

1909.
NEW ZEALAND.

DEPARTMENT OF LANDS:
REPORT ON THE SAND DUNES OF NEW ZEALAND:
THE GEOLOGY AND BOTANY, WITH THEIR ECONOMIC BEARING.

By L. COCKAYNE, Ph.D.

Presented to both Houses of the General Assembly by Command of His Excellency.

INDEX TO CONTENTS.

	Page.		Page.
I. Introduction,—		II. Geology— <i>continued</i> .	
(A.) General remarks	2	(H.) The virgin dunes	15
(B.) Objects of dune-culture	3	(I.) Effect of man, &c., on the dunes	15
(C.) Previous investigations of New Zealand dunes	4	III. Botany,—	
(D.) The dune areas of New Zealand	4	(A.) General remarks	16
(a.) Auckland	4	(B.) Conditions for plant life,—	
(b.) Taranaki	5	(a.) General	16
(c.) Hawke's Bay	5	(b.) Climatic factors,—	
(d.) Wellington	5	(a.) Wind	16
(e.) Nelson	5	(β.) Heat	17
(f.) Marlborough	5	(γ.) Rain	17
(g.) Canterbury	5	(b.) The soil factor	17
(h.) Otago	5	(c.) The plant covering	18
(i.) Southland	5	(C.) The most characteristic plants, their life-forms and adaptations,—	
(j.) Westland	5	(a.) General	18
(k.) Stewart Island	5	(b.) List of leading dune plants,—	
(l.) The Chatham Islands	5	(a.) Sand-binders	18
(m.) The Subantarctic Islands	5	(β.) Sand-collectors	18
II. Geology,—		(γ.) Wet-ground plants	19
(A.) General remarks	6	(c.) Descriptions of plants,—	
(B.) The material of dunes and its origin	6	(a.) Spinifex hirsutus	19
(a.) Origin of dune sand	6	(β.) Scirpus frondosus	19
(b.) Material of dunes	7	(γ.) Euphorbia glauca	20
(c.) Form of the sand-grains	7	(δ.) Calystegia Soldanella	20
(C.) Dune-building on the coast,—		(ε.) Carex pumila	20
(a.) General	8	(ζ.) Coprosma acerosa	20
(b.) Movement of sand by the wind	8	(η.) Pimelea arenaria	21
(c.) Sand-ripples	8	(θ.) Cassinia leptophylla	21
(d.) Plants as dune-builders	9	(ι.) Festuca littoralis	21
(e.) Effect of obstacles	9	(κ.) Calamagrostis Billardieri	21
(a.) Solid obstacles	9	(λ.) Scirpus nodosus	21
(β.) Flexible open obstacles	9	(μ.) Leptocarpus simplex	22
(γ.) Inflexible open obstacles	9	(ν.) Gunnera arenaria	22
(f.) Stratification of dunes	10	(d.) Methods of spreading of dune plants	22
(g.) Effect of climate	10	(D.) The dune-plant associations of western Wellington	22
(D.) The foredune	10	(a.) General	22
(E.) General topography of a dune area in New Zealand	10	(b.) Dune associations proper,—	
(F.) Movements of dunes and dune sand,—		(a.) "Sand-grass" dunes	23
(a.) General	11	(ε.) Shrub dunes	23
(b.) Wind as a destructive agent	11	(1.) Sand-shrub dunes	23
(c.) Dune-wandering	12	(2.) Heath dunes	24
(d.) Sand-drifting	13	(γ.) The fixed dune	25
(G.) Land forms of the dune area,—		(c.) Hollows and sand plains	25
(a.) Dunes,—		(a.) The moist sand plain	25
(1.) Dune ridges	13	(β.) Manuka heath or swamp	26
Fixed ridges	13	(γ.) Lakes and swamps	26
(2.) Isolated hills	13	(δ.) Dry hollows	26
(3.) Wandering dunes	13	(ε.) Rapid drift on to sand-plain	26
(4.) Cliff dunes	14	(ζ.) Stony plain	26
The upper cliff dune	14	IV. List of works consulted	27
(5.) Juvenile dunes	14	(A.) General literature	27
(6.) Sandspits	14	(B.) Literature relating to New Zealand dunes	28
(7.) Sand plains	14		
(8.) Swamps	14		
(9.) Lakes	15		