation along this coastline. Currently, 64-68 % of coastal

dune forest is under statutory protection within nature reserves (Mucina et al. 2006; Wooley 2003). The original extent of dune forest has diminished through anthropogenic actions that have transformed forest in to land uses such as livestock grazing, agriculture (sugarcane), timber plantations, urbanisation, and tourism developments (Mucina et al. 2006). Presently, mining is considered as the largest threat to coastal dune forest conservation (Mucina et al. 2006). Wooley (2003) estimated that, of the total area of coastal dune forest within the Maputaland Centre of Endemism mining activities threatened 20.33 %.

Lawes et al. (2004) consider coastal dune forest to be resilient to disturbances. Weisser & Marques (1979) illustrate this clearly in their review of the changes in dune vegetation between Richards Bay Town and the Umfolozi River from 1937 to 1974. In 1937, there were high levels of degradation due to the clearance of vegetation for grazing and cultivation. The remaining forest habitat was patchily distributed. Between 1937 and 1974, there was commercial reforestation with plantations of *Eucalyptus* spp., *Pinus* spp., and *Casuarina equisetifolia*. A by-product of forestry management, the control of fire, allowed *Acacia karroo* to invade secondary dune grasslands, and eventually to develop as secondary dune forest. Therefore, there was defragmentation of forest as open areas reverted to closed woodland and forest habitat.

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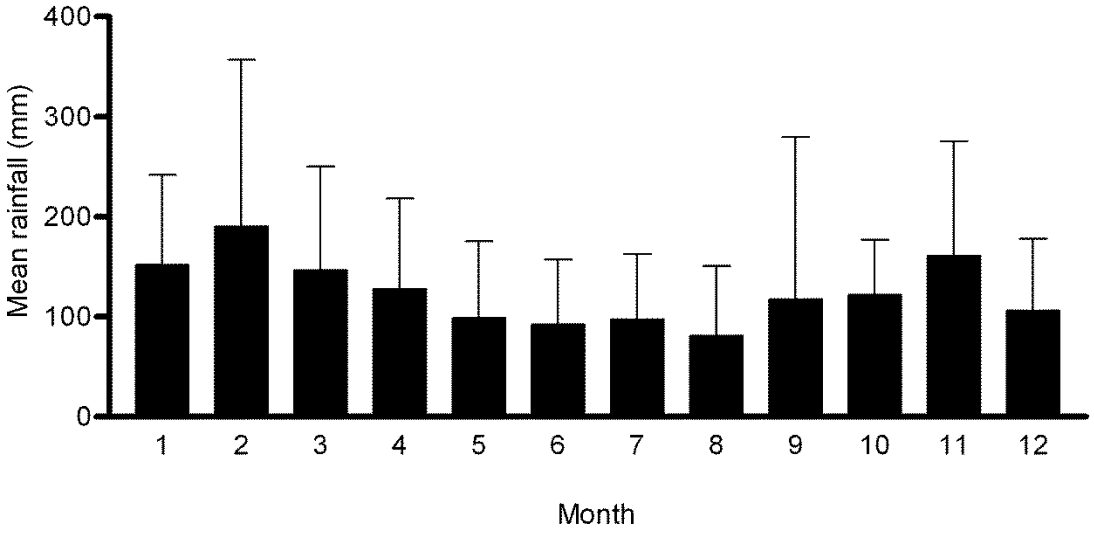

Fig.2-1. Mean monthly rainfall with standard deviation (error bars) calculated as a long term mean between 1976 and 2009 (data courtesy of RBM).

