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AUTHOR(S): D. O. BERGIN & J. W. HERBERT

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ABSTRACT*

Objective 2 of the Revegetation of Sand Dunes programme (Foundation Application Number: 93FRI08416; Output 8) evaluates the role that indigenous plants could have in stabilising dunes. The intention is not to replace marram grass and exotic N-fixing plants for use in all erosion-prone areas, but to provide managers with options where indigenous plant communities would be preferred for cultural, historical, environmental or social reasons. This report covers progress during the 1994/95 financial year including analysis of baseline transect data monitoring indigenous dune plant dynamics, nutritional studies of indigenous foredune plants and setting up of a vegetation monitoring technique for dune profiles surveyed in two regions.

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* **Note: This material is unpublished and must not be cited as a literature reference.**

Foundation Application Number: 93FRI08416
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Programme Short Title: Revegetation of sand dunes

1994-95 REPORT ON REVEGETATION OF SAND DUNES CONTRACT - ROLE OF INDIGENOUS SPECIES

D. O. Bergin & J. W. Herbert
New Zealand Forest Research Institute, Rotorua

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INTRODUCTION

It has been recognised since the beginning of this century that human interference with natural sand dune vegetation had caused a widespread problem of wind erosion and sand drift across productive land. The most successful measures in combating induced erosion have involved the rapid replacement of a continuous and permanent vegetation cover to protect the sand from wind action. The goal of this programme, prompted originally by the demise of yellow tree lupin (*Lupinus arboreus*) during the mid-1980's and the effect this has on the vigour of marram (*Ammophilia arenaria*) -dominated dunes, is to define the best methods for establishing a continuous, persistent and vigorous vegetation cover on coastal sand dunes.

As part of the main thrust of this programme to find a nitrogen-fixing species to replace lupin (Objectives 1 & 3), Objective 2 also evaluates the role that indigenous plants could have in stabilising dunes. The intention is not replace marram grass and exotic N-fixing plants for use in all erosion-prone areas, but to provide managers with options where indigenous plant communities would be preferred for cultural, historical, environmental or social reasons. This interim report covers progress to end to the 1994/95 financial year for work agreed to with the Foundation for Science and Technology for Objective 2 evaluating the two principle indigenous sand binding species for rehabilitation of dunes, spinifex (*Spinifex sericeus*) and pingao (*Desmoschoenus spiralis*).

1994/95 TARGETS FOR OBJECTIVE 2

Investigate the potential of indigenous sand binding plants for sustainable management of erosion-prone dunelands in areas where use of indigenous species can either complement marram planting or are environmentally and culturally appropriate by:

- establishing a baseline dataset of dune plant dynamics using a vegetation point sampling frame to assess vegetation cover and monitoring of dune profiles to determine sand movement on the two selected dune sites and initiating analysis of this database.

- monitoring of potted pingao and spinifex seedlings in glasshouse nutritional trials for survival and growth adding further treatments as appropriate.

Publish an article summarising the NZ FRI indigenous species sand dune research programme in the *What' New in Forest Research* series. Attend a sand dune conference and revegetation projects in Australia where spinifex is widely used for rehabilitation. Facilitate and contribute a paper to a workshop focussing on duneland management, research and technology transfer strategies to be attended by managers, researchers, user groups and kaitiaki. Prepare two 6 monthly reports on the dune plant dynamics study and the glasshouse nutritional trial for the CEO of the NZ Forest Research Institute.

DUNE PLANT COMMUNITY DYNAMICS

Sites: Two sand dunes sites, Matarangi Beach and Whiritoa Beach, both of which are located on the eastern coast of the Coromandel Peninsula, were selected for monitoring of plant communities and dune dynamics.

The two sites selected have different sand dune morphology and vegetation communities. The Matarangi Beach is part of a 4 km long sand spit immediately south of the Whangapoua Harbour and is characterised by a wide flat dune system typical of spit formations. In contrast, Whiritoa Beach is exposed ocean beach that is exposed to easterly storms and large waves, resulting in a steep sandy beach and a relatively steep sided foredune. Subdivision and associated development of most of the Whiritoa shore has reduced the width of the natural dune system.

Method: Transects were located at each site along a relatively uniform section of each beach and a custom-made point-sampling frame used to determine vegetation composition, abundance and distribution within each plot.

Nine semi-permanent transects were established (one per plot) at Matarangi Beach and 4 transects at Whiritoa Beach with each transect running from mean high-water mark to back dune where sand binding vegetation ceased. The point-sampling frame was positioned at varying intervals along each transect (up to 10 sampling frame stations per transect) and 20 spring-loaded needles depressed at each station. The first intercept of each needle was recorded by species where vegetation occurred. The location of each sampling station in relation to foredune, dune slack and a back dune, and any other dune feature, was also recorded.

