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PROCESSES OF COASTAL CHANGE

MANAWATU - HOROWHENUA

Manawatu Catchment Board  
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### 2.3 VEGETATION

Although only small portions of the Manawatu coastline have received intensive development, significant changes have taken place in the vegetation cover during Maori and European occupation. Previous literature has described the original coastal vegetation in detail (Saunders 1968, Esler 1969, 1970). The main features of the native plant communities have been the sand-binding species on the foredune. Both spinifex (Spinifex hirsutus) and pingao (Desmoschoenus Spiralis) dominated with their ability to withstand the harsh environmental conditions of strong winds, salt spray, extreme temperature fluctuations, sand burial, and undercutting. On the lee of the foredune, with more stabilised conditions, shrubs established including, pimelea (Pimela arenaria), sand coprosma (Coprosma acerosa), and cottonwood or Tauhinu (Cassinia leptophyllia). Moving inland, manuka (Leptosperum scoparium) and bracken (Preridium aquilinum var. esculentum) eventually become more dominant. Historical accounts outline a predominantly stable coastal environment at the time of European settlement (Wilson 1959). 'Wandering dunes' did occur but these were considered the exception and have eventually 'blown-out' inland before being stabilised by sand-binding vegetation.

With European occupation, both the vegetation composition and cover has altered, often adversely affecting foredune stability. Disruption of the vegetation cover was initiated early this century with the introduction of stock grazing of the foredune area. Spinifex, the dominant native sand-binding species, is palatable to stock and was, at one stage, completely eaten out. The decline in

protective vegetation enabled the wind to increase sand transportation and start many blow-outs and sand drifts moving inland. These problems of sand stability have been especially prominent north of the Manawatu River.

As early as 1930 dune vegetation replacement, using both spinifex and marram, was being carried out by local farmers and land-owners to stabilise the foredune. Lupin and trees (pine and macrocarpa) have been planted leeward of the foredune to halt sand drifting onto pasture. However for economic reasons, efforts have been concentrated on the inland sand drifts, leaving the neglected foredune in a very unstable condition. Considerable sand loss continues to occur through the foredune blow-outs, along sections of the coastline, and this represents a sizeable loss of sediment from the coastal sediment budget as well as creating land-use problems inland.

The introduction of exotic plant species, such as marram in the 1900's for sand stabilisation has resulted in marked environmental changes on the Manawatu sand dunes. All sand-binding plant species have an important influence on sand dune development but strong differences exist between species resulting in variations in sand dune topography.

Sand-binding species are well adapted to the harsh environmental conditions with an ability to withstand high rates of sand burial. Accumulation of sand occurs when wind encounters an obstacle (plant) and is forced to slow down. When that happens a plant will "catch" sand which is then deposited on the lee of the obstruction, usually to form a tongue of sand.

The ability to trap sand is determined by the plant growth form and behaviour, both of which variably modify windflow and result in a range of distinctive dune land forms depending on the plant species. Cockayne (1911) compared several species in New Zealand, in this respect, and Esler's (1969, 1970) work on the Manawatu sand dunes supported Cockayne's conclusions on the geomorphological effects of the sand-binding species. The main differences between the species are summarised as follows.

In contrast to marram, both spinifex and pingao are comparatively 'flexible' plants with a more diffuse growth habit. The tufted, erect, clumped habit of marram exerts a distinctly sharper influence on the airflow patterns, promoting higher rates of sand accumulation. The extensive rhizome system reinforces the species ability to hold the sand in a clumped topography, further modifying the airflow patterns.

Both spinifex and pingao plant forms exert less influence on the windspeed, and [possess slower growth rates, and their]

Consequently spinifex builds a low dune and pingao lower still with a gently sloping, convex profile. The dune topography is smooth and regular with an even vegetation cover. Spinifex is thought to possess greater salt tolerance as it extends further down the seaward dune face. Pingao is not as effective in holding sand and is prone to wind undercutting. This may account for the more limited distribution of the species.

Although marram is most effective in sand trapping initially, the clumped habit of the species encourages the formation of higher, steeper dunes with an irregular topography. This results in marram covered dunes being more receptive to wind channelling around the plants and the formation of blow-outs being more common than in

spinifex covered foredunes. For these reasons spinifex covered foredunes are considered more desirable for long-term sand stability. Various attempts have been made to use spinifex in foredune protection work. Transplanting is the preferred method due to the immediate protection offered by the vegetation against sand movement. Unfortunately, spinifex is difficult to transplant and if the roots are badly disturbed or exposed to the air, a high mortality rate can be expected. Poor results have also been experienced using Spinifex tip cuttings and seeds, and until the practical difficulties are overcome marram will remain the most popular species for foredune protection work.

The extent of the vegetation cover and stability of the foredune are closely related. Figure 4 gives an indication of the areas of coastline well-vegetated with sand binding plants, and those with a broken vegetation cover. North of the Manawatu River the foredune system extends over a hundred metres inland and has an uneven vegetation cover with both scattered blowouts and parabolic dunes occurring. The dominant sand-binding species is spinifex with extensive colonies of marram grass.

Along the Waitarere coastline between the Manawatu River and Hokio Stream, the foredune narrows with a more stable dune system and a broader beach. Marram grass is intensively used for protection work.

The Hokio-Waikawa coastline is predominantly vegetated in spinifex with both a narrower beach and a foredune system of less than 50m in width.

South of Waikawa as far as Otaki the dune heights are lower with a further reduction in foredune width to less than 25m. The mixed sand and gravel beach extending south from the Otaki River is clear of both dune sand-binding species until south of Te Horo. At this point low dunes are again present and continue for the length of the southern coastline with the exception of some urban areas where shoreline erosion has removed the foredune system completely.

#### 2.4 LAND USE

Extensive land-uses such as forestry and agriculture are located immediately landward of approximately 80% of the Horowhenua-Manawatu coastline. The remaining proportion of the total area has been developed for urban settlement as illustrated in Figure 5.

Each form of land-use has a strong association with coastal stability such that coastal problems that have arisen reflect land development practices. These problems include sensitive or hazardous coastal areas where the interaction between a physical event system, i.e. the sea, and a human-use system (e.g urban development) cause a risk to assets, actual damage to assets, or even the risk of loss of life.

In order to provide effective planning policies to manage the existing and potential coastal problems it is important to determine the nature of the interaction of land-uses with coastal processes.

Subsequent planning controls can then be designed for problems arising from man's land-use of the coastal zone.

##### 2.4.1 Waitarere Forest

A striking contrast occurs between forested and non-forested sections of coastline. Where forests have been established, such as

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