A landcover classification system for Maputaland

Introduction

The distribution of Maputaland's vegetation types are heavily influenced by the soils and climate of the region and can be classified as belonging to one of five ecological zones (Tinley & van Riet, 1981). These zones act as the basis for the landcover classification system used in this project, which are supplemented with categories that describe transformed land and unvegetated wetland habitats.

A) Lebombo zone

The Lebombo zone is defined as the area containing the Lebombo Mountains, which contains poor rocky soils. It contains six main land-cover types that are:

1. **Lebombo aquatic**. This is the vegetation found around the pans, streams, marshes, springs and gorges of the Lebombo Mountains.

2. **Rock-faces**. Some rock-faces are covered by the root mats of *Selaginella dregei*, which also contain dwarf grasses, such as *Orpetium capense*. In addition, a range of shrubs, trees and succulents are found in clumps on the rock-faces or in crevices and around outcrops. These include fig species, such as *Ficus soldanella*, *F. ingens*, *F. glumosa*, the white impala-lily (*Pachypodium saundersiae*), aloes (*Aloe marlothii* and *A. sessiliflora*) and the tree euphorbias *Euphorbia cooperi*, *E. evansii*, *E. tirucalli* and *E. triangularis*.

3. **Lebombo grassland**. This grassland is mostly found on rhyolitic soils and consists of acid, wiry, species that have poor pasture value. The most common grass species are: *Elionurus argenteus*, *Andropogon gayanus*, *Schizachyrium semiberbe*, *Tristachya hispida*, *Brachiaria serrata* and *Hyperthelia dissoluta*. On the heavier dolerite soils, other species such as *Heteropogon contortus*, *Themeda triandra*, *Cymbopogon excavatus* and *Hyparrhenia filipendula* are found and these produce good quality pasture.

4. **Lebombo woodland**. The trees in this woodland are generally 4 to 7 m in height, with the species dominance being influenced by the aspect of the slopes on which they are found. The xeroclines are mostly dominated by *Combretum apiculatum*, whereas the mesoclines are mostly dominated by *Acacia* species. Typical trees also include: *Combretum molle*, *C. zeyheri*, *Terminalia phanerophlebia*, *Acacia burkei*, *A. caffra*, *A. davyi*, *A. swazica*, *Lannea discolor* and *Pterocarpus rotundifolius*.

5. **Lebombo thicket**. Thicket in the Lebombo Mountains is found in a range of conditions and has a varying species composition. Valley thicket species are noted for *Olea europea*, *Ptaeroxylon obliquum*, whereas *Ficus abutilifolia*, *F. ingens*, *F. glumosa*, *Pavetta edentula*, *Olax dissitiflora* and *Cussonia natalensis* are associated with rock outcrops. Typical termitaria thicket components on the summit plateaux are *Pappea capensis*, *Cadaba natalensis*, *Sideroxylon inerme*, *Euclea racemosa* and *Schotia brachypetala*.

6. **Lebombo forest**. This has a canopy that attains 20 m in height and is formed by trees such as C*hrysophyllum viridifolium*, *Heywoodia lucens*, *Homalium dentatum*, *Combretum kraussii* and three *Celtis* species, *C. africana, C. durandii and C. mildbraedii*. This is a mixed or transition forest composed of elements from both tropical and Afrotemperate forests.

B) Cretaceous zone

The cretaceous zone is found between the Lebombo Mountains and the large coastal plain. Its soils have high agricultural value and it contains four natural land-cover types that are:
1. **Acacia tortilis woodland**. This is dominated by *Acacia tortilis* but is also associated with *Spirostachys africana* and *Schotia brachypetala*. The main grasses are *Dactyloctenium australe*, *Chloris virgata* and *Eragrostis rigidior*, but the herbaceous layer is undeveloped.

2. **Acacia nigrescens woodland**. The tree layer is dominated by *Acacia nigrescens* with *Dichrostachys cinerea* common in the sub-story. The herbaceous layer is diverse with *Themeda triandra*, *Panicum coloratum*, *Panicum maximum*, *Urochloa mosambicensis* and *Bothriochloa insculpta* as the dominant grasses.

3. **Acacia grandicornuta bushland**. This is found on the better-drained textured soils with a red surface and impervious subsoil. It typically contains *A. grandicornuta* (although other *Acacia* species are generally present), together with a rich mixture of other trees and shrubs.

4. **Acacia luederitzii thicket**. These are generally in flat, poorly drained areas on dark calcareous vertic clays. The thicket is dense and low (3 to 5 m high) and is dominated by *Acacia luederitzii* and *Euclea divinorum*.

C) Alluvial zone

The alluvial zone is found mostly along the large rivers that cross both the cretaceous and coastal plain zone. This is the only zone that does not have a distinct north-south orientation and it contains four main natural land-cover types:

1. **Floodplain grassland**. This can consist of the medium height *Echinochloa pyramidalis*-*Hemarthria altissima* grass community, the shorter *Cynodon dactylon* lawn grass community or small patches of reeds. These three grass species form the most important dry season pasture in the entire region and their distributions are determined by grazing and burning patterns.