A baseline dataset was established in October 1993 at both Matarangi and Whiritoa Beaches and transects were remeasured in February and October 1994. Approximately 2600 points were sampled at the two sites during each assessment.

Analysis: The mean cover values obtained by the point intercept method were calculated for each species within each transect. Analysis of variance was used to test for differences in vegetation cover between selected distances from foredune to backdune and for the different seasons in which assessment was carried out.

Preliminary results: Results are yet to interpreted as part of the 1996/97 work programme. Clear differences in species composition are apparent with seaward zones at Matarangi and Whiritoa Beach dominated by spinifex and few other species present. At Matarangi, although spinifex is still present in the backdune zone up to 30 m from the high water mark, plots are dominated by a limited range of exotic species including ice plant (*Carpobrotus edulis* spp.), dandelion (*Taraxacum officionale*) and harestail (*Lagarus ovata*). The indigenous grass *Deyeuxia billardieri* occurred on all transects at Matarangi with greatest cover generally in the middle dune zone.

At Whiritoa Beach the shorter steep dune system abruptly changes from a spinifex dominated foredune to a back dune dominated by a dense carpet of pohuehue (*Muehlenbeckia complexa*). Shore convolvulus (*Calystegia soldanella*) was a significant ground cover during the summer survey but had died off and was not recorded as ground cover during the winter survey.

Monitoring will continue for several years to give long-term trends in the vegetation community and in relation to any changes in dune morphology.

NUTRITIONAL STUDIES

Glasshouse pot trials

Method: Spinifex seed (ex Matarangi Beach) and pingao seed (ex Whangamata Beach) was collected in January-March 1994 and seed viability assessed using seed cutting tests on samples. Beach sand with slow release fertiliser (Magamp, medium granule) was placed into 150 10x10 cm pots. For spinifex, approximately 2000 sound seed was separated from spikes (seedheads) and 25 seed sown at 2 cm spacing in each of 75 pots. For pingao, the volume of seed and debris containing at least 25 viable seed was determined. This standard volume (container 3 cm diameter x 2.5 cm

height) of seed was then broadcast sown onto each of a further 75 pots. Pots were then placed in a glasshouse.

Fertiliser treatments including unfertilised controls have been determined as a first step to investigate comparative nutritional requirements of major dune species. Earlier nutritional studies on dune species in Australia have been reviewed to assist with trial design and treatments (Barr & McDonald 1977a; 1977b). Fertilisers to be tested in the current trial include a comparison of fertilisers readily available in New Zealand (Urea. DAP, superphosphate & Magamp) as well as Nitram which is widely used in Australian sand dune revegetation programmes. Fertiliser treatments will be based on nutrient content or each fertiliser to allow direct comparisons. Treatments will be applied to seedlings 4 weeks after germination. Shoots and leaves will be harvested within 6 months of fertiliser application to determine relative differences in biomass between treatments.

Results: Two attempts were made to germinate pingao and spinifex to give a consistent number of seedlings of each species for glasshouse pot trials. However, the first batch of seedlings were virtually completely destroyed within a 2 day period in late 1994 by birds and rodents despite the usual precautions of securing the glasshouse from such pests. Spinifex seed had taken 6 weeks to germinate from time of sowing in contrast to pingao seed which had germinated within 2 weeks.

A second batch of seed was sown of both species in early 1995. Disturbance by birds and rodents were eliminated by covering all pots with bird mesh and laying of rodent baits. Although pingao successfully germinated, there was poor germination of spinifex seed. Of the several provenances of spinifex seed available, the best seedlot from Matarangi was used for this trial. Seed testing indicated that 25.9% of spikelets sorted from seedheads contained seed that had a full white endosperm, a technique which has been a consistently reliable indicator of seed viability in extensive germination trials. Nevertheless, insufficient seedlings germinated in each of the 75 pots.

New pots were prepared and 25 newly germinated seedlings from pots and additional trays were pricked into each pot in an attempt to get an even line of spinifex for nutrition studies. Performance of these seedlings was however, poor with many transplanted seedlings dead or unthrifty. By this time the pingao seedlings that had germinated were damping off. The glasshouse aspect of this objective was therefore abandoned for this year. Remaining resources have been diverted to monitoring long-term transects related to the first project in this objective.

Monitoring long-term transects

Rationale: Sand movement is being monitored on a regular basis using transects by several Regional Councils to provide long-term trends for land-use planning and hazards mitigation purposes. However, there is virtually no information recorded by surveyors on vegetation cover. NZ FRI have a project to develop a method for incorporating a vegetation component into existing sand dune transect monitoring programmes in at least two regions (Waikato and Canterbury).

