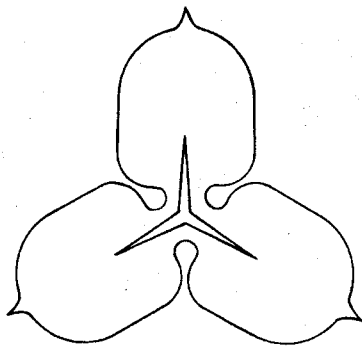


# BOTANY DIVISION DSIR



# REPORT

SAND DUNE VEGETATION AND THE REVEGETATION OF  
CATHODE WASTE DEPOSITS AT TIWAI POINT ALUMINIUM  
SMELTER, BLUFF, SOUTHLAND

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Summary

Although dominated by the adventive sand binder, marram, the low dunes of Tiwai Point contain a large number of associated native sand dune species. Together these provide a vegetation which is able to prevent erosion by wind and sea if left undisturbed.

The establishment of vegetation on the cathode waste deposits require both mulching and summer irrigation. This not only promotes the growth of the species already present, but increases the self-establishment of others.

Plant Communities

marram on foredunes  
exotic grasses and adventive herbs in experimental plot  
on cathode waste.

# Sand Dune Vegetation and the Revegetation of Cathode Waste Deposits

at Tiwai Point Aluminium Smelter, Bluff, Southland

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## INTRODUCTION

During a visit to the Tiwai Aluminium Smelter on 27 January 1982 the authors compiled notes of plant species along the foredune east of Tiwai Point as part of a national inventory of coastal habitats, currently being undertaken by Botany Division, DSIR. We also examined the cathode waste pile at the smelter complex because of our interest in plant colonisation of abnormal or extreme substrates. The results are presented in this report.

### A. Foredune Community

A series of low sand dunes commence at the Trig station to the west of the smelter, reach their greatest width immediately to the east of the smelter, and gradually narrow eastwards to be replaced by a steep bank with a shingle beach beneath. At no point are the dunes of usual width or height. The severe winds and an absence of shelter behind probably maintain the low stature of the dunes.

The sand nearest the sea is coarse while behind this it is considerably finer. Marram (Ammophila arenaria) dominates as sand binder while the native sand binder, pingao (Desmoschoenus spiralis) is rare. Behind the unstable dunes there are a number which have become stabilised by marram with this being replaced by native sand dune species such as Calystegia soldanella, Acaena anserinifolia (bidibid) Carex pumila, Poa laevis and Scirpus nodosus along with adventive grasses and weeds such as Sedum acre (stonecrop), and Hypochoeris radiata (catsear). In sheltered areas where marram is absent, cushions of Raoulia australis are plentiful.

At present the dunes are stable and should remain so provided the cover is not damaged. The presence of only coarse sand in the most exposed part of the dunes demonstrates what would happen to the finer sand behind if it was to become exposed to the wind. The smelter activities are at present all sufficiently far removed from the dunes to be of no consequence and they should remain so to prevent any coastal erosion.

### B. Revegetation of Cathode Waste Deposits

Cathode waste, stockpiled on a concrete slab since the smelter commenced operation in August 1971, typically contains high levels of sodium (8.5 - 17.5%), fluorides (8.0 - 21.0%) and cyanides (0.04 - .2%), together

with carbon levels between 22.0 and 63.0% (Table 5:2, E.I.R., South Pacific Aluminium Ltd and Otago Harbour Board, 1981, 284pp).

Although the cathode waste storage site is surrounded by a diversity of indigenous and adventive plant species, none are able to naturally establish on the debris. The southern end of the heap, the oldest part, remains free of lichens and vascular plant species despite its age.

Attempts have been made to establish a plant cover in the waste material. Following a series of preliminary trials, largely unsuccessful, the Environmental Section of New Zealand Aluminium Smelters Limited managed to get a range of adventive and several native species to grow in a 5 x 5 m experimental plot on a north facing slope. Established in 1979, the plot was overlain with 3 cm of mulch, sown with six pasture species, fertilized with a general purpose mix and watered using a trickle irrigation system. At a later stage marram grass clumps were placed in the plot.

Of the six adventive grasses sown in the plot, yorkshire fog has grown best, although all the other five species persist three years after establishment. Marram is growing well and provides tall cover, protecting the smaller species. Halophytic species may be preadapted to a limited extent to the cathode waste material as coastal environments generally have higher than normal sodium levels. Atriplex hastata and Gnaphalium luteo-album, both widespread coastal herbs, are also well established in the plot, and are apparently self sown.