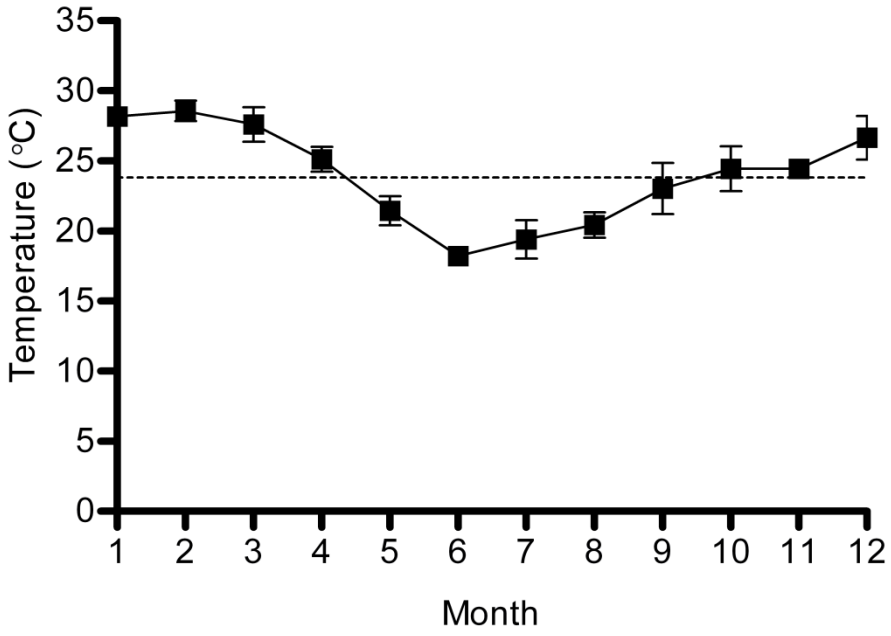

Fig.2-2. Mean (± Standard deviation) monthly temperature between 2006 and 2009 (data courtesy of RBM). The dotted line indicates the long-term mean temperature.

