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CONSERVATION OF NEW ZEALAND FORESTS

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

INTRODUCTION.

THIS report is practically the outcome of the Timber Conference held in Wellington on the 17th July, 1896, and following days. At the close of the Conference the Hon. the Premier of New Zealand, after having obtained the necessary assent of the Premier of Victoria, requested me to visit the forest districts of New Zealand, and advise generally upon the important question of State conservation of forests. Accordingly I left Wellington on the 29th July, and visited the Middle Island, *viâ* Picton, Blenheim, Havelock, Nelson, Buller Gorge, Westport, Mokihinui, Reefton, Arahura, Greymouth, Jackson's, Kumara, Ross, Hokitika, the Otira Gorge, Christchurch, Dunedin, Lake Wakatipu, Invercargill, and Orepuke in Southland; thence returning to Christchurch, and on to Wellington by steamer, when, after interviews with the Premier, I started for a tour of the North Island on the 14th September *viâ* Wanganui; thence up the river to Pipiriki, Raetihi, Waimarino, into the forest country at the head of the Wanganui River, near Taumaranui; thence round the volcanic districts Ruapehu, Tongariro, and Tokaanu; thence by central coach-route to Wai-o-uru, to Ohingaiti, and Marton; back to Wanganui, to Napier, and overland to Rotorua, *viâ* Lake Taupo, Wairakei, Waiotapu, and Tarawera; from Rotorua to Auckland; thence to the kauri-forests at Waitakerei, the Thames, and Coromandel Peninsula, and back to Auckland, sailing thence for Sydney on the 15th October, after exactly three months' inspection of the New Zealand forests.

I regret very much that, owing to the short notice given me to attend the Conference, I was unable (arriving only on the last day of meeting) to take part in the discussion on forest conservation, or share the labours of the committee appointed to deal with this subject, more particularly as I visited New Zealand as delegate for both Victoria and Tasmania.

In this connection, I have to acknowledge the compliment paid me by Sir Edward Braddon in appointing me to represent Tasmania, and thus practically showing his appreciation of my past services to that colony; also to thank Sir George Turner and the Hon. R. W. Best for the necessary leave of absence from my official duties in Victoria, which enabled me to become personally acquainted with the forests of New Zealand, and has led to the compilation of this report. To the Hon. the Premier of New Zealand (Hon. R. J. Seddon) I desire to express my sincere thanks for the facilities given me to inspect the colony thoroughly within the short space of time at my command. I am further indebted to the various officers of the public service for courtesies extended in furtherance of my mission, especially to Amelius Smith, Esq., of the Industries and Commerce Department; S. Percy Smith, Esq., Surveyor-General; and T. Ronayne, Esq., New Zealand Railways; to the Crown Lands Commissioners in both Islands; to the Crown Lands Rangers; to Messrs. Trapp, Brett, and Ross, directors of the Kauri Timber Company, and their energetic manager, Mr. Blair; to the Press of New Zealand also, for kindly notice of my work and antecedents, my special and hearty thanks are due; and to the sawmillers and other gentlemen, whose assistance was given me in a spirit of co-operation which made my task of inquiring into the condition of the New Zealand forests one of love rather than of duty.

I have to apologize for the unavoidable delay which has occurred in the preparation of this report. In consequence of my long absence from my official duties in Victoria my work there had fallen much in arrear, and had to be overtaken without delay. In addition, an unfortunate illness rendered me for some time unable to work at night, and proved a further hindrance in compiling this report.

I have dealt herein superficially with forestry in its many aspects, and trust my report may be the means of resuscitating the work of forest reform so ably inaugurated by Professor Kirk, F.L.S., and others.

SUGGESTIONS FOR THE MANAGEMENT OF NEW ZEALAND FORESTS.

The Experience of Other Countries.

The value of timber from New Zealand forests which has been used in the building of prosperous provincial cities and in other directions during the past fifty years is not easily estimated. It is quite safe to say, however, that the kauri timber alone thus used represents an almost fabulous sum of money. Yet, in spite of expert evidence as to the utilisation of these magnificent resources, in the face of rapid denudation of forest areas near the centres of trade and industry, the probable total extinction of the noble kauri, and the absolute certainty that thousands of acres of forest are practically perishing—since, unlike those of Victoria, New Zealand forests do not readily renew themselves by natural growth—the extraordinary fact remains that past Governments have allowed forest conservation to retrograde, although disaster must inevitably result from such neglect in the loss of their timber-supplies.