Method: A technique was developed based on transects at Whiritoa, Whangamata and Whitianga. The preferred design (since tested and modified on Christchurch transects with Canterbury Regional Council).

Preliminary design:

- assess vegetation cover at survey points along transects where changes in slope occur with extra points where changes in slope are greater than 5 m apart.
- vegetation cover to be assessed within a 2 m diameter circular plot with the survey pole as the plot centre.
- projecting a vertical view of the plot, vegetation cover to be assessed for major species classes and percentage cover codes.
- species codes include -

M	marram
I	ice plant
P	pingao
R	rushes
W	woody species
S	spinifex
O	other species

B bare sand (includes debris, etc,...)

- cover codes to be assigned in 10% cover classes
  ie., cover of 10%, 20%, 30%,.....100%
  to be coded as 1, 2, 3,.....10
- Example: vegetation coding for a typical plot may be:
  M4 I2 O1 B3 = 10 (note: cover codes should always add up to 10).

The aim is to get surveyors familiar with this design so that the vegetation component of their sand dune survey is simple to undertake, can be picked up quickly by new personnel, and it does not add too much time to surveys currently undertaken. In Christchurch the data is to be part of their total station monitoring system and integrated into GIS. (Note - a complete survey of 45 transects of Christchurch dunes will be undertaken in January 1996 using the above vegetation monitoring design).

TECHNOLOGY TRANSFER

All technology transfer obligations have been met in full, and in fact have been exceeded for 1994/95.

An article summarising the NZ FRI indigenous species sand dune research programme has been published (Bergin & Herbert 1994a) and widely distributed to agencies and interest groups involved in management of dunelands.

A NZ FRI scientist attended the Annual NSW Coastal Management conference in Terrigal, Australia in October 1994 and presented a paper on revegetation research in coastal dunes in New Zealand which was well received (Bergin & Herbert 1994b). The theme of the conference was "Integrating the Interests" and brought together a large group of managers, landowners, state and local agency personnel, academics from universities and other research facilities, and Landcare and Dune Care representatives to discuss research and management of the coastal zone. Following the conference, a number of coastal restoration projects were inspected and contacts established with key managing agencies and researchers along the southern NSW coast and much of the Victorian coast. Problems of controlling beach use, weed control and beach revegetation are similar to those in New Zealand. Details of the conference and field inspections and contacts made during the Australian visit are given in first 6 monthly CEO report for this programme objective (Bergin 1995).

NZ FRI co-organised a field-based workshop with a couple of Regional Councils in the North Island and hosted representatives from a number of district and regional coucals, and the Department of Conservation in early 1995. Major NZ FRI sand dune trials were inspected on both the west and east coasts of the North Island and research trial designs and results to date presented. A file note lists the participants, itinerary and major outcomes of the workshop (Appendix 1).

A NZ FRI paper on the Ecological Issues of Restoration of Sand Dunes was presented to the Ecological Restoration Workshop hosted by Manaaki Whenua (Landcare NZ Ltd) held at Christchurch in February 1995. The 2 day workshop was for invited participants most of whom were researchers from Crown Research Institutes and Universities involved in restoration of the natural environment. A paper is being prepared for the Proceedings to be published in late 1995.

Duneland revegetation options and the NZ FRI duneland research programme were also discussed with the following groups and agencies:

- Christchurch City Council (Nov 1994, Feb 1995)
- Canterbury Regional Council (February 1995)
- Matarangi Beach Estates, Matarangi Beach, Coromandel (Jan-Feb 1995)
- Te Koha O Rapa Tio Tio Trust, Whiritoa Beach (April 1995)
- Beach Care Community Group, Whitianga (April 1995)
- Department of Conservation staff - Waikato, Bay of Plenty and East Coast Conservancies; Science Directorate

1994/95 PUBLICATIONS AND REPORTS

- Bergin, D. O. 1995: Restoration and management of sand dunes in New South Wales and Victoria - Coastal Conference and visit to coastal rehabilitation sites. New Zealand Forest Research Institute Project Record No. 4595 (Unpubl.). 20p.

- Bergin, D. O.; Herbert, J. W. 1994a: Restoration of native plant communities on sand dunes. *What's New in Forest Research*, New Zealand Forest Research Institute, No. 232. 4p.

- Bergin, D. O.; Herbert, J. W. 1994b: Restoration of native plant communities on sand dunes in New Zealand. *Proceedings of Fourth Annual NSW Coastal Conference*, Terrigal, 18-20 October 1994. Gosford City Council, NSW, Australia.

- Bergin, D. O. 1995: Restoration and management of sand dunes in New South Wales and Victoria - coastal conference and visit to coastal rehabilitation sites. Six monthly CEO report for FRST contract CO4301. NZ FRI Project Record No. 4595.