

1877.  
NEW ZEALAND.

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# REPORT

OF THE

# CONSERVATOR OF STATE FORESTS.

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

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WELLINGTON.  
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# REPORT

OF THE

## CONSERVATOR OF STATE FORESTS,

WITH

### PROPOSALS FOR THE ORGANIZATION AND WORKING OF THE STATE FOREST DEPARTMENT.

Captain CAMPBELL-WALKER to the Hon. the COMMISSIONER of STATE FORESTS.

(No. 28.)

SIR,— Government Buildings, Wellington, 16th March, 1877.

I have the honor to submit my report, and proposals for the organization and working of the State Forest Department.

2. There is doubtless much in the report with which the members of Government and both Houses of Representatives are already familiar, but I have deemed it right to place on record what I have seen and done during my stay in the colony, in order that it may not be supposed that the conclusions at which I have arrived are based upon insufficient knowledge of the several districts.

3. I have endeavoured, at the same time, to avoid entering into over detail in the record of my inspections and descriptive chapter. Detailed examinations and reports on the forests, district by district, block by block, will form subject of future consideration and report, if the department be constituted.

4. In the same manner I have avoided going into detail of the duties to be performed by the officers whom it is proposed to employ, which will form part of the organization or interior economy of the department, for which the Conservator is responsible.

5. I trust that the manner in which I have occupied my time, and the report which I have now the honor to submit, may meet with the approval of His Excellency and the Government of the colony.

I have, &c.,

J. CAMPBELL-WALKER, Captain,  
Conservator of State Forests.

The Hon. the Commissioner of State Forests.

#### INTRODUCTORY.

ON my arrival in Wellington it was decided at an interview with the Premier (Sir Julius Vogel) that, instead of proceeding at once to organize the State Forest Department, I should devote the year for which my services had been lent by the Government of India to seeing as much of the New Zealand forests as possible, and making myself acquainted with the special circumstances and conditions, not only of the climate and timbers of the colony, but of the existing regulations affecting settlement, acquisition of land, and the general bias or state of feeling of the public with regard to such matters, as well as with regard to the special question of forest conservation by the State or Government.

Acting on this principle, a route or plan of inspection was drawn up with Mr. Kirk's aid, which has, on the whole, been very closely adhered to, and which comprised, at Sir Julius Vogel's suggestion, a stay in Wellington during the worst of the winter months, when the state of the forest renders it almost impenetrable, and during which my time was devoted to reading up the debates and papers bearing on the subject, making the acquaintance of the members of both Houses then in session, and collecting all the information in my power. By these means it was hoped that by the close of the year I should be in a position to submit a report and scheme for forest administration, and the organization of a department based upon some actual experience and knowledge, and therefore more likely to be practicable and workable. This view, which was adopted by Major Atkinson on his becoming Premier, has been steadily adhered to; and I have now the honor to lay before you the results of the ten months' labour, which, insufficient as they may appear, and do seem to me, will, I trust, be deemed not altogether unsatisfactory.

2. Looking back upon the above arrangement, and contrasting my ideas of the New Zealand forests and of a system of State forest administration applicable to them with the knowledge, inadequate though it be, which I have gained by inquiry and personal inspection in, I may say, every part of both islands, and with the views which I have matured as to what is requisite and suitable for the colony and its people, I am fully satisfied of the wisdom of the course pursued, and convinced that any other must have resulted in serious mistakes, which it might have been found difficult to correct, and much unnecessary and unprofitable expenditure of public money, which, coupled with restrictions and interference unsuited to the habits and ways of thought and action of the people, could not have failed to make the department unpopular, and might have resulted in its downfall, and the postponement of the consideration of the great question of forest conservancy, and introduction of a proper system, to a far distant day when it might be too late to save, and forests might have had to be re-made.

3. Amongst other advantages gained by the delay in organizing the department, the abolition of the provincial system of government, which has become an established fact, must not be lost sight of, as under it any scheme of forest conservation for the benefit of the colony at large would, I fear, have been found impossible.

In my detail of inspection tours, I refer of necessity to the several provincial districts which I visited; but in the subsequent treatment of the subject I avoid as much as possible any consideration of the old provincial boundaries and distinctions, and endeavour to treat the subject, as I should wish it to be approached, from a purely colonial point of view.

4. I should explain that the cause of Stewart's Island and the South-west Sounds not having been inspected and reported on was, that no Government steamer could be made available for the work as originally arranged. This was matter of much regret and disappointment to me and Professor Kirk, whose services I had specially secured to visit those localities, the flora of which is, comparatively speaking, little known and undescribed. A good deal of valuable time was subsequently lost on the West Coast, owing to the floods in January and February, which rendered the rivers impassable and the forest impenetrable. This somewhat curtailed my inspections in the northern districts of the South Island, as I had to return to Wellington in order to submit this report before the end of March; but on the whole, with the exception just alluded to, which may be considered a misfortune but not a fault, the programme of inspections, which I think it will be allowed embraced all that could be done within the time, has been fairly adhered to, and should enable me to have formed definite opinions entitled to some weight of the nature, extent, and value of the New Zealand forests, and the measures for their management most likely to prove beneficial, and at the same time least antagonistic to the current of public or popular opinion.

5. I must in justice to myself refer to the very meagre amount of information on record, or even apparently procurable, as to the actual extent of forest in the hands of Government, its situation, value, &c. The papers relating to State forests presented to both Houses of the General Assembly in 1874 contain all that I found available on the subject, and they avowedly consist mainly of estimates and the expressions of individual opinion on the part of Superintendents of provinces and others. On returning from my first tour in the Auckland Province, I issued a series of queries which were sent to the Commissioners of Crown Lands, with the view of collecting all the information procurable. An abstract of their replies in tabular form is given in this report, from which it will be seen how very inadequate the information, most of which has been but recently furnished, still is. In some instances, notably that of Taranaki, the report formed a most useful guide, and saved much trouble and loss of time in useless inspections of private forests, with which it has never been proposed that the State should interfere; but in the majority of cases the replies have been of little or no practical value. This is perhaps not to be wondered at, in the case of a comparatively young colony without any officers whose special business it is to procure or furnish such returns. I simply refer to it as a want which has caused me considerable difficulty and inconvenience. One of the first duties of the State Forest Department would be to acquire accurate information, and prepare statements and maps of the forest areas not already alienated from the Crown. Until this is done, we must to a great extent be working in the dark, ignorant of our actual resources and the proportion of forest area remaining from year to year.

6. In concluding these preliminary remarks I need only add that I do not in this report make any attempt at an exhaustive description of the forests of New Zealand, still less of its flora: to do so would be a work of time far in excess of that at disposal, and I have no doubt, as has been stated, that had that and that only been what was required it might have been furnished better by others more conversant with the New Zealand flora than I am, and possessing high attainments as botanists, to which I lay no claim. I venture, however, to think that this is not the main object aimed at, and have therefore, whilst availing myself as much as possible of the local and scientific knowledge procurable, endeavoured to limit the scope of the report to practical descriptions and suggestions based on the general principles of State forest conservancy throughout the world.

For most of the information on geological and botanical points and distribution I am indebted to Professor Kirk, whose help in identifying trees has been of the greatest service, and whose efforts in the cause of forest conservancy and planting have been unremitting, and merit the highest acknowledgments on my part, and, I think, on the part of the colony at large.

7. The botanical name of each tree is given on its first mention by its English or Maori name, so that there should be no doubt as to what description is meant, and I have endeavoured to be uniform in the use of the English names throughout. In case of any doubt, however, reference should be made to the classified list of the timber trees, in which the botanical, Native, and English synonyms are given. The term Beech, in lieu of the more commonly used but erroneous Birch, is made use of throughout when reference is made to trees of the genus *Fagus*; and the terms Black, Red, and White Pine represent respectively the *Podocarpus spicata*, *Dacrydium cupressinum*, and *Podocarpus dacrydioides*. This explanation may, I trust, serve to obviate confusion or misconception of the exact description of tree referred to.

## CHAPTER I.

### INSPECTION TOURS.

1. I arrived at Wellington on the 3rd of May, and, after a short trip to the Rimutaka, proceeded on the 19th of the same month to Auckland Province, in which I remained till the 25th of June, visiting the kauri and white-pine forest on the Thames and north of Auckland, on the Kaipara and Hokianga Rivers; thence crossing to the Bay of Islands, and *via* Auckland to Mercer and the Upper Waikato and Matamata.

On the 1st of August I proceeded to Canterbury, where I remained till the 9th, visiting the Oxford Forest and Timaru.

On the 15th September I proceeded to Masterton, and, having been prevented by floods from going through the Forty-Mile Bush, returned to Wellington on the 19th, and left on the 21st by the alternative route *via* Foxton and Palmerston to Woodville and the Seventy-Mile Bush to Napier; thence overland to Ohinemutu and Tauranga and *via* Auckland to Taranaki (on 20th October), in which province I spent ten days, after which I came on to Wellington *via* Wanganui.

On the 4th November I went to Canterbury, and remained in that province till the 28th, inspecting the forest on Banks Peninsula, &c., and plantations on the plains.

In December I was in the Otago Province, and did not leave it till the 19th of January, when I proceeded to Westland; thence *via* the Grey, Buller, and Hope Rivers to Nelson, in February, and on to Blenheim by the Rai Valley. In the same month I visited Sherwood Forest (in the Nelson Province) and the Kaikouras, and proceeded to Christchurch *via* Hawkswood and Cheviot Hills, returning to head-quarters on the 3rd March. The total number of days absent from head-quarters during the ten months (3rd May to 3rd March) has been 215, including thirteen days' leave of absence in December. During my inspections in Auckland, Otago, and Westland, I was accompanied by Professor Kirk, who was temporarily attached to the department; and a Mr. Robertson held an acting appointment as forester for forty-four days, in September and October, and did some preliminary inspections in Canterbury.

The maps submitted with this report indicate the routes followed in proceeding from one locality to another.

### DETAIL OF INSPECTIONS.

#### *Auckland.*

2. After visiting the Superintendent and making the acquaintances of several gentlemen interested in the question of forest conservancy, I proceeded with Mr. Kirk to Grahamstown, on the Thames, and thence penetrated into the kauri forests in the Kauaeranga Valley and Mungawhau Creek. On this my first view of a kauri forest I was much struck by the colossal dimensions of this noble tree. Trunks of five and six feet in diameter, running up to fifty and sixty feet without a branch, were not uncommon, whilst those of smaller dimensions, which would be considered fine trees in other countries, were numerous. I was well pleased to note also a fine growth of young kauri interspersed with the rewarewa (*Knightsia excelsa*) coming up wherever fire had not followed in the wake of the bushman, as is too often the case. The mode of felling and methods of transporting the logs from the forest were carefully noted; and, although the subject will be treated separately further on in this report, I may state incidentally that the rolling roads and shoots are on much the same system as those in Germany. The dams and appliances for river transport appear excellent, although a system of supplemental dams, and sleeping of the beds of the streams in which floating is carried on, would be found an improvement. We next visited the Hauraki saw-mill and forests in the vicinity. The forest is situated on low, swampy ground between the Thames and the Piako Rivers, and consists almost entirely of the kahikatea, or white pine (*Podocarpus dacrydioides*). On returning to Grahamstown I saw Mr. Gibbon, an applicant for service in the department, who is possessed of considerable knowledge of the forests in the neighbourhood. He informed me that there is a fine virgin forest containing kauri at Kirikiri, adjoining Kauaeranga, with a good stream of water for working; also partially worked kauri forests at Hikutaia and Waitekauri in the hands of Government, and a fine tract of kauri and white-pine forest in the Ohinemuri district, known as Waituwhetu, partly in Government and partly in Maori hands. This information may be of value for future reference should more detailed inspections and the selection of reserves be proceeded with. Returning to Auckland, after visiting the Domain and noting the growth of the young specimens of indigenous trees, such as kauri (*Dammara australis*), totara (*Podocarpus totara*), rimu (*Dacrydium cupressinum*), puriri (*Vitex littoralis*), which are from eight to twelve years old, we next went by Riverhead and Helensville, in the vicinity of which places there is now little or no timber, to Kaihu on the Wairoa River, the banks of which I observed, as we ascended, are fringed with a dense growth of mangrove, behind which appears white pine in the low, and kauri on the higher, banks, with here and there a few pohutukawa (*Metrosideros tomentosa*) and puriri trees.

The Kopuru and Aratapu saw-mills, below Kaihu, appear very complete, but we had only time for a hurried visit.

From Kaihu we visited the Whakara Forest further up and on the left bank of the river. The kauri here was very fine, and we observed one tree of ten feet diameter. There is a fine tramway for bringing out the timber to the river, which is stated to have cost £5 per chain, or £400 per running mile. The laden trollies are drawn by three horses.

The forest contains also totara, miro (*Podocarpus ferruginea*), tanekaha (*Phyllocladus trichomanoides*), puriri, red and white pine, some of the totara attaining fair dimensions. I observed also, for the first time, the *Santalum Cunninghamii* (Maori maire), the epiphytic plants *Astelia Cunninghamii* and *A. Solandri*, *Coprosma robusta* and *grandifolia*, and *Corynocarpus laevigata*—the two last-mentioned shrubs, under their Maori names of karamu and karaka, being well known.

I am indebted to Mr. Dargaville, proprietor of a portion of these forests, for much valuable information. He informed me that he had from eighty to one hundred men at work felling and floating, and calculates on delivering one million of superficial feet monthly (83,333 feet cube).

The price in log as delivered to the mill was then 3s. 3d. per 100 feet, cost of sawing 2s. per 100, making, with an allowance of 1s. 3d. for wastage in conversion, the net cost 6s. 6d. per 100 feet of sawn timber, the selling price being when I was there 8s. 6d. per 100 feet superficial, delivered at the mill. Mr. Dargaville was also shipping spars and baulk timber to England for the Admiralty, in execution of a contract which Mr. Russell had obtained. I found it impossible to ascertain or arrive at even approximately the average yield of the forest per acre, as it varies greatly, especially under the present irregular system of working. My time did not admit of a detailed valuation survey, nor did it appear necessary, as the forest is private property. On the plains behind Kaihu, on the right bank of the Wairoa River, a good deal of digging for the kauri gum is carried on, causing the surface to present a broken and irregular appearance.

From Kaihu we proceeded *viâ* the Mangonui Bluff to Pukeha, on the Hokianga River. Our road on the first day ran along the banks of the Kaihu stream, with fine white-pine forest on the left, and here and there a little kauri and puriri, the latter of large dimensions.

On the second day the country was more hilly and undulating, chiefly open land, covered with fern, and interspersed with clumps of forest, chiefly kauri, at intervals. It presented in fact a fine park-like appearance, and, were communications opened out and Native claims settled, would doubtless be found suitable for settlement, though the soil is not so good as could be wished. The path across the Mangonui Bluff itself is very steep and muddy, running through heavy forest of kauri, puriri, totara, &c., the clearing through which is too narrow to admit of the sun penetrating sufficiently to dry up the track. It would appear very advisable to make a wider clearing, but a better line for a road could probably be found by a careful survey. North of the Bluff our road lay along the sea shore to Pukeha, which we reached at midnight.

Next day we visited the South Heads, where Mr. Kirk found *Veronica speciosa* growing wild, and brought to my notice the *Coprosma acerosa*, a creeping plant common throughout the colony on sandy soil, which it is useful in binding. We may find it of value in operations to restrain and settle the shifting sand, which is encroaching here and further south.

From Pukeha we went *viâ* Oenoke, where we spent an evening with Judge Maning, to Herd's Point and Mr. Yarborough's forest on the Koku.

Returning to Herd's Point, we crossed to Russell, on the Bay of Islands, by the Kaheke and Ohaeawai. Betwixt the Kaheke and Ohaeawai are extensive plains, covered with the scrub known as manuka or tea-tree (*Leptospermum scoparium*), which must not be confounded with the other species also known as tea-tree, the rawiri (*Leptospermum ericoides*), which attains a height of forty or fifty feet, and is of some value, especially for marine piles.

On these plains the gum-digging industry is largely carried on: its dimensions throughout the province may be gleaned from a consideration of the exports, which were 3,230 tons, valued at £138,523, in 1875. The demand is, I believe, in excess of the supply. Until recently the Government have derived no direct revenue from this produce, but during the past year a small amount was realized by leasing out a tract of Government land to the diggers, and I think this course should be adhered to, and some simple rules enforced in order to husband and regulate the supply of this valuable forest product. To the south of our road there are extensive kauri forests, mostly in Native hands, of which one large block known as Mungakahia has, I was informed, recently been acquired by Government.

I may here mention that the greatest difficulty was experienced in ascertaining what was Government forest and what was not, which led me greatly to abridge my investigations, pending the collection of fuller and more accurate information. The inclemency of the weather at this season (June) induced me to give up the trip further north to Ahipara, where I understand there are extensive forests of *Fagus fusca* in the hands of the Government; and from the Bay of Islands we returned to Auckland, and went next by Mercer to Hamilton, Cambridge, and Matamata, where I saw Mr. Firth's plantations of *P. pinaster* and *insignis*, which well repaid a visit. The seedlings were planted out direct from the mother beds, into furrows 18 inches broad and 10 inches deep, run at 15 feet apart. The growth has been excellent, averaging 25 feet in five years, but it would have been better to have had the trees closer together. Mr. Firth has not as yet been successful in planting deciduous trees, but, with careful nursery treatment and planting out, I believe they would also succeed. On our way we saw the land at Meremere on which Mr. Firth has advocated planting by Government. It appears well adapted for the purpose, and its situation in a country (between Mercer and Hamilton) almost destitute of timber, tapped by the River Waikato and main road, and shortly to be traversed by the railway, is unexceptionally good. I refer to this point further on in its proper place.

On our return to Auckland we spent two days in visiting the plantations and nurseries in the environs, in which I was much interested, and was particularly gratified with the excellent selection of pines and other forest trees in the stocks of Mr. Mason and Mr. D. Hay. The growth of acclimatized trees, especially the Californian pines, is very rapid. It appears unnecessary to particularize the varieties here, but the *Pinus insignis* and *radiata*, the *Araucaria excelsa* or Norfolk Island pine, and the *Pinus austriaca*, may be looked upon as types.

I re-visited the Auckland Province in October, entering it from the east at Lake Taupo, and passing through the Hot Spring district to Tauranga, and thence to Auckland town. The land and forests between Tapuaharuru and the Oropi bush between Ohinemutu and Tauranga being almost entirely in Native hands, I did not specially inspect the forests, but would strongly recommend that steps should be taken to acquire such forests as exist throughout this generally bare country with a view to their conservation.

Between Tapuaeharuru and Ohinemutu there are several patches of fair forest, the best of which is probably Oruanui, said to contain totara in some quantity. On the road from Ohinemutu by Tikitapu to Wairoa, again one passes through some good forest containing totara, red, black, and white pine; and the margin of Lake Tarawera is fringed with pohutukawa and a sprinkling of puriri.

A portion of the Oropi bush on the Tauranga side is said to have been acquired by Government, and I think that, if possible, the whole block should be leased or purchased without delay. It contains black and red pine, beech (*Fagus fusca*), and I believe totara, but I did not see any of the last mentioned.

There is an interesting and useful report on the flora of this Lake District by Mr. Kirk in the Proceedings of the Auckland Institute for 1872. At Tauranga, the District Engineer, Captain Turner, told me of a fine block of totara forest in the Ahikereru Valley (the Ahikereru stream empties into the Rangiteiki at Fort Galatea), which is in Native hands and scarcely utilised, if at all. Captain Turner thought it would be advisable to explore it carefully, and, if possible, acquire it, as good totara is scarce and much in demand in the neighbourhood. This matter should receive early attention, as should the kauri forests in the Ohinemuri Gold Field district and its neighbourhood, notably on the Tuapiro River, where a virgin tract, which I believe to be in the hands of Government, should be reserved.

This finished my travels in the Auckland Province, and, although such opinions as I have formed as to the comparative value of the New Zealand timber trees will be expressed in the section of this report specially devoted to their consideration, I may mention kauri, puriri, and pohutukawa as deserving of special attention. The kauri forests in the hands of Government still cover I believe a considerable area, and more can probably be acquired: in fact, as the land on which some of the best kauri grows is not well suited for any other crop, it may even be found advisable to buy up tracts supposed to have been worked out wherever fire has not destroyed the young growth, and conserve them for the future supply of this valuable timber.

I think very highly of the puriri, and was sorry to note how comparatively few well-grown trees are now to be found. Its growth should certainly be encouraged, and I am inclined to think that in its proper habitat it will repay attempts at reproduction, both natural and artificial, perhaps better than any other indigenous tree in the colony. Nearly allied to the Indian teak, it forms a very handsome tree, and the deposit of its large glabrous leaves could not fail to improve the soil, with which object it should be endeavoured to grow it along with other trees such as the kauri, the leaves of which have no fertilizing effect. Mr Kirk says, "In durability it probably excels all other New Zealand timbers."

The pohutukawa (*Metrosideros tomentosa*) is almost confined to the Auckland Province, where it has been much used in shipbuilding. It forms a fine handsome tree, with beautiful deep crimson flowers, and Kirk says he has "never seen it perforated by teredines, except in the most superficial manner."

#### Taranaki.

3. On landing at New Plymouth I lost no time in seeing the Deputy-Superintendent (Mr. Crompton) and Commissioner of Crown Lands (Mr. Whitcombe), the latter officer having already furnished me with an excellent report on the forests of the province, in which he evinces much interest; and drawing up a route in accordance with their advice. This embraced a trip to the White Cliffs, where Major Tuke kindly placed the services of Captain Messenger at my disposal, and I could not have wished a better guide. We visited Uranui and the Kaipikari Block in the vicinity, recently acquired by Government. At Uranui I got some valuable information from Captain Good regarding the forests in the interior. We next visited the Kaitake and Pouakai Ranges, the latter in company with Mr. Wells, who kindly gave me the benefit of his knowledge of the locality and its flora.

After returning to New Plymouth, we went *via* Inglewood by the mountain road to Hawera, where Captain Messenger left me, and I proceeded to Wanganui by coach, the time at my disposal not admitting of a stay in the Patea country. The chief timber trees of the Taranaki Province may be said to be the red pine and rewa-rewa or honeysuckle—the puriri, which formerly existed in some quantity within ten or twelve miles of the coast line, being unfortunately almost worked out.

At Tutongau and Kaipikari there is a good deal of pukatea (*Atherosperma Novæ-Zelandiæ*), the timber of which tree will, I believe, eventually take a higher rank than that now accorded to it, hinau (*Elæocarpus dentatus*), and kohekohe (*Dysoxylum spectabile*), with a little rata (*Metrosideros robusta*). Further inland I believe there is some quantity of totara, which is also frequent, but in a stunted form, on the slopes of the Pouakai Ranges, where it is mixed with mahoe (*Melicytus ramiflorus*), kawiria (*Hedycarya dentata*). Higher up on those ranges, I observed *Dracophyllum Urvilleanum* and *Libocedrus Doniana*, *Senecio elæagnifolius*, and *Drimys colorata* (horopito of the Maoris), a magnoliaceous shrub called erroneously by settlers the wild pepper, the wood of which makes a pretty veneer. The forest on these ranges is of little commercial value, but should, I think, be rigidly conserved on account of the numerous streams which have their sources on them, and which might be injuriously affected were the clothing of vegetation removed.

A belt of forest extending twenty miles round Mount Egmont itself is nominally reserved under the orders of the Superintendent (Mr. Carrington). To be of value this reservation should be proclaimed in the *Gazette* by order of the Government, and rigidly enforced. On the mountain road beyond Inglewood, the rimu and honeysuckle are the prevailing trees, interspersed with hinau (*Elæocarpus dentatus*) and tawa (*Nesodaphne tawa*); but the character of the forest changes considerably after the first twelve miles, beyond which there is more black pine.

I think every means should be adopted in this province to reproduce and foster the growth of the puriri, and conserve the honeysuckle, which will ere long have a high commercial value as a furniture wood.

The soil, especially along the coast line, is generally good, and very suitable for the growth of the eucalypti and pines, consisting of vegetable deposits resting on a substratum of tertiary clay, with sand here and there.

*Hawke's Bay.*

4. On my arrival at Woodville, *viâ* the Manawatu Gorge, I was met by Mr. Hallett, deputed by Mr. Weber, the Chief Surveyor, and we proceeded together to Pahurite, near which I inspected the forest in what is known as the Tauraki Block, consisting of fine totara, with straight boles running up to 40 and 50 feet without a branch, mixed with black, red, and white pine. Much of the best of the forest in this neighbourhood is still in Native hands. Crossing the road, I saw a tract recently sold by Government, at £5 per acre I believe, containing very fine totara, whence piles for the Napier Harbour works were being taken. The contract price, I was informed, was high—£2 per 100 feet superficial; but there is a good deal of wastage, as many of the trees are honeycombed and unfit for the purpose.

We next proceeded to Takapu, visiting a very fine forest, in what is known as the Mahotoko or Rikaitai Block, where there is to be a railway station. The totara here is exceedingly fine, and older than what I have seen before. The block extends two miles by half a mile, and was recently opened for selection, but withdrawn. A considerable area should certainly be reserved here for future supply. Besides pine, I observed some beech in the gullies in the neighbourhood. A considerable area of totara forest in the neighbourhood of the Danish settlements has been destroyed by fire, which is much to be regretted. Although difficult, it is not impossible to prevent such fires, as has been proved by our experience in India. From Takapu I went *viâ* Waipukurau to Napier, noting the considerable plantation of blue-gums at the former place formed by Mr. H. Russell. At Napier, I saw Messrs. Ormond and Weber, and left on the 29th October for Taupo, inspecting on the way the bush at Pohue and Tarawera, much of which is now freehold. For some fifteen miles beyond Tarawera, the road passes through an undulating country, more or less covered with forest on the higher slopes, the chief timbers being apparently black and white pine, and miro of indifferent growth. I understood that all this country is in Native hands, and therefore deemed a more detailed inspection unnecessary. It will, however, certainly be advisable to acquire and conserve most of the forest in this generally treeless country, in which successful planting can scarcely be looked for, though Mr. Loughley's experiments near Tapuaeharuru show that it is not impossible on a small scale.

I did not visit the Poverty Bay district, as I was told by Mr. Ormond that there was not much demanding special attention there, and time was of course an object.

*Wellington.*

5. My first introduction to a New Zealand forest was in South Karori and Makara, in the neighbourhood of Wellington Town, where I accompanied Mr. Kirk shortly after my arrival in the colony, in order to make myself conversant with the names of the trees, their habits of growth, &c. Shortly afterwards we visited the forests in the neighbourhood of the Upper Hutt, Pakuratahi, and the Rimutaka, which may be considered typical of the forests of the west and south-west coast of the Wellington Province, near the seaboard. The forest in the Hutt Valley has, as is generally known, been extensively cleared, and no time should be lost in making considerable permanent reserves there, if, indeed, it be not too late, as I fear most of the land has already been sold. Mr. Carruthers tells me that he has secured the reservation of some limited areas as protection to the railway works, but a more general reservation would appear advisable. The timber on the Rimutaka Range is chiefly beech (*F. fusca* and *Menziesii*) and red pine, with a little white pine, and I believe considerable quantities of totara in the more inaccessible portions of the range. Considerable damage has been done by fires, which have cleared regular belts or roads through the forest, many trees on which appear also fully mature; but, on the other hand, I am pleased to note a good crop of young beech coming up on the outskirts, which only requires care to form the forest of the future. The height of the saddle where the road crosses is, I believe, 1,800 feet, and I ascended to 2,500 feet in the neighbourhood. In September I again proceeded over the Rimutaka to Masterton, whence I went some distance on the new Castlepoint road, and also visited some fair totara forests on Mr. Lowes's property, which I was glad to learn from him he was about to work and conserve on a definite system. The state of the rivers prevented my getting on through the Forty-Mile Bush to Woodville.

Returning to Wellington, I went by the alternative route *viâ* Paikakariki and Otaki to Foxton and Palmerston, and thence by the Manawatu Gorge to Woodville. There is heavy forest containing fine totara inland from the north of Paikakariki and Otaki, where much of the country is, I believe, unsurveyed. Before any portion is thrown open for settlement adequate reserves should be formed, and the same applies to the neighbourhood of Foxton and Palmerston, where settlement is already in progress, and the forest is rapidly falling without any adequate return to the State.

In November I came from the Patea River to Wanganui, intending to explore some of the forests inland from the latter place, but deferred doing so, owing to its being apparently impossible to ascertain what was in the hands of Government and what was not.

I have collected a good deal of useful information from various sources regarding the forest of the Wellington Provincial District, but have, I think, seen less of it than of any other, and found it more difficult to obtain information from official sources.

*Canterbury.*

6. I first visited the Canterbury district in August, on which occasion I went, by the advice of the Deputy-Superintendent and Chief Surveyor, to Oxford, where I inspected the forest, and was particularly pleased to note the manner in which the beech was renewing itself wherever fire had not followed in the wake of the bushmen. I subsequently received some useful information regarding this and the Harewood Forest in reply to a series of questions, which I submitted to the Deputy-Superintendent. Most of the land, however, is now freehold.

After a visit to Sir Cracroft Wilson's planting, at Cashmere, I went to Timaru, observing the country, and, especially, the state of the river-banks *en route*.

On returning to Christchurch, owing to the inclemency of the weather and absence of Mr. Rolleston, in Wellington, it was deemed advisable to postpone further inspection, and I accordingly returned to Wellington.

Early in November I resumed inspection in Canterbury, when I had the advantage of Mr. Rolleston's advice and suggestions. He kindly deputed Mr. Alexander Lean, the Steward of Reserves, to accompany me, to whom I am much indebted for the amount and nature of the information acquired. After visiting the nurseries in the Public Gardens and, with Mr. Rolleston, the sandy tract by the sea, which extends north of New Brighton to the Waimakariri, on which it appears very desirable that planting operations should be undertaken, Mr. Lean and I visited Colonel Brett and Mr. Holmes's planting, at Kirwee and Bangor. The latter gentleman has planted extensively, and, I may say, regardless of expense, with the best results. We also saw some planting at Home Bush, all three places being in the Malvern Hill district, and situated on the upper part of the Hawkins River.

We next proceeded to Banks Peninsula, visiting Akaroa, Okain's, and Barry's Bay, and returning to Lyttelton by the Purau track over the mountains. The forest in the Peninsula has, as is well known, been periodically devastated by fire; and, although I do not find the utter annihilation which was predicted, so much of the best forest has become freehold that it will probably be impossible to find any suitable compact blocks for Government reserves, and we shall probably have to content ourselves by securing all we can on the crests of hills, and at the head waters of streams, and disposing of the rest to the best advantage.

The saw-millers at present appear to be doing a brisk trade, at profitable rates, whilst at the same time rendering the land which is their own suitable for pasturage. Mr. Thacker, at Okain's Bay, has some 1,500 acres of forest, chiefly black and white pine, with some totara and a little kowhai (*Sophora tetraptera*). His mill can turn out 50,000 feet per week, but averages from 25,000 to 30,000, according to the demand. He estimates the average yield per acre from his forest at about 12,000 superficial feet. Mr. Latter, at the head of the Akaroa Bay, informed me that his mill turns out 30,000 a week; that it has been at work for three years, and that he calculates another three will exhaust his forest. Almost half of his forest is mainly stocked with totara, the remainder being chiefly black and white pine. All the totara, however, which I saw in the Peninsula, was comparatively small and, except in the valleys, stunted.

Our next trip was south to Burnham, where I saw the very successful plantations of eucalyptus, near the Reformatory; the Rakaia, where Mr. Middleton's planting and a Government plantation of 80 acres were inspected; and a visit was paid to Mr. Wason's plantations in the neighbourhood, which extend over some 250 acres.

From Rakaia we went south, by rail, to Timaru, noting reserves suitable for planting on both sides of the line betwixt the Rangitata, Orari, and Waihi Rivers. At Timaru, I visited Mr. Sealy's eucalypti plantations, and made preliminary selections of land in the vicinity suitable for planting, and brought my tour in Canterbury to a successful termination before the end of November, submitting a memorandum of general conclusions arrived at to Mr. Rolleston, which met with his approval and concurrence, and has since been acted upon provisionally.

Towards the end of January, 1877, I was again in the Canterbury Province, *en route* to the West Coast, and inspected some of the bush, which is chiefly *P. Solandri* on the head waters of the Waimakariri, &c.

A subsequent visit to Amberley and the Hurunui, *en route* to Sherwood Forest, exhausts the detail of my Canterbury inspections. I should mention that, during the months of September and October, I employed Mr. Robertson, a Scotch forester, with high testimonials, and candidate for a post in the New Zealand Forest Department, to visit and report on the forests of this province and localities suitable for planting. His report, which is of considerable value, is appended. Mr. Robertson's health giving way he was unable to travel, and resigned his acting appointment in October.

Forest land in Canterbury is now so valuable, realizing £30 an acre for the timber alone, that it becomes very important to reserve all that is left, if only from financial considerations, disposing of all, which it may not eventually be deemed necessary to retain for climatic considerations, to the best advantage, and thus making funds available for planting operations.

#### Otago.

7. On arrival in Dunedin I had an interview with the Hon. George McLean and Mr. McKerrow, and the latter, who was just leaving for Wellington, kindly gave me all the information in his power during the short time at his disposal, and sketched out a route for me which served as a general guide during my stay in the province.

I first proceeded through the gold fields country, *viâ* Waikouaiti, Palmerston, Pigroot, Kyeburn, Naseby, to Clyde and Cromwell, beyond which place I rode fifteen miles up the valley towards Lake Wanaka.

At Clyde I saw Mr. Pyke, M.H.R., and got information from him as to the timber supply and requirements of the district. I also visited Mr. Ferrand's orchard, the rapid growth in which proves what can be done with the aid of irrigation in this locality.

From Clyde I went *viâ* Alexandra, Roxburgh, Benjer Burn or Ettrick, to Lawrence, where I met Mr. Brown, M.H.R., and visited Blue Spur and Weatherstone, in the vicinity, and thence by Waitahuna to Milton, and by rail to Dunedin.

Almost the whole of the country traversed as above—*viz.*, from Palmerston to Lake Wanaka, and Clyde to Lawrence—may be said literally to be quite bare of trees of any description. I have never seen such a treeless region. The general aspect is mountainous, rugged hills rising to a considerable elevation on both sides of the road. The soil, even in the valleys, is poor, being chiefly light clay and sand, and the mountains present generally a rocky and barren appearance. They afford, however, fair feed for sheep, being covered with the grasses known as silver tussock (*Poa australis*, var. *lavis*), and hard sheep's fescue (*Festuca duriuscula*). The only other natural vegetation which I observed was the *Discaria toumatou* and *Aciphylla Colensoi*, known to settlers as the wild Irishman and wild Spaniard, and *Carmichaelia Munroi*, which occur throughout the gold field and lake districts. There is almost every-

where evidence of extensive forests, in the shape of old trunks of trees, said to be chiefly totara and cedar, either a few feet below or on the surface, even on the tops of some of the highest ranges; but of living forest, or even scrub, there is none even in the ravines and gullies. Various conjectures have been hazarded as to the causes which have led to the complete disappearance or destruction of the forests in this locality, but none that I have heard appear satisfactory, or can be substantiated. The fact remains that throughout this extensive mining district, where timber is much required, it is conspicuous by its absence, and ordinary descriptions cost 50s. per 100 superficial feet at Clyde, Oregon pine being even higher. South-east of Ettrick the soil is much better, and at and beyond Lawrence towards Milton the whole character of the country changes, and we find tree and shrub vegetation on the banks of streams, and on some of the hill-sides. I paid special attention to the soil, &c., on the sites of old workings, as Dr. Hector had called my attention to the desirability of planting them. The matter will be alluded to more fully when dealing with the special subject of planting, but I may state here that the tailings seem generally unsuitable, from the soil having been, as a rule, entirely washed away, and nothing but stones and gravel left. In some instances, however, notably in the Weatherstone Flat, near Lawrence, there are suitable tracts left by the miners after "paddocking," which I think it highly advisable to plant. The eucalypti will not answer, on account of the frost, but European and Californian pines would answer well. During my tour on the gold fields Mr. Kirk visited the Oamaru district, and we both returned to Dunedin on the 20th December, and proceeded on the 25th to Balclutha and Catlin's River, where we spent three days inspecting the forests and saw-mills; thence to Maitua, where Mr. McArthur, the Inspector of Forests for Southland, met me, and Invercargill. I spent a week in Southland visiting the forests in the Seaward Bush, Croydon, Winton, &c., and collecting information from Mr. McArthur, Mr. Pearson (the Commissioner of Crown Lands), and other gentlemen. At Invercargill I was much pleased by a visit which we paid to Mr. Cleave's nursery gardens. His collection of larch, spruce, and Scotch fir, *P. austriaca*, *laricio*, *Jeffreyi*, &c., is very extensive, and compares favourably with any I have seen in the colony, the young plants being healthy and well rooted. *Pinus austriaca* is, I think, likely to do exceptionally well in Southland, and *P. laricio* has the additional advantage that it is said rarely to be attacked by rabbits. (*Vide* "Reports on Forest Management," page 93.)

From Southland I visited the Wakatipu, Wanaka, and Hawea Lakes, crossing the crown range from Queenstown to Cardrona and Pembroke, and on to "Fraser's Station" at the head of Lake Hawea and mouth of the Hunter River, and extending my inspection from the head of Lake Wakatipu (Kinloch) to Lake Harris and the slopes above the Holford River.

