1909.

NEW ZEALAND.

DEPARTMENT OF LANDS:

REPORT ON A BOTANICAL SURVEY OF STEWART ISLAND.

By L. COCKAYNE, PH.D.

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

CONTENTS.

Department of Lands,
Wellington, 1st June, 1909.

SIR,—

I have the honour to submit herewith report on a botanical survey of Stewart Island, carried out during the months of September and October, 1908, by Dr. Cockayne, under your instructions.

The fact that the vegetation of Stewart Island has not as yet been interfered with to any appreciable extent by man, and so may be regarded as truly virgin, gives to this report a special interest and value. The progress of all settlement unfortunately carries with it the destruction, either partial or complete, of our native fauna and flora, and while this cannot but be regretted, the loss may be considerably lessened by obtaining, wherever possible, accurate accounts by qualified observers (as in this case) of areas of country not yet affected by the march of civilisation.

Towards this end the present report is a valuable contribution.

I have, &c.,
WILLIAM C. KENSINGTON,
Under-Secretary.

The Right Hon. Sir J. G. Ward, P.C., K.C.M.G.,
Minister of Lands.

PART I.—INTRODUCTION.

A. GENERAL REMARKS.

THIS report is a continuation of those already published by the Department of Lands and Survey (See Nos. 23, 25, and 26 in Bibliography, Part VIII), which seek to put on record, before it is too late, by means of photographs, maps, and descriptions, the general aspect of the vegetation of typical or specially interesting districts, and to supply details regarding the plant formations of which it is composed, the distribution of the species, their life-forms, and other botanical matters of general interest.

Stewart Island is, so far as its natural history is concerned, one of the least explored portions of the New Zealand biological area. No detailed account has been published regarding its vegetation, nor concerning the conditions under which its plants grow. And yet it is botanically a region of special interest owing to its geographical position, isolation, climatic conditions, and geological history. Moreover—and this is a very important matter indeed—its vegetation is absolutely virgin, except in a few spots. This is a great contrast to the mainland, where fire and the axe have driven primitive New Zealand far beyond the reach of most, and where many interesting plant formations and botanical phenomena are gone for ever, unstudied and unknown. But in Stewart Island, a journey of two hours merely from the Bluff, is to be seen a primeval land with meadow or forest exactly as Nature planted, and stocked as abundantly with our native birds, so fast-vanishing elsewhere, as was New Zealand in the pre-European days. Still at night-time does the kiwi steal forth from its shelter, and probe the peaty mountain meadows in quest of worms. Pigeons in their lustrous garb, high in the tree-tops, feed on the red miro drupes. Tuis, less timorous, haunt in springtime the settlers' orchards in quest of honey from the blossoming trees. In marshy ground, the sombre fern-bird utters its monotonous call, making short flights above the sedges.

The botany of Stewart Island offers many interesting problems for solution. The fact of its comparatively small size, but most varied land-surface, gives an opportunity for study under simpler conditions than in the North or South Islands. The limited distribution of many plants; the occurrence of numerous alpine plants at sea-level; the variation of a certain species according to its surroundings; the relationship between the Stewart Island flora and that of the neighbouring mainland on the one hand, and of the subantarctic islands on the other; the vegetation of an ancient strait, or of the accompanying inland dunes: these and many other problems which are dealt with are matters of interest not merely for New Zealand botany, but for general plant-geography.

Besides the purely botanical portion of the report, which I have attempted, apart from technical details, to make intelligible for the non-botanical reader, I have added sections dealing with the bird-life and the scenery, recognising that this report is concerned not only with an interesting scientific region, but with what will be in no very distant future one of the most important watering-places in New Zealand, and perhaps in Australasia.

I must express my great obligations to the following for much valuable assistance: Mr. R. McNab, M.A., LL.B., by whose direction, as Minister for Lands, this work was carried out, and who has supplied the valuable section dealing with the early history of the island; Mr. W. C. Kensington, Under-Secretary for Lands and Survey; the Rev. D. C. Bates, Government Meteorologist; Professor C. Chilton, D.Sc; Mr. F. G. Gibbs, M.A., to whom I am indebted for several fine photographs; Mr. R. Speight, M.A., B.Sc., who has identified certain rocks and given advice on geological matters; Professor L. Diels (University of Marburg); Drs. W. F. Brotherus, G. Lindau, and F. Stephani, who have identified the cryptogams*; and Messrs. R. M. Laing, M.A., B.Sc., J. Crosby-Smith, F.L.S., W. Traill, and A. Traill: finally, I must specially thank Mr. J. W. Murdoch, without whose aid the section on bird-life would not have been written, and who for several years has generously supplied me with information and botanical material.

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* The identifications of the cryptogams arrived too late for embodying in this report. I am publishing the list in the volume of the Transactions of the New Zealand Institute for 1909.

B. EARLY HISTORY OF STEWART ISLAND.

[By Robert McNab, M.A., LL.B.]

Stewart Island was first made known to the civilised world by Cook. With the other portions of New Zealand he had sailed round it, and recorded its position, and such of the more striking characteristics as could be noted from the deck of the "Endeavour." That was 139 years ago.

Outside of the ordinary commonplaces of discovery there are several interesting points associated with Cook's visit. The first is the narrow escape from destruction which the "Endeavour" had, and which will for ever be recorded to navigators in the name "Traps," given to those dangerous rocks which are met with only a few miles from the coast. The passage of the southern point of the island settled the question whether any of the islands of New Zealand formed part of a great antarctic continent—a question which had agitated geographers from the time of Tasman. The third point of interest was the strange mistake made by Cook of concluding that he was sailing round a promontory and not an island.

Following Cook's discovery in 1770 there is no record of Stewart Island having been sighted for a very long time. Its mountainous lands lying away to the south and east must, however, have been repeatedly seen by the vessels which visited Dusky Sound from the time the "Britannia" called there in 1792 until the "Mercury" relieved the crew of the "Endeavour" in 1797. Cook's chart showed a bay where now we know there is a strait, and that kept all captains away from the lee-shore they so much dreaded.

Probably the first man to land upon its rather forbidding coast-line was Captain Oliphant, in a small sealing-craft called the "Endeavour," belonging to Cable and Underwood, of Sydney. In 1803 she procured a cargo of 2,200 skins in the locality of Stewart Island, which at this time was known by the name of the South Cape.

It was not until 1809 that much was done in the way of sealing on the shores of Stewart Island. Captain Grono, in the "Governor Bligh," was in the strait early in 1809, and gave the first report of its existence to the outside world. He spoke of it as "a newly discovered strait" separating South Cape from the mainland. Several other vessels were in or about the strait at the same time, and all of them secured very good cargoes of skins. It is very doubtful indeed whether this was the date of the discovery or not. It is more probable that the strait was discovered some time before, but had not been named until the stirring events of 1808 brought the name of Foveaux to the front, when Grono gave that designation to the hitherto unnamed waterway.

The fact that the island was called Stewart Island has been the means of crediting the discovery to an old-time skipper named William Stewart. It is by no means certain that the credit of discovery is due to him, however. Though the name Stewart Island was given to the land at an early date, the first statement that Stewart discovered it was made in 1826—seventeen years after the alleged discovery—by Stewart himself. Though the evidence that Stewart discovered the island is not by any means clear, it must be pointed out that Stewart was early associated with its survey and exploration. As first officer on board the "Pegasus" he spent some time in visiting and exploring its bays in quest of seals, and his chart of Port Pegasus is dated August, 1809. The chart and his description of the island were afterwards published in the "Oriental Navigator" in 1816, and the former was used by the officers of the navy down to 1840. The name "Stewart Island" was probably given to the land because Stewart surveyed it, not because he discovered it.

Following upon the discovery of Foveaux Strait, considerable activity took place in the sealing trade upon its shores, and Stewart Island contributed more than its quota to the fur-harvest. The names Lords River, Port William, or Williams Bay, as it was at first called, immortalise the name of early Sydney merchants who traded with New Zealand about this time. The revival of trade brought the sealing gangs into conflict with the Natives on different occasions, and boats' crews from the Brothers and the Sydney Cove were killed and devoured by the cannibals.

After the discovery of the Macquarie and the Campbell Islands the Stewart Island trade fell away, and little mention is made of the island until 1813, when a revival in interest in the flax trade took place in Sydney. A vessel, the "Perseverance," was placed under the command of an old Stewart Island sealer, Murray, and sailed for Port William. The moving spirit of the party was a ropemaker of Sydney named Robert Williams. The expedition came to nothing, although several days were spent at anchor in Port William, and a visit paid to a harbour on the mainland now known as the Bluff Harbour.

Beyond the fact that it was a calling-place for sealing-vessels in their regular trips from Sydney, Stewart Island has nothing of moment to chronicle until the expedition sent out by the New South Wales Government in 1822 to investigate the prospects of the flax trade. The "Snapper" proved rather small for the work, but Captain Edwardson visited Mason and Easy Bays and Codfish Island, and reported on everything which came under his notice. His botanical survey of the south-west coast is a very different document from that of which this is a short historical introduction.

Edwardson states that on the island opposite Easy Bay, an Englishman, pursued by Natives, hid himself in a cave, where he subsisted upon shell-fish until rescued by a passing ship and taken to Port Jackson. The same year a woman was rescued from Stewart Island under somewhat similar circumstances. She was a native of Kangaroo Island, and had been taken away by the crew of the "General Gates," an American sealer. The gang which she accompanied was attacked and destroyed by the Maoris, and she, with her little child, escaped and lived under a rock until the savages left. After that she spent eight months living on raw birds and seals before she was rescued by Captain Dawson of the sealing-vessel "Samuel," and taken to Sydney.

The first man-of-war to visit the island was H.M.S. " Tees," to try and effect the rescue of the " Elizabeth Henrietta," which had been cast ashore at Ruapuke. She anchored at Port William from the end of April to the middle of May, 1824, but had to return to Sydney unsuccessful.

In 1826 two remarkable expeditions met at Port Pegasus. Our old friend William Stewart had been in England trying to form a company to settle Stewart Island. He was not successful, but he had induced a party of ships' carpenters and bushmen to come down from the Bay of Islands and form a station at Port Pegasus. While there the expedition of the first New Zealand Company, under Captain Herd, which was being organized in England the same time as Stewart's, also arrived at Pegasus. Both expeditions remained there some time. Both came to a similar end.

As indicating the youth of our country, it may be mentioned that Harry Cook, the eldest son of the headman of Stewart's gang, born at Pegasus the following year, is at this moment a resident of the Bay of Islands.

About the same date a small colony of sealers, who procured for themselves wives from among the Maoris of Stewart Island, obtained and settled upon Codfish Island, where they kept in touch with Sydney by means of occasional visits from sealing craft.

Some say that in 1829, but all are agreed that in 1830, a shore whaling-station was established at Preservation Inlet. Many of those who resided at Codfish Island went over to the inlet for the whaling, and during the " off " season killed seals or cut timber. Port Pegasus was this year (1830) visited by Captain Morrell, of the American sealer " Antarctic," who spent a few days there before sailing up the east coast to the Bay of Islands.

At the time of Morrell's visit a vessel was being built at Pegasus. This vessel ultimately became the property of the Wellers, who established a shore whaling-station at Otago. She was the first craft recorded as being built at Stewart Island, was named the " Joseph Weller," and regularly traded between Sydney and southern New Zealand for several years.

In spite of the great number of vessels which had visited Stewart Island, and the rocky and uncharted coast they were compelled to negotiate, no wrecks had, up to this date, been recorded. The year 1831 brought the first, in the form of the loss of the " Industry " at Easy Bay. During February she had been to Codfish Island, and had run for shelter from a gale then raging to Easy Bay. Captain Wiseman, ten seamen, and six Native women were drowned, two men only escaping. A second wreck was reported in 1836. At various points on the island signs of wreckage were visible, and at one place the Europeans mustered in their boats and dragged ashore the poop of a vessel, portions of which were taken over to the Bluff to the captain of an American whaler there, and he gave his opinion that the vessel was of American build. She had evidently been loaded with cedar, but her name was never discovered.

This brings the narrative down to the commencement of the whaling period so far as it affected Stewart Island, and will give the reader an outline of the history of civilised man's first contact with the southernmost of New Zealand's three principal islands.

C. HISTORY OF BOTANICAL RESEARCH.

Dr. Lyall, surgeon to H.M.S. " Acheron," which carried on a survey of the New Zealand coast during the years 1847–51, made the first collection of Stewart Island plants. This, quite a small one, containing only a dozen or so flowering-plants and a few cryptogams, chiefly seaweeds, was sent to Sir Joseph Hooker, who published the species in the " Flora Novae-Zelandiae " (40).

For the long period of years after Lyall's visit no further details of any moment were added to our knowledge,* and botanically the island was a *terra incognita* until the most praiseworthy zeal in the cause of pure science led to Messrs. D. Petrie, M.A., and G. M. Thomson, F.L.S., visiting the island in January, 1880, in order to investigate its natural history. In a small sailing-craft, with Mr. W. Joss, of the Neck, as captain, they explored Port Pegasus and Paterson Inlet, dredging in their waters or plant-collecting in the lower country. They also crossed over from the head of Paterson Inlet to Mason Bay, an unpleasant task until quite recently, on account of the miles of swamp which had to be traversed, but unfortunately were compelled through lack of time to return without gaining the actual coast. Mr. Petrie published a most interesting paper (69), giving a short account of the nature of the country visited, calling attention to the ancient strait between Mason Bay and Paterson Inlet, and suggesting a recent glaciation of the Pegasus district. Most important was his discovery of numerous alpine plants at sea-level. Amongst remarkable plants discovered were *Liparophyllum Gunnii* and *Actinotus novae-zealandiae*, the former also Tasmanian, but since found to extend as far north as the volcanic plateau of the North Island (Cheeseman, 16A ; Cockayne, 26). Other noteworthy species discovered were : *Ehrharta Thomsoni, Elaeocharis sphacelata*, and *Carex longiculmis*. The paper concludes with a list of two hundred species of flowering-plants, the ferns not being dealt with (Petrie, 1881).

Mr. G. M. Thomson, M.P., F.L.S., had visited the island a year or two previously, hoping also to reach the Snares, and, while wind-bound at Wilson Bay, had made the remarkable find of *Suttonia chathamica* (78), a Chatham Island tree not observed as yet on the New Zealand mainland. Also he had collected the *Brachycome* now bearing his name. But Mr. Thomson's connection with Stewart Island botany does not cease here, for he made use of a number of the plants in connection with his

* Hector (36A) had visited Port William and Paterson Inlet in 1863, and published a line or two regarding the vegetation, along with certain geological details. Professor J. Black in 1872 wrote a report for the Provincial Council of Otago, but, so far as botany is concerned, mentioning only some sixteen species, of which *Sophora tetraptera* is certainly an error.

classical memoir on the fertilisation of New Zealand flowering-plants (Thomson, 79), treating specially of *Utricularia*, and noting the female flower of *Bulbinella Gibbsii*, which he suggested might be cleistogamic.

The same year as Petrie's paper appeared a description of certain Stewart Island plants collected by the Rev. Mr. Stack, and sent to the Christchurch Botanic Garden (see Armstrong, 1 and 2). Amongst these were *Stilbocarpa Lyallii*, *Senecio Stewartiae*, and *Myosotis albida*.

At about this time the late Mr. Charles Traill, who had come to reside on the island of Ulva, in Paterson Inlet, where he was establishing an interesting garden, and proving at the same time the extreme mildness of the winter climate, was interesting himself in the botany of the island, and personally, and with the aid of the Maoris, making extensive collections of the plants, which he sent to the late Mr. T. Kirk, F.L.S. His collections were of great extent and importance, and were recorded by Kirk in the "Students' Flora" (62) and the "Forest Flora" (58) of New Zealand. Mr. Traill continued assiduously his self-imposed task until his death in 1898. He was assisted also by his brothers, Messrs. Walter and Arthur Traill, both of whom have helped considerably to advance the knowledge of Stewart Island botany. In December, 1881, Mr. P. Goyen, F.L.S., and Mr. W. S. Hamilton ascended Mount Rakiahua (a by no means easy task), discovering, amongst other plants, *Raoulia Goyeni* and *Aciphylla Traillii*.

Mr. Petrie's pioneer paper was followed by two (55, 56) by Mr. T. Kirk, published in 1885, which were the outcome of two visits he made—one in January, 1882, and the second in the same month of 1884. On the last occasion he made the first ascent which had been accomplished of Mount Anglem, accompanied by Mr. Arthur Traill, Mr. von Tunzelman (then schoolmaster at the Neck), and two others. There was then no track* up the mountain, and the ascent was consequently extremely arduous, on account of the great density of the subalpine scrub, which was so thick that a retriever dog was unable to proceed. The party fixed a camp the first day near the manuka zone, and next day made the ascent; but, unfortunately, Mr. Kirk only reached the moraine below the final peak, bad weather having come on and time being precious. Messrs. Traill and von Tunzelman pressed on, however, and gained the summit, collecting a remarkable number of plants there and *en route* considering the haste and bad weather.

The return journey was made by another route, the creek from the moraine being chosen, but this proved worse than the ascent, and the party had to spend the night in the forest. It is probable that on this return journey Mr. Kirk collected *Archeria Traversii*, which has not been again found on Stewart Island.

Later on, in the early "nineties," Mr. Kirk paid two more visits to the island, staying at one time about two months. He again received much help from the Messrs. Traill, and also from Mr. Walker, who had the sheep-run at the head of Paterson Inlet. During these visits Kirk explored a good deal of the island, ascending Mount Rakiahua, reaching Mason Bay, and exploring the Pegasus district, where, accompanied by Mr. Walter Traill, he reached the summit of Smith's Lookout and the highest of the Frazer Peaks. Unfortunately, he published no general account of his important explorations, but his collection was partly recorded in the "Students' Flora," and partly by Cheeseman in the "Manual of the New Zealand Flora" (15). Kirk was also assisted by Mrs. Arthur Traill, who procured for him a number of species from Ruapuke; and by Mr. W. Pearson, then the Commissioner of Crown Lands for Southland. Professor H. B. Kirk visited Stewart Island and Ruapuke more than once, and collected certain species for his father, Mr. T. Kirk.

Mr. R. Brown, of Christchurch, spent a number of weeks in Stewart Island in 1890–91, studying the moss flora. His explorations were chiefly at the head of Paterson Inlet and Mason Bay, where he resided for some time with Mr. Walker. He ascended the Thomson Range, I presume by himself—no light task for a man approaching eighty years of age. He also went overland to Port Pegasus from Mason Bay by way of the Central Range of mountains, taking several days for the journey, and running short of food. His results *re* the mosses collected he published in the "Transactions of the New Zealand Institute" (Brown, 7–11). Mr. W. Bell, an enthusiastic collector of mosses, also visited Stewart Island in the early "nineties," or thereabouts, and his discoveries were in part recorded by Mr. T. W. Naylor Beckett in the "Transactions of the New Zealand Institute" (4, 5).

My own connection with Stewart Island botany (apart from cultivating certain plants sent to me by Mr. Brown, and several visits to Dog and Centre Islands and to the coast of Ruapuke), began in June, 1903, when, waiting with the G.s.s. "Hinemoa" for fine weather on the way to the Snares, I had two days ashore, and reached the open ground of the Remarkables, where I had an opportunity to study the winter aspect of the mountain vegetation, and also the winter climate on a typical day of heavy wind, rain, and sleety snow.

In January and February, 1907, I paid a second visit to Stewart Island, in order to specially study the vegetation for my volume of "Die Vegetation der Erde." I had the very good fortune to be accompanied by Messrs. R. M. Laing, M.A., B.Sc., F. G. Gibbs, M.A., and J. Crosby-Smith, F.L.S., who most generously assisted my work in every way possible. The whole party ascended to the summit of Mount Anglem, spending three days on various parts of the mountain. Mr. Laing and I, accompanied by Mr. J. W. Murdoch, spent several days at Mason Bay, and the last named and myself went on an expedition to the Rakiahua Valley, from whence as a base we examined the vegetation of Mount Rakiahua, Table Hill, the low forest, and the boggy plain.

* Even yet there is no track right to the summit, and a good deal of scrub has to be negotiated. Care should be exercised by those climbing the mountain to fix the exact position of where the track ends, so as to save much labour on the return.

In November, 1907, I had part of a day at Port Pegasus along with the Subantarctic Expedition of the Philosophical Institute of Canterbury. Finally, by direction of the Hon. the Minister of Lands, I was engaged by that Department to prepare this report, and in consequence spent several weeks during September and October, 1908, in order to extend my knowledge of the vegetation, and especially examine the neighbourhood of Port Pegasus, the plant-covering of the scenic reserves, and the distribution of the yellow-pine (*Dacrydium intermedium*). I also made considerable collections of the plants, including the mosses and liverworts, and took a large number of photographs. In all this work I was assisted most zealously by Mr. J. W. Murdoch, who is an admirable botanical collector and an excellent observer.

D. PHYSIOGRAPHY.

Stewart Island lies about fifteen miles from the nearest point of the mainland, from which it is separated by the shallow waters of Foveaux Strait. Its area is estimated at 425,390 acres. In shape the island is irregularly triangular. The western side, the longest, runs in a north and south direction for thirty-nine miles, the north-east and south-east being thirty-three and thirty miles respectively (81A); almost everywhere the surface is hilly, and not infrequently mountainous. In the north is a high ridge with many spurs, culminating in a peak, Mount Anglem, or Hananui, 3,200 ft. in height, to the south of which the land continues much broken and hilly to the shores of Paterson Inlet; while the wall-like mass of the Thomson Range forms its south-western boundary, beyond which is the flat valley of the Freshwater or Ohekia River, the principal stream from Mount Anglem. On the south side of the above valley, and west of Paterson Inlet, is Mount Rakiahua, 2,217 ft. high, to the south of which, but separated by the Rakiahua Valley, is a mountain-chain, which attains in places a height of more than 2,000 ft., and whose chief summits are Table Hill, 2,347 ft., and Mount Allen, 2,459 ft. This chain extends down the centre of the island to Port Pegasus, and divides the waters of the south-east from those of the west. The narrow southern extremity of the island is lower, but still mountainous, several curious smooth granite cones rising to a height of more than 1,000 ft. (Photo No. 39), while at the extreme southern extremity is Smith's Lookout, 1,758 ft. in height.

Perhaps the most striking features of Stewart Island are Paterson Inlet and Port Pegasus. The former, a fine broad expanse of lakelike water, irregular in shape, and dotted with islets, pierces right to the centre of the island, running westward for ten miles, and putting forth three extensive arms, known as South-west Bay, North Arm, and Caerhowel Arm (see map).

Port Pegasus, in the south, is smaller and narrower. It runs parallel with the coast for about seven miles, its entrance blocked by three islands, between which are narrow passages. It is divided into a North and South Arm, connected by a narrow strait, the Acheron Anchorage.

There is little really flat ground on Stewart Island. East of the Table Hill dividing-range the country is comparatively low, but it is much broken. At the head of Paterson Inlet is the mouth of the Freshwater River, a sluggish tidal stream of dark water, navigable for small boats for a few miles. Its course lies through a narrow valley, bordered by sandhills, extending northward to the jagged Ruggedy Mountains, and continuing still at a low level north of that range, whence there is quite low country to the sea.* Also, there is an opening to the west following a branch of the Freshwater River, which debouches into a wide, flat area filled with an ancient dune-complex,† and separated from the sea at Mason Bay by a wall of dunes about 400 ft. high.

The coast-line is usually rocky, but here and there are sandy beaches, especially that of Mason Bay.

A number of islands dot the adjacent sea, particularly on the east and south-west, while on the north-west is the fairly large Codfish Island. Nineteen miles eastward is the low island of Ruapuke, four miles and a half long and two miles wide, and in Foveaux Strait lie Dog and Centre Islands, the former two miles and a half, and the latter four miles from the South Island mainland. Thirty-five miles to the westward are the Solanders, islands of volcanic origin (Speight, 77A), the main island 1,100 ft. high, a well-known landmark to sailors. Finally, sixty-two miles south-south-west of the south-west end of Stewart Island lie the Snares, whose vegetation has an equal affinity with that of the subantarctic islands, with which it has been usually classed (Cockayne, 18).

Stewart Island and its outlying islands are composed for the most part of granite and diorite gneiss,‡ but the central dividing-range is partly, at any rate, made up of a schist very similar to that of Central Otago. The Solanders are volcanic, being composed of hornblende-andesite (Speight, 77A).

The Stewart Island granite§ is frequently quite soft, and rapidly disintegrates into clay. In the south it crops out to the surface, and is much weathered (see Photo No. 3), the conical mountains being probably the outcome of this rather than of ice-action, though in appearance many rocks, as Petrie pointed out (69), have certainly the character of *roches moutonnées* (see Photo No. 39). There has been undoubtedly more or less glaciation in Stewart Island. A typical moraine (see Photo No. 1), damming up a small lake, occupies the flattish ground beneath the final precipices of Mount Anglem, and it is more easy to believe that glaciation has been much more extensive than that there was merely at one period a small ice-field on the highest mountain. Mr. R. Speight's recent important discovery of moraines

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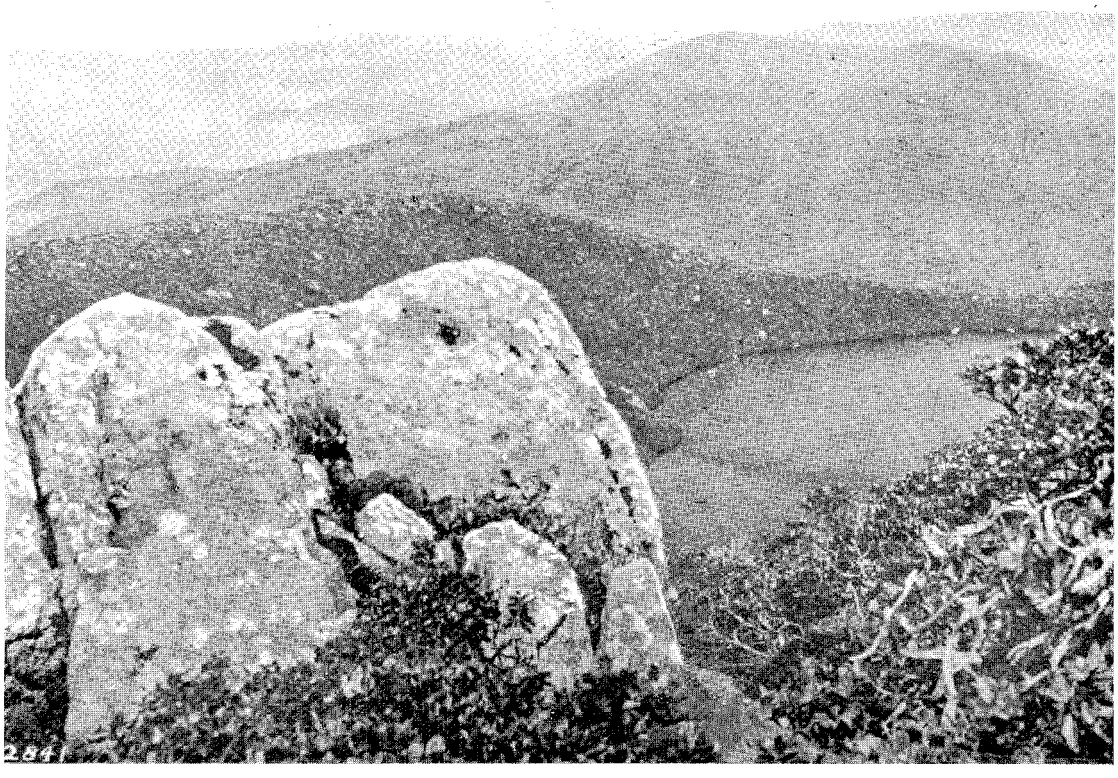
* From information supplied by Mr. J. W. Murdoch.

† For explanation of this term, see my recent report to the Lands Department on sand-dunes.

‡ Marshall (67B, p. 498) gives certain details as to the rocks at Half-moon Bay, Golden Bay, and Ruggedy Point, at which latter is "a large intrusive mass of granophyre, whose resistent nature causes it to form outstanding pinnacles and cliffs."

§ Mr. Speight kindly supplied the following note *re* certain rocks I collected: "All the specimens are yellowish-coloured granite, containing a considerable amount of quartz, that from the Frazer Peaks being a mica variety with a fair proportion of plagioclase. The specimen from Wilson's Bay is very similar in character, except that it contains numerous small patches showing graphic intergrowths of quartz and feldspar on a small scale (granophyric structure). The third specimen, from Thomson Range, contains a large amount of microcline—in fact, it is the dominant feldspar in the rock.



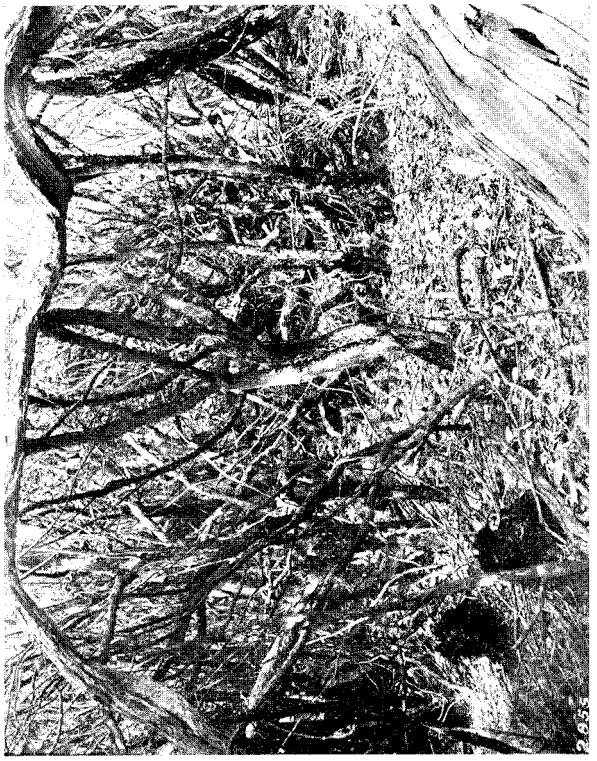
No. 1. Moraine and small glacial lake on Mount Anglem.

[*Photo., F. G. Gibbs.*

No. 2. Coastal scrub. Wind-swept manuka in foreground has replaced *Senecio rotundifolius* in background. Exposed headland in Paterson Inlet.

[*Photo., L. Cockayne.*

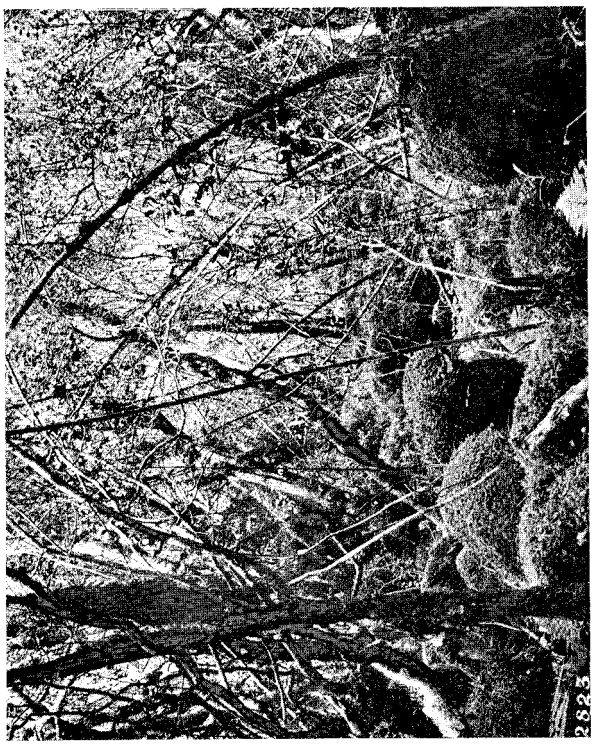
To face p. 6.]



No. 4. Interior of *Olearia Colensoi* scrub on narrow isthmus of the Old Neck, Glory Cove.

No. 6. "Trunk" of southern rata (*Metrosideros lucida*), 10 ft. in diameter, made up of roots.

No. 3. Weathered granite on Frazer Peaks.



No. 5. Interior of scrub on Pryce's Peak, near summit. Moss and liverwort cushions in foreground.

[*Photos. by L. Cockayne.*

in the Auckland Islands (77A) points conclusively to the fact of greater glaciation in Stewart Island and southern New Zealand generally, especially if such were the result of a colder climate. Even were this glaciation correllated with a general rise of the land-surface—and this is the more probable explanation—a general but not a total glaciation would ensue. That the lands in question have never, since their plant-colonisation long ago, at the periods of former northern and southern land-extension, been altogether buried by ice is certain, since in that case the endemic (subantarctic) genera would be non-existent; nor could they have been populated as they now are, considering the diverse affinities of the species, by wind-carriage, bird-carriage, &c., alone.* But, on the other hand, there may have been glaciation sufficient to much reduce the land-surface available for plant-life, and so increase the struggle for existence amongst the plants—a conjecture which an analysis of the present floras seems to demand in order to explain some difficult points in distribution (see section on history of flora).

Within quite recent times the land-surface of Stewart Island became much smaller than it had previously been. The inland dunes point conclusively to a strait having existed in comparatively recent times, when the island would be cut into several portions. Also the quite shallow Paterson Inlet and Port Pegasus could hardly have originated otherwise than as river-valleys when the land was higher, but which, with its sinking, were gradually invaded by the sea. The flat land along the eastern coast-line also points plainly to a depression of the surface below the level of the sea, followed by a slight subsequent elevation. At its smallest, Stewart Island would consist of the Mount Anglem island, the Ruggedy island, perhaps Rakiahua island, and a high triangular wedge of land to the south; while at its greatest extent, at an earlier period, it would reach to beyond Ruapuke, be joined to the South Island, and probably extend to the Auckland and Campbell Islands.

Quite a small elevation of Foveaux Strait would at the present time connect Stewart Island with the mainland and with all its outlying islands, since the sea is very shallow, 21 fathoms being the greatest depth along the cable-line, for instance (chart, Sheet XI). Possibly such connection has taken place more than once, the bulk of the present plants having arrived during such earlier connection. At an earlier geological period there was probably much greater expansion still in the New Zealand area; but with that we are not at present concerned.

The Table Hill Range and its continuation southwards is comparatively level on its summit, and near its rounded highest portion flat stones lie on the surface, and flattened rock, reminding one of parts of Central Otago, crops out. Perhaps it is the remains of much higher land now weathered to a narrow plateau.

The rivers are numerous, but of course small, and the principal ones flow in an easterly direction. The Freshwater, Rakiahua, Toitoi, Lords, and Kopeka are the largest.

The soil is very peaty and boggy in many places, but in others there is much clay, especially as subsoil, arising from the soft granitic rock, and the deposit of peat is not great.

E. CLIMATE.

The meteorological station is situated on the island of Ulva, in Paterson Inlet, and it is self-evident that such a position can give little estimate of the general climate of a wind-swept and mountainous land; in short, the records are quite likely to be misleading.

Generally speaking, there must be a considerable rainfall at all seasons, and also, as may even be seen from the appended table, a great number of rainy days. The sky is also both before and after rain frequently overcast for a considerable period. Westerly gales are common, the wind blowing with excessive violence. There are no extremes of cold and heat, and near sea-level the amount of frost must be slight, judging from the presence of *Pelargoniums* at midwinter in the gardens and from the testimony of the inhabitants. The summer heat is probably less than at similar levels in the south of the South Island,† and I should say rarely reaches 70° Fahr. The north-east portion of the island has undoubtedly less rain and wind and more sunshine than the south, the west, or the higher levels. When it blew so furiously on Mount Anglem as to make it almost impossible to stand upright on the exposed subalpine meadow, at Half-moon Bay there was a calm day. The higher country is frequently enveloped in cloud when the lower is clear and the sun shining. The presence of the yellow-pine association in the south and west also points conclusively to a greater rainfall and number of rainy days. Indeed, the climate of the south and the mountains may be considered subantarctic, approaching that of the Auckland Islands. In the settled district near Half-moon Bay the weather is probably much the same as that of the Southland Plain, though probably the winter is milder.

In winter the snow lies for some time on Mount Anglem, but there is no general covering of the mountains with snow for any length of time, nor do I think the cold will ever fall below 15° Fahr. at the utmost, while probably it is usually much less. *In short, the popular idea of a cold climate in Stewart Island is altogether false.*

The following table gives statistics regarding the rainfall and number of rainy days on the scenic reserve of Ulva; other climatic details are given in the body of the report:—

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* Since my writing the above, Professor James Park, F.G.S., has put forth a theory of total glaciation for New Zealand south of Cook Strait, and an extension northwards of "the polar ice-sheet," New Zealand north of Cook Strait alone remaining free from ice ("The Geology of the Queenstown Subdivision"; Bull. No. 7, n.s., N.Z. Geolog. Survey, pp. 40–43; 1909). In such a case the subantarctic genera *Pleurophyllum* and *Stilbocarpa*, and a host of species now confined to the southern and subantarctic floristic provinces, would have been forced to migrate in front of the advancing ice-sheet to the North Island. Yet at the present time of such plants we find there not a trace, while *Pleurophyllum* during the suppositional retreat of ice and plants did not take up its abode in the well-suited alpine region of the South Island or even Stewart Island, but returned to its original home in the Aucklands, &c., and so too with other endemic plants of the subantarctic province, especially *Azorella Selago* of Macquarie Island! Such a happening seems beyond the bounds of possibility, nor can any theories of glaciation be at variance with the facts of plant distribution.

† During the summer it is rare that a fire indoors, at any rate in the evening, is out of place.

Rainfall on Island of Ulva, Paterson Inlet, Stewart Island, and Days with Rain ·01 or over.

100 points = 1 inch. Observations taken by Mr. W. Traill.

—	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.
1899 ..	..		..		..		..		2·09	17	1·35	17	4·50	20	2·95	16	4·74	23	7·40	23	3·02	17	7·61	21
1900 ..	5·24	18	2·59	18	4·81	17	4·02	14	4·63	18	1·73	11	9·15	28	0·70	13	2·04	16	8·98	23	5·36	22	2·87	11
1901 ..	4·39	20	6·37	19	3·82	15	7·20	19	11·63	31	2·12	16	4·31	20	4·26	19	4·69	21	7·88	24	8·99	28	4·71	26
1902 ..	6·88	19	2·89	18	4·02	19	4·80	21	9·69	26	3·65	21	7·32	30	6·18	25	6·76	28	5·51	26	9·32	29	5·82	21
1903 ..	5·10	24	3·36	18	8·24	21	4·75	20	5·60	23	6·85	27	3·77	23	3·68	22	3·38	16	4·35	15	3·43	20	5·33	22
1904 ..	5·32	14	2·81	15	4·70	16	4·23	22	5·56	25	5·48	25	3·41	19	5·38	26	2·91	17	4·84	24	6·81	24	6·40	23
1905 ..	6·82	19	1·74	14	5·39	23	6·57	27	3·51	21	4·43	22	2·51	18	2·22	15	4·37	20	3·26	19	8·19	24	5·94	22
1906 ..	4·49	21	4·24	15	3·38	14	10·82	22	8·97	25	9·20	26	8·11	24	5·81	19	2·91	14	8·42	18	4·55	22	6·54	22
1907 ..	4·84	13	5·25	20	6·84	24	4·99	20	6·31	24	4·59	20	4·29	20	1·82	12	6·71	19	7·24	22	2·19	14	7·23	21
1908 ..	3·94	18	1·94	13	4·77	17	6·11	21	5·18	26	6·61	22	5·44	23	4·69	23	7·34	21	6·79	24	7·68	19	6·55	18
1909 ..	7·38	25	2·47	12	4·17	12	8·15	19	..		..		..		..		..		..		..		..	
Means	5·44	19·1	3·37	16·2	5·01	17·8	6·16	20·5	6·32	23·6	4·60	20·7	5·28	22·5	3·77	19	4·59	19·5	6·47	21·8	5·95	21·9	5·90	20·7

Annual Totals.

—	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Annual Means for Nine Years.
Inches	52·12	70·37	72·84	57·84	57·85	54·95	77·44	62·30	67·04	63·64
Days	209	258	283	251	250	244	242	229	245	246

PART II.—SPECIAL ECOLOGY.

A. THE ECOLOGICAL CONDITIONS.

The high rainfall and excessive number of rainy days make possible the presence of forest everywhere, even when soil-conditions are not specially favourable. For instance, the high dunes at Mason Bay are in places forest-clad, a quite uncommon occurrence in New Zealand generally. Low-lying land, where the surface-water cannot get away, may become altogether too wet for trees, but a swamp-forest may border such ground. The frequently cloudy skies and comparative poverty of sunshine must bring about a stronger shade within the forest than is the case in many of the allied formations of the mainland, but no investigations have been made on this head. Such lack of light would be greater were it not that the tree-tops are frequently at a considerable distance from one another.

On the other hand, when the forest has been removed, as is shown further on, the climatic conditions are admirably suited for its regeneration, for certain shade-loving plants—*e.g.*, the rimu (*Dacrydium cupressinum*) and the slender tree-fern (*Dicksonia squarrosa*)—thrive quite well in the open. The mild winter is also favourable for tree-growth and for the presence of " tender " species of plants, and *were it not for the comparatively cold summer* the greater part of the New Zealand lowland flora could maintain itself in Stewart Island. On the scenic reserve of Ulva such characteristic northern plants as the nikau palm (*Rhopalostylis sapida*), the rangiora (*Brachyglottis repanda*), and *Pomaderris apetala*, planted by the late Mr. Charles Traill, are quite at home. Just as on the Canterbury Plain the cold of winter is hostile to many species of plants though the heat of summer is favourable, so in Stewart Island is it the reverse, whereas in northern Auckland winter and summer conditions are both suitable, a forest far richer in species being the result (Cockayne, 25).

The clay soil is not in itself very fertile, but the decaying vegetation has added a large amount of humus, rendering it not only more open but richer, its water-holding power at the same time being great. In many places there are considerable accumulations of peat, and even on sloping ground the water cannot get away, and bog-conditions follow.

So far as the grouping of the species is concerned, and the delimitation of the formations, of all ecological factors wind is the most potent. Were it not for its excessive violence there would be little open ground, even on the mountains, where the forest would ascend much higher, as shown now by the presence of the rimu (*Dacrydium cupressinum*) in the subalpine scrub, while this latter formation would occupy much of what is now meadow. The powerful effect of wind is well illustrated by the distribution of the vegetation on the shores of Paterson Inlet.

There the irregularities in the coast-line lead to every imaginable degree of exposure with regard to the prevailing westerly wind, which, its fury augmented in passing through the narrow opening of the Freshwater Valley, strikes the inlet with extreme violence. The vegetation changes exactly according to the degree of its exposure. In sheltered bays the ordinary forest, with its trees, shrubs, tree-ferns, and even filmy ferns, comes right to the water's edge, a special shore-belt being absent. Let the wind strike a little more fairly and *Senecio rotundifolius* makes its appearance, until with further increase of exposure the formation in which this species is dominant is established. With an additional increase manuka (*Leptospermum scoparium*) appears, and finally on the most exposed headlands it, as a wind-shorn shrub, alone flourishes, the Senecio being altogether absent (see Photo No. 2). Just as plants are ecologically defined as " shade-loving " and " shade-avoiding," so may they with equal propriety be designated " *wind-avoiding* " and " *wind-tolerating*," and on this conception may the distribution of many Stewart Island plants be explained. Thus on the exposed peninsula which separates the South Arm of Port Pegasus from the ocean the wind-tolerating inuka (*Dracophyllum longifolium*) is extremely abundant, its erect, slender yellowish heads standing above the general roof-level of the low forest.

The contour of the land-surface has much to do with the distribution of the formations or the associations. In the north of the island slow denudation has formed gullies and valleys where shade-loving and wind-avoiding associations can flourish. Likewise ridges and slopes occur where wind-tolerating plants of different degrees are congregated. In the south of the island a greater and more rapid denudation has reduced the general level of the country. Here, owing also to the narrowness of the land, the wind can exercise its full power, and, although much of the surface is near the sea-level, alpine rather than forest conditions exist in many places, and a formation almost identical with that of wet subalpine meadows is common.

Soil-moisture is a very important factor with regard to distribution, and this is also correllated with the conformation of the ground. Forest, swamp, bog, and sand plants have all their water-enduring capacity, and, on the other hand, their drought-enduring capacity, but each plant has its own special capacity, and in some—*e.g.*, the manuka (*Leptospermum scoparium*) and *Crassula moschata*—the capability to tolerate extremes is enormous.

Excepting insects and certain birds which play a part in pollination, the animal factor is of little moment; no indigenous animal feeds on the plants so as to damage them. On the small outlying islands the sea-birds, as on the New Zealand subantarctic islands (Cockayne, 28), will have to be considered, but I know nothing definite on this subject.