2. **Reed bed**. This consists of tall beds made up of *Phragmites mauritianus* and *P. australis*.

3. **Riverine thicket**. This is mostly composed of *Acacia schweinfurthii*, *Azima tetracantha* and the alien *Eupatorium odoratum*.

4. **Riverine forest and woodland**. The most striking tree species found in this vegetation type are *Ficus sycomorus* and *Acacia xanthophloea* as these have a canopy height of up to 25 metres. Other trees include: *Cordyla africana*, *Syzygium guineense*, *Rauvolfia caffra* and *Trichilia dregeana* (Rogers, 1980). Between the large trees and the water there is often a fringe of dense vegetation overhanging the river bank formed by *Phoenix reclinata*, *Ficus capreifolia*, *Grewia caffra* and *Pisonia aculeata*.

D) Coastal plain zone

The coastal plain zone is the largest of the ecological zones. It lies on several different types of sand and has little agricultural value. There are ten natural land-cover types in this zone and the distribution of each are affected by the position of the water table:

1. **Sedge and grass swamp**. This vegetation type is found in freshwater lakes and marshes and is dominated by two species of grass *Leersia hexandra* and *Panicum meyerianum* that grow out from the margins to form dense floating patches. The taller marsh and swamp grasses and sedges include: *Phragmites* spp., *Scirpus littoralis*, *Caldium* spp., *Cyperus*

papyrus, *C. immensus* and *Typha latifolia*. Other grasses include *Andropogon eucomis*, *Ischaemum arcuatum*, *Sporobolus subtilis* and *Eragrostis lappula*.

2. **Hygrophilous grasslands**. These grasslands tend to be found on flat ground or on inter-dune depressions and are waterlogged for most of the year. The most commonly found species are the grasses *Themeda triandra*, *Ischaemum arcuatum*, *Andropogon gayanus*, *Sporobolus subtilis*, *Imperata cylindrica* and *Brachiaria arrecta*. The forb *Centella asiatica*, the creeper *Desmodium dregeanum* and the sedges *Cyperus obtusiflorus*, *C. natalensis*, *C. tenax* and *Bulbostylis contexta* are also generally present.

3. **Woody grassland**. Woody grasslands are found on dune crests, slopes and relatively high lying level plains. Diagnostic species include the geoxylic rhizomatous suffrutex *Parinari capensis*, which together with other plants, such as *Eugenia albanensis*, *Ancylobothrys petersiana*, *Salacia kraussii* and a dwarf form of *Dichrostachys cinerea*, add a woody component to the grassland. Common grass species include *Themeda triandra*, *Diheteropogon amplectens*, *Urelytrum agropyroides* and *Trichoneura grandiglumis*.

4. **Terminalia woodland**. A wide range of tree species is found in this woodland, although *Terminalia sericea* is the main diagnostic species. Other typical examples of sand woodland trees, which are between 5 and 12 m in height, include: *Sclerocarya caffra*, *Combretum zeyheri*, *C. molle*, *C. collinum*, *S. madagascariensis*, *S. spinosa*, *Acacia burkei* and *Ozoroa engleri*. The grass stratum of these sand woodlands is formed by medium to tall sourveld species such as *Hyperthelia dissoluta*, *Pogonarthria squarrosa*, *Perotis patens*, *Triraphis andropgonoides*, *Digitaria macroglossa* and *Panicum* species.

5. **Woodland on red sands**. The sand woodland trees on red sands are chiefly *Combretum molle*, *C. zeyheri*, *Sclerocarya birrea* (marula), *Strychnos spinosa*, *S. madagascariensis*, *Acacia burkei*, *Lannea stuhlmannii* and *Sterculia rogersii*. Grasses are chiefly acid, wiry or thatch-grass species such as *Aristida* spp, and *Hyperthelia dissoluta*, but better grazing grasses such as *Panicum maximum* and Digitaria occur, the former especially in the crown shade zone of trees such as the marula.

6. **Sand thicket**. The sand thicket is mostly composed of woodland species that form bush clumps beneath large woodland trees. Species include: *Sclerocarya birrea*, *Strychnos spinosa*, *S. madagascariensis*, *Acacia burkei*, *A. robusta*, *Terminalia sericea*, *Peltophorum africanum*, *Spirostachys africana*, *Dichrostachys cinerea*, *Tabernaemontana elegans*, *Commiphora neglecta*, *Albizia versicolor*, *A. petersiana* and *Ziziphus mucronata*.

