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Plants and sand dune development,

Ammophila arenaria versus *Desmochoenus spiralis*

maram *pingao*

on Kaitorete Barrier, Canterbury.

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CONTENTS

ABSTRACT

Vegetation dynamics and its influences on the environment are studied. The relative sand-binding abilities, airflow modification, and sand deposition patterns are determined for Ammophila arenaria and Desmochoenus spiralis. The results when related to the plant morphology and growth behaviour of each species accounted for variations in dune form. This involved measuring sand movement around individual plants and through populations of each species, using several techniques, - direct measurement by pin arrangements, a fluorescent tracer, and Rollability Analysis. Differences were found between the species at the individual level with Ammophila possessing the greatest sand-trapping ability. The airflow patterns around each species were measured by anemometers and smoke patterns, recorded in a wind tunnel. The results showed clear differences between the species. Both plants caused the windspeed to drop leeward of the plant but Ammophila had the stronger effect. Eddies forming leeward of the plants were larger, higher and clearer for Ammophila in comparison to the weaker, smaller and less distinct eddies of Desmochoenus.

From the influences of each species on the sand dune environment, changes in plant community equilibriums are noted.

FIGURE 46: Summary of interrelationships between plant ecology, airflow patterns and sand movement between individual plants and plant communities of marram and pingao.

	MARRAM	PINGAO
INDIVIDUAL PLANTS		
PLANT MORPHOLOGY + ECOLOGY	. inflexible leaves . tufted, erect, clumped habit . rapid growth, thrives in high sand accum. . rhizome system extensive + numerous . prefer exposed habitat	. diffuse, open tufts of leaves . regularly spaced habit . slower growth . rhizomes grow in down slope pattern . prefer sheltered habitat
AIRFLOW PATTERNS	. stronger influence, distinct patterns . lower windspeeds, leeward . increased windspeeds around flanks . less flexibility . large, high eddies	. weaker influence, less distinct patts . low windspeeds leeward . decreased windspeeds around flanks . more flexibility . smaller, lower eddies
INFERRED SAND DEPOSITION PATTERNS	. distinct, larger, clumped . irregular topography	. weaker, lower . smoother topography
SAND MOVEMENT PATTERNS	. greater sand trapping ability . strong interaction with sand movement	. lesser sand trapping ability . relatively weaker influence on sand movement
PLANT COMMUNITIES		
DUNE MORPHOLOGY	. coarser sand size distribution . greater irregularity . concave profile shape . bedforms higher, clumped . dunes higher, with steeper angles	. finer sand size distribution . less irregularity . convex profile shape . bedforms lower, smooth . dunes lower, with smaller angles
SAND MOVEMENT PATTERNS	. marram sand trapping equivalent to Pingao	

CHAPTER VIII

SUMMARY AND CONCLUSIONS.

1. The relative influence of marram and pingao on sand movement was found to differ at the individual plant level. Marram possessed a greater ability to trap sand. This results in larger, clumped, and more irregular bedforms developing leeward of the plant. Pingao, in comparison has a weaker sand trapping ability and the associated sand movement patterns were less distinct. At the community level, of plant interaction with sand, no clear difference was found between each species.

2. Airflow patterns revealed marked differences between the species. Both species caused windspeeds to decrease in the plants lee. Marram had the stronger influence and associated windspeeds were lower than those recorded for pingao. Marram caused windspeeds to increase laterally around the plant, whereas windspeeds around pingao's flanks decreased. The laterally increased windspeeds of marram accentuated the formation of eddies leeward of the plant. These eddies were notably larger and higher for marram in comparison to the lower, less distinct eddies forming leeward of pingao.

3. The sand binding abilities, patterns of sand deposition, and airflow modification of the two species have been explained in terms of plant morphology and growth behaviour. Marram's tufted, erect and clumped habit is thought to be responsible for stronger airflow patterns and consequently larger, clumped bedform deposition. Conversely, pingao's diffuse,

open tufts, and regularly spaced habit have been related to weaker airflow modification, and smaller, lower eddies. Sand deposition leeward of pingao is therefore smaller and lower, with a smoother topography.

4. Differences between the two species' ecology, airflow patterns and sand deposition, have been related to the variations in sand dune form. Marram covered dunes are notably higher, steeper, with concave shaped profiles and irregular topography. Pingao covered dunes are lower, with convex shaped profiles and a smoother topography.

5. These sand-binding plants have been shown to have a strong influence in modifying the environment. In addition each species may cause different habitat changes which influence the sand dune communities. Marram has ecological advantages in colonising exposed areas which make it initially a strong competitor for pingao. However, these advantages diminish as the plant populations grow which implies pingao is better suited to the established, more protected areas where marram is not as stable. Stands of the two species could therefore co-exist on a dune system and provide a vegetation cover in dynamic equilibrium with its environment. This would tend towards a more stable landscape than would be offered by communities of only one sand-binding species.

6. The results have been applied to the broader issue of coastal management and protection with reference to Kaitorete barrier. The relevance of vegetation dynamics and its influence on landforms is particularly significant for the dunes mined for their sand and where revegetation to date has been unsuccessful.