The general character of this lake district closely resembles that which I have already described in describing the gold fields country. There is the same marked absence of tree growth on all the lower or easterly side, and a line drawn from the present terminus of the Invercargill and Kingston Railway at Elbow or Lowther to the lower end of Lake Hawea would pass by no forests worthy of the name.

Only as one ascends the lakes patches of forest are found in the ravines, and the upper ends of all these lakes (Wakatipu, Wanaka, and Hawea) are thickly clothed with beech forest.

The trip from Wakatipu to Lake Harris was most interesting and instructive. We passed through heavy forest of *Fagus fusca*, *Solandri*, and *Menziesii*, the latter predominating in the higher altitudes, where the totara, which was frequent in a young stage of growth in the valley, all but disappears. A most marked and gratifying feature in the forest which has been worked near Kinloch is the fine renewal or reproduction which is everywhere going on, which would, I think, convince the most sceptical that New Zealand forests of this description, at any rate, can be reproduced naturally with ordinary care and the exclusion of fire. The same may also be stated with regard to the forest on the Hunter River and upper end of Lake Hawea, where the forests which we inspected were almost entirely *F. Solandri*, mixed with a little manuka (*Leptospermum ericoides*), the trees of the former being, as a rule, young, and not averaging more than twelve inches in diameter.

In the vicinity of Lake Harris Mr. Kirk found much of botanical interest, amongst which I may note *Dacrydium laxifolium* and *Podocarpus nivalis*, two of the smallest varieties of the pine tribe known. Lower down in the valley we found *Fagus cliffortioides*, a variety of beech described by Dr. Hooker, but not frequently found.

On the 15th of January we were back in Invercargill in hopes that we should find that the steamer "Maori," with the owners of which I had been in negotiation to take us to Stewart's Island and the West Coast sounds, &c., had been made available, but in this we were doomed to disappointment, as I learned by a telegram from the manager of the U.S.S. Company that she had been docked for repairs, which would extend over an indefinite period. We therefore reluctantly retraced our steps *via* Maitua and the Taieri Plains, in which I noted the fine growth of the blue-gum, to Dunedin, and thence by steamer to Christchurch and overland to Hokitika.

It is matter of much regret that no Government steamer could be made available, as originally arranged both with Sir Julius Vogel and Major Atkinson, for the trips to Stewart's Island and the West Coast sounds. Mr. Kirk's services had been specially retained during his Christmas recess for the purpose of making a thorough investigation of the flora of those localities, which is but little known; and the omission of information regarding those forests, which are believed to be extensive and valuable, which it was impossible to obtain in the time at my disposal by making use of a sailing craft, or by any means save that of a steamer specially made available for the purpose, constitutes, I cannot help feeling, a serious want in this report, and in the completeness of my inspections as originally chalked out. Even had I known definitely at an earlier date that no steamer could be made available, I should have made a point of reaching Martin's or Jackson's Bay from the Otago Lake District, but it was not till the first week in January that I was informed that no Government steamer was available, nor until the 15th, as already stated, that I ascertained for certain that arrangements for the "Maori" were impossible. I had then to make the best arrangements I could, and I trust that the Government and House will consider that I did so by gathering all the information I could from Mr. Pearson and others, and making the best of my way to Hokitika overland *via* the Otira.

During my Otago inspection I was met by Messrs. Bolton and Hughan, whose duties are partly those of Forest Rangers, and who afforded me all the information and assistance in their power. Mr. Valpy, the Ranger in the North-East District, I did not see; but it was only after I had left Dunedin for the South that I gathered from a reperusal of the papers relating to forest matters, laid before the House in 1874, that there were any Rangers employed under the late Provincial Government. A reservation of the comparatively small area of forest remaining undisposed of in Otago proper, and of a certain proportion in Southland, the gradual disposal of the rest of the Southland forests to the best advantage, and judicious planting in the gold field and lake districts, appear to me the requirements of this provincial district in the shape of forestry.

#### Westland.

8. I entered Westland from the Canterbury side, and purposed spending some days between the Otira Gorge and Hokitika, but unfortunately the weather was so unfavourable that this was out of the question, and I had to take the coach, which got through just before the road was washed away, and traffic interrupted for several days in January. I could, therefore, only observe, in passing, the luxuriant growth of the rata (*M. lucida*) in the Otira Gorge, and note fine forests of black, red, and white pine and pokako (*E. Hookerianus*) in the vicinity of the Taipo River, on the western side of which the forest of *Fagus fusca* and white pine appeared exceptionally good.

At Hokitika I received much information and every assistance and attention from Mr. Bonar, and endeavoured to see as much as possible, although the original plan of inspection had to be departed from owing to the want of a steamer.

Had the "Wanaka," which was on an excursion trip round the island, not been detained, I should probably, on Mr. Bonar's suggestion, have gone by her to Jackson's Bay, and found my way back overland, although the time at my disposal was rather short, especially as the weather was most unfavourable throughout my stay on the West Coast, and rendered the risk of detention for indefinite periods, from floods in the rivers, and washing away of roads, very great. As it was, the detention of the "Wanaka" at Nelson rendered the trip out of the question, and Mr. Kirk and I were obliged to limit our visits, in great measure, to the forests in the neighbourhood of Hokitika, which we visited in every direction, and collected information from the saw-millers and others connected with the timber trade. We also proceeded to Ross and the southern branch of the Waitahi River, examining the forests on its banks, and those of the Mikonui, further north. Between those two rivers there is some very fine black and white pine, and on the northern branch of the Waitahi a fine young growth of totara, which I was glad to learn is comparatively abundant, of large dimensions, further south. The natural re-growth of young red pine was also very abundant, and would, I am sure, have convinced the most sceptical that this species, as well as others, could be treated under a system of natural reproduction with the best results.

Returning to Hokitika, I had an interview with Mr. FitzGerald, the Commissioner of Crown Lands, and settled generally the main principles of forest conservancy as applicable to this heavily timbered district, should my proposals meet with approval. These were also discussed with Mr. Bonar, and we arrived, on the whole, at satisfactory conclusions.

I then went, by the inland route, to the Grey, passing through somewhat inferior forest of white, red, and silver pine, the latter in considerable quantity. After crossing the Teremakau River the beech appears in some quantity, and we found Hooker's *Dracophyllum uniflorum*, which I had not before seen. The most noticeable feature which we observed throughout the forests of this province is the presence of an undescribed *Dacrydium*, affording timber of much commercial value, which has hitherto only been locally known under the designation of white silver pine. This valuable pine is described in Mr. Kirk's memorandum under the name of *D. Westlandicum*, or the Westland pine, retaining the term of silver pine for *D. intermedium*, a species originally discovered on the Great Barrier Island by Mr. Kirk, but now described for the first time, which yields a timber similar in quality, somewhat darker in colour.

After a visit to the Brunner coal mines, and forests in the neighbourhood, we left the Westland district for Reefton, *via* the Arnold River and Ahaura.

#### Nelson.

9. I entered the Nelson Provincial District from Westland *via* the Grey, and proceeded during heavy floods, which greatly impeded progress and inspection of the forests, to Reefton. All the way from the Arnold River, the Westland boundary, our route lay through heavy forest, consisting at first chiefly of black, white, red, and silver pines, some of the former being very fine; but soon the silver pines disappear, and the others gradually gave place to beech forest as we proceeded, till, just after passing Square Town, we passed through the finest tract of pure beech forest (chiefly *F. fusca*) I think I have seen in the colony.

Our route next lay from Reefton along the valley of the Inangahua River to Lyell, through heavy forest, chiefly beech, with pine in the low-lying localities.

From Lyell we proceeded up the Buller to its junction with the Hope, and thence across the Hope Saddle and Spooner's Range to Foxhill and Nelson. The timber in the Buller Valley is chiefly beech (*F. fusca*) and black and white pine, attaining large dimensions in the lowlands (where there is also some totara), which are however of no great extent, but becoming poor and stunted a few yards up the hill side. The hills throughout this locality are very steep and shingly, and the intervening valleys narrow. Great care must therefore be taken with regard to the timber; extensive reserves will be required; and, except low down in the valleys, the system known as selection felling should alone be adopted. At present any one seems to be allowed to take possession and clear land for which he may have applied, without any permission to do so—a system which, if not put a stop to in time, cannot fail to lead to disastrous results. The same remarks apply generally to the Hope Valley and the large extent of forest, much of which is of little or no commercial value, in this neighbourhood. Ascending to the Hope Saddle the forest naturally becomes stunted and scrubby, but I noticed a great deal of young totara, though no old trees appeared left, a similar coincidence having been observed on the

banks of the Waitahi, in Westland. The almost total absence of the *Weinmannia racemosa*, so frequently confounded with *F. fusca*, with which it is generally found growing, was also noteworthy. Descending on the north-east side of the Hope Saddle the forest gradually improves, and there is some fine black pine and red pine and pokako (*Elæocarpus Hookerianus*) in quantity.

Crossing Spooner's Range, we observed *Celmisia spectabilis* and *coriacea* and *Gentiana pleurogynoides*. After a short trip to the Wairoa I went to Waitapu and the Takaka Valley, where the growth of pines is very fine, but almost all the forest has become freehold. Returning to Nelson, I proceeded through the Rai Valley to Pelorus and Havelock. Subsequently I visited the Sherwood Forest, extending over an area of ten to twelve thousand acres, situated between the Waiau and Conway Rivers. The prevailing timber is beech (*F. Solandri*), with some pine in the hollows; the latter is not of much value, but the tract will probably form a suitable and necessary reserve for climatic considerations and supply of sleepers, should the railway pass through or near it. Considerable damage has been done by fires, which must be guarded against. I also saw something of the extensive plantations on the Culvedon, St. Leonards, Hawkwood, and Cheviot Hills runs, the latter being, both as regards extent and variety, the finest I have seen in the colony. During my stay in Nelson I had several interviews with Mr. Curtis and the Commissioner of Crown Lands, and consulted with them in forest matters.

#### Marlborough.

10. Coming from Nelson, I was advised to proceed by the Rai Valley to Pelorus, and I am glad to have had an opportunity of doing so. Mr. A. Collins, who knows that part of the country probably better than any one else, was unfortunately absent, but I afterwards met him at the Kaikouras. The forest in the Rai Valley is chiefly beech, all three varieties (*F. fusca*, *Menziesii*, and *Solandri*) being represented. There is also a considerable quantity of red pine (rimu) and totara and black (called here *red*) and white pine in some places. The forest is certainly better on the Marlborough side of the dividing range than on the Nelson side, and between the Pelorus River and the sea there is evidently some very fine forest still untouched, and said to contain much totara. This tract is, I believe, still in the hands of Government, and no portion should be alienated without mature consideration and an adequate return, as I am informed that timber in the Pelorus Valley realizes even now more per acre than the original cost of the land and forest.

There is also some fine forest in the right bank of the river after leaving the accommodation house at Pelorus Bridge, which I make forty miles from Nelson, *viâ* the Rai Valley, identical, I believe, with Dr. Hector's estimate; but I am given to understand that all this, as well as that beyond Havelock in the neighbourhood of the large saw-mills there, is private property.

After visiting Havelock, I met the Commissioner of Crown Lands at Blenheim, and Mr. Seymour at Picton, and talked over the objects and prospects of State forest conservancy with them. I then visited the Kaikouras and inspected some of the forest (private property) in the neighbourhood of the only saw-mill now working. The white pine here is particularly fine, being hard and close-grained, quite a different wood from the timber of the same species growing in swampy and low-lying places.

The forest generally is patchy and very uneven, but there is a considerable area which would yield an average return round the base of the hills, and doubtless in some of the gullies further in. Some miles to the northward of the saw-mill there is said to be a very fine patch of virgin totara forest, which unfortunately the time at my disposal did not admit of my visiting. It is said to be accessible by a creek which runs into the sea, and will doubtless form a valuable reserve for future supply. Messrs. Keene and Bullen have both planted a good deal with tolerable success, the latter both at his station in the neighbourhood of the Kaikoura Township and at the Green Hills. The rabbits, which are very abundant, prove of course serious enemies to the young trees.

18. In the foregoing record of inspections I have avoided detail as much as possible, merely endeavouring to give a good general idea of my route, and what I saw and remarked of the forests on it. The inspections were of course merely preliminary, and undertaken with the object of giving me a good general idea of the forests in different localities and their general capabilities, leaving all detailed inspections to a future date, when, if the proposals for a State Forest Department are entertained and general principles laid down, days and weeks will have to be spent in each locality instead of minutes or hours.

The general conclusions arrived at may be briefly summarized here. There is no prospect of a dearth of timber, or injurious effects from clearing for the present or in the immediate future throughout the colony, except in the Canterbury plains, the Otago gold field district, and perhaps the Waikato. The forest, both as regards quantity and quality, is, as usual, very unequally distributed in both islands, and we would naturally like to be able to remove a few thousand acres from one locality to another—from the West Coast to Canterbury, for instance. Still, prevailing rates for building timber, even in the denuded districts, are very low compared with those of other countries, and the supply appears more than equal to the demand. None the less does it appear to me incumbent on the Government to take early steps to secure adequate reserves for future supply and climatic considerations, reduce waste to a minimum, and secure a proper share of public revenue from the valuable wooded area remaining in its hands, a portion of which it can devote to replanting denuded hill-sides and plains destitute of timber. By this means we shall virtually transfer the wealth of timber from places where it is superfluous to where it is most required, and benefit both localities both directly and indirectly by doing so. Nor must it be supposed that, although the supply of timber for the present is ample, it is by any means inexhaustible. No forest is inexhaustible unless systematically worked on principles which insure the capital not being trenced upon and the income alone utilized; and, in the case of the valuable kauri forests of the North, the date at which this exhaustion or annihilation will have become an accomplished fact may almost be set down as within the present generation. With a large export, both intercolonial and foreign, great waste in what the French style "exploitation" and conversion, and no attempt at reproduction, Nature's efforts at which are frustrated by fire, the end is not far to seek. Kirk puts it down at forty years, and I am not sure that he is not beyond the mark.

Again, in the case of much of the forest on the West Coast, often talked of as inexhaustible, a great proportion is situated in very inaccessible places, and is of little or no commercial value as timber; besides which, in the case of narrow valleys with steep shingly hill-sides, covered with but a thin coating of vegetable deposit, we cannot be too careful how we remove the forest, the result of any general or extensive clearing being that the little soil there is soon washed away, leaving barren hill-sides of no value for any purpose, and resulting, by the rapid pouring off of rainwater from their bare and steep slopes, in most disastrous floods, followed by long and often equally disastrous droughts. This is so well known on the Continent of Europe, that what is called "selection felling," by which individual trees only are removed as they mature, is the system universally in force, and experience teaches us that any departure from it under such circumstances is very dangerous, and should invariably be avoided if possible. These points will be dealt with more fully further on in considering climatic considerations, &c. They must strike any one who has studied the subject during a tour such as I have just completed, and no conclusion is more firmly impressed on my mind than that, whilst New Zealand has a splendid and most valuable property in her forests as they exist now, she must be very careful in their management, and no longer proceed blindfold in their disposal and removal, otherwise she will not only lose them without any adequate return or income to the public or colonial purse, but very much besides in the shape of equable climate and ample but not excessive supply of water, which years of labour and heavy expenditure will hardly replace.

## CHAPTER II.

GENERAL DISTRIBUTION OF TIMBER TREES IN NEW ZEALAND (*vide* MAPS).

1. In the rich variety of arboreal vegetation, the forests of New Zealand present a striking similarity to those of tropical countries. Except in the elevated parts of the South Island it is comparatively rare to find extensive areas of forest composed exclusively of a single species. In the North Island, tawa, taraire, kauri, rimu, totara, miro, matai, tanekaha, toatoa, rata, black maire, puriri, rawiri, mangiao, kohekohe, hinau, and many others may be seen growing in close proximity; no one tree, perchance, exhibiting a preponderance in the number of individuals. This feature is so strikingly marked over large tracts of country that it is difficult to select a single tree as specially characteristic of any particular district.

2. The kauri, from its high value, large dimensions, and especially from its marked distribution, has been selected as the typical tree of the northern district; but although it is the most important tree throughout the district, it nowhere preponderates to such an extent, say, as the beeches, in the South Island, or as the white pine in swamp forests, which sometimes extend for miles, and include no other trees within their boundaries.

3. The totara has been selected as the typical tree of the central and south-eastern portions of the North Island. It occurs throughout the colony, but attains its largest dimensions and greatest abundance in the district just defined.

4. The red pine has been selected as the typical tree of the south-western portion of the North Island.

5. It is even more difficult to select typical trees for the lowland districts of the South Island; for although the number of trees that attain dimensions sufficiently large to allow of their being classed as timber trees is less than is found in the North, still they occur so thoroughly intermixed that in many localities it is hard to say which is the most abundant. On the whole, the red pine has been selected, chiefly on account of its possessing the greatest commercial value at the present time.

6. For the elevated portion of the South Island, say above 1,000 feet, the beech must be selected as the typical tree: for miles one or other species, either singly or mixed in different proportions, forms almost the whole of the arboreal vegetation.

7. The tawa is certainly the most abundant tree in many parts of the North Island; but its limited economic value prevents its selection as a typical tree for our purpose. The puriri, pohutukawa, taraire, matai, and miro might each be selected as specially characteristic of certain limited districts, but for the present purpose it does not appear that a better selection is available than that already named.

## NORTH ISLAND.

I.—*The Northern or Kauri District.*

8. This district extends from the North Cape to Tauranga Harbour on the East Coast, and to Port Waikato on the West, and includes nearly the whole of the kauri forest. Its geological structure varies to a considerable extent, but does not appear to exercise a direct influence on the vegetation, none of the more important trees being absolutely restricted to any particular series of rocks. The North Cape is connected with the main land at Mongonui by a long stretch of blown sand, on which little or nothing can grow. Between Mongonui and the Kaipara the country is much broken, trachytic and basaltic rocks overlying palæozoic slates, often excessively broken and displaced, with overlying patches of tertiary rocks, chiefly sandstones, clays, and occasionally limestones. The highest point of this district is the peak of Maungataniwha, 2,100 feet. Many of the ridges are very narrow, with steep sides, forming ravine-like gullies. The greater portion of this district is covered with dense forest. From Waipu to Waitemata is a large tract of country, chiefly of late tertiary formation, and consisting of low ridges and hills, chiefly of sandstones and clays, attaining its greatest elevation, 1,300 feet, at Mount Hamilton, but for the most part between 700 and 1,000 feet. On the Auckland isthmus the tertiary rocks have been pierced by numerous basaltic volcanoes, the decomposing products of which have produced a light soil of great fertility. The Cape Colville district, with its heavy forest unsurpassed in any part of the colony, consists chiefly of trachytic breccia and conglomerates, overlying palæozoic slate, often decomposing into stiff clays.

9. The climate is highly favourable to the growth of a luxuriant vegetation. From the official returns of the meteorological stations at Mongonui and Auckland it is shown that the average mean temperature for the year is  $59^{\circ}7$ ; the mean for the winter quarter being  $52^{\circ}7$ ; for summer,  $66^{\circ}7$ . The extreme difference between the hottest and coldest months does not exceed  $16^{\circ}$ . The average annual rainfall at Mongonui is 55 inches, at Auckland 43 inches; the mean degree of moisture, 76. At Mongonui the prevalent winds are S.W., N.W., and E.; at Auckland, S.W., N.W., and W. The climate is therefore remarkably genial, free from extremes of heat and cold, drought or moisture, so that the arboreal vegetation exhibits greater variety and flourishes with greater luxuriance than in any other part of the colony.

10. The kauri, *Dammara australis*, extends throughout the district, sometimes scattered in single trees, usually clumps of smaller or larger size, most frequently as groves or blocks of greater or lesser extent. At the present time it is most abundant in the Wairoa district and on the Cape Colville Peninsula. Interspersed with the blocks of kauri are incidental blocks of tawa, taraire, entire-leaved

beech, red and white pines, rata, tanekaha, tea-tree, totara, puriri, tawhero, and Ixerba; also scattered trees of kawaka, matai, miro, manuwao, kowhai, maire, black maire, pukatea, hinau, mangiao, maire tawhake, titoki, ackama, karaka, Quintinia, and others. No tree in New Zealand approaches the kauri in its stately massiveness. Huge cinereous columns rising 60 or 80 feet clear of branches, and having a diameter of from 4 to 8 feet or more, stand before the visitor on entering a kauri forest. At the base of each shaft is a mound of *humus*, chiefly arising from the decomposition of its shed bark and leaves. The branches, massive and spreading, clothed with deep-green foliage, spring from a common point, so that the conical shape characteristic of the tree in its young state is entirely lost. A deformed or distorted tree is extremely rare. As a rule the undergrowth in kauri forests is not dense, and consists chiefly of a few small shrubs, mixed with the long interlacing leaves of a liliaceous plant, *Astelia trinervia*, the "kauri grass" of the bushman; and the kauri itself is rarely laden with epiphytes and climbers owing to the deciduous nature of its bark, which scales off in flakes often one or two feet long.

11. The totara, *Podocarpus totara*, is sometimes found associated with the kauri although but rarely: usually it prefers a richer soil with a more copious supply of moisture, and north of the Waitemata seldom occurs in large quantity. The red pine or rimu, *Dacrydium cupressinum*, is much more abundant, and like the totara increases in frequency southwards. In the Hunua and Pokeno district, and in many other localities, it attains larger dimensions with a less proportion of sap than in the South Island. The black pine, *Podocarpus spicata*, and the miro, *P. ferruginea*, are not infrequent, and sometimes attain a large size, but they never form a large proportion of the timber, and are rarely converted in this district.

12. Tawa, *Nesodaphne tawa*, is the prevailing tree in some portions of the district. It attains the height of from 50 to 70 feet, with a trunk two to three feet in diameter, and light spray clothed with elegant willow-like foliage. It is especially plentiful in deep narrow gullies, and is distributed throughout the North Island. It bears a handsome fruit somewhat larger than a damascene.

13. The tanekaha, *Phyllocladus trichomanoides*, occurs in considerable quantity. It is from 50 to 70 feet high, with a trunk 2 to 3 feet in diameter, and yields a timber of great toughness and durability. It is restricted to the North Island. Allied to this is the toatoa, *P. glauca*, another of the celery-topped pines, and confined to the kauri district. It is the most striking and handsome of all the New Zealand pines, sometimes over 30 feet high, with a trunk 18 inches in diameter, but rarely occurs in large quantity.

14. The manao, *Dacrydium Colensoi*, is another pine yielding timber of great durability, but usually of small dimensions. It is rarely more than 40 feet high, and usually smaller, with a trunk 1 to 2 feet in diameter. The lower leaves are an inch in length, and resemble those of the miro; the upper are small and closely compressed, like those of a cypress.

15. The white pine, *Podocarpus dacrydioides*, although occasionally found solitary in dry forests, is usually gregarious, occupying swampy districts to the exclusion of other kinds. It attains a large size, 80 to 100 feet high, with a trunk of from 2 to 5 feet in diameter. A squared spar, lying in a forest in the Wairoa, measured 103 feet in length and 9 inches square at the upper end. It forms forests of great extent, as in many places by the Wairoa, and in the Hauraki Gulf, where it occupies the whole of the swamp land between the Thames and Piako Rivers. Its perfectly straight trunks, which taper very gradually and are devoid of branches, stand at very short distances from each other and much resemble interminable series of columns, an effect produced by no other New Zealand tree.

16. The rawiri or tea-tree, *Leptospermum ericoides*. This useful tree forms large blocks often covering entire ranges. The trunk is from 20 to 40 feet in length, and 1 to 2 feet in diameter; the foliage is very light and graceful. The manuka, *L. scoparium*, seldom attains the dimensions of a tree, but as low scrub, 2 to 12 feet high, often covers large tracts of country.

17. The black maire, *Olea apetala*, with its allies, *O. Cunninghamii* and *O. lanceolata*, are frequently found in mixed forest, and from their glossy foliage at once attract attention. The sandalwood, *Santalum Cunninghamii*, is frequently associated with them. Pukatea, *Atherosperma Novæ-Zelandiæ*, is more plentiful in rather swampy forests, where it forms a noble tree, 100 to 150 feet high, with a trunk 3 to 7 feet in diameter. Another fine laureliad, peculiar to this district, is the mungiao, *Tetranthera calicaris*, which yields a dense white timber, used for ships' blocks, &c. It occurs sparingly in the drier parts of the forest, and attains 50 feet in height. *Ixerba brexioides*, a fine tree with large handsome foliage and white flowers, is plentiful in several localities, usually at slight elevations. It attains the height of 60 feet, with a trunk 1 to 2 feet in diameter, yielding a white timber of great density, and which might be made available for many purposes.

18. In sheltered valleys, much of the forest consists of puriri, *Vitex littoralis*, a tree 50 feet or more in height, with a massive trunk 2 to 5 feet in diameter and smooth white bark. The deep green pinnate leaves are relieved by the red flowers and fruit. About Hokianga it is associated with the graceful *Ackama rosaefolia*, a small tree 30 to 40 feet high, with pinnate leaves enlivened by panicles of flowers greatly resembling in general appearance the mountain ash, *Pyrus aucuparia*, of modern Europe. These again are mixed with the bright glossy foliage of the karaka, *Corynocarpus laevigatus*, a tree 30 feet high. The small-leaved tawhero, *Weinmannia silvicola*, with its innumerable erect racemes of whitish flowers, surmounting a trunk 30 or 40 high, is abundant, and by its side the closely allied tree, *Quintinia serrata*, with its larger and still more attractive flowers. The Northern rata, *Metrosideros robusta*, often 100 feet high, with a massive gnarled trunk 5 to 12 feet in diameter, is abundant all through the district, and when covered from base to summit with bright crimson flowers is a magnificent object.

The taraire (*Nesodaphne taraire*) is peculiar to this district, and forms a handsome tree 40 to 60 feet high, with a trunk 1 to 3 feet in diameter, with white bark and large, brownish, ovate leaves. It often forms the most prominent tree in large tracts of forest.

19. Almost restricted to this district is the magnificent pohutukawa, *Metrosideros tomentosa*, with its huge gnarled branching arms and silvery foliage, abundant everywhere near the sea, and yielding ship timber of the highest value. When covered with crimson flowers, at Christmas, it forms a magnificent object. The kowhai, *Sophora tetraptera*, is plentiful in many localities, but more often forms

a bush than a large tree; its golden flowers are displayed in September; its timber is one of the most durable in the colony. In swampy land the maire tawhake, *Eugenia maire*, yields a timber of great durability: it attains 40 feet in height, and produces its yellow flowers in abundance. The rewarewa, *Knightia excelsa*, frequently attains the height of 40 to 50 feet, and produces a valuable timber for ornamental work, but of no great durability; its peculiar fastigate habit forms a striking contrast to the round topped trees among which it frequently grows. The large New Zealand fuchsia, *Fuchsia excorticata*, has a trunk from 5 to 20 feet in length, and often 2 feet in diameter: although frequently twisted and knotty its timber is very durable.

20. In this district the undergrowth is largely composed of *Alseuosmia*, an endemic genus of *Cuprifoliaceae*, intermixed with *Coprosma*s and numerous shrubs laced together by tataramoa (*Rubus australis*), supple-jack (*Rhipogonum scandens*), and mangemange (*Lygodium articulatum*), so that in many places progress is extremely difficult. So long as this dense undergrowth is not thinned or damaged by cattle or other external agencies, fire can make but little progress in a northern forest; but when it is thinned, or damaged, so that the surface becomes dry, and dead branches accumulate, the forest can be fired with little difficulty.

## II.—Central or Totara District.

21. This district extends from Port Waikato on the West Coast to the Mokau River; from thence its boundary strikes inward by the southern flank of the Ruapehu and the Ohauko plains to the main range of the Ruahine, and is continued along the Tararua and Rimutaka Ranges to the western side of Palliser Bay. On the eastern side it extends to the sea from Palliser Bay, northwards to Tauranga Harbour.

22. The area comprised in the totara and red-pine districts (No. III.) is traversed by a range of mountains, extending from the East Cape to Palliser Bay, and forming a continuation of the Alps of the South Island. Its highest peaks rise to the height of 6,000 feet, and are only inferior to the volcanic mountains Egmont, 8,200, and Ruapehu, 9,200 feet. It is composed of palæozoic or lower mesozoic slates, sandstones, and quartzites; the slates sometimes banded, and the sandstones more or less crystalline. The lower flanks of the eastern slopes to the sea consist chiefly of pliocene clays, conglomerates, sandstones, marls, and limestones. The rocks of this formation are equally developed on the western side, occupying the greater portion of the area drained by the Rangitikei, Wanganui, and Patea Rivers. From Cape Egmont, by Lake Taupo, and the Middle Waikato Basin, to the Bay of Plenty, these later sedimentary rocks are buried under trachytic tufas and lavas which, continued northwards from the Cape Colville Peninsula in the kauri district, extend in an easterly direction nearly to Cape Runaway. Considerable portions of the Middle Waikato Basin and the Taupo district are covered with pumiceous drift and gravels. Recent gravels also occur for some miles inland on the West Coast, between the Wanganui River and Kapiti Island; and on the east side of the main range, over the area occupied by the Forty-Mile Bush and the Wairarapa Valley.

23. Between Tongariro and White Island, in the Bay of Plenty, is a vast assemblage of intermittent geysers, boiling springs, steam jets, solfataras, and sinter terraces, which do not exercise any marked influence on the arboreal vegetation by which they are surrounded, although tropical ferns, not found in other localities in the colony, flourish in the elevated temperature in the immediate vicinity of the more remarkable hot springs.

24. The climate of the northern portion of the totara district is the most agreeable and invigorating in New Zealand, and is much drier than that of the kauri district. Observations taken at Napier show the average mean temperature for the year to be 57°·5; for the winter quarter, 49°·1; summer quarter, 66°·2; the difference between the coldest and warmest months being 19°·2. The annual average rainfall is only 36 inches; prevalent wind N.E. On the West Coast the temperature is slightly higher in winter and lower in summer, with a rainfall of 50 inches. South of Napier the temperature is somewhat lower, with a rainfall of from 45 to 50 inches, and more frequent northerly winds.

25. The totara (*Podocarpus totara*) is found from 60 to 100 feet high and upwards, and from 4 to 7 feet in diameter; the trunk tapers much more rapidly than that of the kauri. The leaves are coriaceous,  $\frac{3}{4}$  in. to 1½ in. long, lanceolate, pungent, and of a peculiar brown hue. When growing in rich alluvial soil, the trunk is straight, with few branches; but in rocky soils and open situations the branches are largely developed; and when growing on the crests of hills, the trunk is comparatively short, carrying a wide-spreading head. The totara district contains incidental blocks of tawa (*Nesodaphne tawa*) often of considerable extent; entire-leaved, tooth-leaved, and round-leaved beeches; black, red, and white pines; titoki, tea-tree, mapau, pokako, ribbon-wood, tawhero, hinau, with scattered trees or clumps of kauri and puriri in the northern portion, ngaio, broadleaf, &c., &c.

26. From Port Waikato to Aotea is a considerable extent of dense forest in which the kauri is occasionally found, as at Whangape and Wahi Lakes, the ranges opposite Ngaruawahia, &c. Small blocks of tooth-leaved beech occur on the hills; large quantities of white pine in the lower parts, with red pine and large patches of totara. The red pine is often of large dimensions; puriri, although often extremely local, is not infrequent; maire tawhake, and pukatea are common in swampy land, and the kawaka occasionally on the higher ground. On the whole tawa and white pine are the most common trees in this portion of the district.

27. The heavy forest between Aotea and the Mokau cannot be examined at the present time, owing to the restrictions imposed by the Maoris. It is said to contain large quantities of red pine and totara.

28. Between Tauranga and Rotorua is a large extent of excellent mixed forest, in which tawa is abundant. It comprises red pine, which is plentiful in some places, totara, tooth-leaved beech, tane-kaha, tipau, mapau, &c., &c. Much of the red pine is of large size and well grown. In the East Cape forests of a similar character occur, but with a larger proportion of tooth-leaved beech, and in many localities of fine totara and kamai. At Ahikereru and Pohue totara is said to be plentiful, and of large dimensions, though at the latter place the best trees have probably been removed. Pohutukawa is said to occur at Waikaremoana, seventy miles from the sea. Totara occurs in many places in the

Forty-Mile Bush, and again in the upper part of the Wairarapa Valley, covering large areas, and attaining unusual dimensions. In fact, scattered trees are found everywhere, and scarcely a mountain valley below 1,200 feet, however small, is devoid of one or more clumps or larger groups. Red and black pines are also plentiful.

29. In the Taupo District, wherever forest is found, unless in exceptionally dry situations, totara invariably enters into its composition, as at Oruanui, where it is abundant, Opepe, and other places above Lake Taupo. In this district the pokako and broadleaf are plentiful. The pokako, *Elæocarpus Hookerianus*, is a tree of remarkably neat habit, attaining a height of from 30 to 50 feet, with a trunk  $1\frac{1}{2}$  to 2 feet in diameter; it produces a profusion of racemose, yellowish-white flowers. Its timber is used for inside work and for sundry purposes where durability is not required. The broadleaf, *Griselinia littoralis*, attains the height of 50 feet, with a short trunk 2 to 4 feet in diameter; the fine ovate, glossy, pale green foliage has a remarkably pleasing effect. The timber is very crooked, and often perforated by the larva of *Hepialus virescens*, but is extremely durable and highly valued for fencing-posts, house blocks, &c.

The highest portions of the ranges are covered with fagus forest, the entire leaved, tooth-leaved, and round-leaved beeches, which often attain large dimensions, the entire-leaved and round-leaved kinds being considered to afford the more durable timber. These trees will be fully described when treating of the forests of the South Island.

### III.—Western or Red Pine District.

30. This district extends from the Mokau River to Palliser Bay, and is bounded on the north and east by the totara district. Its climate is not equally favourable to the development of a varied arboreal vegetation with that of the kauri and totara districts, and on examining its forests we find that the kauri, taraire, toro, ackama, the littoral tarata, the true toatoa, tawari, sandalwood, and other striking forms are no longer seen, while the pohutukawa and puriri are restricted to a very limited district on the coast of Taranaki.

31. Observations taken at New Plymouth yield the same general results with regard to temperature as those taken at Napier: the summer quarter at New Plymouth has a mean average temperature  $1^{\circ}7$  below that at Napier, while the winter quarter is  $1^{\circ}$  higher—the annual mean being the same at both places. The rainfall, however, is greatly in excess of that of Napier, being 60 inches as against 36. The prevailing winds are S.W., N.E., and S.E. It is to this increased rainfall, coupled with the higher winter temperature, that we must ascribe the presence of the puriri and pohutukawa so much further to the south on the West Coast than on the East; the greater abundance and larger dimensions of the red pine are probably due to the same cause.

Observations taken at the Wellington Observatory give a mean annual temperature of  $55^{\circ}5$ —for the winter quarter,  $48^{\circ}7$ ; for the summer quarter,  $62^{\circ}2$ ; difference between the hottest and coldest months,  $14^{\circ}7$ . Annual rainfall, 57.862 inches. Prevalent winds, N.W. and S.W.

The inland portions of the red pine district will probably be found to possess a much lower temperature and a heavier rainfall than that prevailing at Wellington, while a large area on the coast will be characterized by a greatly reduced rainfall and lower winter temperature, these peculiarities being most strongly marked in the lower portions of the valleys of the Rangitikei and Manawatu. Observations at Wanganui show a rainfall of only 38.420 inches; but even this is in excess of the annual rainfall at Carnarvon, on the Rangitikei River. The coastal portion of the red pine district, between Wanganui and Kapiti Island, is probably the driest locality in the North Island.

32. The red pine, *Dacrydium cupressinum*, of the North Island, is usually from 60 to 100 feet high, with a trunk from 3 to 5 feet in diameter, tapering more rapidly than the kauri, but less than the totara. The bark of mature trees presents a close resemblance to that of old specimens of the pinaster, or Scotch fir, and becomes detached in large heavy flakes. The young branches are pendent, not simply drooping, but hanging in parallel lines to the stem, and when young present a peculiarly graceful appearance. The leaves are of a bright-green colour, very short, subulate, and more or less imbricating. In exposed situations it throws out branches at a comparatively short height from the ground, but in sheltered places and on rich bottoms the branches are comparatively few and weak, and the trunk attains a great length. It occurs from the sea level to nearly 2,000 feet, being more frequent on high ranges than the totara. The timber has been generally used for building purposes, bridges, &c., and for furniture, but cannot be commended for durability. When sound, it is stronger than totara, but inferior to kauri. At the present time it is, perhaps, more largely used than any other timber in the colony.

33. In this district totara is of frequent occurrence, either more or less scattered in mixed forest, or forming patches or groves of considerable extent in the more open valleys, but it does not occur in nearly so large quantities as the red pine.

34. Incidental tracts or blocks of entire-leaved, round-leaved, and tooth-leaved beeches are plentiful on the higher parts of the ranges; the round-leaved beech descending to the sea level. Tawa, white pine, black pine, miro, hinau, and titoki also occur as incidental blocks or clumps, with scattered trees of ngaio, pahutuai, pukatea, rata, rewarewa, and maire tawhake.

35. A large area in the Manawatu and Rangitikei Districts is occupied by white pine of large dimensions, the higher land being clothed with red pine and tawa. Patches of black pine and miro are of frequent occurrence, with totara in the valleys.

The black pine, *Podocarpus spicata*, or matai, is a handsome tree with cinereous bark. It attains the height of 50 to 80 feet, with a trunk 2 to 4 feet in diameter. The leaves are small and rather close-set, resembling those of the European yew, but are smaller and glaucous below; the fruit is a bright red drupe. The timber is hard and extremely durable: well adapted for general purposes.

