The impact of marram grass invasion on foredune morphology and backdune dynamics

Andrew Thomas Hart[1]*, *Mike Hilton*[1], *Sarah Wakes*[1]

[1] *Department Of Geography, University Of Otago*

Effective management and conservation of sand dune systems requires the protection of natural processes of sedimentation. These processes are threatened by the establishment of exotic species in the foredune environment. Establishment of exotic species can alter foredune morphology through different growth patterns that effect sedimentation. Changes in foredune morphology resulting in the disruption of natural process have implications for the dynamics of backdune environments. Ammophila arenaria (marram grass) is a highly invasive coastal dune species that causes significant change to foredune morphology. An effective sand-binder, marram grass forms large, continuous, mono-specific foredunes. In southern New Zealand, marram grass has built dunes at rates that exceed the burial or erosion tolerance of indigenous species, resulting in the displacement of these native species. Mason Bay, Stewart Island is a large active transgressive dune system. Since plantings during the 1930s, the area dominated by marram grass has increased by 5,204 percent (Hilton et al., in press). Foredune morphology has changed from a low hummocky foredune under indigenous vegetation to the establishment of a large continuous foredune complex. This study aims to link the development of a parabolic dune with the growth of the foredune complex in the context of the impact of an exotic sand-binder. Numerical modelling was employed to simulate patterns of airflow, over, and downwind of various foredune morphologies. Potential rates of sedimentation, critical for understanding backdune landform development, were inferred from simulation results, and compared against field measurements. Investigations highlight a reduction in velocity downwind of the foredune and a likely starvation of sediment supply related to vertical accretion and stabilisation of the foredune. Associated landward invasion of marram into the long-walled parabolic dunes resulted in a change from sparsely vegetated dunes to densely vegetated dunes with greater definition of parabolic dune morphology. Eradication of marram grass and breakdown of the large foredune complex will likely have implications for the dynamics of the transgressive dune system. Management of this process requires an awareness of the potential loss of contemporary landforms and ecosystems. Eradication may return the system to a more naturally dynamic state, although over time periods of decades. Numerical modelling allows for predictive modelling of sediment dynamics, critical for understanding the essences of the behaviour of transgressive dune systems. Management of these systems must therefore incorporate an holistic approach integrating the beach, foredune and backdune processes.