Nature invariably avenges reckless disregard of her laws, and, if the firestick is thoughtlessly used to strip hillsides of their natural protectors, floods and landslips very soon destroy the arable country at their bases. Because, up to date, no very serious disasters of this kind have overtaken New Zealand farmers it by no means follows such will not occur. On the contrary, it may be regarded as certain that, unless the teachings of experience in European forestry lead to the adoption of such scientific means as are there employed, the occurrence of disaster is merely a question of time. Although not due to precisely the same causes, the disastrous floods at Napier, whereby property valued at £100,000 was destroyed, is an illustration of what is likely to occur through deforesting. All experience shows, indeed, that a disregard of the value of trees in the economy of daily life entails serious consequences upon the country interested; that the wholesale destruction of timber trees is a national mistake, and that reparation of damage thus caused involves the outlay of enormous sums of money.

France, for instance, stands as an object-lesson and warning to those who oppose necessary official control of the timber-cutter's work. The French people cannot be regarded as a nation of fools; yet it would seem to the uninitiated clear evidence of folly that they permitted the destruction of timber on the slopes of the Alps and Cevennes to such an extent that already they have had to expend £850,000 in replanting a hundred and fifty miles of the denuded areas, and are still engaged in the gigantic task of reforesting a further six hundred miles. These mountains were at one time covered with timber. As the grazing of sheep and cattle extended rapidly, timber was ruthlessly destroyed in favour of the grass. Retribution followed. In due course the flood-waters, pouring down the sides of these mountains, carried and distributed over the valuable farm-lands—some of the richest in France—billions of tons of silt, sand, and stones, rendering utterly valueless tens of thousands of acres of splendid country, till the scheme of reforestation above referred to became an imperative necessity.

In Switzerland also the same reckless destruction of trees resulted on several occasions in near approach to a timber famine, which was only averted by the active intervention of the Federal Government.

Of Germany, Austria, Sweden, Norway, and every country in Europe the same story of disaster by avalanche, cyclone, or floods resulting from the denudation of forests is told.

Yet, though these facts are well known, the Governments of Australasia have so far shut their eyes to the lessons they inculcate, and permit the vandalism of the splitter, hewer, &c., to have full access to forest reserves, when it is pointed out that national loss is certain to arise from such a course. Can any one suppose that the great European countries previously referred to employ each thousands of men to protect and conserve their forests on sentimental grounds, or that France undertakes the expenditure of millions in reforestation for no more practical reasons?

In view of the experiences elsewhere, the question of how best to deal with conservation of forests must be regarded as of momentous importance to the people of New Zealand, since upon the efficiency or otherwise of the work undertaken depends whether they shall gain a substantial revenue from their timber or suffer tremendous national loss.

To adopt in their entirety European systems would probably be too severe a shock to the New Zealand timber-cutter, who cannot be expected as yet to recognise the necessity for so drastic a reform.

The Indian system, admirable as it is, is open to the objection of being cumbersome, through the division of control between local and Government authorities, and also on account of the somewhat autocratic methods adopted of dealing with the forests and the numerous industries interested in them.

The democratic tendency of the peoples of Australasia makes the task of the trained forester very difficult indeed, and hence any scheme devised to meet colonial requirements must be of a character to commend itself to the good sense of the public who are chiefly interested in forest products. At the same time, it must embrace the leading principles of scientific forestry without which no scheme with this object can effect any real good. Every care, for instance, must be taken, so far as national interests permit, to minimise the risk of hampering the operations of sawmillers now engaged in the timber trade. To this end sudden and violent changes must be avoided, and existing interests carefully safeguarded. Every possible effort, indeed, should be made to conciliate and win over the sawmillers in favour of systematic organization in his own and the national interest, both of which are equally benefited by it.

During my New Zealand tour I am happy to record that I found among sawmillers a most intelligent appreciation of the necessity for forest reform, and a strong desire on the part of leading members of the trade to help the Government to place forest matters on a better footing. These men have been keen enough to see that the present wasteful system, and the frequent occurrence of disastrous fires must, unless remedial measures are speedily adopted, drive them from their holdings by cutting off supplies from the mills within a very short time.

Undoubtedly there has been a feeling of antagonism to forest expert treatment on the part of timber-cutters and dealers, but this has generally resulted from ignorance of what expert treatment of forests really is.

By the efficient forester, the sawmiller and his employés are regarded as "aids" to forest conservation, the object of their presence on the reserves being to remove matured timber as soon as it is fit for conversion with as little damage as possible to the trees left standing.