The miro, *Podocarpus ferruginea*, closely resembles black pine, but usually attains greater dimensions, and may easily be recognized by the larger leaves, which are never glaucous below. The timber is of a lighter colour than black pine and less dense. It is not durable, but is valued for inside work.

The tawa, *Nesodaphne tawa*, often forms large portions of the forest on the lower slopes of the Rimutaka and Tararua Ranges. Its black trunk is frequently 3 feet in diameter, and its elegant spray and light-green foliage are unique in the New Zealand forest flora. Unfortunately its wood lacks durability, but it is applicable to all the purposes for which birch, *Betula alba*, is used in Europe.

36. In the valley of the Rangitikei numerous clumps of forest trees comprise a large proportion of titoki, *Alectryon excelsum*, a remarkably handsome tree 40 feet high, with a trunk 1 to 2 feet in diameter, and large pinnate leaves resembling those of the European ash. The timber is remarkably tough and elastic, and is much valued for tool handles, &c. In other parts of the Rangitikei the ngaio, *Myoporum laetum*, forms a small but graceful tree 30 feet high, or more, with a trunk 12 in. to 18 in. in diameter, affording a dark-coloured timber, valuable for fencing purposes, &c., &c.

37. About Wellington, and in other localities, the hinau, *Elæocarpus dentatus*, clothes many of the low ranges. It has a round head, and attains the height of 50 feet, with a trunk about 2 feet in diameter. The timber is extremely durable, and greatly superior to that of the allied pokako. It is valued for fencing posts, and has been used in bridges with good results.

The pukatea, *Atherosperma Novæ-Zelandiæ*, is a noble tree, attaining the height of 150 feet, with a trunk 3 to 6 feet in diameter, yielding a compact brown-coloured timber, which appears to have come into general use in Taranaki, although not highly valued elsewhere. In Auckland it was formerly used for boat-building. Puriri and pohutukawa are restricted to the vicinity of New Plymouth. The rewarewa, *Knightia excelsa*, is abundant in the red pine district, and attains its maximum dimensions. Its red finely marked timber, not being durable, has scarcely been utilized in the colony, but might form a profitable export for cabinetwork.

38. Several trees are confused under the name maire: the chief are the sandalwood, *Santalum Cunninghamii*, which, however, does not occur in the red pine district, and the fine olives, *Olea lanceolata* and *O. Cunninghamii*, which appear to be rare, if, indeed, the former has been observed so far south. The black maire, *Olea apetala*, attains its maximum abundance and largest dimensions in this district, the trunk being sometimes 4 feet in diameter, although usually smaller. The timber is extremely compact, fine-grained, and of great durability. It has been advantageously used for wood engraving, and might form an article of export for that purpose.

#### IV.—The South Lowland or Red Pine District.

39. The geological characteristics of the two forest districts of the South Island may be briefly stated. From D'Urville Island to the Waitaki Valley the Southern Alps consist chiefly of palæozoic or mesozoic slates and sandstones of similar character to those forming the chief mountain range of the North Island, and attain their greatest height in Mount Cook, somewhat under 13,500 feet. On the eastern side a low tract of post-tertiary silts, shingles, and gravels forms the Canterbury Plains, having a total length of about 120 miles, with an extreme breadth of 45 miles, rising from the sea level to 1,000 feet at the Malvern Hills. North and south of the Canterbury Plains are limited areas of tertiary clays and marls. On the western slope of the range is a large extent of schistose rocks, which is continued southwards to Jackson's Bay, when it crosses the island in a broad band to the East Coast, covering the entire area between Shag Point and the Clutha. Small areas of post-tertiary drift gravels, &c., occur in Blind Bay, the Grey Valley, and at other points on the coast and inland. This schistose area is succeeded by an irregular narrow belt of palæozoic slates crossing the island. Between the mouth of the Clutha and the Maitara Valley, palæozoic slates, sandstones, quartzites, and conglomerates again occur. The extensive area between Milford Sound and Preservation Inlet is chiefly composed of syenitic gneiss, flanked on the east by foliated schists, of which an outlying area extends from the Waiau River to Riverton. The Southland Plains are chiefly composed of post-tertiary shingle, sands, and clay.

40. The southern red pine district comprises those portions of the South Island below 1,000 feet of elevation. The chief peculiarities of the climate of this district are the excessive rainfall on the western side, 115·418 inches at Hokitika, and the arid climate of the eastern side and southern portions of the interior. At Oamaru the annual rainfall is under 20 inches per annum.

The mean annual temperature at Nelson is 54°·8; Christchurch, 52°·8; Hokitika, 52°·3; Dunedin, 50°·7; and of Southland, 50°·3; so that the mean difference between the northern and southern extremities is only 4°·5. The greatest difference between the hottest and coldest months is at Christchurch, 18°·7; the least at Hokitika, 14°·7. The mean annual rainfall at Nelson is 68·068 inches; Cape Campbell on the East Coast, 24·830 inches; Christchurch, 25·821 inches; Dunedin, 31·346 inches; Southland, 41·090 inches; and at Hokitika, as above, 115·418—the means being for the five years, from 1871 to 1875 inclusive, as per tabular statement further on. The prevailing winds at Hokitika are E. and N.E.; Dunedin and Southland, N.E. and S.W.; Christchurch, S.W. and N.E.; at Nelson, N.E., N., and S.E. The winter temperature of the East Coast is 2° below that of the West; Southland, 3° lower.

41. A luxuriant forest growth extends along the western coast of the South Island, running inland for a varying width, but nowhere of great extent except in the wider river valleys, such as the Tere-makau, the Grey, &c. In many valleys, as the Waitaha, the forest assumes a subalpine aspect at a very short distance from their mouths; but usually the lowland district exhibits luxuriant forest of the densest growth from West Wanganui to Catlin's River, being broken only in few places and for short distances.

42. On the eastern side the forest areas are extremely limited and far between. Totara, white, black, and red pines, &c., occur in the lower parts of the Kaikouras, intermixed with beeches. Banks Peninsula, although containing much beech in the higher parts, has a large extent of red and white pine, miro, and other lowland timbers. The Oxford Bush in the Canterbury District consists of black, white, and red pine, with a little totara and the beeches. There are also several small tracts of forest at the Ashburton, Mount Somers, Mount Peel, Geraldine, the Waimate, composed of the same trees, with occasional patches of tea-tree and beech in the higher portions. Similar patches occur at Otepopo; and again there is some extent of mixed forest on the hills north of Dunedin, with the addition of

cedar, manuao, hinau, &c. At the mouth of the Clutha is similar forest, with a large proportion of totara. Of the nature of the forest between Riverton and Martin's Bay, and on Stewart's Island, I am unable to speak from personal knowledge; but, from the best information that could be obtained, am inclined to think that the chief portion of valuable timber occurs between Big River and Dusky Bay, and that the total quantity has been greatly over-estimated.

43. In the Westland and Southland portions of the district, the red pine, *Dacrydium cupressinum*, is the prevailing tree over large areas. Although it rarely attains the large dimensions which characterize it in the northern red-pine district, it is of great length, straight, and tapers very gradually, with few branches. The bulk of the trees in some localities would not exceed 2 feet in diameter at the butt, and the proportion of sapwood is much larger than in the North Island. With the red pine we find incidental blocks of entire-leaved, tooth-leaved, and round-leaved beeches, black and white pines, Westland or white silver pine, yellow silver pine, ironwood, tea-tree, kamai, cedar, quintinia, pokako, southern toatoa. Nearly all of these also occur as scattered trees, with the addition of pukatea and tawa in the northern parts of the district.

In the Hokitika portion of the district the chief trees often occur in a succession of narrow belts or stripes. A belt of red pine will be succeeded by a belt of Westland pine, this by a belt of white pine or quintinia, and so on. This singular characteristic is confined to slightly undulating, low alluvial districts, and is well marked in several parts of the line of road between Hokitika and Ross, which cuts through successive belts.

44. *Quintinia serrata* forms a small tree 30 feet high or more, with a straight trunk 12 to 15 inches in diameter. It is the variety B of the Handbook of the New Zealand Flora, and differs from the northern form in its greater size and broader leaves. Its timber is used for fencing purposes, tramway sleepers, mine props, &c.

Westland pine, silver pine or white silver pine, *Dacrydium Westlandicum*, n.s., is a handsome tree, which has hitherto been confused with white pine by botanists, but, in reality, belongs to a different genus. So far as known, it is restricted to the western portion of Nelson and Westland. It is a handsome tree 30 to 50 feet high; trunk,  $1\frac{1}{2}$  to  $2\frac{1}{2}$  feet in diameter, with white thin bark and minute closely imbricating mature leaves. The young leaves are terete and spreading; gradually become shorter and somewhat flattened, resembling the young leaves of white pine, before they pass into the appressed condition. The timber is hard, dense, and extremely durable; it is used for general building purposes, piles, bridges, and wharves, and realizes a higher price in the market than red pine. It has been exported in bulk to Melbourne, where it is in demand. In altitude it ranges from the sea level to nearly 2,000 feet, and was observed at intervals from Greymouth to Okarita; in all probability it will be found along the whole of the West Coast as far south as Dusky Bay.

Yellow silver pine, *Dacrydium intermedium*, n.s. This species somewhat resembles the preceding, but has larger mature leaves, less closely imbricating; the young leaves also are larger and resemble those of red pine; the branches are stouter, with dark bark, which is much thicker than the preceding. It not unfrequently branches from near the base. The timber is yellowish, dense, and heavy; it is even more durable than that of *D. Westlandicum*. It has a wider range than that species, being found in the North Island, but does not descend to the lowest levels.

Ironwood, *Metrosideros lucida*. This tree often attains a large size. Specimens were observed 60 feet high, with a clean trunk  $2\frac{1}{2}$  feet in diameter; but usually the trunk is short, branching from near the base. It produces a durable timber of great density, and is inferior only to the northern pohutukawa and rata for shipbuilding purposes. In the extreme south it replaces the pohutukawa of the North Island, and is especially plentiful on the margins of maritime creeks and inlets, although it rarely attains equally large dimensions.

Cedar, *Libocedrus Bidwillii*. About Dunedin the elegant cone-shaped tops of this tree form an agreeable contrast with the round-headed trees amongst which it grows. It attains the height of 50 feet, but the trunk is rarely more than 2 feet in diameter. Its timber is compact, even in the grain, and of great durability, but rather light and brittle.

Kamai, *Weinmannia racemosa*. This handsome tree is inferior in the beauty of its flowers to its near ally, the towai of the North, *Weinmannia silvicola*, which is confined to the kauri district. The tawhero or kamai extends from the Hauraki Gulf to Stewart's Island, and attains its maximum development in Westland, Seaward Forest, and Catlin's River Forest. It is from 30 to 60 feet high, with a trunk 1 to 3 feet in diameter. The timber is hard when cut, but twists and cracks to an excessive degree, which must necessarily detract from its value alike with regard to strength and durability. At Catlin's River, where this tree attains unusually large dimensions, recently sawn scantling, 9 and 10 inches square, was cracked to a depth of seven inches. It would probably answer for railway sleepers if cut during the winter season and left exposed at the ends to allow the escape of the sap. The kamai ascends from the sea level to 3,000 feet.

45. The Seaward Forest contains large quantities of miro, kamai, black pine, ironwood, &c., but consists chiefly of red pine, which forms clean well-grown trunks of good dimensions. At Catlin's River the forest comprises a large amount of red pine, with a greater proportion of round and notch-leaved beeches and kamai.

Between Invercargill and Winton are several patches of forest in some places, consisting chiefly of white pine; at others of red pine, matai, and miro; at others again chiefly of beech.

In warm sheltered valleys, such as that of the Teremakau, the white pine, miro, black pine, and red pine attain their largest dimensions, the pines sometimes rivalling the finest specimens found in the North Island.

#### V.—The Southern Upland or *Fagus* District.

46. This district comprises those portions of the South Island above 1,000 feet of altitude. Sufficient data have not been recorded to admit of our forming precise ideas of the fluctuations of temperature in the *Fagus* district, meteorological observations having as yet been taken at only two stations within its limits—Bealey, altitude 2,104 feet, situate at the entrance to Bealey Gorge, on the eastern side of

the main chain, and about 1,000 feet below the summit of the principal pass leading to the West Coast; and Queenstown, altitude 1,070 feet, on the margin of Lake Wakatipu. In this locality, the temperature is favourably influenced by the proximity of so large a body of water.

At Bealey, the mean annual temperature is  $45^{\circ}76$ ; for the summer quarter,  $54^{\circ}86$ ; for the winter quarter,  $37^{\circ}40$ . The difference between the hottest and coldest months is  $18^{\circ}1$ . Annual rainfall, 97<sup>o</sup>738 inches. Prevailing winds, W., N.W.

At Queenstown, 2 degrees further south than Bealey, but 1,000 feet below it in altitude, the mean annual temperature is  $51^{\circ}0$ ; of the summer quarter,  $51^{\circ}7$ ; of the winter quarter,  $59^{\circ}2$ . The difference between the hottest and coldest months,  $23^{\circ}8$ . Annual rainfall, 30782 inches. Prevailing winds, N.W.

In the latitude of Bealey, the mean annual temperature of the upper limit of the *Fagus* forests may be estimated approximately at under  $40^{\circ}$  Fah.

47. The chief forests of the upland district, like those of the lowland, are found on the Western Coast, but, as might be expected, are not correspondingly developed in the extreme southern portion of the island. They are composed of the different species of *Fagus*, either singly or mixed in varying degree with scattered specimens of totara, red pine, matai, kamai, silver pine, ironwood, cedar, &c., in their lower ranges; and alpine toatoa, pokako, *Panax simplex*, and other shrubs or small trees in the upper.

In lowland forests, and especially in warm river valleys, all the beeches attain large dimensions and form noble trees; as a general rule, large trees do not occur above 2,500 feet. Miles of forest may be explored without finding a single trunk 2 feet in diameter. Even at the lower limit, it is not uncommon to find forests consisting of straight regular stems of great height, but small diameter. This is especially the case with the entire-leaved beech (*F. Solandri*), which, although ranging from the sea level to 4,500 feet, and forming the chief portion of the alpine forest of the South Island, requires shelter and good soil to enable it to attain fair dimensions.

48. The *Fagus* forest seldom attains a greater altitude than 4,500 feet, unless in a few exceptional localities in the north-western portion of the district. In Otago it rarely exceeds 3,500 feet, and more frequently runs out below 3,000 feet. In the upper part of the Buller it runs for miles in a remarkably even line, estimated at 4,300 feet. Where it runs out, the trees are sometimes reduced to shrubs a few feet in height, with disproportionately stout branches, supporting a dense growth of short interlacing spray, forming a surface sufficiently compact to walk upon.

49. Tooth-leaved beech, *Fagus fusca*, is the prevalent tree in the lower parts of the district, although it ranges from the sea level upwards. It is from 80 to 100 feet high, with a trunk 3 to 8 feet in diameter. Its spray and foliage are remarkably elegant; the leaves are membranous, prominently ribbed, and with sharply serrated edges. The bark is longitudinally fissured, and varies from black to a rich chestnut brown. In forests, it is not uncommon to find trees of all ages, from gigantic specimens, with clean symmetrical trunks 50 feet long and 3 to 6 feet in diameter, downwards to a dense growth of young seedlings, a constant process of renewal being evident through the entire area. At others, the forest consists of trees of almost uniform dimensions, and so closely set that the eye can only pierce a short distance between the trunks.

The timber of the tooth-leaved beech is rather stout-grained, but hard and durable, well adapted for sleepers, constructive works, and all purposes requiring strength and durability. It is the most valuable of the New Zealand beeches, and has the widest range, occurring from Ahipara to Stewart's Island.

50. Round-leaved beech, *Fagus Menziesii*. A noble tree, often fully equalling, or even surpassing, the tooth-leaved beech. When young, its bark is white, and resembles that of the European birch, *Betula alba*; but in mature trees it is often fissured longitudinally, a difference which has misled many observers. The leaves are ovate or rounded, coriaceous, with rounded indentations or crenatures on the margin, and with indistinct veins.

The timber is finer in the grain and more compact than that of the tooth-leaved beech, so that it is readily worked; when grown in mountain districts it is probably little inferior in durability to the preceding species, but when growing in low alluvial land, as at Catlin's River, it may be less durable. In the upper part of the Buller Valley, and other localities where it has been much used, it is considered of even greater value than *F. fusca*, as affording durable timber.

51. Entire-leaved beech, *Fagus Solandri*. This species does not usually attain the large dimensions of either of the preceding, although in favourable situations, at low elevations, it is occasionally but little inferior. It is distinguished by its rather stiff entire leaves, which are wedge-shaped at the base, and often white below. The spray is very short and thick-set, so that the tree has a more rigid habit than either of the other species. It is the most abundant form at high levels. Its timber is of comparatively little value, on account of its want of durability, and is now but little used, except in situations where other timbers cannot be obtained.

52. *Fagus Cliffortioides*. This species has been generally confused with *F. Solandri*, which it greatly resembles at first sight. It is usually of small size, 50 feet, with a trunk  $1\frac{1}{2}$  feet to 2 feet in diameter and may be distinguished from *F. Solandri*, the entire-leaved beech, by its leaves being roundish or heart-shaped at the base instead of wedge-shaped; they are moreover somewhat larger and thinner. Its spray is more graceful than that of the preceding species, and closely approaches the European *F. sylvatica*. Nothing definite is known as to the quality of its timber, which will probably be found to resemble that of the tooth-leaved beech. Should this be the case, it will account to a great extent for the contradictory opinions expressed regarding the durability of the timber of *F. Solandri*, which is certainly the least valuable of the New Zealand species.

53. The various beeches are termed almost indiscriminately black, white, red, or brown birches, so that no reliance can be placed on their application; the same names are also applied to other timbers.

#### DISTRIBUTION OF SPECIES.

##### CLASS I.

1. *Dammara australis*, Lam. Kauri.—North Island: From the North Cape to Maketu, on the East Coast, and Kawhia on the West. Kauri forests, however, are not found south of Waiuku on the West Coast, or Katikati on the East; although isolated trees occur as far as the localities

stated. Forests, moreover, are only found below 1,000 feet of altitude, although scattered trees occur up to 2,300 feet.

2. *Podocarpus Totara*, *A. Cunn.* Totara.—Throughout the colony: is most abundant in lowland districts, and especially those of the southern part of the North Island. Large trees are rarely seen at above 1,000 feet; although isolated specimens occur up to 3,000 feet, in favourable localities.

3. *Podocarpus spicata*, *Br* Black pine.—Throughout the colony: most plentiful under 1,000 feet; not observed at above 2,000 feet.

4. *Libocedrus Doniana*, *Endl.* Kawaka.—North Island: From Mongonui to Wellington; but often local. Seldom occurring above 1,000 feet.

5. *Libocedrus Bidwillii*, *Hook. f.* Cedar.—North Island: Ruahine Mountains, Tararua Mountains. South Island: From Nelson to Otago, from sea level in Westland to 6,000 feet (?) in Nelson. I never saw it below 1,000 feet in Otago.

6. *Phyllocladus trichomanoides*, *Don.* Tanekaha.—North Island: From the North Cape to Taupo; certainly not found in the South Island.

7. *Dacrydium Colensoi*, *Hook. f.* Manoao.—General, Whangaroa North to Dunedin, ascending from sea level to 6,000 feet (unless the alpine forms belong to an undescribed species).

8. *Dacrydium Westlandicum*, *n.s.* Westland Pine.—South Island: At present only known on the West Coast, from Greymouth to Okarita; but will probably be found as far south as Martin's Bay. Ascends from sea level to 2,000 feet.

9. *Dacrydium intermedium*, *n.s.* Yellow Silver Pine.—North Island: Great Barrier Island, Cape Colville Ranges, 1,800 to 2,500 feet. South Island: Nelson, Westland, 500 to (?).

10. *Fagus Menziesii*, *Hook. f.* Round-leaved beech.—From the East Cape to Dunedin; sea level to 3,500 feet.

11. *Vitex littoralis*, *A. Cunn.* Puriri.—North Island: From the North Cape to New Plymouth, on the West Coast, and Poverty Bay on the East. Ascends from sea level to 1,500 feet.

12. *Fagus fusca*, *Hook. f.* Notch-leaved Beech.—From Ahipara to Catlin's River. Ascends from sea level to 3,500 feet.

13. *Metrosideros tomentosa*, *A. Cunn.* Pohutukawa.—North Island: North Cape to New Plymouth, on the West Coast; and to the East Cape, on the East Coast. Almost exclusively littoral.

14. *Metrosideros robusta*, *A. Cunn.* Rata.—North Island: Common throughout, from the sea level to 2,000 feet.

15. *Metrosideros lucida*, *Menzies.* Ironwood.—North Island: From the Great Barrier Island to Wellington. South Island: From Nelson to Stewart's Island. Auckland Islands. From sea level to 3,500 feet.

16. *Leptospermum ericoides*, *Rich.* Rawiri.—Common throughout the colony, ascending from sea level to 2,000 feet and upwards.

17. *Sophora tetrapetala*, *Aiton.* Kowhai.—Throughout the colony, ascending to 2,000 feet.

18. *Olea apetala*, *Vahl.* Black Maire.—North Island: From Bay of Islands to Wellington, but often local. Not observed above 1,000 feet.

19. *Eugenia Maire*, *A. Cunn.* Maire Tawhake.—North Island: From Mongonui to Wellington, in lowland swamps.

#### CLASS II.

20. *Dacrydium cupressinum*, *Soland.* Red Pine.—Throughout the colony. From sea level to 2,000 feet and upwards, but chiefly below 1,000 feet.

21. *Podocarpus dacrydioides*, *A. Rich.* White Pine.—Throughout the colony in lowland swamps. Not observed above 1,000 feet.

22. *Podocarpus ferruginea*, *Don.* Miro.—Throughout the colony, from sea level to 1,500 feet.

23. *Fagus Solandri*, *Hook. f.* Entire-leaved Beech.—From the East Cape to Otago. Ascending from sea level to 6,000 feet.

24. *Weinmannia silvicola*, *Banks and Sol.* Towai.—North Island: From the North Cape to the Hauraki Gulf. Ascends from sea level to 2,300 feet.

25. *Weinmannia racemosa*, *Forst.* Kamai.—From the Middle Waikato to the Bluff. Ascends from the sea level to 3,000 feet.

26. *Atherosperma Novæ-Zelandiæ*, *Hook. f.* Pukatea.—From the North Cape to Westland. Not observed above 1,500 feet.

27. *Elæocarpus dentatus*, *Vahl.* Hinau.—Throughout the colony. Ascending from sea level to 2,000 feet on the Hiraikimata Range, Great Barrier Island.

28. *Elæocarpus Hookerianus*, *Raoul.* Pokako.—From the Hauraki Gulf to the Bluff. Ascending from coast level to 3,000 feet.

29. *Nesodaphne Tawa*, *Hook. f.* Tawa.—North Island: Abundant throughout. South Island: Nelson, rare and local; erroneously reported to occur in the Oxford Bush, Canterbury. Ascends from the sea level to 2,500 feet.

30. *Nesodaphne Taraire*, *Hook. f.* Taraire.—North Island: From the North Cape to the Lower Waikato. Rarely observed above 1,000 feet.

31. *Alectryon excelsum*, *D.C.* Titoki.—From the North Cape to Banks Peninsula. Below 1,000 feet.

32. *Ixerba brexioides*, *A. Cunn.* Tawari.—North Island: From the Bay of Islands to the Hauraki Gulf. Reported to occur in Wellington, but the habitat requires confirmation. From 500 feet to 2,300 feet.

33. *Tetranthera calicaris*, *Hook. f.* Mangiao.—From Mongonui to the Hauraki Gulf. Rarely seen above 500 feet.

34. *Knightia excelsa*, *Br.* Rewarewa.—From the North Cape to Banks Peninsula. From sea level to 1,000 feet.

35. *Hedycarya dentata*, *Forst.* Kaiwhiria.—Throughout the colony. From sea level to 1,500 feet.

36. *Dysoxylum spectabile*, *Hook. f.* Kohokohe.—North Island: Often local. South Island: Nelson, rare. Ascends to 1,500 feet.

DESCRIPTION AND PROPERTIES OF NEW ZEALAND TIMBERS.

54. Under this section I think it better merely to reprint for the most part Mr. Kirk's "Report on the Durability of New Zealand Timbers in Constructive Works," which we have thoroughly revised and added to. But little if any new and reliable information has been, so far as I am aware, collected since Mr. Kirk wrote in 1875. Mr. Blair, C.E., has written a paper on the timbers of Otago; and Dr. Hector informs me that he has furnished a paper in connection with the Philadelphia Exhibition on the New Zealand timbers exhibited there. Neither has, however, yet been published.

55. I have endeavoured to give a general description of the several timber trees in the first section ("General Distribution of Forests") of this chapter, and submit also classified lists of the timber trees with their systematic native and settlers' name. For facility of reference, I have also inserted the name of the family to which each belongs. Mr. Kirk's English nomenclature for the three beeches (*F. fusca*, *Menziesii*, and *Solandri*) is retained, though I am not sanguine of its ever being generally adopted. It is, however, impossible, to identify them by the usual settlers' names of black, red, and white birch, which are applied sometimes to one and sometimes to another, and frequently, as Mr. Kirk points out, to totally different trees, such as *Pittosporum* and *Weinmannia*. Doubtless this has gone a great way to detract from their value, especially that of *F. fusca*, as a most durable timber.

56. I reprint also, at the close of this section, Mr. Kirk's remarks "On the Best Season for felling Timber in New Zealand," as I fully concur in his conclusions, and consider the point one of great importance both to the producer and consumer. I refer again to this point in the section devoted to a consideration of the present system, &c.

57. A collection of dried specimens, in illustration of the report and of some points of interest indirectly connected therewith, has been forwarded to the Colonial Museum.

CLASS I.

TIMBERS of GREAT DURABILITY, adapted for GENERAL BUILDING PURPOSES or Constructive Works, &c.

A.—For General Building Purposes.

Systematic Name.	Family.	Native Name.	Settlers' Name.
1. <i>Dammara australis</i> , Lam. ... ..	Coniferae ...	Kauri ...	Kauri.
2. <i>Podocarpus Totara</i> , A. Cunn. ... ..	"	Totara ...	Totara.
3. " <i>spicata</i> , Br. ... ..	"	Matai ...	Black pine.
4. <i>Libocedrus Doniana</i> , Endl. ... ..	"	Kawaka ...	Arbor vitæ.
5. " <i>Bidwillii</i> , Hook. f. ... ..	"	Pahautea ...	Cedar.
6. <i>Phyllocladus trichomanoides</i> , Don. ... ..	"	Tanekaha ...	Celery-topped pine.
7. <i>Dacrydium Colensoi</i> , Hook. ....	"	Manoao ...	Manoao.
8. " <i>Westlandicum</i> , n.s. ... ..	"	... ..	Westland pine.
9. " <i>intermedium</i> , n.s. ... ..	"	... ..	Yellow silver pine.
10. <i>Fagus Menziesii</i> , Hook. ... ..	Cupuliferae ...	Tawai ...	Round-leaved beech

B.—For Constructive Works or Special Purposes.

11. <i>Vitex littoralis</i> , A. Cunn. ... ..	Verbenaceæ ...	Puriri ...	New Zealand teak.
12. <i>Fagus fusca</i> , Hook. f. ... ..	Cupuliferae ...	Hutu tawhai ...	Tooth-leaved beech.
13. <i>Metrosideros tomentosa</i> , A. Cunn. ... ..	Myrtaceæ ...	Pohutukawa ...	Pohutukawa.
14. " <i>robusta</i> , A. Cunn. ... ..	"	Rata ...	Rata.
15. " <i>lucida</i> , Menzies ... ..	"	Rata ...	Ironwood.
16. <i>Leptospermum ericoides</i> , A. Rich ... ..	"	Rawiri ...	Tea-tree.
17. <i>Sophora tetraptera</i> , Aiton ... ..	Leguminosæ ...	Kowhai ...	Kowhai.
18. <i>Olea apetala</i> , Vahl ... ..	Jasmineæ ...	Maire raunui ...	Black maire.
19. <i>Eugenia Maire</i> , A. Cunn. ... ..	Myrtaceæ ...	Maire tawhake ...	Maire tawhake.

1. KAURI.—(*Dammara australis*.)

The kauri is the finest tree in New Zealand, and produces the most valuable timber. It is restricted to the northern part of the North Island, and does not occur in any quantity south of a line drawn from Port Waikato to Tauranga, although solitary trees or small groups are found as far south as Maketu on the East Coast, and Kawhia on the West. It attains the height of 120 to 160 feet, and upwards: clean symmetrical trunks may be seen from 50 to 80 or even 100 feet in length, varying 5 to 12 feet and upwards in diameter. The timber has acquired a reputation above all other New Zealand kinds from its value for masts, spars, and other purposes of naval architecture, which, about the commencement of the present century, led to its being exported for use in the British dockyards.

Except for general building purposes, its use has been chiefly confined to the North Island, where there is abundant evidence of its durability for more than thirty years in some of the old mission buildings at the Bay of Islands, the weather-boarding of which exhibits no signs of decay. The same must be said of some of the oldest houses in the city of Auckland and in other parts of the province, although I have been unable to obtain trustworthy evidence of their existence for more than twenty-three or twenty-four years, as in all the towns most of the old buildings have been removed to make way for improvements.

Kauri has been employed, in conjunction with totara, for the upper timbers of the Auckland Wharf, the largest work of the kind in the colony, and with most satisfactory results. Braces, stringers, and tie-beams are in good condition after being eighteen years in use. The greater portion of the old Wynyard Pier was recently removed in the formation of the Waikato Railway, when many of the timbers were found sound, although others were much decayed, after fully twenty-three years' service.

It has been extensively used for bridge timbers with the best results, but I am not aware of any instance of older date than the Auckland Wharf.

The superiority of kauri to Tasmanian blue-gum, under heavy wear and tear, has been demonstrated by the use of both timbers on the Auckland Wharf, when the former was found to last twice as long as the latter, under severe tests.

At the Taupiri Coal mines, sleepers were in good condition after from five to nine years' use. It has been used in the tramways of the Thames Gold Field, where it is sound and good after being five years in use. Mr. A. Sheath, Inspector of Telegraph Lines for the North Island, informs me that the kauri kerbing opposite Government House, Auckland, was taken up after having been laid eighteen years, and was then perfectly sound.

It has been employed for tramway rails on the Thames Gold Field, and was nearly everywhere found in excellent condition after five years' wear and tear. At the Waikato Coal Mines it has been employed for the same purpose for nine years, and is still serviceable, which is remarkable, as the rails were cut from small-sized trees growing in the neighbourhood. Totara and rimu rails laid at the same time have perished, the former probably from having been also sawn out of young timber.

On the Thames Gold Field it is used for mine props, struts, and cap-pieces, and maintains its character for durability, although for this purpose tanekaha and black birch are often used on account of their smaller cost.

It is not adapted for piles for bridges or jetties, as it is attacked by the teredo directly the bark has decayed; and although squared timber will resist the teredo for a longer period, it is greatly inferior to totara for this purpose.

A striking instance of the uselessness of sappy timber for permanent works was afforded by the telegraph line, erected in 1863, by the Royal Engineers, between Auckland and Queen's Redoubt, in which most of the poles were round kauri saplings, from 14 to 18 inches in diameter, almost destitute of heart-wood. Many of these were useless from decay in less than three years from the date of their erection. The whole line was taken down in about five years, and replaced by sawn heart posts, which are likely to stand for many years.

It is, however, worthy of remark that the sapwood of kauri and other native timbers is less speedily affected by decay when exposed to the influence of sea-water. In a small jetty at the Thames, one or two kauri poles, about 7 or 8 inches in diameter, driven nearly five years ago, are still sound and fresh, although nearly destroyed by teredines below the water-level. Within a few yards, heart of kauri scantlings, driven at the same time, are scarcely attacked.

Near Papakura, an ancient kauri forest has been buried at some remote period: in some places the logs still show above the surface. Much of the timber has been dug up in perfectly sound condition, and used for sleepers on the Auckland and Waikato Railway. A more convincing proof of its great durability could scarcely be afforded.

A steady export of kauri is carried on, chiefly with Australia, Tasmania, and Mauritius; it is, in fact, the only New Zealand timber exported to any extent. It is significant alike of its intrinsic value and of the abundance in which it occurs in the limited area to which it is confined, that the export of kauri timber from Auckland, for the seven years ending 31st December, 1873, amounted to £144,068, while the total export of all other timber from other parts of the colony amounted only to £19,739; and, as showing the growing estimation in which it is held, it may be further remarked that its export has more than doubled in the last three years.

## 2. TOTARA.—(*Podocarpus Totara.*)

The totara is found throughout the colony, usually attaining its greatest dimensions on rich alluvial lands, or on dry hill-sides of low elevation. Large specimens are found north of the Waitemata, but it does not occur in abundance until after passing the southern limit of the kauri. Although not equal in size to the largest specimens of the kauri, trees are occasionally found from 8 to 10 feet in diameter, 4 to 6 feet being the average size; height, 40 to 70 feet. From the extensive area which it occupies, it has been more generally used than the kauri, and is the chief timber employed for building purposes in the Province of Wellington, where it occupies a similar position to that held by the kauri in the Province of Auckland.

Although, as shown by the Sydney and Dunedin experiments on the strength of timber, totara ranks below kauri in point of strength, it is scarcely, if at all, inferior to it in durability. The general unanimity of opinion in its favour is remarkable: in one or two instances there is a disposition to consider it superior to kauri for general building and constructive purposes, but I have been unable to procure evidence in support of this conclusion. The actual durability of either timber must be considered an unsettled question for some time to come.

I have not examined any totara buildings so old as the kauri weather-boarding at the Bay of Islands, but the oldest totara houses, probably constructed above twenty-three years, are equal in condition to those of kauri of similar age; the weather-boarding in good condition, the wall-plates more or less decayed when in contact with the ground, but otherwise sound and good. Of course, these are cases in which good timber only has been used; sappy timber of either kind would perish in much less time.

Totara post-and-rail fences are expected to last from ten to thirteen years, and would probably stand for a longer period if split of larger dimensions. I have not seen any fence in thoroughly good condition that has been of greater age than twelve years.

Totara sleepers have been in use on tramways at the Taupiri Coal Mines for nine years; some of them are still good, although of small scantling, and split from small-sized trees. On the Invercargill railways, totara has been sparingly used for sleepers. All that I saw were in capital condition, after having been down eight years, and contrasted strongly with rimu sleepers, which were worthless at the end of seven years.

For piles for marine wharves and bridges, &c., it is one of the most valuable timbers known. In addition to its great durability, it has the power of resisting the attacks of teredo for a considerable period, especially if driven with the bark intact. It is said that trees felled during the growing season will resist the attacks of teredo for a longer period than those felled during the winter. Although I have been unable to obtain direct evidence in support of this, I entertain little doubt of its truth, but fear the advantages that may be derived from the property are overrated. I have seen totara piles attacked by teredo within a year of their being driven; but usually from two to four years elapse before they are touched, and, if the bark is preserved intact, a much longer period: in fact, I have never seen the bark of any timber perforated by teredines. Heart of totara will resist the teredo still longer. In the Auckland Museum is a section of a Tasmanian blue-gum pile, taken from the wharf after having been driven six or seven years. The pile itself is closely perforated, but heart of totara cradle sections bolted to it have not been touched. When the sap-wood of totara has been thoroughly perforated, it sometimes happens that the teredo dies out, being unable to attack the heart-wood until it has been subjected for a longer period to the action of sea water, when the mollusc resumes possession, and the destruction of that part of the pile exposed to its ravages is a mere matter of time. The fine wharf at the Bluff Harbour, constructed scarcely ten years ago, already shows the substantial totara piles in many cases perforated to the heart. Still, no other native timber, except perhaps the puriri, has equal power to resist the teredo.

With regard to simple durability, the oldest totara piles yet driven in our wharves and piers are perfectly sound, whether below the mud level or above high-water mark—in short, where not actually exposed to the attacks of teredo. Piles driven in the Auckland Wharf have been drawn twenty years after being driven, when the portion below the mud-level was fresh and sound, even the bark undecayed; and wherever used for beams, girders, or stringers, the same durability is shown, even in the oldest works, wherever good heart timber has been used.

Totara piles in inland bridges exhibit earlier signs of decay: the sap-wood decomposes more speedily, and appears to affect the heart. In situations of this kind, it is of great importance to remove the sap-wood before the pile is driven; and the same remark applies when totara is used for house blocks. The heart-wood will last longer if the sap is removed before the pile is used.

On the Otago mountains, and, I believe, on other mountains in the South Island, are still to be found large numbers of fallen totara trees which must have occupied their present position long before the advent of settlers. Many of these logs are said to be sound and good after their protracted surface exposure, a far more trying test than would be afforded in most constructive works. I had the opportunity of examining a portion of one of these logs, which was quite sound, although evidently of great age.

It may be fairly estimated that kauri and totara afford more than two-thirds of the indigenous timber employed for buildings and constructive works in the colony. A concise summary of their comparative use and durability may, therefore, be considered of special interest.