The plants themselves react one upon the other, shade, shelter, increase of moisture in the air, and so on being provided by the presence of certain life-forms. The luxuriant growth of the punui (*Stilbocarpa Lyallii*) is favoured by the branching habit and leaf-form of *Olearia Colensoi*; *Sphagnum* cushions in bogs permit the presence of certain plants which would not grow on the actual wet sour ground; tree-fern stems support a rich vegetation; the peat-making habit of the coastal ferns leads to certain other species settling on rock-faces. Some plants act negatively, and by their close growth or special

form forbid the presence of competitors for the ground. For instance, the close rosettes of *Plantago Raoulii* may hinder all other growth on sandy soil; where tree-ferns are plentiful, there is but little on the floor beneath; the horizontal pinnae of the umbrella-ferns exclude the light, and forbid other ground-vegetation. There are certainly other and more subtle reactions of plant upon plant, but such a study is in its infancy so far as the higher plants are concerned.

Sea-spray and brackish water play some part in plant-distribution, but the former is usually of no great moment. *Asplenium obtusatum* and *Blechnum durum* of the coastal rocks both grow luxuriantly within the forest quite beyond the reach of spray. The effect of salt on plant-distribution in New Zealand generally is rather of an inhibitory than constructive nature, and there are very few of the true coastal plants which will not thrive excellently away altogether from the sea (Cockayne, 20).

B. ECOLOGY OF THE PLANTS.

1. General.

There is no intention here to deal with the ecology of the Stewart Island plants as a whole, but chiefly with those characteristic of the district. The bulk of the flora is common in many parts of New Zealand, and the majority of the plants doubtless owe their special forms and organs to a somewhat different environment from that of Stewart Island.

The plants may be either stationary (" spot-bound ") or wandering. To the former class belong most of the woody plants, though some, usually spot-bound, may wander, as in the case of the manuka dealt with further on. Others—*e.g.*, *Dacrydium Bidwillii*—are spot-bound when fully adult, but wandering in the juvenile stage. A large percentage of the herbaceous plants are wandering, and this habit and special mode of increase make them formidable in the struggle for existence with the spot-bound herbs. *Epilobium*, *Cotula*, *Liparophyllum*, *Gunnera*, *Helichrysum*, *Lagenophora*, *Hymenophyllum* are examples of genera with wandering species. The creeping stems may be under or above ground. The splendid *Stilbocarpa Lyallii* covers many square yards by means of its arching runners and the young plants produced at their extremities. Naked banks are rapidly covered by *Gunnera albocarpa* or *Gnaphalium trinerve*, and acre upon acre may owe its plant-covering and physiognomy to the wandering habit of some special plant, as in the case of the lowland bogs with *Gleichenia alpina*.

2. Life-forms.

(*a.*) *Trees.*

Of the seven species of tall trees, three (*Dacrydium cupressinum*, *Weinmannia racemosa*, *Metrosideros lucida*) are abundant, two (*Podocarpus Hallii*, *P. ferrugineus*) are common; and two (*P. dacrydioides*, *P. spicatus*) are very rare indeed, especially the last named.

The rimu (*D. cupressinum*) has much the same habit as in New Zealand generally. It is in Stewart Island an erect-growing tree, with a trunk from 1 ft. to 3 ft. in diameter, unbranched for its lower two-thirds or thereabouts. Its branching head is slender, the final branchlets drooping, thus giving a special character to the tree. The Stewart Island plant is smaller than that of the mainland in general. Its seedlings are rare in the forest but abundant in the open, though this does not say the plant is shade-loving, but in harmony rather with the special climate of the district.

The kamahi (*Weinmannia racemosa*) is an upright-growing tree, with a moderately large crown of spreading branches furnished with toothed, oblong, thick leaves of a pale yellowish-green colour, 2–3 in. long, and slightly crinkled on the margin. Their anatomy shows a cuticularised epidermis on both surfaces, beneath which is a water-tissue composed of one row of large cells on the under-surface and one row of moderate-sized cells on the upper surface, beneath which is a second row of large cells; beneath these is a 2-layered palisade, and then an open pneumatic tissue rather deeper than the palisade. This is a distinctly xerophytic structure.

In Stewart Island the base of the trunk is almost always most irregular owing to the tree having grown as a seedling either on a fallen log or a tree-fern trunk, and as it increased in size sent down roots to the ground in quest of water, which finally grew together into a great amorphous mass full of chinks and hollows, and from which branch-like roots spread out laterally, raised above the surface of the ground (see Photo No. 10). Enclosed within this " root-trunk " may sometimes be seen the remains of the log, which has often been a matai (*Podocarpus spicatus*). From this irregular base pass upwards usually two or even more branches, which are the true trunks, so that it looks as if two or more independent trees were growing closely.

The southern rata, or ironwood (*Metrosideros lucida*), is at times an erect tree, but usually has a more or less leaning or sometimes prostrate trunk. This latter habit is clearly the effect of excessive wind, but there may also be a natural (hereditary) tendency, under the stimulus of wind, towards the horizontal position, *since in a forest where all the neighbouring trees are erect the rata will frequently be semi-prostrate or prostrate.*

The southern rata is frequently epiphytic in its young state, and, like the kamahi, just noted, or its northern namesake (*M. robusta*), sends down roots to the ground, which, growing into one another, form a most irregular, frequently very thick composite root-trunk (see Photo No. 6). The branches are generally irregular in form, and of spreading habit. They are much-branched near their extremities, ending finally in a great number of close leafy twigs. Each branch system is distinct from its fellows, so that the crown of a tree consists of a number of small, rather flat heads of foliage, with considerable spaces between (so, too, with the northern rata—Cockayne, 25). (See Photo No. 40, on left.)

The leaves are 1 in. or 2 in. long, lanceolate in shape, bright glossy green on the upper surface, and dotted with oil-glands beneath. Their anatomy shows a strong cuticle, an occasional row of water-containing cells beneath the upper epidermis, a 3-celled parenchyma for one-third of the leaf, then a fairly close layer of roundish cells, and the remainder of the leaf open pneumatic tissue. Above and below the main vascular bundles is a layer of stereome.

The roots of the trees do not usually go deeply into the ground, but spread laterally at no great distance below the surface. This is specially noticeable in a rimu which has been blown down.

(*b.*) *Small Forest-trees and Shrubs.*

Twenty-five plants belong to this class, seventeen of which are widely spread on the mainland, the remainder being usually mountain plants elsewhere.

Between low trees and tall shrubs it is hard to draw the line, the possession of a trunk, or the contrary, in one and the same species being largely a matter of environment. About fourteen species have frequently distinct trunks, and may be considered trees so far as their normal form goes. The remaining eleven are true shrubs.

Generally speaking, the plants under consideration are of a somewhat straggling and irregular habit, and rather sparsely branched, but everything depends upon their situation within the forest, and the light relation is here all-important. *Coprosma rotundifolia* and *C. areolata* are of the divaricating habit, and consequently more or less dense (see further on in section *re* different forms according to environment).

Regarding the adult leaves, one (*Schefflera digitata*) has compound, but all the rest have simple, though some have compound in the juvenile stage; sixteen have entire and nine toothed; one has fairly large, nine medium-sized, and fifteen small; ten have thin and fifteen coriaceous, some being especially thick (*Pseudopanax crassifolium, Griselinia littoralis*).

The leaf-anatomy in most of the species shows a distinct hygrophytic structure quite in harmony with the moist forest interior. Usually there is a very open pneumatic tissue (*Melicytus lanceolatus, Coprosma foetidissima, Nothopanax Edgerleyi, Carpodetus serratus, Griselinia littoralis, Plagianthus betulinus, Aristotelia racemosa,* &c.); there may be a weak development of palisade parenchyma (*Melicytus lanceolatus, Aristotelia racemosa*), but generally there are several rows (*Carpodetus serratus, Plagianthus betulinus, Coprosma foetidissima*); the epidermal walls are often quite thin, and the outer wall but little cuticularised or not at all (*Coprosma rotundifolia, Rapanea Urvillei, Aristotelia racemosa, Melicytus lanceolatus,* &c.). A certain amount of xerophytic structure is, however, frequently present —*e.g., Griselinia littoralis* has a strong cuticle on both surfaces; *Coprosma lucida, Nothopanax Edgerleyi, Carpodetus serratus* have a 2-layered epidermis; *Drimys colorata* has a strong cuticle and thickened outer wall of epidermal cells.

So far as any of the plants are intimately connected with Stewart Island conditions, only the following need brief mention: *Coprosma foetidissima, C. Colensoi, Dacrydium intermedium, Nothopanax Edgerleyi.*

The hupiro (*Coprosma foetidissima*) is a slender, graceful, twiggy bush, 10–15 ft. tall, or sometimes taller. There is usually a very short, stout main stem half a foot or more in diameter, from which are given off three or four, or more, stout secondary stems, semi-horizontal in direction, unbranched for some 10 ft. or so, but the apical 5 ft. branches profusely into many twigged branchlets, which bear numerous rather distant pale-green subcoriaceous leaves, more or less oblong in shape and one to two inches long. The weight of the final leafy twigs causes the boughs to curve towards the ground, and gives the characteristic appearance to the shrub or low tree, as it frequently is.

Coprosma Colensoi is a quite small, slender shrub, with an erect main stem, 2 ft. or 3 ft. tall, or more, which gives off rather small lateral branches almost at a right angle, these branching more or less in a similar manner, and being furnished with more or less oblong, moderately thick, rather shining green leaves, which vary much in size, some being as much as 1½ in. long.

Edgerley's ivy-tree (*Nothopanax Edgerleyi*) and the yellow-pine (*Dacrydium intermedium*) are dealt with under the heading "prolonged juvenile forms."

(*c.*) *Low Trees and Shrubs of the Scrubs and Heaths.*

Twenty-nine species belong to this class, seven of which (*Dacrydium Bidwillii, Dracophyllum longifolium, Olearia angustifolia, O. Traillii, O. Colensoi, Senecio Stewartiae,* and *S. rotundifolius*) are sometimes trees, and ten (*Aristotelia fruticosa, Hymenanthera dentata* var. *alpina, Nothopanax anomalum, Suttonia divaricata, Coprosma parviflora, C. ciliata, C. propinqua, Olearia virgata* (the two vars.), and *O. divaricata*) are divaricatingly branched shrubs. This life-form is exhibited to its greatest perfection in the *Hymenanthera*, a very high degree of xerophily being reached in its low, rounded somewhat flattened form, stout, twisted, inflexible, almost leafless branches, bearing at their extremities short, stout, rigid, branchlets, which are virtually spines. The mingi-mingi (*Styphelia acerosa*) is also of dense habit, and might almost be included with the above. *Nothopanax Colensoi* has stout, erect, straight, terete, naked stems, marked with old leaf-scars, which branch near their extremities into short branches bearing the leathery, dark-green, digitate leaves. The *Veronicas* are of the usual habit of that class, the branches being numerous, opposite, decussate, and at an acute angle, which leads finally to rounded bushes; but in *V. elliptica* exposure to wind conduces to much irregularity of form. *V. buxifolia* var. *odora* is smaller and of a looser habit than usual, and the var. *prostrata* is quite prostrate and but little branched.

Dracophyllum Menziesii (see Photo No. 7), under favourable conditions, may be 3 ft. tall, but is often less than 2 ft. The stems are slender, straight, rigid, and each crowned at its apex with a rosette

of stiff coriaceous leaves, so strongly reflexed that their filiform tips almost meet. Such rosettes are 1 ft. or so apart. The leaves are pale-green, bordered more or less deeply with red; they are 6 in. long, ¾ in. broad at the base, and taper gradually to a fine point.

The inuka, grass-tree (*Dracophyllum longifolium*), is a small tree or shrub of an erect, fastigiate habit, having many stiff vertical branches crowded together, bearing at their apices a number of long, closely inserted needle-like leaves, which are more or less vertical in direction. The leaves are remarkably like those of a xerophytic grass, the xerophily being secured by reduction of surface and loss of photo-synthetic power, whereas in *D. Menziesii* a much larger leaf-surface is available, owing to the reflexed habit, which avoids the direct rays of the sun and offers little resistance to the wind.

The tall species of *Olearia* and *Senecio* (daisy-tree, shrubby groundsel) have much the same life-form. The branches are spreading, naked below, but furnished near their extremities with rosettes of usually fairly large leaves, coriaceous, thick, and covered with a thick mat of tomentum beneath. Usually about three branches are given off fairly closely at a narrow angle, such branching being repeated several times, the final branchlets curving so as to bring the rosettes close together and into the light. Thus far-spreading rounded heads are formed, while below are a number of stiff, bare branches (see Photo No. 8, where towards centre, the twigs arching upwards and to the right, the naked branches of *O. Colensoi* may be seen). The leaf-tomentum in this life-form is an important adaptation, as it allows a maximum of leaf-development. (The rounded head may be seen in Photo No. 15.)

Of the twenty-nine shrubs under consideration, only one (*Nothopanax Colensoi*) has a compound leaf; one has a large leaf; eight have medium and twenty small leaves; eighteen have entire and eleven toothed leaves; all have more or less coriaceous or thick leaves, and those of fourteen are glabrous, while the remainder have them more or less hairy, and some tomentose. The leaf-anatomy shows chiefly xerophytic adaptations—*e.g.*, strong cuticle (*Veronica buxifolia, V. Laingii, V. elliptica, Styphelia acerosa, Olearia Colensoi*, &c.); subepidermal water-tissue (*Senecio rotundifolius, Olearia nitida, O. avicenniaefolia, Veronica elliptica*, &c.); strong stereome (*Styphelia acerosa, Olearia ilicifolia*, &c.); sunken stomata (*Veronica buxifolia, V. Laingii*,* &c.).

The branches are frequently stout, rigid, and stiff. In some cases, especially *Olearia Colensoi*, there is distinctly an hereditary tendency towards a prostrate trunk (see also Cockayne, 18, *re O. Lyallii*, of Auckland Islands), young seedlings growing in a still atmosphere being generally more or less prostrate.

(*d.*) *Herbaceous and Suffruticose Plants.*

The plants of this section consist of those which bear the stamp of the modified subantarctic climate of Stewart Island, and also of those ordinary New Zealand mesophytes which are not furnished with adaptations against extremes of wind, drought, acid soil, and so on. The whole consist, with a few exceptions, of evergreen herbs or subshrubs—*i.e.*, plants whose aerial portions are perennial and herbaceous or suffruticose, as the case may be. Those plants with subterranean storage organs, so common in many temperate regions, may be called summer-green herbs; but this class (very few in New Zealand) is not in harmony with a mild climate, where great extremes are absent.

The mesophytic herbs, although numerous enough in species, play little part in the physiognomy of the vegetation, since they are usually not plants of the characteristic wet stations, but rather, owing to their being readily disseminated, find such a sheltered station as they need, where there is sufficient water for their requirements.

Plants spreading by means of stolons, rhizomes, prostrate rooting-stems, &c., are common, and frequently mat or turf forming, admirable life-forms in a boisterous climate.

The special subantarctic life-forms alone need mention here, the most important being the *cushion form*, so well suited to withstand wind.

(α.) *Cushion Plants.*

Cushion plants are represented in most diverse families—*e.g.*, *Musci, Hepaticae, Gramineae, Cyperaceae, Centrolepidaceae, Epacridaceae, Stylidiaceae, Compositae.* The cushions are formed, generally speaking, by densely tufted branches, which branch profusely into very short branchlets, usually covered near their extremities with closely imbricating small leaves, and pressed together into a close and possibly very hard rounded mass. Such an organism as the Stewart Island vegetable-sheep (*Raoulia Goyeni*) looks more like a lump of coral than a living plant. Some shrubs are cushion plants. *R. Goyeni* would more correctly be so classed. No plant-form could seem more fixed and unchangeable than are these vegetable cushions, and yet with moist-air culture such a typical example as *Phyllachne clavigera* quickly grows out of recognition, putting forth long shoots with open leaves no longer crowded.† Here the cushion form vanishes; *it has not really been a fixed structure, but dependent upon the station, plus an hereditary tendency to assume such a form under a certain stimulus.* It is, in fact, much in the same position as a garden annual *stunted* through lack of nutrition when growing in a poor and dry soil.

(β.) *Rosette Plants.*

Rosette plants are another important life-form. *Plantago triandra* var. *Hamiltonii* has small flat rosettes of shining coriaceous leaves 1 in. or 2 in. in diameter, pressed close to the ground; and hundreds of these, all touching, making a hard glossy turf, as in one part of Centre Island, is a curious sight. The silvery rosettes of *Celmisia argentea* pressed closely together give that plant the cushion form (see Photo No. 9).

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* Really a meadow-plant.

† From an experiment of Professor Chilton in the experiment garden, Canterbury College. The plant unfortunately died before a photograph was taken.

No. 7. *Dracophyllum Menziesii* with straight naked stems, each with a rosette of leaves at its apex, rising above Colenso's daisy-tree (*Olearia Colensoi*). Low subalpine scrub on moraine of Mount Anglem.

[*Photo., L. Cockayne.*

No. 8. Subalpine scrub, Table Hill, at 1,500 ft. altitude. On right, Colenso's daisy-tree (*Olearia Colensoi*), showing how the final stems bend upwards. On left, typical small dense head of manuka (*Leptospermum scoparium*).

[*Photo., L. Cockayne.*

To face p. 12.]

No. 9. Cushion of the silvery mountain-daisy (*Celmisia argentea*), showing the small rosettes and a few blooms. Boggy meadow, Table Hill, 1,900 ft. altitude.
[*Photo., L. Cockayne.*

No. 10. Base of "trunk" of kamahi (*Weinmannia racemosa*) formed out of roots.
[*Photo., L. Cockayne.*

(γ.) *The Tussock Form.*

The tussock form plays no great part in Stewart Island; still, it is important in the subalpine scrub, where the great moplike green heads of *Gahnia procera* are raised on pear-shaped trunks 20 in. high, and measuring 8½ in. in diameter at the base and 13 in. at the summit, built out of the decay of leaves, stems, &c. Peat forming and utilising is indeed an important characteristic of many of the plants. The leaves of the cushion plants decay and build up masses of peat within the cushions, into which the young shoots of the periphery send down short roots. The peat acts both as a water-reservoir and a food. Leaf-bases in *Celmisia*, *Aciphylla*, various grasses and sedges, *Astelia*, &c., remain decaying and decayed round the bases of the living leaves, equalling them in bulk.

(δ.) *The Yucca Form.*

The yucca form, shown by one section of the genus *Aciphylla*, is not of moment in Stewart Island, being represented by *A. Traillii* alone, which is likewise, under certain conditions of the soil, &c., of cushion habit. That most anomalous grass, *Danthonia pungens*, may also perhaps be classed here. It forms large patches of tufted culms, varying in size and length of leaves, which may be a foot or more or only a few inches long. The leaves are not erect, but incline at an angle to the ground. They are very stiff and coriaceous, flexible, pale-green in colour, marked with brown, ⅜ in. broad at the base in large specimens, and taper gradually to an extremely sharp and pungent apex. The blade is much incurved and striated, and waxy upon the upper surface. The leaf-sheaths remain attached to the plant, slowly rotting, and hold much moisture. The roots are stout and wiry.

(ε.) *The Large-leaved Plants.*

The large-leaved plants so characteristic of the New Zealand subantarctic islands are represented by the punui (*Stilbocarpa Lyallii*), and perhaps *Ranunculus Lyallii* and *Aciphylla intermedia* may be included here. *Stilbocarpa Lyallii* is a striking plant, with large, thin, shining bright-green leaves, orbicular-reniform in shape, 1 ft. or more across, somewhat resembling those of a vegetable-marrow. The petioles are 2 ft. or more long, hollow, tapering, and arise from small rhizomes marked with old leaf-scars, and furnished with long, thick, rather woody roots. These rhizomes are connected together by stout, hollow stolons, which arch above the ground, and are 2–2½ ft. in length, and by means of which the plant can increase enormously. When a growing stolon has reached a certain length, a young plant will be developed from its extremity which will possess two or three leaves before the young rhizome bent to the ground by the arching of the stolon shall have taken root. Great colonies are formed in this manner, covering many square yards of ground, the stolons passing in some instances beneath rocks, so that plants far distant from one another are still actually in connection. The small purple flowers on large compound umbels equal or are just hidden by the leaves (see Photo No. 38).

Other noteworthy plants of this section are dealt with when treating of the formations.

(ζ.) *Leaves.*

The leaves of the bog and subalpine meadow-plants are very various: most are thick and coriaceous, some are tomentose, generally they are small. A few brief notes may be given as to the leaf-anatomy of some of the specially southern or characteristic plants. *Ranunculus Kirkii*, a plant of wet ground, has a hygrophytic structure, with its thin-walled, large epidermal cells, raised stomata, 1-celled palisade, and pneumatic tissue. *Aciphylla flabellata*, of rock-crevices, is xerophytic, with a strong cuticle to both surfaces, 5-layered palisade, and close pneumatic tissue. *A. Traillii* has the middle third of the leaf composed of open pneumatic tissue, a 3-rowed dense palisade to both surfaces, small epidermal cells, sunken stomata on both surfaces, and much stereome. *Celmisia rigida* has a strong cuticle on the upper surface, large epidermal cells with thickened inner walls, 2-layered palisade, and open pneumatic tissue. *Ehrharta Thomsoni* has strong cuticle, close chlorenchyma of rounded cells divided regularly by bands of stereome, and on under-surface from epidermis several cells side by side arranged fanlike at regular intervals, and reaching to the centre of the chlorenchyma. *Crassula moschata* has a thin-walled epidermis, 1-layered palisade, and rest of leaf a close tissue of roundish cells, many of which are colourless. *Celmisia linearis* has strong stereome, 2-layered palisade, strong cuticle. *Abrotanella muscosa* a close chlorenchyma of roundish cells and thick-walled epidermis on both surfaces. *Ourisia Colensoi*(?) has a typical dorsi-ventral leaf. *Geranium sessiliflorum*, although growing on sand-dunes, has stomata on both surfaces, and is generally of a mesophytic structure. *Liparophyllum Gunnii* has a palisade of roundish cells 2–4 deep round periphery of leaf, but remainder of interior is of loose pneumatic tissue. *Forstera sedifolia* var. *oculata* has a strong cuticle to both surfaces, 2-layered palisade of smallish cells, and large epidermal cells. *Myosotis albida* has thin-walled epidermis, 2-layered palisade, open pneumatic tissue—not at all the structure for a coastal rock-plant. *Ranunculus Lyallii* has slightly raised stomata on both surfaces, 2-layered palisade, open pneumatic tissue, and thin outer epidermal cells. *Donatia novae-zelandiae* has the pneumatic tissue in centre of leaf, close palisade round periphery, strong cuticle, and much-thickened epidermal walls. *Astelia linearis* has slightly cuticularised epidermis, subepidermal water-tissue, rest of leaf close roundish-celled chlorenchyma. *Gnaphalium trinerve* has large-celled upper epidermis with cuticle, layer of large cells without much chlorophyll in centre of leaf and air-spaces, and below this smaller-celled tissue with abundance of chlorophyll. *Plantago triandra* var. *Hamiltonii* has slightly cuticularised epidermis, 2-layered palisade, stomata both surfaces, rather close round-celled pneumatic tissue. *Danthonia pungens* has a strong cuticle on upper surface, subepidermal row of colourless cells, stomata in the furrows, close chlorenchyma of round cells, strong stereome at margin of leaf. *Stilbocarpa Lyallii* has very large thin-walled upper epidermal cells, 2-layered palisade of short cells, roundish-celled pneumatic tissue. *Caltha novae-zelandiae* has cuticularised epidermis, stomata on upper surface, 2-layered palisade of long cells. *Veronica Laingii** has ordinary structure of

* Although a shrub, mentioned here since it is a meadow-plant.

a whipcord veronica—*i.e.*, very thick cuticle on under (outer) surface, sunken stomata, much-thickened epidermal cell-walls, close palisade for half thickness of leaf or more, and roundish and close-celled pneumatic tissue.

(*e.*) *Lianes.*

Climbing plants are not an important feature of Stewart Island, though most of those found in the southern floristic province are present. Leaving the climbing ferns on one side, there are eleven species, which may be thus classified: Scramblers—*Tetragonia trigyna, Rubus australis, R. schmedelioides R. schmidelioides* var. *coloratus, R. subpauperatus;* twiners—*Rhipogonum scandens, Parsonsia heterophylla, Muehlenbeckia australis, M. complexa;* tendril-climbers—*Clematis indivisa;* root-climbers—*Metrosideros hypericifolia.* All except *Tetragonia* are woody plants.

The species of *Rubus* climb by means of numerous hooked prickles situated on the midribs of the leaves, and in some cases on the stems. In *R. subpauperatus* the leaves are much reduced, and serve partly as special climbing organs.

The supplejack (*Rhipogonum scandens*) is to be found principally in forest-gullies. The young stem is soft, succulent, virtually leafless, and of rapid growth. At first erect, it soon gains a shrub, which, if small, it ultimately leaves for another, until finally a support may be gained by which it can reach the forest-roof, where it puts forth leaves and flowers in abundance. Adult leaves are also frequently present on lateral branches from the climbing stem at no great distance from the ground (for further details regarding this liane see Cockayne, 25, p. 24). The characteristic entanglements of stems without supports arises from these having perished.

The climbing white rata (*Metrosideros hypericifolia*) has a slender woody leafless main stem, which is fastened closely to the bark by roots 1 in. or more long, given off at a right angle so closely together as to touch, and holding tightly to the tree-trunk. Small, lateral, very slender, flexible twigs pass off from the climbing stem at a wide angle, and are provided with numerous small, shining, dark-green ovate leaves on their flanks. Such shoots look rather like a long pinnate leaf, and are rarely held close to the bark. Frequently the plant is prostrate upon the forest-floor, in which case there will be a flexible, stout creeping stem beneath the loose peaty soil, many yards in length,* and which branches frequently, putting forth terrestrial shoots which creep over logs or climb the tree-trunks, the plants of adjacent trees in this manner being at times merely branches of one plant. The species of *Muehlenbeckia* are rare, and rather grow over shrubs near the shore than in the forest; both are more or less deciduous.

(*f.*) *Epiphytes.*

This important ecological class, so striking in northern New Zealand forests, is of comparatively slight importance in those of Stewart Island. Epiphytic asteliads and pittosporads are wanting, nor do ferns, except on tree-fern trunks, play much part. But the origin of the epiphytic habit—*i.e.*, the adopting the perching life by certain ground-plants—is in evidence, while also true spermophytic epiphytes—*e.g., Dendrobium Cunninghamii,* the two species of *Earina* and *Sarchochilus adversus*—are not wanting.

As in the forests of the north we see the puka (*Griselinia lucida*) as a true epiphyte, so, too, in Stewart Island is the broadleaf (*G. littoralis*) very common, perched high on the branches of a rimu, the seeds brought originally by some bird. But, unable to occupy such a position permanently, as it increases in size, its demand for water likewise augments, and a root is sent to the ground looking just like a liane-stem (see Photo No. 12). The southern rata (*M. lucida*) behaves similarly, thanks to the lightness of its seeds, and the composite root-trunks of many trees have thus originated (see Photo No. 6). The kamahi (*Weinmannia racemosa*) as a seedling is common, growing on the trunk of *Dicksonia squarrosa.* The epiphytic orchids are fastened to the tree-trunks or boughs by their much-branching roots, whose spongy tissue near their extremities absorbs water, of which there is usually no lack even on the tree-trunks, but in case of drought the leaves are of xerophytic structure. The roots of *D. Cunninghamii* are of great length, and hold the plant very firmly, even to a vertical trunk.

(*g.*) *Ferns.*†

The richness of Stewart Island in ferns was pointed out by Kirk (56, p. 228), though this is rather in number of individuals than in species, since out of sixty-five at least sixteen are rare or local.

The two common species of tree-ferns are not generally very tall. They are most abundant in the gullies. All the ferns are evergreen, excepting the thousand-leaves (*Hypolepis millefolium*), the alpine shield-fern (*Polystichum cystotegia*), and the cut-leaved bracken (*Histiopteris incisa*); but in spring (October and November) new fronds are developed, the older ones gradually dying. Besides the true tree-ferns, the common hard fern (*Blechnum discolor*), the crape-fern (*Leptopteris superba*), and the prickly shield-fern (*Polystichum vestitum*) have distinct trunks, those of the *Leptopteris* being of a curious pyramidal shape. The mountain tree-fern (*Alsophila Colensoi*) has its trunk prostrate, and more or less buried beneath the ground.

Many of the ferns have coriaceous leaves, a matter probably more connected with their evergreen character than with the water-relation. Some have, however, true xerophytic leaves in harmony with the epiphytic mode of life (*Polystichum capense, Cyclophorus serpens, Asplenium flaccidum*), or their xerophytic stations (*Blechnum durum, B. Banksii, Asplenium obtusatum*—ferns of coastal rocks; *Polypodium pumilum*—subalpine rocks); fleshy stems, as in *Polypodium diversifolium* (the climbing polypody), serve the same end.

* I am indebted to Mr. Laing, who called my attention to this habit.

† Not really a true ecological class, but it is convenient to deal with them under one head.

The filmy ferns have, with the exception of the kidney-fern (*Trichomanes reniforme*), leaves only one cell thick, and are without stomata, the plants being as much " aquatic " as if they were submerged. Many live on the forest-floor, others on decaying logs, and some are true epiphytes (*H. rarum, H. pulcherrimum, H. scabrum, H. rufescens, H. flabellatum, T. Lyallii, T. venosum*), some being especially abundant on the trunks of tree-ferns. All these stations are plentifully supplied with water by the frequent showers, and plants on logs and trees, or even on the ground, are generally associated with bryophytes of various kinds, which hold water like a sponge, and amongst which the wiry, far-spreading rhizomes, furnished with numerous roots, can ramify. In some cases the hairs on the leaves help to hold water, and so keep them wetted, as in the rusty filmy fern (*H. ferrugineum*), where every frond may have a drop of water hanging from its apex. Those species with finely cut leaves retain water between their leaf-segments.

In very wet gullies is the almost black-leaved black hard fern (*Blechnum nigrum*), and it is a curious fact that in a similar situation the crape-fern (*Leptopteris superba*) has excessively dark-coloured fronds. The liverworts of the genus *Hymenophytum* and some others " mimic " the filmy ferns, and their assimilation-shoots are analogous to leaves, and function just as those of *Hymenophyllum*, growing also under the same conditions.

The genus *Gleichenia* is well represented in Stewart Island, both in species and individuals. They cover large areas of ground, increasing rapidly vegetatively by means of their far-spreading rhizomes. The flat-margined species, *G. Cunninghamii* (the umbrella-fern) (see Photo No. 20) and *G. circinata* (scrambling umbrella-fern), are generally in the forest—*i.e.*, are " shade-loving "—whereas the species having segments with recurved margins (*G. dicarpa, G. alpina*) are plants of the open, bog-xerophytes, and " shade avoiding."

In the *Gleichenias* the apical growth of the leaf is arrested periodically, the circinate leaf-tip, which is incorrectly called an " adventitious bud," and the new growth " proliferous," commencing to unfold in the spring.* Through the plagiotropous position of the pinnae which are thus formed there are frequently two, and often very many more, distant tiers one above the other. This reaches its maximum in *G. circinata*, which is a true liane, scrambling for a height of 10 ft. or more through the branches of shrubs, the plagiotropous pinnae acting as climbing-organs, while the leaf itself is practically of unlimited growth. The same thing occurs, but to a much greater degree, in *Lygodium articulatum*, of northern Auckland, whose fronds may thus reach a length of 50 ft., or considerably more.

Heterophylly is frequent amongst the ferns, and is usually connected with spore-production, the sporophylls differing more or less from the foliage leaves. This is especially the case in the genus *Blechnum*, the sporophylls being more erect and narrower than the foliage leaves, but transitional forms are common.

In some cases the foliage leaves vary much in form on the same individual, being entire or irregularly pinnatifid, as in the case of *Blechnum Patersoni* or *Polypodium diversifolium*. Such variation seems quite independent of outer circumstances. Variation may also occur amongst individuals, and in some instances may be hereditary. This is probably the case in some of the forms of the " variable " common spleenwort (*Asplenium bulbiferum*), a " species " which would repay patient experimental investigation. The proliferous form is usually confined to specially moist situations; but, strange to say, it is not as luxuriant in Stewart Island as in many other parts of New Zealand.

Schizaea fistulosa var. *australis* (the slender comb-fern) has the habit of a small rush, and is a well-marked bog-xerophyte. The sporangia are confined to the apical portion of the leaf, which consists of a few short, slender, linear pinnae arranged closely together. The basal portion is rigid, wiry, and filiform.

3. Variation according to Environment.

Here only certain striking cases are dealt with which directly concern Stewart Island.

(*a.*) *Large Size of Leaves.*†

Various plants possess considerably larger leaves than do the average of the same species on the main islands of New Zealand. The wineberry (*Aristotelia racemosa*) is of a specially luxuriant habit. The leaves are of a dark colour, and not infrequently measure, even when growing in the open, 8 x 5½ in., with petiole 4 in., whereas 3 in. is a common length of leaf on the mainland.

The lawyer (*Rubus australis*) has remarkably fine leaves, often measuring 1 ft. in length, with the petiole, and the leaflets 4½ x 2¼ in., thus being very different from the narrow-leaved form so common in the Auckland Province.

Olearia nitida, Nothopanax simplex, and *N. Edgerleyi* furnish other examples.

Olearia Colensoi (Colenso's daisy-tree) is a somewhat different case. On the mountains of the mainland it is a shrub, with leaves about 2–2½ in. long; but as a member of the coastal scrub of Stewart Island it is a small tree, and its leaves are 8½ x 4¼ in., or larger; while in the subalpine scrub they are much smaller, approximating to those of the mainland. It seems probable that the coastal plant may be the subantarctic *O. Lyallii*, or that this latter and *O. Colensoi* are one and the same, but varying according to their surroundings.

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* Goebel (Organography, p. 319, part ii) also ponts out that no species of *Gleichenia* has a dichotomous leaf, the so-called "forking" being in consequence of the two pinnules below the circinate persistent leaf-tip developing equally.

† Very large leaves may be found on plants within the forest of the Otago fiords, but in Stewart Island the large leaves referred to are on plants in the open.

(b.) Effect of Wind and Soil.

Wind and soil conditions are the chief factors with regard to non-hereditary variation so far as Stewart Island plants are concerned, altitude also playing some part. That exposure to wind leads to a general stunting, &c., of the vegetation can occasion no surprise, and would be hardly worthy of comment; but when forms of the same plant have an absolutely different appearance, and even special adaptations in harmony with the change of circumstances, the matter is one for careful examination and record. *Coprosma areolata* and *C. rotundifolia* are two forest-shrubs with numerous slender branchlets more or less interlacing, and given off from the larger branches at a right angle or thereabouts. Within the forest the density of growth is slight, but at its outskirts, near the seashore, the shrubs have the densest habit imaginable, forming close, rounded, wiry masses of twigs. This dense form is normal in the shrubby ribbonwood (*Plagianthus divaricatus*) of salt-meadows. In the ribbonwood (*P. betulinus*) there is also an interlacing, twiggy form, but it is confined to the earlier years of the tree's life, which finally assumes the ordinary tree-form.

The leaves of *Suttonia chathamica* (the Chatham Island matipo) growing near the sea at Wilson Bay vary according to their position on the low tree. Those of the periphery are only $\frac{7}{8}$ x $\frac{1}{4}$ in., while those sheltered within the tree are $2\frac{1}{2}$ x $1\frac{3}{8}$ in.

The common forest-trees are in the subalpine scrub much reduced in size and changed in aspect. The rimu (*Dacrydium cupressinum*), a tall tree no longer, remains still of the tree-form, and erect, but in height only 12 ft. or 15 ft., resembling in appearance the pyramidal trees of old-fashioned German boxes of toys. On the other hand, in the southern rata (*Metrosideros lucida*) and the kamahi (*Weinmannia racemosa*) the tree-form is never reached, the plants remaining as branching shrubs.

Excessive wind causes certain plants to assume the mat-habit, and become depressed close to the ground, this being aided to some extent by the wet nature of the sour saturated soil. The mountain-pine (*Dacrydium Bidwillii*) and *Olearia Colensoi* (mentioned above as a tree) are fairly frequent, depressed mat-like to the ground on the wind-swept subalpine meadows.

The manuka (*Leptospermum scoparium*) is an especially striking case. This extremely common New Zealand plant is quite frequent in certain parts of the Stewart Island forest as a tree. On the coast-line it is a shrub. It is specially abundant in the lower subalpine region, forming a belt above the forest-line, and extending thence as a shrub into the subalpine scrub, reaching finally the boggy meadow, when its appearance, and even habits, are altogether changed.

The manuka just above the forest line is a small tree, at times more than 20 ft. tall, with a stout erect trunk half a foot in diameter, some of its bark hanging in long strips. At the upper third a few branches are given off, which are much branched at their extremities, finally forming small dense flat heads of foliage. In contradistinction to the above, the manuka of the boggy ground is absolutely prostrate, branches and twigs lying pressed closely to the soil, and forming a somewhat fan-shaped dense mass (see Photo No. 16). The final leafy twigs, which are $1\frac{1}{4}$ in. in length at the most, through turning to the light, are erect, and, growing closely together, form a close sward, which *puts down roots into the ground, and can thus spread vegetatively.* Frequently the main stem is without bark, and bleached white, and in any case it functions chiefly as an anchor. Here, then, is a complete change in habit and behaviour from the upright tree, the presence of self-rooting shoots hardly to be expected, since cuttings of the manuka are by no means easy to "strike." That the turf-forming plant is identical with the tree is amply demonstrated by the gradual merging of the one into the other through every degree of intermediate.*

Still more remarkable is the behaviour of *Dracophyllum politum.* This shrub—one of the commonest constituents of boggy meadow formations—is, when growing in the open, a low cushion or mat plant, whose stout, hard, woody stem and general branch system are hidden by the quite short, erect stems covered with dead and near their apices with living, closely imbricating, stout, horny leaves, and whose shoots pressed together make a hard but rather springy turf. Where sheltered the habit changes, and long branching and densely leafy trailing shoots are given off 8 or 9 in. in length. *Thus, instead of a close mat or low cushion, is a trailing shrub.*

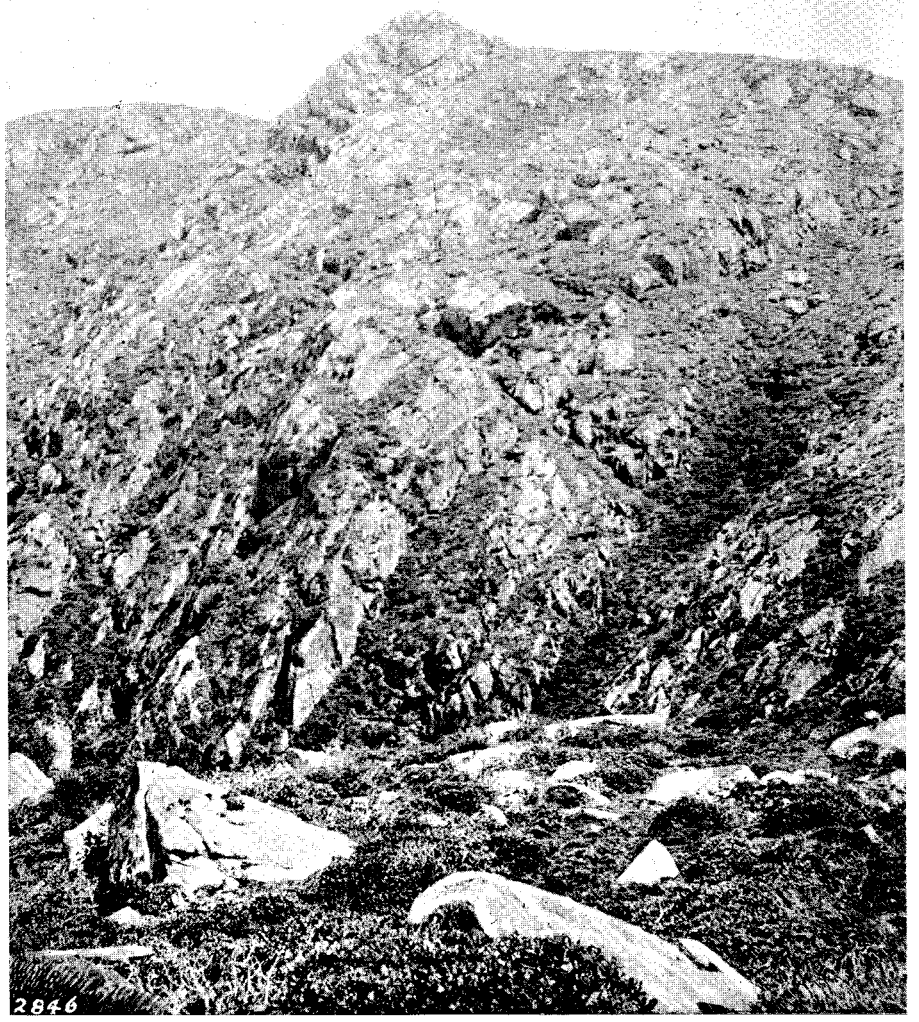
Again, when growing in the partial shelter of a "scrub island," or of very low, open subalpine scrub, the plant forms huge cushions (see Photo No. 13), sometimes flattened, sometimes rounded, and which one could hardly connect with the bog plant were it not for the frequent occurrence of long shoots such as those described above. As far as I can see, the cushion form here depends upon shelter and drier ground allowing a more vigorous growth in the first place, while at the same time the wind checks the formation of long shoots, reducing the internodes, and so causing the dense habit.

4. Prolonged Juvenile Forms; Heterophylly.

The following plants have either a juvenile form distinct from the adult, and which persists for a number of years, *the adult and juvenile frequently belonging to distinct ecological classes*, or they show a marked heterophylly, the juvenile stage being often reproduced on an adult plant: (Taxaceae) *Podocarpus spicatus, P. dacrydioides, Dacrydium biforme, D. Bidwillii, D. cupressinum, D. intermedium, D. laxifolium;* (Polygonaceae) *Muehlenbeckia australis, M. complexa;* (Ranunculaceae) *Clematis indivisa, Ranunculus Lyallii;* (Cunoniaceae) *Weinmannia racemosa;* (Rosaceae) *Rubus schmidelioides;* (Elaeocarpaceae) *Aristotelia fruticosa;* (Malvaceae) *Plagianthus betulinus;* (Violaceae) *Hymenanthera dentata* var. *alpina;* (Halorrhagaceae) *Myriophyllum elatinoides, M. propinquum* var. *tenuifolium;* (Araliaceae) *Nothopanax simplex, N. Edgerleyi, N. parvum, N. anomalum, Schefflera digitata, Pseudopanax*

* This prostrate form is the variety *prostrata* of Hooker. It is clear that it is not a floristic variety at all, and it is an example of how unsatisfactory are descriptions based merely on herbarium specimens, the life-history of the plant being unknown. And yet superficially it seems more distinct from the type than are many species from one another.

To face p. 46.]



No. 11. Cliffs of final peak of Mount Anglem. Moraine with stunted scrub in foreground.

[Photo., F. G. Gibbs.

No. 12. Roots looking like climbing stems descending along trunk of a rimu (*Dacrydium cupressinum*) from an epiphytic broad-leaf (*Griselinia littoralis*).

[Photo., L. Cockayne.

No. 13. Cushion of *Dracophyllum politum* about 2 ft. tall, surrounded by low-growing *Olearia Colensoi*. Base of moraine, Mount Anglem.

[*Photo., L. Cockayne.*

No. 14. The round-leaved shrubby groundsel (*Senecio rotundifolius*), jutting out over shore of Paterson Inlet for 13 ft. and showing density of foliage.

[*Photo., L. Cockayne.*

crassifolium; (Epacridaceae) *Dracophyllum longifolium, D. politum;* (Apocynaceae) *Parsonsia heterophylla;* (Scrophularinaceae) *Veronica salicifolia, V. elliptica, V. amabilis* var. *blanda, V. buxifolia* vars. *odora* and *prostrata, V. Laingii;* (Stylidiaceae) *Phyllachne clavigera;* (Compositae) probably *Raoulia Goyeni.*

From the above list it may be seen how diverse are the families which exhibit the phenomenon of prolonged juvenile forms. There is no space for a discussion of this important question here, but I am preparing a full account of the subject so far as concerns the New Zealand flora. Only one or two plants are dealt with which especially concern Stewart Island.

Weinmannia racemosa (the kamahi).—The adult, which is normally a tall tree, has simple leaves, but those of the juvenile are ternate, and may remain in this condition, *the plant flowering during the shrubby stage.* The early seedling has simple leaves. The closely related *W. sylvicola* has compound leaves in the adult (see Cockayne, 25, p. 22).