The sawmiller should be encouraged to place his mill in such a position as will insure the readiest means of cutting out timber in "rotation blocks," marked out and shown on working-plans, to provide for the removal of one block per year, a sufficient number of blocks being so laid out as would enable the miller to carry on work continuously for a stated number of years. The exact number, of course, depends upon the length of time required to bring the young trees, either planted by hand or growing up naturally, to maturity. Such sawmill sites should, in the first instance, be let by tender, and no more than one mill should be allowed to operate on the same series of "rotation blocks." The effect of this system would be to check that undue competition by close proximity of several mills which results in too close a cutting of the forests. It would also insure greater care on the part of the sawmiller, by giving guarantee of permanent occupation for the stipulated period. The annual output could be gauged by the work of previous years at each mill, and thus the size of blocks required for an annual supply could be determined. This briefly describes the "rotation" system of cutting, which should be carried out on a working-plan approved at head-quarters, and from which no deviation should be allowed.

In connection with the adoption of a practicable scheme of forest conservation for New Zealand, great and valuable preliminary work has been done by Professor Kirk, whose reports of 1886 suggest a satisfactory basis.

Not having at hand a copy of the New Zealand State Forests Act, I am not in a position to comment upon it in detail. If, however, it has been framed on the general lines laid down by Captain Campbell Walker and Professor Kirk I am satisfied very slight alterations will be necessary to bring it into line with up-to-date forestry requirements. I will therefore briefly summarise the suggestions which I think should be carefully considered in dealing with this important subject.

1. A new Act, or amendment of Acts now in force, should be passed to create a Forest Department, and fix the status, duties, and emoluments of its officers. Power should be given—(1) To make permanent and inalienable existing reserves, no curtailment of area being permitted except such as is sanctioned by both Houses of Parliament; (2) to permanently reserve such other areas as from time to time may be found necessary. Political interference with the actual working of the forests, apart from State policy, should be specially guarded against. The Conservator should manage the forests from a scientific and national standpoint, giving due consideration to all interests involved. All technical work should be left to his expert and trained judgment, and in no case remitted to the political chief, who should as far as possible give the Conservator a free hand with regard to his professional duties.

2. No new settlement within the area of State forests should be permitted, and where such have been established the settlers should be bought out.

3. Areas should be so reserved that each forester could supervise one large or a group of smaller forests, except in sparsely-timbered districts. State forests should not be of small area; such are relatively more expensive to supervise and work than those of large extent.

4. It is absolutely essential that the chief officer, or Conservator, should be a trained expert, otherwise the principles of scientific forestry cannot be carried out, and the work of the department must end in failure.

5. The Conservator should have absolute authority in all matters of technical or professional detail connected with plantation, conservation, supervision, &c.; also over the employés of his department. To this end, he should have special powers, and be entirely free from political pressure or interference of any kind.

6. Apparently, the only means of making this officer independent of political influence would be the creation of a powerful buffer between him and the Minister who presides over his department. Such a buffer could only be provided by constituting a Forest Board of three Commissioners, with the Conservator as *ex officio* chairman. The Trust should be non-political, and meet once a month, members receiving a stated fee for each attendance. The duties of these Commissioners would be—(*a.*) To safeguard the forests as national property against all attempts at encroachment by private individuals or local bodies. (*b.*) To act as a board of advice to the Minister on questions of forest policy, such as royalties, increase or reduction of forest areas, and generally to strengthen the hands of the Conservator. (*c.*) To submit an annual report upon the work of the department during the past year. Among the clauses framed to constitute this Board and define its duties and powers should be the following:—

(1.) The State forests shall be permanently reserved and inalienable equally against Her Majesty as against other persons. All forest buildings, nurseries, plantations, fences, and improvements of any kind whatsoever shall be vested under joint control of the Commissioners of Forests, or (as an alternative, if thought advisable) in the Minister and the Commissioners of Forests.

(2.) Commissioners (including the Conservator) shall be appointed by the Governor in Council, *aut vitam aut culpam*, subject to removal from office only with the sanction of Parliament. Upon all questions relating to general policy, the alienation of, increase of, or excision from State forests, to royalties, &c., the Commissioners shall make suggestions to the Minister, who shall cause such suggestions to be laid upon the table of the Legislative Assembly. After the expiry of fourteen days these suggestions, or such amendments as Parliament may make, shall be formally approved by the Minister, and, after being gazetted in the usual way, shall become law.