Both are extensively used for general building purposes, and exhibit the same amount of durability; kauri, however, is easier worked, and takes a higher finish. Owing to the great abundance, in the kauri district, of puriri and manuka, which afford the most durable fence constructed in the colony, totara has been used to a far greater extent than kauri for fencing purposes, but without evincing greater durability. I am not aware that either timber has been tried on a sufficient scale to obtain average results as to their durability for sleepers; but, so far as known, the results are equal. For the timbers of constructive works, kauri has the advantage of greater strength coupled with equal durability, so far as tested. For piles for marine wharves, jetties, bridges, &c., totara stands alone. Kauri has been extensively employed in shipbuilding for many years, and ranks deservedly high for this purpose. Totara has been but sparingly employed, and I have been unable to ascertain with what results. Both timbers are extensively used in the manufacture of furniture. Lastly, both are found exposed from natural causes of remote date, and exhibit great durability under the varied and severe tests thus applied.

### 3. MATAI—BLACK PINE.—(*Podocarpus spicata*.)

Found throughout the colony, but not in great abundance north of the Upper Waikato. It usually attains a height of from 50 to 70 feet, with the trunk from 2 to 4 feet in diameter, and affords a timber of great durability, used for a variety of purposes—piles for bridges, wharves, and jetties; bed-plates for machinery, millwrights' work, house blocks, railway sleepers, houses, &c., &c.

Great confusion has arisen from the crossing and misapplication of the common names of this and the next species, the miro (*Podocarpus ferruginea*), so that it has been often difficult to ascertain what timber was intended by either name, and obtain correct information, more especially as the two kinds bear a close resemblance after the timber has been in use for a time, and it is not easy for ordinary bushmen to distinguish the foliage. In the account of the Otago experiments on the strength of New Zealand timbers, matai is erroneously called *P. ferruginea* instead of *P. spicata*, although the latter is clearly the tree intended, as is evident from the description of the cross-section of the heart-wood. I am indebted to Mr. W. N. Blair, of Dunedin, for having cleared up any doubts I entertained of this, by showing me the fruit of what he considered the true black pine, which is clearly *Podocarpus spicata*, the tree with solitary fruit being the miro (*P. ferruginea*).

In Dunedin I saw large house blocks taken up which were perfectly sound after having been down upwards of fifteen years: weather-boards and flooring were good after having been in use twenty-five years—the weather-boards fully equal to totara and kauri. Several piles in the old jetty at Dunedin are sound after having been in use nineteen years. At Invercargill, two or three piles of a bridge near the railway station were drawn after being down nearly twelve years, and found perfectly sound throughout. In a situation in which the piles are exposed to teredines, at Port Chalmers, one or two specimens were much perforated, but sound above, after being in use thirteen years. Bridges in various parts of the colony afford similar proof of its durability, alike as regards piles, stringers, and braces; but it has been far more extensively used in the South than in the North, partly on account of its greater abundance in the former and the comparative rarity of totara.

Used for tramway sleepers at the Taupiri Coal Mines, good results were obtained. Sleepers in use for nine years were perfectly sound, with the exception of the sap.

Although it has been somewhat brought into disrepute by the substitution of miro for it in several localities, there can be no doubt that it is one of the most durable timbers in the colony. For sleepers, piles, &c., it will probably rank next in value to puriri, the most durable of all New Zealand timbers. I was much struck with the remarkably durable appearance of a large quantity of new black pine sleepers laid near the Chain Hill Tunnel, Dunedin, and have no doubt they will be found superior to totara, kauri, and black birch, all of which are in use on the same line of railway.

The *P. spicata* is generally known throughout the Nelson and Marlborough Provincial Districts as red pine, and is shipped under that name, the proper red pine (*Dacrydium cupressinum*) being known invariably by its native name of rimu (No. 20).

#### 4. KAWAKA.—(*Libocedrus Doniana*.)

This fine tree attains the height of from 60 to 100 feet, with a trunk 3 to 5 feet in diameter. The timber has been used for fencing and for cabinetwork; it is smooth and compact, although light, and will, I have little doubt, prove of equal durability with the next species. It attains unusually large dimensions in the Hunua and Pokeno districts, and ought to come into general use.

#### 5. CEDAR—PAHAUTEA.—(*Libocedrus Bidwillii*.)

A handsome, conical tree, 60 to 80 feet high, 2 to 3 feet in diameter, producing a dark red, close-grained timber of great durability, but rather brittle. Found on the central ranges of the North Island, and sparingly throughout the South Island: most abundant in Otago, but rarely descends below 1,000 feet.

For my knowledge of the value of this timber for constructive works I am entirely indebted to Mr. W. N. Blair, who is now using it for sleepers on the Otago railways. He showed me a fencing post, taken up at Tokomairiro after having been in the ground sixteen years. The post showed slight symptoms of decay, but would probably have lasted two or three years longer. The timber is now largely employed in the district for fencing purposes, and is preferred to totara.

Mr. J. E. Brown, engineer to the Southbridge Highway Board, in a letter to Mr. Blair, states that a bridge constructed chiefly with this timber over the Tokomairiro River in 1868, having the piles driven 12 feet into the bed of the river, is still in good condition, but has had the roadway renewed, the 3-inch planking originally laid not having proved equal to the heavy traffic.

Other bridges of the same material in the same district, but laid with 4-inch road planking, have withstood the effects of heavy traffic without requiring repairs.

It appears to be a timber well adapted for railway sleepers, if cut of somewhat larger scantling than usual; but I should be inclined to question the propriety of employing it for the bearing timbers of bridges of large span subject to heavy traffic.

Mr. Blair suggests that many of the prostrate logs found on the Otago mountains in all probability belong to this species.

NOTE.—In the North Island the native kohekohe (*Dysoxylum spectabile*), which yields a tough reddish-coloured wood, useful for the manufacture of furniture, but liable to be injured by insects when exposed, is also called cedar by the settlers.

#### 6. TANEKAHA.—(*Phyllocladus trichomanoides*.)

A straight, handsome tree, 50 to 60 feet high, trunk rarely exceeding 3 feet in diameter. Common in hilly districts in the North Island, and more abundant in the Province of Auckland. The timber is white, dense, and heavy, closely resembling the best crown Memel of Europe in everything but size. No experiments have been made to test its strength and elasticity, but it appears to be one of the strongest timbers in the colony, and one of the most durable, although, from its occurring most freely in the kauri district, it has scarcely been utilized at present.

On the Thames Gold Field it is greatly valued for mine props, struts, and caps, which were perfectly sound after having been in use six years. Tramway sleepers were in the same good condition after having been laid five years. Used as round piles, it was sound, fresh, and untouched by teredines after being driven four years.

Squared land piles in the Waikato Coal Mines showed the sappy edges decayed after having been driven nine years, but the heart in excellent condition. Totara from small trees, and large manuka under exactly the same conditions, were badly decayed at ground level: miro and rimu were worthless.

A quantity of railway sleepers, split at the commencement of the Auckland and Drury Railway, in 1865, were stacked in Mr. Hay's paddocks at Papakura, where, in consequence of the discontinuance of the works, they remained untouched until 1873, when the stacks were taken down. The bottom layer of one of the stacks was composed of tanekaha sleepers, which had been laid directly on the grass, and, although in this trying position for about eight years, had remained perfectly sound, with the exception of some trivial patches of sap, which had decayed without affecting the heart-wood.

I have been informed that tanekaha has been used for water-tanks at the Bay of Islands, and has remained sound after being eighteen years in use.

This timber appears specially adapted for railway sleepers and for road planking for bridges. As it occurs in several places near the line of the Auckland and Waikato Railway, its durability may be readily tested.

It does not occur in the South Island.

#### 7. MANOAO.—(*Dacrydium Colensoi*.)

A small tree, 30 to 40 feet high, found in various places from the Bay of Islands to Dunedin, but has scarcely been utilized except locally for house-building, although well known to the Natives as one of the most durable timbers in the colony. Mr. Bell, of Whangaroa, informed me that round piles, the thickness of a man's arm, driven into the bed of the river at Waimate, in the construction of a Native pa, were perfectly sound, although eighty years old.

8. WESTLAND PINE.—(*Dacrydium Westlandicum*, n.s.)

A small tree of similar dimensions to the manaoa, but easily distinguished by the smaller mature leaves and branchlets. In the young state the leaves have a general resemblance to the young leaves of white pine. It is usually from 40 to 50 feet high, with a trunk from 1 to 2 feet in diameter, and produces a white dense timber of great durability. It attains its greatest dimensions in moist forests on the West Coast of the South Island, and bears a general resemblance to white pine.

It is also called silver pine, or white silver pine.

Notwithstanding its rather small size it must be considered a timber of the first class, well adapted for piles, bridges, constructive works, and general building purposes, for all of which it has been extensively used on the West Coast, where it commands the highest price of all the native timbers.

9. YELLOW SILVER PINE.—(*Dacrydium intermedium*, n.s.)

A tree of similar dimensions to the preceding, but with larger bright-green leaves, somewhat resembling those of the red pine in the young state, but the branches are always erect. Timber yellowish, very dense, and reputed to be even more durable than the preceding. It was first observed on the Great Barrier Island and Cape Colville Peninsula, and was supposed to be a tree form of the pigmy *Dacrydium laxifolium*. On the West Coast it does not descend to the lowest levels, although it is occasionally found growing with *D. Westlandicum* on elevated terraces. It is a valuable addition to our durable timbers.

10. ROUND-LEAVED BEECH.—(*Fagus Menziesii*.)

A handsome tree, not usually attaining the extreme dimensions of the tooth-leaved beech, although exceptional specimens are not unfrequent. The timber is more even in the grain than that of either of the other species, but it does not appear to equal the tooth-leaved beech in strength. When grown in dry elevated situations the timber is equal in durability to that of *F. fusca*, but may possibly be inferior when grown in rich alluvial soil. In the upper part of the Buller Valley it is considered the most durable species, and is termed brown birch; in Otago it is commonly termed red birch, or silver birch.

When young the bark is white and silvery, but when old it becomes longitudinally furrowed. This has led some observers to consider the two forms distinct, but without the slightest foundation. The leaves are roundish or ovate, rather thick, and with indistinct veins; the margins have round indentations or crenatures.

11. PURIRI.—(*Vitex littoralis*.)

This tree attains a height of from 40 to 60 feet, with a trunk from 3 to 5 feet and upwards in diameter. It does not occur south of a line drawn from the East Cape to Stoney River, Taranaki, and, although often found solitary or in groups, forms the greater part of the forest in some localities on the west coast of the Kaipara. It has been appropriately styled the New Zealand teak: it is, in fact, closely allied to the Asiatic teak, and affords a timber of great density and extreme durability, closely resembling lignum vitæ in general appearance. In durability it probably excels all other New Zealand timbers.

The growing tree is subject to the attacks of the larva of the puriri moth, which bores holes sometimes three-eighths of an inch in diameter, but the durability of the timber is not directly affected, and the timber is never attacked when worked up.

It is in general use for house blocks in all districts where it can be procured. In the oldest houses taken down in Auckland, the blocks are almost invariably in a perfectly sound condition, after having been in use from twenty to thirty years.

It is extensively used for fencing-posts, which always command the highest price in the market on account of their great durability. Even the sap-wood alone of old trees will last several years, and it is no uncommon thing to see fencing-posts without a particle of heartwood. Heart posts which have been in the ground twenty years are still sound and good.

It has been used for piles for bridges, and in all cases known to me the piles are as good as when first driven, but the dates of erection are too recent to allow of its durability being tested. No instance of its use in marine structures has come under my notice. Small logs, exposed in situations where other timbers have been attacked by teredines, remained untouched for several years.

Railway sleepers, split about 1864 or 1865, were largely used on the Taranaki and Grahamstown Railway about four years ago, and will afford evidence as to the durability of puriri for this purpose at some future day.

On account of its great strength it is highly valued on the Thames Gold Fields for mine props, caps, &c., but the supply is not nearly equal to the demand.

12. TOOTH-LEAVED BEECH: HUTU-TAWHAI.—(*Fagus fusca*.)

The true black birch is a noble tree, found from Kaitia, in the North Island, to Otago, but often local and absent from extensive districts. It ascends the mountains from the sea level to 3,000 feet. The tree is usually from 60 to 90 feet in height, with a trunk from 3 to 8 feet in diameter. In many districts it is abundant, and forms a large portion of the forest. This species is almost invariably termed black birch in Auckland and Otago, red birch in Wellington and Nelson.

So much confusion has arisen from the misapplication of the names "black birch," "red birch," and "white birch," that without actual examination it is difficult to say what tree may be intended in any particular instance. In many parts of the colony, the small-leaved tarata (*Pittosporum tenuifolium*) is called black birch; in others, the name is applied to the tawhero (*Weinmannia racemosa*). In fact, the term "birch" may be regarded as a generic name applied by bushmen to any small-leaved tree, and qualified with the prefixes "black," "white," or "red," at the caprice of the individual, or as may be suggested by the colour of the foliage, bark, or timber.

It is certain that the reputation of *Fagus fusca* has suffered from the substitution of other timbers known as "black birch," notably of the next species, *Fagus Solandri*, and of the tawhero (*Weinmannia racemosa*). The timber of the latter greatly resembles that of the true black birch, but may be at once distinguished by its lighter specific gravity.

The tree, when growing, may be distinguished from the other species of *Fagus* by its sharply serrated leaves. The timber is red, rather stout in the grain, and very durable. It seems well adapted for sleepers and upper timbers for bridges, wharves, and jetties; it has also been used for piles.

In the North, the abundance of kauri and other timbers has led to its neglect, even for fencing purposes. The first instance of its being used to any extent was on the Thames Gold Fields, where it was largely employed for sleepers on the tramways, and is still perfectly sound, except where sap has been used, after being laid five years. On account of its strength and durability it is highly valued for mine props, cap pieces, &c.

In Wellington it is highly valued for fencing purposes, and especially for posts; the next species being frequently used for rails. Fences of this species are said to remain in good condition for fifteen years and upwards.

In Nelson it has been sparingly employed, with the next species, for marine piles. Mr. Akerson, of Nelson, informed me that he has taken up piles of this species which had been driven seventeen years, and found them perfectly sound except where attacked by teredo. He also stated that, in addition to its superior durability, it had the power of resisting the attacks of the teredo for a longer period.

I am informed by Mr. Blackett that the Waiau-ua Bridge was constructed eleven years ago entirely of this timber (*Fagus fusca*), and that on a recent close examination no trace of decay could be detected.

With the view of obviating the confusion caused by the misuse of the common names hitherto applied to the New Zealand beeches, I would suggest the adoption of new names based on the obvious characteristics of their foliage:—For *Fagus fusca*, tooth-leaved beech; for *Fagus Solandri*, entire-leaved beech; and for *Fagus Menziesii*, round-leaved beech. Should this suggestion be adopted by the Public Works Department, and the names be introduced into specifications, their use by timber merchants and bushmen would follow as a matter of course. It might be advisable to deposit for public inspection an authenticated specimen of the timber of each, and a dried specimen of the foliage, at the central and district offices of the department.

NOTE.—Since the above was written, it has been objected that the proposed names are unsuitable, as the distinctions are occasionally too fine to be easily recognized. Instances of this kind must be extremely rare, and can easily be allowed for by persons accustomed to forest work, although possibly perplexing to beginners. I have never experienced the slightest difficulty in identifying each species by its leaves.—T. K.

### 13. POHUTUKAWA.—(*Metrosideros tomentosa*.)

This tree is almost peculiar to the Province of Auckland, where it is abundant on rocky coasts, sometimes attaining the height of 70 feet, or more, but with a comparatively short trunk, 2 to 4 feet in diameter, and numerous massive tortuous arms. Its peculiar habit, combined with its great durability, renders it specially adapted for the purposes of the ship-builder, and it has usually formed the framework of the numerous vessels built in the Northern province. For this purpose it is superior to the Northern rata (*Metrosideros robusta*) and to the Southern ironwood (*Metrosideros lucida*), both of which are now used. I am not aware that it has been used for constructive works, but its density and durability render it valuable for the framing of dock gates, sills, &c. I have never seen a log of this timber perforated by teredines, except in the most superficial manner.

### 14. RATA.—(*Metrosideros robusta*.)

Almost confined to the North Island, and specially abundant in some parts of the Kaipara district, where it attains its maximum of development. Height, 60 to 100 feet; diameter of trunk, 5 to 12 feet and upwards. The timber closely resembles the preceding in its appearance, and is equally dense and durable, while it can be obtained of much larger dimensions, so that it affords greater facilities for the manufacture of railway wagons. It is used for ship-building, but for this purpose is inferior in durability to the pohutukawa, although, as it can be more easily procured in some situations, it will doubtless be frequently substituted.

On the tramways at the Thames it has been used for sleepers, which are perfectly sound after five years' use.

### 15. IRONWOOD—RATA.—(*Metrosideros lucida*.)

Usually found in hilly situations, from Cape Colville southwards. Descends to the sea level in the Bluff Harbour.

A handsome tree, 30 to 60 feet high: trunk usually 2 to 5 feet in diameter; often short. The timber resembles the preceding, but is less dense in texture, and has the disadvantage of splitting freely. It has been used in ship-building in the South Island, and has lately been utilized in the construction of goods trucks on the Invercargill Railway, for which its great strength and durability render it well adapted.

### 16. RAWIRI—TEA-TREE.—(*Leptospermum ericoides*.)

A well-known tree, 40 to 50 feet high, with the trunk 15 to 30 feet in length and 1 to 2 feet in diameter, wood hard and dense; much used for house blocks, fencing-rails, and especially valued for small marine piles.

This timber has been largely used throughout the colony for piles in the construction of jetties, wharves, &c., where timber of large dimensions is not required. It exhibits greater durability in marine structures than when driven for land or fresh-water bridges, &c. House blocks, even in dry situations, rarely continue in good condition for more than ten years. Used for land piles it usually decays at the ground level in six years, although that part of the pile above ground may remain

perfectly sound. On the other hand, piles in marine works in Auckland and Dunedin have remained sound after twenty years' use, which may probably be taken as the average limit of its durability. In Lyttelton Harbour a piece of shore piling is perfectly sound after being constructed fourteen years. In Otago, it is considered to resist the attacks of teredo better than any other timber, but I observed some fender piles at Port Chalmers much perforated. In Auckland I have seen it attacked within two years, and seriously injured in less than four years. Mr. D. E. McDonald, engineer to the Auckland Harbour Board, informs me that he has found manuka piles, cut during the growing season, resist the attacks of teredo much longer than those cut in the winter.

In the North it is generally used for fencing-rails, for which it is considered superior to all other timbers.

#### 17. KOWHAI.—(*Sophora tetraptera*.)

Found throughout the colony; varying in size from a small shrub to a tree 30 to 40 feet high, with a trunk 1 to 3 feet in diameter. The timber closely resembles the European laburnum, and is of great strength and durability; but the supply of large timber is extremely limited, the tree being often reduced to a mere bush.

It has been occasionally used for sleepers, piles, house blocks, &c., and is everywhere valued for its durability. Fencing posts, piles, and house blocks, which have been fixed for nearly twenty years, in Dunedin and other places, are still sound and good.

#### 18. BLACK MAIRE.—(*Olea apetala*, Vahl.)

The value of this noble olive as a timber tree is but little known. It is the largest of all the species termed maire by the Natives, and grows from 50 to 70 feet high, with a trunk 2 to 4 feet in diameter. Its foliage is large and glossy, but not so smooth and bright as that of *O. Cunninghamii* and *O. lanceolata*, with which it is generally confused. It yields a very hard, dense timber of great durability and strength, and is sufficiently smooth to admit of its being used for wood engraving. It might form an item of export.

Most of the specimens labelled *Santalum Cunninghamii* in the New Zealand museums belong to this species. It is found in many parts of the North Island.

#### 19. MAIRE-TAWHAKE.—(*Eugenia Maire*.)

A small tree about 40 feet high, 1 to 2 feet in diameter. Common in swampy land in the North Island. Timber compact, heavy, and durable.

This has been utilized for mooring-posts and jetty-piles on the Waikato, where I observed many instances in which it was perfectly sound after having been in use for seven years. It is highly valued for fencing, and, in localities where it is plentiful, might be advantageously employed for railway sleepers.

### CLASS II.

TIMBERS adapted for GENERAL BUILDING or SPECIAL PURPOSES, but not possessing great durability.

Systematic Name.	Family.	Native Name.	Settlers' Name.
20. <i>Dacrydium cupressinum</i> , Soland. ... ..	Coniferae ...	Rimu ...	Red pine.
21. <i>Podocarpus dacrydioides</i> , A. Rich ... ..	"	Kahikatea ...	White pine.
22. <i>Podocarpus ferruginea</i> , Don. ... ..	"	Miro ...	Miro.
23. <i>Fagus Solandri</i> , Hook. f. ... ..	Cupuliferae ...	Tawhai ...	Entire-leaved beech.
23A. <i>Fagus Cliffortioides</i> , Hook. f. ... ..	"	"	"
24. <i>Weinmannia silvicola</i> , Banks & Sol. ... ..	Saxifrageae ...	Towai ...	Towai.
25. <i>Weinmannia racemosa</i> , Forst ... ..	"	Tawhero ...	Tawhero.
26. <i>Atherosperma Novæ-Zelandiæ</i> , Hook. f. ... ..	Monimiaceae ...	Pukatea ...	Pukatea.
27. <i>Elæocarpus dentatus</i> , Vahl. ... ..	Tiliaceae ...	Hinau ...	Hinau.
28. <i>Elæocarpus Hookerianus</i> , Raoul ... ..	"	Pokako ...	Pokako.
29. <i>Nesodaphne Tawa</i> , Hook. f. ... ..	Laurineae ...	Tawa ...	Tawa.
30. <i>Nesodaphne Taraire</i> , Hook. f. ... ..	"	Taraire ...	Taraire.
31. <i>Alectryon excelsum</i> , D. C. ... ..	Sapindaceae ...	Titoki ...	Titoki.
32. <i>Ixerba brexioides</i> , A. Cunn. ... ..	Saxifrageae ...	Tawari ...	Tawari.
33. <i>Tetranthera calicaris</i> , Hook. f. ... ..	Laurineae ...	Mungeao ...	Mungeao.
34. <i>Knightia excelsa</i> , Br. ... ..	Proteaceae ...	Rewarewa ...	Honeysuckle.
35. <i>Hedycarya dentata</i> , Forst. ... ..	Monimiaceae ...	Kaiwhiria ...	Whitewood.
36. <i>Dysoxylum spectabile</i> , Hook. f. ... ..	Meliaceae ...	Kohekohe ...	Cedar.

#### 20. RED PINE—RIMU.—(*Dacrydium cupressinum*.)

A tree from 40 to 80 feet high; trunk, 3 to 5 feet in diameter. Found throughout the colony, but increasing in frequency from the Auckland Isthmus southwards.

This timber has been extensively used in the construction of public works, especially in the southern part of the colony, and has hitherto had a higher reputation for durability than it deserves.

Its chief drawback arises from its liability to decay under the influence of wet. Wherever moisture can penetrate, as at joints, sun-cracks, shakes, or even the concavities on the surface of hewn beams, decay speedily commences, although intervening spaces may remain sound for a considerable period.

Separation of the ligneous tissue frequently takes place during growth, leaving small cavities, which become filled with a resinous deposit. This becomes shaken when the tree is felled, affording fatal facilities for the access of moisture.

In the North Island, red pine was extensively used in the Waikato district, soon after the war of 1865-66, in the construction of bridges; but in all cases where it was employed, the bridges have had to be partially or entirely rebuilt at considerable expense. Many of the principal timbers were entirely decayed, and in nearly every case the joints were in the same state.

At Invercargill, hewn stringers, 16 inches square, were used in the construction of a railway bridge, erected about twelve years ago. Although used in this instance under most favourable circumstances, without road planking or cross-beams, it has been found necessary to replace a portion of the beams, owing to their decayed condition, and I was informed the others would be removed in a short time. In this case the decay appears to have chiefly arisen from the concavities of the upper hewn surface allowing the retention of rain.

At the Bluff Harbour, a double row of round piles, erected to protect the railway embankment, is connected by red pine scantlings, which are let into the piles and secured by spikes. In nearly every instance the scantlings are completely rotten where in contact with the piles, although often sound in the middle.

It has been much used for bridges in the South Island, but with general results similar to those observed in the Waikato.

It has been used for sleepers on the Invercargill lines, and is said to last in good condition for six years, which is probably its limit of durability for this purpose, as a large number that had been laid seven years were found greatly decayed on being taken up.

In the South Island it has been used for house-building purposes, for which it seems better adapted than for constructive works, as the joints are more or less protected from the influence of wet. In one or two small houses in Dunedin, rimu weather-boarding twenty years old was in fair condition, but by no means equal to kauri, totara, and black pine of similar age.

Although it cannot be considered a suitable timber for outside work, its great strength, and the facility with which straight logs of large dimensions can be obtained, enable it to be used with advantage for heavy beams, girders, &c., under cover.

It is largely used in the manufacture of furniture.

#### 21. KAHIKATEA—WHITE PINE.—(*Podocarpus dacrydioides*.)

A fine tree, 50 to 100 feet high, and upwards, with trunk 2 to 4 or even 5 feet in diameter. Found throughout the colony, frequently forming extensive forests in swampy districts.

When grown on hill-sides, the timber is more compact and durable than when grown in swamps, which has led to the idea of two species being confused under the systematic name, but there is no direct evidence in favour of the supposition.

The timber is white and tough, and is well adapted for indoor work, but will not bear exposure. In Wellington and other places it is said to be subject to the attacks of a minute coleopterous insect; it is, however, possible that this is only the case when the timber is felled in the summer time and used in a green condition. There can, however, be no doubt that the timber is not in any way adapted for exposure, although it is occasionally used for general building purposes where kauri and totara cannot be readily procured.

In the Waikato it was used in the construction of some of the bridges hastily erected during the war. When in contact with the ground it speedily decayed, not lasting three years. Scarcely a beam was in sound condition at the end of five years, and in many instances large timbers were mere masses of decay.

Used for house timbers, wall-plates become hopelessly decayed in three or four years if in contact with the ground. As weather-boarding, painted on the outside, it is more durable, although not to be recommended for the purpose.

On the western side of the Kaipara district it is sometimes used for fencing-rails. When split of large dimensions and perfectly free from sap it will last from seven to eight years, but I have seen rails become worthless within two years of their being used.

In Dunedin I had the opportunity of comparing its durability as weather-boarding with the Baltic white deal (*Abies excelsa*), and found it decidedly inferior; but as the Baltic deal had been felled in the winter, and was doubtless in a seasoned condition when used, while the white pine was in all probability felled in the summer and used in a green state, the comparison was not made under fair conditions as regards the latter. The white pine may be said to hold a similar position, in regard to kauri and totara, to that held by the Baltic white deal in respect to the red or yellow deal (*Pinus sylvestris*) of Europe. It is specially adapted for flooring-boards, and for that purpose might be used with advantage in houses constructed mainly of kauri and totara.

Although of lighter specific gravity, its strength is about equal to rimu; it might therefore, within certain limits, be used for inside beams, &c., but its apparent liability to the ravages of insects will always prevent architects from recommending it to any extent. I have never seen exposed specimens of the timber attacked by insects. Contrary to what might have been expected, it appears to possess considerable power to resist the attacks of teredo. Mr. George, manager of the Wellington Gas-works, informed me that he had seasoned kahikatea in use for landing-stages in Wellington Harbour for two years before being attacked.

#### 22. MIRO, also called BLACK PINE in Otago.—(*Podocarpus ferruginea*.)

Of similar distribution to the last, which it closely resembles. It is easily distinguished when in fruit, as the fruit is solitary instead of spicate. The cross section of the timber shows the heart-wood star-shaped and irregular. Much disappointment has arisen from the common names matai and black pine having been erroneously applied to the miro, which, under ordinary circumstances, is not a durable timber.

It appears, however, to be specially adapted for use in situations where it is partially exposed to the influence of sea water, and under these circumstances exhibits greater durability. A most instructive lesson on the durability of timber under different circumstances is afforded by an examination of the piling constructed for the protection of the railway embankment at the Bluff

Harbour. This protective work extends, with short intervals, for several miles, and is composed of two rows of piling, the outer row being driven strictly within high watermark and about 8 or 9 feet above the ground level; the inner row is driven into the embankment about 8 or 10 feet behind the outer row, and about 3 feet above the ground level. The two rows are connected by rimu scantlings, which are roughly let into the piles and secured by spikes, the front row being covered, to the height of 5 or 6 feet, with rimu boarding, and the space between the two rows of piles for the most part left open.

Many of the piles in both rows are miro, but a most remarkable difference is shown in the durability of those in the front row, which are exposed to the influence of sea water, and those in the back row, which are not. Not a single miro pile in the back row is in a sound condition—many of them can be easily kicked to pieces. In the front row, not a single pile is unsound, and the bark and sap-wood, in many instances, appear as fresh as when the trees were cut. Mr. Hawkins, Inspector of Permanent Way, informed me they had been driven ten years.

I have been unable to find another instance in which the miro has exhibited equal durability in exposed circumstances. Used as piles for fresh-water bridges, it has decayed in less than seven years.

### 23. ENTIRE-LEAVED BEECH.—(*Fagus Solandri*.)

This tree occurs from the centre of the North Island to Otago, and is often found in much greater abundance than the preceding species. It attains similar dimensions, but is easily distinguished by the entire leaves. The heart timber is of a darker colour, and the white sapwood much larger in proportion, which has probably led to its being called white birch in certain districts.

The timber is certainly less durable than that of *Fagus fusca*, but, owing to the confusion arising from the misapplication of the common names of the different beeches even in the same district, I have been unable to obtain precise and satisfactory evidence on this point, except with regard to its employment for piles.

For fresh-water piles it is said to last eight years in good condition. In marine situations it is usually attacked by the teredo as soon as the bark is detached, and is often much damaged in two or three years, but will stand for ten years without requiring removal. Mr. Akerson, of Nelson, is of opinion that it would stand for more than twenty years, if protected with copper sheathing. Piles drawn thirteen years after being driven had the parts exposed to the attack of the teredo perforated to the centre and badly decayed; the upper and lower portions of the pile in fair condition, but not equal to *Fagus fusca* under similar circumstances.

Mr. Thornton, Engineer for the Province of Canterbury, informed me that the first sleepers used on the Lyttelton Railway were of this species, and that they were so badly decayed within eighteen months as to require removal. He attributed this rapid decay to their indifferent and sappy quality.

For this species I propose the name "entire-leaved beech."

### 23A. *Fagus Cliffortioides*. (Hook.)

This is a much smaller tree than the preceding, with which it has been generally confused. The largest specimens observed in the Wakatipu district had trunks not exceeding  $2\frac{1}{2}$  feet in diameter. In the Grey Valley all the specimens were much smaller.

The spray of this tree is somewhat intermediate between that of *F. fusca* and the European beech, *F. sylvatica*. The foliage has a close resemblance to that of *F. Solandri*, but the leaves are round at the base, instead of wedge-shaped; somewhat thinner and larger.

Nothing certain is known with regard to the durability of the timber, but in all probability it will be found to approach that of *F. fusca*.

### 24. TOWAI.—(*Weinmannia silvicola*.)

### 25. TAWERO.—(*Weinmannia racemosa*.)

The Towai is a tree 30 to 60 feet high or more, with a trunk 1 to 3 feet in diameter. The mature leaves are usually more or less compound, and it bears a profusion of erect racemes of pinkish flowers. It is found from the North Cape to the Hauraki Gulf, and attains its maximum dimensions at elevations of 1,500 feet and upwards.

The Tawero attains similar or larger dimensions, and is distinguished by its mature leaves being usually simple, and its racemes rather smaller. It occupies a much wider area than the preceding, and has come into more general use. Its maximum size is attained at Catlin's River and about Hokitika.

Both trees produce timber of apparently similar quality, but the grain of the towai is the finest of the two. They appear of equal density.

The timber of the towai has not been utilized, so far at least as known to me, but the tawero has been used in various parts of Westland and Otago. In 1874 I observed small specimens, which had been driven as piles, sound and in good condition after nine years: larger specimens, which had been lying in the forest for some years, were much decayed and worm-eaten.

Railway sleepers were in good condition after being down five years.

A great drawback to its value is the excessive amount of cracking and twisting to which it is subject on conversion. Recently sawn scantling about 10 in. by 10 in., at Catlin's River, was cracked nearly the whole depth, so that it was almost worthless, except for firewood.

The bark of both species has been extensively used for tanning, for which it is of great value.

The tawhero is also known as kamai and black birch in Otago.

Mr. Blair considers the durability of tawhero under the most trying circumstances to be thoroughly established; my opinion of its value is not equally favourable.

### 26. PUKATEA.—(*Atherosperma Novæ-Zelandiæ*.)

A striking tree, sometimes 150 feet high, with a trunk 3 to 6 feet and upwards in diameter. Common in swampy places. Timber soft, but apparently durable in water. It has been used in Auckland for boat-building, but is not valued. In Taranaki it is utilized for general purposes, and much valued.

27. HINAU.—(*Elæocarpus dentatus*.)

Common throughout the colony; especially plentiful in some parts of the Province of Wellington.

At the Taupiri Coal Mines, I examined some sleepers and props which had been in use nine years, and were then perfectly sound and in the best possible condition. The logs from which the props and sleepers had been split were taken from the bed of the river when clearing it of obstructions; and the mine manager assured me that the timbers had become harder since they had been in use. The hinau is much valued by the settlers in the Province of Wellington, as affording most durable fencing posts and rails. I have also seen it employed in the construction of one or two bridges, but of too recent date to afford any proof of its durability. It appears, however, to split too freely for purposes of this kind, even when it can be procured of the requisite dimensions. The heart-wood is well adapted for sleepers.

The timber is of a light dull brown colour, very tough, strong, and durable. Height, 50 to 60 feet; trunk, 2 to 3 feet in diameter.

28. POKAKO.—(*Elæocarpus Hookerianus*.)

This species sometimes attains the height of 50 feet, with a trunk 2 feet in diameter, but is usually smaller. It differs widely from the preceding species in its more compact habit; smaller, closer-set leaves; and small flowers, which are produced in great abundance. The young plant has small, crowded, various-shaped leaves, and interlacing flexuous branches, in no way resembling the mature plant.

The timber is whitish and compact, but apparently not durable. It is often sold as white pine in Westland and Otago, and has been utilized in the construction of earth wagons on the Southland railways.

It may be used for a variety of inside work with advantage.

29. TAWA.—(*Nesodaphne Tawa*.)30. TARAIRE.—(*Nesodaphne Taraire*.)

In some localities in the North Island the tawa forms two-thirds of the forest. It is a handsome tree some 60 feet high, with a trunk 1 to 3 feet in diameter, black bark, and elegant, willow-like foliage. The timber is white, hard, and compact, but will not stand exposure. It is specially adapted for the manufacture of French bedsteads and other cheap furniture, as well as for general turnery purposes: in fact, it is available for all purposes to which beech is applied in Europe. I believe that if the Auckland and Wellington cabinetmakers were aware of the facility with which it could be worked, and the readiness with which any possible demand could be supplied, it would be extensively used. As it can still be procured within three or four miles of Wellington, a large portion of the heavy cost attendant upon the long land carriage of totara or rimu might at once be saved. I am informed by Mr. Stewart that it has recently been utilized for the panels of railway carriages, for which it seems admirably adapted. It has also been employed in the manufacture of tubs and buckets, &c., and is used for firewood in the southern part of the North Island.

The taraire usually attains larger dimensions than the tawa, and develops fewer branches; it is easily distinguished by its broad, ovate leaves and light-coloured bark. Its timber splits more freely than that of the tawa, and is applied to similar purposes. It does not occur south of the Lower Waikato.

31. TITOKI.—(*Alectryon excelsum*.)

A handsome tree, with foliage resembling the European ash. Height, 50 to 60 feet; trunk, sometimes 3 feet in diameter, but usually smaller. It affords a fine-grained, compact red timber of great toughness and elasticity, well adapted for the purposes of the machinist and shipwright, but is not durable when exposed. Much valued for carpenters' tool handles.

Chiefly in the North Island.

32. TAWARI.—(*Ixerba brexioides*.)

A remarkably attractive tree, with long, lanceolate, bright green leaves, and large white flowers. Height, 50 to 60 feet, with trunk 1 to 3 feet in diameter, but often smaller. Wood, white, hard, dense, and heavy; apparently of great durability, but has not been utilized.

It attains its largest dimensions at an altitude of 1,500 feet and upwards, on the Hirakimata and Cape Colville ranges, and is most plentiful in the kauri district.

33. MANGEAO.—(*Tetranthera calicaris*.)

A tree 30 to 40 feet high; trunk,  $1\frac{1}{2}$  to  $2\frac{1}{2}$  feet in diameter; producing a white, close-grained timber of great toughness. Extensively used in Auckland for the manufacture of ships' blocks, &c., bullock-yokes, and for various wheelwrights' purposes.

34. REWAREWA.—(*Knightia excelsa*.)

This is usually esteemed a perishable timber, and, I think, with justice. The late Mr. Millett, Gold Fields Engineer at the Thames, held a different opinion, and employed it experimentally for sleepers on a small portion of one of the tramways, I believe about two years ago, but I have not learned the results. I examined a pile in a jetty at the Thames, which was perfectly sound, even the sap fresh, after having been driven five years. The base was attacked by teredines, but not greatly damaged. I have also seen fencing-rails perfectly sound after five years' use. On the other hand, trees cut down and left in the bush are often badly decayed within a year.