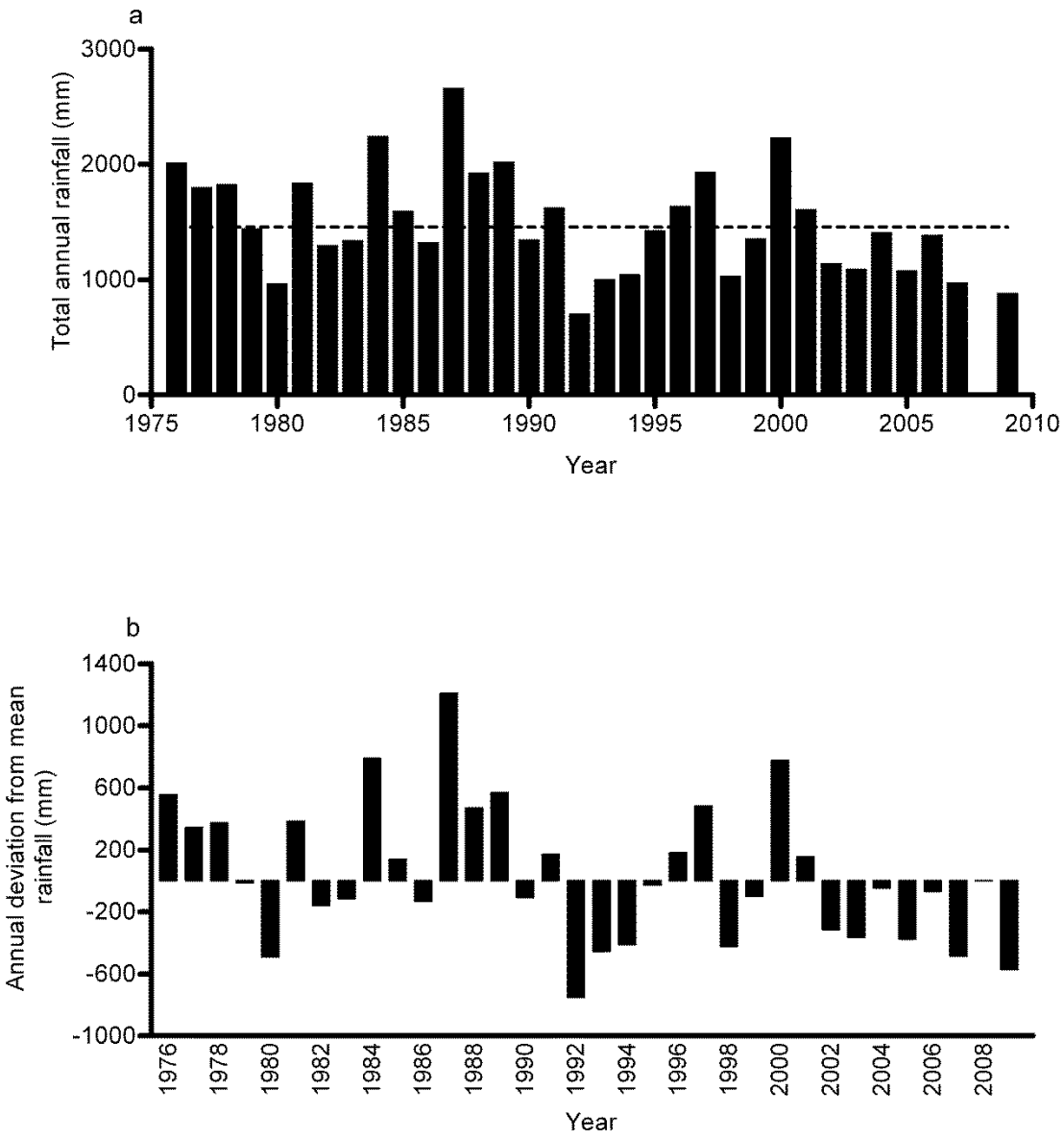

Fig.2-3. Total rainfall (a) per year between 1976 and 2009 (data courtesy of RBM). The dotted line indicates the long-term mean yearly rainfall. The annual deviation from the long-term mean annual rainfall is shown in (b).

Table 2-1. The tree species recorded in the Sokhulu Forest and Mapelane Nature Reserve between 1997 and 2005.

Latin name	Quartile >75 % = "Very Common"; 50 % to 74 % = "Common"; 25 % to 49 % ="Rare"; <25 % "Very Rare"
Dracaena aletriformis	Very Common
Diospyros natalensis	Very Common
Erythroxylum emarginatum	Very Common
Teclea gerrardii	Very Common
Drypetes natalensis	Common
Psychotria capensis	Common
Euclea racemosa subsp. sinuata	Common
Deinbollia oblongifolia	Common
Peddiea africana	Common
Chionanthus peglerae	Common
Pavetta revoluta	Rare
Celtis africana	Rare
Mimusops caffra	Rare
Dovyalis longispina	Rare
Acacia kraussiana	Rare
Ochna natalitia	Rare
Scutia myrtina	Rare
Englerophytum natalense	Rare
Scolopia zeyheri	Rare

Euclea natalensis	Rare
Diospyros inhacaensis	Rare
Clausena anisata	Rare
Carissa bispinosa	Rare
Rhoicissus tridentata	Very Rare
Eugenia natalitia	Very Rare
Pancovia golungensis	Very Rare
Tricalysia sonderiana	Very Rare
Erythrococca berberidea	Very Rare
Sideroxylon inerme	Very Rare
Gymnosporia nemorosa	Very Rare
Kraussia floribunda	Very Rare
Apodytes dimidiata	Very Rare
Ekebergia capensis	Very Rare
Strychnos gerrardii	Very Rare
Catunaregam spinosa	Very Rare
Allophylus natalensis	Very Rare
Turraea floribunda	Very Rare
Canthium inerme	Very Rare
Dalbergia armata	Very Rare
Elaeodendron croceum	Very Rare
Strelitzia nicolai	Very Rare
Grewia occidentalis	Very Rare
Monanthotaxis caffra	Very Rare
Capparis sepiaria	Very Rare
Pavetta Sp.	Very Rare