Dacrydium intermedium.—The juvenile plant has drooping branches, clothed with spreading, long, narrow pointed leaves. These pass by gradations into the final adult, short, thick, rhomboid, imbricating leaves, which are closely pressed to the branch. Juvenile and adult shoots have no resemblance whatsoever. The important point is, however, that in Stewart Island the actual adult stage is not everywhere met with, and juvenile trees of the open-leaved character bear cones abundantly. To this form Kirk gave the varietal name of *gracilis* (Kirk, 55, p. 224).

Dracophyllum longifolium.—In the adult this has long erect needle-like leaves, but in the juvenile they are much broader, of spreading habit, and more or less recurved, as those of *D. Menziesii.* Juvenile plants before changing their form may reach a height of from 6–10 ft.

Nothopanax Edgerleyi, N. simplex.—Some juvenile forms of these two species are almost identical, having much-cut compound, digitate leaves. Similar leaves are frequent also as reversion-shoots.

Ranunculus Lyallii (the mountain-lily).—The adult has a peltate leaf, a remarkable leaf-form for the genus. The seedling has a reniform leaf. I have collected adult blooming plants in Westland with reniform leaves. *R. lobulatus* of the Kaikoura Mountains shows transitions from the reniform to the peltate, the former in that species being the normal leaf-form (Cockayne, 19A, p. 371). The blooming of heterophyllous plants at the juvenile stage is a matter of great importance, as Diels has shown, for in such cases we see new species originating before our very eyes (Diels, 30A). Formerly I have expressed the opinion that in such plants as are here under notice we have virtually two species in one and the same plant.

There are various other matters connected with the ecology of Stewart Island plants—*e.g.*, seasonal changes, pollination—but space will allow no further details in this section.

PART III.—THE PLANT FORMATIONS.

A. COASTAL VEGETATION.

1. General.

The coast-line of Stewart Island, owing to the spacious inlets cutting far into the land, possesses a length out of all proportion to the size of the island, and offers situations of all kinds with regard to sun, shade, and the prevailing winds. Generally the shore-line is rocky, but there are also extensive mud-flats bare at low water, tidal rivers, and dunes, so that a rich collection of coastal plants might be expected. There are, indeed, pretty nearly all that are to be met with in the south floristic province of New Zealand (see Cockayne, 20); and, in addition, some of these which are there extremely scarce or comparatively rare have their headquarters in Stewart Island, such as *Stilbocarpa Lyallii, Olearia angustifolia, O. Traillii, Brachycome Thomsoni, Cotula Traillii, Myosotis albida, Geranium sessiliflorum* (as a dune plant), and *Atropis novae-zealandiae.*

Apparently the coast should offer at almost any part suitable stations for any of the coastal plants, and yet some strange contradictions occur. Thus on the east coast *Olearia angustifolia, O. Traillii,* and *O. Colensoi** are not known to occur to the north of Paterson Inlet, though they are on its southern entrance, the Neck. *Senecio Stewartiae* and *Poa foliosa* are only recorded from the adjacent outlying islands, or, regarding the latter, from headlands near the South Cape also. *Plantago triandra* var. *Hamiltonii* was only seen by me at the southern end of Mason Bay, and yet it is a most abundant plant of Centre Island. The endemic *Celmisia rigida* is known only as yet from cliffs to the south of Mason Bay. *Aciphylla intermedia* is a plant only of the west and south. *Suttonia chathamica* is confined to Wilson Bay and the Old Neck. *Gunnera Hamiltonii* and *Azorella Cockaynei* are known only from Mason Bay.

2. Dunes.

(*a.*) *General.*

Speaking generally, the dunes of Stewart Island correspond with those of the south floristic province of New Zealand, but there are some striking and important differences, the most interesting being the presence of a flourishing forest on the sheltered side of the high dunes at Mason Bay, whereas on the mainland of the South Island there is at most a xerophytic scrub. *Pimelea arenaria,* so common on dunes throughout almost the whole New Zealand biological region, is wanting, but in its place is the usually alpine *P. Lyallii. Geranium sessiliflorum,* also found on dunes in Southland and on Dog and Centre Islands, but not a dune-plant usually, is common. *Sonchus littoralis,* generally a plant of coastal rocks elsewhere, is common on the Mason Bay dunes near the shore.

Usually the dunes are low and isolated, but on the west coast, at Mason Bay, they rise in places to the height of 400 ft.† and extend for a number of miles. The inland dunes are treated of under another head. With the dunes is included the vegetation of the adjoining strand.

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* This is abundant on Ulva. † According to J. W. Murdoch.

(*b.*) *Port William.*

The dunes here are quite low. Their covering differs in character to any I am acquainted with in New Zealand. There is a continuous growth of the sand Coprosma (*Coprosma acerosa* var. *arenaria*),* not forming its characteristic isolated wiry cushion-like bushes, but making a low continuous mat-like growth. With it is great abundance of prostrate *Pimelea Lyallii*, much after the manner of *P. arenaria* of the mainland. The pale-leaved *Geranium sessiliflorum* forms patches sometimes several feet in extent, its leaves close to the ground, its long woody root descending very deeply, and the plant quite flat on the sand. Behind this zone of indigenous plants the dunes are covered with introduced grasses and some other plants, amongst which the parsnip (an escape from gardens) is most common. Here, too, are tussocks of *Poa caespitosa* and *Festuca littoralis*. On the sandy shore is a good deal of the succulent *Atriplex Billardieri*.

(*c.*) *Mason Bay.*

The dunes extend along the sandy beach from the hills at its northern end to the cliffs at the south. To the north of the cliffs draining the ancient dune-complex of the interior the hills rise to more than 400 ft., separating the latter from the sandy shore, and from the recent low line of hay-cock-like dunes at their base, 6–10 ft. tall, but reaching three times that height at the north end of the beach. These foremost dunes are quite brown with the pingao (*Scirpus frondosus*), so that the sand is barely seen. There is also some sand fescue-grass (*Festuca littoralis*). Towards the north end of the beach the dunes proper cease, but there is a belt of blown sand on the face of the conglomerate hills, and here is a broad line of the stiff club-rush (*Scirpus nodosus*), with the holy-grass (*Hierochloe redolens*) growing through it, and mixed with it the wild celery (*Apium prostratum*) and the sea sow-thistle (*Sonchus littoralis*). In many places *Brachycome Thomsoni* comes right to the front, mixed with *Cotula Traillii*, and bushes of prostrate *Veronica elliptica*, 6 in. tall or less, and 1 ft. or so across, are dotted about.

The green-leaved *Acaena novae-zealandiae*, mats of the silvery *Pimelea Lyallii*, and the yellowish-brown creeping *Coprosma acerosa* are abundant. Higher up on the steep face of the conglomerate rock, but also where there is plenty of sand, is an abundance of *Aciphylla intermedia*, but only 4–6 in. tall, with semi-horizontal leaves, making pale-green patches. Close to the shore is a zone of plants consisting of the stiff club-rush (*Scirpus nodosus*) (dominant), the shore spleenwort (*Asplenium obtusatum*), *Gnaphalium luteo-album*, and *Geranium sessiliflorum*.

Proceeding along the shore to the south of the creek alluded to above, a belt of dunes about a mile in width abut upon the forest-clad hills behind. They are much damaged by the wind, being quite blown away in places, with long lanes opened out 2 chains or more in width, from the level of which the individual hills or ridges are 18–20 ft. in height. Frequently, but at some distance from the shore, their hollows are full of dense and almost impassable scrub of the puheritaiko (*Senecio rotundifolius*) chiefly. The pingao (*Scirpus frondosus*) is the chief plant occupying the summits of the dunes. Near the shore the New Zealand spurge (*Euphorbia glauca*) is common, its green contrasting with the colour of the sand. Small dunes are occasionally quite fixed by the close mat of *Pimelea Lyallii*.

At the south end of the bay the dunes are in many places quite stable, and have evidently been sown with various introduced grasses, &c.—*e.g.*, cocksfoot (*Dactylis glomerata*), white-clover (*Trifolium repens*). Here, too, the yellow toadflax (*Linaria vulgaris*) has become naturalised.

On the landward side of certain parts of the high dune the sand is unstable, and moves downwards by the action of gravity, after the manner of the stones of an alpine "shingle slip." In such places is a rather curious assemblage of plants, much of the shingle-slip character, namely: The xerophytic moss *Racromitrium lanuginosum;* the blue-bell (*Wahlenbergia saxicola*), with unusually thick leaves; a species of wood-rush (*Luzula*), *Craspedia uniflora* var. *major*, the narrow-leaved snowberry (*Gaultheria perplexa*), *Aciphylla intermedia*, *Pimelea Lyallii*, and *Coprosma acerosa*, none of which, excepting the last named, are to be expected as dune plants.

Where the sand is backed up on to the coastal hills are many dense, silvery patches of a variety of *Raoulia australis*, 5–6 in. in diameter, stunted *Scleranthus biflorus*, *Luzula campestris* var., *Gentiana saxosa*, and stunted *Poa caespitosa*.

The Dune Forest.

This is quite a low growth, being only some 15–20 ft. tall. The trees are often semi-horizontal, and rarely erect. On the trunks are *Polypodium grammitidis*, in very large tufts; *Lycopodium varium; Hymenophyllum sanguinolentum*, with its fronds 6 in. or more in length; *Earina mucronata*, *Polypodium diversifolium*, *Hymenophyllum dilatatum*, and many seedlings of the trees, &c. The dominant tree is the broadleaf (*Griselinia littoralis*), its thick leaves being suitable for the dry soil, just as they favour the epiphytic life in the rain-forest. The other trees are: *Rapanea Urvillei*, *Aristotelia racemosa*, *Nothopanax simplex*, *Carpodetus serratus*, *Pittosporum Colensoi*, *Fuchsia excorticata*, *Dracophyllum longifolium*, *Pseudopanax crassifolium*, and *Metrosideros lucida*.

There is usually but little undergrowth, but in some places this is abundant, and consists of *Coprosma rhamnoides*, *C. foetidissima*, *Nothopanax simplex*, and young *Carpodetus serratus*. On the open floor, where the forest is sheltered—*i.e.*, in the gullies—are large breadths of the umbrella-fern (*Gleichenia Cunninghamii*); in other places plenty of *Blechnum discolor*, and much fine *Polystichum vestitum*, on tall trunks; and again elsewhere *Polypodium diversifolium*, *Asplenium bulbiferum*, *Pterostylis graminea*, *Corysanthes triloba*, *Nertera depressa*, and *Blechnum capense*. *Rubus australis*, *R. schmidelioides* and var. *coloratus*, *R. subpauperatus*, and *Muehlenbeckia complexa* are fairly common lianes in the gullies. In some parts the southern rata (*Metrosideros lucida*) is abundant, and its dark green stands out in contrast to the general lighter green of the flat forest-roof.

* This is the type of Allan Cunningham's *C. acerosa*, and if the var. *brunnea* be considered a species—a course I am adopting in my sand-dune report—then the var. *arenaria* would be synonymous with the specific name.

(*d.*) *The Old Neck.*

The dunes are about 45 ft. high. They have been much modified by the grazing of sheep and cattle. *Euphorbia glauca, Scirpus frondosus, S. nodosus, Geranium sessiliflorum, Acaena Sanguisorbae, Hydrocotyle novae-zealandiae, Cotula Traillii, Pimelea Lyallii, Plantago Raoulii* are common.

On the seaward side of these dunes are cliffs, and here the blown sand, underlain by rock, is covered with a scrub of *Senecio rotundifolius* and *Olearia angustifolia*, now partly destroyed. The new open ground is occupied by *Poa pratensis, Trifolium repens, Ranunculus plebeius, Hydrocotyle novae-zealandiae, Sagina procumbens, Cotula Traillii, Epilobium pedunculare, Plantago Raoulii, Brachycome Thomsoni*, and a species of moss.

(*e.*) *Wilson Bay.*

At Boat Harbour, the only part of the bay visited by me, is a flat piece of ground, with a sandy shore and small low dunes up to the forest. Here there has been a Maori settlement at one time.

On the sandy shore is the shore-dock (*Rumex neglectus*) and some shore-buttercup (*Ranunculus acaulis*). The dunes are flat, and have wettish hollows. They are quite covered with vegetation. *Scirpus nodosus* is dominant, but it is frequently mixed to nearly an equal extent with the holy-grass (*Hierochloe redolens*), which spreads extensively by stolons. The wetter hollows contain much *Hydrocotyle novae-zealandiae;* and in the wettest, where swamp-conditions prevail, is abundance of *Carex ternaria* and some *Carex secta.*

On the seaward slope *Aciphylla intermedia* is abundant, and beneath the shelter of certain shrubs is the punui (*Stilbocarpa Lyallii*). Everywhere the common mint (*Mentha spicata*) is naturalised, and there is a good deal of a species of *Brassica*, probably *B. Rapa.*

3. Coastal Scrub.

(*a.*) *General.*

As already pointed out, the wind factor determines the composition of that shrub-belt which in most parts of Stewart Island clothes the coast-line, forming the outer limit of the forest-mass. Where subject to a certain degree of exposure the puheritaiko (*Senecio rotundifolius*) appears, and as the exposure increases becomes dominant, until it, in its turn, where the full fury of the gale is felt, gives place to still better equipped wind-resisting shrubs.

The *Senecio* scrub is by no means of uniform composition everywhere. Where the wind is not specially excessive, as within the inlets in many places, it is composed of *S. rotundifolius, Dracophyllum longifolium, Metrosideros lucida, Veronica elliptica*, and, on the shores of Port Pegasus, *Phormium Cookianum* also.

In more exposed positions, as on the islets in the ocean, on headlands of the east coast, and possibly on much of the west coast, the teteawaka (*Olearia angustifolia*) and *O. Colensoi*, one or both, appear in quantity, and may become dominant. Also, mixed with the above true scrub-shrubs are frequently more or less of the forest-shrubs—that is, there are all kinds of intermediates between true *Senecio* scrub and low forest.

To the formation under consideration is given the popular name of "mutton-bird scrub" by the settlers of Stewart Island. The scrub may be divided into the *Senecio rotundifolius* and *Senecio-Olearia* associations.

(*b.*) Senecio rotundifolius *Association.*

This association, made up of quite a few species, and to which the name "mutton-bird scrub" is sometimes limited, forms a narrow belt round the inlets, and in other parts of the coast, extending from the margin of the forest proper to high-water mark, some of its constituents jutting out from the cliffs or banks on which they grow right over and almost into the water. It is made up of the following species: (Liliaceae) mountain-flax, *Phormium Cookianum;* (Myrtaceae) southern rata, *Metrosideros lucida;* (*Epacridaceae*) inuka, grass-tree, *Dracophyllum longifolium;* (Scrophularinaceae) *Veronica elliptica;* (Compositae) puheritaiko, *Senecio rotundifolius.* Besides the above, many of the forest-shrubs may enter into the combination, and in places may altogether replace the true scrub.

The association grows usually upon rocky ground overlain with peat, but it is not infrequent on flat ground fronted by a gravelly or sandy shore.

Senecio rotundifolius, which is from nine to twelve feet in height, is easily dominant, its spreading habit, many naked branches covered with smooth brownish bark, and especially the thick and rounded or somewhat flat head of large round leathery leaves shining bright green but rather pale, and clad beneath with buff-coloured tomentum, render it very conspicuous (Photo No. 14). Seen from the sea, the roof of the association is flat, but there projects through it the erect yellowish *Dracophyllum.* Behind, forming an inner belt, or extending outwards, are the dark-green southern ratas, not with distinct crowns, but each branch system forming a small and flattish head to itself, and these at some distance from one another. Patches of green standing out here and there on the outer part of the scrub denote the presence of *Veronica elliptica*, the relative amount of which varies greatly.

On wind-swept headlands, narrow necks of land, moderately exposed islands, such as those at the openings of Port Pegasus, the association under consideration may extend far into the forest, the general colour of which is then changed.

Within the scrub are many stout prostrate or semi-prostrate trunks and stiff entangled branches, after the manner of the subalpine scrub. On the floor are the ferns *Asplenium obtusatum* and *Blechnum durum.*

(*c.*) Senecio-Olearia *Association.*

I have only had an opportunity of examining this association to the north and south of Mason Bay, at the Old Neck, Glory Cove, and Anglem Point, and have noted it on the Breaksea Islands, at a certain point on Pearl Island, and on some of the more northern islands.

(*α.*) *Mason Bay.*

The hills near the shore at the north end of Mason Bay are deeply cut by gullies, on the sides of which is abundance of *Olearia-Senecio* scrub, so tall it might almost be called low forest. The members of the association are: (Compositae) *Senecio rotundifolius*, puheritaiko; *Olearia Colensoi*, Colenso's daisy-tree; (Scrophularinaceae) *Veronica elliptica*, coastal veronica; (Cornaceae) *Griselinia littoralis*, broadleaf; (Araliaceae) *Stilbocarpa Lyallii*, punui; (Filices) *Polystichum vestitum, Asplenium lucidum, Blechnum durum.*

The general colour of the scrub as seen from without is sage-green, but relieved in places by a few green patches, especially at some distance from the sea, which mark the presence of the broadleaf (*G. littoralis*). In some places the roof is almost flat, in others more rounded, but in any case there is always a dense mass of foliage.

Inside the scrub, which is 12 ft. or more tall, little is to be seen save the bare twisted stems and prostrate trunks of the shrubs, or small trees as they should be called, and the floor is quite bare. But frequently, where the roof is not altogether so thick, great colonies of the punui (*Stilbocarpa Lyallii*) spread for many yards, the bright and shining green leaves, each more than a foot in diameter, rising to a height of 3 ft. and more. Here, too, will be a luxuriant growth of the ferns noted above. The broadleaf is specially noteworthy on account of the size of its leaves, which recall those of its more northerly relative, *Griselinia lucida.*

Olearia angustifolia (Photo No. 15) is not nearly so abundant as the other shrubs, and is chiefly to be found in the bottoms of gullies or near the shore.

At the southern end of Mason Bay, above the cliffs, *Olearia angustifolia* makes an almost pure association. Where examined the shrubs were close-growing, 4 ft. or 5 ft. tall, and the ground was either bare beneath or there were the usual fern colonies.

(*β.*) *The Neck, the Old Neck, Glory Cove.*

At the Neck and the Old Neck a *Senecio-Olearia* association occupies the slopes to the sea and the rocky ground above the actual shore. The photos give some idea of the general appearance of the scrub and of individual plants (Photos Nos. 15 and 4).

At Glory Cove the narrow neck between Paterson Inlet and the ocean is filled with scrub, which, besides *O. Colensoi* and *Senecio rotundifolius*, contains a number of low forest-trees or shrubs—*e.g.*, *Carpodetus serratus, Coprosma foetidissima, C. areolata, C. lucida, Griselinia littoralis, Fuchsia excorticata, Olearia nitida,* also the liliaceous *Astelia nervosa* and the ferns *Polystichum vestitum* and *Blechnum discolor.*

The *Senecio* and *Olearia* trunks are 1 ft. or thereabouts in diameter, and often prostrate or nearly so, though some are erect. Their frequent branching leads to a close entangled mass, as in a typical subalpine scrub (See Photo No. 4). On the floor, when the two dominant species are present, is nothing but dead leaves and an occasional plant of the ferns *Blechnum durum* and *Polystichum diversifolium.*

4. Salt Meadows and Related Associations.

So far as my observations go, salt meadows and marshes do not play any extensive part in the vegetation of Stewart Island. The old Mason Bay–Paterson Inlet strait is occupied still in many places by the salt-meadow plants *Leptocarpus simplex* and even *Apium prostratum,** but except at the mouth of the Freshwater River and near the mud-flats there is no salt meadow. My notes as to this locality are quite meagre, merely mentioning the following plants: *Leptocarpus simplex, Selliera radicans, Apium prostratum, Schoenus nitens* var. *concinnus, Triglochin striatum* var. *filifolium, Cotula Traillii;* also, but how much exposed to brackish water is not clear, *Hierochloe redolens* and *Deschampsia caespitosa.*

Near the small creek flowing into Half-moon Bay at the old sawmill is a typical New Zealand salt meadow, except that in place of the halophytic grass *Atropis stricta* is *A. novae-zelandiae.*

The ground is flat, full of crabs' holes, and liable to flooding with brackish water: where wettest (liable to most flooding) *Atropis novae-zelandiae*, forming glaucous green tufts 4–6 in. tall, and with it some *Scirpus filiformis;* where drier there is a turf of bright shining green *Apium filiforme*, brownish *Samolus repens*, very small bright-green *Selliera radicans* (at times the dominant plant), tufts of *Atropis*, a little *Cotula pulchella;* and here and there tussocks of *Scirpus nodosus*, in the shelter and shade of which the *Apium* is much larger. Also, but not everywhere over the formation, are *Ranunculus acaulis* and *Crassula moschata.*

At Port William there is some wetter ground than the last described, where water lies always and salt-marsh conditions exist. Here is *Leptocarpus simplex* dominant; *Carex litorosa;* a very small amount of *Plagianthus divaricatus; Calamagrostis Billardieri; Selliera radicans;* and near the margin some *Arundo conspicua* and a little *Phormium tenax*, though these last cannot be called halophytes.

At the south end of Mason Bay, facing the Earnest Islands, is a terrace of boulders. This, although not a salt meadow, nor even a coastal moor (see Cockayne, 20, p. 317), is closely related to the latter.

As for the plants, *Asplenium obtusatum* is abundant everywhere. Between the boulders are—*Scirpus aucklandicus, Crassula moschata, Apium prostratum*, abundance of *Tetragonia trigyna, Samolus*

* This is interesting as showing for how long a time plants "adapted" to a specific station (in this case halophytes) can still occupy the ground when the conditions of life are markedly changed.

No. 15. Isolated trees of the purple-flowered daisy-tree (*Olearia angustifolia*) growing above low cliff at the Neck. The tree on left is about 10 ft. tall, its trunk is 1 ft. 3 in. in diameter, and the rounded crown 21 ft. through.

[*Photo., L. Cockayne.*

No. 16. Wind-swept manuka on Table Hill. The open ground the result of excessive wind; on it manuka as a turf. The shrubs on left are midway between the erect and turf-making forms.

[*Photo., L. Cockayne.*

To face p. 20.]

No. 17. Manuka belt on Mount Rakiahua, at 1,300 ft. altitude.
[*Photo., L. Cockayne.*

No. 18. Forest view, as seen from road in neighbourhood of Half-moon Bay. The trees are mostly kamahi (*Weinmannia racemosa*).
[*Photo., L. Cockayne.*

repens, *Apium prostratum*, *Poa Astoni*, very large plants of *Myosotis albida*, *Selliera radicans* (as a turf), stunted *Veronica elliptica*, *Chenopodium glaucum*, *Gentiana saxosa*, *Mesembrianthemum australe*, a little *Aciphylla intermedia*, and, although not in my notes, I feel almost certain a plant or two of *Plantago trianda* var. *Hamiltonii* were present.

There are frequently open spaces amongst the "*Senecio-Olearia* scrub" at the north end of Mason Bay. On such is a combination of *Aciphylla intermedia*, *Apium prostratum*, *Scirpus aucklandicus*, *Epilobium nerterioides* var. *minimum*, *Cardamine heterophylla* var. *uniflora*, *Crassula moschata*, *Cotula Traillii*, *Poa Astoni*, *Carex lucida*, *Blechnum durum*, and *Brachycome Thomsoni*. The above constituents show that there is a close mat, out of which the taller plants grow singly or in groups. *Cotula Traillii* makes extensive pale-coloured mats; *Brachycome Thomsoni* (with scapes 1 ft. long in January and early February) is abundant, and makes dense mats; here and there sheets of *Crassula moschata* give a red colour. The fern *Blechnum durum*, its fronds flattened to the ground build small hillocks. Tufts of *Poa Astoni* grow up through the other plants. *Aciphylla intermedia* is in abundance, many plants growing side by side, and all touching.

At the mouth of Duck Creek, Mason Bay, as it passes through the recent dunes on the sandy bed, the ground is carpeted with a dense growth of a species of *Gunnera*,* its small dark-coloured leaves flattened to the ground; and mixed with it *Crantzia lineata*, *Epilobium nerterioides* var. *minimum*, *Hydrocotyle tripartita*, *Calamagrostis filifolia*, *Scirpus aucklandicus*, *S. filiformis*(?), *Elaeocharis acuta*, *Azorella Cockaynei*, and *Liparophyllum Gunnii*. The sand becomes very wet, owing to the spreading of the water over its bed. The *Gunnera* makes dark patches, which are relieved by the green *Hydrocotyle*, the reddish *Epilobium* and the bright-green tufts of *S. aucklandicus*. Where the ground is drier the *Gunnera* and *Azorella* are absent and the *Epilobium* and *Hydrocotyle novae-zelandiae* become dominant. On the bare sand a small species of *Juncus* is common. The above association is evidently, from its composition, related rather to bog than to salt meadow.

5. Cliffs.

The cliff vegetation is almost identical with that of the base of the Bluff Hill, on the mainland. Its luxuriance, and to some extent its character, depends on the position of the rock-face to sun and wind, and on the nature of the rock. Low cliffs are frequently shaded by the neighbouring coastal scrub, and the light is much reduced, ferns alone being present. Frequently the rock-face is thickly covered with peat, which is often a foot or more in depth, and which affords soil enough for the coastal veronica (*V. elliptica*) and many of the scrub shrubs. The chief plants of the formation are the maritime ferns (*Asplenium obtusatum*, *Blechnum durum*, *B. Banksii*), the two former frequently of large size, the thick leaves a foot or more in length, growing on the summit of short trunks; *Poa Astoni*, a grass of tussock or semi-tussock habit, the bunches isolated or close together, and frequently a foot or more in length, but generally drooping, except where exposed, when they are erect and smaller; *Myosotis albida*, its thick succulent hairy leaves 4 in. or more in length; *Crassula moschata*, forming close reddish mats or lines in crevices; *Linum monogynum*, this not everywhere; the celery (*Apium prostratum*); stiff tussocks of *Scirpus nodosus*; *Aciphylla intermedia* in the south and west. On the high cliffs of hard granite to the south of Mason Bay is, in places, abundance of *Aciphylla flabellata*, the long stout roots passing far down into the crevices. Here, too, is the fine *Celmisia robusta*, a plant with thick large green tomentose leaves in erect rosettes, but chiefly at the summit of the cliffs.

B. LOWLAND VEGETATION.

1. Forests.

(*a.*) *General.*

With the exception of certain places—notably, flat river-valley (treated of further on)—the whole of Stewart Island, up to an altitude of 1,000 ft. more or less, is covered with taxad forest, a continuation of the great formation of that character of the North and South Islands of New Zealand. This extensive assemblage of trees owes its presence to the wet and mild climate, its absence in certain spots being due to the violence of the wind or to soil-conditions. Near the shore it merges into the coastal scrub, and at its upper limit it is succeeded by a belt of manuka (*Leptospermum scoparium*), whose vertical distribution depends on the situation of the slope with regard to wind (Photo No. 17).

The differences between the taxad formation of Stewart Island and that of New Zealand generally are chiefly negative, depending partly on climatic conditions, and partly on the geological and biological history of the region, this latter, of necessity, a matter more or less obscure. Thus climate is accountable for the comparative small size of the taxads, the absence of many epiphytes among the seed-plants, the scarcity of woody lianes, the dominance of a certain class of undergrowth, and the extreme wealth of mosses and liverworts, while the geological and biological history are responsible for the absence of a number of common forest plants and the presence of others in very limited amount.

The most important fact regarding the forest formation is its being composed of two distinct associations—the "Rimu-Weinmannia" and the "Yellow-pine"—the former alone occurring in the north and east of the island, so far as I am aware, and the latter in the west and south, where it is found side by side with the Rimu-Weinmannia association, or between the two are intermediates. Ecologically, the Rimu-Weinmannia association is climatic, and the yellow-pine association depends on the soil-conditions (edaphic).

* Perhaps *Gunnera arenaria*.

(*b.*) *Composition of the Forest.*

So far as the species are concerned, the forest-plants are denoted in the general list of species at the end of this report, while a good many details regarding the life-forms of the forest are given in the section dealing with special ecology of the plants. The following numbers give some idea of the ecological composition of the forest: Trees, 7; low trees, 16; shrubs, 14; lianes (spermophytes), 9; epiphytes (spermophytes), 5; herbaceous plants, 36; parasites (spermophytes), 1; ferns and lycopods, 52.*

As for the floristic composition of the formation, there are 139 species of spermophytes and pteridophytes belonging to twenty-nine families and sixty-three genera.†

(*c.*) *The Rimu-Kamahi Association.*

(*a.*) *Physiognomy.* (*Photos Nos.* 18, 31, 37.)

Seen from without, and at some short distance away, the association under consideration appears as a dull-coloured mass, which is relieved by the yellow-green of the straight but rather slender heads of the numerous rimu-trees (*Dacrydium cupressinum*), which are not massed together but dotted abundantly over the whole. Here and there, in some places more than in others, the dark green of a southern rata (*Metrosideros lucida*) shows up distinctly, and the greyish hue of a group of kamahis (*Weinmannia racemosa*), while where the tall trees are distant a green feathery tree-fern may project above the shrubby undergrowth.

In the interior of the association the general appearance of any particular part depends upon various causes not sufficiently understood, such as the nature of the ground, its slope, exposure with regard to sun and wind, and so on. Generally speaking, the growth is not dense, the trees are a considerable distance apart, their crowns do not touch, and, though the intervening spaces between the trunks are occupied by an undergrowth, there is usually but little difficulty in pursuing one's way except in the gullies or on their lower slopes. The actual physiognomy of the forest depends upon the presence in superabundance of quite a few plants, and, as compared with the New Zealand taxad forest in general, upon the absence or paucity of certain well-known features. Considering this latter aspect of the question first, the Stewart Island forest as a whole is less tropical in aspect than that of the northern or central floristic provinces of New Zealand, or even the related forest of the west of the South Island. The species are fewer in number; the trees, *Metrosideros lucida* excepted, are lower and with more slender trunks; lianes, *Rhipogonum* in the gullies excepted, play an inconsiderable part; epiphytic asteliads are wanting, nor are the epiphytes in general of much physiognomic importance; tree-ferns, though excessively abundant, are not usually very tall; finally, the tree-trunks are frequently almost without a covering of other plants.

The vegetation of the association may be referred to four layers—viz., The floor; a layer of the smaller ferns and seedling trees, &c.; the low trees, tall shrubs, and tree-ferns; and the tall forest-trees.

So far as the tall trees are concerned, the rimu (*Dacrydium cupressinum*) is easily dominant in the least exposed parts of the forest, and where the soil is richest. Its straight bare trunks, varying in diameter from 1–3 ft. at most, covered with a dark-coloured scaling bark, and distant a few yards, or it may be as much as 2 chains or more, rise up unbranched to a height of 30 ft. or 40 ft. Here and there through openings in the undergrowth, looking upwards, may be seen the yellowish-green heads of the rimus, with their elegant weeping habit.

The thin-barked totara (*Podocarpus Hallii*) and the yew-like miro (*P. ferrugineus*), though not uncommon, are never plentiful enough to be of physiognomic importance.

On the drier ridges the kamahi (*Weinmannia racemosa*) is frequently dominant, two or three slender whitish trunks standing side by side, and looking like independent trees, though really belonging to one moss- and fern-covered "root trunk" of most irregular form, and perhaps huge dimensions (see Photo No. 10).

In the upper forest, or on specially exposed ridges, the southern rata (*Metrosideros lucida*) is often extremely abundant, its trunk prostrate as in the Auckland Islands, semi-erect or quite perpendicular, and conspicuous through its irregularity, great size at times (see Photo No. 6), and covering of reddish-brown bark, some hanging in long strips.

The ground is extremely uneven, and this is accentuated by many fallen trees at various stages of decay, and the surface rooting of the trees, especially of *Weimannia racemosa*. The forest-floor may be bare, and covered merely with dead rimu twigs and fallen leaves, but almost always is it occupied by patches, colonies, or it may be a vast carpet of bryophytes, filmy ferns, and certain creeping spermophytes, especially the forest snowberry (*Luzuriaga marginata*), *Nertera depressa*, and *N. dichondraefolia*, the two latter being extremely conspicuous when covered with their red fruits. Occasionally there is no undergrowth above of ferns or shrubs, in which case great breadths of the delicate bright shining green *Hymenophyllum demissum* may cover the ground, or mats of liverworts and mosses (species of *Plagiochila, Aneura, Gottschea, Trichocolea, Tylimanthus, Mastigobryum, Schistochila, Mniodendron, Sciadocladus, Dicranoloma*, &c.), while in such places *Polystichum adiantiforme*, its thick fronds about 1 ft. tall, may abound. *Polypodium diversifolium* is also a common fern, forming pure colonies, and in the neighbourhood of the sea *Asplenium obtusatum* may be the dominant ground fern.

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* The cryptogams have not been sufficiently collected to allow a satisfactory estimate to be given, but more than a hundred species of bryophytes are conspicuous through their abundance or size.

† The above figures might be increased or lessened slightly according as one includes or excludes certain uncommon forest plants which really do not belong to the forest at all; in fact, statistics of this kind depend upon the opinion of the observer, and are at best but closely approximate.

The tier of ferns and small shrubs rising a few feet above the ground owes an extreme physiognomic importance to the presence in excessive numbers almost everywhere, and sometimes pure for many yards at a time, of the common hard fern (*Blechnum discolor*). This fern has a trunk a foot or two tall, crowned with thirty or more shining rather dark-green fronds, which, semi-erect, close, and curving outwards, form a leafy vase, at the bottom of which dead vegetable matter collects, each leaf some 3 ft. in length and 5 in. broad. The plants grow so closely that the fronds touch, the ground being altogether hidden. Sometimes these colonies are not pure, the long hard fern (*Blechnum capense*) being abundant. To this same tier belong the smaller shrubs, the slender little-branched *Coprosma Colensoi* being common everywhere, and the dense *C. rhamnoides*, with small brownish leaves and in its season red with the small drupes, is fairly common.

The many prostrate and rotting trunks mentioned above offer a favourite station for mosses, liverworts, and filmy ferns, and these are present in almost indescribable profusion, accompanied by luxuriant growths of *Luzuriaga marginata*, *Nertera depressa*, and several creeping ferns, especially *Polystichum adiantiforme* and *Polypodium diversifolium*.

But the forest as a whole is far from being as open as just described, and the space between the tree-trunks is more or less closely filled by a few small trees or tall shrubs of slender habit. Especially are the graceful twiggy bushes of the hupiro (*Coprosma foetidissima*) dominant, whose three or four long naked branches arch downwards through the weight of the numerous thin but stiff leaf-bearing twigs covered closely with their pale-green leaves. Along with this tallest undergrowth are multitudes of tree-ferns, especially *Dicksonia squarrosa*, whose slender dark-coloured trunk is covered above with remains of former leaf-stems, but below is a mat of aerial roots overgrown frequently with a rich covering of filmy ferns (*Trichomanes venosum*, *Hymenophyllum flabellatum*, and *H. ferrugineum*), and many seedlings of the kamahi (*Weinmannia racemosa*), and various bryophytes—*e.g.*, *Rhizogonium novae-hollandiae*, *R. distichum*, *Hymenophytum Phyllanthus*, and other *Hymenophyllum*-like liverworts.

In many parts of the forest *Coprosma foetidissima*, the rimu and kamahi trunks, and colonies of *Blechnum discolor* alone meet the eye, and were all the other species removed the general physiognomy would remain unchanged. All the same, many of the other forest plants will be present, and probably within the limits of an acre the greater part of the species could be collected. In many places, too, there is abundance of the other forest trees or shrubs, and when these are present in quantity the pale-green leaves and arching twiggy habit of *C. foetidissima* no longer dominates. The most important of these other low trees or shrubs are — *Nothopanax Edgerleyi*, *N. simplex*, *Pseudopanax crassifolium* (especially its juvenile form), *Schefflera digitata*, *Carpodetus serratus*, *Coprosma lucida*, and in some localities *Myrtus pedunculata*. In the forest near Port Pegasus, *Dacrydium intermedium* invades the association. *Leptospermum scoparium* is also more or less scattered through many parts of the forest. Near the sea, and sometimes ascending almost to the subalpine region, is a certain amount of *Senecio rotundifolius*. *Dracophyllum longifolium*, too, may invade the forest proper. Thus, when the last-mentioned two species, which differ so much in colour and form of leaf and in general habit, replace the more typical undergrowth, the general physiognomy is strikingly changed.

It has been pointed out that epiphytes play comparatively little part in the Stewart Island forest, and that the tree-trunks are frequently bare of other plant-life. All the same, such coverings are not wanting, by any means. The beautiful translucent drooping filmy fern, *Hymenophyllum dilatatum*, is frequently extremely conspicuous, especially on the irregular bases of the kamahi (*Weinmannia racemosa*), where it may be accompanied by *Polystichum adiantiforme* and *Polypodium diversifolium*. The long pendant fronds of *Asplenium flaccidum* hang from many trees, and here and there are the swinging tassels of *Lycopodium Billardieri*, a foot or two in length. Masses of the orchid (*Dendrobium Cunninghamii*), with its grasslike leaves, are frequent on rata boughs especially, and the two epiphytic *Earinas* are common throughout the forest. Mantles of bryophytes hide the bark—*e.g.*, *Rhapidostegium cerviculatum*, *Stereodon chrysogaster*, *Rhapidostegium leptorrhynchium*, and two species of *Leucobryum* on the bases of the trunks. The lycopod, *Tmesipteris tannensis*, is not, as in the northern forests, confined to the trunks of tree-ferns, but pushes its rhizome of several inches in length amongst the humus of the tree-bases and of rotting logs, its condition being saprophytic rather than epiphytic.

The vegetation of gullies is of a special character. The taller trees are frequently quite absent. *Coprosma foetidissima* is no longer dominant, but there is a much greater mixture of small trees, whose growth is more irregular and stems more moss-clad than in the level forest or gentler slopes. Tree-ferns abound (Photo No. 19), *Hemitelia Smithii* is commoner and the trunks of *Dicksonia squarrosa* are altogether hidden by the multitude of the reddish fronds of *Hymenophyllum ferrugineum*. The ground is covered thickly with bryophytes of many kinds. Moss and liverwort cushions made up of *Dicranoloma Billardieri* and *Plagiochila gigantea*, 1 ft. or 2 ft. in height, are plentiful in the forests of the west and south, and one may step from cushion to cushion. The boulders of a stream may be green with the great thick thalli of *Monoclea Fosteri*. The crape-fern (*Leptopteris superba*) forms extensive colonies, the fronds on short massive trunks of pyramidal shape, and 1 ft. 6 in. or more tall. Specially characteristic of the gullies are close entanglements of the black stems of the supplejack (*Rhipogonum scandens*). Steep banks are clothed with fronds of *Blechnum capense* 3 ft. or much more in length, and where especially shaded and moist may be great colonies of the dark-coloured *Blechnum Patersoni*. Also *Leptopteris hymenophylloides*, *Blechnum fluviatile*, *B. lanceolatum*, and *B. nigrum* are more specially ferns of the gullies.

(β.) *Affinities of the Association.*

The *Dacrydium-Weinmannia* association of Stewart Island resembles very closely indeed the forest on the Bluff Hill, distant some twenty miles, the species and physiognomy being almost identical. *Dacrydium intermedium* does not occur in the Bluff forest, but it is merely an occasional constituent

of the association under consideration, and wanting in the north-east of the island. It has also many features in common with the Longwood forest near Orepuki, but this is at once distinguished by the presence in its upper portions of *Nothofagus* and the abundance of *Coprosma Banksii*.

The forest of the west of Otago being a taxad-beech forest right to sea-level belongs to a different category, although the bulk of the species are identical. The subalpine forests of the central mountain-chain of the North Island and of the volcanic plateau, although they are *Nothofagus* formations, have much in common with the forest of Stewart Island, especially in their undergrowth (see Cockayne, 26).

(*d.*) *The Yellow-pine* (Dacrydium intermedium) *Association.*

This association, so far as my observations go, does not extend northwards beyond the valley of the Freshwater River; from thence it is abundant in low-lying country to the south coast. How far it extends eastward I cannot say. The tree itself (*D. intermedium*) is to be met with in the ordinary rimu-kamahi association of the Port Pegasus district*; but the special association is confined to wet ground, or to situations exposed to wind.

Besides the presence of the small pine (*D. intermedium*), with its curious dimorphic yellowish-green foliage and weeping habit of growth when young, the floor of the low forest or scrub is covered with huge moss and liverwort cushions, sometimes quite globular in form, which are one of the most remarkable sights of Stewart Island (Photo No. 24). It is hard at first sight to believe that these cushions are not moss-covered boulders, and one naturally expects on kicking one to strike a hard substance. Frequently they are so close that progress can only be made by stepping from cushion to cushion.

A typical example, such as is shown in the photograph (No. 24), consists entirely of the moss *Dicranoloma Billardieri*. Its height will be from 1 ft. 6 in. to 2 ft., and its diameter about the same. Within the cushion the moss is dead, and changing into peat. The ultimate leafy shoots are pale yellow-green in colour, and $1\frac{1}{2}$–$1\frac{3}{4}$ in. long. Such a cushion is nearly always sopping wet with rain-water, and permeated by a network of small roots coming from the neighbouring trees. The liverwort cushions have identically the same habit (see Photo No. 25); they are formed by perhaps *Plagiochila gigantea* and *P. ramosissima*, but I am not quite certain as to the species. The shoots continue to grow outwardly and die inwardly, thus increasing the size of the cushion up to a certain limit. Moss-cushions of smaller size quite encircle slender stems of trees or shrubs, or occupy the basal portion of larger trunks. Epiphytic on the cushions are other mosses and liverworts, seedlings, filmy ferns, and lycopods.

On the flat ground of river-valleys, or where most sheltered, the association consists of nearly all the ordinary forest trees and shrubs, but they are of slender habit, and for the most part of irregular growth. The hupiro (*Coprosma foetidissima*) is no longer dominant, as in the undergrowth of the rimu-kamahi forest; but the broadleaf (*Griselinia littoralis*), the simple-leaved and Edgerley's panaxes (*Nothopanax simplex, N. Edgerleyi*), the native fuchsia (*F. excorticata*), the small-leaved myrtle (*Myrtus pedunculata*), small thin-barked totara (*Podocarpus Hallii*), manuka (*Leptospermum scoparium*), the sharp-leaved heath (*Styphelia acerosa*), and the weeping-matipo (*Suttonia divaricata*) play a conspicuous part. Erect green tussocks of *Gahnia procera* are as plentiful as in the subalpine scrub. Filmy ferns are not nearly so numerous as in the rimu-kamahi forest, but, on the other hand, there are great breadths of the umbrella-fern (*Gleichenia Cunninghamii*) (see Photo No. 20), and, as usual, a great deal of the common hard fern (*Blechnum discolor*). The forest-snowberry (*Luzuriaga marginata*) is abundant on the floor and on the moss cushions. Near the outskirts of the association, where it abuts on a manuka heath, &c., is generally much very tall *Gleichenia dicarpa* (scrambling umbrella-fern), climbing by means of its long flexible stem and horizontal pinnae.

In many parts of a forest such as the above, the ground between the moss cushions,† or places where these are not numerous, is covered everywhere with species of mosses and liverworts; indeed, the rich growth of these is astonishing. Where the bryophyte carpet is densest, ferns are almost absent. Finally, an occasional tall rimu (*D. cupressinum*) rises above the forest-roof.

Where the wind strikes the association strongly, it decreases in height, more manuka appears, the low trees press more closely together, the bryophyte cushions and *Gahnia* tussocks get closer, and a scrub results.

In ascending the Remarkables from Port Pegasus, on each flat piece of ground where boggy conditions prevail the taller forest gives place to a piece of yellow-pine association such as described above, but in which there are many rimus no taller than the other low trees, and a strong undergrowth of *Dacrydium Bidwillii*.

(*e.*) *Regeneration of Forest.*

There is a deep-rooted popular belief that when the New Zealand forest is once interfered with, and the light let in through trees being removed, and so on, it is doomed. This opinion is one of those half-truths that arise from an imperfect acquaintance with the facts. It is true that forests do cease to be; but it is not merely the cutting-out of a certain proportion of the trees which has led to their destruction, but fire and cattle-grazing must be added to the destructive influences. All over New Zealand remnants of the former forest-covering may be seen holding their own, even where no particular care is given to keep them intact, and in no few places old forest growths have reasserted themselves.

Climate more than any other factor governs the growth of rain-forests. The primeval dense forest of New Zealand was the result of excessive rain, and that same rain which caused the trees originally to mass themselves into forests will favour their regeneration should no detrimental factors be working for the contrary.