This ornamental timber is used by cabinetmakers and inlayers, and, although nearly valueless at present, might be advantageously exported if sawn into planks from 3 to 6 inches in thickness, and dried in airy sheds. From its liability to become "foxy," it would be useless to ship it in an unseasoned condition, as it would become worthless during the voyage. I am convinced that, if once fairly

established in the London market, the demand would speedily exceed the supply, so that good prices would be realized. At present, thousands of trees are destroyed yearly with the progress of clearing, so that its utilization in any way would be of great advantage. As it is a timber, even when dry, of difficult combustion, it might be advantageously used for certain special purposes, irrespective of its beauty.

Height, 50 to 60 feet; trunk, 2 to 3 feet in diameter. A striking tree on account of its fastigate habit, rigid foliage, and red flowers.

35. KAIWHIRIA.—(*Hedycarya dentata*.)

A handsome tree 40 feet high; trunk, 1 to 2 feet in diameter, with deep green foliage; yielding a white hard timber, apparently not very durable, although it is sometimes converted with other common timbers. It is utilized in New Plymouth, but not to any great extent.

36. KOHEKOHE.—(*Dysoxylum spectabile*.)

A tree 40 to 50 feet high, with handsome pinnate light-green foliage. Trunk 2 to 3 feet in diameter. Timber compact, red, tough, but not durable. A valuable furniture timber, but only utilized in Auckland.

CLASS III.

TIMBERS chiefly of SMALL DIMENSIONS; but adapted for various purposes.

Systematic Name.	Family.	Native Name.	Settlers' Name.
37. <i>Drimys axillaris</i> , Forst ... ..	Magnoliaceæ ...	Horopito ...	Pepper-tree.
37A. „ <i>colorata</i> , Raoul ... ..	„ ...	„ ...	„
38. <i>Pittosporum eugenioides</i> , A. Cunn. ... ..	Pittosporæ ...	Tarata ...	Tarata.
39. „ <i>crassifolium</i> , Banks and Sol. ... ..	„ ...	Kihii ...	Kihii.
40. „ <i>tenuifolium</i> , Banks and Sol. ... ..	„ ...	Kohuhu ...	Turpentine-tree.
41. <i>Melicetyus ramiflorus</i> , Forst ... ..	Violaceæ ...	Mahoe ...	Mahoe.
42. <i>Plagianthus betulinus</i> , A. Cunn. ... ..	Malvaceæ ...	Houi ...	Ribbonwood.
43. <i>Melicope ternata</i> , Forst ... ..	Rutaceæ ...	Wharangi pirou ...	Wharangi pirou.
44. <i>Pennantia corymbosa</i> , Forst ... ..	Olacineæ ...	Kaikomako ...	Kaikomako.
45. <i>Dodonæa viscosa</i> , Forst ... ..	Sapindaceæ ...	Akeake ...	Akeake.
46. <i>Corynocarpus lævigata</i> , Forst ... ..	Anacardiaceæ ...	Karaka ...	Karaka.
47. <i>Quintinia serrata</i> , A. Cunn. ... ..	Saxifrageæ ...	„ ...	Quintinia.
48. <i>Carpodetus serratus</i> , Forst ... ..	„ ...	Piripiriwhata ...	White mapau.
49. <i>Ackama roseifolia</i> , A. Cunn. ... ..	„ ...	Makamaka ...	Makamaka.
50. <i>Leptospermum scoparium</i> , Forst ... ..	Myrtaceæ ...	Manuka ...	Small tea-tree.
51. <i>Myrtus bullata</i> , Banks and Sol. ... ..	„ ...	Ramarama ...	Ramarama.
52. „ <i>pedunculata</i> , Hook. f. ... ..	„ ...	Rohutu ...	Rohutu.
53. <i>Fuchsia excorticata</i> , Linn. f. ... ..	Onagraceæ ...	Kohutuhutu ...	Fuchsia.
54. <i>Panax crassifolium</i> , Dec and Planch. ... ..	Araliaceæ ...	Horoeke ...	Lancewood.
55. <i>Griselinia littoralis</i> , Raoul. ... ..	Cornææ ...	Poukata ...	Broadleaf.
56. <i>Coprosma arborea</i> , n.s. ... ..	Rubiaceæ ...	Karamu ...	Tree-karamu.
57. <i>Olearia Traversii</i> , Muell. ... ..	Compositæ ...	Akeake ...	Akeake.
58. „ <i>ilicifolia</i> , Hook. f. ... ..	„ ...	„ ...	Native holly.
59. „ <i>dentata</i> , Hook. f. ... ..	„ ...	„ ...	„
60. <i>Dracophyllum latifolium</i> , A. Cunn. ... ..	Epacrideæ ...	Neinei ...	Neinei.
61. „ <i>Traversii</i> , Muell. ... ..	„ ...	„ ...	Grass-tree.
62. <i>Myrsine Urviliei</i> , A. DeC. ... ..	Myrsinææ ...	Mapau ...	Mapau.
63. „ <i>salicina</i> , Heward ... ..	„ ...	Tipau ...	Long-leaved mapau.
64. <i>Sapota costata</i> , A. DeC. ... ..	Sapotææ ...	Pau ...	Pau.
65. <i>Olea lanceolata</i> , Hook. f. ... ..	Jasminææ ...	Maire ...	Maire.
66. „ <i>Cunninghamii</i> , Hook. f. ... ..	„ ...	„ ...	„
67. <i>Santalum Cunninghamii</i> , Hook. f. ... ..	Santalaceæ ...	„ ...	„
68. <i>Avicennia officinalis</i> , Linn. ... ..	Verbenaceæ ...	Maanawa ...	Mangrove.
69. <i>Myoporum laetum</i> , Forst ... ..	„ ...	Ngaio ...	Ngaio.
70. <i>Persoonia Toro</i> , A. Cunn. ... ..	Proteaceæ ...	Toro ...	Toro.
71. <i>Epicarporus microphyllus</i> , Raoul ... ..	Urticææ ...	Towai ...	Milk-tree.
72. <i>Phyllocladus glauca</i> , Carr ... ..	Coniferæ ...	Toatoa ...	Toatoa.
73. „ <i>alpinus</i> , Hook. f. ... ..	„ ...	„ ...	Alpine toatoa.

37. HOROPITO.—(*Drimys axillaris*.)

37A. HOROPITO.—(*Drimys colorata*.)

A small tree, 10 to 20 feet high or more, with black bark and bright green ovate leaves, or in the South with pale blotched leaves, when it is *D. colorata*. The trunk is rarely more than 6 or 8 inches in diameter; wood used for inlaying, &c. The pepper-tree of the settlers.

38. TARATA.—(*Pittosporum eugenioides*.)

A tree 30 to 40 feet high, with light green foliage and white bark. Trunk, 1 to 2 feet in diameter; wood compact, white, but worthless for all purposes where durability is required. Adapted for turnery purposes, &c.; difficult of combustion.

39. KIHII OR TARATA.—(*Pittosporum crassifolium*.)

Of similar dimensions to the last, but restricted to the kauri district. Leaves, dark green; bark, black; only found in littoral situations. Wood similar to the last.

40. KOHUHU.—(*Pittosporum tenuifolium*.)

A lesser tree than either of the preceding, with small membranous pale green leaves. Trunk, rarely more than 10 or 12 inches in diameter. Wood similar to the last.

*P. Colensoi* can only be considered a variety of this species.

All the large New Zealand Pittosporads are called tarata by the Natives, and turpentine trees by the settlers.

41. MAHOE.—(*Melicytus ramiflorus*.)

A common tree in lowland districts throughout the colony, sometimes 40 feet high, with a trunk 2 feet in diameter, but usually smaller. Wood soft, white, not durable. Foliage eaten by horses and cattle.

42. HOUL.—(*Plagianthus betulinus*.)

A graceful tree, 30 to 50 feet high; trunk, 1 to 2½ feet in diameter; more closely resembling the European birch in appearance than any other tree in the colony. Wood white, compact, remarkably fissile, but not durable. Has been used for shingles, &c. One of the trees termed ribbonwood by the settlers.

43. WHARANGI PIROU.—(*Melicope ternata*.)

A small tree, or more frequently a shrub, with pale green trifoliate leaves. Wood of a peculiar satiny lustre; used in Auckland for inlaying.

44. KAIKOMAKO.—(*Pennantia corymbosa*.)

A small tree, 20 to 30 feet high, bearing a profusion of handsome waxy white flowers. Trunk, 1 foot or more in diameter. Wood, dense, compact; sometimes used by cabinet-makers.

45. AKEAKE.—(*Dodonaea viscosa*.)

This sometimes attains the dimensions of a small tree, 30 feet high, when it affords a dark, heavy timber, of even compact grain and great durability.

46. KARAKA.—(*Corynocarpus laevigata*.)

A well-known tree, with large ovate, glossy, coriaceous leaves. Height, 30 to 40 feet; trunk, 1 to 2 feet in diameter. Wood white, compact, but not durable. Foliage avidly eaten by horses and cattle.

47. NEW ZEALAND LILAC.—(*Quintinia serrata*.)

The typical form of this tree is confined to the kauri district, where it varies from a shrub with viscid foliage and lilac-coloured flowers, to a tree 40 feet high, trunk 12 to 18 inches in diameter.

In the south lowland district, the variety B forms large portions of the forest, attaining greater dimensions and forming clean, well-grown trunks, adapted for a variety of purposes, as tram-way sleepers, fence stuff, &c.; &c. Its durability is probably about the same as that of tawhero, to which indeed it is closely allied.

48. PIRIPIRIWHATA.—(*Carpodetus serratus*.)

This also is closely allied to the tawhero, but it is a much smaller tree, with slender straggling branches, bearing clusters of small white flowers. Trunk rarely more than 9 inches in diameter; wood, compact and tough.

49. MAKAMAKA.—(*Ackama rosafolia*.)

A handsome tree, with foliage resembling the mountain ash (*Pyrus aucuparia*) of Europe. Trunk sometimes more than 2 feet in diameter, producing a timber similar to the tawhero, with which it is closely allied. Bark used for tanning.

50. MANUKA—TEA-TREE.—(*Leptospermum scoparium*.)

This well-known plant attains the dimensions of a tree but rarely; it is usually a shrub from 1 to 15 feet high, but occasionally forms a trunk 12 to 18 inches in diameter, affording a deep red timber, inferior in strength and durability to the rawiri (*L. ericoides*).

51. RAMARAMA.—(*Myrtus bullata*.)

52. ROHUTU.—(*Myrtus pedunculata*.)

The ramarama is almost confined to the North Island, where it varies from a shrub to a tree, with a trunk 10 inches in diameter, the wood of which is valued for purposes requiring density and toughness; it is also used for cabinetwork. Its brown inflated foliage and myrtle-like leaves render it an attractive plant.

The rohutu yields a timber of similar quality, but rarely attaining such large dimensions; it is plentiful in Otago. The wood of *M. obcordata* is doubtless of equal value with the above.

53. KOHUTUHUTU.—(*Fuchsia excorticata*.)

This attains large dimensions in many districts; the twisted gnarly trunk is sometimes 10 or 12 feet long, and over 2 feet in diameter. The timber is certainly durable, and well adapted for house blocks, which are found sound and good after being down upwards of twenty years.

54. LANCEWOOD—HOROEKA.—(*Panax crassifolium*.)

A shrub or small tree, sometimes 20 to 30 feet high, with a trunk 10 or 12 inches in diameter. The timber is compact and firm, but not durable in ordinary circumstances, although Mr. Blair states that small piles, driven in a jetty at Port Chalmers twenty-seven years ago, are still in good preservation.

*Panax Colensoi* and *P. Edgerleyi* afford good firewood.

55. BROADLEAF.—(*Griselinia littoralis*.)

The broadleaf is a handsome tree, with bright green foliage. It is usually from 30 to 50 feet in height, with a trunk 2 to 4 feet or upwards in diameter, but twisted, gnarled, and crooked. The timber is hard, compact, and of great durability, but, owing to its crooked habit of growth, it is rarely obtained in logs of sufficient length to be used for general purposes. It is valued for fencing posts, sills, boats' knees, &c.

56. TREE KARAMU.—(*Coprosma arborea*, n.s.)

A small tree, sometimes 25 feet high, with a trunk not exceeding 1 foot in diameter. Wood hard and compact; used for fence rails and other purposes. Not found south of the Waikato. Other species of *Coprosma* of smaller dimensions are occasionally used by cabinet-makers.

57. AKEAKE.—(*Olearia Traversii*.)

Confined to the Chatham Islands, where it is said to form one of the largest trees, the trunk being sometimes over 2 feet in diameter. Wood of old trees mottled; has been used in Auckland for inlaying.

58. NATIVE HOLLY.—(*Olearia ilicifolia*.)59. NATIVE HOLLY.—(*Olearia dentata*.)

Small trees ranging from the sea level to 3,500 feet, with sharply-toothed or dentate leaves. Trunk sometimes 18 inches in diameter; affords timber available for the same purposes as the last.

*Olearia virgata*, *O. Cunninghamii*, and *O. avicennifolia* afford a similar wood, but of smaller dimensions.

60. NEINEI.—(*Dracophyllum latifolium*.)61. NEINEI.—(*Dracophyllum Traversii*.)

The large grass-tree of the settlers. Sometimes 20 feet high, with a short trunk 2 feet in diameter, and long straggling branches, each tipped with a tuft of flat recurved linear leaves 12 to 18 inches long, and crowned with a terminal panicle of handsome red flowers.

In cross section the wood is prettily marked, and is valued by cabinet-makers for inlaying.

62. MAPAU.—(*Myrsine Urvillei*.)63. LONG-LEAVED MAPAU.—(*Myrsine salicina*.)

The mapau is a small, erect, twiggy tree, about 20 feet high, with a trunk from 8 to 12 inches in diameter, affording a useful timber for inlaying and other cabinetwork. It is largely used for firewood.

The long-leaved mapau is a much larger tree, sometimes 40 feet high, with a trunk 2 feet in diameter, but usually smaller. The leaves are 3 inches in length. Timber superior to that of the mapau, and more highly valued by the cabinet-maker.

64. PAU.—(*Sapota costata*.)

This tree is only found north of the Hauraki Gulf. Large specimens are 40 to 50 feet high, with a trunk 2 feet in diameter, but it is usually much smaller. Wood hard, fine-grained, and compact, but has been little utilized.

65. MAIRE.—(*Olea lanceolata*.)66. MAIRE.—(*Olea Cunninghamii*.)67. MAIRE.—(*Santalum Cunninghamii*.)

The first two species are fine olives, called maire alike by Natives and settlers, and are most plentiful in the northern part of the colony, where they attain the height of 40 feet or more, with a trunk 1 to 2 feet in diameter. The timber is hard, dense, and durable, but has only been used for fence-posts, &c., and occasionally for machine beds, bearings, &c. The third species, also termed maire, is the New Zealand sandalwood, and does not attain nearly so large dimensions as the olive, but the wood is hard, dense, and extremely durable. Stems no thicker than a man's wrist make excellent fence-rails.

68. MAANAWA—MANGROVE.—(*Avicennia officinalis*.)

This tree is confined to tidal mud flats north of Tauranga, and attains its greatest dimensions in the Hokianga and Kaipara districts, Whangururu, &c., where it is often 25 to 30 feet high, and produces a white timber containing a large percentage of potash.

69. NGAIO.—(*Myoporum laetum*.)

In favourable situations this forms a graceful tree, with punctate pale-green foliage, dotted with pellucid glands. It is sometimes 30 feet high or more, with a trunk 1½ feet in diameter. Heart-wood hard, dark, and durable; used for fence-posts, cabinetwork, and turning purposes.

70. TORO.—(*Persoonia Toro*.)

This elegant tree is only found in the northern parts of the colony, where it attains the height of 40 feet, with a trunk 1 to 2 feet in diameter. Wood red, beautifully marked, but not of great durability; adapted for veneering, cabinet manufacture, inlaying, &c.

71. MILK-TREE.—(*Epicarpurus microphyllus*.)

A small tree, with a trunk 1 to 2 feet in diameter, producing a white, rather soft, but compact timber, which does not appear to have been utilized except for firewood. The bark exudes a copious supply of a thick milky juice.

72. TOATOA.—(*Phyllocladus glauca*.)

A handsome tree, 40 feet high, with trunk sometimes  $1\frac{1}{2}$  to 2 feet in diameter; by far the most striking of the celery-topped pines, owing to the large dimensions of the petiolar expansions, which in this genus take the place of leaves. Wood white and compact, splits easily, and is apparently durable.

73. SMALL TOATOA.—(*Phyllocladus alpinus*.)

Most plentiful in alpine districts, but descends to the sea level in Westland. It attains small dimensions, the trunk being rarely more than from 6 to 10 inches in diameter and 20 feet high. Wood very tough and elastic, valued for levers, &c., but too small to come into general use. It is the only species of the genus found in the South Island.

Mr. Kirk writes as follows:—

## ON THE BEST SEASON FOR FELLING TIMBER IN NEW ZEALAND.

Wellington, 11th July, 1874.

Considerable misapprehension on this subject has arisen from the prevalence of the erroneous idea that trees have no period of rest in this colony—that they continue to grow alike at all periods of the year: an idea which may have been caused by certain fancied resemblances between the climate and vegetation of New Zealand and of tropical countries, but for which there is very slight foundation.

It is true that on the coast north of the Auckland Isthmus, especially on the eastern side, frosts are but little known, so that vegetation does not receive the sudden check which is felt in other places on the approach of winter; but it by no means follows from this that trees are growing as freely as during the spring and summer months. Even at the Bay of Islands, deciduous trees shed their leaves. The oak, ash, elm, sycamore, &c., &c., are as bare of leaves during winter as in any part of Europe: it is, therefore, obvious that a complete cessation of growth takes place.

At Mangere, only eleven miles from Auckland, I have seen transplanted specimens of the native puriri, which chanced to make late autumnal shoots, much injured by frost, while older trees in the immediate vicinity were untouched. At Pokeno, the pohutukawa, under similar circumstances, is cut back to the old wood, while small established specimens sustain no injury; and in the adjacent forest, the kauri, the most tender of all our native trees, does not exhibit the slightest discoloration. It is, therefore, evident that at least a vast diminution in the activity of arboreal growth must take place during the winter months, and this is demonstrated by an examination of the terminal shoots of any forest trees, when it is found that the soft pulpy condition characteristic of summer growth has become hardened in a greater or lesser degree. Some portion of the herbaceous and fruticose vegetation, under the favouring shelter of the larger forest trees, is doubtless in a more active condition; but even here growth is often reduced to a minimum, and many winter-flowering shrubs do not produce new leaves until the spring.

The property exhibited by summer-felled totara, of resisting the attacks of teredines for a longer period than that felled in the winter, appears to be dependent upon causes connected with the greater activity of the sap at the former season as compared with its dormant condition in the latter.

There can, therefore, be no question that, even in the warmest parts of the colony, the circulation of the sap in trees is in a much less active condition in the winter season than in the summer, and consequently that the durability of timber felled in the winter is much less likely to suffer from the process of fermentation than that felled during the spring or summer months.

With regard to the southern parts of the colony, an examination of the arboreal vegetation at Nelson, Christchurch, Dunedin, and the Bluff, shows that the growth of trees is arrested in the months of April, May, June, July, and August. So obvious is this that I can only suppose observers have been so deeply impressed with the occasional flowering of certain herbs and small shrubs, during the winter months, in places near the sea, as to lead to the inference that a similar state of activity must of necessity pervade the forest vegetation—an inference scarcely more reasonable than it would be to suppose that the winter flowering of certain plants in favourable localities in the British Islands, evidenced similar activity in the oak, ash, elm, and pine of northern countries.

A partial exception to the general rule may perhaps be found in the case of the kauri, which evinces a decided preference for growing in sheltered places, even in the warm and limited area to which it is naturally restricted. This appears, in ordinary seasons, especially when growing in rocky soils, to suffer an arrest of growth immediately after the hot weather and diminished rainfall usually experienced in January and February. In compensation for this, it usually commences its spring growth earlier than the totara, black birch, rata, &c., &c., in its immediate vicinity. This arrest of growth in the kauri is probably facilitated by the comparatively shallow depth to which its roots penetrate, and the absence, in kauri forests, of the dense shrubby vegetation so abundant under all other northern trees.

I have therefore no hesitation in recommending, as a general rule, that timber should not be felled before April or later than July, except in the case of the kauri, which in many situations may be felled from March to June; but much must be left to the judgment of the forester. South of Banks Peninsula, the felling season might certainly be extended through August.

## ON THE CHIEF TIMBERS UTILIZED FOR FIREWOOD.

Nearly all the timbers mentioned in the preceding list are available for use as firewood, with the addition of a large number of species belonging to the genera *Melicytus*, *Coprosma*, *Panax*, *Discaria*, *Metrosideros*, *Myrtus*, *Aristotelia*, *Hoheria*, and others. The tarata, fuchsia, hinau, pukatea, and rewarewa are difficult of combustion; tarata and fuchsia are sometimes termed "bucket-of-water wood" by the firewood cutter.

In Auckland the favourite fuel is tea-tree or rawiri, which is sold in 4-foot lengths, at from 12s. to 16s. per ton, presumably of 40 cubic feet. In heating power it is inferior to puriri, pohutukawa, and kowhai, which, however, fetch a lower price in the market on account of the extra trouble involved in reducing them to dimensions suitable for the fireplace or stove. Their use is chiefly confined to brickmakers, &c. Where tea-tree cannot be procured, rata and kowhai take its place. Tawa, taraire, and other timbers are but rarely used where either of the preceding kinds can be obtained, although they are of really good quality as fuel, and could be supplied at a low price. They are usually lumped together as "Paramatta" or "white wood." Firewood cutters on private land usually pay a royalty of 1s. per ton, with an extra sum for all logs suitable for fence rails, or small piles, &c.

The tops of the kauri and other pines are rarely or never utilized as fuel in the Auckland district.

In Wellington rawiri is comparatively rare, and the firewood most in demand is rata, which is cut into 2-foot lengths and delivered at from 30s. to 36s. per cord of nominally 128 cubic feet. The tops of rimu, matai, and miro, with a considerable quantity of tawa, are also used. Entire and tooth-leaved beech is delivered at the Pipitea Railway Station, from the Upper Hutt, in 4-foot lengths, at 20s. per cord. It is chiefly used by brickmakers, but is considered inferior to black and red pine; the tops are considered inferior to trunk wood. Beech yields a larger proportion of ash than pine. In Nelson the common pines and the entire-leaved beech supply the chief portion of the firewood, black pine being most valued. On the West Coast of the South Island, black pine, red pine, and miro are mixed with Quintinia, notch-leaved beech, and tawhero. The same kinds of timber are also used in Otago with the addition of broadleaf and maupo. In the North Island maupo is considered to rank before tawa and taraire for firewood.

As heat-producers the chief kinds used for fuel rank in the following order:—1, puriri; 2, kowhai; 3, pohutukawa; 4, rawiri or tea-tree; 5, rata; 6, black pine; 7, red pine; 8, tooth-leaved beech; 9, tawa. Tea-tree, however, on account of its rather slower and more complete combustion, is the most economic of all, except, perhaps, puriri. The beeches leave the largest proportion of ash.

#### MISCELLANEOUS FOREST PRODUCTS.

##### *Kauri Gum.*

Independently of timber, few forest products have been utilized at present. The chief of these is undoubtedly the *kapia* or kauri gum, which is found in a fossil or sub-fossil condition on the sites of old kauri forests or at the base of growing trees, from the North Cape to the Middle Waikato—often occurring in large masses. It has long formed a valuable export, and is extensively used in Europe and America as a substitute for gum mastic, as a base for fine varnishes, and for other purposes. Its price varies in England from £40 to £80 per ton; selected and remarkably clear specimens fetch a much higher price. The exports for the ten years from 1867 to 1876 amount to £1,171,949. For the year 1876 alone, the quantity exported was 2,888 tons, valued at £109,234. The largest quantity exported in any one year was 5,045 tons, valued at £167,958, in 1871; the highest value in any one year was £175,074 for 4,391 tons, in 1870; showing an average price in Auckland of £39 per ton in 1870, and £33 in 1871.

##### *Bark.*

The bark of the towai, tawhero, tanekaha, mangrove, hinau, and tooth-leaved beech have been largely used in the colony for tanning leather, and exported to a small extent. The towai ranks very high for this purpose, being superior to the English oak. The bark is collected in a careless and wasteful manner; the tops are never peeled, and it is no uncommon thing to see a fine towai stripped of its bark as far up as a man can reach, and left standing. The bark of tawa would probably prove of value for tanning purposes, and, if so, could readily be procured in large quantities. Nearly the whole of the bark collected is used by local tanneries, the total value exported during the year 1876 being only £300.

##### *Fungus—Hirneola polytricha, Mont.*

In 1871, this plant was first collected for exportation to China, where it is used as an article of food, being boiled and mixed with bean curd and vermicelli; it is also administered as a medicine to purify the blood. Its price in Hong Kong is 10½d. per lb. retail. In most parts of New Zealand Chinese merchants pay the collector 3d. per lb., or £28 per ton for the fungus when dry. Fresh specimens lose four-fifths of their weight when drying. The total quantity exported to the end of 1876 was of the value of £18,294. During the year 1876 alone, 2,633 cwts. were exported, valued at £6,224.

##### *Tree Ferns.*

These are exported for cultural purposes to the value of about £600 per annum.

##### *Charcoal.*

This is only manufactured to a limited extent, and fetches a disproportionally high price as compared with its cost in England. No particular selection of woods for this purpose is made in the colony, as far at least as my knowledge extends.

##### *Potash, &c.*

Although thousands of acres of forest land are cleared annually in this colony, it does not appear that any attempt has been made to utilize the ashes of the burnt timber for the manufacture of potash—an important article of commerce constantly in demand, and requiring scarcely any expenditure in its manufacture beyond the labour required in burning the timber, saturating the ashes with water, and watching the final evaporation.

The utilization of the waste tops, branches, leaves, and stumps of trees for conversion into potash, while proving a source of profit, would at once greatly reduce the risk of fire in standing forest—one of our greatest dangers under the present want of system.

The waste tops and roots of the New Zealand pines might also be utilized in the manufacture of tar and pitch, which are imported at present to a considerable amount. Under suitable arrangements, the manufacture of charcoal and extraction of tar could be carried on conjointly.

Valuable oils could be extracted from several forest trees, notably from the different species of rata, which are found in all New Zealand forests to a greater or lesser extent. The manufacture of eucalyptus oil is already assuming considerable proportions in Australia; but there is no reason to suppose that it possesses properties of greater value than that so freely produced by *Metrosideros robusta* and other plants closely allied to the Australian eucalypti.

#### PLANTATIONS.

I devote a section to a review of the plantations I have visited, and general consideration of results obtained by private enterprise in this direction, and what steps appear necessary in the shape of establishing plantations by direct Government agency, and encouraging tree-planting generally.

The first plantation visited was Mr. Firth's, at Matamata, in the Auckland Provincial District. It consists of *P. pinaster* and *insignis*, planted out straight from the mother beds, when about two years old, into furrows 18 inches broad by 10 inches deep and 15 feet apart. The growth has been very good, averaging 25 feet in five years; and Mr. Firth informed me that the cost had been small. Hitherto he has failed with deciduous trees; but, I have no doubt, with greater care as regards nursery treatment and planting them with nurses if required, he will yet succeed. The only fault which I saw in the plantation was that the trees are too far apart, which, I may state, is one very general in New Zealand. In and about Auckland itself the planting of clumps of trees has been largely undertaken, and the growth of the Norfolk Island pine (*Araucaria excelsa*), *P. insignis*, *austriaca*, *tuberculata*, *pinaster*, *radiata*, *Cupressus macrocarpa*, *torulosa*, and others, forms a marked feature in the landscape. The public gardens contain fine specimens of many varieties of European and Californian conifers, whilst the oak trees in the garden of Government House appear to flourish no less luxuriantly than their more tropical brethren. It may be said in general of all towns in New Zealand that much attention has already been paid to planting, and that, wherever there are public gardens or domains, the greatest care appears to have been taken to introduce and acclimatize all descriptions of trees and shrubs valuable either for their timber or ornamental planting. Wellington, from its situation and want of space, compares at present badly with most other places; but I have little doubt that Dr. Hector will succeed ere long in making the public gardens there worthy of the capital of the colony; and meanwhile, a visit to Messrs. Ludlam and Mason's gardens, at the Lower Hutt, will satisfy the most ardent lover of variety in tree growth, and furnish a useful and interesting study of the habits and rate of growth of the numerous introduced varieties.

I paid special attention to plantations and the requirements of the country in this respect in Canterbury and Otago. In the former much has been done in the shape of ornamental planting, and under the provisions of "The Tree Planting Encouragement Act," under which, however, I find that the total awards, up to end of November last, were 765 acres, representing a total area of 382 acres planted, and not thousands, as was stated in the House last session.

The eucalypti plantations at Kirwee (Colonel Brett's), Burnham, Rakaia, Mr. Wason's station, Timaru, &c., may be said to be successful, the prevailing descriptions being *E. globulus*, *amygdalina*, and *viminialis*. Those at Burnham, and Mr. Middleton's, at the Rakaia, appear, on the whole, to have afforded the best results, considering the cheap method of planting adopted at Burnham; the land is ploughed twice, harrowed, and seed mixed with sand, then sown broad-cast. Some wattle (*A. dealbata*) has been sown with the eucalypti, the advisability of which is doubtful. The growth under such a system is, of course, irregular; but some trees two years old are fully 10 feet high. The estimated cost per acre is 30s., without the fencing. Mr. Middleton's small plantation of 10 acres has been very successful, and some of the trees four years old are fully 30 feet high. He has used broom in some portions—a plan which has also been adopted by Mr. Wason, who has 250 acres planted with conifers, eucalypti, oak, poplar, &c. There is also a Government plantation of 80 acres at the Rakaia, sown broad-cast, on the same system as at Burnham.

In Mr. Sealey's extensive eucalypti plantations near Timaru, the trees first put out—which, I believe, were transplanted from nursery beds—have done well, and average 20 feet in height with fine straight stems, the distance apart being 6 feet, and 9 feet between the rows; the later planting, or rather broad-cast sowing, cannot be deemed a success. The soil is apparently very light. Mr. G. Holmes's planting at Bangor has been conducted with a view more to ornament and shelter than financial results: in fact, no care or expense has been spared to make the trees grow well, and we cannot therefore be surprised at their doing so. Many, or in fact most of them, are planted out in pits four feet square, a crop of oats having first been taken off the land, which is poor. I observed *P. atlantica* and *ponderosa*, along with the deodar, spruce, and larch (doing exceedingly well), and the oak and other hard-wood trees. Mr. Holmes finds that the blue-gums do not grow to advantage on account of the frosts. At Homebush, close by, the Scotch firs fifteen years old exhibit a fair growth, which would have been much better had they been planted closer. I was unfortunately unable to visit Mr. Potts's plantations at Governor's Bay, which I much regret. The finest plantations, however, which I have seen in the colony, are certainly those of the Hon. W. Robinson, at Cheviot Hills, in the Nelson Provincial District, which I visited in February, 1877. I was unable to ascertain the exact extent, but there are certainly 300 or 400 acres under timber. Some pure oak plantations, planted at 6 feet apart, are doing exceptionally well; the trees straight and without any tendency to become stag-headed; they average about 30 feet in height, and were planted about ten years ago. A young plantation of spruce, planted amongst *Pinaster*, which is to be gradually removed as the spruce comes on, promises well, as do also the young larches.

The number of varieties of conifers is very great, comprising *P. macrocarpa*, *rigida*, *Sabiniana*, *tuberculata*, *muricata*, *Benthamiana*, *austriaca*, *excelsa*, *longifolia*, *cembra*, *Cedrus deodara*, *Cupressus torulosa* and *macrocarpa*, &c., with some very fine specimens of *Wellingtonia*, and one of *Thujopsis japonica* on the lawn.

On the neighbouring properties of Hawkswood and St. Leonards a considerable amount of planting, chiefly of coniferous trees, has also been done; and Sir Cracroft Wilson has not been behindhand either at Culverden or Cashmere. A considerable amount of planting has also been done by order of the late Provincial Government near the Railway Station at Templeton, and elsewhere along the railway lines, under the able superintendence of Mr. Armstrong, the curator of the Government gardens at Christchurch. There has also been some planting on protective works on river banks undertaken by the conservators.

Comparatively little planting has apparently been undertaken in the Otago Provincial District. There are some fine clumps of blue-gum in the Taieri Plain, but not of any extent; and Sir Dillon Bell appears to have done some planting on his station in the Shag Valley. On the whole, however, perhaps because I had no guide like Mr. Lean in Canterbury, and did not know where to look for them, I saw no plantations in Otago deserving of special mention.

Mr. Kirk visited the Hon. Mathew Holmes's plantations near Oamaru, and I print his memorandum on them in full in the Appendix, as being very interesting, and conveying much valuable information regarding that district, which I did not visit from want of time.

There is no doubt that the results of planting operations in Canterbury will prove highly beneficial, and that the private proprietors who have undertaken it are conferring a great boon on their neighbours and the district generally. I have little doubt also that such planting, when undertaken on carefully matured plans, and carried on with skill and economy, will yield a direct as well as indirect pecuniary gain. At page 36 of the "Papers relating to State Forests," is a memorandum by Mr. Calcutt, giving an estimate of the cost of planting and subsequent management of 100 acres of suitable land in trees. I consider his estimate of outlay sufficiently accurate, except that the cost of the land, or an annual rental for it, should clearly be added, as, if not growing trees, it might be used for other purposes. As to the income, it is very difficult to form an opinion; but I should be inclined to pronounce it rather too sanguine. A large allowance should be made for casualties, or trees which never come to any good, and I doubt if the trees at 5 feet apart, taken out at the end of five years, would realize 3d. each. A few hundreds might do so, but, when we come to dispose of 130,700, I fail to see a market in most places: where hop-growing is carried on, they might find a ready sale as hop-poles. I have no doubt that thirty-year-old gum trees, fairly grown, would realize £1 each, probably much more, but they would require then to stand at more than 10 feet apart.

Whilst, therefore, I think there can be no room for doubting that planting in carefully selected localities will prove a financial success, and probably Mr. Calcutt has good reason for his estimates of income derivable, I prefer not to follow in his footsteps and hazard any detailed estimates of the probable cost and return from plantations.

I have, however, no hesitation in recommending planting operations on a considerable scale being undertaken in the Canterbury Plains, the Otago gold field district, and tract of low hills between Meremere and Rangiriri in the Waikato (Auckland).

The reclamation of the sandy wastes on both coasts of the North, and east coast of the South, Island also demands attention, not only because they can thus be utilized and improved, but the destruction of valuable property further inland arrested.

If the State Forest Department be established on a proper footing, I propose at once commencing planting operations in Canterbury, and perhaps also in Auckland. In the former we have the railway and plantation reserves ready for our purpose. Mr. Rolleston and I talked the matter fully over, and agreed as to the outlines of the scheme. We should probably let portions of the reserves for three years, to be handed back fenced and broken up, whilst, in the meanwhile, we got ready our young plants in the nurseries, and collected seed of the eucalypti for broad-cast sowing. We might, also, in some cases, dispose of portions of the reserves to small settlers on conditions of planting and maintaining a certain area adjoining under adequate supervision. Wherever possible, we propose to retain and utilize the existing machinery and *employés* in the work. In Auckland, in the same manner, we would commence on a small scale, first forming a nursery and placing a gardener in charge to rear young plants from seed. Mr. Firth's advice and local experience would be of great value, and I am sure he would gladly give us the benefit of both.

Both in Canterbury (except just under the hills) and Auckland the blue-gum is certainly the tree to grow for the speedy supply of timber and money return. Its greatest drawback is that it impoverishes instead of improving the soil, and admits of no congeners. I should not, therefore, limit operations to that species, but plant out areas of pure conifers and the hard-wood trees of Europe—oak, ash, elm, sycamore, &c.—with conifers as nurses; whilst on the sandy tracts on the seaboard our first efforts would be directed to binding the soil, and providing shelter for the young trees by the growth of scandent shrubs, brooms, and grasses suitable for the purpose. All this is matter of detail, and careful estimates and plans would have to be prepared, in each case, before operations were commenced. These form an important part of a forester's work, as without them we should be proceeding on chance, and working in the dark.

In the Otago gold fields district the want of timber is felt more than in any other part of the colony, as there is absolutely none, and the district is, for the most part, remote from the sea coast, and without railway communication or good roads. Ordinary timber now costs from 25s. per 100 feet at Cromwell, to which place it can be floated down the Molyneux (or Clutha) and Kawarau Rivers, to 50s. at Clyde and Alexandra, to which places the greater proportion is carted from Dunedin at a charge of £6 per 1,000 feet of 1-inch planks; but this is not the description required for mining purposes, which may be said to be to a great degree paralyzed for want of timber.

I was much struck by the wonderful growth of the fruit trees in Mr. Ferraud's garden at Clyde, and by his remark, which I consider not far from the fact, that the adjoining district "would soon have a population of twenty to five-and-twenty thousand were timber made available for mining purposes."

Wherever we can obtain a supply of water sufficient to irrigate, there would be no difficulty in forming plantations, the supply being gradually decreased as the trees grow up, until they can do without it, which is exactly the plan pursued in some of our Indian planting operations. The tailings from old workings, or "paddockings," would also be made use of for planting purposes wherever practicable, but for the most part they are too rocky and devoid of soil to give good results.