Mystroxylon aethiopicum	Very Rare
Ziziphus mucronata	Very Rare
Landolphia kirki	Very Rare
Ficus burtt-davyi	Very Rare
Eugenia capensis	Very Rare
Trichilia emetica	Very Rare
Ochna sp.	Very Rare
Psydrax obovata	Very Rare
Turraea obtusifolia	Very Rare
Brachylaena discolor	Very Rare
Chaetacme aristata	Very Rare
Clerodendrum glabrum	Very Rare
Olea capensis	Very Rare
Cola natalensis	Very Rare
Grewia caffra	Very Rare
Rhus natalensis	Very Rare
Vangueria randii	Very Rare
Ephippiocarpa orientalis	Very Rare
Acacia karroo	Very Rare
Capparis tomentosa	Very Rare
Cordia caffra	Very Rare
Cussonia sphaerocephala	Very Rare
Rhoicissus rhomboidea	Very Rare
Rhoicissus digitata	Very Rare
Acokanthera oppositifolia	Very Rare
Maytenus undata	Very Rare

Salacia gerrardii	Very Rare
Trichilia dregeana	Very Rare
Keetia gueinzii	Very Rare
Maerua nervosa	Very Rare
Antidesma venosum	Very Rare
Vepris lanceolata	Very Rare
Strychnos henningsii	Very Rare
Ficus craterostoma	Very Rare
Garcinia livingstonei	Very Rare
Pavetta Sp.	Very Rare
Bauhinia tomentosa	Very Rare
Maytenus procumbens	Very Rare
Uvaria caffra	Very Rare
Gardenia thunbergia	Very Rare

Table 2-2. The herbaceous plant species recorded in the Sokhulu Forest and Mapelane Nature Reserve in 2005.

Latin name	Quartile >75 % = "Very Common"; 50 % to 74 % = "Common"; 25 % to 49 % ="Rare"; <25 % "Very Rare"
Isoglossa woodii	Very Common
Asparagus falcatus	Common
Laportea peduncularis	Common
Pupalia lappacea	Common
Pyrenacantha scandens	Common
Clausena anisata	Rare
Commelina benghalensis	Rare
Cynanchum ellipticum	Rare
Dactyloctenium australe	Rare
Microsorium scolopendrium	Rare
Tragia glabrata	Rare
Acalypha villicaulis	Very Rare
Achyranthes aspera	Very Rare
Achyropsis avicularis	Very Rare
Ancylobotrys petersiana	Very Rare
Aneilema aequinoctiale	Very Rare
Asparagus setaceus	Very Rare
Asparagus sp.	Very Rare
Asplenium prionitis	Very Rare

Asystasia gangetica	Very Rare
Canthium sp.	Very Rare
Chlorophytum bowkeri	Very Rare
Chromolaena odorata	Very Rare
Cissampelos torulosa	Very Rare
Coccinia variifolia	Very Rare
Commelina eckloniana	Very Rare
Cyperus albostriatus	Very Rare
Cyphostemma hypoleucum	Very Rare
Cyphostemma woodii	Very Rare
Digitaria diversinervis	Very Rare
Dioscorea sylvatica	Very Rare
Drimiopsis maculata	Very Rare
Eragrostis sp.	Very Rare
Eugenia woodii	Very Rare
Flagellaria guineensis	Very Rare
Ipomoea ficifolia	Very Rare
Krauseola mosambicina	Very Rare
Mariscus macrocarpus	Very Rare
Menispermaceae sp.	Very Rare
Mikania natalensis	Very Rare
Neonotonia wightii	Very Rare
Oplismenus hirtellus	Very Rare
Panicum maximum	Very Rare
Rhynchosia caribaea	Very Rare
Sansevieria hyacinthoides	Very Rare

Scadoxus membranaceus	Very Rare
Secamone filiformis	Very Rare
Senecio deltoideus	Very Rare
Senecio quinquelobus	Very Rare
Senecio tamoides	Very Rare
Solanaceae sp.	Very Rare
Thunbergia dregeana	Very Rare
Tinospora caffra	Very Rare
Vernonia angulifolia	Very Rare
Vernonia aurantiaca	Very Rare
Zehneria parvifolia	Very Rare

Table 2-3. Bird species recorded in the Sokhulu Forest and Mapelane Nature Reserves between 1997 and 2009. I have added in the common name to ease identification.