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* The word "district" is not used here in a plant-geographical sense.

† The term "moss cushion" is intended to include both mosses and liverworts.

Nowhere have I seen this fundamental truth so well illustrated as in Stewart Island. There cut the forest to the ground, burn its last remnant to ashes, and in a very few years, notwithstanding the presence of cattle, it will reappear! This would not be altogether good news were the land suitable for farming, but in a spot whose chief wealth is its forest scenery, the knowledge that the scars wrought by the sawmillers and fires of the past will some day be quite obliterated is very pleasant knowledge indeed. Nor is it, as in most parts of New Zealand, merely certain members of the forest undergrowth which reappear, but that plant of all plants that can usually least tolerate exposure, thanks to the absence of excessive sunshine and to the frequent rain, the rimu, appears again in the rejuvenating forest in its thousands (see Photo No. 22).

The sequence of regeneration is not the same everywhere. In some places the wineberry (*Aristotelia racemosa*), the commonest "fire-weed" of New Zealand, is quite wanting, the hupiro (*Coprosma foetidissima*) being dominant. On the road to Kaipipi Bay by the bush track an area is traversed which has been first "milled" and then burned twenty years ago or more.* At the present time there is a very thick growth of young trees and shrubs 12–15 ft. tall, all growing into one another. *Weinmannia racemosa* is dominant, and *Coprosma foetidissima* is almost equally abundant, the yellow-green of the former contrasting with the much paler green of the latter. There are many young trees of the rimu (*Dacrydium cupressinum*) of fastigiate habit, and with weeping long shoots, some 10 ft. tall or more. The juvenile lancewood, *Pseudopanax crassifolium*, is very plentiful, its straight stiff stem piercing the general mass of foliage, and finally bringing the adult leafy head into the light. Other common constituents are: *Nothopanax simplex*, *Griselinia littoralis*, *Coprosma lucida*, and, as undergrowth, *C. rhamnoides* and *Gahnia procera*. There is an occasional southern rata (*Metrosideros lucida*), miro (*Podocarpus ferrugineus*), and *Nothopanax Colensoi* mixed with the taller plants, and a few small tree-ferns (*Dicksonia squarrosa*). On the floor are *Nertera depressa*, *Lycopodium volubile*, and some small *Gaultheria antipoda*. *Aristotelia racemosa* was not noted at all!

Regeneration is not everywhere as just described; proximity to the shore, the degree of shelter, nature of the ground, manner and extent of destruction—all these and other matters have to be taken into consideration. My notes only enable me to deal very superficially with this important question.

Frequently *Carpodetus serratus* is an important constituent. Lianes are more abundant than in the virgin forest, particularly *Rubus schmidelioides* and *Metrosideros hypericifolia*.

If the forest is removed in the neighbourhood of the shore, the ground is rapidly occupied by *Senecio rotundifolius*, the seeds of which germinate readily, and thousands of seedlings appear everywhere. Without a close examination it would be thought there were little but the *Senecio* in the new growth, but it contains many of the ordinary forest plants—*e.g.*, *Carpodetus serratus*, *Aristotelia racemosa*, *Myrtus pedunculata*, *Coprosma foetidissima*, *Weinmannia racemosa*, *Dacrydium cupressinum*, *Rubus schmidelioides*, *Suttonia divaricata*, *Metrosideros hypericifolia*, and various ferns, especially *Blechnum capense* and *Dicksonia squarrosa*. Such a combination as the above would eventually result in the eradication of the coastal *Senecio* and the reinstatement of a rimu-kamahi association.

Where the subalpine manuka association has been burned, as in places on Mount Anglem, which occurred at the cutting of the track six years ago, the original association of close-growing *Leptospermum scoparium*, and in much smaller quantity *Dracophyllum longifolium*, *Olearia Colensoi*, *Dacrydium cupressinum*, *Nothopanax simplex*, *Gahnia procera*, and *Gleichenia circinata*, is being replaced by the following: *Leptospermum scoparium*, 2 ft. tall; a little *Phormium Cookianum* and *Dracophyllum longifolium;* abundance of *Gleichenia*, *Olearia Colensoi* (some about 7 in. tall), and *Gahnia procera;* here and there is *Cassinia Vauvilliersii*, *Coprosma foetidissima*, and an occasional *Dacrydium cupressinum*, also a little *Gleichenia Cunninghamii*. In many places the ground is carpeted with *Lycopodium ramulosum*, and the green tufts of the *Gahnia* are everywhere.

There have been several extensive fires in the neighbourhood of Port Pegasus, especially in the now open country between the Frazer Peaks and Smith's Lookout. This district was originally covered, in large part, with manuka scrub and a low mixed forest, a remnant of which consists of the following: *Dracophyllum longifolium* (dominant), *Griselinia littoralis*, *Nothopanax Colensoi*, *Coprosma lucida*, *C. Colensoi*, *C. rhamnoides*, *C. propinqua*, *Nothopanax simplex*, and *Podocarpus Hallii*. Probably there would also be in many parts much *Dacrydium intermedium*. The original forest and scrub are now for the most part gone, but the new growths are altogether indigenous plants; scrub much the same as the original, but far denser and of various heights, according to the age of each burning, is everywhere (see Photo No. 39), except for certain open ground occupied by subalpine herbaceous plants and prostrate shrubs, as already described, some of which is a new formation and some probably the original covering before the time of fires.

2. Heath.

(*a.*) *General.*

By the term "heath" I refer to that formation where usually shrubs or low trees of the manuka (*Leptospermum scoparium*) make, along with other shrubs, a special plant society. The heath of Stewart Island occurs principally on the open ground at about sea-level in the Freshwater River and Rakiahua Valleys, on low-lying ground near Port Pegasus, and on the ancient dunes inland from Mason Bay, where there is an assemblage of plants very different from those of dunes either ancient or recent in any other part of the New Zealand botanical region.

* The final burning which actually prepared the ground for new growth may have been much more recent.

(*b.*) *Heath of Ancient Dunes, Valleys of Rivers Freshwater and Rakiahua.*

Probably this formation has been frequently burnt, and a good deal of the manuka will be second or third growth. The manuka makes a continuous and close growth in places, in others it is scattered in clumps or individual plants. Where open, the sandy ground is covered with abundance of the alpine umbrella-fern (*Gleichenia alpina*), forming a close yellowish-green covering some 6 in. tall. The small wiry mats of a reddish colour of *Styphelia empetrifolia* are very abundant, and sometimes it is the dominant plant. There is the low-growing dark-green *Pentachondra pumila* here and there, tufts of the rush-like *Cladium Vauthiera*, young *Dracophyllum longifolium*, stunted *Hypolaena lateriflora*, stunted bracken fern (*Pteridium esculentum*), large breadths of the creeping club-moss (*Lycopodium scariosum*) straggling over the ground, and small *Blechnum capense* var. *minor*. Also fairly common are—*Coprosma repens*, *Drapetes Lyallii*, stunted *Luzuriaga marginata*, the small fern *Lindsaya linearis*, and *Celmisia longifolia*.

On the dunes in the Rakiahua Valley the dwarf pine, *Dracydium laxifolium*, is very abundant, forming matted masses about 7 in. tall. Its slender cord-like brown stems, covered with green leaves near their extremities, are quite incapable of standing erect.*

The dune-heath is closely related to the neighbouring bog-formation, where the change in water-content has brought in some additional species. Probably the old dunes have been populated from the bogs rather than the contrary, the physiologically dry soil of the latter providing life-forms able to tolerate the physical dryness of the former.

(*c.*) *Mason Bay.*

The dry parts of the old dunes inland from Mason Bay are occupied by a heath, or steppe, differing a good deal from the foregoing. My notes say nothing as to any manuka being present, but it is plentiful in the adjacent dune-bogs.

Uncinia rubra is very abundant, and its red colour gives a distinct appearance to the formation. In other places the leading plant is the steppe-grass, *Danthonia Raoulii*, forming its customary tussocks. Other plants noted were: *Phormium tenax*, *Blechnum penna marina*, *Poa pusilla* (abundant), *Libertia ixioides*, *Helichrysum filicaule*, *Geranium microphyllum*, *Carex ternaria*, *Nertera setulosa*, *Pteridium esculentum*, *Acaena novae-zelandiae*, *A. Sanguisorbae* var., *Veronica buxifolia*, *Cassinia Vauvilliersii*.

(*d.*) *Heath at Port Pegasus* (Photo No. 39).

This has been burnt in many places, but, as stated before, is being reproduced much in its normal condition. It consists principally of manuka. Where tall it is rather forest than heath, and shades off into the yellow-pine association. The soil is peat, and will contain humous acids.

3. Bogs and Swamps.

(*a.*) *General.*

I am here, partly on account of their close relationship and partly because my observations are not sufficient, treating the vegetation of wet ground as a whole, and not separating that which is permanently covered with a more or less deep sheet of water from that which is merely usually in a state of saturation, and where at times small water-holes exist. Extensive bogs and swamps occupy much of the low-lying ground of the Freshwater and Rakiahua Valleys, those of the former extending along the course of the ancient strait to Mason Bay, where in the hollows and on the flat ground of the inland ancient dunes are many bogs. In the neighbourhood of Port Pegasus what are virtually subalpine bogs at almost sea-level are on all the open ground, and these, through burning of the manuka heath, are probably on the increase, the newcomers being all indigenous plants. Also along the Toitoi† River, on the south-east of the island, are extensive swamps, but these I had no opportunity of investigating. There is a close relationship between the neighbouring bog vegetation and that of the sandy heath already described, the drier bog offering a transitional stage. The life-forms of the formations are, for the most part, strongly xerophytic.

(*b.*) *Freshwater and Rakiahua Valleys.*

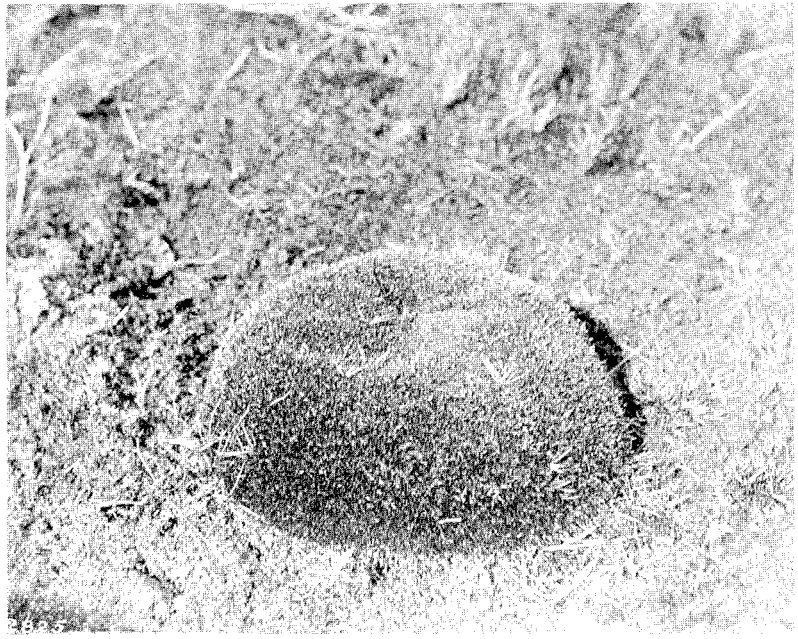
The vegetation of the driest bogs in the Freshwater and Rakiahua Valleys consists of extensive masses of the pale-green alpine umbrella-fern (*Gleichenia alpina*) (Photo No. 36) and the darker green wiry-stemmed leafless *Hypolaena lateriflora*. On the barer ground the small green grasslike leaves of *Herpolirion novae-zelandiae* are everywhere, and in December the blue flowers close to the soil are there by thousands. Velvety cushions of *Gaimardia ciliata*, soaked with water, and sometimes 9 in. in diameter and 3 in. from the ground (see Photo No. 21), are dotted about all over the wetter ground, together with patches of *Carpha alpina*, small plants of *Coprosma repens*, and mats of *Lycopodium ramulosum*, colonies of reddish *Drosera spathulata* and *Utricularia monanthos* more or less filling up the ground between. Where water lies in the Freshwater Valley are broad colonies of the coastal plant *Leptocarpus simplex*, its stiff erect rush-like stems massed together, the red colour rendering it conspicuous. Also in the wet ground and the numerous water-holes are *Cladium Gunnii*, *C. Vauthiera*, and stunted manuka.

On the bog proper the following are common: *Pentachondra pumila*, *Oreobolus strictus*, *Schizaea fistulosa* var. *australis*, *Cladium Vauthiera*, young *Dracophyllum longifolium*, *Thelymitra uniflora*, *Danthonia semiannularis*, *Coprosma acerosa* var., *Gaultheria antipoda*, and *Styphelia empetrifolia*.

* I did not note this plant in the Freshwater Valley, but it is recorded as growing there by Kirk (55).
† So spelt on the map. Should be "Toetoe."

To face p. 36.]

No. 19. Interior of Forest. Tree-ferns (*Dicksonia squarrosa*) in gully. On right, *Nothopanax Edgerleyi*.



No. 21. The bog pincushion (*Gaimardia ciliata*) 8 in. in diameter. Lowland bog, valley of Freshwater River.

No. 20. Colony of the umbrella-fern (*Gleichenia Cunninghamii*). Forest near Ohekia River.

No. 22. Regeneration of forest. Young rimu-trees after sawmilling and burning.

[Photos. by L. Cockayne.

No. 25. General view of piece of boggy land covered with alpine umbrella-fern and *Hypolæna lateriflora*. Rakiahua Valley.

[*Photo., L. Cockayne.*

No. 24. Cushion of the moss *Dicranoloma Billardieri*, 2 ft. 4 in. tall. Seedlings of *Olearia Colensoi* growing on it. Lower subalpine scrub of Mount Rakiahua.

[*Photo., L. Cockayne.*

(*c.*) *Old Dune Bogs near Mason Bay.*

The sand-dune bogs* near Mason Bay are of a different character to the above. They themselves vary considerably as to their water-content. Where water lies always *Carex ternaria* is dominant. In many places *Leptocarpus simplex*, waist-high, makes a pure association. There is an abundance of large *Sphagnum* cushions, and growing on them much *Gunnera prorepens*, the dark-coloured, almost black leaves pressed close to the moss, the plant eventually extending by means of its creeping stems beyond the bog out on to the dry ground; *Hydrocotyle asiatica; Lagenophora petiolata;* stunted *Leptospermum scoparium; Olearia virgata; Blechnum capense* var. *minor;* young *Dracophyllum longifolium; Thelymitra longifolia; Celmisia longifolia; Nertera setulosa;* and *Viola Cunninghamii.* Where water lies is *Hydrocotyle tripartita, Ranunculus rivularis, Potamogeton Cheesemannii*(?), *Elaeocharis Cunninghamii*, and in places *Phormium tenax.*

Bog such as the above merges into the drier ground already described under the heading "Heath," and it is difficult to draw a hard-and-fast line between these two formations. There may be a piece of comparatively dry ground, and at the next step the water oozes out, while farther on is a hole with water lying. And there are many acres of such land. On such *Gleichenia alpina* and *Hypolaena* are very plentiful; there are many small shrubs of *Veronica buxifolia* and *Cassinia Vauvilliersii.* Water can usually be wrung out of the ground. In some places *Danthonia Raoulii* tussocks are abundant, and another association has entered in. Besides all the bog plants already enumerated are the following: *Halorrhagis micrantha, Gaultheria perplexa, Geranium microphyllum, Carex stellulata, Pratia angulata, Hierochloe redolens, Juncus lampocarpus, Acaena Sanguisorbae*, and *Prasophyllum Colensoi.*

(*d.*) *Swamp.*

The bogs become more swamp-like in character in the narrow valley connecting Mason Bay and the Freshwater River Valley. A drain has been cut for a few years through the above, and much less water must lie on the floor of the swamp than formerly, though it is still extremely wet.

Where water lies the vegetation is in dark-green and reddish patches a chain or more in length, the latter marking the presence of pure *Leptocarpus simplex* 2 ft. or more tall. The green consists of *Cladium glomeratum*†(?), the stems rush-like, 1 ft. or more tall, and the ground bare beneath. Here and there on the muddy ground is *Elaeocharis Cunninghamii*, and where water lies *Carex stellulata.* In some places *Carex ternaria* is dominant, and on the open muddy floor is *Hydrocotyle asiatica, Hydrocotyle tripartita, H. americana, Blechnum capense* var. *minor*, and *Ranunculus rivularis.* Where wettest of all are niggerheads (*Carex secta*).

(*e.*) *Bogs near Port Pegasus.*

In the valley at the head of Crooked Reach, Port Pegasus, is much boggy ground, interspersed with "manuka heath" and occasional *Danthonia Raoulii* meadow. The bog is, in part, although at nearly sea-level, of a subalpine character. In some places *Schoenus pauciflorus* is dominant; in others *Hypolaena lateriflora* is everywhere. There is much wind-flattened manuka 1 ft. or 2 ft. high, and cushions of *Oreobolus pectinatus* are everywhere. *Phormium Cookianum* is abundant. *Senecio Lyallii* is extremely common, and in many places the leading plant; also *Senecio bellidioides* is excessively plentiful. Other common plants are certain mosses (*Dicranoloma setosum, Campylopus bicolor, C. introflexus*), *Dracophyllum politum, Donatia novae-zelandiae, Pentachondra pumila, Astelia linearis, Drapetes Dieffenbachii, Gaimardia ciliata, Carpha alpina, Gleichenia alpina, Ranunculus Kirkii, Coprosma acerosa*, and *Gaultheria perplexa* entangled together, *Veronica buxifolia, Dracophyllum Pearsoni, Lycopodium ramulosum*, and *Cassinia Vauvilliersii.* There is a fair amount of *Bulbinella Gibbsii* and a certain quantity of *Celmisia argentea, C. linearis*, and *Caltha novae-zelandiae*, while *Ehrharta Thomsoni, Liparophyllum Gunnii*, and *Actinotus novae-zealandiae* are plentiful.

(*f.*) *Boggy Meadow.*

Tussock meadow is quite rare in Stewart Island, but there are patches of considerable size in the Rakiahua and Freshwater River Valleys, where at a distance only the waving red tussock (*Danthonia Raoulii*) can be seen. The tussocks are 4 ft. or 5 ft. tall; they touch, or there are spaces between filled with *Hypolaena* and *Leptocarpus;* or there is a turf of various low-growing plants—*e.g., Carpha alpina, Lagenophora petiolata*, species of *Drosera, Celmisia longifolia, Geranium microphyllum, Hydrocotyle asiatica, Dichondra brevifolia, Helichrysum filicaule, Gaultheria perplexa, Halorrhagis micrantha, Lindsaya linearis, Lycopodium ramulosum, Oreostylidium subulatum, Thelymitra uniflora, Apium prostratum*, small *Dracophyllum longifolium*‡, *Drapetes Dieffenbachii, Gaimardia ciliata, Actinotus novae-zelandiae, Geum leiospermum, Liparophyllum Gunnii, Lycopodium ramulosum*, and *Ehrharta Thomsoni. Carex appressa* forms considerable patches in some places. *Ourisia modesta* was collected only in the Rakiahua Valley, growing in company with *Ranunculus Kirkii* and forming small mats.

The *Danthonia* meadow near Port Pegasus may have the tussocks close or distant, in which case the spaces may be filled by *Veronica buxifolia, Cassinia Vauvilliersii, Coprosma acerosa* var., *C. parviflora*, and *Phormium Cookianum.* The floor-plants are *Hypolaena, Ranunculus Kirkii, Blechnum capense* var. *minor, Cladium Vauthiera*, and probably a number of other plants not in my notes.

* The origin of wet ground in a dune-area is explained in my report on the sand dunes of New Zealand, recently issued by the Department of Lands.

† It was not in flower, and I have no specimen.

‡ Perhaps this is *D. Urvilleanum* var. *Lessonianum.*

(C.) THE VEGETATION OF THE MOUNTAINS.

1. General.

The mountains of Stewart Island, notwithstanding the fact that the highest is only 3,200 ft., are covered with a vegetation just as truly alpine in form and species as are the highest New Zealand mountains. Mount Anglem, being about 1,000 ft. higher than are the other mountains with open ground on their summits, possesses a rather richer florula, *Ranunculus Lyallii, Celmisia Sinclairii, Veronica Laingii, Polystichum cystotegia, Archeria Traversii* var. *australis, Dracophyllum Menziesii, Carex dissita* var. *monticola, Helichrysum Loganii, Ourisia caespitosa, O. prorepens(?), O. sessiliflora,* and *Uncinia compacta* var. *caespitiformis* having not as yet been found elsewhere on the island. On the other hand, *Ranunculus Crosbyi, Senecio scorzonerioides,* and *Celmisia linearis* are only known, the two former from Table Hill and the latter from Rakiahua to the neighbourhood of Port Pegasus. *Abrotanella muscosa* also has only been noted on Mount Rakiahua and Table Hill.

Very few indeed of the mountain plants are confined to the mountains in Stewart Island, although they are strictly alpine or subalpine in the mountains of the North and South Islands, any open ground at about sea-level in the west or south of the island having more or less alpine species amongst its plants. More remarkable still is it that *Dacrydium laxifolium,* specially a plant of high altitudes (3,000 ft. and upwards), does not occur on the Stewart Island mountains at all, but only on certain ancient dunes at virtually sea-level.

The number of species of alpine plants in Stewart Island, so counting all species from the scrub-line upwards, is about 126, of which eight have not as yet been recorded elsewhere; but until the southern and western ranges of Otago are properly explored it is more than likely, bearing the present distribution of what were thought endemic Stewart Island plants in mind, that they will be found to be of wider range.

The mountain zone begins at about 1,500 ft.,* at which point the forest gives place first to a belt of manuka and then to the subalpine scrub, above which is the open ground, covered with low-growing herbaceous, suffruticose, or woody plants.

The peculiarities of the Stewart Island subalpine vegetation arise from the climatic conditions. These, briefly stated, are: constant wind, with frequent violent gales; excessive rainfall and extreme number of rainy days leading, together with the two following conditions, to a wet and sour, peaty soil; cloudy sky and little sunshine; low summer, but equable temperature. The above factors have a twofold significance, concerning on the one hand *distribution,* and on the other *plant form* and *formation physiognomy.* These matters are discussed under other heads. Here it may be pointed out *that there is a curious boggy meadow made up of cushion plants; there are special wind-forms of certain species, and there are formations depending on the presence or absence of wind.*

In what follows, an attempt is made for the first time to classify the mountain vegetation, a by no means easy task.

(2.) The Manuka (Leptospermum scoparium) Formation (Photo No. 17).

With the increase in altitude the force of the wind becomes more intense; wind-resisting plants enter into the forest, especially the manuka, until at a height of from 1,000–1,800 ft. an almost pure belt of this small tree encircles a Stewart Island mountain, the altitude at which it appears depending upon the position of the slope with regard to the prevailing wind. With the manuka at first are mixed many of the ordinary forest plants, the small trees (*Nothopanax Edgerleyi, Dacrydium biforme, Griselinia littoralis, &c.*), and even the forest-tree *Weinmannia racemosa* making merely a shrubby undergrowth, while the rimu (*Dacrydium cupressinum*) does not exceed the manuka in stature. Where the manuka is pure, or almost so, multitudes of bare poles meet the eye, beneath which are moss cushions, yellow mosses (species of *Dicranoloma*) on the ground, together with carpets of *Lycopodium ramulosum* and a close undergrowth of *Styphelia acerosa,* green tussocks of *Gahnia procera* and prostrate mountain-pine (*Dacrydium Bidwillii*). The roof of the formation is flat, greyish in colour, and made up of small dense heads of foliage. Where the wind strikes fully, the manuka is much reduced in height, and its twisted branches bear plainly the mark of frequent gales (see Photo No. 17).

Scrub of the Lower Hills, Pryce's Peak.

At an altitude of about 900 ft. the scrub of Pryce's Peak commences. It is composed of most of the forest trees and shrubs, but the manuka (*Leptospermum scoparium*) is in much greater abundance, and there is an undergrowth of *Styphelia acerosa* in large quantity, together with *Coprosma Colensoi,* the broadleaf (*Griselinia littoralis*), *Suttonia divaricata, Coprosma foetidissima, Gahnia* tussocks and moss cushions. Higher up manuka becomes dominant, but mixed with much *Dacrydium Bidwillii.* The scrub is about 20 ft. to 25 ft. tall; the manuka rises above the general level. Within is a tangle of stems and semi-prostrate trunks. The moss cushions are almost as abundant and large as in the scrub formations of Port Pegasus (see Photo No. 5).

I examined the vegetation of no other of the lower hills, except in the south where the conditions differ, but conclude the above will be fairly typical of such altitudes, except in the south.

(3.) Subalpine Scrub (Photos Nos. 26 and 27).

(*a.*) *General.*

Between the subalpine scrub proper and the manuka formation are distinct transitions, but the former is to be distinguished by the absence of *L. scoparium* as *the* dominant plant, and the presence of a superabundance of Colenso's daisy-tree (*Olearia Colensoi*). On hills of 1,000 ft. altitude the *character*

* All heights must be taken as approximate only.

No. 25. Liverwort cushion of *Plagiochila gigantea* nearly 3 ft. tall and 2 ft. 6 in. through at base. *Lycopodium volubile* growing on it. On left, trunk of *Weinmannia* covered with *Ancura eriocaula*. Yellow-pine association, Rakiahua River.

[*Photo., L. Cockayne.*

No. 26. Exterior of subalpine scrub of Mount Anglem. In foreground the mountain-pine (*Dacrydium Bidwillii*). The grass-tree (*Dracophyllum longifolium*) raising its erect branches above the general roof of *Olearia Colensoi*, &c.

[*Photo., F. G. Gibbs.*

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No. 27. Horizontal branching of Colenso's daisy-tree (*Olearia Colensoi*), subalpine scrub of Mount Anglem.

[*Photo., L. Cockayne.*

No. 28. Scrub-island on boggy meadow of Table Hill. Round cushion of *Dracophyllum politum* in centre.

[*Photo., L. Cockayne.*

of the vegetation changes: the forest-trees become stunted and gnarled, and, as mentioned *re* the manuka zone, certain shrubs appear which were wanting or rare at a lower altitude; but the new association may be considered merely a changed forest. It is only on mountains of 2,000 ft. and upwards that a true subalpine scrub occurs analogous to that of the Southern Alps and high mountains of the North Island (see Cockayne, 19A and 29). All the same, the formation under consideration is ecologically related to certain of the coastal scrubs, to one phase of the yellow-pine association, and to the scrub found at quite a low altitude in the south of the island.

(*b.*) *Composition of the Formation.*

List of the Species.

(Filices) *Trichomanes Lyallii, Hymenophyllum sanguinolentum, H. Cheesmannii, H. multifidum, Polystichum vestitum, Blechnum discolor, B. capense, Polypodium Billardieri, P. grammitidis, Gleichenia dicarpa;* (Lycopodiaceae) *Lycopodium ramulosum;* (Taxaceae) *Podocarpus Hallii, Dacrydium Bidwillii, D. biforme, D. cupressinum;* (Gramineae) *Ehrharta Thomsoni;* (Cyperaceae) *Gahnia procera, Uncinia caespitosa, U. rupestris* var. *capillacea, U. filiformis, U. compacta* var. *caespitiformis;* (Liliaceae) *Astelia montana, Phormium Cookianum, Luzuriaga marginata;* (Cunoniaceae) *Weinmannia racemosa;* (Myrtaceae) *Leptospermum scoparium;* (Araliaceae) *Nothopanax simplex, N. Colensoi;* (Cornaceae) *Griselinia littoralis;* (Ericaceae) *Gaultheria antipoda* var. *erecta;* (Epacridaceae) *Styphelia acerosa, Archeria Traversii* var. *australis, Dracophyllum Menziesii, D. longifolium, D. Pearsoni, D. politum;* (Myrsinaceae) *Suttonia divaricata;* (Rubiaceae) *Coprosma parviflora, C. ciliata, C. ramulosa, C. foetidissima, C. Colensoi, C. retusa, C. cuneata;* (Compositae) *Olearia Colensoi, Senecio elaeagnifolius.*

The only species actually confined to the subalpine zone are *Dracophyllum Menziesii, Archeria Traversii,* and *Uncinia compacta* var. *caespitiformis,* while the two most important members of the formation—*Olearia Colensoi* and *Dracophyllum longifolium*—are also coastal plants. *The different species are present rather because they can tolerate frequent wind and plenty of light than from a preference for a special altitude or decrease of temperature.*

(*c.*) *Distribution.*

The true subalpine scrub—*i.e.*, that in which *Olearia Colensoi* is the dominant plant—succeeds the narrow manuka belt at first as an unbroken girdle round the higher mountains, but afterwards is confined to gullies and sheltered spots, or occurs as islands in the subalpine meadow, ascending to 2,500 ft. or more on Mount Anglem. It appears to be present only on those mountains which exceed 1,500 ft. I have observed it on Mount Anglem and the unnamed peak to the south, the Thomson Range, Mount Rakiahua, the Table Hill Range, and the Remarkables, and it is certain to be on the Deceit Peaks. On the lower hills, such as Pryce's Peak, the scrub contains only a few plants of *O. Colensoi,* and is made up of the forest plants, but with certain species in greater abundance than in the forest proper.

(*d.*) *General Character and Physiognomy.*

The subalpine scrub is of the most extreme density. At first, particularly in the gullies, it may be 15 ft. tall or more; but as the altitude increases it becomes waist-deep, while finally certain of its characteristic members may form mere mats upon the ground. Seen from some point of vantage, the roof appears as a close, flattish, or slightly billowy mass of a sage-green colour, through the prevalence of *Olearia Colensoi,* with erect yellow-green slender bunches of twigs of *Dracophyllum longifolium* rising above it at short distances (see Photo No. 26). Within all is a complete tangle of stiff, rather thick bare trunks and branches, absolutely rigid, jutting out semi-horizontally as well as vertically, interlaced, touching, and extending right to the surface of the ground, and above are the heads of dense foliage.

The trunks of the *Olearia* may be prostrate, and yet quite tree-like, their horizontal spread exceeding the vertical height of the formation in dimensions (see Photo No. 27). *Suttonia divaricata* is abundant, and its crown of weeping and divaricating stiff twigs adds to the general density, though it plays no such conspicuous part as in the scrub of the Auckland and Campbell Islands. On the floor of the scrub itself any open space beneath the far-stretching branches is occupied by great tussocks on peaty trunks of *Gahnia procera,* and by moss and liverwort cushions. Progress through the formation can alone frequently be made by creeping under or climbing over the horizontal boughs. Seated upon the ground, or upon such a trunk as the above, the eye meets only a network of stiff, bare, horizontal, and semi-horizontal stems of a brown colour, huge green tussocks of *Gahnia* and yellow moss cushions of *Dicranoloma Billardieri* resembling moss-covered boulders. On the trunks of *O. Colensoi* will be a good deal of *Hymenophyllum sanguinolentum,* and on the floor and moss cushions colonies of *H. multifidum* and abundance of seedlings of *Olearia Colensoi.*

The scrub at first contains many small pyramidal trees of the rimu (*Dacrydium cupressinum*), small bushy kamahi (*Weinmannia racemosa*), and other aborescent members of the forest. The ivy-tree (*Nothopanax Colensoi*), with long, straight, naked, bamboo-like stems, is fairly common. In some places manuka is an abundant constituent, and may be recognised at a distance by its brown colour; in others, the mountain-pine (*Dacrydium Bidwillii*) will form one-half of the formation. The southern rata (*Metrosideros lucida*) growing merely as a shrub, the hupiro (*Coprosma foetidissma*), and the inuka (*Dracophyllum longifolium*) are also abundant. *Dracophyllum Menziesii* (Photo No. 7) occurs, so far as is known for Stewart Island, only on Mount Anglem, and there merely in the low scrub on the moraine. On the other hand, *Senecio elaeagnifolius* is absent on Mount Anglem, but is plentiful on the Table Hill Range.

The " scrub islands " (Photo No. 28), especially on the Table Hill Range, give a character to the landscape, forming patches of a more or less sage-green colour in the apparently smooth meadow. Such an " island " may consist of *Olearia Colensoi, Veronica buxifolia* var. *odora* (this a plant of certain aspects of the meadow, and not of the continuous subalpine scrub), *Nothopanax Colensoi, Gahnia procera, Phormium Cookianum, Styphelia acerosa, Dracophyllum longifolium* (all these about 3 ft. tall, and of lower growth), *Suttonia divaricata, Astelia montana, Coprosma foetidissima,* and *Styphelia empetrifolia.* On the floor of the scrub are *Astelia linearis, Coprosma ramulosa,* and *Danthonia pungens,* while on the leeward side will be abundance of *Celmisia linearis.* The cushions of *Dracophyllum politum* are abundant in the shelter of these scrub islands (see Photo No. 28). Where the wind is too violent the island may be reduced to a solitary plant of the *Olearia,* or in other places only the *Astelia montana* remains, forming flattened masses, and reminding one of its similar appearance on the Tararua Mountains.

4. Boggy Meadow (Photo No. 29).*

There is little difference between actual bog and the ordinary open ground of a Stewart Island mountain, the boggy meadow having as its groundwork a number of species—*e.g., Donatia novae-zelandiae, Carpha alpina, Astelia linearis, Ehrharta Thomsoni, Oreobolus pectinatus,* and *Phyllachne Colensoi,* which are characteristic alpine or subalpine bog plants. The ground is a wet peat, which can be kneaded into the consistency of porridge. Many of the species are cushion plants, but the cushion habit is quite masked through their growing one into the other, and thus making a close turf. On Mount Anglem this cushion-turf is not such a feature as on Table Hill and Mount Rakiahua.

A typical boggy meadow, such as covers nearly all the open ground on the Table Hill Range, consists of a dense mass of plants, the dominant species growing into one another, thus making a kind of turf, springy to the tread, and into which the heel sinks, but which rises back into position. There is a groundwork made of the dominant plants, others entering in according to certain changes in conditions, and then possibly becoming the leading feature. This groundwork consists of pale-green grasslike tufts of *Carpha alpina,* the leaf-apices dead, straw-coloured, and twisted spirally ; close low cushions of *Donatia novae-zelandiae,* the green leaves with bright orange tips, and in very small rosettes pressed together ; *Dracophyllum politum,* much like *Donatia* outwardly, but the leaves more open and tipped with red ; green cushions of *Oreobolus pectinatus ;* and growing through, and mixed with the whole almost everywhere, *Astelia linearis,* and the short, glaucous leaves of *Ehrharta Thomsoni.* At distances of a few feet there project obliquely above the general mass tufts of the rigid, pale-green, and reddish-brown leaves of that most ungrass-like grass *Danthonia pungens.* Where the ground becomes slightly drier the general carpet is dotted everywhere with the silvery cushions of *Celmisia argentea* and *C. linearis* (see Photos Nos. 9 and 30), the former having a greenish tinge. In many places the meadow is marked for acres with the broad shining green leaves, arranged in starry rosettes, of *Senecio scorzonerioides,* which with its large white flower-heads is very showy in December. Frequently there are many plants here and there of the stiff-growing *Aciphylla Traillii.* At times *Celmisia linearis* (see Photo No. 30) makes great silvery patches on the hillside, the individual low cushions merging into one another. Near the subalpine scrub the prostrate form of manuka (*Leptospermum scoparium*) is an important member of the formation, making pale-green patches (Photo No. 16).

The following plants not mentioned above occur more or less frequently in the formation, some being rare, and none usually adding any special feature to the physiognomy : *Veronica buxifolia* var. *prostrata, Phyllachne Colensoi, Hierochloe Fraseri, Senecio bellidioides, Forstera sedifolia* var. *oculata, Prasophyllum Colensoi, Suttonia nummularia, Danthonia semiannularis, Raoulia Goyeni, Aciphylla aromatica, Caltha novae-zelandiae, Gentiana lineata, G. Griesbachii, Euphrasia Dyeri, Celmisia longifolia, Lycopodium fastigiatum,* and *Pentachondra pumila.*

On Mount Anglem the meadow is somewhat drier ; *Celmisia linearis* is absent, and *C. argentea* not usually abundant ; *Bulbinella Gibbsii* is plentiful ; glaucous green mats of *Celmisia Sinclairii* are dotted about ; *Veronica buxifolia* var. *prostrata* is common ; there is no *Senecio scorzonerioides,* but plenty of *S. Lyallii ; Danthonia pungens* is everywhere ; *Schoenus pauciflorus* is not uncommon, and many " scrub islands " give a special aspect to the scene.

Especially interesting is the summit of the highest peak, where on the windward side is an astonishing assemblage of cushion plants, *Raoulia Goyeni* and *Dracophyllum politum* being everywhere, together with large patches of *Danthonia pungens.* Here, too, are plants absent or rare elsewhere on the mountain—*e.g., Veronica Laingii, Blechnum penna marina, Ourisia caespitosa, O. sessiliflora, Helichrysum Loganii*(?), *Hymenanthera dentata* var. *alpina, Polystichum cystotegia, Cardamine heterophylla,* and *Plantago Brownii.* But on the sheltered side of the peak the character of the vegetation altogether changes—the cushion plants are wanting, or, at any rate, no longer dominate, and *Ranunculus Lyallii* and *Senecio Lyallii* become abundant, while *Danthonia pungens* and *D. crassuiscula* give the physiognomic stamp. There are large breadths of *Astelia montana* and a great deal of *Viola filiformis. Veronica Laingii* is also of much greater size.

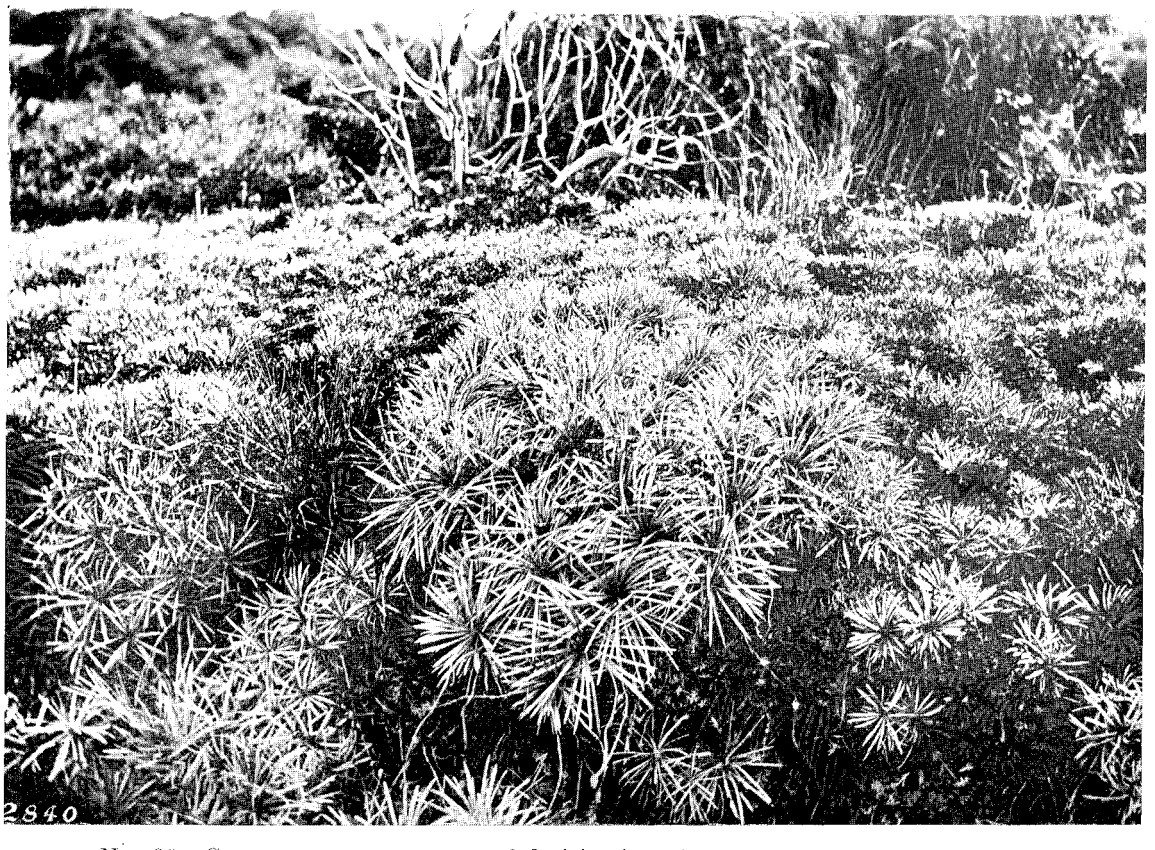
A sheltered gully on Table Hill shows a somewhat similar change. Here tussocks of *Danthonia Raoulii,* a grass absent usually on the Stewart Island mountains, are plentiful, together with *Veronica buxifolia* var. *odora.* The cushion plants no longer crowd together, but form true cushions, and, as usual, there is a turf of *Carpha alpina. Olearia divaricata* is fairly common.

The lower meadows of the same range, above the bush-line, where they occur as openings in the subalpine scrub, the ground being too wet for the latter formation, have much *Gleichenia alpina* and *Hypolaena lateriflora.* They are, in fact, a transition to the bog of the lowland.

* The term "moor" might be more applicable than " meadow," and is used by Warming for the formations of sour soils (55, pp. 193–217). Meadows such as those of the Northern Hemisphere are only known in New Zealand as artificial formations, the result of cultivation. The New Zealand meadows of my ecological writings are in part steppes, in part moors, and in part fell-fields, if Warming's classification be adopted.

No. 29. Typical piece of boggy subalpine meadow of Table Hill. Plants enumerated in text. The grass-tufts projecting semi-vertically are *Danthonia pungens*.

[*Photo., L. Cockayne.*

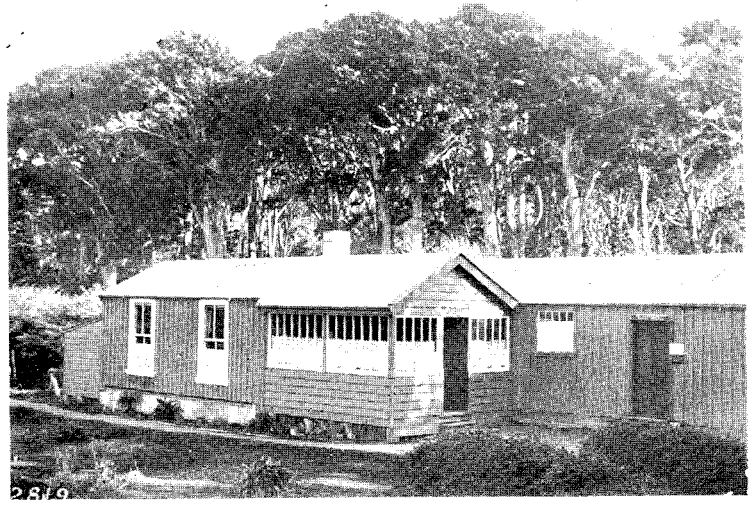


No. 30. Close view of plant of *Celmisia linearis*. Meadow of Table Hill.

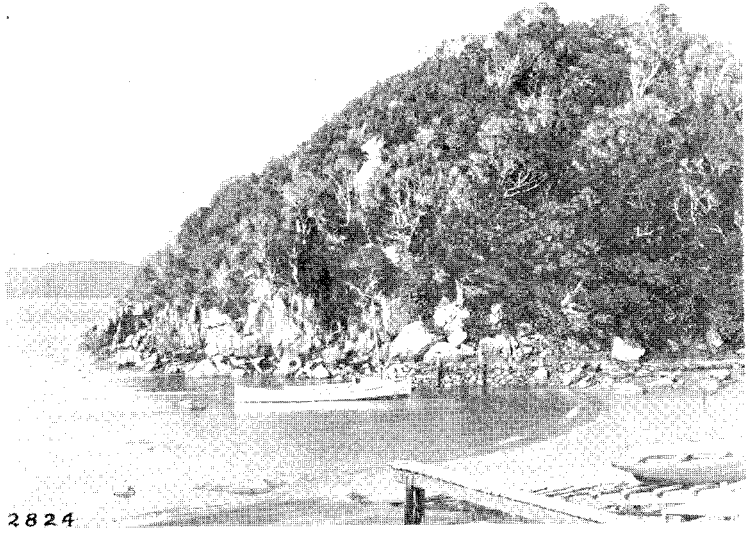
[*Photo., L. Cockayne.*

To face p. 30.]

No. 31. Interior of forest, showing the slender straight trunks of the rimu (*Dacrydium cupressinum*).



No. 32. Mr. Traill's cottage at Ulva. Group of rimus in background.



No. 33. One of the landing-places for the scenic reserve of Ulva. Coastal scrub on headland.

No. 34. Scene in Ulva scenic reserve. The home of the forest-birds.