Our first step here would be the selection of suitable situations, securing a supply of water, and deciding on the description of trees to plant both as regards growth and the special purposes for which the timber is required. The eucalypti will not do in Otago, away from the sea, but conifers exhibit good results, and of these we should probably find the Scotch fir, larch, spruce, and *P. austriaca*, the best on the whole. It is on account of these preliminaries, and not by any means from under-estimating the urgent want of plantations in the Otago gold field district, that I propose commencing operations elsewhere, whilst the preliminary steps in Otago are being taken. The only other planting which has been suggested to me is in Nelson, where Mr. Curtis mentioned some 7,000 acres at Moutere as suitable and available for the purpose; but there appears no immediate necessity for planting in that district, and we cannot be too careful not to attempt too much at the outset, and have no intention of undertaking to plant all the bare land in the colony not otherwise useful. We need not, therefore, consider this matter for the present, and I restrict my proposals for planting by direct Government agency to the localities in the Canterbury, Auckland, and Otago Provincial Districts already referred to.

As regards the encouraging and subsidizing planting by private individuals, the Forest Trees Planting Encouragement Act of 1872 has recently been brought into force throughout the colony. I had no intimation that this was intended, or should certainly have recommended Government to await the submission of this report and take time to consider the subject generally.

I am strongly in favour of encouraging private planting in districts where plantations are necessary for the benefit of the community at large, and where the circumstances are such as to justify a reasonable hope that the planting will confer a real public benefit. In such cases the inducements held out cannot well be too liberal; but I would certainly not advocate the subsidizing from public funds plantations formed, where not absolutely necessary or advisable, for the improvement and ornament of a private property or residence, or the mere gratification of a hobby on the part of an individual. Whilst I admit the generally good and beneficial results that have attended planting under the Act in Canterbury, I know of cases in which it has been abused, or at least in which the circumstances of the case and locality, the description of trees planted, the manner in which the work has been done, and its real object, do not, to my mind, justify a reward from the public purse. Moreover, whilst I do not think the amount of the land order (£4), representing two acres for one, is excessive in that district, I do think that in others—for instance, where land is only £1 per acre—the grant is needlessly large and extravagant. It is, I submit with deference, too much the practice to regard a land order representing so many acres of public land as quite another thing to a payment of an equal sum in public money. This I think is a great mistake, and I submit that the Government have no more right to be wasteful of the former than of the latter public property under their charge. The day will, I think, come ere long, when this is more generally felt and admitted than it appears to have been hitherto or is now.

In harmony with these views I would recommend that the Act may not be made in force throughout the colony, but only in such districts and localities as the Governor may from time to time direct, and that the regulations made under it be modified in the following respects:—

1. The land which it is proposed to plant to be inspected and reported on by a competent officer duly delegated by the Governor, *before* the planting is commenced; and no planting to come under the provisions of the Act, or regulations framed thereon, unless so inspected and passed for planting.

2. The description of trees which it is proposed to plant to be approved of by the officer authorized to certify, and the number to be planted per acre to be prescribed by him.

3. The amount of the land order in no case to exceed the value of two acres of land in the district for each acre planted, and maintained for at least three years to the satisfaction of the officer authorized to certify.

The above would, I think, put a stop to any abuse or undue advantage being taken of the Act, and secure the best results. If the State Forest Department be organized, the officer appointed to inspect and certify should invariably be the Assistant Conservator of Forests or Forest Ranger of the district.

I would further introduce or extend the Otago Regulations of 1874, I think, under which parties could take up waste lands of the Crown for planting, and acquire the freehold of them by doing so satisfactorily under analogous regulations, as to previous inspection and conditions of planting, to those already referred to. I submit a list of trees which I consider the most suitable for planting in the colony, reiterating what I said at Dunedin on the subject—viz., "The special necessities and requirements of each case must always be carefully considered before planting operations are commenced, and, with a climate and conditions so varied as they are in this colony, it would be absurd and misleading to attempt to generalize on this point. The situation, soil, rainfall, purpose, and species should all have careful consideration before any money is spent, even in the formation of a nursery." And again, "Regarding the species most suitable for planting, as with the particular method to be adopted, much must of necessity depend upon the circumstances and locality, and in a general paper like this I might only mislead if I attempted to prescribe. Those who have experience know better than I do what will and will not grow in their own locality, and to those who have not, I would recommend their making special reference, stating the soil, situation, object, &c. Should the State Forest Department be maintained, it will be one of the duties of the local Forest Officers to give such information and assistance when asked. But at present, as I have said, it would be premature on my part to attempt to lay down any general rules. I would, however, certainly not try planting any of the indigenous descriptions, though we may do so in the department as matter of experiment and for guidance."

*A List of Timber Trees suitable for Artificial Plantations and Forests in New Zealand.*

Pinus— pectinata cephalonica Nordmanniana Webbiana grandis amabilis excelsa Lambertiana Douglassii Ayacahuite communis Morinda Menziesii sylvestris leiophylla Strobus Coulteri Canariensis Jeffreyi insignis Sabiniana ponderosa radiata	Pinus— Laricio Austriaca Pinaster nobilis rigida.  Cedrus— Deodara.  Cupressus— macrocarpa Lawsoniana torulosa.  Thuja— gigantea.  Araucaria— excelsa imbricata.  Sequoia— Wellingtonia	Sequoia— sempervirens.  Taxodium— distichum.  Larix— Kämpferii Europæa.  Casuarina— quadrivalvis.  Quercus— pedunculata Cerris macrocarpa alba Suber Sideroxylon.  Populus— monilifera fastigiata	Populus— alba nigra.  Fagus— sylvatica.  Fraxinus— excelsior Americana.  Ulmus— campestris Americana.  Eucalyptus— amygdalina obliqua piperita marginata Siderophloia crebra globulus botryoides	Eucalyptus— rostrata resinifera Gunnii diversicolor maculata coccifera.  Juglans— regia cinerea.  Carya— tomentosa alba.  Castanea— sativa.  Acer— pseudo-platanus saccharinum macrophyllum platanoides.
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*Native Trees.*

The following are of more easy culture than the majority of native trees, and are kept in stock in the principal nurseries, but are not recommended for indiscriminate planting.

Phyllocladus— trichomanoides.	Podocarpus— Totara.	Fagus— fusca Solandri Menziesii.
Libocedrus— Bidwillii.	Dammara— australis.	

*Trees suitable for Street Planting, Avenues, &c.*

Quercus— Suber Ilex Cerris Toza.	Tilia— Europæa Americana.	Corynocarpus— lævigata.
Platanus— occidentalis.	Eucalyptus— platyphylla Gunnii.	Ficus— macrophylla.
Gymnocladus— Canadensis.	Liriodendron— tulipifera.	Casuarina— quadrivalvis.
		Grevillea— robusta.

## ANNUAL CONSUMPTION OF TIMBER—EXPORTS AND IMPORTS.

It is very difficult to estimate, even approximately, the annual consumption of timber and firewood in New Zealand, but it must be very large and daily increasing. The replies received from the Commissioners of Crown Lands on this point are very vague, and it will be seen by a reference to the statement that in only four instances\* do they even attempt to answer my query No. 7, and that in a very general manner. The Commissioner for Taranaki goes most into detail, and estimates the consumption of his district at upwards of twenty millions of superficial feet of timber, forty-five millions of superficial feet of firewood (93,750 tons) per annum. He sets down the total consumption at 6,802,083 cubic feet, and estimates that ten millions of superficial feet of timber having an economic value, are annually destroyed in clearing. The Commissioner of Hawke's Bay gives the general requirements of his district at upwards of seven million superficial feet; Westland, at 1,200,000; and Southland at twelve million superficial feet; whilst the Commissioners of Auckland and Otago give the annual consumption of firewood alone at 25,000 tons (for the town of Auckland only), and 150,000 cords (480,000 tons) respectively. The annual requirements for Government works are estimated for six provincial districts†, omitting Wellington, Marlborough, and Auckland, for which there are no returns, at upwards of seven millions of superficial feet; whilst the Chief Engineer gives the probable requirements of railway sleepers at 20,000 in 1880, 75,000 in 1885, and 175,000 in 1890—each sleeper being 1·7 cubic feet, and the timbers required being kauri, totara, puriri, black pine, and beech (*F. fusca*).

A perusal of those returns serves but to show how large the general consumption must be; and the out-turn of the saw-mills, so far as we have been able to collect it, given in the next section, fully corroborates this view, especially when we consider the large quantities consumed by settlers for fencing, &c., of which no returns, however vague, can be expected.

It will form one of the first duties of the forest officers to collect accurate information and compile statements of the annual requirements of the colony, both for Government works and general purposes, in order that we may know how we stand for the present, although in a colony like this, rapidly increasing in prosperity and the number of its inhabitants, such returns will form little or no guide to what the consumption will be twenty or even ten years hence.

Turning to the exports and imports of timber, and what we style minor forest produce, I find that they stood as per following statement for 1875, compiled from the official statistics of New Zealand for that year:—

\* Taranaki, Hawke's Bay, Westland, and Southland. † Taranaki, Hawke's Bay, Nelson, Canterbury, Westland, and Otago.

STATEMENT of EXPORTS and IMPORTS of TIMBER and Minor Forest Produce from and into  
New Zealand, during the Year 1875, compiled from the official statistics.

EXPORTS.				IMPORTS.*			
Description.	Quantities	Value.	Total.	Description.	Quantities	Value.	Total.
1. <i>Timber and Firewood</i> —	Sup. feet.	£	£	1. <i>Timber and Firewood</i> —	Sup. feet.	£	£
Timber—Baulk ...	2,069,063	10,818		Timber—Hewn ...	544,809	6,116	
„ Sawn ...	3,003,564	16,096		„ Sawn ...	9,196,889	92,685	
	No.				No.		
„ Logs ...	1,390	8,980		„ Spokes and } ...	79,727	8,751	
„ Spars ...	401	3,965		„ Felloes } ...	22,524		
Laths and shingles ...	150,000	127		„ Pieces ...	14,407	18,992	
Palings ...	1,600	8		Logs and piles ...	997,401	1,178	
Posts and rails ...	1,210	74		Laths ...	2,013,641	15,800	
Firewood— { tons	180	83		Palings ...	136,565	5,326	
(whale fishery) { cords	8			Posts and rails ...	13,243,870	11,593	
			40,151	Shingles ...			160,441
2. <i>Minor Forest Produce</i> —				2. <i>Minor Forest Produce</i> —			
Bark ... { tons	7	40		Bark ... .. tons	2,135	18,979	18,979
Kauri gum ... { „	3,230	138,523	138,563				
†							
TOTALS ... ..	...	...	£178,714	TOTALS ... ..	...	...	£179,420

† Fungus, of which 2,247 cwts., valued at £5,744, were exported in 1875, should be included under this section.

It will be observed that the balance of imports over exports of timber is very considerable, but that the export of kauri gum, which we may fairly class as a minor forest product, and the collection of which on waste lands of the Crown should be leased or farmed out, balances the account almost exactly. The exports were chiefly to Victoria and New South Wales, with a considerable quantity of baulk timber and spars, probably all kauri, to the United Kingdom. The item under “Firewood” is set down to the whale fishery, I presume, for boiling down. A very large proportion of the imports is from Tasmania, which sent us 4,375,482 superficial feet of sawn timber, 13,230,270 shingles out of a total number of 13,243,870 imported, and 1,995,391 palings. New Zealand also took from her 1,107 tons of bark, valued at £8,493.

I am informed that most of the Tasmanian timber arrives in comparatively small quantities, being used in packing and filling up cargoes of fruit, preserves, &c.; but this would scarcely account for the large imports just quoted, and I am inclined to think that a cheaper and better supplied labour market has a good deal to do with it. This must certainly be the case with regard to the bark used for tanning purposes, for that of the New Zealand *Weinmannia*, *F. fusca*, and the tanekaha of the North Island, is quite equal, if not superior, to the Tasmanian wattle, and procurable in any quantity required.

The timbers of the Australian Continent and Tasmania are, however, so different from those of New Zealand, and both are so eminently adapted for special and widely different purposes, that I do not see cause to fear any injurious competition from that quarter, even if the rates for New Zealand timber advance considerably. I look forward, rather, to a larger export of New Zealand timbers to the other colonies, as their special qualities and advantages become better known and recognized, and they are shipped in better condition for immediate use. Neither ought there certainly to be any fear of competition detrimental to our timber industry from the importation of American or Baltic pines, for I consider some of our New Zealand descriptions quite equal to Oregon or Memel, which are, however, placed upon the market in better condition, being frequently seasoned artificially.

Much may, I think, be done to increase the durability of the New Zealand pines by impregnation, for which there are several processes, known under their several designations of kyanizing, creosoting, &c. A valuable paper on this subject, by Mr. Warth, was read at the Indian Forest Conference in 1875, but I have, unfortunately, no copy to refer to.

Brandis, in his suggestions printed with the “Reports on Forest Management,” recommends Boucherie’s system and impregnation in air-tight cylinders as likely to meet Indian requirements. The antiseptic substances most in use on Continental railways are chloride of zinc and sulphate of copper, whereas, in England, creosote is most generally made use of in the impregnation of railway sleepers.

Burnett’s process is also favourably spoken of; nor must we leave out of consideration Mr. Watson’s suggestions as to charring as a preventive against the attacks of insects, larvæ, &c., recently communicated through the Hon. Mr. Waterhouse.

I believe that New Zealand white and red pine, treated by one or other of the above processes, would take a high place, and be much in demand at greatly enhanced prices, both for local works and export, and I am astonished that in an enterprising colony like this nothing would appear to have been done in this direction, either by the Public Works Department or private firms.

I do not know the principles upon which the Customs duties are fixed, but, if it be considered advisable to tax manufactured timber imported, I think the same rule should apply to bark, which I observe enters free. I would suggest attention to this point.

#### METHODS OF “EXPLOITATION,” CONVERSION, &c.

I have already alluded, in Chapter I., to the methods adopted in removing the gigantic kauri logs from the forests to the mills, but think it desirable to advert to the subject generally. I consider that

\* The duty collected on imports amounted to £10,555 18s. 4d., of which £6,651 13s. 7d. was on sawn and, I presume, manufactured timber, and £2,013 14s. on palings.

the felling and removal of timber, known by the French as *exploitation*, is carried on in New Zealand in a most expeditious and workmanlike manner, but, from the large supply and comparatively low rates generally ruling, especially for small stuff, without much, or indeed any, consideration as to waste of material, and still less of care in its removal not to damage the young crop of trees left standing.

Felling is usually performed with the axe; indeed it is only on the West Coast (near Hokitika) that I found the saw in general use for this purpose, one side of the tree being first scarped with the axe. The saw recommends itself wherever material is scarce, as its use certainly effects a saving of several cubic feet in a fair-sized tree, and wherever it is desired to fell trees carefully and in a certain direction so as to interfere as little as possible with the standing crop. It could not, however, be brought into general use with the kauri, from the enormous size of their trunks, and I am not sure that it is economical as regards labour, although the bushmen at Hokitika consider it is so. When the tree is felled one or more logs of convenient lengths are cut out of the trunk by cross-cutting, and the rest, including top, lop, and branches, left lying in the forest. It is very striking what fine pieces, which would be of great value in other countries, are thus left to rot or burn: this is especially the case in the kauri forests, where none but the best portions of the finest trees have been, as a rule, made use of, and where the bushman looks with contempt on anything under 3 feet diameter, which he terms a "ricker."

The logs are next moved to the side of the timber slip, where such is used, and rolled down it to the nearest sidling on the tramway, or dragged, generally by bullocks, direct to the tram. I have not seen any regular rolling roads, except in the kauri forests, where on the other hand the work of getting the logs to the tram is done by manual labour, whereas in others bullock power is used. The Auckland bushman makes use of a powerful auxiliary in the shape of the screw-jack, and it is marvellous the amount of work two men trained to its use will get through, and the enormous logs which they will move about as required by its aid.

In other parts of the colony, where the logs are smaller and lighter, the jack is not much used, its place being taken by what are known as cant-hooks of various constructions.

The universal use of the tramway forms a marked feature in the treatment of New Zealand forests. I have seen them of all descriptions, and no saw-miller ever dreams of working a forest without one. They are, as a rule, constructed by bushmen on contract, the price per chain varying greatly, according to locality, nature of the country in which the forest is situated, and size of timber to be taken out. In the Pelorus, near Havelock, the forest tramway assumes the shape of a regular light railway, with iron rails and locomotives specially constructed and solely used for the transport of timber; but, as a rule, the rails or longitudinal sleepers are of wood; their construction is identical with those met with in Switzerland (described in the supplement to "Reports on Forest Management"), and the haulage is by horses. I have seen no such system *generally* applied in any of the forests I have visited out of New Zealand, but it may possibly be common in America.

Floating is common for the transport of timber in the Auckland district, where dams are constructed on the smaller rivers or streams to store up the water till required. One of those which I saw at Mangawhau cost as much as £1,000.

The use of dams on the subsidiary streamlets to augment the supply of water as required would probably be found an advantage, and still more the preparation, by means of sleeping, and construction of locks on the stream down which the logs are floated, as is universal in the Black Forest and other parts of the Continent of Europe, where, however, the supply of timber, being under systematic management, is permanent and regular—not, as in the kauri forests, merely temporary.

I have not seen floating in any other parts of New Zealand, though it is resorted to in Otago, and doubtless elsewhere, the main difficulty being, as in India, that many of the timbers will not float unaided in a green state, and there is at present no demand for the lighter descriptions which might serve as floats or rafts. Taken as a whole, there is nothing to find fault with, and much to admire and copy elsewhere, in the felling and transport of timber in and from the forests to the mill or market, except the waste, and damage caused to what is left—evils which will cure themselves when the produce is more scarce, and found only in more inaccessible places, requiring a greater outlay of capital to work a forest, and pieces and descriptions now discarded as worthless acquire a marketable value. Systematic management, and the leasing of only such portions of the forest as are actually required to supply the demand, or which it is desirable to clear for the extension of settlement, will also tend to this result. At present, any one working a tract of forest knows he can readily get another, and consequently finds or considers it preferable only to take the cream, and leave one block for another. This system would not so much matter were the worked portion left in a state to recover by the process of natural reproduction; but unfortunately it is not so. The saplings have already been rudely damaged; the covering or compactness of the forest has been abruptly broken, and a flood of light and air suddenly admitted. Decay of the half-mature trees sets in, and fire generally follows, which, fed by the *débris* and want of healthy vitality in the growing trees, completes the havoc, and destroys the forest for ever.

Turning to the methods of conversion, I need scarcely state that by far the most usual is that of saw-machinery, of which the motive power is generally steam, but in some instances water. The saw-mills of New Zealand compare favourably, I should imagine, with those in any part of the world. From the Aratapu Saw-mill, on the Wairoa River (Auckland Provincial District), capable of turning out 150,000 superficial feet per week of six days, without overtime, to the small mill turning out its 5,000 or 10,000 superficial feet per week, I consider they are generally eminently adapted for the work which they have to do, and the greatest boon to the settler and general public in providing a supply of sawn timber ready, it may be said, at every one's door. The saw-mill indeed appears to me, no less than the forest tramway, a marked feature and excellent institution in connection with the working of the forests. I have given the subject much attention, and been specially employed in selecting saw-machinery for the Bombay forests, where its use has until lately been quite unknown—the majority of our Indian timbers are very hard and difficult to saw, and the climate in the forests is often deadly at some seasons of the year—but I have nowhere in Europe seen machinery better adapted for the purpose or so generally employed as here.

A digging "rush" like that at Kumara has scarcely set in before there is one, and now, if I mistake not, two saw-mills on the spot providing for the requirements of the new town, which, if it depended on hand-sawing, would require months or years instead of as now days and weeks to assume quite a habitable and comfortable appearance.

I do not propose to give a description of any individual saw-mills: to do so would serve no good purpose, and the subject is one properly dealt with by itself. The circular saw, with patent feed and latest appliances, is by far the most general in use; and the light and easily-worked pines of New Zealand give little or no trouble in the shape of buckled saws, &c., which forms the chief drawback to the adoption of this description for large logs in other countries. A supply of more or less skilled workmen is also generally available. There are of course breaking-down, frame, and gang saws, but not in general use save in the kauri districts.

I submit the following very incomplete return of the saw-mills at work in the several districts and their out-turn:—

RETURN showing NUMBER of SAW MILLS in OPERATION worked by Steam or Water Power, and their Approximate Out-turn, for Year ending 31st December, 1876.

Provincial District.	No. of Mills.	Approximate Out-turn, super. feet.	REMARKS.
Auckland ... ..	25	46,000,000	
Taranaki ... ..	3	1,049,471	220,000 feet sawn by hand.
Wellington ... ..	10	7,569,954	
Hawke's Bay ... ..	1	561,747	Complete returns not received.
Marlborough ... ..	16	15,465,379	
Nelson ... ..	20	1,583,659	Returns from thirteen mills not received.
Canterbury ... ..	30	15,716,733	35,000 feet sawn by hand.
Westland ... ..	10	6,824,500	100,000 feet sawn by hand.
Otago ... ..	...	...	No returns received.
Southland ... ..	10	8,267,594	Being 4,207,147 feet less than out-turn for year 1875, arising mainly from completion of railways. Twenty saw-mills in district—two on freehold property, eight not working; if all employed, maximum out-turn about 90,000 feet daily.
TOTAL ... ..	125	103,039,037	

It will be observed that, although we have been calling on the Commissioners of Crown Lands for information on this point for the last two months, there is none for Otago; for seven mills only, out of 20, in Nelson; and a very vague return from Hawke's Bay. I was also desirous of exhibiting the maximum out-turn of the mills, provided there was demand, but information on that point is incomplete. We cannot, of course, demand returns from saw-millers working on freehold, but I think the information required might have been obtained with a little trouble; and had I had any idea that the Commissioner of Otago would have found it impossible to furnish it, which I only learned this morning by telegraph, I should have endeavoured to collect it myself through the Rangers and private firms. The out-turn in Otago must be very considerable. Incomplete as the return is, it exhibits a large quantity of sawn material, especially when it is remembered that the past year was undoubtedly one of depression and low prices in the timber trade.

In some localities conversion is still of course executed by hand-sawing in pits, but this is comparatively rare, and daily becoming more so.

The returns of timber sawn in this manner, so far as I have been able to get information, give only 220,000 superficial feet in Taranaki, 35,000 superficial feet in Canterbury, and 100,000 superficial feet in Westland, but, doubtless, the quantities are considerably in excess of those figures.

Of the quantity converted by splitting for fencing, and chopping for firewood, &c., we may be said to know literally nothing, but it must be very large in proportion to the population, if we consider the number of miles of wood fencing in New Zealand, and how often posts have to be renewed.

The firewood supply must also total up to considerable quantities if we take the estimates—for Taranaki, 93,750 tons; Otago, 480,000 tons; and Auckland Town, 25,000 tons—as a guide.

Information on all those points is very much required, and I should hope and expect to know, and be in a position to report, a good deal more about it within a year from the organization of a Forest Department.

#### CONSIDERATION OF PRESENT SYSTEM, ITS ADVANTAGES AND DISADVANTAGES, AND ULTIMATE RESULTS.

It appears very necessary to consider the present system under which the forests are treated, I cannot say managed, its advantages, if any, and the probable ultimate results.

I submit an abstract of the reports received from the Commissioners of Crown Lands, and send original reports in manuscript, also a *précis* of the sections of the Waste Lands Acts for the several provincial districts remaining unrepealed which refer to the subject of timber, and contain provisions for its removal from forest lands of the State.

ABSTRACT OF INFORMATION received from the COMMISSIONERS OF CROWN LANDS and other OFFICERS in REPLY to QUESTIONS sent out by the CONSERVATOR OF STATE FORESTS. (*Vide* his Letter, No. 1, dated 20th July, 1876.)

QUESTIONS.	AUCKLAND.	TARANAKI.	WELLINGTON.	HAWKE'S BAY.	MARLBOROUGH.
1. Situation and extent of tracts of forest or woodland in the hands of Government (General or Provincial) ?	Hokianga to Bay of Islands, 125,000 acres; Hokianga to Kaihu, 300,000 acres; Whangarei to Auckland, 55,000 acres; Waikato, 40,000; Coromandel Peninsula, 250,000 acres; Tauranga and Opotiki, 40,000 acres; Mokau, 40,000 East Coast, 110,000: total, 960,000.	All forest, with exception of a belt of open land from the sea coast, of an average of 4 miles inland. 227,000 acres Government land. 800,000 acres confiscated.	773,305 acres scattered over the provincial district, and situated upon broken and mountainous country.	Seventy-Mile Bush 80,000 acres; Rushine, 14,000 acres; Pukititiri and Pohui, 9,000 acres; Nubaka, 20,000 acres; Tautane, 15,000 acres: total, 138,000.	About 500,000 acres, situate partly in the Wairarapa, Polorus and Queen Charlotte's Sounds, and Port Underwood. Country of a mountainous nature.
2. Description and approximate quantity of timber in the several tracts ?	Kauri, totara, matai, and puriri. The former exists in considerable quantities, but is difficult of access in some districts on account of broken country. The latter (totara, matai, and puriri) in small quantities.	Rimu abounds in large quantities in some parts, from 20 to 30 trees to the acre. White and black pine much scarcer. Totara in small quantities. Puriri, matai, hinau, puketea, kahikatea, rata, pohutukawa, titoki, akeake, kowhai, rewarewa, kohekohe, tawa, and towai in limited quantities.	Totara, red and white pine, matai, manuka, birch (black and red), rata, and hinau. Quantities not stated.	Rimu, white pine, matai, totara, birch, rata, and tawa. Approximate quantities not given.	Kahikatea, matai, rimu, with little totara and birch. Estimated quantity not given.
3. Uses, if any, to which the forests are put at present ?	None.	Not worked with any system. Forest being rapidly destroyed.	No information given.	None. No licenses issued to cut on Crown lands.	Sawn timber and fencing.
4. Whether the forests are worked at all; if so, to what extent, and on what principle ?	Worked on small scale for building purposes.	Two saw-mills only at work. Small quantity used for bridges, building, and fencing.	Not stated.	Not worked.	14 saw-mills in operation. Estimated out-turn per annum, 17,940,000 feet.
5. The public revenue and expenditure from each during the past five years ?	£838 18s. 2d. revenue; expenditure, nil.	None.	Information not given.	No revenue. Expenditure included in that of the Crown Lands Office generally.	No information as to revenue.
6. Situation and extent of tracts of land in the hands of Government, or readily obtainable for planting operations ?	Tract of land in hands of Government, 2,250,000 acres.	A large area of land along the coast. Suggests advisability of planting the sand hills to prevent further inroads being made by it.	No information given.	Mangaharuru District, 25,000 acres; Mohaka, 50,000 acres; Wairoa, 100,000 acres; Kaweka, 10,000 acres: total, 185,000 acres.	Not stated.

ABSTRACT of INFORMATION from the COMMISSIONERS of CROWN LANDS—*continued.*

QUESTIONS.	AUCKLAND.	TARANAKI.	WELLINGTON.	HAWKE'S BAY.	MARLBOROUGH.
7. General descriptions of the forests; estimated annual consumption of timber and firewood by the general public, and whence supplied, <i>i.e.</i> , from private forests, other countries, or Government forests?	Description of forests not given. Probable consumption of firewood in Auckland, from 20,000 to 25,000 tons annually. Unable to state requirements for country districts. No information given as to where the supply comes from.	Northern portion of country of a broken and rough character. Estimated annual consumption for building and furniture, say 300,000 sup. ft.; firewood, 45,000,000 sup. ft.; fencing, 20,000,000 sup. ft.; waste in sawing and splitting, 16,325,000 ft. Of the 300,000 ft. for building and furniture, about 150,000 ft. is imported; remainder supplied from private lands.	No information given.	Principal timbers are rimu, white pine, totara, and matai, all of excellent quality. About 7,060,000 ft. consumed annually. Of this, 5,000,000 ft. is imported from Auckland, about 2,000,000 ft. from local mills, and 60,000 ft. from V.D.L. for wheelwright purposes. Local timber all derived from private and Native land.	No information.
8. Estimated annual requirements of timber for general or provincial works; description of timber used; rates paid; and whence the supply has been hitherto obtained, <i>i.e.</i> , from private forests, from other countries, or from Government forests?	Not able to state probable annual requirements. Timber hitherto used are kauri, totara, matai, tanekeha, tawhai, puriri. Unable to furnish prices.	275,000 sup. ft. rimu, matai, and kauri. Rates paid for same, 16s. per 100 ft. for rimu, and 17s. 6d. for kauri, which is supplied from Auckland.	No information.	About 5,000,000 ft. has been used the past 4 years for Government works on railways; totara being used for piles and railway sleepers, Australian timber for bridges, and matai, totara, and birch for plank-ing. Rates per 100 ft. not stated.	Not stated. White pine, 7s. 3d. to 8s. 6d. per 100 ft.; matai, 11s. to 12s.; black birch, 18s.; rimu, 8s. to 10s.; totara, 16s. to 18s. Other information not given.
QUESTIONS.	NELSON.	CANTERBURY.	WESTLAND.	OTAGO.	SOUTHLAND.
1. Situation and extent of tracts of forests or woodland in the hands of Government (General or Provincial)?	2,682,000 acres.	Banks Peninsula, 24,000 acres; Oxford District, 50,000 acres; Alford Forests, 5,700 acres; Wanaka and Upper Waimakariri, 128,000 acres: total, 207,700.	2,623,550 acres of forest land.	2,000,000 acres, scattered over the district.	Unsold forests, 729,141 acres reserved from sale; in private hands, 70,859 acres.
2. Description and approximate quantity of timber in the several tracts?	Cannot be given.	Totara, black and white pine, rimu, and manuka. Unable to give quantity of timber in districts.	Red and black pine, white pine and silver pine, miro, totara, kahaka, ironwood, toatoa, black, white, and red birch, all of which grow in large quantities.	Description of timber not given. On East Coast 14,521 acres on public lands, and 43,760 acres on private; on West Coast no information.	Red, white, and black pine, totara and ironwood; estimated average of 15,000 ft. per acre, valued at 100s. per 1,000 feet.
3. Uses, if any, to which the forests are put at present?	No information.	Government forests not worked. Private forests are worked to considerable extent with steam saw-mills.	Mining, building, and fuel.	Building and fencing purposes.	Building, fencing, railway sleepers, bridges, and general purposes.
4. Whether the forests are worked at all; if so, to what extent, and on what principle?	No information.	Private forests on Banks Peninsula, at Oxford, &c., are worked. (See answer to query No. 3.)	Worked to very little extent, most of the timber having been cut off private property, and worked by steam power.	No information.	No information to what extent forests are worked.

ABSTRACT of INFORMATION from the COMMISSIONERS of CROWN LANDS—*continued.*

QUESTIONS.	NELSON.	CANTERBURY.	WESTLAND.	OTAGO.	SOUTHLAND.
5. The public revenue and expenditure from each during the past five years?	Nil.	£204 10s. received for bush licenses. No expenditure. The above sum was paid between Feb., 1872, and June, 1873. Since that date no licenses have been issued.	Timber licenses, £497 10s.; saw-mill sites, £25: total, £522 10s. Expenditure, Ranger, £50 per annum.	Revenue received, £5,430 17s.; expenditure £2,062 10s.	Revenue, £6,000; expenditure, £1,500.
6. Situation and extent of tracts of land in the hands of Government, or readily obtainable for planting operations?	No information.	Reserves for planting purposes in hands of Government, as follows:—Along railway lines, 19,855 acres; along coast, 1,600 acres: total, 21,455 acres, of which 300 acres have been planted by Government.	Open land in hands of Government, 164,955 acres.	The whole of the interior of the district, comprising an area of 2,000,000 acres.	Any portion of unsold lands can be obtained for planting operations.
7. General description of the forests; estimated annual consumption of timber and firewood by the general public, and whence supplied, <i>i.e.</i> , from private forests, other countries, or Government forests?	No information.	No information as to general description of forests. No estimate of consumption given, or whence supplied.	See query No. 2. Export coastwise, 4,660,000 feet; other colonies, 189,000 feet; firewood, cords, 30,000; round timber for building, mining, and fencing purposes, 200,000 ft. Supplied from Government and private forests. Local consumption, 1,000,000 feet.	Principal timber country lies south of Dunedin, a description of which is not given. Estimated consumption of firewood, 150,000 cords, obtained from Government and private lands. General requirements for building purposes not given.	For general description of timber, see query No. 2. Annual consumption, 12,000,000 superficial feet. Estimated consumption of firewood not obtainable. Supply from Government forests.
8. Estimated annual requirements of timber for general or provincial works; description of timber used, rates paid, and whence the supply has been hitherto supplied, <i>i.e.</i> , from private forests, from other countries, or from Government forests?	Foreign timber, 18,035 ft., at 30s.; Government forests, 326,000 feet; private forests, 681,000 feet: total, 1,007,000 feet. Totara, 18s. to 20s.; birch, 14s. 6d. to 15s.; red pine, 12s. 6d. to 13s. 6d.; rimu, 10s. 6d. to 11s. 6d.	Amount of timber used in Public Works Department from March 1875, to March, 1876, as follows: 796,184 ft. New Zealand timber; 437,593 feet foreign timber: total, 1,233,777. Prices of New Zealand: Kauri, 25s.; totara, 21s.; pine, 18s. to 21s. per 100 feet. Supplied from private forests, principally.	Requirements estimated, 150,000 feet. Rates paid are various, according to description of timber, which are not stated. Supply principally received from Government forests, small quantity from private forests, and little from foreign ports.	Upwards of 2,265,300 feet of New Zealand timber is used upon public works; 935,418 feet of imported also used by department. Native timber worth from 18s. to 22s. per 100 feet for use of above department.	Requirements for Government works not obtainable. Prices not given. Supply hitherto from Government forests. Little or none from private property.

*Timber Regulations at present in force in the Colony.*

**AUCKLAND.**—All forest lands are under the control of the Waste Lands Board, with power to make permanent forest reserves that shall not be dealt with otherwise than as the General Assembly shall direct. Local reserves for timber and firewood may be handed over by the Waste Lands Board to the local Road Board, to prevent injury by fire, and to be administered by it as the Waste Lands Board shall direct. Areas of forest land, to an extent in the discretion of the Waste Lands Board, may be leased for not more than ten years, at a peppercorn rent; sales thereof to be at public auction. All forest lands may be placed by the Waste Lands Board under the immediate supervision of the local Highway Board. No provision that regulations for conservation, &c., shall be made.

**TARANAKI.**—Nothing in force.

**HAWKE'S BAY.**—Nothing in force.

**WELLINGTON.**—To every block open for settlement a sufficient reserve of timber to be made for the exclusive use of settlers on the block; but not for sale outside. No other provision for control or management of forest lands. Ordinary timber licenses are issued, with right of renewal in case roads have been made or other improvements. Licenses for twelve months without limit, except that timber that has been reserved for the public use may not be cut.

NELSON.—Timber lands come in with other land, no special provision being made in that respect.

MARLBOROUGH.—Occupation licenses for ten years granted by the Waste Lands Board on such terms as it thinks fit, for the cutting of timber; no further provision. Licenses not to prevent sale of the land, nor in any way to affect the rights of the Crown thereto. Certain regulations for the issue of timber licenses appear to have been framed in 1875, but they do not seem to have been acted upon or enforced.

CANTERBURY.—Reserves may be made of land for preservation or sale of the timber growing thereon. Timber licenses may be issued within such reserves. The timber to be sold at auction, and to be removed within a certain time, else again put up to auction. Licensee making roads or erecting pits protected within a certain distance from his pit, and no one allowed to use his road without leave. Wilful injury or destruction of timber to forfeit license. Sections of timber reserves may be excluded from timber licenses, and be absolutely reserved as timber. Licenses are not now being issued, and proposals have been made for reserving all the forest lands remaining unalienated in Banks Peninsula, and at the head-waters of rivers, &c.

WESTLAND.—The same regulations as in Canterbury. Licensees now pay £5 per annum for each man (bushman or sawyer) employed, and there is a Ranger to see that the regulations are not evaded.

OTAGO.—Timbered land in areas at discretion of Board may be sold as ordinary rural land, subject, however, to assent of the Governor. Seven years' licenses for cutting timber granted by the Board upon such terms as it thinks fit. Not to preclude the Board from selling the land, or including it within a Hundred. The form of license being at the discretion of the Board, it may issue the license subject to such regulations as they please. Any lessee or occupier of waste lands in Otago may cut down what timber he wants for fencing or for firewood from any Crown lands, so long as the timber itself has not been specially reserved. There are three Rangers, whose duties are however mainly in connection with the Crown Lands Department, and who have little time to look after the forest.

SOUTHLAND.—Subsequent to the reunion of Southland with Otago the law in Southland as to timber land has been re-enacted, and is now *ipsissimis verbis* the same as in Otago; but the regulations framed on it are different, all the forest area remaining undisposed of being reserved, and portions leased to saw-millers on payment of a tithe. Settlers must also take out licenses or payment for all timber and firewood required from the Government forests. There is an Inspector of Forests, whose duty it is to enforce the regulations.

The former exhibits, in reply to query 1, in a very general manner the area of forest lands in the several provincial districts remaining undisposed of, amounting roughly to twelve millions of acres (11,640,696), including 800,000 acres in Taranaki classed as confiscated, but not, I presume, actually available to be dealt with as we choose.