Plants in the plot lack the typical lush appearance of the surrounding vegetation and are generally dull-grey-green, a condition frequently seen in plants under nutrient stress. It would be worth comparing element levels in plant foliage on the spoil with conspecific material from nearby. Intra-specific differences in element concentrations on the two contrasting substrates may indicate the important factors limiting plant growth on the cathode waste pile and possibly provide detailed information on the best possible corrective fertilizer mix.

Mulch and summer irrigation are clearly important in the early phases of plant growth on the spoil. Organic matter frequently combines with heavy metals rendering them unavailable to plants, and it also buffers soil surface temperature changes, enabling better germination and growth.

#### SUMMARY

Although dominated by the adventive sand binder, marram, the low dunes of Tiwai Point contain a large number of associated native sand dune species. Together these provide a vegetation which is able to prevent erosion by wind and sea if left undisturbed.

The establishment of vegetation on the cathode waste deposits require both mulching and summer irrigation. This not only promotes the growth of the species already present, but increases the self-establishment of others.

TABLE 1 Vascular plant species recorded from (a) sand dunes and (b) cathode waste experimental plot in January 1982 at Tiwai Point, Bluff. Species relative abundance, values are given and naturalised are indicated by \*.

Species	Common names	a	b
<i>Acaena anserinifolia</i>	Bidibidi	f	
* <i>Agrostis stolonifera</i>	Creeping bent	o	c
* <i>Agrostis tennis</i>	Browntop		o
* <i>Ammophila arenaria</i>	Marram	d	a
* <i>Anthoxanthum odoratum</i>	Sweet vernal	o	o
<i>Apium australe</i>		r	
<i>Atriplex hastata</i>	Orache	o	
* <i>Bromus mollis</i>		r	o
* <i>Cakile edentula</i>	Sea rocket	r	
<i>Calystegia soldanella</i>	Shore convolvulus	f	
<i>Carex pumila</i>		o	
* <i>Cerastium fontanum</i>	Mouse ear chick weed	o	
* <i>Cirsium arvense</i>	Californian thistle	o	
* <i>Cirsium vulgare</i>	Scotch thistle	r	
<i>Coprosma acerosa</i>		r	
<i>Coprosma propinqua</i>		r	
* <i>Cynosurus cristatus</i>	Crested dogstail		o
* <i>Dactylis glomerata</i>	Cocksfoot	o	
<i>Desmoschoenus spiralis</i>	Pingao	r	
<i>Epilobium komarovianum</i>	Willow herb	r	
<i>Festuca rubra</i> subsp. <i>commutata</i>	Chewings fescue		o
* <i>Galium aparine</i>	Cleavers	r	
<i>Gentiana saxosa</i>		r	
<i>Geranium sessiliflorum</i> var <i>arenarium</i>		r	
<i>Graphalium luteo-album</i>		o	c
* <i>Holcus lanatus</i>	Yorkshire fog	o	
<i>Hydrocotyle americana</i>		r	
* <i>Hypochoeris radicata</i>	Catsear	f	
* <i>Juncus bufonius</i>	Toad rush		o
* <i>Orobanche minor</i>		r	
* <i>Phleum pratense</i>	Timothy		o
<i>Phormium tenax</i>	Flax	o	
<i>Pimelea lyallii</i>		r	
* <i>Plantago major</i>	Broadleaved plantain	o	
<i>Poa laevis</i>	Silver tussock	o	
* <i>Poa pratensis</i>		o	
<i>Pteridium aquilinum</i> var <i>esculentum</i>	Bracken	f	
<i>Raoulia australis</i>		f	
* <i>Rumex crispus</i>	Curled dock	o	
<i>Scurpus nodosus</i>		f	o
* <i>Sedum acre</i>	Stonecrop	a	
<i>Selliera radicans</i>		o	
<i>Senecio biserratus</i>		r	r
<i>Senecio minimus</i>		r	r
* <i>Sonchus asper</i>	Prickly sow thistle	r	
* <i>Sonchus oleraceus</i>	Sow thistle	r	

*Stellaria media	Chickweed	r	
*Trifolium repens	White Clover	o	o
*Ulex europaeus	Gorse	r	
*Vicia sativa	Vetch	o	

## KEY

d = dormant  
a = abundant  
f = frequent  
o = occasional  
r = rare