[Photos. by L. Cockayne.

Colonisation of New Ground.

Where the full force of the wind strikes, the plant-covering may be quite killed, and bare hollows are formed, where water lies after rain. Such are soon repopulated from the neighbouring meadow. First, if wet enough, comes *Liparophyllum Gunnii;* then *Ehrharta Thomsoni* appears, this being followed by *Donatia, Carpha,* and *Dracophyllum politum,* when typical "meadow" is soon reinstated.

5. Bog.

Where shallow water lies all the year round, and alongside water-holes and lagoons, are bogs. Their plants differ little from those of the boggy meadow, *Ehrharta Thomsoni, Donatia novae-zelandiae, Dracophyllum politum, Carpha alpina, Astelia linearis, Oreobolus strictus,* and *O. pectinatus* being common. On the muddy surface subject to frequent submersion are colonies of *Liparophyllum Gunnii,* making dark-green patches, relieved in January by the numerous pretty starlike flowers. *Actinotus novae-zelandiae* is in the wettest parts: it is in full bloom in November. *Drosera stenopetala, D. Arcturi,* and *D. spathulata* are always more or less common.

Where open spaces occur in the subalpine scrub, and water lies, will be an abundance of *Carpha alpina, Lycopodium ramulosum, Gleichenia dicarpa,* creeping *Leptospermum scoparium, Astelia linearis,* and species of *Drosera.*

6. Rock Vegetation.

Almost any of the subalpine plants may be found growing on rocks. This is not because they are specially adapted for such a position, but because masses of peat are readily formed in the mountain climate on flat rock surfaces or in crevices, and because where rain is very frequent the rocks never become too dry for the ordinary bog-xerophytes. Similarly certain true rock plants can also live in bogs.

The following are the only special rock plants: (Filices) *Polypodium pumilum;* (Umbelliferae) *Aciphylla flabellata;* (Compositae) *Raoulia Goyeni* and *Helichrysum grandiceps.*

On Mount Anglem the much broken cliff-face (see Photo No. 11), from the summit to the glacial tarn below, contains a considerable plant-covering; but I had no chance to examine what should be an interesting spot.

The moraine on Mount Anglem, built up of huge blocks of granite (see Photo No. 1), is covered with low subalpine scrub, containing plenty of *Dracophyllum Menziesii* (see Photo No. 7). On the summit, where the wind is felt in all its force, the scrub is reduced to stunted plants, and there is plenty of open space for other growths. Here the great feature is the extraordinary brown cushions everywhere and of all sizes of *Dracophyllum politum,* large globe-shaped examples measuring 20 in. in height and a yard in length and breadth (see Photo No. 13). Very often the wind has blown away the peaty soil from their bases, and nothing remains but the stout, naked branches, betraying the shrubby character of this remarkable growth. Everywhere are the tussocks of *Danthonia crassiuscula* more than 2 ft. tall, the bright-green coriaceous leaves, brown and dead at their extremities, waving in the breeze. *Astelia montana* forms large masses. Growing on the most exposed parts of the moraine are many white hard cushions of the Stewart Island vegetable-sheep (*Raoulia Goyeni*), pressed close to the stones, and held firmly in position by the woody tap root. Growing on or with it is much silvery *Celmisia argentea.*

On Mount Anglem the following were noted on the face of a rock not far from the summit: *Raoulia Goyeni, Helichrysum grandiceps, Dracophyllum politum, Celmisia argentea, Phyllachne Colensoi, Gaultheria antipoda, Senecio Lyallii, S. bellidioides, Poa Colensoi,* and sheets of *Polypodium pumilum.*

On Table Hill the final slope to the summit has the schist rock exposed, and the ground is covered with flat, weathered slabs of stone. In places gravel lies above the slabs. Most of the ordinary boggy meadow plants are present, but not crowded or even touching. The stony slope is silvery and red in places,* owing to the abundance of *Raoulia Goyeni* and *Dracophyllum politum,* and growing through them are the stiff leaves of *Danthonia pungens.*

On rocks on the summit of Table Hill (2,347 ft.) the following were noted: *Abrotanella muscosa* (also on summit of Rakiahua), *Raoulia Goyeni, Danthonia pungens, Celmisia argentea, Aciphylla Traillii, Senecio bellidioides, Colobanthus Billardieri, Drapetes Dieffenbachii, Polypodium pumilum, Gaultheria antipoda,* and *Aciphylla aromatica.* Where soil occurs on the rocks are virtually all the meadow plants; even *Carpha alpina* occurs in the rock-chinks.

The bare steep granite cliffs and smooth rocks of the Frazer Peaks offer only footing for plants in their cracks and crannies. *Aciphylla flabellata* is in every crack in some places, its long roots penetrating far into the rock. Other plants are the two coastal ferns (*Blechnum durum* and *Asplenium obtusatum*), *Celmisia linearis, Leptospermum scoparium, Ehrharta Colensoi, Astelia linearis, Drapetes Dieffenbachii,* and *Dracophyllum politum.*

PART IV.—HISTORY OF THE FLORA.

1. General.

Stewart Island, usually considered as a floral province equal in value to the other provinces, seems to me better included as a well-marked district of the southern floristic province, which latter extends northwards through the South Island of New Zealand to latitude 42° S. With the Stewart Island district must be included Ruapuke, Dog Island, Centre Island, the various mutton-bird islands, and

* In winter so *red* are the mountain meadows that the colour effect of those of Mount Anglem can be seen from the sea.

the Solanders. The Snares probably might be included here also, but for the presence of a more marked subantarctic facies, its special plant formations, and the occurrence of *Poa litorosa*, *Stilbocarpa robusta*,* *Aciphylla acutifolia*, *Colobanthus muscoides*, and *Olearia Lyallii* (if this latter is not identical with *O. Colensoi*). The Snares' flora, indeed, forms a connecting-link between that of Stewart Island and the subantarctic province proper. Also, a plea might be urged for adding the Bluff Peninsula to the Stewart Island district, since its flora and formations have a well-marked Stewart Island stamp (presence of coastal moor, as on Dog and Centre Islands, rimu-kamahi forest, coastal-rock vegetation, presence of *Olearia angustifolia*, and *Myosotis albida*).

The number of species and more or less well-marked varieties of spermophytes and pteridophytes recorded in this report is 491. Of these, only nineteen, of which three are varieties, are endemic to Stewart Island, the remainder, with one or two exceptions, belonging to the southern floristic province outside of the Stewart Island district. One hundred and six of the latter also occur in the subantarctic province.

The affinities of the flora beyond New Zealand are given in detail in Part VII (2). Here we are concerned chiefly with the plants of the southern and subantarctic floristic provinces.

2. Evidence regarding Land-connection with the South Island.

(*a.*) *In favour of Land-connection.*

From the geological side, the evidence of former land-connection with the South Island, Foveaux Strait being dry land, is very strong—the very shallow sea, nowhere deeper than 336 ft., and in places only 72 ft. in the centre of the strait; the numerous granite islands; the affinities of certain rocks to those of western Otago; the drowned river-valleys of Stewart Island; the glaciation of Mount Anglem, probably due to elevation; and zoological evidence brings further proof in the presence, *inter alia*, of certain earthworms and flightless or semiflightless birds identical, or nearly so, with those of the South Island.

When we turn to the botanical evidence,† there is much that is contradictory. Further light is needed on various points—*e.g.*, the plants of southern and western Otago are insufficiently known; we know little as to the means by which certain seeds could travel, or what is their salt-water-resisting capacity. In favour of land-connection is the presence on the mainland of 467 plants out of a total of 491; the rimu-kamahi forest being similar to that of the Bluff Hill, and most closely related to that of part of the Longwood Range; the maritime rock plants being almost identical on both sides of Foxeaux Strait; the coastal scrub, although not quite the same, being very similar to that of the west-coast sounds; the resemblance between the mountain vegetation and that of the Longwood Range; the species being nearly all identical with those of the Southern Alps, while all those formerly thought to be specially characteristic of Stewart Island go far to the north, *Liparophyllum Gunnii* even reaching to the volcanic plateau of the North Island.

(*b.*) *Against Land-connection, or Contradictory.*

If Foveaux Strait had always formed a barrier, there is no doubt but that Stewart Island would have had a fairly rich flora. A large proportion of New Zealand plants are well adapted for bird-carriage, and many others can travel by means of wind. Also there is a powerful current from the north to the west coast of the island, as evidenced by the pumice, logs of *Nothofagus*, &c., cast up on the beach at Mason Bay. Nor can any one now question the extreme efficacy of carriage by sea-currents, wind, and birds with the evidence afforded by Krakatoa, which, at about the same distance as Stewart Island from other land, has during twenty-five years gained a plant-population of 137 species, its surface in 1883 being absolutely barren (see Ernst, 33A).

(*a.*) *Characteristic Genera or Species absent from Stewart Island.*

A further examination of the flora reveals some curious contradictory facts regarding its relationship with the flora of the southern floristic province and the theory of land-connection with the South Island. If one genus more than any other might be expected, had land-connection existed, it would be the subantarctic *Nothofagus*,‡ so abundant on parts of the Longwood Range, and a constituent of the mixed forest of Western Otago; yet it is altogether absent. Also, the following genera or species common in the southern floristic province are wanting: *Hoheria*, *Carmichaelia*, *Sophora*, *Gaya*, *Phyllocladus*, *Hedycarya*, *Podocarpus totara*, *Leptospermum ericoides*, *Melicope*, *Pennantia*, *Oxalis*, and *Pimelea arenaria*.

(*β.*) *Anomalies of Distribution on the Outlying Islands of the Group.*

Further, in order to draw any final conclusions regarding increase or decrease of the Foveaux Strait land-areas, it is necessary to examine the flora of the adjacent small islands—viz., the various mutton-bird islands, Dog Island, Centre Island, the Solanders, and perhaps the Snares, and the Bluff Peninsula (virtually an island) might be added. The result of such an examination is that we find—(1) That the floras of all these are closely related ecologically and floristically to that of Stewart Island; and (2) that the following occur on some of these islands, *but not on Stewart Island itself nor on the mainland of the South Island*: *Senecio Stewartiae* (mutton-bird islands, Snares, and Solanders); *Urtica*

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* *Stilbocarpa robusta* comb. nov. = *Aralia Lyallii* Kirk var. *robusta* Kirk in "Students' Flora," p. 216, 1899.

† Botanical evidence can never be nearly so strong as zoological, since it may always be urged that any special plant might have arrived by wind, bird, or water carriage, &c.

‡ Fig. 250 in Schimper's "Plant Geography" shows a Stewart Island view where the forest is described as "beech forest," the trees so called being really the southern rata (*Metrosideros lucida*), and in the background rimu-kamahi forest.

australis (Dog Island, Centre Island, Auckland Islands, Antipodes Island, and Chatham Island). Of course, both these plants may occur on Stewart Island itself, just as does in one or two spots, easily passed over, the subantarctic grass *Poa foliosa*, a plant of the Auckland, Campbell, Macquarie, Snares, mutton-bird islands, and the Solanders. The important point here is rather the occurrence of the *Urtica* on Dog Island, which is so low that in any general recent depression it would have been submerged, and, with a rising of the land, either have received this plant from Centre Island (twenty-two miles distant), or from some nearer part of the mainland where it is now extinct. But, of course, further research may show the above plant to occur either on the mainland, Stewart Island, or both.

(*c.*) *Attempted Explanation of Some of Foregoing Difficulties.*

Twenty-five years ago, Mr. T. Kirk (Kirk, 55, p. 225) called attention to the absence of some of the plants before mentioned, but attempted no explanation, stating merely, "The absence of many species of general distribution is most remarkable, but in most cases not easy to be accounted for." But more is now known as to the distribution of species and their ecological requirements than when those words were written, and an explanation may be attempted.

Taking, first, the crucial case of the southern beeches (*Nothofagus*), this genus, which is confined to southern South America, Tasmania, eastern Australia, and New Zealand—a characteristic subantarctic genus, in fact—is also absent in the New Zealand subantarctic province, notwithstanding had there been land-connection with South America this would probably have been part of the connecting "bridge," and that the genus lived on the antarctic continent the fossils collected by the Swedish Expedition have proved.* But if we examine the distribution of *Nothofagus* in New Zealand itself we find many wide gaps in its occurrence from its northern to its southern limit. The Otira Valley, in Westland, is quite without an example of the genus, yet it is the sole tree of the vast forests on the east side of the dividing range. In the neighbouring Teremakau Valley *Nothofagus* forms pure colonies, but is not a constituent of the general forest. On the other hand, in the forest of the West Coast Sounds it is mixed abundantly with the taxads. In the southern part of the Longwood Forest it is dominant at high levels, but absent in the lower forest. On the Bluff Hill it does not occur at all, although *N. Menziesii* is found in south-east Otago (Petrie, 73, p. 573).† Bearing facts such as the above in mind, it is quite possible, then, that, land-connection notwithstanding, *Nothofagus* has never occurred on Stewart Island, or, on the other hand, that *it and the other absent genera have been less well-adapted to the Stewart Island conditions than the present commonest members of the vegetation, and so have gradually been wiped out,* or were not able to obtain a firm footing in the first instance.

The great abundance of the yellow-pine (*Dacrydium intermedium*) in the south and west of the island shows how change in soil-conditions (this the result of a different rainfall) can replace one tree-association by another.

The presence of plants in any isolated district, which one would reasonably expect to be common, in only extremely limited numbers, has always seemed to me strong evidence of the gradual disappearance of such owing to some climatic or other change, especially reduction of land-surface, increasing the struggle for existence, and favouring some plant better suited to the conditions (Cockayne, 17A, p. 316). Stewart Island supplies the following additional examples, if we accept at some period a much smaller land-surface than its maximum as demanded by the geological evidence :—

(i.) *Cordyline australis* (the cabbage-tree).—This, the physiognomic plant *par excellence* of lowland New Zealand, is only known at one spot—viz., in the Freshwater Valley, where there are but a few trees. It is quite easy to see that it could not tolerate the forest conditions, and possibly the wind-factor is too powerful, yet it is hard to believe that the plants now present are not the sole survivors of much larger numbers.

(ii.) *Plagianthus betulinus* (the ribbonwood).—This extremely common New Zealand tree would seem well suited for the forest outskirts, and yet there are only known a few trees in the Rakiahua Valley and a tree or two on the south side of Paterson Inlet, near Hapuatuna.

(iii.) *Dacrydium laxifolium* (the pigmy pine).—This common bog and wet-meadow plant of the Southern Alps would be expected as an important constituent of the subalpine boggy meadow formation, and yet it is confined to the ancient dunes of the Rakiahua and Freshwater Valleys.

(iv.) *Olearia ilicifolia* (the native holly) and *O. avicenniaefolia* (the mountain akeake).—Any New Zealand botanist would expect to encounter these, especially the former, in the subalpine scrub, and yet they are absent in that formation, occurring merely as rare lowland plants.

(v.) *Senecio elaeagnifolius*.—This shrub, so abundant in the subalpine scrub of New Zealand generally, although common in that formation on Table Hill, and as a lowland plant on the banks of the Rakiahua River, is absent on Mount Anglem, which is not only the highest mountain, but the nearest to the mainland.

(vi.) *Podocarpus dacrydioides* (the white-pine).—This very common forest-tree, which elsewhere affects the wettest forests, is confined to a few places in the forest near the North Arm of Paterson Inlet, and along the Freshwater Valley. *When in course of time these trees die, a future observer would have no reason to think the species had ever been on the island.*

(vii.) *Podocarpus spicatus* (the black-pine).—This is even a more striking and crucial case than the last. Only a few living specimens are known in Stewart Island of this common tree of the adjacent

* Dusen, P., "Die tertiare Flora der Seymour-Insel"; Wiss. Erg. d. Schwed. Südpol. Exped., 1908.

† Still greater gaps could be shown if the distribution of *Nothofagus* in the northern floristic province were considered.

mainland, and yet fallen trees hundreds of years old, but not yet decayed, are frequent, and such logs are generally embraced by the composite trunk of adult kamahis (*Weinmannia racemosa*).*

(ix.) *Cyathea medullaris* (the black tree-fern).—This is confined to a very limited and narrow strip of land on the east coast, nor is it there abundant.

(x.) *Olearia angustifolia* (the teteaweka) does not occur north of Paterson Inlet, though on the mainland it is found both at the base of the Bluff Hill and Puysegur Point (T. Kirk, 58, p. 265).

(xi.) The curious little Ourisia, *O. modesta*, has only been observed in the Rakiahua Valley, and cannot be very common, yet it grows quite readily when cultivated in ordinary garden soil.

The above facts—and others could be cited—although they do not prove the absent genera or species to have inhabited Stewart Island, point out clearly enough that species may be more or less abundant and become reduced in quantity or eradicated.

It is a hard matter for a species to establish itself in a forest or any closed formation, and it is much more reasonable to conclude that the plants common elsewhere, which are rare in the district considered, are survivors there of formerly abundant individuals rather than newcomers.

The ecological conditions at the present time must not be lost sight of, nor certain facts derived from the study of the formations. The boggy condition of the mountain meadows leaves little room for other alpine plants now absent which cannot tolerate wet or sour ground, while some such are not "alpine" in Stewart Island, but have found suitable conditions in the lowlands—*e.g.*, *Celmisia rigida* (coastal cliffs), *Wahlenbergia saxicola* ("sand-slips" in the dunes), *Olearia ilicifolia* (open ground near coast-line), *Pimelea Lyallii* (dunes), *Geranium sessiliflorum* (dunes), and *Ourisia Colensoi* (river-banks). Also, there is the remarkable yellow-pine association, which clearly shows climatic plus soil effects, its moss cushions partly replacing the filmy ferns of the drier forest.

Proof of a smaller land-surface at a comparatively recent period has already been given in section D, Part I, and it seems to me from the above facts that to this subsidence may be traced the anomalies in the flora under discussion. Species can appear in abundance in the early stages of colonisation, but many must go to the wall as the formations become closed and established. With land-shrinkage species must decrease, whereas they can increase to little extent on an isolated re-expanding land-surface covered already with a close vegetation.

As for the presence of certain characteristic subantarctic plants on the mutton-bird islands, Solanders, &c., it is probable all may yet be found on Stewart Island proper. At any rate, such islands offer very special conditions through their small size, exposure to wind, and presence of sea-birds. Some of their commonest special plants occur also to a limited extent on the coast of the South Island —*e.g.*, *Stilbocarpa, Olearia angustifolia, O. Traillii.*

3. Subantarctic Relationship.

The relationship between the Stewart Island district and the subantarctic province of New Zealand is well marked, but can only be briefly touched on, since, as the facts concern the flora of New Zealand as a whole, and are not peculiar to Stewart Island, the question is too wide for a searching examination here. The number of species common to the two is about 106, most of which, however, occur also in the south floristic province generally.

Without entering into further details, the flora proper of the subantarctic province is probably the remains of a very ancient one which extended over a former extensive land-area (Hooker, 40; Engler, 33), of which the New Zealand biological region and the present antarctic continent are remnants. This flora would, at a later date, during a northern extension of the land, receive its tropical or subtropical element, the climate being then possibly warmer than at the present time.

Subantarctic herbaceous plants are specially adapted to an equable climate, with low summer temperature, little direct sunshine, and a saturated atmosphere. Cushion plants, the persistence of dead leaves, &c., turned and turning into peat, xerophytic contrivances against bog-conditions—these are characteristic of a large percentage of New Zealand alpine plants. Such plants were probably originally lowland (Cockayne, 28), and they can still enjoy lowland conditions equally with alpine. Thus in Stewart Island, in the south part of the South Island of New Zealand (Cockayne, 20), and throughout the whole subantarctic region (Schenck, 75) we see such plants—"alpine" they have hitherto been called (Petrie, 69; Kirk, 55)—at sea-level.

The boggy subalpine meadow of Stewart Island, or boggy ground in the Southern Alps, demands analogous "adaptations" as the lowland *Pleurophyllum* meadow of the Auckland and Campbell Islands, the balsam-bog (*Bolax glebaria*) association of Fuegia, or the *Azorella* formation of Kerguelen Land.

Everywhere, as has been shown for Stewart Island, in its west and south, where forest is naturally or artificially absent, the mountain vegetation of subantarctic plants takes possession (*Gaimardia ciliata, Donatia novae-zelandiae, Dracophyllum politum, D. Pearsoni, Astelia linearis*, &c.), and there is a return to a fragment of the possible primitive plant-covering, but enormously changed through the absence of species long since vanished—*Pleurophyllum*,† *Stilbocarpa, Phyllachne, Donatia, Azorella, Celmisia*, and other curious genera still surviving.

* This is also an excellent example of a radical change in a primitive plant formation apart from any geological movement, and it indicates how species may be eradicated by imperceptible climatic or ecological changes.

† This genus does not extend to Stewart Island.

4. Affinities with the Chatham Islands.

The occurrence of *Suttonia chathamica* at Wilson Bay in abundance, sparingly at the Old Neck, many miles to the north, and perhaps on Ruapuke is very remarkable. Wilson Bay was an old Maori settlement, and a suspicion must arise that perhaps the tree was introduced at no distant date by the Maoris; but, without going into the matter, it seems to me unlikely, and this will be certain if the Stewart Island form differs in any way; but to ascertain this I require better Chatham Island material than is available while writing.* The macrocephalous *Olearias*, *Urtica australis*, the close relationship of *Senecio Stewartiae* with *S. Huntii* (Chatham) and of *Cotula Traillii* with *C. Muelleri* (Chatham) also show affinities between the respective floras.

5. General Conclusions.

To sum up, Stewart Island may have been connected at an early period with the subantarctic islands, the mainland of New Zealand, and perhaps with the Chatham Islands. A comparatively recent depression would sever the connection with the South Island, finally reducing it to a group of islands. This would bring about greater exposure to the wind and a fiercer struggle between the species, in which many—*Nothofagus*, *e.g.*—would go to the wall. Re-expansion of the land-surface owing to its being crowded with plants would not lead to new population. The glaciation of the mountains would also have induced stronger competition between the species, and driven alpine plants to the lowlands; but the presence of such there at the present time may be better explained by the majority of the species not being alpine but subantarctic.† Finally, the presence of man has not, as yet, modified the vegetation to any extent, so that it is truly virgin.

PART V.—REMARKS ON THE BIRD-LIFE OF STEWART ISLAND.

1. General.

Except in the immediate neighbourhood of the settlements, and in certain cases detailed below, the birds of Stewart Island are just as plentiful as they ever were. This pleasing state of affairs arises from the smallness of the population, the difficult nature of the country, the primeval character of the vegetation, and the absence of naturalised ferrets, weasels, and stoats. But the birds are not without their enemies. Wild cats are common in many parts of the lowland regions, and rats—the most deadly enemy of the indigenous birds—are abundant. Also, visitors from the mainland, in wanton so-called "sport," work havoc amongst the sea-birds, shooting them from boats; nor are those of the land unmolested, notwithstanding most are protected by law. Burning the heath and bog vegetation also causes much destruction so far as certain birds are concerned. I would strongly recommend that notices pointing out that shooting birds was illegal be posted up in public places, especially on the wharf. Nearly all native birds are protected, while scenic reserves and areas for preservation of the fauna and flora are sanctuaries.

Regarding the depredations of cats and rats, the island of Ulva furnishes an important object-lesson. This beautiful island, now a scenic reserve (Photos Nos. 32, 33, 34), is well cared for by Mr. Walter Traill, whose dogs allow no cats to exist, and also keep the rats in check, while he himself is able to prevent shooting on the island. The consequence is that certain of the birds—*e.g.*, the bell-bird, now quite wanting in the neighbourhood of settlements—is still extremely abundant.

So far as I know, no list of the birds of Stewart Island has been published. The works of Buller, especially the Supplement (14), as also Hutton and Drummond's popular book (46), contain references to certain species as occurring on the island, but many common birds are not noted. Reischek also furnishes a few details as to the bird-life of Lords River (74), and Black notes twenty species in his report (6, p. 7). For what follows I am indebted to Mr. J. W. Murdoch, who has most generously put at my disposal the information he has gathered for many years, both as a most accurate observer and lover of the birds. Without his assistance I could have published nothing on this head of any moment. The account of the mutton-bird is drawn up from an interview with Mr. Bragg, whose knowledge is first-hand, and derived from having yearly been engaged in "mutton-birding" since as long as he can remember.

2. List of Species and Notes thereon.

The Orange-wattled Crow (Glaucopis cinerea).—This beautiful bird, now extinct in most parts of the South Island, where formerly it was abundant, is plentiful in the country to the south of Paterson Inlet up to the upper limit of the subalpine scrub. The birds always go in pairs, and are never found solitary. Extremely tame, they approach, hopping, to within a few feet of the intruder. Their power of flight is slight, progress being made by hopping or by very short flights. Unaided, the species could hardly have reached Stewart Island had Foveaux Strait always existed.

The Fern-bird (Bowdleria fulva *Roth.*).—Perhaps this identification is wrong, and the Stewart Island species may be the extremely closely related *B. punctata*. The bird in question is found chiefly on the low-lying open boggy or swampy ground, but I have seen it in the low forest near the Freshwater River, where, early in October, it was probably nesting amongst the low shrubs. Although still present

* I would unhesitatingly declare the two forms distinct, were it not for the fact of the leaf-variation according to change of environment as detailed in Part II.

† There is no relation between the low altitude of the alpine plants in Stewart Island and a severe climate, as originally suggested by Petrie (69, p. 325)—*i.e.*, if by "severe" extremely cold was meant. On the contrary, the winter climate is comparatively warm, as already shown.

by hundreds, they are gradually becoming fewer, owing to destruction by fires and cats. They are of extremely feeble flight, flying a few yards, then hopping amongst the tangle of the alpine umbrella-fern or low shrubs, and again making a short flight. If pursued they try to escape in the same manner, but are very soon exhausted, and may then be caught by hand. This bird also could hardly have crossed Foveaux Strait.

The Yellow-breasted Tit (Petroica macrocephala *Gmel.*).—This lively little bird, so easily recognised by its black head and back and bright-yellow breast, is met with everywhere in the forest, digging in the ground for food, but never scraping with its feet. It appears to be confined to the lower forest, not ascending to the subalpine scrub. Happily it is not averse to civilisation, and is quite at home amongst the bushes near the settlers' dwellings. The female is of dingier colour than the male. It frequently nests in holes or depressions of trees, especially of the broadleaf (*Griselinia littoralis*).

The South Island Robin (Miro albifrons *Gmel.*).—This most friendly and tamest of birds, now so rare in the South Island, is still plentiful in the virgin forests of Stewart Island, *but has altogether left the settlements*. It ascends to the highest portions of the forests, and is especially abundant in the neighbourhood of Port Pegasus. At one time it was a very common bird, but unhappily it falls an easy prey to cats.

The Pied Fantail (Rhipidura flabellifera *Gmel.*).—This sprightly little bird, darting with wide-expanded tail hither and thither in fantastic aerial dance, pursuing sandflies and such small game, is not merely a common sight in the forest everywhere, but it is quite at home in gardens and even round houses. Its nests are not uncommon in low shrubs on the forest's outskirts.

The Black Fantail (Rhipidura fuliginosa *Sparrm.*).—Although a common species in the South Island, this bird is quite rare in Stewart Island. I was fortunate, then, to observe one in the lowland forest, which Mr. Murdoch told me was the first he had seen for two years.

The Native Canary (Clitonyx ochrocephala *Gmel.*).—This is fairly common, flocks of six to twelve or more being met with in the higher forest or subalpine scrub, but never coming to the lower country. They flit busily about on the branches of the shrubs in search of insects, chirping noisily the while.

The Brown Creeper (Finschia novae-zealandiae *Hutton*).—These birds go together in flocks, never alone. They are abundant in the Port Pegasus forest and on Ulva. They are especially plentiful in the subalpine scrub.

The Bell-bird (Anthornis melanura *Sparrm.*).—From the North and South Islands alike comes the alas too-true lament that this bird is fast vanishing. Indeed, in most districts where formerly its sweet song made glad the silent forest it is gone for ever. But in Stewart Island it is still plentiful, though close to the settlements it is absent. It is to be seen everywhere in the forests, but is most abundant in the upper forest and the subalpine scrub, where it is still the most common bird.

The Tui (Prosthemadera novae-zealandiae *Gmel.*).—The tui is the commonest land-bird of the island. During my last visit there was no portion of the forest but I heard its song. Dozens of birds, too, were in every orchard in October sipping the honey from the fruit-tree blossoms. It is present in the higher as well as the lower forest, and is to be encountered in the manuka belt and the subalpine scrub.

The Wax-eye (Zosterops caerulescens *Latham*).—Although this is one of the few birds not decreasing in numbers in New Zealand generally, it is not at all common in Stewart Island, and is most frequent in the winter months. It is found chiefly round the settlements.

The Ground-lark or Pippit (Anthus novae-zealandiae *Gmel.*).—Where the ground is open, as in the valley leading to Mason Bay, or on the boggy flat near the Frazer Peaks, one is sure to be frequently preceded by this lively but rather sombrely attired bird, with its greyish-brown plumage and white breast spotted with brown, running along the ground a few yards ahead, and rarely taking to the wing. Its nest amongst the grass or fern is not hard to find if the startled bird darts forth.

The Rifleman (Acanthidositta chloris *Sparrm*).—This, the smallest of our birds, is to be found in forest-gullies busily running up the tree-trunks searching for insects in the cracks and crannies of the bark. It is particularly common in the Port Pegasus forests, but is never found near a settlement.

The Kingfisher (Halcyon vagans *Lesson*).—The kingfisher is common along the shores of the inlets, and may be very often seen seated on a projecting branch of the mutton-bird scrub. It builds in hollow trees.

The Shining Cuckoo (Chalcococcyx lucidus *Gmel.*). — This migratory bird appears in Stewart Island about the middle of October, and stays but a very short time, leaving towards the end of December.

The Long-tailed Cuckoo (Urodynamis taitensis *Sparrm.*).—The long-tailed cuckoo does not appear before the end of November, and leaves again at the end of February.

The Morepork (Ninox novae-zealandiae *Gmel.*).—This little owl is extremely common, and its curious cry is, as on the mainland, one of the most familiar sounds of the night when camped out in the forest.

The Kaka (Nestor meridionalis *Gmel.*).—The kaka is abundant in all the forests of the island, and even comes close to the settlements for food, in which case large numbers are shot. They go about in threes or more. Their nests are in hollow trees, and they lay about five eggs.

The Red-headed Parrakeet (Cyanorhampus novae-zealandiae *Sparrm.*).—This bird is not at all plentiful, but is most abundant in the upper forest. They go about in pairs, not in flocks, and build in hollow trees.

The Yellow-fronted Parrakeet (Cyanorhampus auriceps *Kuhl.*).—This, although more plentiful than the red-fronted species, is not abundant. It is most common near Port Pegasus.

The Kakapo (Stringops habrophilus *Gray*).—It is probable that the kakapo is to be found at the south end of the island. Mr. Ford's dog is said to have killed one at Pegasus which is reported to have been extremely large, and bigger than those seen by Mr. Ford* in the South Island, at Preservation Inlet.

The Bush Hawk (Nesierax australis *Homb. and Jacq.*).—This small but fierce hawk is fairly common, and visits the settlements at times.

The Harrier (Circus Gouldii *Bonap.*).—This hawk is found in the open country. It is far from common. It makes its nest in the swamps.

The Wood-pigeon (Hemiphaga novae-zealandiae *Gmel.*).—This, perhaps the most beautiful of New Zealand birds, is very plentiful, the miro trees being a favourite haunt, but its presence in general is correlated with the fruiting of different trees and shrubs.

The Stewart Island Weka (Ocydromus Scotti *O. Grant*).—All over the island, on the mountain meadows, the low ground, or the shore of the inlets, is this very friendly bird to be found. Buller describes the weka as "semi-nocturnal," but every day I met more than one, and in the North and South Islands have constantly seen them in the daytime. All the same, they become very active towards dusk, at which time especially their cry can be heard. They frequently make their nests under the *Gahnia* tussocks in the forest or subalpine scrub, and lay about six eggs. The old bird feeds the chickens, calling them up as does a domestic fowl, and breaking for them any piece of hard food with her strong beak, using it after the manner of a pickaxe.

The Pukeko (Porphyrio melanotus *Temm.*).—The pukeko occupies the swampy ground in the Freshwater Valley and Mason Bay, but it is not in great numbers.

The White Heron (Herodias timoriensis *Cuvier*).—Not long ago a pair of these beautiful birds lived at Port Pegasus, but now only one remains, which may be frequently seen near the freezing-works. Probably, as elsewhere in New Zealand, the white heron was never very abundant. It would be an excellent thing to reintroduce the white heron into New Zealand, and Stewart Island is admirably suitable for the experiment. The bird is plentiful in many parts of the world, being a native of Australia, India, Ceylon, Malaya, &c.; and its reinstatement, if successful, would add an additional attraction to the Dominion.

The Blue Heron (Demiegretta sacra *Gmel.*).—The blue heron may be occasionally seen standing on some point of vantage on the rocky shore of Port Pegasus or Paterson Inlet, but at the present time it is a very rare bird.

The Bittern (Botaurus poeciloptilus *Wagler*).—The haunt of the bittern is amongst the sedges of the open swampy ground in the Rakiahua and Freshwater Valleys. It is fairly common.

The Godwit (Limosa novae-zealandiae *Gray*).—This migratory bird, known in Stewart Island as the snipe, returns from its long journey from the far north in September and October. It is more than probable that numbers do not migrate, but remain for the winter.† They are only to be found at Paterson Inlet, where they feed at low-water on the mud-flats at its head, flying in a great flock up or down the inlet at the turn of the tide. On a windy day the flight of the godwit flock is remarkable enough. At first there may be a long, thin, undulating, black line high overhead, not unlike the tail of a huge kite; but this, kaleidoscope-like, constantly changes in appearance, occasionally breaking up into the constituent black dots of which it is composed, but which, high above, look like a swarm of flies or bees rather than birds.

The Redbill (Haematopus longirostris *Vieill.*).—The redbill, or pied oyster-catcher, is found in the same localities as the following species, but is a comparatively rare bird.

The Redbill, or Black Oyster-catcher (Haematopus unicolor *Wayl.*).—This is abundant on all the beaches of Stewart Island. Numbers of these birds may always be seen on the sandy shore of Mason Bay. There, at the end of November, they nest on the dunes.

The Dottrel (Ochthodromus obscurus *Gmel.*).—The dottrel is plentiful on beaches and also on the mountain-tops, where, as on the Table Hill Range, it nests in November in depressions of the peaty ground.

The Banded Dottrel (Ochthodromus bicinctus *Jard. and Selb.*).—This species, which is not so plentiful as the last noted, may be seen at Mason Bay, where it runs along the shore in front of the observer.

The Sea-hawk (Megalestris antarctica *Less.*).—The sea-hawk is common on all the western beaches, but it may be occasionally seen on the east coast. It is very frequent at Mason Bay, making a nest of a few straws upon the dunes, in the shelter of the pingao (*Scirpus frondosus*).

The Swallow-tailed Tern (Sterna vittata *Gmel.*).—This tern is common. It breeds during November and December, laying its eggs right on the bare rock of small islands in the inlets.

The Black-backed Gull (Larus dominicanus *Licht.*).—This well-known bird is to be met with on every shore. It breeds at Mason Bay, laying its eggs beneath the pingao (*Scirpus frondosus*) tufts, on the summits of the highest dunes.

The Mackerel Gull (Larus scopulinus *Gray*).—This charming little bird is everywhere on the coast. No sooner is a boat anchored than numbers perch upon its bowsprit or bulwarks. It nests on outlying rocks.

The Mutton-bird (Puffinus griseus *Gmel.*).—This petrel, familiarly known as mutton-bird, is of special importance to Stewart Island, since on its presence depends an industry of some moment, and one, moreover, capable of considerable development. The adult bird is brownish-black in colour, but lighter beneath, and the under wing-coverts are white. The bill is bluish-white, and so are the wings and feet. The average size is about 17 in. from the apex of the bill to the tip of the tail, and the fully expanded wings measure about 12 in.

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* A resident at Port Pegasus.

† Mr. J. Drummond in his notes "In Touch with Nature," *Lyttelton Times*, 21st November, 1908, brings a good deal of evidence favouring this view.

Although mutton-birds are to be found in enormous numbers on all the outlying islands of the Stewart Island group, and which in consequence are called collectively "mutton-bird islands," they are not there all the year round, but migrate at a certain season to the north of New Zealand, where they are to be seen in the winter, few, if any, remaining in the south.

On about the 25th September the great mutton-bird army arrives, flocks of hundreds of thousands darkening the sky. The first procedure of the newly arrived birds is to clean out the old nests. Holes which have been partly filled up by the falling peat are opened out; those too wet are extended into drier ground by side-channels, and a hole thus may have three or four branches. The depth of the nesting-holes depends upon that of the soil overlying the rock. At any rate, they are never very deep, since their direction is not vertical, but, after descending for some inches, pass horizontally, branching in various directions. In this manner the peaty ground becomes quite honeycombed with these subterranean passages. The holes cleaned out, they are next lined with the dead leaves of the puheritaiko (*Senecio rotundifolius*), but the nest is quite a rough one at best. The birds do not appear to use any hole indiscriminately, but return to the same year by year. Thus, Mr. Bragg states how in one particular hole he found during four successive years a white nestling, the usual colour being sooty black. This discovery is also interesting, as possibly showing an origin by mutation of a new race, or at any rate a remarkably distinct and sudden variation. While cleaning out the holes and making the nests the birds go without food, both sexes taking a share in the work; but, the nests once finished, the birds sally forth to the sea, catching fish until about the 25th November. On or about this day each bird lays its one large, white, semi-transparent egg, the birds as a whole laying at nearly the same time.* If any birds are delayed by the wind their eggs are dropped into the sea, and thus there appears to be some connection between the weather and the abundance, or the contrary, of the mutton-bird harvest. Also, if food is scarce, the "season" will be a bad one.

The birds feed on small crustaceans and fish, especially such as are oily. Shark's liver is much relished, and they will bolt huge lumps until they can hardly fly.

On the 25th December, or thereabouts, the egg is hatched. At first the young bird is a mere ball of down, and absolutely helpless. It remains in the nest until about the 1st April, still a fluffy ball of down, but with feathers beneath, its bones quite soft, and body enormously fat. This latter condition of affairs arises from the constant attention of the parent-bird, who has supplied it with very great quantities of food, going right into the hole and vomiting the much broken-up morsels into the young one's mouth. The nest is, however, kept absolutely clean, and no trace of food is left upon the ground.

The food consists for the most part of fish, but occasionally the meat of a dead whale may be utilised. In each nest there is but one bird.

About the middle of April the old bird ceases to feed the young one, which, gradually losing its excessive fat in consequence, becomes vigorous, and, leaving the nest in the night-time, essays to fly, flaps its wings awkwardly, gets on a stone, stump, or other point of vantage, flops aimlessly off, and performs many curious antics. It is at this stage that the best birds may be caught, as previously they would be altogether too fat.

With the cessation of the feeding the old birds migrate northwards, the young ones following as soon as they are able to fly. At about the end of May, thousands upon thousands of mutton-birds may be seen going northwards at many parts of the New Zealand coast. About six months are spent in the north and six in the south. At the same time, it must be borne in mind that certain birds remain always in the north, nesting being recorded from Kapiti Island, Karewa, Rurima Rocks, and Whale Island (Buller, 14). Buller records how he saw great flocks preceeding *southwards* from the neighbourhood of Timaru in the month of April, but these would probably be Stewart Island birds returning from a northern expedition in search of food.

Long before the northern migration of the young birds the Maori owners of the islands have been busy. At the present time the various "mutton-bird islands" are claimed by different Maori families, and thither, during April, does the whole Native population of Stewart Island and Ruapuke—men, women, and children—go, living on these small and gale-swept dots upon the ocean until about the 14th or 16th of May. The first batch of birds caught are too fat for the fastidious southern palate, and they are all sent north, where they are much prized by the northern Maoris.

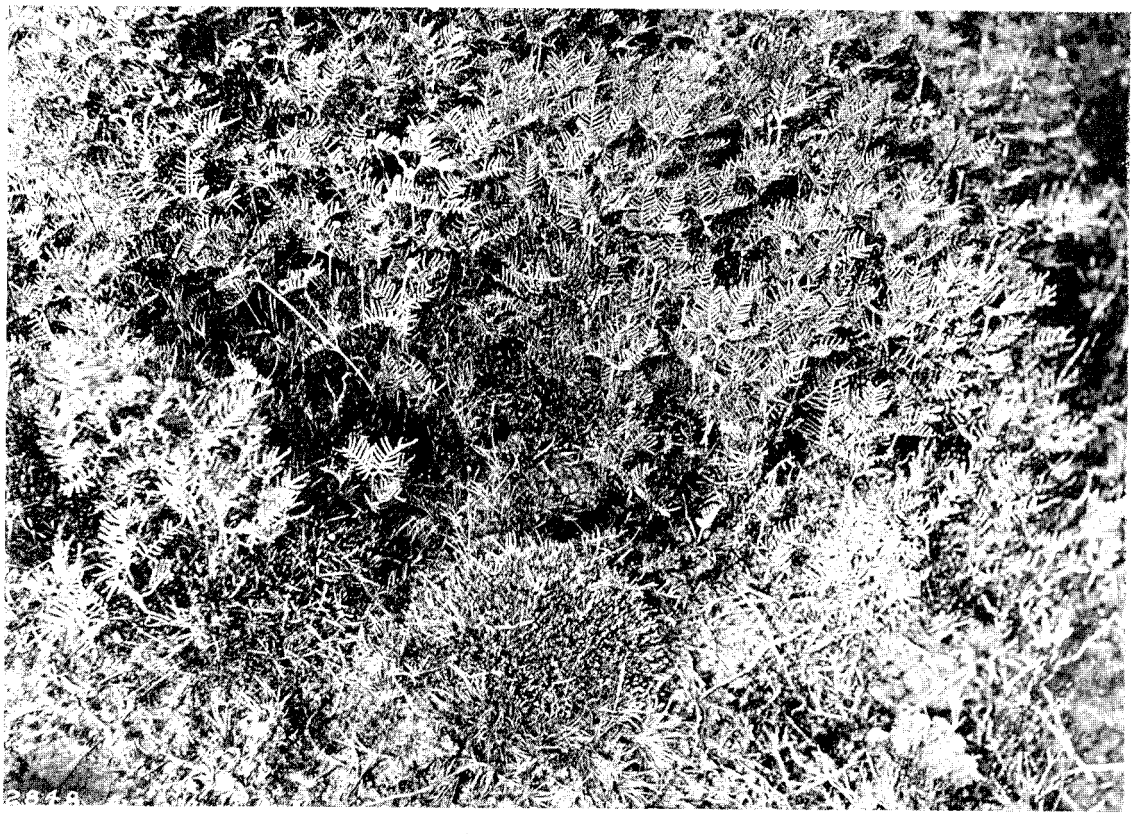
It is when the young birds come forth at night-time that the special slaughter begins. Torches have been prepared two or three days in advance. These are made of dry totara bark,† tied with strips of *Phormium*, and quite saturated with the mutton-bird oil. They give sufficient light, and defy the constant gusts of wind. The young birds are easily caught, and are killed by breaking their skulls with the blow of a stick. Formerly the killing was done by the old Maoris with their teeth. During the daytime, too, in the earlier part of the season, the birds are captured in their holes, the arm being thrust in at times up to the shoulder.

After killing, the birds are plucked. First, the feathers are pulled out; but under these is much down, which is taken off by dipping the bird for an instant into boiling water, and then removing it with the hand. They are next hung up for a night in the open air so as to make the flesh firm, the birds being tied in strings and slung over a rail. Next day the wings, legs, and neck are cut off, and the bird split open, cleaned, and well rubbed with dry salt. The birds are then packed into casks, and stand thus in the salt for one day. Finally, they are removed from the casks and packed into bags made of the great bull-kelp (*Durvillaea utilis*) (Photo No. 35). These bags are made by splitting

* My informant insisted that all the birds lay exactly on the same day, but I have taken the liberty of modifying this statement, which, of necessity, cannot be proved, and seems most unlikely. But there is probably little doubt that a general egg-laying does take place at a certain well-defined period.

† It may be remembered it is the thin-barked totara (*Podocarpus Hallii*) which grows on Stewart Island, and not he thick-barked (*P. totara*), whose bark would not be so suitable.

No. 35. The bull-kelp (*Durvillea utilis*) at low water. Dog Island.
[*Photo., L. Cockayne.*



No. 36. Lowland-bog vegetation. *Gleichenia alpina* 1 ft. tall. In centre of foreground, cushion of *Gaimardia ciliata* more than ½ ft. in diameter. Rakiahua Valley.
[*Photo., L. Cockayne.*

To face p. 58.]

