

3.1 Coastal Dunes

Coastal vegetation is that subset of terrestrial vegetation that falls under the direct influence of the ocean and its associated climate. The plants grow on substrates mainly of marine origin, including shells, sand, pebbles, rocks and bedrock.

The nature of the South African coastline, its landform and geology, and the varied climate of the subcontinent results in six major coastal regions, viz. the West, Southwest, South, Southeast, Transkei and KZN coasts. The subtropical KZN coast is characterised by being east or southeast facing, with a summer rainfall, as highlighted in *Section 2.1*, and coastal thicket or forest vegetation. These features separate it from the other five coastal regions.

The terrestrial plant communities along the shoreline are largely influenced by the type of shoreline, which may range from sand or pebble beaches, through rocky headlands or wave-cut rocky platforms. The KZN coast is dominated by sandy shores with exposed rocky headlands or wave-cut rocky shores seen along the southern section of coast, both ecosystems are described in more detail in *Section 3.2* and *Section 3.7* respectively.

The main environmental factors that account for the variety of vegetation types are: the stability of the substratum (e.g. mobile sands driven by strong winds and the related sand blasting); salt spray and occasional inundation with salt water by exceptionally high tides; strong soil acidity gradients from the shore inland; and intense radiation from the sun as a result of reflection from the sea and sand.

Floristic or plant species distribution

There are clear discontinuities in species distributions along the whole coastline from the southwest coast northwards to KZN. Some species are confined to specific regions due to climate or substrate. The distribution of plant species is related to the distribution of their propagules (seeds, fruits or vegetative parts), climatic differences (especially moisture, temperature and wind) and the gradients in the distribution of the major floristic types in southern Africa. As a consequence, the attractive dune creeper *Canavalia maritima* is common on this shore but not found farther southward. Similarly, the Natal wild banana is found in KZN and stretches down the Transkei coast, but does not grow farther west.

KZN coastal dunes, with pioneer vegetation.



Photo: Fiona MacKay



There is a low diversity of species in the pioneer plant communities and changes in species distribution along the coast are reflected in the species composition of these communities. The communities occur in fairly distinct zones from the shoreline landwards and may also represent stages in a successional gradient towards the climax community of the stable dunes. The composition of the climax plant community is largely influenced by environmental factors.

Coastal plant communities

Temperature and moisture (mostly rainfall) are major factors affecting the size, density and structural complexity of the terrestrial plant communities. There is a change as one moves around the coast from Namibia and up the southeast coast to KZN. The KZN coast shows the most complex of vegetation types, with taller trees and shrubs and an abundance of herbaceous layers, reflecting the more equable temperatures and higher and more consistent rainfall along this coast.

Dune systems

Dry coastal dune systems are ever changing with storms and seasons and many of the coastal communities may disappear in a single storm event or gradually change in response to changing environmental factors. Many of the pioneer plant species of coastal dunes are cosmopolitan (e.g. the coastal kweek, or the dune goat's foot). The coastal dune communities are often quite distinct, consisting of monospecific stands of pioneer plants. In other cases there may be a graduation from the pioneers into thicket, so that the different communities are not that distinct.

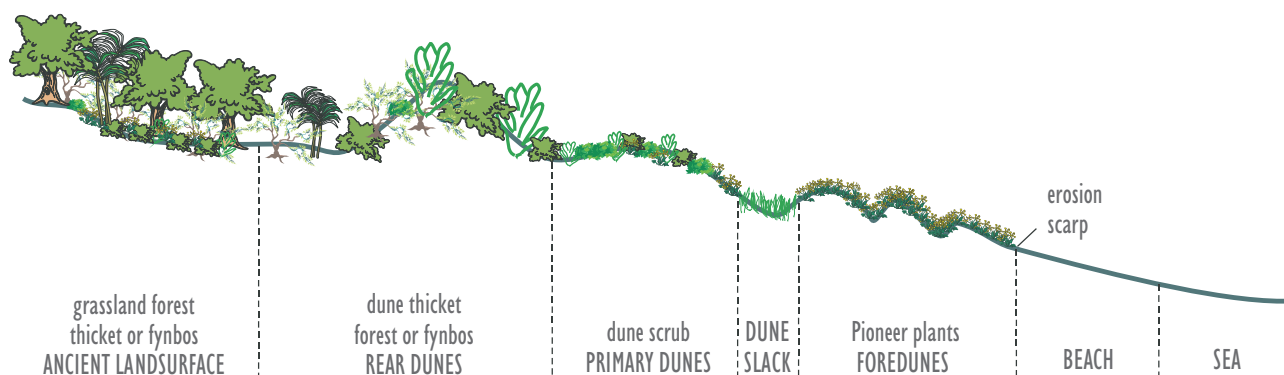
Pioneer Species and Dune Formation

Dune pioneer plants are able to colonise the bare shifting sand (dune zone) above the intertidal beach zone by means of special adaptations and plant modifications. These are a creeping rhizomatous growth form with leaves covered by a thick waxy cuticle, tolerant of salt spray and abrasion. Many species can withstand burying for some time and have adaptations to prevent water loss. The critical stage is germination and seedling establishment, which usually occurs during the rainy season. Once established, the young plants are able to stabilise the sand, growing in response to the accumulation of sand (accretion). This results in the growth of the sand dunes to form foredunes above the spring high tide mark. If the winds are too strong or persistent or rainfall is too low, the plants are unable to grow and the foredunes may not develop, allowing mobile dune systems to dominate.