Common name	Latin name	Quartile >75 % = "Very Common"; 50 % to 74 % = "Common"; 25 % to 49 % ="Rare"; <25 % "Very Rare"
Yellow-bellied Greenbul	*Chlorocichla falviventris*	Very Common
Green-backed Camaroptera	*Camaroptera brachyura*	Very Common
Collared Sunbird	*Hedydipna collaris*	Very Common
Yellow-breasted Apalis	*Apalis flavida*	Common
Dark-backed Weaver	*Ploceus bicolor*	Common
Terrestrial Brownbul	*Phyllastrephus terrestris*	Common
Black-backed Puffback	*Dryoscopus cubla*	Common
Eastern Olive Sunbird	*Cyanomitra olivacea*	Common
Yellow-rumped Tinkerbird	*Pogoniulus bilineatus*	Common
Sombre Greenbul	*Andropadus importunus*	Rare
Red-capped Robin-Chat	*Cossypha natalensis*	Rare
Dark-capped Bulbul	*Pycnonotus tricolor*	Rare
Square-tailed Drongo	*Dicrurus ludwigii*	Rare
White-eared Barbet	*Stactolaema leucotis*	Rare
Cape White-eye	*Zosterops virens*	Rare
Rudd's Apalis	*Apalis ruddi*	Rare
Southern Boubou	*Laniarius ferrugineus*	Rare
Livingstone's Turaco	*Tauraco livingstonii*	Very Rare

Woodwards' Batis	*Batis fratrum*	Very Rare
Blue-mantled Crested Flycatcher	*Trochocercus cyanomelas*	Very Rare
Grey Sunbird	*Cyanomitra veroxii*	Very Rare
Black-bellied Starling	*Lamprotornis corruscus*	Very Rare
Lemon Dove	*Aplopelia larvata*	Very Rare
Trumpeter Hornbill	*Bycanistes bucinator*	Very Rare
Tawny-flanked Prinia	*Prinia subflava*	Very Rare
Black-throated Wattle-eye	*Platysteira peltata*	Very Rare
Crowned Hornbill	*Tockus alboterminatus*	Very Rare
Green Malkoha	*Ceuthmochares aereus*	Very Rare
Eastern Nicator	*Nicator gularis*	Very Rare
Tambourine Dove	*Turtur tympanistria*	Very Rare
Thick-billed Weaver	*Amblyospiza albifrons*	Very Rare
Ashy Flycatcher	*Muscicapa caerulescens*	Very Rare
Burchell's Coucal	*Centropus burchellii*	Very Rare
Green Twinspot	*Mandingoa nitidula*	Very Rare
Red-fronted Tinkerbird	*Pogoniulus pusillus*	Very Rare
Red-backed Mannikin	*Lonchura nigriceps*	Very Rare
Zitting Cisticola	*Cisticola juncidis*	Very Rare
Pale Flycatcher	*Bradornis pallidus*	Very Rare
Purple-banded Sunbird	*Cinnyris bifasciata*	Very Rare
Eastern Bronze-naped Pigeon	*Columba delegorguei*	Very Rare
Golden-tailed Woodpecker	*Campethera abingoni*	Very Rare
African Paradise-Flycatcher	*Terpsiphone viridis*	Very Rare