No. 37. Interior of forest; trunks of rimu (*Dacrydium cupressinum*) in centre.
[*Photo., L. Cockayne.*

No. 38. *Stilbocarpa Lyallii* growing amongst rocks, Ruapuke Island. Inflorescence dimly seen hidden by leaves in foreground.
[*Photo., L. Cockayne.*

the " leaves " longitudinally, beginning at the narrow end, the margins of the " leaf " remaining intact. Such a bag may be 4 ft. in length by 2 ft. in width, but they are made of all sizes, and hold from 25 to 125 birds. Finally, each bag is put into a flax (*Phormium*) basket, and held in position by tightly packed totara bark. Such a bag of mutton-birds will keep fresh for twelve months.

The salting method just described is a modern one. The ancient Maoris put a slit in the neck, and dissected the flesh from the skeleton. The boned birds were then boiled in fat, which was poured in the kelp bags round the birds. This method is still practised to some extent to supply special orders, but is no longer general.

Wholesale, the birds are worth about 5d. each. They are much esteemed by the Maoris, and many Europeans consider them a delicacy. Their chief drawback as a food is the large amount of fat which renders them not easy of digestion for many.

More than a hundred thousand birds are annually caught in the Stewart Island group, and this is certainly a low estimate. There is no falling-off in the supply, since it is quite impossible to catch all the young ones; moreover, the birds are in millions. The sea-hawks do not prey on the nestlings, but rats, originally brought by the boats, work a great deal of damage.

The young birds, as stated before, are enormously fat, a bird containing in its interior a lump of solid fat as large as the closed fist. This is removed, but it is not wasted, being sold to soapworks, &c., and used for various purposes, making, *e.g.*, a fairly good lubricating oil.

From the above account it may be seen that the mutton-bird industry is capable of great development with improved methods, the supply of birds being practically inexhaustible, while certain islands teeming with birds are as yet unexploited.

The Nelly (Ossifraga gigantea *Gmel.*).—This bird nests on an island near Fright Cove, Port Pegasus, in December.

The Mollymawk (Thalassarche melanophrys).—This magnificent bird is in abundance near the coast, but does not breed on any part of the Stewart Island group.

The Blue Penguin (Eudyptula minor *Forst.*).—A colony of these birds makes itself evident by the fearful noise made by them at night. They build in holes under ratas near the shore, and are plentiful in many parts of the island.

The Yellow-eyed Penguin (Megadyptes antipodum *Homb. and Jacq.*).—Rookeries of these occur on the east coast—*e.g.*, at Lord's River (Reischek, 74). At sundown they come ashore in considerable numbers.

The Gannet (Sula serrator *Gray*).—The gannet is never seen in fine weather, but during storms comes occasionally into Paterson Inlet.

The Pied Shag (Phalacrocorax varius *Gmel.*).—Rookeries of this shag are to be found in Paterson Inlet. The nest is placed in rata boughs overhanging the water, and is made out of dried twigs laced together (Buller, 14, p. 24).

The Frilled Shag (P. melanoleucus *Vieillot*).—This is given on the authority of Buller (14).

The Spotted Shag (P. punctatus *Sparrm.*).

The Pink-footed Shag (P. chalconotus *Gray*).—To be seen in Paterson Inlet and Port Pegasus. Also recorded by Buller.

The Stewart Island Shag (P. Huttoni).—This is the common shag or cormorant of the island. Its black shining back, white breast, white band on the wings, crested head, and flesh-coloured legs and feet render it conspicuous. Very frequently it is to be seen standing on some bare rock. It is common all round the island and in the inlets. The nests are placed in the rata-trees, a dozen or more near one another, and built of sticks. Whatever damage the shags as a whole may do on the mainland, they are quite harmless in Stewart Island, and there might well be included in the list of protected birds. It is no " sport " to take pot-shots at a bird standing motionless on a rock a few yards away.

The Paradise Duck (Casarca variegata *Gmel.*).—A few paradise ducks are to be seen in the vicinity of Mason Bay and the mouth of the Freshwater River (Reischek noted them also at Lord's River), but they were never common in Stewart Island. They nest about Christmas time on the tops of the hills.

The Grey Duck (Anas superciliosa *Gmel.*).—Flocks of grey ducks are common at the head of Paterson Inlet, the Rakiahua River, and the rivers of the east coast. They build in the swamps amongst the *Leptocarpus*.

The Black Teal (Fuligula novae-zealandiae *Gmel.*).—This extremely tame little bird swims up the rivers, but does not come into the salt or brackish water like the grey duck. It is gradually getting scarcer, as its tameness leads to its illegal destruction *all the year round.** It nests in grasses or sedges near the river-banks.

The Stewart Island Kiwi (Apteryx Lawryi *Rothsch.*).—This is the largest of the kiwis. It belongs to the spotted section of the genus. Its distribution in Stewart Island is remarkable, *it being found only to the south of the Freshwater River and Paterson Inlet*, coming east as far as Big Glory Harbour, and thence right to the sea on both coasts, and ascending to the mountain-tops. Fortunately, the Stewart Island kiwi is still very abundant. Being nocturnal birds they are not readily seen, but their mark—a funnel-shaped hole where they dig for worms—is very common. They nest under ratas, in hollow logs, and so on. The young ones appear about April. Mr. Marklund, then collector for Sir Walter Buller, describes how they make well-beaten tracks half a mile in length from the lower to the higher country (14). Worms are the principal food, but the " seeds " of *Gahnia procera* are also eaten, and thus the kiwi will undoubtedly assist the spreading of this plant.

* Of course, on the scenic and natural history reserves it is illegal to kill it at any time.

PART VI.—THE FUTURE OF STEWART ISLAND.

1. Agricultural Capabilities.

The agricultural statistics for the Dominion give a clear idea of the present position of Stewart Island with regard to farming. Thus, so far as domestic animals are concerned, there are merely 6 horses, 24 pigs, 264 cattle, and 1,492 sheep. Similarly, the agricultural plant-covering consists of 68 acres of pasture (laid down), 557 acres of surface-sown land, 1 acre of corn crop, 7 acres of green crops, 19 acres of gardens, orchards, and plantations, and 23,486 acres of unimproved grass land. If the latter be taken into account, the amount of stock seems ridiculously small, but a considerable part of the so-called grass land—perhaps one-half—is occupied by bogs, swamps, heath, and dunes, the vegetation of which is worthless; while on the other part the plants available for "feed" certainly do not form more than one-fourth of the plant-covering. The only farms—and these are but of a few acres, the land being frequently only partially cleared—are in the neighbourhood of Half-moon Bay, the adjacent shores of Paterson Inlet, and the Neck, the latter more especially feeding the greater portion of the sheep. Were the Mason Bay run occupied, the number of sheep would be greater, but the total which could be carried under present conditions would be trifling for an island of more than 425,000 acres.

However, it is not the present condition of affairs which concerns us here, but rather the question as to the value of the island as a whole and in the future for farming purposes. To this the preceding botanical part of the report furnishes a clear answer. There it has been shown that the present soil and climatic conditions have clothed the mountains above the forest-line—the part, indeed, of much moment to the sheep-farmer in the Southern Alps—with an absolutely worthless vegetation from the grazing standpoint. Furthermore, the ecological conditions which favour such a vegetation are altogether antagonistic to the growth of pasture plants. Even were the land to be drained and the subalpine scrub burned, the climate most adverse to stock could not be suppressed. So, too, with the open lands of the lower country, where the alpine umbrella-fern (Photo No. 23) and *Hypolaena lateriflora*, covering acres at a time, testify to the worthlessness of the land, and where the one indigenous grass in any abundance is the red tussock (*Danthonia Raoulii*), a plant rejected by most animals.

The forest lands, then, alone remain for consideration. Those occupied by the yellow-pine (*Dacrydium intermedium*) may be at once ruled out of court, and that eliminates much of the country to the south of Paterson Inlet, except just along the east coast. There then only remains the rimu-kamahi forest. When this is removed, economic grasses (see list of introduced plants) and various crops —*e.g.*, potatoes—may be grown successfully, and gardens or orchards established. But the expense of reclaiming the land is very great. The forest when cut down and burnt re-establishes itself, as already shown, most quickly and vigorously, and for years there must be a constant struggle with the rejuvenating forest before the land can be successfully grassed. Undoubtedly the forest can be finally converted into good meadow land, but it seems to me the cost is too great to justify the outlay at the present time. Nor have I mentioned at all the broken nature of the country, its deep gullies and steep slopes, matters much affecting the value of agricultural land. However, as New Zealand becomes more populated, the more difficult lands will be conquered, and then much of north-east Stewart Island will be turned into dairy farms, since its climate will be suitable for grazing and not for cropping. Had the land been adapted for farming it would have been occupied long ago, the cheap water carriage and excellent harbours being most favourable for the development of the island, as pointed out by Mr. W. H. Pearson (68, p. 5). Finally, it may be interesting to quote the opinion of Mr. T. Heale, Chief Surveyor of Southland, as published in the *New Zealand Gazette* so long ago as the 25th March, 1864: "On the whole, it is impossible to resist the conclusion that the colonisation of Stewart's Island presents very great difficulties and drawbacks. It will ultimately, I have no doubt, form a very important and valuable part of the colony, but so much labour will be required to be expended before any portion can be made available that it would be quite idle to attempt to people it by the same means as are applicable to the level, accessible, and well-grassed plains of Southland."

2. Sawmilling.

Although nearly the whole of Stewart Island is forest-clad, a comparatively small portion of the forests is suitable for sawmilling purposes. This arises from the fact of there being two types of forest, of the rapid decrease in size of the rimu with altitude, and of the greater abundance of the kamahi in many places. Still, especially in the north-east of the island, there is much fine forest, with an abundance of rimu (Photo No. 37), which could easily be shipped from certain of the bays on the east coast. This water carriage is very favourable for the industry. The trees are never of the great dimensions of those of the mainland, and the "plant" required is naturally not so expensive as when dealing with logs of the largest size.

One point to be considered is the value to New Zealand as a whole of the forests of Stewart Island from the scenic point of view—*i.e.*, whether it is more profitable on a purely cash basis to convert them into timber or to let them stand. This is discussed further on; here it need only be said that even from the scenic point of view there can be no harm done by removing the timber from any part of the island *where the scenery of the inlets will not be changed by so doing*. The forests of the Freshwater Valley along the Mason Bay track, and from the northern shores of Paterson Inlet to the Mount Anglem Range, *leaving the shores of the inlet undisturbed*, might be advantageously cut down, and the country finally turned, if practicable, into grazing-land.

3. Stewart Island as a Watering-place.

(*a.*) *General.*

The capabilities of Stewart Island as a pleasure and health resort can hardly be overestimated. That it will eventually be celebrated, not only in New Zealand, but throughout Australasia, is certain.

Even at the present time hundreds visit the island during the summer months, notwithstanding the inadequate means of transport over Foveaux Strait, and the available accommodation is taxed to excess. Boating, excellent fishing, bathing, picnics under the most delightful surroundings, scenery of the highest character, walks through unspoiled forest full of ferns, with glimpses of sea (Photo No. 42) or mountain through the greenery, and, for the more ambitious, mountain-climbs or yachting on the actual ocean—these are amongst the attractions at present offered. Within a mile's radius of Half-moon Bay as a centre a dozen easy walks may be taken, each different, and all equally delightful (see Frontispiece). The beautiful islet of Ulva is distant by boat some half-hour; a good path traverses it from end to end, and the visitor passes through a perfect piece of virgin forest (Photo No. 34).

And this brings me to that feature which gives the island its special and perhaps some day unique value. The face of the earth is changing so rapidly that soon, in temperate regions at any rate, there will be little of primitive Nature left. In the Old World it is practically gone for ever. Here, then, is Stewart Island's prime advantage, and one hard to overestimate. *It is an actual piece of the primeval world.*

(*b.*) *The Scenery of Stewart Island* (*Rakiura, the Land of Heavenly Glows*). (See Photo No. 42.)

It is hard to speak of the scenery of Stewart Island without using a superabundance of superlatives. There is, indeed, no part but is delightful, and in many spots it is unsurpassed by the best that New Zealand as a whole can offer. Paterson Inlet and Port Pegasus, with their numerous wooded islets (Photos Nos. 40 and 41), deep or shallow indentations, and hidden nooks, present ever-changing pictures. Caerhowel Arm, piercing almost to the centre of the island, is wonderfully beautiful. At first a couple of miles or less in width, the hills on either side rising steeply for 1,000 ft., and covered with a close forest of varied greens, it gradually narrows as its head is approached, the mountains increasing in height. Then the calm waters of the Rakiahua River are gained, which, winding through the forest, unfold new beauties at each bend, the banks adorned with tall shrubs of many kinds, their leaves glittering in the sunshine, while forest, shrubbery, and the neighbouring mountains are perfectly mirrored in the dark waters, unruffled save where the dainty little teal swims quite fearless of the intruder.

The scenery of Port Pegasus and that of the southern part of the island generally is of a sterner character (see Photo No. 39). This is the veritable "land's end," where naked granite cones pierce the heavens for 1,000 ft., rising from a bleak and barren moorland framed by the evergreen New Zealand forest, here at its most southern outpost, unless we include its grotesque subantarctic continuation on the inhospitable Aucklands.

What variety do the waters themselves show! See them just before sunrise on a calm day—a glistening sheet of slaty blue, bounded by distant hills, indigo in hue, the summits masked by smoke-like cloud. View them in the glowing noontide—the myriad tiny waves aflame with gold. Or watch them lashed in white fury by the western gale.

In contradistinction to the inlets and sheltered bays of the east is Mason Bay, on the west. Here is a fine semicircular sweep of some ten miles of firm sand, terminating at either end in cliffs, and backed by sandhills more than 400 ft. in height. The beauty of the bay is increased by a rugged island in the north, dark in colour, and two islets draped with sage-green foliage close inshore at the southern boundary. But the glory of Mason Bay are the great foam-crested rollers that day after day break upon its strand, for here the southern ocean, unchecked for thousands of miles, strikes from the west with the full power of its might. Nor come the waters altogether empty-handed. Many strange offerings lie upon the glistening sands—the precious and perfume-bearing ambergris, pumice from the volcanic region of the north, curious shells and trees, too, not of Stewart Island. Many sea-birds congregate on this desolate shore, or fly overhead uttering harsh cries (Cockayne, 21).

Space forbids an account of the views from the summits of Mounts Anglem or Rakiahua (the former of great extent), or from the more easily gained Pryce's Peak (reached by boat from Golden Bay in an hour, with another hour or so to the summit),* the scene from which is both extensive and charming.

(*c.*) *Protection of the Fauna and Flora.*

It has been shown that the future of Stewart Island does not depend upon its agricultural capabilities, but upon its value as a pleasure resort, this value arising, indeed, from the general uselessness of the plant-covering as food for stock and the slight value of much of the forests for timber purposes. It has also been shown what a splendid asset to Stewart Island and to the Dominion is the possession of a primeval plant-covering, with its accompanying bird-life, and how this virgin state of the island increases infinitely its value as an attraction to visitors.

The lesson to be learnt therefrom, and which is illustrated by almost every page of this report, is that *the plant-covering should, as far as possible, be kept intact;* that, in fact, the forest as it is and the other plant-associations as they are, are far more valuable from the monetary point of view to the Dominion than if they were destroyed and turned into farms, the value of which would be at best very problematical. This fact the Government has recognised by the gazetting of those parts of the island shown on the map as, on the one hand, scenic reserves, and, on the other, reserves for preservation of the fauna and flora.

It now remains to see that these reserves are kept sacred. No bird should be destroyed within their precincts, no trees should be felled, and fires should be carefully guarded against. On the preserving of these reserves inviolate the prosperity of Stewart Island depends. Certain sanctuaries for plants and animals have now been in existence for several years in New Zealand, but in order to protect them *no one is allowed to visit them.* This gazetting of the large areas in Stewart Island has

* I would strongly recommend that a track be cut to the summit of this hill. The expense would be slight, and a delightful excursion be put easily within reach of every visitor to the island.

virtually created another sanctuary, but here is the difference: *it is one which can be visited*, and where, for all time, if it is religiously guarded, our own people, and visitors from all parts of the world, will be able to see the wonderful plant-life of New Zealand and her unique birds exactly as nature planted the one and provided for the other.

(*d.*) *Introduced Animals.*

Stewart Island is fortunate in not possessing so many species of naturalised foreign animals as are in New Zealand generally. The hare, rabbit,* ferret, stoat, and weasel are absent. On the other hand, the so-called Australian "oppossum" was introduced a few years ago. It is already doing some damage in gardens, and also to the forest plants, especially to the tree-ferns, I am told. Virginia deer have been liberated in the neighbourhood of Port Pegasus, and red-deer in the Freshwater Valley. *Animals, such as the above, which feed on herbaceous plants or shrubs, must bring about changes in the vegetation, altering its character and with that the scenery, and undoing exactly what the setting-aside of so much of the island as a plant and animal sanctuary is designed to effect.* Nor, in this case, can the value of these animals for sport be held as a plea, since the trivial amount of open ground, the dense character of the subalpine scrub (see Photos 8, 26, and 27), and the close forest growth renders Stewart Island *quite unsuitable as a hunting ground.*

The presence of rats and cats, and their effect on the bird-life has already been referred to. The common introduced European birds are plentiful, but they are chiefly in the neighbourhood of settlements and in the more open country, and have not interfered to any extent as yet with the indigenous avifauna.

PART VII.—THE FLORISTIC BOTANY.

A. DESCRIPTIONS, ETC., OF NEW SPECIES, VARIETIES, ETC.

(i.) Uncinia compacta R.Br. var. caespitiformis Kükenthal var. nov.

Rhizoma caespitos densos formans et stolones breves agens. Culmus foliaque rigida. Spicula angusta. Utriculi maturi subpatentes.†

(ii.) Bulbinella Gibbsii Cockayne, sp. nov.

Herba perennis *B. Rossii* similis sed multo minor. Folia ensiformia 12–22 cm. longa, 13–37 mm. lata. Scapus folia superans, 12–30 cm. altus. Racemi haud densi 5–9 cm. longi, pedicellis 1·7 cm. longis, floribus dioicis.

Stewart Island: Bogs and subalpine meadows; abundant.

Much closer to *B. Rossii* than to *B. Hookeri*, but an altogether smaller plant, with much more slender scape, and very much shorter and more open racemes. The perianth segments are shorter in the female than in the male flower.

Mr. G. M. Thomson called attention to this plant in 1881 (79, p. 287), but no reference has been made to it since. He attributed the differences in the blooms to cleistogamy, writing, "On Frazer Peaks, Stewart Island, I found a very stunted form of this species (*Anthericum Hookeri*)‡ tending strongly towards cleistogamy. The flowers were crowded on short rigid scapes, but had their perianth lobes so greatly reduced in size as to give the racemes a pale yellowish-green hue. The stamens were also greatly reduced, but the ovaries were well developed."

(iii.) Astelia subulata Cheeseman comb. nov., M.S.—*A. linearis* var. *β. subulata* Hook. f. in "Flora Antarctica," vol. i, p. 76.

A full description of this species has been prepared by Mr. T. F. Cheeseman, while this report was being written, for his memoir of the systematic botany of the New Zealand subantarctic islands, now in the Press, otherwise I had intended describing it, as I had previously expressed the opinion it was distinct from *A. linearis* (Cockayne, 18).

(iv.) Ranunculus Crosbyi Cockayne, sp. nov., M.S.

I can, unfortunately, give no diagnosis, the living plants growing in my garden having died. The species was only noted at the summit of Table Hill. It is a small plant with radical leaves hairy—so far as I remember, with reddish hairs. The scape is short and 1-flowered. Named after Mr. J. Crosby-Smith, F.L.S., of Invercargill.

(v.) Cardamine heterophylla (Forst. f.) O. E. Schultz, var. uniflora (Hook. f.) comb. nov.—*Cardamine hirsuta* L. var. *uniflora* Hook. f. in Handb. N.Z. Flora, p. 12.

(vi.) Rubus subpauperatus Cockayne, sp. nov.

Frutex scandens ramis gracilibus aculeis rubris aculeatis, foliis ternatis foliolis lineari-lanceolatis petiolis gracilibus aculeatis, paniculis parvis 5 cm. longis floribus dioicis sepalis ovatis pilosis.

South Island: Common throughout. Stewart Island: Forest, Mason Bay; rare.

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* I understand that rabbits were at one time, and perhaps are yet, on Native Island, in Paterson Inlet, where Black (6, p. 3) also records the presence of goats.

† Description written by Pastor G. Kükenthal.

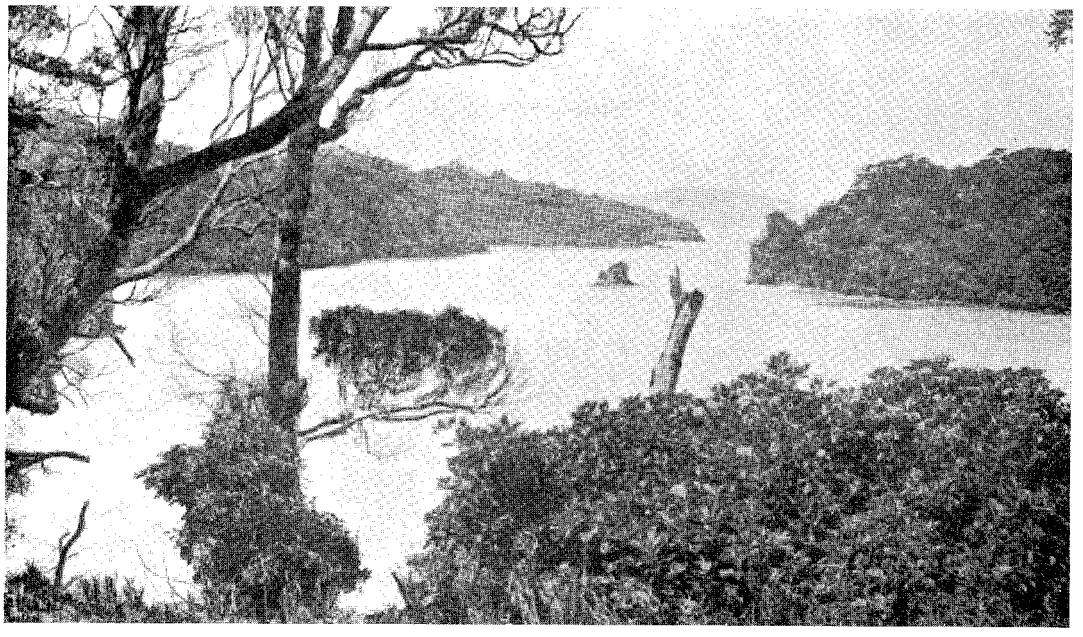
‡ Its former name.

No. 39. Highest peak of Frazer Peaks, south of Stewart Island. Manuka scrub in foreground; on right, scrub of extreme density reproduced after burning.

No. 40. On left, portion of Iona Island, in Paterson Inlet. South side of inlet in distance.

No. 41. A glimpse of the inlet on the Thule Track. The fern on left is *Blechnum capense*.

To face p. 42.] [*Photos. by L. Cockayne.*



No. 42. View of portion of Paterson Inlet.

[*Photo., F. G. Gibbs.*

No. 43. A favourite walk close to Half-moon Bay. The trees mostly kamahi (*Weinmannia racemosa*). Path formed out of tree-fern trunks.

[*Photo., L. Cockayne.*

At first sight easily confounded with *R. cissoides* A. Cunn. var. *pauperatus*, and frequently a companion plant, but distinguished by its prickly stems, those of the last named being unarmed, reddish, not yellowish, prickles, and smaller panicles. Bushes in the open produce flowers, whereas those of *R. cissoides* var. *pauperatus* seldom or never do so.

(vii.) EPILOBIUM NETERIOIDES A. Cunn., var. MINIMUM (T. Kirk), comb. nov.—*E. nummularifolium* var. *minimum*, T. Kirk in " Students' Flora," p. 174.

This very distinct plant is only known from the south coast of the South Island and Stewart Island. It might well be considered a species.

(viii.) GUNNERA ALBOCARPA Cockayne, comb. nov.—*Gunnera monoica* Raoul, var. *albocarpa* T. Kirk in Trans. N.Z. Inst., vol. xxvii, p. 344, 1895.

South Island: West coast, common; Southland. Stewart Island: Common.

This is a very well-marked species, and distinguished at once by the small globose white fruits tipped with the black calyx-lobes. It grows frequently on wet banks dripping with water.

(ix.) NOTHOPANAX PARVUM (Kirk) Cockayne, comb. nov.—*Panax simplex* Forst. f., var. *parvum* T. Kirk in " Students' Flora," p. 217, 1899.

North Island: Waimarino Forest. South Island: West coast. Stewart Island: Yellow-pine association. Nowhere abundant.

Differs from *Nothopanax simplex* (Forst. f.) Seem., in its more shrubby habit, much smaller leaves, and few-flowered umbels. The leaves are narrow, oblong to ovate, and from 2–5 cm. long. I have not noted a cut-leaved juvenile form, but ternate leaves are frequent as reversion-shoots.

(x.) AZORELLA COCKAYNEI, Diels in Rep. nov. sp., Regni veg., vol. vi 3/8, p. 96, 1908.

Very small creeping herb, rooting at the nodes and emitting stolons, completely glabrous, perhaps an annual. Leaves simple, in small tufts; petiole 1–1·5 cm. long, blade 2–4 mm. in diameter, ovate-elliptic or suborbicular, simple, entire, fleshy-coriaceous, obtuse or slightly emarginate; margins not recurved. Cauline leaves opposite; petioles shorter. Stipules triangular-ovate, about 1·5 mm. long. Involucral leaves concave ovate, unequal. Umbels 3–4-flowered; pedicels stout, about 1 mm. long. Calyx after flowering pentagono-campanulate; teeth short, broadly triangular; petals minute, boat-shaped, about 0·8 mm. long, deciduous.

Stewart Island: Mason's Bay, on salt-meadows, with young fruits, 30th January, 1907; R. M. Laing and L. Cockayne.

This species is nearest to *A. exigua* Benth. and Hook., but differs in the habit, in the absence of a stout rhizome, and by the quite entire leaves not lobed or crenate, the blade much smaller and in some minor details of the inflorescence. It is a form with a juvenile habit of leaf, but which flowers.*

(xi.) DRACOPHYLLUM POLITUM (Cheesem.) Cockayne, comb. nov.—*D. rosmarinifolium* R. Br. var. *politum* Cheesem. in Manual of New Zealand Flora, p. 427, 1906.

South Island: Mount Maungatua (Manual of New Zealand Flora). Stewart Island: Extremely abundant from almost sea-level to summits of mountains.

A somewhat full account of this remarkable plant has been already given in Part II (3).

As growing on the open meadow there is a stout hard woody stem about 7 mm. in diameter, which branches into very short branches, which, again branching several times, finally give off numerous short stems furnished with densely imbricating leaves which are about 8 mm. long, green with orange apex, erect, stout, horny, extremely hard and stiff, convex on the upper, concave on the under surface, their apices obtuse, rounded, or almost truncate, and the base sheathing and more than half the length of the lamina. In sheltered situations long trailing shoots are given off, the main stem 23 cm. long, densely leafy, and with short lateral shoots, which bend upwards. The leaves are frequently much longer than those described above, and may taper to a long-drawn-out point. The flowers are solitary, terminal, do not project beyond the leaves which quite enclose them; sepals acute, ciliated, rather longer than cerolla-tube.

By Kirk this plant was referred to *D. muscoides* Hook. f., but it differs in the longer and blunter leaves and general habit. It is also related to *D. prostratum*. So far as all three " species " are concerned, it seems to me that they are much in need of revision with the aid of abundant living material. It may eventually be shown, when the variability according to environment is properly investigated, that all three are one and the same. On the other hand, I hold the typical *D. rosmarinifolium* (Forst. f.) R. Br., or the plant New Zealand botanists have referred to that species, as altogether distinct.

(xii.) MYOSOTIS ALBIDA (T. Kirk) Cheesm., comb. nov.—*M. capitata Hook. f.* var. *albiflora*, J. B. Armstg. in Trans. N.Z. Inst., vol. xiii, p. 340; *M. capitata* subsp. *albida* T. Kirk in Trans. N.Z. Inst., vol. xvii, p. 224.

South Island: Eastern, Western, and especially Southern Otago. Stewart Island: abundant, and also on the Solanders. Subantarctic islands: The Snares.

A full description of this will be given in Cheeseman's memoir, mentioned above.

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* Written by Dr. L. Diels, who also sent Latin diagnosis, which it was not necessary to use, the species having been already published in Latin.

Large examples are 27 cm. tall. Leaves may measure as much as 14 cm. long, with the blade 9 × 3·2 cm.; they are somewhat flaccid, succulent, and copiously hairy on the under-surface. The flowers are in dense heads, white, 7 mm. in diameter, and the filaments considerably exceed the anthers. The species, then, belongs to the section *Exarrhena.*

(xiii.) VERONICA LAINGII Cockayne, sp. nov.

Fruticulus humilis 15–25 cm. altus. Caules pauci primum procumbentes deinde erecti ramosissimique. Rami ultimi stricti, teretes circ. 5 cm. longi, 2 mm. in diam. Folia 4 seriata, dense adpressa imbricata paribus oppositis basi connatis tumida ovato-deltoidea, 3–3·5 mm. longa, 2·5 mm. lata marginis ciliatis apicibus obtusis. Flores circ. 8 in apicibus ramulorum in parvis capitulis 10 mm. longis, calycis lobis obtusis ciliatis circ. 2 mm. longis corollae tubum aequantibus, ovariis glabris.

Stewart Island: Near summit of Mount Anglem; flowers in January, seed ripe end of February.

A smaller plant than *V. Hectori*, with the ultimate branchlets more slender, and not arranged round the main stem on all sides vertically, but mostly on one side, giving a dorsi-ventral appearance to the shoot system, as in *V. Armstrongii.* The leaves of *V. Hectori* have more rounded apex than those of *V. Laingii;* they are connate for more than half their length, and the apex of the leaf-lamina next below does not nearly extend to the angle of division of the leaves above, as in *V. Hectori.* It is more closely related to *V. salicornioides*, differing in the shorter branchlets and less acute leaves.

(xiv.) VERONICA BUXIFOLIA Benth. var. PROSTRATA Cockayne, var. nov.

Caulibus prostratis; foliis imbricatis; spicis typo brevioribus.

South Island: Longwood Range, in wet subalpine meadow. Stewart Island: Subalpine meadows of highest mountains.

(xv.) OURISIA MODESTA Diels sp. nov. in Rep. nov. sp. Regni veg. 1909. (I have not yet seen the description, and so cannot give further particulars as to publication.)

A small herb, forming matted patches of slender, much-branching creeping stems, rooting at the nodes.

Stems creeping on surface of the ground, rather wiry, pale green, about 1 mm. in diam., very sparsely hairy, with pale weak hairs. Leaves very small, petiolate, variable in size, almost rotund, sparsely hairy on petiole and occasionally on margin of lamina, sometimes glabrous; lamina dark green especially on veins, moderately thick, somewhat wrinkled on upper surface, 6–3 mm. in diam., generally quite entire, rarely emarginate, sometimes slightly lobed at base; petiole about 13 mm. long, more or less erect, frequently channelled above.

Flowers white, small.

Stewart Island: Rakiahua Valley, in wet ground. Blooms at end of December and beginning of January.

All my flowering specimens were sent to Dr. L. Diels, so I can give no detailed description of the flower. The species, Dr. Diels tells me, is allied to *Ourisia breviflora* Benth. of Fuegia, and also to *O. integrifolia* R. Br. of Tasmania. It differs altogether in size of flower and general appearance from any other New Zealand species.

(xvi.) CELMISIA RIGIDA (T. Kirk) Cockayne, comb. nov.—*C. petiolata* Hook. f. var. *rigida*, T. Kirk in "Students' Flora," p. 286, 1899.

Stewart Island: On cliffs to south of Mason Bay; not subalpine.

Closely related to *C. petiolata*, but stouter in all its parts, with leaves broader, usually longer and much thicker, those of *C. petiolata* being membraneous; midrib green, not purple; tomentum more or less ferruginous, not white; scape stout, and flower-head larger than in *C. petiolata.*

The plant is quite different in its general appearance to *C. petiolata*, but the differences are hard to define. It is much more amenable to cultivation, and keeps its characters unchanged. Living plants of the two species growing side by side can be distinguished at a glance.

(xvii.) OLEARIA DIVARICATA Cockayne sp. nov.

Frutex erectus ramosissimus 1 m. altus v. altior, ramis rigidis virgatis tenuibus oppositis divaricatis, foliis parvis anguste obovatis 7 mm. longis 3 mm. latis subtus ferrugineo-tomentosis, capitulis 6 mm. longis saepe solitariis v. 2–4 ramulis abreviatis.

An erect shrub 1 m. or more in height, with stiff, slender, twiggy, divaricating branches. Bark pale, smooth except for two or three long ridges, slightly hairy on young twigs. Under-surfaces of leaves, pedicels, and involucral leaves more or less densely covered with rusty short hairs. Leaves rather dark-green, narrow, obovate, with cuneate base gradually narrowed into a short petiole, inserted 2 or 3 together on the short reduced lateral branchlets. Flower-heads 6 mm. long, cylindrical, solitary or 2–4 on reduced lateral branchlets; pedicels slender, 8 mm. long, spreading out radially; involucral bracts short, stained dark purple or pale green, ovate or oblong, obtuse, pilose with rusty hairs; ray-florets 4, reflexed; disc-florets 2–3; achene scantily pilose.

Distinguished at once from *O. odorata* by the few florets and rusty tomentum, and from all forms of *O. virgata* by the stiffer branches, more divaricating habit, rusty tomentum, few florets, and pale bark.

Stewart Island: Table Hill, in sheltered subalpine meadows. Not noted elsewhere. Flowers in early February; flowers very sweet-scented.

B. LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES.

EXPLANATION OF ABBREVIATIONS USED.

N. = Northern botanical province of New Zealand. C. = Central botanical province of New Zealand. S. = Southern botanical province of New Zealand. Ch. = Chatham Islands botanical province. Sub. = New Zealand subantarctic islands botanical province. Ker. = Kermadec Islands botanical province. End. = Endemic. Aus. = Australian and Tasmanian (one or both). S.A. = South American and subantarctic (one or both). Pol. = Polynesian. Mal. = Malayan and South Asian (one or both). Cos. = Generally distributed in temp. (= temperate) or trop. (= tropical) lands. An asterisk attached to a species = endemic Stewart Island botanical district.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES.

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
PTERIDOPHYTA.						
HYMENOPHYLLACEAE.						
Trichomanes reniforme Forst.f.	Raurenga, kopakopa, kakakopamutu	Kidney-fern ..	End. ..	N. C. S. Ch.	Forest ..	Quite a rare plant. Kaipipi (Murdoch), Paterson Inlet and Half-moon Bay (Walker ex Kirk).
——— *Lyallii* (Hook. f.) Hook.	..	Lyall's bristle-fern	New Cal.	N. C. S.	Forest, subalpine scrub	On inclined trunks of *Metrosideros lucida*, Mount Anglem, 1,500–2,200 ft. (Kirk, 56, p. 230). I have seen an authentic specimen.
——— *venosum* R. Br. ..	..	Veined bristle-fern	Aus. ..	Ker. N. C. S. Ch.	Forest ..	Abundant on trunks of *Dicksonia squarrosa*.
——— *strictum* Menzies ..	..	Stiff bristle-fern	End. ..	N. C. S.	Forest ..	Rare in damp gullies. Ulva, Kirk! forest north of Paterson Inlet, L.C.
Hymenophyllum rarum R. Br.	..	Thin-leaved filmy fern	Aus. ..	N. C. S. Ch. Sub.	Forest ..	Forests, but quite rare.
——— *sanguinolentum* (Forst. f.) Sw.	..	Scented filmy fern	End. ..	N. C. S. Sub.	Forest, subalpine scrub	Very common. Kirk, 56, p. 230, calls attention to variation in this species.
——— *villosum* Col. ..	..	Alpine filmy fern	End. ..	N. C. S. Sub.	Subalpine rocks	In the northern province only on Thames mountains.
——— *australe* Willd. ..	..	Crisped filmy fern	Aus., Mal., India	N. C. S. Sub.	Forest ..	Very rare.
——— *pulcherrimum* Col. ..	..	Tufted filmy fern	End. ..	N. C. S.	Forest ..	Very rare; recorded by Kirk, but not observed by me. Northern province only on Thames mountains.
——— *dilatatum* (Forst. f.) Sw.	Irirangi, matuamauku	Broad-leaved filmy fern	Aus., Mal., Pol.	N. C. S. Ch. Sub.	Forest ..	Extremely common, especially on logs and leaning trunks.
——— *demissum* (Forst. f.) Sw.	Irirangi, piripiri	Drooping filmy fern	Mal., Pol.	N. C. S. Ch. Sub. Ker.	Forest. ..	Common.
——— *flabellatum* Lab. ..	..	Fan-leaved filmy fern	Aus., Pol.	N. C. S. Ch. Sub.	Forest ..	Common on tree-trunks and stems of tree-ferns.
——— *rufescens* T. Kirk ..	..	Reddish filmy fern	End. ..	N. C. S. Sub.	Upper forest	Recorded by Kirk for Rakiahua, where also I found it in abundance. At base of *Metrosideros lucida*, Pryce's Peak; L. C. This fern is very close to *H. flabellatum*, to which species it might perhaps be referred.
——— *ferrugineum* Colla. ..	..	Rusty filmy fern	S.A. ..	N. C. S.	Forest ..	Very abundant, especially on trunks of tree-ferns in moist gullies.
——— *Cheesemanii* Bak. ..	..	Cheeseman's filmy fern	End. ..	N. C. S.	Subalpine scrub	Rare.
——— *minimum* A. Rich...	..	Little filmy fern	End. ..	C.(?) S. Ch. Sub.	Rocks and trees near the shore	Not common.
——— *tunbridgense* (L.) Sm.	..	Tunbridge fern	Aus., S.A., Europe, S. Africa, Jamaica	N. C. S. Sub.	Forest ..	Common.
——— *peltatum* (Poir.) Desv.	..	One-sided fern	Aus., S.A., Europe, S. Africa	N. C. S.	Forest ..	Only on Thames mountains, of northern province. Noted only by Kirk. Have seen authentic specimen.
——— *multifidum* (Forst. f.) Sw.	..	Sharp-toothed filmy fern	Aus., Mal., Pol., Norf. Isld.	N. C. S. Ch. Sub.	Forest, subalpine scrub	Common.
——— *bivalve* (Forst. f.) Sw.	..	Two-valved filmy fern	Aus. ..	N. C. S. Ch.	Forest ..	Common.
CYATHEACEAE.						
Dicksonia squarrosa (Forst. f.) Sw.	Wheki, weki, tirawa	Slender tree-fern	End. ..	N. C. S. Ch.	Forest ..	Extremely common, especially in gullies.
Cyathea medullaris (Forst. f.) Sw.	Mamaku, korau	Black tree-fern..	Aus. ..	N. C. S. Ch.	Forest ..	Only found on east coast, near Half-moon Bay.
Hemitelia Smithii (Hook. f.) Hook	Neineikura ..	Pale-leaved tree-fern	End. ..	N. C. S. Sub.	Forest ..	Common.
Alsophila Colensoi Hook. f...	..	Mountain tree-fern	End. ..	C. S. ..	Forest ..	Mount Anglem, Kirk; base of Table Hill and Thomson Range, L. C.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
PTERIDOPHYTA—*contd.*						
POLYPODIACEAE.						
Dryopteris punctata (Thbg.) C. Chr.	..	Hairy polypody	Aus., Norf. Isld., S.A., Pol., Asia, Japan, African Islands	N. C. S. Ch. Sub.	Forest ..	Common, especially where forest has been milled.
Polystichum hispidum (Sw.) J. Sm.	..	Hairy-stemmed fern	Aus. ..	N. C. S. Ch.	Forest ..	Common.
—— *vestitum* (Forst. f.) Presl.	Puniu ..	Prickly shield-fern	Aus., S.A.	N. C. S. Ch. Sub.	Forest, coastal & subalpine scrub	Common, but rather local, and usually absent from the tall lowland forest. In the northern province of New Zealand only on the Thames mountains.
—— *cystotegia* (Hk.) J. B. Armstg.	..	Alpine shield-fern	End. ..	C. S. Sub.	Amongst rocks near summit of Mount Anglem	Did not note this on any of the other mountains visited by me.
—— *adiantiforme* (Forst.f.) J. Sm.	..	Thick-leaved shield-fern	Aus., Norf. Isld., S.A., Pol., S.Af. Tristan da Cunha, Cuba	N. C. S. Ch.	Forest ..	Generally in Stewart Island a plant of the forest-floor, and often excessively abundant.
Lindsaya linearis Sw. ..	..	Narrow-leaved lindsaya	Aus., New Cal., Norf. Isld.	N. C. S. Ch.	Lowland bog; heath of old dunes	Fairly common in places.
Asplenium adiantoides (L.) C. Chr.	Petako, peretao	Drooping spleenwort	Aus., Pol., E.Af. and adjacent islands, Asia	N. C. S. Ch	Forest ..	Fairly common.
—— *obtusatum* Forst. f. ..	Paretao ..	Shore spleenwort	Aus., S.A., Tristan da Cunha	Ker. N. C. S. Ch. Sub.	Coastal cliffs, floor of forest near sea, open peaty ground near sea	Extremely common, and attaining a large size.
—— *scleropium* Homb. and Jacq.	.. ..	Toothed shore spleenwort	End. ..	S. Sub.	Coastal cliffs, margin of forest near sea	Local, Paterson Inlet, Port Pegasus, Wilson Bay, L. C.; Herekopere Island, Kirk.
—— *Lyallii* Moore ..	..	Lyall's spleenwort	End. ..	N. C. S. Ch.	As for preceding	Local, but in a good many localities.
—— *lucidum* Forst. f. ..	Huruhuruwhenua	Shining spleenwort	Aus. ..	Ker. N. C. S.	Forest near sea	Not very common.
—— *bulbiferum* Forst. f...	Mauku, moku, mouku, tururumauku = young plants	Common spleenwort	Aus., N. India, Penang, Pol.	N. C. S. Ch. Sub.	Forest ..	Fairly common, especially in gullies.
—— *flaccidum* Forst. f. ..	Raukatauri ..	Pendant spleenwort	Aus., S. Africa, Pol.	N. C. S. Ch. Sub. Ker.	Forest ..	Frequently epiphytic; very common.
Blechnum Patersoni (R. Br.) Mett. var. *elongatum* (Mett.)	Peretako, peretao, petako	Paterson's fern	Pol., Mal., India	N. C. S. Sub.	Forest ..	Occasionally met with in dark gullies, but not common.
—— *discolor* (Forst. f.) Keys	Piupiu ..	Common hard fern	Aus., Norf. Isld.	N. C. S. Ch. Sub.	Forest, subalpine scrub	Extremely common
—— *vulcanicum* (Bl.)Kuhn.	..	Triangular hard fern	Aus., Pol., Mal.	N. C. S.	Forest, rocky places, shady banks in open	Local.
—— *lanceolatum* (R. Br.) Sturm.	Rereti ..	Lance-leaved hard fern	Aus., Pol., S.A.(?)	N. C. S. Ch.	Forest ..	Plentiful in moist gullies.
—— *durum* (Moore) C. Chr.	..	Thick-leaved hard fern	End. ..	S. Ch. Sub.	Coastal rocks	Very abundant.
—— *Banksii* (Hook. f.) Mett.	..	Bank's hard fern	End. ..	N. C. S.	Coastal rocks	Fairly common.
—— *penna marina* (Poir.) Kuhn.	..	Alpine hard fern	Aus., S.A.	N. C. S. Ch. Sub.	Heath on old dunes	Not widely spread.
—— *capense* (L.) Schlecht.	Kiokio, tupari, horokio, koropiu, piu (the usual name in the Hokianga district)	Long hard fern	Aus., S.A., Pol., Mal., S. Africa	N. C. S. Ch. Sub. Ker.	Forest, subalpine scrub	Extremely common.
—— —— var. *minor* Hook. f.	..	..	Aus. ..	N. C. S. Ch. Sub.	Bog, heath, subalpine scrub	Common.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
PTERIDOPHYTA—*contd.*						
POLYPODIACEAE—*contd.*						
Blechnum nigrum (Col.) Mett	..	Black hard fern	End. ..	N. C. S.	Forest ..	Moist gullies; rare.
——— *fluviatile* (R. Br.) Lowe	..	Creek fern ..	Aus. ..	N. C. S. Ch. Sub.	Forest ..	Common.
Hypolepis tenuifolia (Forst. f.) Bernh.	..	Thin-leaved hypolepis	Aus., Norf. Isld., Pol., Mal., China	N. C. S. Ch. Ker.	Forest ..	Especially where the forest has been partially cleared. Moderately common.
——— *millefolium* Hook. ..	..	Thousand-leaves	End. ..	C. S. Sub.	..	(?) Base of Table Hill, but am not certain of exact locality. My notes only record it as a new "find" while in the vicinity of Table Hill.
Adiantum affine Willd. ..	..	Common maidenhair	(?) Norfolk Island	N. C. S. Ch. Ker.	Rocks near sea.	Very rare. So far as I know, confined to one place near Half-moon Bay.
Histiopteris incisa (Thbg.) J. Sm.	Matata ..	Cut-leaved bracken	Aus., Norf. Isld., S.A., Cos. trop.	N. C. S. Ch. Sub.	Open ground	Especially where the forest has been felled. Very common.
Pteridium esculentum (Forst. f.) Cockayne	Rauaruhe, rahurahu, koeata=the young shoots, aruhe, marohi, meke, motuhanga, parara, renga, roi=names applied in different districts to the edible rhizome	Common bracken	Aus., Norf. Isld., S.A.	Ker. N. C. S. Ch. Sub.	Heath ..	Not very common.
Paesia scaberula (A. Rich.) Kuhn.	..	Rough bracken	End. ..	N. C. S. Ch.	Open forest ground	Chiefly where forest has been cleared.
Polypodium Billardieri (Willd.) C. Chr.	..	Narrow-leaved polypody	Aus., S.A., S. Africa, N. Guinea	N. C. S. Sub.	Forest, subalpine scrub	Epiphytic; common. Also makes extensive colonies on forest-floor.
——— ——— var. *rigidum* (Homb. and Jacq.) Cockayne	..	..	End. ..	S. Sub.	Forest ..	Mount Anglem, on tree-trunks; rare.
——— *pumilum* (J. B. Armstg.) nom. nov. =*Grammitis pumila* J. B. Armstg. in Trans. N.Z. Inst., vol. xiii, p. 341, 1881	..	Dwarf polypody	End. ..	C. (?) S. Sub.	Subalpine rocks	Near summits of the highest mountains.
——— *grammitidis* R. Br. ..	..	Saw-edged polypody	Aus. ..	N. C. S. Ch. Sub.	Forest, subalpine scrub	Common; epiphytic on tree-trunks.
——— *diversifolium* Willd.	..	Climbing polypody	Aus., New Cal., Norf. Isld.	Ker. N. C. S. Ch. Sub.	Forest ..	Abundant on ground, but frequently climbing trees.
Cyclophorus serpens (Forst. f.) C. Chr.	..	Thick-leaved polypody	Aus., New Cal., Norf. Isld.	Ker. N. C. S. Ch.	Forest ..	Fairly common.
GLEICHENIACEAE.						
Gleichenia circinata Sw. ..	Waewaekaka, waewaematuku	Scrambling umbrella-fern, tangle-fern	Aus. Mal., New Cal.	N. C. S.	Outskirts of southern forest	Fairly common.
——— *dicarpa* R. Br. ..	..	Bog umbrella-fern, woolly tangle-fern	Aus., New Cal.	N. C. S. Ch.	Southern forest, near outskirts; subalpine scrub	Very common.
——— *alpina* R. Br. ..	..	Alpine umbrella-fern, alpine tangle-fern	Aus. ..	N. C. S. Ch.(?)	Bogs ..	Abundant. This species and *G. dicarpa* are kept distinct in the "Index Filicum," but I think the respective forms depend most likely on the environment, and that neither is really stable.
——— *Cunninghamii* Hew.	Tapuwaekotuku, waeakura	Umbrella-fern ..	End. ..	N. C. S.	Forest, especially southern forest	Common. It is extremely abundant in the flat scrubby forest near the Freshwater River (see Photo No. 11).
SCHIZAEACEAE.						
Schizaea fistulosa Labill. var. *australis* (Gaud.) Hook. f.	..	Rush-fern, slender comb-fern	Aus., S.A., New. Cal., Mal., Madagascar	N. C. S. Ch. Sub.	Bogs ..	Common.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
PTERIDOPHYTA—*contd.*						
OSMUNDACEAE.						
Leptopteris hymenophylloides (A. Rich.) Pr.	Heruheru ..	Single crape-fern	End. ..	N. C. S.	Forests ..	Not very common.
——— *superba* (Col.) Pr. ..	Heruheru, punui	Double crape-fern, Prince of Wales's feather	End. ..	N. C. S. Sub.	Forest, especially southern forest	Local, but very abundant, and of large size where it occurs. The subantarctic distribution is from Handb. N.Z. Flora, p. 384, said to be collected by Bolton, but not observed by any other collector.
SALVINIACEAE.						
Azolla rubra R. Br. ..	..	Red azolla ..	Aus. ..	N. C. S.	Still water	Only noted on Ruapuke.
LYCOPODIACEAE.						
Lycopodium Selago L. ..	..	Fir club-moss ..	Cos. temp.	C. S. ..	Bogs ..	My notes say nothing as to abundance of this or the species following.
——— *varium* R. Br. ..	..	..	Aus. ..	N. C. S. Ch. Sub.	Bogs.	
——— *Billardieri* Spring. ..	Whiri-o-raukatauri, iwituna	Hanging club-moss	Pol.(?) ..	N. C. S. Ker.	Forest ..	Epiphytic. The plant noted here seems intermediate in habit between the typical forms of *L. Billardieri* and *L. varium.*
——— *ramulosum* T. Kirk.	..	Matted club-moss	End. ..	S. ..	Bog, openings in subalpine scrub, subalpine meadow	Extremely common.
——— *fastigiatum* R. Br. ..	..	Alpine club-moss	Aus. ..	N. C. S. Ch. Sub.	Subalpine meadow	Fairly common.
——— *scariosum* Forst. f. ..	..	Creeping club-moss	Aus. ..	N. C. S. Ch. Sub.	Heath on old dunes	Not widely spread.
——— *volubile* Forst. f. ..	Waewaekoukou	Climbing club-moss	Aus., Pol., Mal., New Cal.	N. C. S. Ch.	Forest ..	Especially in the forest of flat ground in valleys of Rakiahua and Freshwater Rivers.
Tmesipteris tannensis Bernh.	..	..	Aus., Pol.	Ker. N. C. S. Ch. Sub.	Forest ..	On tree-trunks, tree-fern stems, and humus on fallen rotting trees.
SPERMOPHYTA.						
TAXACEAE.						
Podocarpus Hallii T. Kirk...	Totara, kotukutuku. The same name as *Fuchsia excorticata*, so given on account of its thin bark (Best, 5A)	Thin-barked totara, large-leaved totara	End. ..	N. C. S.	Forests, subalpine scrub	Rare in many parts. Common in forest on Table Hill Range.
——— *ferrugineus* Don ..	Miro, toromiro	Black-pine (but this name had best be limited to *P. spicatus*)	End. ..	N. C. S.	Forest ..	Fairly common, but never abundant.
——— *spicatus* R. Br. ..	Matai, mai ..	Black-pine ..	End. ..	N. C. S.	Forest ..	There are only a few plants on the island, though evidently much more abundant at one time.
——— *dacrydioides* A. Rich.	Kahikatea ..	White-pine ..	End. ..	N. C. S.	Forest ..	A very scarce tree. There are a few examples in the valley of the Freshwater River, and trees are occasionally cut at the North Arm sawmill. No seedlings were noted.
[*Dacrydium Kirkii* F. Muell	Monoao ..	Kirk's pine ..	End. ..	N. S. (?)	Forest ..	The occurrence of this is very doubtful. Cheeseman does not cite it in his Flora.]
——— *biforme* (Hook.) Pilger	..	Yellow-pine, tarwood	End. ..	C. S. ..	Southern forest, subalpine scrub	Fairly common near Port Pegasus.
——— *Bidwillii* Hook. f. ..	..	Mountain-pine ..	End. ..	N. C. S.	Subalpine scrub, forest	In northern province, only recorded from summit of Moehau. Common.
——— *cupressinum* Sol. ..	Rimu ..	Red-pine ..	End. ..	N. C. S.	Forest, subalpine scrub	The dominant tree of the island.
——— *intermedium* T. Kirk	..	Yellow-pine, yellow silver-pine	End. ..	N. C. S.	Southern forest	This is known by every one on Stewart Island as the "Kirk pine," and is confused also with *D. biforme* and *D. Bidwillii*, the three also being called "swamp pine." Abundant.
——— *laxifolium* Hook. f...	..	Pigmy pine ..	End. ..	C. S. ..	Old dunes in Rakiahua Valley	Although always a plant of high altitudes in New Zealand generally, in Stewart Island it is confined to almost sea-level, and is absent from its favourite habitat, the boggy mountain meadows.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