The type of pioneer plants often determines the type of vegetation that will establish in that particular region. On the KZN coast, there is a prevalence of longitudinal foredunes if the pioneer plant species are *Scaevola plumieri* and *Ipomoea pes-caprae*, but dune hummocks are formed if the pioneer species are *Arctotheca populifolia*.

Secondary Communities

Most often on the KZN coast, especially on steep dunes, there is a rapid change from pioneer zone species to dune thicket. However, sometimes distinct scrublands occur landward of the pioneer zone. The most common and dominant shrub species is the widespread *Passerina rigida*, which is widely spaced, often with grass species and herbs, and about 1-2 m tall. Many other species occur once the dunes have been stabilised, resulting in extensive stabilised dune fields.



Profile of the Dune System along the KZN coastline, from the pioneer communities to thicket or forest vegetation.

Climax Communities

Dune thicket is a dense tangle of almost impenetrable shrubs or small trees and creepers. There is no distinct layering or strata in thicket and no understory of herbs or grasses. Dune forest, on the other hand, consists of at least three strata; a grass and herb layer, a shrub layer and a tree layer. Lianas may be present, interconnecting the three layers of vegetation. Forests are also not as dense as thickets, but are taller than the thickets.

Rocky shores

Rocky shores differ from dune coasts in having stable substrata and shallow soils, and are often subject to high winds and salt spray. The vegetation on the rocky shores is very sparse and small in size. There may be an accumulation of saline water bodies with brackish streams in some sites where halophytic salt marsh plants may be found. The accumulation of sand on the rocky shores may result in the establishment of pioneer species and communities common to the dune fields.

Successional change in the coastal dune field

The dunes in the Mlalazi Nature Reserve at Mtunzini provide an excellent example of succession on a prograding coastline. In fact, it is one of the most outstanding areas in the world to study the change in plant communities over time. At this site it is possible to see distinct dune ridges or longitudinal dunes running parallel to the shore. As one moves inland across the dune ridges one can observe the change from pioneer communities, through a variety of shrub and grassland communities, to a climax coastal forest farthest inland.

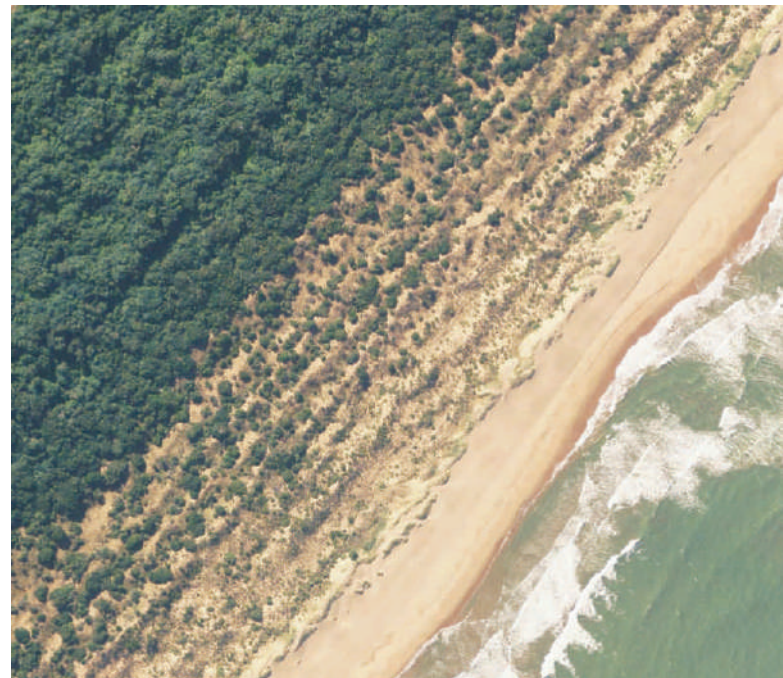
In this region, the high summer rainfalls and supply of sand from soil erosion along the Thukela River ensures a continuous deposition of sand and silt at the river mouth; and by longshore drift northwards to Mlalazi. This opens up new dunes for pioneer plants to invade, and over a few years, changes in communities from pioneers to climax forest can be observed.

It is possible to relate successional changes to the chronology of dune development using aerial photographs. A study

showed that it would take five years for a dune ridge to be formed under present conditions in this area. Eight communities were identified along a gradient of increasing distance from the sea, and increasing age of the dunes (from 5-120 years), as estimated from dating the parallel dune ridges. The pathway of change was as follows: pioneer, enriched pioneer, open dune scrub, closed dune scrub, bush clumps, bush clump/forest margin transition, forest margin and, finally, forest.

These communities showed a general increase in species richness, cover, stature and biomass from pioneer to forest. However, sometimes species diversity can reach a maximum value prior to achieving the climax community, whereafter diversity decreases. As one moves inland the number of species in each community along the gradient increases, as does community complexity.

Coastal habitats and vegetation are under increasing pressures from, amongst others, coastal development, dune mining and the stabilisation of mobile dune systems. The KZN coast has more sandy systems than anywhere else in South Africa, making it a special region. Importance should be paid to the protection of sensitive coastal areas, in order to ensure long-term sustainability. ■



Successional change at Mtunzini.

Photo: DAEA