Yellow Weaver	*Ploceus subaureus*	Very Rare
Brown-hooded Kingfisher	*Halcyon albiventris*	Very Rare
Red-eyed Dove	*Streptopelia semitorquata*	Very Rare
Woolly-necked Stork	*Ciconia episcopus*	Very Rare
Cape Wagtail	*Motacilla capensis*	Very Rare
Gorgeous Bush-Shrike	*Telophorus quadricolor*	Very Rare
African Green-Pigeon	*Treron calva*	Very Rare
Speckled Mousebird	*Colius striatus*	Very Rare
Willow Warbler	*Phylloscopus trochilus*	Very Rare
Yellow-fronted Canary	*Serinus mozambicus*	Very Rare
Amethyst Sunbird	*Chalcomitra amethystina*	Very Rare
Buff-Spotted Flufftail	*Sarothrura elegans*	Very Rare
Cape Canary	*Serinus canicollis*	Very Rare
Purple-crested Turaco	*Musophaga porphyreolopha*	Very Rare
Barn Swallow	*Hirundo rustica*	Very Rare
Black-crowned Tchagra	*Tchagra senegala*	Very Rare
Black-headed Oriole	*Oriolus larvatus*	Very Rare
Cape Rock-Thrush	*Monticola rupestris*	Very Rare
Common Waxbill	*Estrilda astrild*	Very Rare
African Emerald Cuckoo	*Chrysococcyx cupreus*	Very Rare
Fork-tailed Drongo	*Dicrurus adsimilis*	Very Rare
Grey Cuckooshrike	*Coracina caesia*	Very Rare
Grey Waxbill	*Estrilda perreini*	Very Rare
Hadeda Ibis	*Bostrychia hagedash*	Very Rare
Little Bee-eater	*Merops pusillus*	Very Rare
Scaly-throated Honeyguide	*Indicator variegatus*	Very Rare

Scarlet-chested Sunbird	*Chalcomitra senegalensis*	Very Rare
Bar-throated Apalis	*Apalis thoracica*	Very Rare
Olive Woodpecker	*Dendropicos griseocephalus*	Very Rare
Crested Guineafowl	*Guttera pucherani*	Very Rare
Bearded Scrub-Robin	*Cercotrichas quadrivirgata*	Very Rare
African Firefinch	*Lagonosticta rubricata*	Very Rare
Cardinal Woodpecker	*Dendropicos fuscescens*	Very Rare
African Dusky Flycatcher	*Muscicapa adusta*	Very Rare
European Nightjar	*Caprimulgus europaeus*	Very Rare
Grey Tit-Flycatcher	*Myioparus plumbeus*	Very Rare
Fiscal Flycatcher	*Sigelus silens*	Very Rare
Klaas's Cuckoo	*Chrysococcyx klass*	Very Rare
Narina Trogon	*Apalpderma narina*	Very Rare
Orange-breasted Bush-Shrike	*Telophorus sulfureopectus*	Very Rare
Rufous-naped Lark	*Mirafra africana*	Very Rare
Spotted Ground-Thrush	*Zoothera guttata*	Very Rare
Brown Scrub-Robin	*Cercotrichas signata*	Very Rare
Weavers[1]	*Ploceus*	Very Rare
Malachite Kingfisher	*Alcedo cristata*	Very Rare

[1] Yellow weavers (*Ploceus subaureus*) and Lesser masked weavers (*P. intermedius*) were considered as a morpho-species because females are difficult to distinguish in the field

Table 2-4. Millipede species recorded in the Sokhulu Forest and Mapelane Nature Reserves between 1997 and 2009.

Latin name	Quartile >75 % = "Very Common"; 50 % to 74 % = "Common"; 25 % to 49 % ="Rare"; <25 % "Very Rare"
Centrobolus fulgidus	Very Common
Centrobolus richardii	Common
Spinotarsus anguiliferous	Rare
Doratogonus sp.	Rare
Ulodesmus micramma zuluensis	Very Rare
Spirostreptidae sp. 1	Very Rare
Centrobolus rugulosus	Very Rare
Sphaerotherium punctulatum	Very Rare
Spirostreptidae sp. 2	Very Rare
Sphaerothrium sp. E	Very Rare
Gnomeskelus tuberosus	Very Rare
Juliaformia sp. 3	Very Rare
Sphaerotherium rotundatum	Very Rare
Orthroporoides sp.	Very Rare
Sphaerotherium giganteum	Very Rare
Sphaerotherium sp. D	Very Rare