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SPERMOPHYTA—*contd.*						
POTAMOGETONACEAE.						
Zostera nana Roth. ..	..	Grass-wrack, eel-grass	Cos. temp.	N. C. S.	Sandy shores between high and low water-mark	Plentiful where sheltered and water shallow.
Potamogeton polygonifolius Pourr.	..	Persicaria-leaved pond-weed	S.A., Aus., Europe, Asia, Af., N. Am.	N. C. S.	Slow-flowing rivers.	
—— *Cheesemanii* A. Benn.	Manihi, rerewai	Cheeseman's pond-weed	Aus. ..	N. C. S.	Slow-flowing rivers; wet bog	Common.
SCHEUZERIACEAE.						
Triglochin striata Ruiz and Pav. var. *filifolia* Buchen.	..	Three-ribbed arrow-grass	Aus., S.A.	N. C. S. Ch.	Salt meadow	Not common.
GRAMINEAE.						
Ehrharta Thomsoni Petrie ..	..	Small bog-grass	End. ..	C. S. Sub.(?)	Bogs; subalpine meadow	Very common. At present, so far as the New Zealand mainland is concerned, only recorded from Longwood Range (Southand) and coastal mountains of western Nelson, but it is almost certain to be found in the mountain region of south-west Otago.
Microlaena stipoides R. Br.	Patiti	Meadow rice-grass	Aus., Norf. Isld.	N. C. S.	Banks near the sea.	
—— *avenacea* (Raoul) Hook. f.	..	Bush rice-grass	End. ..	N. C. S. Sub.(?)	Forests ..	Common.
Hierochloe redolens (Forst. f.) R. Br.	Karetu ..	Holy-grass ..	Aus., S.A.	N. C. S. Ch. Sub.	Banks not far from sea	Fairly common.
—— *Fraseri* Hook. f. ..	..	Alpine holy-grass	Aus. ..	C. S. ..	Subalpine meadow	Common.
Agrostis Dyeri Petrie ..	..	New Zealand bent-grass	End. ..	C. S. ..	Subalpine meadow	Fairly common in places.
Calamagrostis filiformis (Forst. f.) Cockayne	..	Toothed bent-grass	Aus., Norf. Isld.	N. C. S. Ch.	Open ground (lowland)	
—— *Billardieri* (R. Br.) Steud.	..	Sand bent-grass	Aus. ..	N. C. S. Ch.	Dunes.	
—— *setifolia* (Hook. f.) Cockayne	..	Bog bent-grass; alpine bent-grass	End. ..	C. S. ..	Subalpine meadow.	
—— *avenoides* (Hook. f.) Cockayne	..	Oatlike bent-grass	End. ..	N. C. S.	Heath.	
—— *quadriseta* (R. Br.) Benth.	..	Spiked bent-grass	Aus. ..	N. C. S.	Heath.	
Dichelachne crinita (Forst. f.) Hook. f.	..	Long-haired plume-grass	Aus., Norf. Isld.	N. C. S. Ch.	Heath.	
Deschampsia caespitosa (L.) Beauv.	..	Tufted hair-grass	Cos. temp.	N. C. S. Ch. Sub.	Semi salt meadow	Not common.
—— *Chapmanni*, Petrie ..	..	Southern hair-grass	End. ..	S. Sub.	Subalpine meadow.	
Trisetum antarcticum (Forst.f.) Trin.	..	Shining oat-grass	End. ..	N. C. S. Ch.Sub.(?)	Heath, subalpine meadow	
Danthonia Cunninghamii Hook. f.	..	Tussock oat-grass	End. ..	N. C. S.	Banks near sea.	
—— *Raoulii* Steud. ..	..	Snow-grass, red tussock	End. ..	C. S. ..	Open ground in valleys	Forms meadows in a few places, but of no great extent.
—— *flavescens* Hook. f. ..	..	Broad-leaved tussock oat-grass	End. ..	C. S. ..	Subalpine meadow	It is just possible I may in my notes have confused this with the next species.
—— *crassiuscula* T. Kirk	..	Alpine oat-grass	End. ..	S. ..	Subalpine meadow	Common in places on Mount Anglem.
—— *pungens** Cheesem...	..	Bayonet-grass ..	End. ..	S. ..	Subalpine meadow	Very common above the scrub-line on all the mountains visited. So far as known at present, confined to Stewart Island.
—— *pilosa* R. Br. ..	..	Purple-awned oat-grass	Aus. ..	N. C. S.	Heath, boggy ground, banks.	
—— *semiannularis* R. Br.	..	Common oat-grass	Aus. ..	N. C. S. Ch.	Bogs, heath on old dunes, open ground generally	Common.
Arundo conspicua Forst. f. ..	Toetoe-kakaho	New Zealand reed, erect-plumed tussock-grass	End. ..	N. C. S. Ch.	Wet ground, river-banks, heath	Fairly common.
Poa foliosa Hook. f. ..	..	Southern Islands poa	End. ..	S. Sub.	Peaty ground near sea	Only on the "mutton-bird islands" and perhaps on certain headlands near the South Cape, but this may be a mistake. Solander Islands, Captain J. Bollons!

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

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SPERMOPHYTA—*contd.*						
GRAMINEAE—*contd.*						
Poa novae-zealandiae Hack.	..	Large-flowered poa	End. ..	C. S. ..	Subalpine meadow	Rare; only noted on Mount Anglem.
—— *Astoni* Petrie ..	..	Seashore poa ..	End. ..	S. Sub.	Coastal cliffs	Common. I am not at all sure that this is distinct from *Poa litorosa* of the subantarctic islands.
—— *seticulmis* Petrie ..	..	..	End. ..	N. C. S.	Open ground near sea.	
—— *pusilla* Berggr. ..	..	Slender poa ..	End. ..	S. ..	Open ground near sea	Abundant on Dog Island.
—— *caespitosa* Forst. f.	..	Common tussock-grass	Aus. ..	N. C. S.	Heath. ..	Not very common. The type not north of the Waikato.
—— *Colensoi* Hook. f. ..	..	Blue tussock-grass	End. ..	N. C. S.	Subalpine	Only on Thames mountains, in northern province of New Zealand. Not abundant in Stewart Island.
—— *imbecilla* Forst. f. ..	..	Weak poa ..	Aus.(?) ..	N. C. S. Ch.	Heath.	
Atropis novae-zealandiae (Petrie) Hack.	..	New Zealand atropis	End. ..	S. ..	Salt meadow	Occurs on ground subject to a covering of brackish water. Perhaps the name should be *A. Walkeri* (T. Kirk).
Festuca littoralis Labill. ..	..	Sandhill-fescue..	Aus. ..	N. C. S. Ch.	Dunes ..	Common.
—— *rubra* L.	..	Red-fescue ..	Eur., N. Asia	C. S. ..	Heath.	
Agropyron scabrum (R. Br.) Beauv.	Patiti ..	Blue-grass ..	Aus. ..	N. C. S. Ker.	Heath.	
Asprella gracilis (Hook. f.) T. Kirk	..	Slender glumeless grass	End. ..	N. C. S.	..	Near bank of River Rakiahua, in shade. Also noted by Petrie (69, p. 332), but habitat not given.
CYPERACEAE.						
Eleocharis sphacelata R. Br.	Paopao, kutakuta	Tall spike-rush..	Aus. ..	N. C. S.	Swamp ..	Freshwater Valley and swamps to Mason Bay.
—— *acuta* R. Br. ..	..	..	Aus., Norf. Isld.	N. C. S. Ch.	Swamp.	
—— *Cunninghamii* Boeck.	..	Slender spike-rush	End. ..	N. C. S.	Swamp, wet ground.	
Scirpus aucklandicus (Hook. f.) Boeck.	..	Auckland Island club-rush	Aus., Amsterdam Isld.	C. S. Sub.	Salt meadow, subalpine	Fairly common.
—— *filiformis* Savi ..	..	Nodding club-rush	Cos. ..	N. C. S. Ch. Sub.	Salt meadow	This is *S. cernuus* Vahl.
—— *antarcticus* L. ..	..	Antarctic club-rush	Aus., S. Africa, St. Helena	C. S. ..	Bog.	
—— *inundatus* (R. Br.) Poir.	..	Swamp club-rush	Aus., S.A., Mal.	N. C. S. Ch.	Swamp.	
—— *sulcatus Thouars* var. *distigmatosa* C. B. Clarke	..	Proliferous club-rush	End. ..	N. C. S.	Swamp ..	It is possible I may be mistaken in this identification, and possess no specimens, unfortunately; but the name stands without query in my notes, and I have already published it as from Stewart Island (Cockayne, 24).
[—— *muscosus* T. Kirk ..	..	..	End. ..	S. ..	..	"A minute species less than 1 in. in height, forming moss-like patches at the head of Paterson Inlet. Also on the Bluff Hill" (Kirk, 1885 (1), p. 224). This is not mentioned by Cheeseman in his Flora, and I know nothing of it.]
—— *nodosus* (R. Br.) Rottb.	..	Stiff club-rush ..	S.A., Aus., S. Africa, Norf. Isld., L. Howe I., St. Helena, Amsterdam Isld.	Ker. N. C. S. Ch.	Dune, salt meadow	Common.
—— *frondosus* Banks and Sol.	Pingao ..	Yellow sand-sedge	End. ..	N. C. S. Ch.	Dune ..	Common.
Carpha alpina R. Br. ..	..	Alpine carpha ..	Aus., New Guinea	N. C. S. Sub.	Bogs, subalpine meadow	Very common at all altitudes. Only found on Thames mountains, in the Northern Province.
Schoenus pauciflorus Hook. f.	..	False snow-grass	End. ..	C. S. ..	Subalpine meadow, lowland bog	Abundant on Mount Anglem and on open ground Port Pegasus.
—— *axillaris* Poir. ..	..	..	Aus. ..	N. C. S. Ch.	Wet ground	
—— *nitens* (R. Br.) Poir.	..	..	Aus. ..	C. S. ..	Heath.	

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.*						
CYPERACEAE—*contd.*						
Cladium glomeratum R. Br. ..	..	..	Aus., Mal., E. Asia	N. C. S. Ch.	Swamps.	
—— *Gunnii* Hook. f. ..	..	Gunn's twig-rush	Aus. ..	N. C. S. Ch.	Bog ..	Fairly common.
—— *Vauthiera* C. B. Clarke	..	Square-stemmed twig-rush	End. ..	N. C. S.	Bog ..	Common.
Gahnia procera Forst. ..	..	South Island gahnia	End. ..	S. ..	Forest, especially southern forest, subalpine scrub	Hardly belongs to the central province of New Zealand. Extremely common.
Oreobolus pectinatus Hook. f.	..	Common oreobolus	End ..	N. C. S. Sub.	Bog, subalpine meadow	Very common. My notes also record *O. pumilio*, but the identification may be wrong. *O. pectinatus* only in northern province on the Thames mountains.
—— *strictus* Berggr. ..	..	Narrow-leaved oreobolus	End. ..	C. S. ..	Bog ..	Fairly common.
Uncinia compacta R. Br. ..	..	Mountain uncinia	Aus., S.A.	C. S. ..	Subalpine meadow	The S.A. refers to Kerguelen and Amsterdam Islands.
—— —— var. *caespitiformis** Küken.	..	..	End. ..	S. ..	Subalpine scrub, meadow	Only on Mount Anglem.
—— *caespitosa* Boott ..	..	Narrow-leaved uncinia	End. ..	N. C. S.	Forest, subalpine scrub	
—— *uncinata* (L. f.) Küken. (= *U. australis* Pers.)	Matau-a-maui	Broad-leaved uncinia	Sandwich Islds.	N. C. S. Ch. Sub.	Forest ..	I am indebted to Pastor Kükenthal for the change in nomenclature.
—— *pedicellata** Küken..	..	Stewart Island uncinia	End. ..	S. ..	Forest ..	The commonest species of the lowland forest. By a slip of the pen wrongly spelt "pedicillata" in certain papers of mine.
—— *leptostachya* Raoul ..	Matau-ririki ..	Tall uncinia ..	End. ..	N. C. S.	Forest.	
—— *riparia* R. Br. ..	..	Leafy uncinia ..	Aus., L. Howe Id., N. Guinea	N. C. S.	Forest ..	Hardly in the northern province of New Zealand.
—— *rubra* Boott ..	..	Red uncinia ..	End. ..	C. S. ..	Old dunes	Grows abundantly on the inland dunes near Mason Bay. Also recorded by Kirk in list of alpine plants growing in Stewart Island at sea-level (Kirk, 55, p. 225).
—— *rigida* Petrie ..	..	Stiff uncinia ..	End. ..	C. S. ..	Old dunes	Grows in company with *U. rubra*.
—— *filiformis* Boott ..	..	Slender uncinia	End. ..	N. C. S.	Forest, subalpine scrub	Hardly in the northern province of New Zealand. Common.
—— *rupestris* Raoul var. *capillacea* Küken.	..	..	End. ..	S. ..	Forest, subalpine scrub	Fairly common.
Carex appressa R. Br. ..	..	Tall sedge ..	Aus., New Cal.	S. Sub.	Wet ground near sea	Common.
—— *secta* Boott ..	..	Niggerhead ..	End. ..	N. C. S.	Swamp.	
—— *stellulata* Good. var. *australis* Küken.	..	Prickly sedge ..	End. ..	N. C. S.	Swamp ..	Common. This is *C. echinata* Murr. of Cheeseman's manual.
—— *ternaria* Forst. f. ..	..	Cutting-grass ..	End. ..	N. C. S. Sub.	Swamp, wet ground in dunes	Common.
—— *testacea* Sol. ..	..	Slender sedge ..	End. ..	N. C. S.	..	Not noted by me.
—— *lucida* Boott ..	..	Shining sedge ..	End. ..	N. C. S.	Rather wet ground	Culms elongate to a great length.
—— *uncifolia* Cheesem. ..	..	Hook-leaved sedge	End. ..	N. C. S.	..	Recorded by Cheeseman (15, p. 827). I did not note this species.
—— *comans* Berggr. ..	..	Hair-like sedge	End. ..	N. C. S.	Heath ..	Plentiful on Centre Island.
—— *litorosa* Bailey ..	..	Salt-marsh sedge	End. ..	N. C. S.	Salt marsh.	
—— *dissita* Sol. ..	..	Flat-leaved sedge	End. ..	N. C. S.	Forest ..	Fairly common on the mountains.
—— —— var. *monticola* Küken.	..	Mountain-sedge	End. ..	C. S. ..	Subalpine scrub, subalpine meadow	
—— *Solandri* Boott ..	..	Solander's sedge	End. ..	N. C. S.	Forest ..	
—— *longiculmis** Petrie..	..	Long-stalked sedge	End. ..	S. ..	..	Confined as far as is known to Stewart Island, and only recorded from some of the bays of Paterson Inlet. Not noted by me, unless a plant not in flower at Glory Harbour was this species.
—— *trifida* Cav. ..	..	Great sedge ..	S.A. ..	C. S. Sub.	Wettish ground, near shore	
—— *pumila* Thunb. ..	..	Dune sedge ..	Aus., S.A., E. Asia	N. C. S.	Dunes.	
—— *Oederi* Retz var. *cataractae* (R. Br.) Küken.	..	Yellow sedge ..	Aus., S.A., S. Africa	C. S. ..	Swamp.	Moderately common.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.*						
RESTIONACEAE.						
Leptocarpus simplex A. Rich.	Oioi	Red rush	End.	N. C. S. Ch.	Swamp	Both in brackish and fresh water, very common; follows course of old strait from head of Paterson Inlet to Mason Bay.
Hypolaena lateriflora Benth.	..	..	Aus.	N. C. S. Ch.	Bogs	Also the var. *minor* Hook. f., which seems to me not a true variety, but merely a depauperated form. Extremely abundant.
CENTROLEPIDACEAE.						
Gaimardia ciliata Hook. f.	..	Bog-pincushion	End.	C. S. Sub.	Bog	Common.
—— var. *ligulata** T. Kirk	..	..	End.	S.	..	Not mentioned by Cheeseman. Described by Kirk in Trans. N.Z. Inst., vol. xxiii, p. 442, with habitat Stewart Island, near Frazer Peaks.]
Gaimardia setacea Hook. f.	..	..	End.	S.	Bog.	
JUNCACEAE.						
Juncus pallidus R. Br.	..	Giant rush	Aus.	N. C. S.	Wet ground, forest clearings	Very abundant where forest has been cleared, and on the increase.
—— *effusus* L.	..	Common rush	Cos.	N. C. S.	Wet ground	
—— *bufonius* L.	..	Toad-rush	Cos. temp.	N. C. S. Ch. Sub.	Wet ground, near settlements.	Common.
—— *planifolius* R. Br.	..	Flat-leaved rush	Aus., S.A.	N. C. S. Ch. Sub.	Wet ground	
—— *antarcticus* Hook. f.	..	Antarctic rush	End.	C. S. Sub.	Subalpine meadow, bogs.	Fairly common.
—— *lampocarpus* Ehr.	..	Jointed rush	N. temp. region	N. C. S.	Wet ground, lowland.	
—— *novae-zelandiae* Hook. f.	..	Alpine rush	End.	C. S.	Bogs.	
Luzula campestris D. C. var. *Petriana* Buchen.	..	..	End.	N. C. S. Sub.	..	I cannot give the exact habitats of the species of *Luzula*, which I find impossible to identify during rapid work in the field.
—— —— var. *picta* (A. Rich.) Hook. f.	..	..	End.	N. C. S.	..	
—— —— var. *australasica* Buchen.	..	..	End.	N. C. S. Ch.	..	
—— —— var. *migrata* Buchen.	..	..	End.	N. C. S. Ch.	..	
—— —— var. *Banksiana* (E. Mey) Buchen.	..	..	End.	C.(?) S.	Rocks	Dog Island, on rocks. (No. 5394, herb, Cockayne) cited by Buchenau in "Pflanzenreich" heft 25 (iv, 36), p. 91.
LILIACEAE.						
Rhipogonum scandens Forst.	Kareao, pirita, kakareo	Supplejack	End.	N. C. S. Ch.	Forests	Very common, but chiefly on sides and bottoms of gullies.
Luzuriaga marginata (Banks and Sol.) Benth. and Hook.	Nohi, puwatawata	Snowberry, forest snowberry	S. A.	N. C. S.	Forest	Very abundant. Not found north of the Thames mountains, in the northern province.
Cordyline australis (Forst. f.) Hook. f.	Ti, ti-kauka, tirahau, kouka, ti-whanake	Cabbage-tree, palm lily	End.	N. C. S.	Open ground, probably swampy	A few plants occur near western end of Freshwater Valley, according to Mr. J. W. Murdoch.
Astelia linearis Hook. f.	..	Dwarf astelia	End.	C. S. Sub.	Bog; subalpine meadow	Very common from sea-level to summit of highest mountains.
—— *subulata* (Hook. f.) Cheesem.	..	Sharp-leaved creeping astelia	End.	S. Sub.	Bog	Rare; open ground near base of Frazer Peaks.
—— *nervosa* Banks and Sol.	Kakaha	Bush-flax	End.	N. C. S. Ch.(?)	Forest	I am not sure that the Chatham Island plant is identical with this species. Common.
—— *montana* (Kirk) Cockayne	..	Alpine bush-flax	End.	C. S.	Subalpine scrub, subalpine meadow	Common; frequently forms large patches to exclusion of all else.
Phormium tenax Forst.	Harakeke, korari = the flower-stem	New Zealand flax	Norf. Isld.	N. C. S. Ch.	Swamp	Common in low-lying open ground, but not everywhere.
—— *Cookianum* Le Jolis	Whaririki	Hill-flax, mountain-flax	End.	N. C. S.	Coastal rocks, subalpine meadow	Common on coastal rocks of Port Pegasus, but not noted in Paterson Inlet.
*Bulbinella Gibbsii** Cockayne	..	..	End.	S.	Bog, subalpine meadow	Near sea-level, open ground, Port Pegasus; reaches almost to summit of Mount Anglem. Common
Herpolirion novae-zelandiae Hook. f.	..	..	Aus.	C. S.	Bog	Very common in many parts of valley of Freshwater River.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.*						
IRIDACEAE.						
Libertia ixioides (Forst. f.) Spreng.	Tukauki, turutu, maanga-a-huripapa	Common libertia	End. ..	N. C. S. Ch.	Heath of ancient dunes	Inland from Mason Bay. Two species are included under *L. ixioides*, the one forming tufts (tussocks) and the other spreading into large colonies by stolons. The latter is the Stewart Island plant. It is also abundant on dunes near Cook Strait.
—— *pulchella* Spreng. ..	..	Forest libertia ..	Aus. ..	N. C. S.	Forest.	Fairly common.
ORCHIDACEAE.						
Dendrobium Cunninghamii Lindl.	..	Common dendrobe	End. ..	N. C. S.	Forest ..	Common.
Earina mucronata Lindl. ..	Peka-a-waka ..	Pointed - leaved earina	End. ..	N. C. S. Ch.	Forest ..	Common.
—— *autumnalis* (Forst. f.) Hook. f.	Raupeka ..	Sweet - scented earina	End. ..	N. C. S.	Forest ..	Common.
Sarchochilus adversus Hook. f.	..	..	End. ..	N. C. S. Ch.	Forest ..	Rare, but also easily overlooked.
Thelymitra longifolia Forst.	Makaika ..	Common thelymitra	Aus. ..	N. C. S. Ch. Sub.	Heath ..	Common.
—— *uniflora* Hook. f. ..	..	Blue thelymitra	End. ..	C. S. Sub.	Bog ..	Common.
Microtis unifolia (Forst. f.) Rchb.	Maikaika ..	Onion - leaved orchid	Aus., Norf. Isld.	Ker. N. C. S. Ch. Sub.(?)	Heath ..	Common.
Prasophyllum Colensoi Hook. f.	..	..	End. ..	N. C. S. Sub.	Boggy gr'd, subalpine meadow.	Common.
Pterostylis Banksii R. Br. ..	Tutukiwi ..	Common hooded orchid	End. ..	N. C. S. Ch.	Forest ..	Common.
—— *australis* Hook. f. ..	..	..	End. ..	C. S. Ch.	Forest ..	Common.
—— *graminea* Hook. f. ..	..	Narrow - leaved hooded orchid	End. ..	N. C. S.	Forest.	
Lyperanthus antarcticus Hook. f.	..	..	End. ..	C. S. Sub.	Boggy gr'd, lowland, subalpine meadow.	Common.
Caladenia Lyallii Hook. f.	..	Lyall's caladenia	End. ..	C. S. Sub.	Subalpine meadow	Common.
—— *bifolia* Hook. f. ..	..	Two-leaved caladenia	End. ..	N. C. S. Ch. Sub.	..	
Chiloglottis cornuta Hook. f.	..	..	End. ..	N. C. S. Ch. Sub.	..	
Corysanthes oblonga Hook. f.	..	..	End. ..	N. C. S. Sub.	Forest.	
—— *rivularis* Hook. f. ..	..	..	End. ..	N. C. S.	Forest ..	Common.
—— *rotundifolia* Hook. f.	..	Round-leaved spider-orchid	End. ..	N. C. S. Sub.	Forest ..	Common.
—— *triloba* Hook. f. ..	..	Common spider-orchid	End. ..	N. C. S.	Forest.	
—— *macrantha* Hook. f.	..	Large - flowered spider-orchid	End. ..	N. C. S. Ch. Sub.	Forest ..	Common.
Gastrodia Cunninghamii Hook. f.	Perei, makaika	..	End. ..	N. C. S. Ch.	Forest ..	Rare.
CHLORANTHACEAE.						
Ascarina lucida Hook. f. ..	..	..	End. ..	N. C. S.	Forest ..	Cheeseman's Manual, with name of C. Traill, but without mark of exclamation. Possibly not on the island. Not recorded from mainland nearer than Preservation Inlet.
URTICACEAE.						
Urtica incisa Poir. ..	..	Forest-nettle ..	Aus. ..	N. C. S.	Forest ..	
—— *australis* Hook. f. ..	..	Subantarctic nettle	End. ..	S. Ch. Sub.	Gravelly shore	Dog and Centre Islands; not on Stewart Island so far as known.
LORANTHACEAE.						
Loranthus micranthus Hook. f.	..	Common New Zealand mistletoe	End. ..	N. C. S.	Forest ..	Not common.
POLYGONACEAE.						
Rumex neglectus Kirk ..	..	Sea-shore dock..	End. ..	C. S. Sub. Ch.(?)	Sandy and pebbly shores	Fairly common.
Muehlenbeckia australis (Forst. f.) Meissn.	..	..	Norf. Isld.	N. C. S. Ch.	..	Not common. Abundant on Centre Island.
—— *complexa* (A. Cunn.) Meissn.	Pohuehue ..	...	End. ..	N. C. S.	Dune forest	
—— —— var. ..	..	..	End. ..	N. C. S.	..	The form of the open, with small almost entire leaves, and which does not climb usually. I think this form comes "true" from seed.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.*						
CHENOPODIACEAE.						
Chenopodium glaucum L. var. *ambiguum* (R. Br.) Hook. f.	..	Oak-leaved goosefoot	Aus. ..	N. C. S.	Salt meadow	
Atriplex Billardieri Hook. f.	..	New Zealand orache	Aus ..	N. C. S. Ch.	Sandy shore	Not everywhere.
AIZOACEAE.						
Mesembrianthemum australe Sol.	Horokaka ..	Pig's face, ice-plant	Aus., Norf. Isld., Lord Howe Isld.	Ker. N. C. S. Ch.	Coastal cliff	Not common. South end of Mason Bay.
Tetragonia expansa Murr. ..	Kokihi ..	New Zealand spinach	Aus., S.A., Norf. Isld., Lord Howe Isld., Japan	Ker. N. C. S.	Sandy shore	
—— *trigyna* Banks and Sol.	..	Climbing New Zealand spinach	End. ..	Ker. N. C. S. Ch.	Near shore, climbing over shrubs	Fairly common in places.
PORTULACACEAE.						
Claytonia australasica Hook. f.	..	..	Aus. ..	C. S. ..	..	Mentioned by Kirk (55, p. 225). Not seen by me.
Montia fontana L. ..	..	Water-chickweed	Cos. temp.	N. C. S. Sub.	Wet ground	
CARYOPHYLLACEAE.						
Stellaria parviflora Banks and Sol.	..	Small-flowered chickweed	End. ..	N. C. S. Ch.	Forest ..	Common.
Colobanthus Muelleri Kirk ..	..	..	End. ..	N. C. S. Ch.	Coastal rocks, blown sand	Fairly common.
—— species, perhaps *C. Billardieri* Fenzl.	..	..	? (Aus.) ..	(C. S. Sub.) ?	Subalpine meadow	Not common.
Spergularia media (L.) Presl.	..	Salt-marsh sand-spurrey	Cos. ..	N. C. S.	Salt meadow	
Scleranthus biflorus (Forst.) Hook. f.	Kohukohu ..	..	Aus. ..	N. C. S.	..	Not common.
RANUNCULACEAE.						
Clematis indivisa Willd. ..	Pikiarero, puawhananga in certain districts the flower only	Native clematis	End. ..	N. C. S.	Forest, especially on the outskirts	Fairly common. Comes into bloom early in October.
Ranunculus Lyallii Hook. f.	..	Mountain-lily, shepherd's lily	End. ..	S. ..	Subalpine meadow	Summit of Mount Anglem, chiefly on the sheltered side. Blooms December and early January.
—— *gracilipes* Hook. f. ..	..	Slender alpine buttercup	End. ..	S. ..	..	Cited by Cheeseman on authority of a specimen from G. M. Thomson (15, p. 18). Not mentioned by Kirk (62) nor seen by me.
—— *hirtus* Banks and Sol.	Kopukapuka, kopukupuku, maruru	Common New Zealand buttercup	Aus. ..	N. C. S. Ch.	Heath.	
—— *Kirkii** Petrie ..	..	Stewart Island buttercup	End. ..	S.	Wet ground	Paterson Inlet, in valleys of Rakiahua and Freshwater Rivers, and low-lying open ground Port Pegasus; abundant, but local. Differs much from the mainland plants which have been referred to this species, and is apparently confined to Stewart Island.
—— *Crosbyi** Cockayne ined.	..	..	End. ..	S. ..	Stony ground	Only observed at summit of Table Hill.
—— *rivularis* Banks and Sol.	Wauriki, waoriki	Marsh-buttercup	End. ..	N. C. S. Ch.	Bogs on old dunes	A local plant in Stewart Island.
—— *lappaceus* Sm. ..	..	..	Aus. ..	N. C. S.	Open ground, heath	
—— *acaulis* Banks and Sol.	..	Shore-buttercup	S. A. ..	N. C. S. Ch. Sub.	Sandy shore, salt meadow	Common.
Caltha novae-zelandiae Hook. f.	..	New Zealand caltha or marsh-marigold	End. ..	C. S. ..	Bog, subalpine meadow	Occurs from almost sea-level at Port Pegasus to the summits almost of the mountains. Commences to bloom at end of September at low levels.
MAGNOLIACEAE.						
Drimys colorata Raoul ..	Horopito ..	Pepper-tree ..	End. ..	N. C. S.	Forest.	Fairly common. Hardly extends into the northern province of New Zealand.
CRUCIFERAE.						
Cardamine heterophylla (Forst. f.) O. E. Schulz.	..	Hairy bitter-cress	Aus., S.A.	N. C. S. Ch. Sub.	Forest.	
—— —— var. *uniflora* (Hook. f.)	..	Few-leaved bitter-cress	End. ..	S. Sub.	Coastal rocks, coastal moor	Common.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.*						
CRUCIFERAE—*contd.*						
Lepidium oleraceum Forst. f. var. *acutidentatum* Kirk.	..	Cook's scurvy-grass	End. ..	N. C. S. Ch. Sub.	..	Not noted by me.
——— *tenuicaule* T. Kirk ..	..	Shore-cress ..	End. ..	S. ..	Gravelly shore	Not seen on Stewart Island; common on Dog Island, Centre Island, and Ruapuke. I also saw another *Lepidium*, but not in flower, which might be the var. *australe* T. Kirk, a plant I do not know.
DROSERACEAE.						
Drosera stenopetala Hook. f.	..	Subantarctic sun-dew	End. ..	C. S. Sub.	Bog ..	Fairly common.
——— *Arcturi* Hook. ..	..	Alpine sun-dew	Aus. ..	C. S. ..	Bog ..	Common.
——— *spathulata* Labill. ..	..	Spoon-leaved sun-dew	Aus. ..	N. C. S.	Bog ..	Fairly common
——— *binata* Labill. ..	..	Forked-leaved sun-dew	Aus. ..	N. C. S.	Bog ..	Fairly common.
CRASSULACEAE.						
Crassula moschata Forst. f. ..	..	Shore stonecrop	S.A. ..	C. S. Ch. Sub.	Coastal rocks, open spaces in coastal scrub	Common. Grows in water also on Dog Island.
——— *diffusa* (T. Kirk) (= *Tillaea diffusa* T. Kirk in Trans. N.Z. Inst. xxiv, 424, 1891)	..	..	End. ..	C.S. ..	..	Not noted by me, but easily overlooked.
SAXIFRAGACEAE.						
Carpodetus serratus Forst. ..	Putaputawheta, piripiriwhata, kaiweta	New Zealand hawthorn	End. ..	N. C. S.	Forest ..	Common.
PITTOSPORACEAE.						
Pittosporum Colensoi Hook. f.	Rautawhiri ..	Colenso's pittosporum	End. ..	C. S. ..	Forest ..	Common. Has leaves larger, more glossy, and more uniform in shape than the plant of the volcanic plateau of the North Island.
CUNONIACEAE.						
Weinmannia racemosa L. f...	Kamahi, towai	..	End. ..	N. C. S.	Forest, sub-alpine scrub	Extremely common. Extends in northern province of New Zealand to Thames forests. Commences to bloom beginning of October.
ROSACEAE.						
Rubus australis Forst. f. ..	Tataramoa ..	Bush-lawyer ..	End. ..	N. C. S.	Forest ..	Not very common in virgin forest; more abundant where it has been cut into. Begins to bloom beginning of October.
——— *schmidelioides* A.Cunn.	..	Rose-leaved lawyer	End. ..	N. C. S.	Forest ..	Rare in virgin forest; very plentiful where forest is partially cleared.
——— ——— A. Cunn. var. *coloratus* Kirk	..	White-leaved lawyer	End. ..	N. C. S.	Forest ..	Rare. Near Thule Bay, Paterson Inlet; Mason Bay.
——— *subpauperatus* Cockayne	..	Narrow-leaved lawyer	End. ..	(?)N. C. S.	Forest (outskirts)	Rare.
Geum leiospermum Petrie ..	..	..	End. ..	C. S. ..	Bog ..	Rare. Freshwater River valley.
Potentilla anserina L. var. *anserinoides* (Raoul) T. Kirk	..	Silverweed ..	End. ..	N. C. S. Ch.	Bog ..	Rare.
Acaena novae-zelandiae Kirk	..	Red piripiri, red New Zealand burr	End. ..	N. C. S. Ch.	Heath ..	Common.
——— *Sanguisorbae* Vahl.	Piripiri, hutiwai	Biddy-biddy, Biddy-bid, New Zealand burr	Aus., Tristan da Cunha	N.C. S. Sub.	Heath, forest	Probably introduced into the New Zealand subantarctic islands, the var. *antarctica* being there the plant of the primitive formations.
GERANIACEAE.						
Geranium microphyllum Hook. f.	..	Small-leaved cranesbill, slender geranium	End. ..	N. C. S. Sub.	Heath, wet ground	Common.
——— *sessiliflorum* Cav. ..	..	Short-flowered cranesbill	Aus., S.A.	N. C. S.	Dunes ..	Confined to dunes. Much more robust, pilose, and branching than the type. Leaves somewhat glaucous, never dark-coloured; petioles stout, rather long, reaching in cultivation more than 7 cm. Flowers white; peduncles elongate after flowering, and reach in cultivated specimen 5·5 cm. and more. Also on dunes coast of Foveaux Strait, South Island. If constant from seed, should have a name.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.*						
GERANIACEAE—*contd.*						
Pelargonium australe Jacq...	Kopata ..	..	Aus., Norf. Isld., Tristan da Cunha	N. C. S. Ch.	Heath.	
LINACEAE.						
Linum monogynum Forst. f.	Rauhuia ..	White flax ..	End. ..	N. C. S. Ch.	Open ground near sea, coastal rocks	Not very abundant.
EUPHORBIACEAE.						
Euphorbia glauca Forst. f. ..	Waiuatua ..	New Zealand spurge	Norf. Isld.	N. C. S. Ch.	Dunes ..	Common.
CALLITRICHACEAE.						
Callitriche Muelleri Sond....	..	Southern water star-wort	Aus. ..	Ker. N. C. S. Ch.	Wet ground, streams	
CORIARIACEAE.						
Coriaria ruscifolia L. ..	Tutu, tupakihi	Common tute ..	S.A. ..	Ker. N. C. S. Ch.	Forest, heath	I am of opinion more than one species is included under this name in New Zealand.
—— *thymifolia* Humb. and Bonp.	Tutupapa ..	Thyme-leaved tute	S.A. ..	C. S. ..	Sandy gr'nd with rock beneath; dune	Only noted near Mason Bay.
—— —— var. intermediate between *C. ruscifolia* and *C. thymifolia*	..	..	End. ..	S. ..	Sandy gr'nd with rock beneath; dune	Only noted near Mason Bay.
ELAEOCARPACEAE.						
Aristotelia racemosa (A. Cunn.) Hook. f.	Makomako ..	Wineberry, native currant	End. ..	N. C. S.	Forest ..	Rare in forest; abundant in clearings. Blooms in early October.
—— *Colensoi* Hook. f. ..	..	Colenso's wineberry	End. ..	C. S. ..	Scrub in river-valley	Rakiahua Valley, near sea-level.
—— *fruticosa* Hook. f. ..	..	Mountain-currant, or wineberry	End. ..	N. C. S.	Scrub in river-valley	Rakiahua Valley; near head of Crooked Inlet, Port Pegasus; northern province, Thames mountains only.
Elaeocarpus Hookerianus Raoul	Pokaka, hinaupuka	..	End. ..	N. C. S.	Forest ..	Not common.
MALVACEAE.						
Plagianthus divaricatus Forst.	..	Salt-marsh ribbonwood	End. ..	N. C. S. Ch.	Salt meadow	Not common. Only noted at Port William.
—— *betulinus* A. Cunn. ..	Manatu ..	Ribbonwood	End. ..	N. C. S.	Forest ..	Extremely rare. Rakiahua Valley and Paterson Inlet.
GUTTIFERAE.						
Hypericum japonicum Thunb.	..	Japanese St. John's wort	Aus., Mal., E. Asia	N. C. S.	Heath ..	Not abundant.
ELATINACEAE.						
Elatine americana Arn. var. *australiensis* Benth.	..	Water-wort ..	Aus. ..	N. C. S.	Wet ground.	
VIOLACEAE.						
Viola filicaulis Hook. f. ..	..	Slender violet ..	End. ..	N. C. S.	Subalpine meadow, wet ground, lowland	Common.
—— —— var. *hydrocotyloides* (Armstg.) Kirk	..	Water-penny violet	End. ..	S. ..	Wet ground	
—— *Cunninghamii* Hook.f.	..	Common New Zealand violet	Aus. ..	C. S. ..	Dunes.	
Melicytus lanceolatus Hook. f.	..	Lance-leaved whitewood	End. ..	N. C. S.	Banks near the sea	Not common.
—— *ramiflorus* Forst. ..	Mahoe ..	Whitewood ..	Pol., Norf. Isld.	Ker. N. C. S.	..	Recorded by Petrie, but not seen by either Kirk, myself, or Murdoch, this observer, however, stating he has been told it is near Saddle Point.
Hymenanthera dentata R. Br. var. *alpina* Kirk	..	..	End. ..	S. ..	Subalpine meadow; shrub'y side of stream, in open ground	Rare. Sea-level almost to about 3,000 ft. Only noted near Port Pegasus and on Mount Anglem.
THYMELAEACEAE.						
Pimelea Lyallii Hook. f.(?) ..	..	Lyall's pimelea..	End. ..	C. S. ..	Dunes ..	I am not at all sure as to identification of this plant.
Drapetes Dieffenbachii Hook.	..	Common drapetes	End. ..	N. C. S.	Subalpine meadow, old dunes	Only on Thames mountains, in northern province of New Zealand.
—— *Lyallii* Hook. f. ..	..	Lyall's drapetes	End. ..	C. S. ..	Open gro'nd, lowland, subalpine meadow	Common.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.*						
MYRTACEAE.						
Leptospermum scoparium Forst.	Manuka, kahikatoa	Red tea-tree ..	Aus. ..	N. C. S. Ch.	Coastal scrub, forest, subalpine scrub	The so-called var. *prostrata* is also in great abundance, but, as shown in body of report, is merely a form depending on the environment.
Metrosideros lucida (Forst. f.) A. Rich.	Rata ..	Ironwood, southern rata, mountain-rata	End. ..	N. C. S. Sub.	Forest, subalpine scrub	Principally in a belt near the shore, and in the upper forest and subalpine scrub. There is a form with white or cream-coloured flowers near Port Adventure similar to the one recorded by Kirk in the Otira Gorge and to another near the new Otira Hotel. Blooms at beginning of January.
—— *hypericifolia* A. Cunn.	..	Slender climbing white rata	End. ..	N. C. S.	Forest ..	Fairly common, but much more abundant where forest has been partially cleared.
Myrtus pedunculata Hook. f.	Rohutu ..	Small-leaved myrtle	End. ..	N. C. S.	Forest ..	Fairly common, especially in scrubby forest of river-valleys, where it is a small tree.
ONAGRACEAE.						
Epilobium pallidiflorum Sol.	..	Large white willow-herb	Aus. ..	N. C. S. Ch.	Bog ..	Only noted on old dune bogs, Mason Bay.
—— *Billardierianum* Ser.	..	Red-stemmed willow-herb	Aus. ..	N. C. S. Ch.	Wet ground	
—— *junceum* Sol. ..	..	Narrow-leaved willow-herb	Aus. ..	N. C. S.	Heath.	
—— *pubens* A. Rich. ..	..	Soft-leaved willow-herb	Aus. ..	N. C. S. Ch.	Heath, forest	
—— *pictum* Petrie ..	..	Variegated willow-herb	End. ..	C. S. ..	Heath.	
—— *alsinoides* A. Cunn.	..	..	End. ..	N. C. S. Ch. Sub.(?)	Heath.	
—— *insulare* Haussk. ..	..	Creeping marsh willow-herb	End. ..	N. C. S. Ch.	Wet places	
—— *rotundifolium* Forst. f.	..	Round-leaved willow-herb	End. ..	N. C. S. Ch.	Forest.	
—— *linnaeoides* Hook. f.	..	Forest willow-herb	End. ..	N. C. S. Sub.	Forest.	
—— *pedunculare* A. Cunn. (and an unnamed var.)	..	Long-stemmed willow-herb	End. ..	N. C. S.	Heath, subalpine meadow	A very distinct form, or perhaps sp. nov., with slender stems, small leaves, and very large and pretty flowers; grows in the subalpine meadow, but is much more abundant on the Longwood Range. Unfortunately, I have no material for drawing up a description.
—— *nerterioides* A. Cunn.	..	Wrinkled willow-herb	End. ..	N. C. S. Ch.	Heath.	
—— —— var. *minimum* (Kirk) Cockayne	..	Short-stemmed willow-herb	End. ..	S. ..	Moist banks, wet sandy ground	Fairly common in places.
—— *novae-zelandiae* Haussk.	..	Pale-leaved willow-herb	End. ..	N. C. S.	Heath.	
Fuchsia excorticata L. f. ..	Kotukutuku, konini = the fruit	Native fuchsia	End. ..	N. C. S. Sub.	Forest ..	Fairly common.
—— *Colensoi* Hook. f. ..	..	Shrubby fuchsia	End. ..	N. C. S.	Forest ..	Not abundant.
HALORRHAGACEAE.						
Halorrhagis erecta (Murr.) Schindler	Toatoa ..	Tall haloragis ..	Aus., Juan Fernandez	Ker. N. C. S.	Heath.	
—— *diffusa* (Hook. f.) comb. nov. = *H. tetragyna* Hook. f. var. *diffusa* Hook. f. in Handb. N.Z. Flora, p. 65, 1864	..	..	End. ..	N. C. S.	Heath.	
—— *uniflora* Kirk ..	..	..	End. ..	N. C. S.	Heath.	
—— *micrantha* (Thunb.) R. Br.	..	Marsh-haloragis	Aus., Mal., Himalaya M., China, Japan	N. C. S. Sub.	Boggy ground, lowland	
Myriophyllum elatinoides Gaudich.	..	Common water-milfoil	Aus., S.A.	N. C. S.	River.	
—— *propinquum* A. Cunn. var. *tenuifolium* Schindler.	..	..	End. ..	N. C. S.	River.	
—— *Votschii* Schindler...	..	..	End. ..	N. C. S.	Wet ground, lowland	