At page 35 of the Papers relating to State Forests, printed in 1874, is an estimate of forest land by Dr. Hector, which gives the total area at 12,130,000 acres; but if the estimates furnished by the Commissioners of Crown Lands be anything like accurate, and we add to them the area of forest in Native and private hands generally, the total will be greatly in excess of Dr. Hector's estimate. The rate of consumption and destruction must, however, be enormous, as may be judged from reference to the imperfect statement of out-turn of the several saw-mills at work accompanying this report, and the knowledge that this does not represent one-tithe of the total consumption in the shape of posts and rails, firewood, &c., and takes no account of the timber wasted and destroyed by fire and other causes. It appears unnecessary to recapitulate here the gist of the replies to the other queries received from the several districts. They are, as a rule, so vague, and contain so little of the information which I wished to obtain, that I conclude it is not available, and that its collection and submission must be left till we have a body of special officers, one of whose first duties it would be to obtain accurate information on the several points regarding which we are now in the dark. To one point, however, attention may be called—viz., that whereas to my knowledge most of the forests are being indented on to no small degree, the State is receiving little or nothing from them. In several cases the returns say they are not worked at all, but in others—*e.g.*, Auckland, "worked on a small scale;" Taranaki, "two saw-mills at work;" Marlborough, "fourteen saw-mills in operation: estimated out-turn per annum, 17,950,000 feet"—the revenue derived is given as *nil*. The provisions of the several Waste Lands Acts bearing on the subject are most instructive, showing the diversity of opinion with which it has been approached and handled, and when compared with the results, as given in the reports of the Crown Lands Commissioners, how generally they would appear either not to have been in force, or to what an extent they have been evaded.

The fact is that, except in Southland and to a certain extent in Otago and Westland, there has, I believe, been no machinery to secure compliance with the regulations, which therefore were never enforced; still more so when forest land was being sold outright for not more, and in some cases much less, than the rent or royalty asked for the user of the timber thereon.

We must therefore, I think, consider those sections and the regulations framed on them as a dead-letter except in the districts mentioned above, especially Southland, where by reserving all the forest lands from sale and leasing out blocks to saw-mills as required, the Waste Lands Board made a commencement in the right direction, and have laid the foundation of a real system of conservancy and working.

Having dismissed all idea of control over the forests exercised by the Government or Waste Lands Boards, there remains but little doubt that the saw-millers, hand-sawyers, and splitters have made the most they could out of them for their own advantage, and doubtless also that of the purchasers. They have very naturally cut out the best of the timber and left the rest standing, paid little or no attention to the exclusion of fire from their own or neighbouring blocks of forest—in short, conducted their operations on the simplest and most remunerative plan for themselves, but most wasteful and detrimental to the public estate. I do not in any way wonder at nor blame them; on the contrary I think they deserve the highest praise for their energy and enterprise, and the manner in which they have supplied and are supplying the market. The industry is a very important one, giving employment to a large number of hands, the wages distributed in Southland alone averaging, according to Mr. McArthur, the Inspector of Forests, £60,000 per annum. During the debates on the

forest question in the House of Representatives in 1874, it was stated that New Zealand, so far as could be judged from the printed reports, was far in advance of many other countries in the shape of appliances for the removal of the timber from the forests and its conversion. After an inspection in every part of the colony I can fully indorse that view. Certainly the saw-millers and bushmen of New Zealand have nothing to learn from India, nor, I think, from Europe, in these respects.

The methods of felling, logging, and "exploitation" or removal from the forest, from the appliances made use of in handling the gigantic kauri trees of the Auckland forest to the smaller descriptions at the Seaward Bush in Southland, are excellent, and the same may be said of the breaking-down or converting machinery, which is, as a rule, the best of its kind produced, and specially adapted to the description of work which it has to perform. I have already given some information in a general manner regarding the methods of conversion, saw-mills, &c., and it does not fall within the limits of any report such as this to go into further details regarding them, and the excellent arrangements I have seen in all parts of the colony. The subject indeed forms matter for a report in itself.

There is, be it understood, great waste, or more properly speaking neglect, in utilizing the timber; but this clearly results from an abundant and seemingly inexhaustible supply, high rates of labour, and very low rates of sale, which has led to only the best portions of the best trees in the most accessible localities being made use of, and the rest either left standing, or their upper portions and branches left lying on the ground to decay or feed the forest fires.

Another very important point demands consideration here—viz., the way in which timber trees have been felled and worked up at all seasons of the year, the timber being made use of for constructive works without any attempt at seasoning. The results of such a system are everywhere apparent in the warping, contraction, and rapid deterioration of the timber in houses, bridges, wharves, and other buildings, and furniture. It has done very much to give the timbers of New Zealand a bad name, and it should be one of our first aims to put a stop, as much as possible, to felling and conversion in the spring and summer months, and induce saw-millers and timber merchants to allow of seasoning both in log and plank before placing the timber in the market. The advisability of some such measures is admitted on all hands, and the saw-millers on the West Coast have, to a certain extent, already set an example in the right direction, and limit the felling, especially of silver or yellow pine, to a minimum in the summer months. Whether this is due to their having a considerable export trade, and finding that timber felled in the autumn and winter months fetches better prices, I cannot say, but I firmly believe that any timber merchant possessing the means and determination to sell only timber so felled and after a certain amount of seasoning, and being able to guarantee his timber as of a certain season, &c., would find himself well repaid by a steady demand at enhanced rates. The timber trade is at present, as stated in the section devoted to saw-mills, in rather a depressed state, especially in the South Island, the rates ruling very low indeed, especially in Southland, where pine from the Seaward Bush, delivered at the mill, generally alongside the railway, realizes only from 6s. 6d. to 7s. 6d. per 100 feet superficial, leaving scarcely any margin of profit, even under the most favourable circumstances, to the saw-miller. The reasons generally given for this state of things are general dulness of trade and stagnation in building generally; but I cannot reconcile this with the numbers of new buildings everywhere springing up. I am inclined rather to ascribe it to the effects of over-competition, the low rates at which forest can be acquired, and the little value set upon it, causing numbers to embark in the timber trade, who, once in, are bound to go on and keep their mills going even if they barely make the men's wages by so doing. I anticipate a considerable rise in the price of timber throughout New Zealand in the course of the next few years, especially if the measures of conservancy and securing a forest revenue to the State, which I am about to propose, be introduced. I do not think that this result, if gradually brought about, will in any way paralyze or cripple the timber industry, nor will the rise be such as to be felt severely by the consumer and prevent the extension of building. The main thing to be guarded against is raising the price to such an extent that it would be found cheaper to import from other colonies, America, or Europe, which would of necessity have a most disastrous effect on the trade. I see no reason to anticipate any such movement. The timbers of Australia are of a perfectly different character from those of New Zealand, and, although imported to a certain extent, and, I may say, a greater extent than I can see any adequate reason for, it is for special purposes, and not, except perhaps in the case of Tasmanian shingles, which are ousting those of New Zealand wood from the market, in competition with New Zealand timbers. Comparatively small quantities of Baltic and Oregon pine do even now find their way into the New Zealand markets, and are sold at comparatively low rates, but they are generally shipped to make up or pack cargo, and not as a speculation in themselves. I am inclined, therefore, to think that, if the subject be properly dealt with, we have nothing to fear from imports of foreign timber, and that, if anything, the tendency will be the other way, and that, as the evils of felling at the wrong time of year and want of seasoning are realized and remedied, a considerable increase in the export timber trade, especially from the West Coast to Victoria and New South Wales, may be looked for.

The evils to which I have referred will gradually remedy themselves as timber becomes scarcer and more valuable, and we should endeavour very gradually to overcome them and secure more economy in working. I do not at all despair of being able to do so, as the private or freehold forests become worked out and we get the thing more into our own hands.

Much the same may be said with regard to forest fires, with regard to which much has been said and written, and on which point I have a reference from the Minister of Justice, forwarding rider to a report of a Coroner's jury at Kaiapoi, praying for some legislation to check or prevent them. The forest trees of New Zealand are certainly very impatient of the effects of fire, and, at some seasons of the year, the bush is exceedingly inflammable; but not more so than in India, where we have grappled with and overcome the difficulty in some of our reserves with the most satisfactory results. Once place the conservancy of the forests and their management under officers specially responsible for them and duly authorized by law to prevent waste and damage to the State property in their charge, and I am confident that fires and other evils will gradually decrease and eventually disappear altogether. The Inspector of Forests in Southland informs me that such is already the case there, and that bush fires in the portions leased by saw-millers are, comparatively

speaking, unknown. The reason is not far to seek: the saw-miller has embarked his capital in plant for working a block of forest; if that is burnt he loses not only a great proportion of the timber on which he purposes to make a profit, but probably all or part of his plant, in the shape of saw-mill, tramway, &c., and therefore will gladly take all the steps in his power to prevent fire, and would probably succeed, if he could find a market for the smaller trees and loppings, which, I think, he will gradually do, especially if the railways will burn firewood whenever possible, a matter with regard to which I am in correspondence with the Chief Engineer, as I believe it to be not only feasible but likely to prove economical to the Railway Department, whilst of the greatest service to us.

The interests of the saw-millers are, I consider, really identical with our own, that is, with those of a State Forest Department; and I think, if their position be properly viewed and dealt with, we shall find it a great boon to have such means at our disposal for utilizing our forest produce to the best advantage, and not being forced, as we have been in great measure in India, to become, more or less, timber merchants, sawyers, and bushmen. It is, I repeat, an undoubted advantage of the system, or want of system, so far as the State is concerned, in the past, that such an industry is in existence and has attained the dimensions and general excellence which characterize it.

A continuance of the present system of waste, burning, and devastation of the forests, must result in their deterioration and eventual disappearance. Viewed from a purely conservancy point of view, it is, of course, suicidal, and even where it is not proposed to retain or reproduce the timber, but make the land available for settlement or pasturage, it is, to say the least of it, open to objections from a financial point of view.

Judging from what I have seen and heard I have no reason to apprehend any objections or obstructions on the part of saw-millers, hand-sawyers, splitters, &c., to any moderate restrictions, conditions, and payments for the use of Government forest when required, provided that such restrictions, conditions, and payments are clearly understood before they enter on a lease or take out a license for working on Government forest, and that no invidious exceptions are made in favour of any class or individuals.

I am, therefore, of opinion that, if treated with judgment and tact, the present system, under which the forests are worked by an independent body of saw-millers, &c., may be by degrees ingrafted on a proper scheme of conservancy and, in the case of the reserves, reproduction; but that, if left uncontrolled, it must result in damage and eventual destruction of the State forest property, without any adequate return.

#### CLIMATIC CONSIDERATIONS, WITH SPECIAL REFERENCE TO THIS COLONY.

The general influence of forests on climate and rainfall and moisture has been so frequently and fully ventilated during the past few years that it appears only necessary to call attention to the authorities on the subject, and what may be considered the general conclusions arrived at, before referring more particularly to the special conditions and circumstances of New Zealand in this important respect.

Marsh, in his work on *Man and Nature*, published in 1864, says, "One important conclusion, at least, upon the meteorological effects of forests is certain and undisputed: the proposition, namely, that within their own limits, and near their own borders, they maintain a more uniform degree of humidity in the atmosphere than is observed on cleared ground." And again, "It is well established that the protection afforded by forests against the escape of moisture from the soil insures the permanency and regularity of springs, not only within the limits of the woods, but at some distance beyond their borders. As the forests are destroyed, the springs which flowed from the woods, and consequently the greater watercourses fed by them, diminish both in number and volume." Mr. Marsh illustrates his propositions by numerous authentic instances, and concludes that it is necessary to preserve the wood round the sources of watercourses and on ridges.

Marshal Vaillant, M. Mathieu, Hooker, Schleider and Fries, Becquerel, Humboldt, Boussingault, and many others, have all written to the same effect; and recently Dr. Crombie Brown, formerly Government Botanist at the Cape of Good Hope, has been doing good service by publishing a series of works bearing on the subject, entitled "*The Hydrology of South Africa*," "*Reboisement in France*," "*Forests and Moisture*," or, "*Effects of Forests on Humidity of Climate*," &c., which will repay perusal by any one interested in the subject. I may also refer to a paper on the subject by the Rev. W. B. Clarke, M.A., F.R.S., read on the 1st November last before the Royal Society of New South Wales, containing considerable information.

Space forbids the multiplying of authorities, and citing their opinions, and I will only add an extract from my Dunedin paper, as summarizing my view of the question:—

"Much has been written on the subject of the influence of forests on rainfall, springs, or streams of water, and the humidity of the atmosphere generally. I do not think we can consider it proved that their existence or non-existence influences in any appreciable degree the total rainfall of a district, although they probably do cause the clouds to precipitate their moisture in certain localities. [Hof Rath Wex, in a paper on the 'Decrease of Water in Rivers and Springs,' communicated to the Vienna Geographical Society in 1875, states that the decrease of water in the Elbe and Oder has been 17 inches; in the Rhine, 24; Vistula, 26; and Danube, at Orsova, 55 inches—in 50 years.] As to their favourable influence in the case of springs and streams there is little doubt, and many instances could be quoted from Von Humboldt, 'Marsh on Man and Nature,' and other standard works. They not only prevent excessive evaporation, but, by their presence and action, render the flow of water more regular and permanent, thus preventing disastrous floods and torrents during the winter or rainy season, and long droughts in summer. Their removal from mountain-tops and hill-sides cannot but be regarded as an evil, often followed by the most disastrous results. So much has this been found to be the case in France, that they are now engaged in a gigantic work of replanting the slopes of the Alps and Pyrenees, which had been cleared in former years for grazing. Those replantings are to extend over 200,000 English acres, to cost £400,000, and the work is estimated to extend over 140 years, which is considered 'not an unreasonable time to undo the work of twenty centuries.' Only fourteen years

of the 140 have as yet expired, and £40,000 has been expended in replanting ('*reboisements*') at the points most threatened, and, I am glad to learn, with the best results. Extensive planting is also being carried on in the Landes, and district of the Gironde. The latest contributions to our forest literature on the subject of the influence of forests on climate is, I think, given in the reports of the Forest Conference held at Simla in October, 1875, in the shape of a translation from a paper by M. J. Clavé, which appeared in the '*Revue des Deux Mondes*,' from which I extract the following:— 'There are four separate actions of Nature through which it may be said that forests influence, in some way or other, the physical condition or climate of a country. 1st. There is a chemical action through the leaves in decomposing the carbonic acid of the air. 2nd. A physical action in retaining moisture in the earth, and in checking the violence of the wind. 3rd. A physiological action in transmitting to the air, through the leaves, a portion of the moisture which the roots draw from the earth. 4th. A mechanical action, through the roots, in retaining in its place the earth, especially on the sides of mountains and hills.' The writer then proceeds to examine each action in detail, and deduces conclusions favourable on the whole. He admits that 'the action and influence of forests on the climate and physical condition of countries is yet but imperfectly understood;' and concludes, 'It seems to have been clearly proved that, whenever countries have been denuded of trees, their climate has been radically changed. Not to quote again the case of France, Asia Minor may be quoted as a country which, in the era when it was covered with forests, was richly cultivated, and supported, easily, a high rate of population, but which at the present day, owing to the destruction of the forests, has become so arid that the crops fail to come to maturity, and thousands of human beings are now perishing from hunger and want.'"

Referring more particularly to this colony, I do not see any good ground for inferring that any damage has as yet taken place from the clearing away of forests, although it has been stated, and may be the case, that the floods in the valley of the Hutt are much more frequent and disastrous since the extensive clearings there. Certainly whatever may be the effect of forest on the actual rainfall, there can be no doubt as to its indiscriminate removal from the sources of springs, ridges, and steep hill-sides being productive of the most disastrous results.

The history of *reboisement* in France, just alluded to, is most instructive on this point, and peculiarly applicable to the circumstances of New Zealand, where the tendency is to clear the hill-sides in order to provide grazing for sheep and cattle. This is exactly what was done in France, with the result that the vegetable soil soon disappeared, and "the evils calling for remedial measures, though varying in the degree of importance attached to them, have been the destruction of the mountains, the covering up of fertile lands in the valleys with sterile detritus, and the inundation of the plains beyond by the superabundant waters." This is exactly what I fear may be the case in New Zealand, if steep hill-sides such as those of the Buller and its tributaries, are cleared of forest. The timber is not of much value on the upper portions, so that we should not conserve it for that; but I would on no account allow it to be cleared, and whatever may be taken out should be on the system known as "selection felling," or removal of individual trees.

It is natural that the inhabitants of such localities, and throughout a densely timbered district like the West Coast, should long for the clearing away of the bush and opening up of the country for pastoral and agricultural purposes in their own immediate interests, and of course a very large proportion of the timbered land will eventually be so cleared and brought under grass or cereal crops. I would only counsel care and consideration in the treatment of such densely wooded areas, and a general supervision and control by a central authority not likely to be led away by local bias, but at the same time not obstructive, nor blind to the real interests of the colony and settlers at large.

I would gladly see all the low-lying forests betwixt the sea and mountains in Westland and in the lower portions of the valleys cleared away, only striving to have the timber utilized, at least to some extent, and not wasted and destroyed; but I should view with very great anxiety any clearing of the hills which form the dividing range or back-bone of the island, and am convinced that it would be followed, sooner or later, by the most disastrous results, both in the shape of deterioration of the climate, dangerous floods and landslips, and drying up of the springs and sources of rivers, which form so marked and important a feature throughout New Zealand, and invite such favourable comparison with the water supply of neighbouring colonies.

Nor would the immediate gain of clearing such mountain tracts and rendering them available for sheep and cattle runs be anything like what is generally supposed, even presuming the time arrived when the timber, such as it is, could be disposed of at prices covering at least the cost of felling, and conveyance to market. The shingly nature of these mountains is well known to all who have visited them, and I am convinced that, in almost every case, a comparatively few years would see the thin coating of vegetable deposit, capable of yielding crops of grass, washed away, and nothing left but bare and arid hill-sides, affording neither sustenance nor shelter for any animal.

I cannot say that anything which I have seen would lead to the conclusion that bad effects from forest clearing have been experienced in New Zealand. The vagaries and dangers of New Zealand rivers date, I imagine, from too far back to attribute any of the difficulties connected with their control and the conservation of their banks to the removal of forest at their sources, which has besides not as yet taken place to any great extent. Be this as it may, we cannot be wise too soon, and nothing struck both Mr. Kirk and myself more forcibly, when on the West Coast, than the devastations which would be likely to ensue to cultivation and villages in the valleys, and to the towns of Hokitika, Greymouth, and Westport, from extensive forest denudation on the head-waters and course of the Hokitika, Grey, and Buller Rivers and their tributaries. The same doubtless holds good generally, and I have, therefore, thought it right to recommend that, as a first step towards a system of reservation, the forest at the head waters of all the rivers in Canterbury be reserved. Mr. Rolleston approved of this suggestion, and I believe the Waste Lands Board have been requested to give it effect.

It will be observed that I do not consider it proved that the presence or absence of forests alone exercises any appreciable influence on the total rainfall of a locality, though there can be no doubt that they do affect the general humidity of the atmosphere, and render the climate more equable. I have gone carefully through the meteorological returns of New Zealand during the past ten years,

from which I have compiled, for facility of comparison, a statement showing the rainfall from 1866 to 1875, with the mean of each of the periods of five years constituting the decade. There cannot be said to be any marked change at any of the stations either as to quantity or number of days on which rain fell, nor, from my personal observations, did I expect to find any. The rainfall appears indeed to have been greater during the last five years, but much is doubtless due to increased accuracy in observations. Christchurch, with a mean of 27 and 25 inches, is the driest station, if we except Cape Campbell, for which we have only two years' observations; whilst Hokitika, with a mean of 112 and 115 inches, bears the palm as the wettest station in the colony.

STATEMENT showing the MEAN ANNUAL RAINFALL during the first and second Period of Five Years, during the Ten Years from 1866 to 1875 inclusive.

Stations.	1866.		1867.		1868.		1869.		1870.		Mean for 5 years, 1866-70 inclusive.		Remarks.
	Days	Inches.	Days	Inches.	Days	Inches.	Days	Inches.	Days	Inches.	Days.	Inches.	
Mongonui ...	...	...	186	55.20	...	...	183	48.340	164	52.870	177	52.136	Observations for 3 years only.
Auckland ...	151	42.0	198	53.18	195	49.087	200	52.797	190	44.831	186	48.379	
Taranaki ...	156	55.7	165	60.69	161	50.420	152	55.125	175	54.720	161	55.331	
Napier ...	47	30.0	...	...	...	...	...	...	93	32.410	70	31.205	Observations for 2 years only.
Wellington ...	131	41.1	126	41.95	184	55.522	166	56.768	158	48.205	153	48.709	
Nelson ...	66	56.0	87	46.31	91	79.370	86	65.230	85	48.430	83	59.068	
Christchurch ...	87	19.4	96	30.07	128	30.041	120	27.292	137	28.364	113	27.033	2,104 feet above the sea.
Bealey ...	...	...	155	81.61	214	126.018	186	85.875	181	106.293	184	99.949	
Hokitika ...	212	127.5	193	110.51	214	120.210	180	88.210	188	116.680	197	112.622	
Dunedin ...	179	29.0	175	39.05	116	33.893	169	32.918	171	39.202	162	34.812	
Southland ...	136	47.2	153	41.62	169	46.346	156	42.680	159	53.950	154	46.359	
Stations.	1871.		1872.		1873.		1874.		1875.		Mean for 5 years, 1871-75 inclusive.		Remarks.
	Days	Inches.	Days	Inches.	Days	Inches.	Days	Inches.	Days	Inches.	Days.	Inches.	
Mongonui ...	185	57.640	180	46.900	158	63.720	165	56.950	160	52.530	169	55.548	Observations for 2 years only. 2,104 feet above the sea.
Auckland ...	194	47.505	186	42.096	170	41.237	174	35.024	200	51.310	184	43.434	
Taranaki ...	207	72.120	158	63.640	181	53.120	167	57.220	169	66.960	176	62.612	
Napier ...	106	35.890	108	23.940	143	42.380	147	37.940	144	38.260	129	35.682	
Wanganui ...	...	...	135	38.120	122	38.720	131	36.930	121	47.940	127	40.422	
Wellington ...	183	64.057	165	50.945	173	54.985	191	53.496	176	65.827	177	57.862	
Nelson ...	101	55.670	102	78.610	93	65.440	95	71.550	106	69.070	99	68.068	
Cape Campbell ...	...	...	...	...	...	...	109	28.150	106	21.510	107	24.830	
Christchurch ...	126	27.935	114	19.741	134	26.330	120	22.790	135	32.310	125	25.821	
Bealey ...	167	106.801	170	97.130	165	82.071	170	98.095	160	104.595	166	97.738	
Hokitika ...	196	122.440	179	123.210	161	96.170	171	104.480	186	130.790	178	115.418	
Dunedin ...	149	22.146	132	27.393	167	35.825	156	28.739	158	42.631	152	31.346	
Queenstown ...	...	...	117	28.880	131	32.300	115	30.190	114*	31.760	119	30.782	
Southland ...	144	39.030	144	40.110	191	37.480	206	44.650	201	44.180	177	41.090	

\* For 11 months.

## CHAPTER III.

## PROPOSALS FOR ORGANIZATION AND WORKING.

1. I confess that I see no feasible plan of dealing with the forest question in New Zealand save by the agency of a State Department, acting on definite and well-matured principles of scientific forestry, and supported by a Forest Act giving the necessary powers, and prescribing adequate penalties for the infringement of the forest laws. I am aware that many who are strongly in favour of some intervention to save the forests from destruction consider that it can be done by local bodies—that is, I presume, Waste Land Boards, County Councils, or Road Boards. The experience of other countries is, however, quite opposed to this theory. Not only are such local bodies naturally more or less ignorant of the very rudiments of forestry, but they must of necessity take far too local and limited a view of the question; they are besides subject to constant changes amongst their members, to local and political influences and bias, and to the very natural inclination of members of all such bodies to make the best of things, especially financially, during their lifetime, without regard for the welfare of future generations. I have said that the experience of other countries is opposed to the experiment of intrusting the great question of forest conservancy to local and non-professional bodies. It has been tried in Germany, and I believe also in France in the case of the Communal forests, but the *régime* proved so detrimental that they have all been placed in charge of the Imperial Department. It has been tried over and over again in India with like results; and, to come still nearer home, it has been, and I believe still is being, tried in Victoria with anything but encouraging results. There have been repeated appeals to the Government of Victoria in the Melbourne *Argus* during the past twelve months to do something in the matter, and the Forest Act recently introduced seems to have failed to satisfy the requirements of the country for the very reason that it provides no adequate special machinery, but hands over matters to local bodies, whilst giving what may be regarded as too much latitude to the Government as regards the making and enforcing regulations. So recently as the 10th of last month the *Australasian* concludes an article on "Forest and Lake," with the following words: "Let the Government not attempt to shirk its duty by handing over to local bodies the management of forests, but let it grapple with the whole question in a statesmanlike manner, and earn, even though it may not immediately win it, the gratitude and respect of the people whose interests have been intrusted to its care." I do not maintain that planting operations on a comparatively limited scale may not be carried out by the help of local bodies, as is proposed in South Australia: nay, if we limit our aspirations to this, fairly good results have been obtained in Canterbury under the Tree Planting Regulation Act of 1872, without the intervention of any public body at all. But this is not forest conservancy. Still less do I propose that the State Forest Department should stand alone and without the co-operation and support of the local bodies and councils—far from it: no department can less afford the loss of such support, and that of the weight of public opinion, for it must often, from the very nature of its duties, be unpopular for a time, or in a certain locality. All I do maintain is that some central controlling agency, with adequate machinery, working on a uniform and preconceived plan or system, is absolutely necessary to introduce and work out to advantage any satisfactory scheme of forest conservancy, such as New Zealand has it in her power to initiate and maintain. By all means utilize all existing local agencies, and ingraft the forest management as much as possible on the local or county institutions; but we cannot, if we hope to introduce a successful system, not for this generation alone but for the future, leave each local body to its own devices, or trust to them any more than to private enterprise for the conservation and maintenance of the forests of the colony.

I cannot, I think, conclude the consideration of this point better than by re quoting an extract from a despatch from the Secretary of State for India to the Government of Fort St. George, already cited in my address in Dunedin:—

"To forests, from their nature, the usual maxim of political economy which leaves such undertakings to private enterprise cannot be applied. Their vast extent, the long time that a tree takes to reach maturity, and the consequence that few persons live long enough to obtain any, and more especially the highest, returns from expenditure even once in the course of their lives, are proofs of the necessity that forest management should be conducted on permanent principles, and not be left to the negligence, avarice, or caprice of individuals, and therefore point to the State as the proper administrator, bound to take care that, in supplying the wants of the present generation, there is no reckless waste, no needless forestalling of the supply of future generations. This is matter of experience, not in India only, but in all other countries of the world."

2. But, it has been urged, the colony is too young for such a scheme—it will be time enough a century hence, when timber will be becoming scarce, and we shall be better able to afford it. The fallacy of this argument is, to my mind, so apparent that I have been astonished to hear it made use of by men whose opinions are, as a rule, worthy of consideration, and carry weight. It seems, indeed, scarcely necessary to refute it by pointing out that when the want is felt it may be too late to provide for it, and apply remedial measures, even at enormous cost, to the evils, especially those affecting the climate, which a century of abuse and heedless waste of natural resources will certainly engender. Population will have increased, vested rights and privileges sprung up, and incalculable damage to property been done, which it will be all but impossible to deal with and rectify.

The forest question is daily attracting more and more attention at the hands of all enlightened Governments and individuals. New Zealand is in a position to benefit by the experience of older countries, and what I understand to be the object of conservancy in this country is, to take Time by the forelock, preserve as much as is necessary of the State or public forest property *before* the crop of standing timber has been exhausted or deteriorated by indiscriminate felling and want of system, whilst we secure all the legitimate revenue we can from the sale of the large margin of "bush" which it

is proper should be cleared for the immediate supply of timber for public and private works and the progress of settlement.

I propose that we should profit by the example of other countries by introducing systematic management ere it be too late, and following in their footsteps in so far as they are adapted to the climate and conditions of New Zealand and its people. Nor can the colony ever better afford it than now. Every year the difficulties and obstacles in the way will be greater; vested rights will have sprung up; the wants of a large population for an immediate supply of timber will be paramount; and, whereas the object can now, I am confident, be attained at little or no cost, and a property of great indirect value in the present, and capable of producing a large and ever-increasing public revenue in the future, be secured to the colony, a hundred years hence it would probably cost thousands, if not millions, to attain anything approaching those results.

Ask France what she would give to undo the devastations of the past fifty years, made primarily in the supposed interests of the graziers and agricultural classes. Ask Austria what she would give to get back the public forests sold to meet the exigencies of the day. Ask Victoria and other Australasian colonies, and India, what it will cost them to remedy the devastations of the past. Ask even England, with exceptional advantages and circumstances in the shape of extensive planting by large landed proprietors, the command of the markets of the world, a small and densely populated country in which every acre cultivated with food grains is a boon, whether she would not have done better to conserve her public forests and place restrictions on the growth of common rights, which, so far as the public are concerned, mean private advantages acquired to the detriment of the interests of the public at large. The universal answer would, I feel sure, be, "Be wise in time, and secure the advantages which you now possess in your own interests and those of your posterity." I cannot sufficiently caution the Government of this country against the growth of so-called "rights and privileges" in the public estate. There are, I may say, none at present in New Zealand, but already there is evinced a tendency on the part of individuals and communities to advance and claim them on the score of uninterrupted enjoyment for a term of years. Nothing can be more natural, and nothing causes more heart-burning and dissatisfaction than to have to tell a man or body of men that what they have enjoyed free for any time is not their right and must henceforward be withdrawn, or only taken under certain conditions and on payment, even if it be but of a nominal sum. The sooner, therefore, the growth of such privileges is stopped the better and easier will it be.

3. Having thus combated, I hope successfully, some of the arguments against a State or public supervision of the forests, I proceed to state as briefly as possible what steps I propose should be taken to organize a department suitable for the purpose. First of all, I consider that a Forest Act is required providing for the selection and demarcation of the State reserved forests, and vesting their control and that of the unreserved forests, so long as they remain Crown lands, in a Conservator and body of officers specially appointed for the purpose, subject only to the authority of a Minister, to be styled the Commissioner of Forests, responsible to the House of Representatives and the public. Such an Act should provide the requisite legal machinery for the constitution of such reserved forests by the Conservator and forest officers, subject to the approval of the Commissioner, and authorize the Governor to make and promulgate regulations having the force of law for their due maintenance, conservation, and improvement. The control of such reserved forests should, in fact, be absolute, and, once duly constituted, they should be inalienable save by Act of the General Assembly. Power should also be taken to make regulations for the control and disposal of the portions of forest being waste lands of the Crown remaining unreserved, and of endowment forests the property of public corporations or institutions such as churches, schools, or hospitals, Harbour Boards, &c.; but such power should not be so wide, nor the regulations issued under it so stringent. These classes of forest would, of course, be alienable, and it would appear advisable to vest a certain amount of control and responsibility in this respect with regard to the unreserved State forests in the hands of the Waste Land Boards, subject always to the approval of the Minister for Crown Lands, who should also invariably be the Commissioner of Forests.

Full powers would be required for the assessment and collection of forest revenue, and the control and regulation of timber and other forest produce during removal from the forest, whether by land or water. The penalties for breaches of the provisions of the Act, or of regulations made under it, and the methods of enforcing them, should also be clearly prescribed. The power of allotting funds for State forest requirements and the disposal of the revenues accruing from State forests, whether reserved or unreserved, must rest with the General Assembly; but the Governor should be empowered to enter into agreements with the Conservator and all officers of the fixed or permanent establishment for periods of at least five years.

I am not sufficiently conversant with the course of legislation in New Zealand to attempt to draft such an Act; but I trust it will not be deemed presumption on my part to have thus called attention to some of the leading points which appear to demand special consideration or provision. Such an Act cannot, I would submit, be too minute in its definitions and provisions, so as to avoid even the appearance of illegality in our proceedings, especially at the outset. The regulations framed under it for each district or forest should also be very carefully considered, so that there should be no doubt but that we can legally enforce them. Neglect of such precautions has caused much trouble and detriment to the department in India, where, however, we have the rights and privileges exercised by two hundred millions of natives from time immemorial to consider and deal with.

It would by no means follow that the provisions of the Act should be at once applied throughout the colony. I should prefer that it be gradually introduced and extended as we felt our way, and could frame new regulations in accordance with the special circumstances of each district and its inhabitants. *Festina lente* is, to my mind, an excellent motto for forest officers in all parts of the world. We cannot be too careful not to introduce sweeping reforms and regulations, however excellent in themselves, without the support of or in opposition to public opinion. Granted that we had such an Act, I propose to proceed gradually with the constitution of the State reserves, whilst administering all forest lands of the Crown to the best advantage.

4. The State reserves would naturally form a very small proportion of the total area now under forest. It is difficult to lay down any hard and fast rule as to what proportion they should bear,

and I should prefer leaving it an open question, and deciding each case on its merits as we proceed. I do not think there is much fear of our reserving more than is absolutely necessary for climatic considerations and the supply of the future. Should there be any inclination to do so on the part of the departmental officers, the Waste Lands Boards, Crown Lands Department, and ultimately the House itself, would doubtless exercise a salutary check, and prevent our locking up, so to speak, too large a proportion of the colonial lands. Sir Julius Vogel's original Forest Bill of 1874, which did not meet with the approval of the House, proposed a maximum of 3 per cent. of the total area of the colony, but I am of opinion that in the case of some districts at least this would be found inadequate, whereas in others we could not obtain it in suitable localities or blocks, owing to the extensive alienations already made.

The proportion of forest to total extent throughout the German Empire is 25 per cent., of which about one-half, or 12½ per cent., is under State management. In India, where the constitution of reserved forests has only recently been commenced, and is in progress, the proportion at present varies from 2·7 per cent. in the Central Provinces to 18·7 per cent. in Coorg.

The task of selecting these reserves will be a very long and laborious one, but it is of the greatest importance even when, as in the case of the more densely wooded districts, we merely demarcated and surveyed them, and then let them alone till required without attempting any measures of improvement for the present. The procedure for their reservation would be somewhat as follows:—

The local forest officer would select in the first instance, and have the blocks roughly marked out, submitting his proposals to the Conservator, who, after visiting the localities, and consulting the Waste Lands Board and other local bodies, would decide whether to recommend the reservation or not. On the reservation of any block being approved by the Commissioner, it would be accurately surveyed and mapped, proclaimed as a Reserved Forest in the *New Zealand Gazette*, and, if deemed necessary, a Crown grant issued transferring it entirely to the State Forest Department.

In case of difference of opinion between the Forest Department and Waste Lands Board as to the advisability of constituting any reserve, the Minister for Crown Lands and Forests would of course decide. I see no difficulty in initiating this system and laying down a few simple rules for its working.

5. By far the more difficult problem presents itself as to the course to be adopted with regard to the large area of waste lands covered with forest pending the selection of the reserves, and how we are to insure the disposal of the balance or unreserved forests to the best advantage, and with the best financial results, not from a forest point of view only, but in the interests of the colony at large. I feel great difficulty and diffidence in approaching this point, for, whilst I cannot shut my eyes to the waste of natural resources now going on with little or no direct or indirect benefit to the colony, and cannot but feel that for the State to dispose of land at £2 per acre, the forest on which alone is worth £30 per acre, is surely not good political economy, I shall probably on the other hand lay myself open to the charge of advocating measures calculated to check the spread of legitimate settlement, the opening up of large tracts for depasturing or agricultural purposes, &c., when I propose that some check be at once placed on the disposal of forest lands throughout the colony, and that it should no longer be considered advisable to get rid of them without a substantial return.

I cannot, however, do otherwise than protest against the principle under which bush land has been alienated—I might almost say given away—at any sacrifice, and against the policy which I am aware has many advocates even now, which maintains that every acre of forest land taken up even without any payment to the State, and the entire loss of the timber on it by fire, is a national gain. I am far from wishing to check unduly the timber industry, the legitimate opening out of the country, and settlement of the people on the land, and I look forward to a time when probably nine-tenths of what is now forest will be cleared and brought under cultivation; but I submit that there is no hurry or necessity for pushing this forward, that there is plenty of room in New Zealand at present for all its inhabitants without sacrificing land covered with valuable timber for a few shillings per acre, and the prospect of indirect revenue in the future.

I would adopt generally the system now in force in Southland, by which all forest land is reserved from sale, unless specially surveyed and notified for selection and purchase. It is not, of course, proposed in Southland to lock up the forest lands for ever; but they find that the best plan of dealing with them is to lease by block to saw-millers for a term of years, on payment of a royalty or tithe, the idea being that, when the saw-miller has taken out all he can utilize, the splitter and firewood-chopper be allowed to follow, and then the land be exposed for sale.\* I say this is the system or theory, though, doubtless, it is not acted upon strictly in practice, new blocks being given before the old ones are sufficiently cleared; but the result, even with the very inadequate machinery at command for checking license-holders, &c., appears to be that Southland collects a considerable forest revenue (£1,200 a year); and I have not heard any complaints as to undue restrictions, or interference with settlement. I would intrust the entire charge and control of *all* the forests to the special department, which should manage them to the best advantage, lease blocks to saw-mills, regulate felling on license, and generally protect the forests from damage or waste; but, apart from the selection of the State reserves, I would vest the right of final disposal of the forest area, not so reserved, in the Waste Lands Board, instructing the Commissioner of Waste Lands and forest officers that they were expected to co-operate and settle periodically what forest is to be thrown open for sale, as well as the local rates and royalties to be levied, &c. In short, any proposal to dispose of forest waste land should be referred to the forest officer before the land be declared open for sale, and the Waste Lands Board be guided, so far as they think right, by his opinion. This need cause no unnecessary delay, as the reference would be made and settled *before* the land was declared open for sale; and I would allow no land to be taken possession of and cleared, as has been done in some districts, until it was declared open and surveyed.