7. **Sand forest**. The tree component of sand forest forms a canopy of 5 to 12 m that includes: *Newtonia hildebrandtii*, *Cleistanthus schlechteri*, *Pteleopsis myrtifolia*, *Hymenocardia ulmoides*, *Cassipourea mossambicensis*, *Craibia zimmermannii*, *Dialium schlechteri*, *Haplocoelum gallense*, *Balanites maughamii* and *Erythrophleum lasianthum* (Kirkwood & Midgley, 1999). This land-cover type is seen as a conservation priority as it is only found in Maputaland and contains many endemic plants species (Tinley & van Riet, 1981).

8. **Inland evergreen forest**. This type of forest is found in the west of the region and contains a wide range of species, having similarities with both sand and dune forest. The drier forests, such as Nyaneni Forest near Lake Sibaya, have more sand forest species such as *Hymenocardia ulmoides*, *Dialium schlechteri* and *Euphorbia grandidens* and the wetter forests tend to be taller and are composed of both tropical and Afrotemperate trees (Van Wyk et al., 1996).

9. **Swamp forest**. Swamp forests occur on many of the perennial bog drainage lines that enter the coastal lakes. The canopy is generally between 8 and 18 m high. The trees grow

on mounds of bog soil that are surrounded by standing or slow-moving water. The predominant trees are *Ficus trichopoda*, although other species such as *Syzygium cordatum*, *Voacanga thouarsii* and *Barringtonia racemosa* may assume local dominance. This is an equatorial rainforest type but it also contains moist forest trees typical of the temperate uplands e.g. *Podocarpus falcatus*, *Rapanea melanophloeos*, *Ilex mitis*, *Erythrina caffra* and *Halleria lucida*.

10. **Mangroves**. Five species of mangrove occur in the salt-water estuaries of Maputaland and the height of these trees varies between 2 and 10 m. These species are *Avicennia marina*, *Bruguiera gymnorrhiza*, *Rhizophora mucronata*, *Ceriops tagal* and *Lumnitzera racemosa*.

E) Coastal dune zone

This zone is the narrowest, as it only includes the wind-formed sand dunes that border the Indian Ocean. It contains three main natural vegetation types:

1. **Beach**. This includes the dune pioneer community that is found above the high water mark and dominated by the short robust shrub *Scaevola plumieri* and the forb *Gazania uniflora*.

2. **Dune thicket**. This community is found on the seaward slopes of coastal dunes and has a height of between 1 and 5 m (Weisser, 1980). The vegetation has a “clipped hedge” appearance caused by the effect of sea spray and mechanical blasting by windblown sand. Typical trees and shrubs include: *Eugenia capensis*, *Diospyros rotundifolia*, *Mimusops caffra*, *Brachylaena discolor* and *Sideroxylon inerme*. The vegetation is extremely dense and bound together by tangles of creepers and climbers, of which the most common are *Rhoicissus digitata* and *Smilax kraussiana*.

3. **Dune forest**. This community is found on the landward dunes that run parallel to the coast from north to south. Dune forest tends to have an uneven upper canopy between 6 and 15 m in height. Typical forest trees include: *Diospyros inhacaensis*, *Celtis africana*, *Inhambanella henriquesii*, *Diospyros natalensis*, *Euclea racemosa* and *Croton gratissimus*. The fern *Microsorium scolopendrium* and the shrubby forb *Isoglossa woodii* are found as ground cover.

F) Transformed land-cover types

1. **Roads**. There are two main types of road in Maputaland. Tarred roads include the N2 motorway, which forms the westerly boundary of the study region and primary roads that link the major towns with the motorway. The others are dirt roads, which are found throughout the region and in some cases are classed by the National Roads Department as secondary roads.

2. **Towns**. This consists of high-density housing, in addition to commercial and industrial areas.

3. **Subsistence agriculture.** Subsistence agriculture is typified by small fields growing maize and vegetables, as well as by grazing areas for cattle and goats, and it is found throughout the region. Many of these fields are smaller than that of the resolution of the satellite imagery and so cannot be individually identified. However, areas of subsistence agriculture tend to be distinctive on these images as they typically have lower vegetation biomass levels because of livestock grazing and fuel-wood collection.

4. **Large-scale commercial agriculture**. A variety of crops are grown commercially in Maputaland, including maize, cotton, sugar cane and pineapples. Most of this agriculture is found in the Cretaceous and alluvial zone and less commonly in the coastal plain zone.

5. **Plantations of non-native species**. The most widespread type of plantation contains *Eucalyptus* spp. and *Pinus elliotii*. Most of these are very large and found in the coastal plain zone but the companies that own them have also encouraged local landowners to set up smaller plantations that are found through the region. Some native species also tend to be present, especially in young plantations, together with the alien *Chromolaena odorata* (Lubbe, 1996). The second type of plantation consists of stands of *Casuarina equisetifolia*, which were planted to stabilise the sand dunes along the coastline. The NCS are in the process of removing them because dune movement is now seen as an important ecological process.

G) Other land-cover types

1) Open water.

2) Mud flats.

3) Salt Marsh

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