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.*						
HALORRHAGACEAE—*contd.*						
Gunnera albocarpa (Kirk) Cockayne	..	White-fruited gunnera	End. ..	S. ..	Wet banks, lowland	Very common. Probably on increase on "cuttings," &c.
—— *prorepens* Hook. f. ..	..	Creeping-gunnera	End. ..	C. S. ..	*Sphagnum* bog	Abundant on old dunes, Mason Bay and Rakiahua Valley.
—— *Hamiltonii* Kirk ..	..	Southland gunnera	End. ..	S. ..	Wet ground, in open	Very rare. Mason Bay, Murdoch!
—— *arenaria* Cheesem.(?)	..	Sand-gunnera ..	End. ..	N. C. S.	Wet sand	I am not at all sure of my identification. Only noted at Mason Bay.
ARALIACEAE.						
Stilbocarpa Lyallii J. B. Armstg.	Punui ..	Stewart Island stilbocarpa	End. ..	S. ..	Coastal scrub	Common beneath shade of *Olearia angustifolia* or of rocks (Photo. No. 38), especially on muttonbird islands, where it forms immense colonies. Differs altogether from the Snares plant, which has a rhizome, as in *S. polaris.*
Nothopanax simplex (Forst. f.) Seem.	Haumakaroa ..	Simple-leaved panax (ivy-tree)	End. ..	N. C. S. Sub.	Forest, subalpine scrub	Only on Thames mountains, in northern province of New Zealand. Abundant in Stewart Island.
—— *parvum* (Kirk) Cockayne	..	Small-leaved panax (ivy-tree)	End. ..	C. S. ..	Forest ..	Low-lying forest in Freshwater River valley. Fairly common.
—— *Edgerleyi* (Hook. f.) Seem.	Raukawa, homangaroa, koreare = the juvenile form	Edgerley's panax (ivy-tree)	End. ..	N. C. S.	Forest ..	Abundant.
—— *anomalum* (Hook.) Seem.	Wauwaupaku..	Shrubby panax (ivy-tree)	End. ..	N. C. S.	With other shrubs, on river-bank	Rare. Only noted in Rakiahua Valley.
—— *Colensoi* (Hook. f.) Seem.	..	Mountain-panax (ivy-tree)	End. ..	N. C. S.	Forest, subalpine scrub	Common.
Schefflera digitata Forst. ..	Pate, patete, kotete	Native fig ..	End. ..	N. C. S.	Forest ..	Common.
Pseudopanax crassifolium (Sol.) C. Koch. var. *unifoliatum* Kirk	Horoheka, hohoeka	Lancewood, grass-tree (this name is common in Stewart Island and the south)	End. ..	N. C. S.	Forest ..	Common. Very abundant where forest has been removed.
UMBELLIFERAE.						
Hydrocotyle tripartita R. Br.	..	..	Aus. ..	C. S. ..	Bog ..	Noted only in bogs of old dunes, Mason Bay.
—— *americana* L. ..	..	American marsh-pennywort	S.A., North America	N. C. S.	Lowland, wet ground generally	
—— *novae-zelandiae* D.C.	..	New Zealand marsh-pennywort	End. ..	N. C. S.	Wet ground	I have a specimen labelled "*H. moschata* small form" in Kirk's handwriting, but it seems to me to be rather *H. novae-zelandiae.*
—— *microphylla* A. Cunn.	..	Small-leaved marsh-pennywort	End. ..	N. C. S.	..	Not noted by me. I have specimen so named and collected by Kirk.
—— *asiatica* L. ..	..	Asiatic marsh-pennywort	Trop. and Subtr. Cos.	N. C. S. Ch.	Bog, wet ground	Common.
*Azorella Cockaynei** Diels ..	..	..	End. ..	S. ..	Salt meadow	Rare. Only observed one place at Mason Bay.
Actinotus novae-zealandiae Petrie	..	..	End. ..	C. S. ..	Bog ..	Common in wet bogs, both lowland and subalpine. In full bloom at end of September. Perhaps identical with *Actinotus bellidioides* of Tasmania, but kept distinct in the Index Kewensis.
Apium prostratum Lab. ..	..	Wild celery ..	Aus., S.A., S.Af., Tristan da Cunha, Norf. Isld.	Ker., N. C. S. Sub.	Salt meadow, coastal rocks	Common.
—— *filiforme* (A. Rich.) Hook.	..	Slender celery ..	End. ..	N. C. S.	Salt meadow	
Oreomyrrhis andicola Endl. var. *Colensoi* (Hook. f.) Kirk	..	..	End. ..	N. C. S. Ch.	Semi-bog..	Only noted in Rakiahua Valley.
Crantzia lineata Nutt. ..	..	Common crantzia	Aus., S.A., N. America	N. C. S. Ch.	Salt meadow	Local.
*Aciphylla Traillii** T. Kirk.	..	Stewart Island spear-grass	End. ..	S. ..	Subalpine meadow	Probably confined to Stewart Island. The Central Otago plant most likely a different species.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.*						
UMBELLIFERAE—*contd.*						
Aciphylla intermedia (Hook. f.)	..	..	End. ..	S. ..	Dunes, blown sand on rock, banks near sea	Common, but only to south and west of the island.
—— —— var. *oblongifolia** Kirk	..	..	End. ..	S. ..	..	Probably the Solanders plant may be referred here.
—— *aromatica* (Hook. f.)	..	..	End. ..	C. S. ..	Subalpine meadow	Not common.
—— *flabellata* (Kirk)* Cockayne	..	..	End. ..	S. ..	Cliffs and rocks of coast and inland	Local, but fairly common in its station. Confined to south and west of island.
CORNACEAE.						
Griselinia littoralis Raoul ..	Kapuka, papaumu	Broadleaf ..	End. ..	N. C. S.	Forest, sub. scrub	Frequently epiphytic.
ERICACEAE.						
Gaultheria antipoda Forst. f. var. *erecta* Cheesem.	Tawiniwini ..	Erect snowberry	End. ..	N. C. S.	Forest, subalpine scrub	Fairly common.
—— —— var. *depressa* Hook. f.	..	..	Aus. ..	C. S. ..	Subalpine meadow	Rare.
—— *perplexa* Kirk ..	..	Narrow - leaved snowberry	End. ..	C. S. ..	Heath ..	Fairly common in its station.
EPACRIDACEAE.						
Pentachondra pumila (Forst. f.) R. Br.	..	..	Aus. ..	N. C. S.	Open and boggy ground	Lowland to subalpine. Only on Thames mountains of northern province.
Styphelia acerosa Sol. ..	Mingimingi, ngohungohu	Sharp - leaved heath	Aus. ..	N. C. S.	Forest, subalpine scrub	Common.
—— *empetrifolia* (Hook. f.) Diels	..	..	End. ..	N. C. S. Sub.	Open and boggy ground	Lowlands to subalpine. Common.
—— *Fraseri* (A. Cunn.) F. Muell.	Patotara, totara	Dwarf heath ..	Aus. ..	N. C. S.	Heath ..	Moderately common.
Archeria Traversii Hook. f. var. *australis* T. Kirk	..	..	End. ..	S. ..	Subalpine scrub	Only observed by Kirk; probably very rare; Mount Anglem.
Dracophyllum Menziesii Hook. f.	..	..	End. ..	S. ..	Subalpine scrub	Only noted on Mount Anglem, where it is fairly common on the moraine.
—— *longifolium* (Forst. f.) R. Br.	Inanga ..	Grass-tree ..	End. ..	C. S. Sub.	Coastal scrub, forest, subalpine scrub	Abundant.
—— *Urvilleanum* A. Rich. var. *Lessonianum* (A. Rich.) Cheesem.	..	Smaller grass-tree	End. ..	C. S. ..	Heath(?)	This is given in Cheeseman's Manual. Kirk also referred plants growing at head of Paterson Inlet to *D. Urvillanum* and *D. scoparium*, but I am not at all sure but that the plants in question are not merely small examples of *D. longifolium*.
—— *Pearsoni** Kirk ..	..	Pearson's needle-leaved heath	End. ..	S. ..	Subalpine scrub, bogs	From almost sea-level to the subalpine zone. The bog-form is much reduced in size. Fairly common on the mountains throughout and on any open ground near Port Pegasus.
—— *politum* (Cheesem.) Cockayne	..	Cushion - forming heath	End. ..	S. ..	Bog, subalpine scrub	Abundant from almost sea-level to the tops of the mountains. Blooms in January and early February.
MYRSINACEAE.						
Rapanea Urvillei (A. D. C.) Mez.	Mapau, tipau	Red mapau, matipo or maple	End. ..	N. C. S.	Forest ..	Common.
Suttonia chathamica (F. Muell.) Mez.	Matipo ..	Chatham Island matipo	End. ..	(?) S. Ch.	Scrub near shore	Abundant at Wilson Bay. One plant or so at Old Neck. Possibly introduced. Leaves smaller than in type, but in shade and on seedlings are typical. It is hard to see why the Maoris should have introduced this plant, but it is suspicious, seeing that the thickets are on old dunes where was a Maori settlement. Said also to be on Ruapuke.
—— *divaricata* (A. Cunn.) Hook. f.	..	Weeping-matipo	End. ..	N. C. S. Sub	Subalpine scrub, forest	Abundant.
—— *nummularia* Hook. f.	..	Creeping-matipo	End. ..	C. S. ..	Open and boggy ground, subalpine meadow	Not common.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.*						
PRIMULACEAE.						
Samolus repens (Forst.) var. *procumbens* R. Knuth.	..	Southern water-pimpernel	Aus., S.A.	Ker. N. C. S. Ch Sub.	Salt meadow	Common.
LOGANIACEAE.						
Mitrasacme novae-zelandiae Hook. f.	..	..	End. ..	S. ..	..	Probably rare, but easily overlooked; mountains near Port Pegasus; Rakiahua.
GENTIANACEAE.						
Gentiana lineata T. Kirk ..	..	Tiny gentian ..	End. ..	S. ..	Boggy meadow	Not common, but easily overlooked.
——— *Griesbachii* Hook. f.	..	Common New Zealand gentain	End. ..	C. S. ..	Subalpine meadow, wet ground, lowland	Form with calyx cut almost to base, and segments equally corolla; flower, ⅞ in. long. Blooms in January.
——— *saxosa* Forst. f. ..	..	Coastal gentian	End. ..	S. ..	Coastal moor	Very common on Dog and Centre Islands.
Liparophyllum Gunnii Hook. f.	..	..	Aus. ..	C. S. ..	Bogs ..	From nearly sea-level to the subalpine region. Blooms in January.
APOCYNACEAE.						
Parsonsia heterophylla A.Cunn.	Kaiku, kaiwhiria, totoroene	New Zealand jasmine	End. ..	N. C. S.	Forest ..	Not common.
CONVOLVULACEAE.						
Calystegia tuguriorum (Forst.f.) R. Br.	..	New Zealand convolvulus	S.A. ..	N. C. S. Ch.	Outskirts of forest	Not common.
——— *Soldanella* (L.) R. Br.	..	..	Cos. temp.	Ker. N. C. S. Ch.	Dunes ..	Fairly common.
Dichondra brevifolia Buch. ..	..	..	End.	N. C. S.	Heath.	Moderately common.
BORAGINACEAE.						
Myosotis antarctica Hook. f. var. *Traillii* Kirk	..	Small-flowered forget-me-not	End. ..	S. ..	Sandy shore	Not common.
——— *albida* (T. Kirk) Cheesem.	..	Coast forget-me-not	End. ..	S. Sub.	Coastal rocks and cliffs	Usually not in great abundance, but widely distributed. Flowers in January. Seed ripe in middle of February.
——— *spathulata* Forst. f...	..	Spoon-leaved forget-me-not	End. ..	N. C. S. Ch.	Bank of river	Rare. Only noted growing in mud of River Rakiahua.
LABIATAE.						
Mentha Cunninghamii Benth.	..	New Zealand mint	End. ..	N. C. S. Ch.	Heath.	Moderately common.
SCROPHULARINACEAE.						
Glossostigma elatinoides Benth.	..	..	Aus. ..	N. C. S.	Wet ground, lowland.	
Veronica salicifolia Forst. f.	Koromiko, kokomuka	Common veronica	End. ..	N. C. S.	..	Not common.
——— *elliptica* Forst. f. ..	..	Coastal veronica	S.A. ..	C. S. Sub. Ch.(?)	Coastal scrub	The form on Centre Island has large leaves, very different from the type, approximating to the large-leaved form of the Snares and Auckland Islands.
——— *amabilis* Cheesem. var. *blanda* Cheesem.	..	Large-flowered veronica	End. ..	S. ..	Outskirts dune forest	Only noted one plant at Mason Bay.
——— *buxifolia* Kirk var. *odora* Kirk	..	New Zealand box, box-leaved veronica	End. ..	C. S.	Semi-bog, heath	Common in open ground, Port Pegasus, Mason Bay.
——— ——— var. *prostrata* Cockayne	..	The prostrate New Zealand box	End. ..	S. ..	Boggy subalpine meadow	Mount Anglem.
——— *Laingii** Cockayne..	..	Laing's whipcord veronica	End. ..	S. ..	Subalpine meadow	Fairly common near summit of Mount Anglem.
Ourisia Colensoi Hook. f. (?)	..	Colenso's ourisia	End. ..	(?)C. S.	..	Rare; Mount Anglem, on bank of creek in forest; Port Adventure; Rakiahua Valley, J. W. Murdoch! I consider this plant distinct from *O. Colensoi* Hook. f. as growing on the volcanic plateau, North Island, but it is hard to find any reliable distinguishing characters. It is the *O. macrophylla* Hook. f. of Cheeseman's catalogue (16). I do not think *O. macrophylla* extends south of the central floristic province, except perhaps on the mountains of north-west Nelson.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.*						
SCROPHULARINACEAE—*contd.*						
Ourisia sessilifolia Hook. f...	..	Hairy ourisia ..	End. ..	S. ..	Subalpine meadow	Upper slopes of Mount Anglem. Not abundant.
——— *caespitosa* Hook. f...	..	Creeping ourisia	End. ..	C. S. ..	Subalpine meadow	Upper slopes of Mount Anglem. Not abundant.
——— *prorepens* Petrie (?)..	..	Petrie's ourisia	End.	S. ..	Subalpine meadow	Upper slopes of Mount Anglem. Rare. The identification is open to doubt.
——— *modesta** Diels .	..	Tiny ourisia ..	End. ..	S. ..	Wet ground, lowland	Only noted in the Rakiahua Valley, but easily overlooked if not in bloom.
Euphrasia Dyeri Wettst. ..	..	Dyer's eye-bright	End. ..	S. ..	Subalpine meadow	"Near Port Pegasus, Kirk" (Cheeseman, 15, p. 556); Table Hill, fairly plentiful, but easily overlooked.
——— *repens* Hook. f. ..	..	Snowy eye-bright	End. ..	S. ..	Coastal moor	Common, Dog and Centre Islands, and Ruapuke(?), but rare Stewart Island. Forms close soft cushions, which in December are white, with the rather large (for size of plant) blooms.
LENTABULARIACEAE.						
Utricularia monanthos Hook.f.	..	Common bladderwort	Aus. ..	C. S. ..	Bogs ..	Common.
PLANTAGINACEAE.						
Plantago Raoulii Decne. ..	Kopakopa ..	Raoul's plantain	End. ..	N. C. S.	Peaty banks, near sea	Fairly common. On Dog Island and in some parts of Stewart Island is rapidly increasing, owing to the ease with which it reproduces itself by seed.
——— *Brownii* Rapin ..	..	Brown's plantain	Aus. ..	C. S. ..	Subalpine meadow	Not abundant.
——— *triandra* Berggr. ..	..	..	End. ..	S. ..	Subalpine meadow	Table Hill.
——— ——— var. *Hamiltonii* (Kirk)	..	..	End. ..	S. ..	Peaty ground, near sea	Mason Bay, south end. On Centre Island the plants grow so closely as to form a hard smooth turf, to the exclusion of all other vegetation.
RUBIACEAE.						
Coprosma lucida Forst. f. ..	Karamu, patutiketike	Shining coprosma	End. ..	N. C. S.	Forest ..	Common.
——— *rotundifolia* A. Cunn.	..	Round-leaved coprosma	End. ..	N. C. S.	Forest ..	Common.
——— *areolata* Cheesem. ..	..	Thin-leaved coprosma	End. ..	N. C. S.	Forest ..	Fairly common.
——— *rhamnoides* A. Cunn.	..	Red-fruited coprosma	End. ..	N. C. S.	Forest ..	Abundant.
——— *parviflora* Hook. f. ..	..	Small-flowered coprosma	End. ..	N. C. S. Sub.	Forest, subalpine scrub	Fairly common.
——— *ciliata* Hook. f. ..	..	Hairy coprosma	End. ..	C. S. Sub.	Subalpine scrub, forest	Fairly common. This is *C. parviflora* var. *pilosa Cheesem.*, but it seems to me identical with *C. ciliata* Hook f. It is abundant on the western side of the Southern Alps.
——— *ramulosa* Petrie ..	..	Straggling coprosma	End. ..	C.S.	Subalpine scrub	Mount Anglem; Table Hill, and probably on all the higher mountains.
——— *acerosa* A. Cunn. ..	..	Dune coprosma	End. ..	N. C. S. Ch.	Dunes ..	Common.
——— ——— var. ..	..	..	End. ..	S. ..	Open ground	Port Pegasus; valleys head of Paterson Inlet.
——— *propinqua* A. Cunn.	..	Common coprosma	End. ..	N. C. S. Ch.	Shrub-association, bank of rivers	Rakiahua and Freshwater Valleys; not common.
——— *foetidissima* Forst. ..	Hupiro, karamu, pipiro	Stinkwood ..	End. ..	N. C. S. Ch.(?)	Forest, subalpine scrub	Abundant.
——— *Colensoi* Hook. f. ..	..	Colenso's coprosma	End. ..	N. C. S.	Forest, subalpine scrub	Abundant. Thames mountains only in northern province.
——— *Banksii* Petrie ..	..	Banks' coprosma	End. ..	C. S. ..	Forest, subalpine scrub	Not common. Abundant in the Longwood Forest, on the mainland.
——— *retusa* Petrie ..	..	Retuse coprosma	End. ..	S. ..	Subalpine scrub	Table Hill.
——— *cuneata* Hook. f. ..	..	Wedge-leaved coprosma	End. ..	C. S. Sub.	Subalpine scrub	Fairly common.
——— *repens* Hook. f. ..	..	Alpine creeping coprosma	End. ..	C. S. Sub.	Bogs and meadow	Lowland to subalpine.
Nertera depressa Banks and Sol.	..	Fruiting duckweed	Aus., S.A., Tristan da Cunha	C. S. Sub.	Forests ..	Very common on ground and on fallen trees.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.*						
RUBIACEAE—*contd.*						
Nertera setulosa Hook. f. ..	..	..	End. ..	N. C. S.	Bogs ..	Not common.
——— *dichondraefolia* (A. Cunn.) Hook. f.	..	..	End. ..	N. C. S.	Forest ..	Common.
Galium umbrosum Sol. ..	..	New Zealand bed-straw	End. ..	N. C. S.	Heath.	
Asperula perpusilla Hook. f.	..	..	End. ..	N. C. S.	Wet ground.	
CAMPANULACEAE.						
Pratia angulata (Forst. f.) Hook. f.	Panakenake, pinakitere	Creeping pratia	End. ..	N. C. S.	Bog.	
Wahlenbergia saxicola (R. Br.) A. D. C.	..	New Zealand blue-bell	Aus. ..	C. S. ..	Ancient dunes	Not observed except on dunes near Mason Bay.
——— *gracilis* (Forst. f.) A. D. C.	..	Slender blue-bell	Aus., E. Asia, S. Af. Norf. Isld.	Ker. N. C. S. Ch.	Heath.	
GOODENIACEAE.						
Selliera radicans Cav. ..	..	Creeping selliera	Aus., S.A.	N. C. S.	Salt meadow	Common.
STYLIDIACEAE.						
Phyllachne clavigera (Hook. f.) F. Muell.	..	Club-leaved phyllachne	End. ..	S. Sub.	Bog, meadow	From almost sea-level to the summits of the mountains.
——— *Colensoi* (Hook. f.) Berggr.	..	Colenso's phyllachne	End. ..	C. S. ..	Bog, meadow	From almost sea-level to summits of the mountains.
Donatia novae-zelandiae Hook. f.	..	New Zealand donatia	End. ..	C. S. ..	Bog, meadow	From almost sea-level to summits of the mountains.
Oreostylidium subulatum (Hook. f.) Berggr.	..	..	End. ..	C. S. ..	Bog ..	Not observed except at a low altitude.
Forstera sedifolia L. f. ..	..	Common forstera	End. ..	S. ..	Bogs, boggy meadow	I am not sure as to abundance of this.
——— ——— var. *oculata* Cheesem.	..	Large-flowered forstera	End. ..	S. ..	Bogs, boggy meadow	Common. This seems to be the most abundant form for Stewart Island.
COMPOSITAE.						
Lagenophora Forsteri D. C...	Papataniwhaniwha	New Zealand daisy	End. ..	Ker. N. C. S. Ch. Sub.	Dune, bog	Common. This should probably be named *Lagenophora pumila* (Forst. f.).
——— *petiolata* Hook. f. ..	..	Slender New Zealand daisy	End. ..	(?) Ker. N. C. S.	Heath.	
[*Brachycome pinnata* Hook. f.	..	..	End. ..	S. ..	Dune(?) ..	According to Handbook, collected at Port William by Lyall. Kirk was of opinion there was some mistake, as he searched in the original locality for the plant. Also, I failed to find it there, and Murdoch recently has sent me a full collection of the Port William plants, but it is absent. I think Lyall must have confused his habitats in this case—an easy matter even where all care is taken.]
——— *Thomsoni* T. Kirk (excluding vars. *membranifolia* Kirk and *polita* (Kirk) Cheesem.)	..	Thomson's daisy	End. ..	S. ..	Open turfy ground near sea	Also, according to Cheeseman, found on east of Otago.
——— ——— var. *minima** T. Kirk	..	..	End. ..	S. ..	..	According to Kirk (62, p. 260), on Dog Island and Ruapuke. I know nothing of this form.
Olearia angustifolia Hook. f.	Tete-a-weka ..	Purple-flowered daisy-tree	End. ..	S. ..	Coastal scrub	Common on headlands to south of Paterson Inlet and on the mutton-bird islands. On mainland only recorded from Preservation Inlet and base of Bluff Hill. Blooms in December. At Mason Bay (full bloom beginning of February) is a form with narrower leaves than the type and *white* disc florets.
——— *Traillii* T. Kirk ..	..	Traill's daisy-tree	End. ..	S. ..	Coastal scrub	Much same habitats as *O. angustifolia*, but not recorded as yet from Mason Bay. Said to be on coast near Ruggedy Mountains. Not common.

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.* COMPOSITAE—*contd.*						
Olearia Colensoi Hook. f. ..	..	Colenso's daisy-tree	End. ..	C. S. ..	Subalpine and coastal scrubs	Extremely abundant. The coastal plant has frequently leaves as large as those of *O. Lyallii*; in fact, I fail to see any difference between these species so far as the large-leaved form is concerned. Also, the Stewart Island plant varies much in size and shape (relative breadth) of leaf, and there is certainly only one species on Stewart Island, whether it be *O. Colensoi* or *O. Lyallii*.
—— *nitida* Hook. f. ..	..	Glossy-leaved daisy-tree	End.	C. S. ..	Outskirts of forest	Should probably be called *Olearia arborescens* (Forst. f.).
—— —— var. *cordatifolia* Kirk	..	..	End. ..	S. ..	..	Recorded only from Stewart Island and Bluff Hill. I think this is merely a form depending on environment, and not a true variety.
—— *ilicifolia* Hook. f. ..	..	Native holly ..	End. ..	C. S. ..	Outskirts of forest	Rare. I have only noted it on land which has been cleared of forest.
—— *avicenniaefolia* (Raoul) Hook. f.	Akeake ..	..	End. ..	C. S. ..	Outskirts of forest	Rare. Sloping banks with other shrubs, Half-moon Bay.
—— *divaricata** Cockayne	..	Stiff-branched daisy-tree	End. ..	S. ..	Subalpine meadow	With shrubs in open meadow of Table Hill. Not seen elsewhere.
—— *virgata* Hook. f. ..	..	Twiggy daisy-tree	End. ..	N. C. S.	Heath, forest outskirts	Not common. In northern province only in neighbourhood of the Thames.
—— —— var. *lineata* Kirk	..	Slender daisy-tree	End. ..	C. S. ..	Shrubs near river	Only noted in Rakiahua Valley.
Celmisia Sinclairii Hook. f.	..	Sinclair's celmisia	End. ..	C. S. ..	Subalpine meadow	Mount Anglem. This form is closely related to *C. discolor*.
—— *rigida** (Kirk) Cockayne	..	Stewart Island celmisia	End. ..	S. ..	Coastal cliffs	South of Mason Bay. Evidently a rare plant; does not ascend to the mountains.
—— *longifolia* Cass. ..	..	Common celmisia	Aus. ..	N. C. S.	Subalpine meadow, bogs	I collected on Mount Anglem a distinct form, with rather broad membraneous leaves, 11 mm. wide and 7·5 cm. long, longer than inflorescence, with recurved margins, much-keeled midrib, and lamina narrowing into a short petiole, which broadens into a sheathing-base. Head 1·8 cm. long.
—— *linearis* J. B. Armstg.	..	Narrow-leaved celmisia	End. ..	(?)C. S.	Boggy meadow, bog lowland	There are two distinct forms in Stewart Island, one much smaller than the other, and only noted on Mount Rakiahua. The large form differs from that of the Southern Alps in its open-leaved, not sharp-pointed, and close-leaved flower-bud, rather blunt leaves which have much-recurved margins, conspicuous veins on under-surface, upper surface longitudinally wrinkled, tomentum not quite silvery, but with a brownish tinge, and leaf-sheath only half length of blade. The above differences lead to leaves of very different appearance.
—— *sessiliflora* Hook. f.(?)	..	Short-flowered celmisia	End. ..	C. S. ..	Subalpine meadow.	Not common.
—— *argentea* Kirk ..	..	Silvery celmisia	End. ..	S. ..	Subalpine meadow	Abundant on the mountains and occasionally near sea-level, Port Pegasus.
Gnaphalium trinerve Forst. f.	..	..	End. ..	C. S. ..	Banks near sea, "cuttings" on side of road, &c.	Common, but especially in artificial stations.
—— *luteo-album* L. ..	Pukatea ..	White cudweed	Cos. ..	Ker. N. C. S. Ch. Sub.	Dunes, heath	
—— *japonicum* Thunb. ..	..	Japanese cudweed	Aus., Mal., Norf. Isld., Lord Howe Isld., E. Asia	Ker. N. C. S. Ch.	Heath, dune	

LIST OF THE INDIGENOUS PTERIDOPHYTES AND SPERMOPHYTES—*continued.*

Species, Family, &c.	Maori Name.	English Name.	Distribution.			Remarks.
			Beyond New Zealand, or Endemic.	Within New Zealand.	In Stewart Island.	
SPERMOPHYTA—*contd.* COMPOSITAE—*contd.*						
Gnaphalium collinum Lab...	..	Hill cudweed ..	Aus. ..	Ker. N. C. S. Ch.	Heath.	
Raoulia australis Hook. f. ..	..	Silvery raoulia..	End. ..	C. S. ..	Dunes ..	Only observed at Mason Bay on dunes a considerable distance from sea.
—— *glabra* Hook. f. ..	..	Glabrous raoulia	End. ..	C. S. ..	..	Rare. Only noted on bed of a small stream near north end of Half-moon Bay.
—— *Goyeni** Kirk ..	..	Stewart Island vegetable-sheep	End. ..	S. ..	Subalpine rocks, subalpine meadow	Common. Mount Anglem, Table Hill, Rakiahua.
Helichrysum bellidioides (Forst. f.) Willd.	..	Mountain-daisy	End. ..	C. S. Sub. Ch.	Subalpine meadow, heath.	Fairly common.
—— *Loganii* (Buch.) Kirk (?)	..	..	End. ..	? C. S.	Rocky ground	Near summit of Anglem. Identification doubtful.
—— *grandiceps* Hook. f.		New Zealand edelweiss	End. ..	C. S. ..	Subalpine rocks	Not common. Only on summits of Mount Anglem, Table Hill, Mount Allen (Murdoch).
—— *filicaule* Hook. f. ..	..	..	End. ..	N. C. S. Ch.	Heath of dunes	Mason Bay; not noted elsewhere.
Cassinia Vauvilliersii Hook. f.	..	Mountain-cassinia	End. ..	C. S. Sub.	Boggy ground near sea-level	Common.
Craspedia uniflora Forst. f. var. *robusta* Hook. f.	..	..	End. ..	C. S. ..	Damp sandy ground, base of dunes	Mason Bay quite local. A form with very large heads.
—— —— var. *minor* Hook. f.	..	..	End. ..	C. S. Sub.	Wet ground.	
Cotula coronopifolia L. ..	..	Swamp-cotula ..	Aus., S.A., Eur.(?) N. Am.(?)	N. C. S. Ch.	Wet ground of cultivated land	Rare; perhaps introduced.
—— *Traillii* Kirk ..	..	Stewart Island cotula	End. ..	S. ..	Dunes, salt meadow or relatedassoc.	Common. Confined to Stewart Island district and shores of Foveaux Strait.
—— *pulchella* Kirk ..	..	..	End. ..	S. ..	Coastal moor, salt meadow	Very common, Dog and Centre Islands; rare, Stewart Island. I am not absolutely sure of my identification, but the plant in question is constant over a considerable area, and seems a well-marked species.
Abrotonella linearis Berggr...	..	..	End. ..	C. S. ..	Subalpine meadow.	
—— *muscosa** Kirk ..	..	..	End. ..	S. ..	On peat on rocks	Summit of Table Hill and Mount Rakiahua, but very easily overlooked.
Erechtites prenanthoides (A. Rich.) D. C.	..	Common fireweed	Aus. ..	N. C. S. Ch. Sub(?)	Forest.	
—— *arguta* (A. Rich.) D. C.	..	Woolly fireweed	Aus., Norf. Isld.	N. C. S.	Heath.	
—— *scaberula* Hook. f. ..	..	Scabrid fireweed	End. ..	N. C. S. Ch.	Forest and heath.	
—— *quadridentata* (Lab.) D. C.	..	White fireweed	Aus. ..	N. C. S. Ch.	Forest and heath.	
—— *diversifolia* Petrie ..	..	Petrie's fireweed	End. ..	C. S. ..	Heath.	
—— *glabrescens* Kirk ..	..	Kirk's fireweed	End. ..	C. S. ..	Forest.	
Senecio bellidioides Hook. f...	..	Common mountain-groundsel	End. ..	C. S. ..	Bogs and wet ground	Very common near Port Pegasus. Probably on the increase where vegetation has been burnt.
—— *Lyallii* Hook. f. ..	..	Lyall's groundsel	End. ..	C. S. ..	Boggy subalpine meadow lowland bogs	Extremely common; almost at sea-level on open ground near Port Pegasus.
—— *scorzonerioides* Hook.f.	..	The great white groundsel	End. ..	C. S. ..	Boggy subalpine meadow	Table Hill; common. Did not note it on Mount Anglem.
—— *lautus* Forst. f. ..	..	Coast-groundsel	Aus., Norf. Isld.	Ker. N. C. S. Ch.	Coastal rocks	
—— *Stewartiae* J. B. Armstg.	..	Stewart Island shrubby groundsel	End. ..	S. Sub.	Coastal scrub	Only known on the various mutton-bird islands and the Solanders, but probably on some of the exposed headlands.
—— *elaeagnifolius* Hook.f.	..	Common mountain shrubby groundsel	End. ..	C. S. ..	Subalpine scrub	Only noted on Table Hill Range.
—— *rotundifolius* Hook. f.	Puheretaiko ..	Round-leaved shrubby groundsel	End. ..	C. S. ..	Coastal scrub, forest	Extremely abundant.
Taraxacum glabratum (Forst.f.) Cockayne	..	New Zealand dandelion	End. ..	N. C. S. Sub.	..	Not common; near shore, Half-moon Bay.
Sonchus littoralis (Kirk) Cockayne	..	Coastal sow-thistle	End. ..	N. C. S.	Dunes ..	Only noted at Mason Bay.
—— *oleraceus* L. ..	..	Sow-thistle ..	Cos. ..	Ker. N. C. S. Ch.	..	

C. LIST OF INTRODUCED PLANTS.*

GRAMINEAE.

Anthoxanthum odoratum L. (Sweet vernal grass.)
Agrostis alba L. var. *stolonifera* L. (Marsh bent-grass.)
—— *tenuis* Sibtp. (= *A. vulgaris* With.) (Redtop, fine bent-grass.)
Holcus lanatus L. (Yorkshire fog.)
Aira caryophyllea L. (Hair-grass.)
Deschampsia flexuosa Trin. (Wavy mountain hair-grass.)
Dactylis glomerata L. (Cocksfoot.)
Poa annua L. (Annual meadow-grass.)
——— *pratensis* L. (Meadow-grass.)
Lolium perenne L. (Rye-grass.)
Festuca rubra L. var. (Chewing's fescue.)

POLYGONACEAE.

Rumex crispus L. (Curled dock.)
——— *obtusifolius* L. (Common dock.)
——— *sanguineus* L. var. *viridis* (Sibth.). (Green-veined dock.)
——— *Acetosella* L. (Sorrel.)

CHENOPODIACEAE.

Chenopodium album L. (Fat-hen.)

CARYOPHYLLACEAE.

Silene anglica L. (= *S. gallica* L.)
var. *quinquevulnera* (L.) (Variegated catchfly.)
Cerastium viscosum L. (= *C. glomeratum* Thuill). (Mouse-ear.)
——— *vulgatum* L. (= *C. triviale* Link). (Larger mouse-ear.)
Stellaria media Vill. (Chickweed.)
Sagina procumbens L. (Pearl-wort.)
Spergula arvensis L. (Spurrey.)
Polycarpon tetraphyllum L. (Four-leaved allseed.)

RANUNCULACEAE.

Ranunculus repens L. (Creeping-buttercup.)
——— *acris* L. (Field-buttercup.)

CRUCIFERAE.

Radicula Nasturtium-aquaticum Rend. and Brit. (= *Nasturtium officinale* R. Br.) (Water-cress.)
Brassica Rapa L. (Turnip.)
Capsella Bursa-pastoris Medic. (Shepherd's purse.)
Coronopus didymus Sm. (= *Senebiera*). (Wart-cress.)

ROSACEAE.

Rubus fruticosus L. (Blackberry.)

LEGUMINOSAE.

Lupinus arboreus Sims. (Tree-lupin.)
Ulex europaeus L. (Gorse.)
Cytisus scoparius Link. (Broom.)
Medicago denticulata Willd. (Toothed medick.)
Trifolium pratense L. (Red-clover.)
——— *repens* L. (White-clover.)
——— *procumbens* L. (Hop trefoil.)
——— *dubium* Sibth. (Yellow suckling.)
Vicia sativa L. (Common vetch.)

GERANIACEAE.

Geranium molle L. (Soft cranesbill, dovesfoot.)
Erodium cicutarium L'Herit. (Stork's bill.)

EUPHORBIACEAE.

Euphorbia Peplis L. (Milk-weed.)

GUTTIFERAE.

Hypericum Androsaemum L. (Tutsan.)

VIOLACEAE.

Viola cornuta L. (Horned violet.)

UMBELLIFERAE.

Peucidanum sativum Benth. and Hook. (Parsnip.)

PRIMULACEAE.

Anagallis arvensis L. (Pimpernel.)

* Only the plants of Stewart Island itself recorded here. Probably many more introduced plants will be discovered.

GENTIANACEAE.

Centaurium umbellatum Gilib. (= *Erythraea Centaurium* Pers.). (Centaury.)

LABIATAE.

Mentha spicata L. (= *M. viridis* L.). (Spearmint.)
——— *Pulegium* L. (Pennyroyal.)
Prunella vulgaris L. (Self-heal.)

SOLANACEAE.

Solanum tuberosum L. (Potato.)

SCROPHULARINACEAE.

Linaria vulgaris Mill. (Toadflax.)
Mimulus luteus L. (Monkey-musk.)
——— *moschatus* Dougl. (Common musk.)
Veronica arvensis L. (Wall speedwell.)
——— *serpyllifolia* L. (Thyme-leaved speedwell.)

PLANTAGINACEAE.

Plantago major L. (Greater plantain.)
——— *lanceolata* L. (Ribwort, ribgrass.)

CAPRIFOLIACEAE.

Sambucus nigra L. (Elderberry.)
Leycesteria formosa Wall.

COMPOSITAE.

Bellis perennis L. (Daisy.)
Erigeron canadensis L. (Canadian fleabane.)
Achillaea Millefolium L. (Yarrow.)
Chrysanthemum Leucanthemum L. (Ox-eye daisy.)
Senecio vulgaris L. (Groundsel.)
——— *Jacobaea* L. (Ragwort.)
Cnicus lanceolatus Willd. (Spear-thistle.)
——— *arvensis* Hoffm. (Californian thistle.)
Lapsana communis L. (Nipplewort.)
Crepis capillaris Wallr. (= *Crepis virens* L.) (Smooth hawkesbeard.)
Hypochaeris radicata L. (Cat's ear.)
Taraxacum officinale Weber. (Dandelion.)

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Map of STEWART ISLAND NEW ZEALAND.

N.Z. LANDS AND SURVEY

REFERENCE.

Reserves for the Preservation of Native Fauna and Flora shown thus:

Scenic Reserves shown thus:

SCALE OF ENGLISH MILES

Habitat of Suttonia chathamica.

Compiled and drawn by W. Doverell. November 1898

N. M. Skeet, Chief Surveyor, Invercargill.

168° East Longitude

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