6. To carry out this system, however, it will be necessary that a portion of the sale proceeds of all forest land be credited to the Forest Department. This is only fair, and any other course would naturally lead to the forest officers raising objections to all alienations, as affecting most injuriously the forest revenue both directly and indirectly.

\* Mr. Curtis, the late Superintendent, of Nelson, informs me that he suggested an exactly similar system, which was approved of by the Provincial Council, but thrown out by the General Assembly, in 1874.

I am inclined further to advocate that an increased price, to be settled according to the circumstances of each district, but in no case less than 10s. per acre, be charged for all forest or bush land (of course I do not include mere scrub). This proposal is likely, I am well aware, to be met by the assertion that open land is often, if not generally, more valuable than that covered with bush; that it costs much money to clear the latter, and that, therefore, to ask a higher price for it would be absurd and unreasonable. My reply would be that we do not want people to take up bush land unless they can afford to clear it, and can dispose of the timber and forest produce to advantage; that, if the forest is not worth paying for now, it will be some day, and that, in fact, we prefer to wait, in the case of forest land, until it has an appreciable value, and the State be enabled to secure the direct advantage of the increased price of its land, and the utilizing of the timber from it, instead of its being wasted and destroyed as now.

The colony cannot, I maintain, afford any longer to give away its waste lands at a mere nominal value, still less to have their natural products squandered and destroyed by individuals without any adequate contribution to the State or colonial revenue. If we are to have a self-supporting Forest Department we must obtain revenue from the indigenous forests, to meet the cost of supervision, selection, and eventual development and improvement of the reserved forest area, formation of plantations, &c. And this can be done by (a.) sale of State forests not required as reserves; (b.) lease of State forests to saw-millers, on payment of tithe, or an annual rent per acre; (c.) license fees and royalties from splitters, firewood gatherers, and all parties taking timber from any of the Government forests; (d.) the leasing of Crown lands, more or less covered with forest, for the depasturing of cattle or sheep—a plan which has been adopted in South Australia with, I am informed, the best results.

7. A very considerable revenue can, I am confident, be realized from these sources without any undue curtailment of legitimate advantages enjoyed by New Zealand colonists. I would make no exceptions to the rule that parties making use of Government forest in any way should pay for the privilege, but I would make such payments very light, so as neither to interfere injuriously with the timber trade or industry, nor press heavily on the holders of pastoral leases, farmers, and others. It would occupy too much space, and serve no good purpose, to enter into further detail of the measures proposed. I have but endeavoured to give their broad outlines. They may be summarized as follows:—

1. The formation of a State Forest Department, consisting of a permanent staff of officers, whose special duty shall be the care of the colonial forests, the selection and subsequent valuation, improvement, and working of State forest reserves, to be set apart for climatic considerations and the permanent supply of timber for the future (supplemented by artificial plantations where required).
2. The introduction of a special Act, giving the Governor power to appoint such officers, constitute the reserves, and promulgate regulations for the better management and control of all forests, being Crown property.
3. The selection, demarcation, and survey of the said reserves and their systematic management and improvement by the departmental officers.
4. The gradual disposal of the remaining forest area, or of the timber and other forest products which it produces, to the best advantage.
5. The formation of Government plantations as circumstances demand and funds admit. This subject is dealt with in the portion of Chapter II. devoted to the consideration of existing plantations.
6. The encouragement of planting by private individuals, also dealt with in Chapter II.

8. To initiate these measures and gradually enforce the regulations, I propose, for the present, the following permanent staff:—

- 1 Conservator of State Forests.
- 2 Assistant Conservators.
- 10 Forest Rangers.
- 4 Clerks in the office of the Conservator and Assistant Conservators.

The following tabular statement shows the rates of pay and allowances proposed, and the probable total cost per annum of such a staff:—

*Statement showing the proposed Rates of Pay and Allowances of the Permanent Staff of the State Forest Department, N.Z.*

No. and Designation.	Annual Salary.	Fixed Allowance.	Travelling Allowances calculated for six months at 3s. 6d. per £100.
1 Conservator of State Forests ...	£1,000	...	£315
2 Assistant Conservators at £400 each ...	800	...	270
2 Forest Rangers at £250 each ...	500	£50	} 675
3 Forest Rangers at £200 each ...	600	75	
5 Forest Rangers at £175 each ...	875	125	
2 Clerks in Conservator's Office at £200 and £150 ...	350		
2 Clerks in Assistant Conservators' Office at £150 each ...	300		
Totals ...	£4,425	£250	£1,260

The above represents a total charge for salaries and allowances of £5,935, or say £6,000 per annum, to which must be added £1,000 for actual travelling expenses.

9. I must explain that I have entered the salary of the Conservator at £1,000 per annum, as I do not think the colony will get one for less; it is the lowest rate of pay in that grade in the Indian Forest Department. The assistants' salaries I have retained at the figures now laid down in the Act, though I should prefer to give one £450 and the other £350. I have entered no fixed horse allowance for these officers, as the range of their inspection will be so wide that it would be impossible to get over them by maintaining one or two horses, which must therefore be purchased or hired as required. In the case of the Forest Rangers it is different: their ranges will be comparatively small, and it is very important that they should, as a rule, travel slowly through them on horseback, and therefore maintain a horse permanently, for which I have entered a fixed allowance of £25 per annum all round. Beyond this sum and the usual travelling allowance fixed by the Civil Service Regulations, I should deprecate any special travelling expenditure by the Rangers, *e.g.*, coach, railway, or boat fares, and only pass them under special circumstances. I would ask that the Governor be authorized to enter into agreements with the small staff specified, so as to give it a sense of permanency. The number of Rangers, and probably of Assistant Conservators, will doubtless be found inadequate ere long, and have to be increased: at present we shall but make a beginning, and as the revenue increases, as I believe it will, we can increase our establishments as required. Besides the permanent staff, it will be necessary to employ foresters, forest guards, gardeners, &c., as required, to assist the Rangers in controlling the felling, preventing damage to the forests, and formation of nurseries and plantations; but all this will be undertaken gradually and as we feel our way.

10. All I would ask the House to do would be to continue the grant of £10,000 a year for five years, as well as the annual revenue derived from the forests during that time, or as much of it as may be found necessary year by year for planting operations. From these allotments we shall meet all charges, including pay of the establishments just mentioned; and, at the end of five years, the department would, I should say, be in a position to do without the £10,000 a year, and have an annual excess of revenue over expenditure, depending merely on the amount of planting done on the one hand, and the rates of royalty, &c., it is deemed advisable to levy on the other.

Were I asked for an estimate for the next financial year, provided the department were organized and at work, I should say,—

Expenditure, pay, and allowances of the permanent staff, as per statement	£6,000
Travelling expenses of ditto	1,000
Pay of temporary establishments	2,500
Purchase of seeds, tools, &c.	500
Total	£10,000

The amount entered for planting (purchase of seeds, &c.) may appear low, but it is merely preliminary and for the formation of small nurseries; whilst the plantation reserves in Canterbury, where, I think, we should commence planting operations, are being leased for two or three years on conditions of fencing, breaking up, &c., free of cost to the State.

11. It is of course difficult, if not impossible, to estimate the revenue until we introduce the system even tentatively. In Southland it averages about £1,200 a year, and for the whole of the Otago Provincial District it is nearly double that amount, although it is admitted on all hands that the timber regulations are not complied with or enforced for want of supervision. In Auckland, Westland, and Canterbury a small revenue has been collected by the Provincial Governments of late years, but none apparently in the other provinces. The average for the past five years throughout the colony appears to have been £2,600 in round numbers. I think I may safely calculate on double that amount, or £5,000, during the first year of the existence of a State Forest Department; and of course, in the event of our being credited with a fair proportion of the sale proceeds of forest Crown lands, this sum would be largely exceeded. These are small figures, but everything must have a beginning. It may be thought that I have given too much consideration to this financial aspect, and apparently too little to conservancy and planting. Let me, however, not be misunderstood on this point. Conservancy for climatic considerations, the improvement of production, and permanency of supply of timber, &c., is the paramount aim and object of the forester; but financial results and economy of working must always exercise great influence on this question as on all others, and it is very important to consider them at the outset and endeavour to arrive at some conclusions, however vague they may be from the absence of the necessary data, as to the financial prospects of a department such as I have recommended to be established.

12. Forest conservancy in India was commenced some twenty years ago on a very limited scale, and with, generally speaking, a less clear understanding of its aim and object than I trust the Government of this colony now have. The issuing of permits or licenses to remove so many trees or cart-loads of timber, under certain restrictions and regulations, may be said to have been the first step which was taken, in Southern India at all events. In 1874 the Indian forest revenue was upwards of £700,000—nearly double what it was ten years before. The forest property taken charge of by the Indian Forest Department was in a much more dilapidated condition than that of New Zealand, and burdened by the rights and privileges of upwards of two hundred millions of native inhabitants. If conservancy there has been self-supporting and already yields a considerable surplus revenue to the State, there can be little doubt but that it can be made so here, where we have millions of acres of virgin forest unencumbered with any communal or individual rights.

13. I trust that the Government, after perusal of this report, will agree with me that, taking it for granted that "Forest Conservancy," in its broadest sense, is advisable and necessary in the interests of the colony at large, financial considerations need not prevent nor delay its introduction, and the formation of a State Forest Department in New Zealand.

J. CAMPBELL-WALKER, Captain,  
Conservator of State Forests, N.Z.

Government Buildings,  
Wellington, 16th March, 1877.

## APPENDICES.

## APPENDIX B.

## NOTES ON FORESTS AND PLANTATIONS IN THE OAMARU DISTRICT, BY T. KIRK, F.L.S.

OAMARU is the port of a district having an area variously estimated at from 12,000 to 15,000 square miles, devoid of extensive forests. With the exception of some limited patches of mixed forest at Otepopo, south of Oamaru, and at the Waitaki River on the northern boundary of Otago, Oamaru is entirely dependent upon imported timber for building and general purposes, even for firewood. On the north there is no really good forest nearer than Banks Peninsula, the produce of which goes entirely into local consumption and will soon be exhausted.

Timber, however, is less costly in Oamaru than might be expected from the above statement. The district exports vast quantities of cereal produce, especially to Auckland and Dunedin. Auckland vessels engaged in the traffic find it more advantageous to load with timber for the Southern trip at Auckland wharf or one of the adjacent saw-mills, at extremely low freights, than to take in extra ballast, which would have to be thrown out at Oamaru without the slightest return. In like manner Dunedin vessels loading for Oamaru take in a cargo of red or white pine at Catlin's River, so that during a large portion of the year the import of boards and scantling is rather in excess of the demand. I was informed that kauri ranged from 24s. to 28s. per 100 feet superficial; red pine, 16s. to 22s.; white pine, 12s. to 16s. Firewood, however, which is seldom imported by grain vessels, frequently sells at 60s. per cord, or higher. (At the time of my visit coals were selling at 70s. per ton.) The supply of fencing stuff is limited and uncertain, so that a large quantity of inferior material has been used in the district.

The soil in the vicinity of Oamaru is chiefly of a calcareous character and well drained; it is favourable to the rapid growth of many kinds of valuable timber. No trustworthy statistics as to the amount of rainfall could be obtained, but it is certainly much less than the average for the colony, in all probability not exceeding 22 inches per annum. \* In seasons when late autumnal rains prevail, the eucalypti do not ripen their young wood, and consequently suffer slightly from frost.

Large numbers of trees have been planted in the district, chiefly as single specimens, along fence lines, or in small clumps, although but few plantations have been formed at present. The most extensive plantations are those formed at Awamoa, by the Hon. Mathew Holmes, whose efforts have been attended with the best results. In nearly all cases in the district the trees exhibited a remarkably vigorous and robust habit. The trees selected by Mr. Holmes are chiefly eucalypti, conifers, and English oaks. Of the first he has fully twenty forms growing, either singly or in plantations. Of conifers he has fully 120 kinds (including *Cupressinae*, &c.) The plantations, including the ornamental ground about the house, cover nearly 120 acres, the greater portion of which was ploughed and subsoiled to a depth of from 18 to 20 inches.

The eucalypti most extensively planted by Mr. Holmes are termed "blue-gum," "red-gum," "peppermint," "cider-gum," and "stringy-bark." The common names of timber trees, as a rule, are applied with such a want of precision that no reliance can be placed upon them, and it is greatly to be feared that in so large a genus as eucalyptus, containing fully 140 forms, many of which are at present but little known and difficult of discrimination, even by good botanists, the evil will be felt to a greater extent than has been the case with our native trees. The majority of the eucalypti at Awamoa were not in a fit state for discrimination at the date of my visit, but Mr. Kidd, curator of the public gardens at Oamaru, has kindly promised to dry specimens in flower and fruit, and forward them with the common names attached for identification, when I hope to report at greater length. At present, I may remark, the blue-gum, *E. globulus* (Labill.), is rightly named; it may always be recognized by the large solitary, sessile, axillary flowers, and woody capsules. Both the Tasmanian and Victorian forms have been introduced by Mr. Holmes, and alike flourish with remarkable vigour, although the rate of growth is not quite so rapid as in the northern part of the colony. The Tasmanian form is distinguished by larger flowers and fruit. Trees nine years old are 33 feet high, with trunks 7 to 9 inches diameter. At least ten species are known by the name of "red-gum;" the Awamoa tree appears to be one of the many forms of *E. amygdalina* (Lab.), but could not be positively identified in the absence of flowers. Young trees six years planted are 23 feet high, with a trunk 6 inches in diameter at 3 feet from the ground. Whatever may be the correct name of this plant it is certainly one of the most valuable forms. The stringy-bark is probably *E. capitellata* (Lin.), and does not grow so rapidly as the preceding. Two or three different forms are termed "peppermint-gum;" one of them is *E. viminalis* (Lab.), sometimes called "weeping-gum." The cider-gum is probably identical with *E. Gunnii* (Hook.) of Tasmania and Victoria, where it is tapped for its juice, which is fermented and drunk as cider. It is one of the hardest species, although of small size. The white-gum and many other forms I was unable to identify, even approximately, and it is not unlikely that good flowering and fruited specimens of the kinds already named may show that errors have been made in the attempted identifications.

Nothing could exceed the clean-grown vigorous appearance of the great majority of the trees. In a few instances, I noticed that the leading shoots of eucalypti had been killed by frost, but the injury done was slight, and in nearly every case a new leader was rapidly replacing the old one. I have already stated that injury from frost is reduced to a minimum by dry autumns, which cause a more complete maturation of the summer growth: injury from frosts is less frequent in the low hills than in the valleys. At the same time it is abundantly clear that *E. globulus*, the true "blue-gum," apparently the most valuable species for the greater part of this colony, is not sufficiently hardy to warrant its being planted in the interior of the South Island. I saw no instance in which the "cider" or "peppermint" gums had been touched by frost.

\* Observations taken at Oamaru, 1871 and 1872, show a rainfall of 16·23 inches and 19·93 inches respectively.

The conifers most extensively planted at Awamoa are *Pinus insignis*, *P. halepensis*, *P. pinaster*, and *P. sylvestris*. The latter especially flourishes more luxuriantly than I have observed it elsewhere in the colony. Of *Pinus muricata*, there are fine symmetrical specimens 18 inches high; also of *P. austriaca*, *P. Jeffreyana*, *P. laricio*, *P. Benthiana*, *P. Sabiniana*, and many others. The majority of these, however, are planted out as single specimens. In the copious collection of spruce and silver firs, *Abies Douglassii*, *A. Menziesii*, *A. morinda*, and the well-known *A. communis*, demand special notice; also *Picea Nordmanniana*, *P. Fraseri*, *P. Webbiana*, and *P. pectinata*. The European species will probably prove of greatest value in this colony. *Thuja* and *Libocedrus* are well represented, and there is a comprehensive collection of cypresses, the specimen of *C. Craigiana*, although small, being one of the most attractive. Some remarkably well-grown deodars, numerous cedars of Lebanon (raised from seed collected on Mount Lebanon), and a fine Atlas cedar, are of special interest.

*Quercus robur* has been introduced into some of the plantations, mixed with pines and other trees; also the European ash, elm, sycamore, birch, lime, beech, oriental and occidental planes, with several poplars, &c., &c., nearly all exhibit the robust, vigorous growth so characteristic of these plantations.

In addition to the trees already mentioned, Mr. Holmes has formed good collections of *Crataegus*, *Ilex*, *Fraxinus*, *Pyrus*, *Ulmus*, and of general ornamental shrubs.

*Quercus Cerris*, the Turkey oak, is found in some of the plantations, and exhibits greater luxuriance than *Q. robur*. Although its timber is not equal in durability to that of the English oak, it is well adapted for general plantations in New Zealand, and is especially worthy of notice for street planting.

One or two of the plantations were formed by loosening and pulverizing the soil, in spaces about a foot square, at regular distances, as if for planting, then sowing two or three seeds of eucalyptus near the centre of each space, and ultimately pulling up the weaker of the seedlings. Although the general results obtained by this method are good, they are not equal to those obtained by ploughing, subsoiling, and planting, and in places where the work was somewhat slurred the difference is equal to three or four years' growth.

The great value of the holly for permanent live fences is demonstrated by a capital hedge of this plant at Awamoa. Three-years-old nursery plants were set out four years ago, 15 inches apart; the hedge is now perfectly sheep-proof, greatly superior to hawthorns planted at the same time. It is the best fence plant we have in this colony, for all ordinary soils.

The plantations were formed rather for shelter and effect than with a view to profit from the growth of timber. Had the latter object been kept in view I venture to think that even more satisfactory results might have been obtained by thick planting than could possibly be secured under the thin planting adopted in the mixed plantations.

In a young plantation of from 35 to 40 acres, to be made up to 60 acres, the trees, pines, poplars, oak, ash, willow, &c., are planted fully 24 feet apart between the rows, and 12 feet in the rows. Mangolds or potatoes are cultivated between the rows for the first three or four years, and kept clean by horse-hoeing. This certainly has the advantage of keeping the soil open and improving it without any great amount of impoverishment, so far as the trees are concerned. But if the plants were restricted to one or two kinds, and, if more than one, of kinds having a tolerably equable growth, and planted at a distance not exceeding 6 feet apart over all, the annual increment of growth would be greatly larger, as the energies of the plants would not be wasted on the excessive growth of lateral branches so largely encouraged by thin planting. At the same time the thinnings would almost from the first command a profitable sale in such a district as Oamaru, so that the trifling gain from root crops would be speedily exceeded.

There are few districts in which the formation of plantations is of greater importance, whether viewed with regard to their climatological effects or as furnishing a future timber supply, and I know of no district, on the whole, in which plantations could be undertaken with greater prospects of success, and direct profitable results.

#### APPENDIX C.

##### REPORT BY DANIEL ROBERTSON, FORESTER, UPON THE FOREST LANDS IN THE PROVINCE OF CANTERBURY.

SIR,—

In compliance with your instructions to me dated 23rd August, 1876, I proceeded to make an inspection of the forests and forest lands, hereinafter named, in the Province of Canterbury, and beg to report in detail as follows:—

##### FOREST OF WAIMATE.

The forest of Waimate, which originally extended to nearly 4,000 acres, is situated principally on the flat and lower portion of the hill about a mile distant from the township of Waimate, which township is twenty-eight miles from Timaru and the same distance from Oamaru—the nearest sea-ports. The main trunk line of railway, when finished, will pass within four miles of the forest. The timber consists of black and white pine and totara in nearly equal proportions, with patches of manuka along the upper edge. The whole, with the exception of 100 acres of a Government reserve, near the centre, and about 200 acres up a ravine in the north-west corner, has become freehold. In the former, the great part of the heavy timber has been removed, and the remainder sold to the owner of a saw-mill in the vicinity, by order of the Road Board. In the latter the timber is much lighter, and, being very difficult of access, is only worth (including land) from £7 to £8 an acre.

As these two patches represent the whole of the timber land belonging to the Government in the neighbourhood, they would not be worth the trouble of conserving. There are four saw-mills at work in the forest, and, if they are kept going at the present rate, ten or twelve years will clear the ground of its crop. This, as well as all the other forests in Canterbury, has been sold in large blocks to private individuals, at the nominal price of £2 an acre (land inclusive), and the present owners are selling the timber only to the saw-mill proprietors at about £65 per acre, and the land when cleared will readily realize an additional £6 an acre.

There is no timber of any description within a radius of forty miles of this forest.

## GERALDINE

Is twenty-four miles from Timaru and three from the Orari Railway Station, and originally consisted of about 400 acres of black and white pine and totara. Upwards of 300 acres are freehold, and have been almost cleared, and there are seven acres in the township of Geraldine divided into quarter-acre sections, which are exposed for sale every three months, and generally realize £45 per section.\*

In addition to this there is a Government reserve of sixty acres occupying a fine position on a rising ground immediately above the township,† the timber of which would be worth £24 per acre, and the land a similar sum per acre; but, as it is situated in such a picturesque position and forms a beautiful relief to the township and adjoining country, I would beg to suggest that it be retained. The trees are grown up, and the block could be let for pasture land at a small rental.

## PEEL,

Sixteen miles north-west of the Orari Railway Station, stands on a flat close to the foot of Mount Peel—a snowy range. The original extent, 1,400 acres, has been reduced to 800, and the timber consists of black, white, and red pine and totara, with a few patches of manuka up the face of the range. The timber on the flat is of fine quality, and would be worth at least £30 to £35 an acre. This block is entirely freehold, with the exception of the manuka portion, which could only be used for fencing purposes, and is not worth the trouble of looking after as timber land.

## ALFORD

Is situated irregularly along the flat at the foot and up the face of Mount Somers, distant about thirty miles from the Ashburton Railway Station, which is the nearest point of communication. It is about ten miles in length by one and a half in breadth, and the timber consists of black and white birch, with a few white and black pines near the south end. The whole of the timber land is freehold, with the exception of a strip about half a mile in breadth along the upper edge, the wood of which is of less value, owing to its smaller growth, the difficulty of access, and the top portion being little better than bush. The very expensive land carriage prevents the timber from being wrought so extensively as it would be if the transportation of the same was more easily effected, but a couple of saw-mills are at work, and a brisk trade is carried on in rail-splitting.

It would, considering all the circumstances, be difficult to say whether the portion in the hands of Government be worth conserving, or if it should be sold at the upset price, although I would be inclined to favour the latter course. Some years ago a large portion of this forest was destroyed by fire, the origin of which is said to have been accidental.

## OXFORD OR HAREWOOD.

Harewood, or, as it is more generally known, Oxford Forest, extends along the slope of Oxford Hill, forty to fifty miles from Christchurch. The original acreage, 56,000, has been considerably reduced, and a large portion at the east end entirely worked out. The wood consists principally of black and white birch, with a slight mixture of black, white, and red pine and totara. All the lower portion from one end to the other, and extending more than two-thirds up the hill, is freehold, and only about 7,000 acres now remain in the Government's hands. The timber on 3,000 acres of this would be worth, taking everything into consideration, from £8 to £10 per acre, and the remainder, being further up the hill, of considerably less value. If a stop could be put to any further sale I would recommend that the 7,000 acres be conserved.

As it would be difficult to prevent freeholders from clearing their lands of rubbish by means of fire, and as a precaution against the spread of the same to the Government lands, I would further recommend that a stripe of a hundred yards in breadth be cut and cleared between the freehold and Government lands. The expense of clearing would be amply defrayed by the price obtained for the timber thus removed.

I find there is an opinion generally prevalent that as soon as the Provincial Governments are abolished a different system of management will be exercised in the disposal of the timber lands, and the result of this is that an extraordinary run is being made on the same by speculators, and it is possible that the better part of this forest also may be bought up prior to the Abolition Bill taking effect.

There are eleven saw-mills in or near the forest, nine of which turn out from 20,000 to 30,000 feet per month, while the other two are devoted to the manufacture of firewood. The system adopted by the mill-owners in cutting down the timber is to let the same to log-men, who get so much for every 100 feet of output of the mills, and these men fell the trees in a rough and ready manner, which they deem the most profitable for sawing purposes, leaving the smaller, the crooked, and the decayed trees standing on the ground. The owners then let the remainder of the crop to fence-makers, who convert to their purposes all they consider suitable. The residue of the timber that remains, after the fencers have finished, being only fit for firewood, the ground is leased to men who prepare and remove it.

The work of cutting down, however, has been progressing at such an enormous rate that there are many thousands of tons of limbs, tops, and dead trees lying on the ground rotting, which would be very liable to catch fire at any time. Some few months ago a fire originated on the freehold portion of this forest which destroyed two saw-mills and several dwelling-houses. Inquiry failed to trace how the ignition happened.

Besides the mill-owners, there are numbers of others who have bought timber land on speculation, and who are holding their portions intact pending a rise in prices.

The means of transport are exceedingly convenient, the terminus of the Christchurch and Oxford Railway being at the very edge of the forest.

\* Note by Mr. Rolleston:—They are not now being offered for sale, and I think should not be.

† Note by Mr. Rolleston:—This is a recreation ground.

## LAKE WANAKA AND UPPER WAIMAKARIRI

Consist of 128,000 acres.\* The lower end almost joins the west end of the Oxford Forest, and extends for miles on either side of the Waimakariri River. As there are no roads near this block, and there being snow on the ground when I visited it, I only saw the lower portion; but I ascertained that the trees were similar to those in Oxford, and that, with the exception of the requirements of the settlers in the neighbourhood, who freely use the timber for fencing and firewood, the forest remains entire. Perhaps the best mode of treating this block would be to claim it as forest land, lease it to runholders at the ordinary run rental, and put a stop to all unauthorized cutting, the probability being that the value of the wood will be greatly augmented by the certain increase of population in this district when the supplies from other quarters are exhausted.

## BANKS PENINSULA.

All round Pigeon Bay, Akaroa, Robinson's Bay, Goff's Bay, and Le Bon's Bay, the land is entirely freehold, excepting a few Educational, Harbour, and Military Reserves from which the timber has been sold. In these districts 30,000 or 40,000 acres of timber were destroyed by fire several years ago. There are four saw-mills at work, but they are now merely gleaning what they can from the neighbouring freeholders. There is a block of timber at a place between Goff's and Le Bon's Bays, which is at present in its natural state, but I understand that the proprietor of the saw-mill at the last-mentioned place has purchased 500 acres, which will comprise all that is valuable as timber land. All along the tops of the ranges from this point to Little River there are several thousands of acres of bush still in the hands of Government, but I was unable to form a probable estimate of the acreage. In the valley of Little River there are patches of timber still pertaining to Government, but the best parts have been bought up, and the remainder, being scattered through the bush, is not worth while retaining as timber land. A very large saw-mill at this place is doing a good trade, the owner of which has bought up almost all the timber in the surrounding country, but the cost of transportation to the coast, necessitating, as it does, a considerable amount of boat and tramway conveyance, materially affects the value.

Upon the whole, the timber trade on Banks Peninsula is nearly at an end, the main object of the landowners being to get the ground cleared of timber and bush, and converted into pasture as rapidly as possible. Their mode of clearing here is to engage men at about 50s. an acre to cut the bush, which is afterwards allowed to dry on the ground prior to being burnt, and, should any large trees interrupt the progress of clearing, the expense of cutting is avoided by building the dried bush round them and setting fire to the pile. The fire has the effect of killing the trees, and many thousands of them remain standing in a scorched and blackened condition. Immediately on the bush being cleared, grass seed is sown above the *débris* of the fire, and it grows most luxuriantly from the first season.

The bush land remaining in the Government hands on Banks Peninsula is so broken up with small freeholds that it would be very difficult to get it leased, and in my opinion the most profitable plan would be to claim it as forest land and sell it.

In taking leave of Banks Peninsula, I consider that the clearing of the timber would not materially affect the rainfall of the district, as the land is so indented with bays, and as there will always be a sufficiency of bush to exercise the necessary and beneficial climatic influences.

With regard to the forests of Oxford, Alford, Peel, and Waimate, I am of opinion that the destruction of these would not alter the rainfall, they being closely tucked under and extended up the slopes of the snowy ranges, although their removal might lessen the flow of water (by the absence of shade) to the brooks and rivulets near them.

## UNAUTHORIZED CUTTING.

I do not think that unauthorized cutting prevails in any of the forests but those of Alford and Oxford, where, I believe, it is carried on to a great extent.

The absence of Rangers in the Canterbury Province would make it difficult to prove a case against trespassers, and a stranger would hardly be able to detect the line of march between the Government and freehold land, as the surveyors' pegs and narrow lines are in many instances covered with undergrowth and fallen trees; but, if the suggestion I previously offered relative to clearing a hundred yards as a dividing line be favourably considered, I feel confident it would prevent further interference in Oxford at least.

## WASTE OF TIMBER.

I am astonished at the reckless and improvident manner in which the timber lands of Canterbury have been managed; and it is no wonder that the Forest Department has derived no benefit from the sales effected, as it would appear that the timber—the growth of ages—had been considered and treated as an incumbrance on the land rather than a source of wealth, and invariably sold along with the ground, apparently without a thought being given to the value of the crop or the future necessities of the province, at the nominal rate of £2 per acre. Perhaps this is the reason that there exists so much senseless waste in its removal; and, if the present system of wholesale decimation is persisted in, the existing generation will see all the available timber in Canterbury cleared out.

If the Oxford and Alford Forests, where the principal crop is black and white birch—trees which grow freely from seed with little or no preparation—had been properly managed by clearing the ground of the original crop in a regular manner, and the inroads of cattle and sheep prohibited, I have no doubt but that by the time the present growth got exhausted a fresh supply of young timber would be getting up to be useful.

\* Note by Conservator:—There is some confusion here—the two are perfectly distinct and far apart, but were shown together in report on area available.

## FORMATION OF NEW FORESTS.

I could not find any of the seed in the Oxford or Alford Forests, neither could I get any reliable information from people in the neighbourhood; but from the fact that masses of young trees, varying from 6 inches to 20 feet, exist wherever openings occur, it is evident that there is seed, and that it grows freely. Both the black and white birch are useful and hardy trees, suitable for building purposes as well as for railway sleepers and fencing; and in the formation of new forests I would suggest that the seed of these trees be looked after, and, if it be possible to collect it, feel confident it would prove a cheap and expeditious method of raising a fresh crop, as by merely ploughing the proposed new forest ground, and sowing the seed broadcast and thinly, all the trouble and expense of rearing and transplanting could be avoided.

## SITES FOR NEW FORESTS.

With regard to the sites for new forests, the plains of Canterbury—180 miles long by about 25 broad—can supply plenty of situations, for, with the exception of a few round the various homesteads, not a single tree enlivens the monotony of the scene.

The climatic influences would be more beneficial on the plains than where the present woods exist, especially if planted in large blocks, the country being too exposed for the cultivation of small patches or belts.

I believe that the various sorts of English trees would grow there as well as blue-gum; and it would be politic to have a belt of 300 or 400 yards of native birch surrounding the large tracts.

As such large tracts of forest form climates of their own, stringy-bark, as well as other Australian trees, could, I believe, be got to grow in the centres.

There is one large reserve near the Waitaki Railway Station, another between Orari and Rangitata, and a belt along the line of railway for a considerable distance between that and Christchurch. In addition to these, there are large tracts on the plains belonging to the Government, but at present used for sheep runs, which could be used for forest purposes.

The sooner the proposed sites are fixed upon and pegged off the better, as portions of these lands are being bought every week.

I have, &c.,  
D. ROBERTSON.

Dunedin, 21st October, 1876.

## APPENDIX D.

STATEMENT of EXPENDITURE of STATE FORESTS DEPARTMENT from 1st March, 1876, to 31st May, 1877.

Particulars of Expenditure.	Amount.
Salary, Travelling Allowance, and Expenses, including passage from and to India, of Conservator ... ..	£    s.    d. 1,661 19 2
Salary, Travelling Allowance, and Expenses of two Assistant Conservators ... ..	454 15 5
Clerical Assistance, Office Furniture, and Contingencies ... ..	152 0 6
Total ... ..	£2,268 15 1



# SKETCH MAP OF NEW ZEALAND NORTH ISLAND

To accompany Report  
— of the —

Conservator of State Forests

March 16<sup>th</sup> 1877.

## REFERENCE

To illustrate the Report Chapter II.

No I the Kauri District

No II the Totara

No III the Red Pine

Kauri frequent

Totara

Red Pine

White Pine

Black Pine

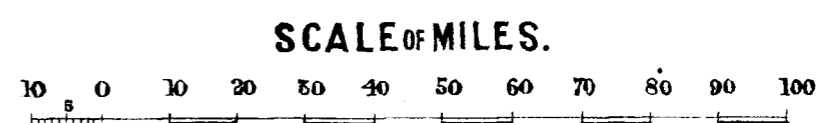
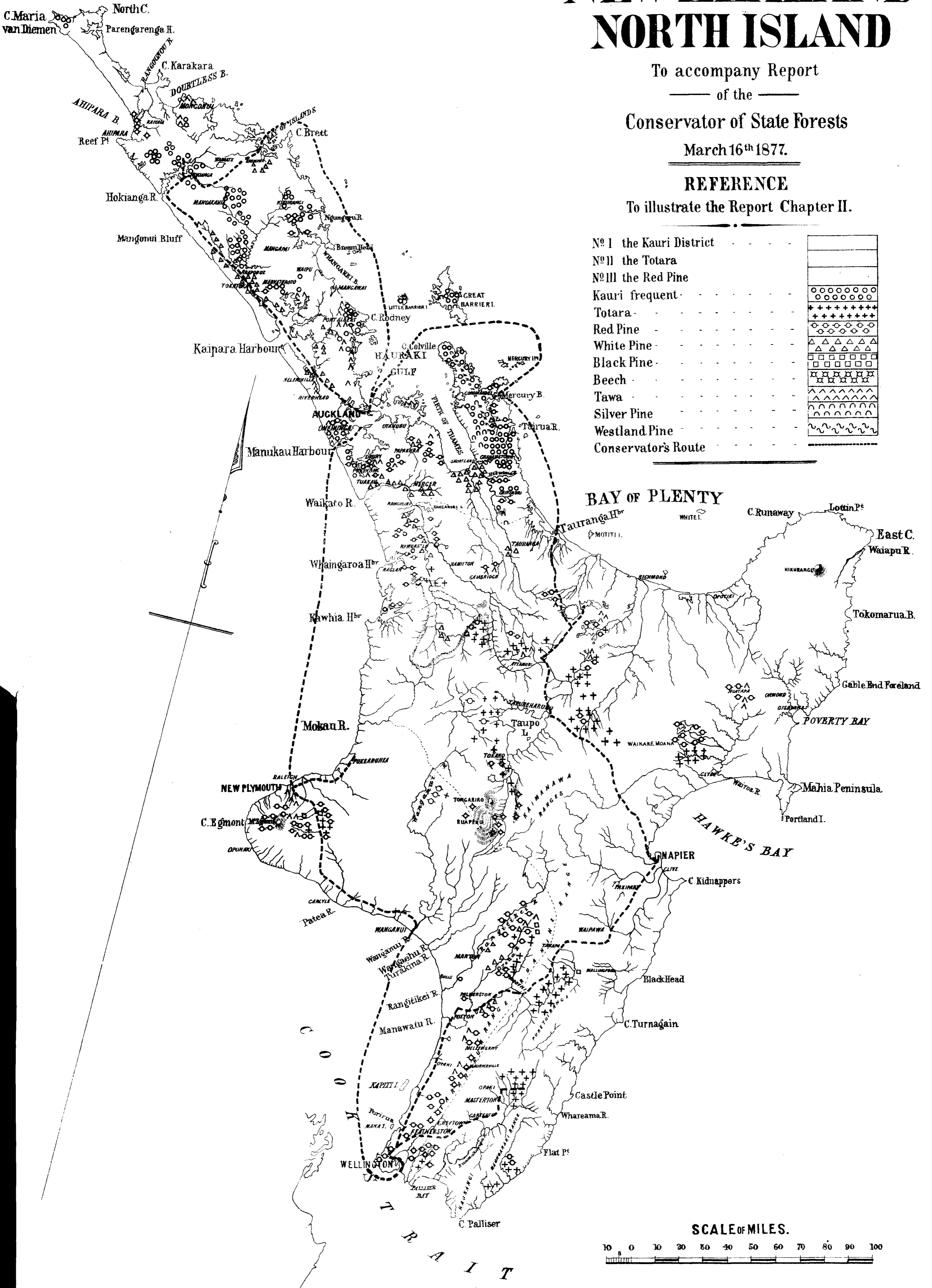
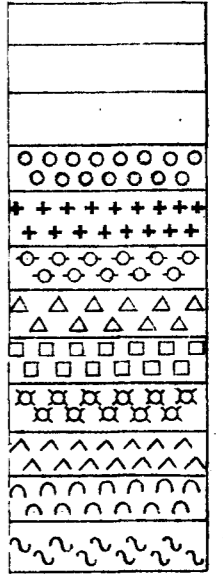
Beech

Tawa

Silver Pine

Westland Pine

Conservator's Route





# SKETCH MAP OF NEW ZEALAND SOUTH ISLAND

To accompany Report  
— of the —  
Conservator of State Forests  
March 16<sup>th</sup> 1877.

## REFERENCE

To illustrate the Report Chapter II.

N<sup>o</sup> IV Southern Lowland or Red Pine (Rimu) District

N<sup>o</sup> V Southern Upland or Façus

Kauri frequent

Totara

Red Pine

White Pine

Black Pine

Beech

Tawa

Silver Pine

Westland Pine

Conservator's Route