Should the Commissioners be unable to agree upon any question of forest policy the Minister shall appoint some prominent State official to act as arbitrator, and, subject to the Minister's approval, his decision shall be final.

If it be decided to apply a carefully-considered and approved system of working the forests according to accepted scientific principles and working-plans, after mature consideration and a rigid inspection of special local surroundings is adopted, it is absolutely imperative that no outside interference should be permitted, or consideration of political or private interests be allowed to retard the work by altering the scheme inaugurated.

The life and growth of trees vary to such an extent that years must of necessity elapse before a system modelled on the French, German, Swiss, or Indian forest codes can be fully worked out. Any interference with the Conservator in carrying out the details of his scheme must therefore in many instances render futile the work of years, and in some cases risk the overthrow of the entire system. It must be remembered that the culture of forest-trees entails a "rotation" plan extending from forty to eighty years. However well conceived and carried out such a plan may be, any "break" must overthrow it. It is quite simple for a Minister, influenced by people who are ignorant of forestry principles and requirements, to cause such a "break," but it is a work of greater difficulty, which involves many years of time lost, to repair the damage so done.

For all these reasons the foundation and most essential condition to the establishment of a successful Forest Department is an Act of Parliament giving the Conservator of Forests secure tenure of office and ample powers to insure the uninterrupted and continuous progress of the work intrusted to him. This Act should contain clauses to provide that all timber areas now in the hands of the Government (or that may be hereafter acquired from the Maoris) should be proclaimed permanent State forests, and should be safeguarded by the most stringent conditions. It should further provide for the adoption in working the forests of the broad principles of systematic and fixed conservancy, details being left entirely in the hands of the skilled officers; and insure the officers from all danger of intimidation in the exercise of their duties.

An experience of four colonies, extending over sixteen years, of the manner in which political considerations are permitted in Australasia to override the essentials of forest conservation and culture, justifies the emphatic assertion that without such an Act the establishment of a successful system is impossible.

As part of the duty placed upon me by the Hon. the Premier, I feel bound, therefore, as a forest expert, to fearlessly express my views on this and all other matters which, by subjecting forest officers to rebuffs and trials of a vexatious nature, not only dishearten any man who understands and loves his work, but make the ultimate success of his operations utterly impossible. It is with a view of enabling your Government to make provision at the outset against such difficulties and dangers as I have described that I have written so frankly upon forestry as carried out in the Australasian Colonies at the present time.

The necessity for immediate action in New Zealand is apparent, and unless forest reforms are inaugurated speedily the timber famine, which already threatens in your colony, must come.

Enormous quantities of timber are required to meet the great and increasing demand for wood-paving in all the great cities of the world—a trade as yet only in its infancy. When the authorities really grasp the fact that Australian hardwoods are absolutely the best timbers in the world for such purposes, the possibilities of forestry will assume startling significance, and neglect to provide for profit from this demand must be regarded as almost criminal.

Blue-gum is largely grown in New Zealand, and as soon as jarrah and red-gum become scarce (the latter already is so in most of the colonies) this timber must be one of the foremost in public favour, being particularly adapted for wood-paving, and especially so for such use in wet places. Large plantations of these and other *Eucalypti* (which mature so rapidly that in twenty-four years they are ready for the sawmiller) could be planted with great profit, both by the Government and by private persons.

Already the Americans have become dissatisfied with their own deals for street-paving, and the City of Philadelphia has commissioned its museum authorities to inquire into the suitability in price, quality, and quantity available, of Australian hardwoods for this purpose. This fact alone indicates the probability of an extensive trade in such timbers in the near future.

During the past forty years millions of money have been sent to America in payment for the soft woods of that country, and now there is every probability, if our opportunities are seized upon, of some of these millions coming back to Australia.

The cultivation of such *Eucalypti*, as may be found by experiments now being conducted in Melbourne and elsewhere, most suitable for the purpose, opens up a vast field for the operations of up-to-date forestry, and there is no reason why New Zealand should not compete with the other colonies in supplying the demand for these timbers, while her own indigenous timbers will become too valuable for use in this way.

Before closing this portion of my report I feel bound once more to warn the Government of New Zealand that if forestry operations—of such vital and momentous importance to them—are not placed at the outset upon a solid and permanent basis no practical good can result. No half-hearted measures, no subsequent "tinkering" with the subject, can insure the maintenance of the forests and profitable use of their timber. It is absurd to appoint experts, waste money upon a "bastard" system, and yet allow what little good work might be done even under that to be neutralised by alterations of policy on a change of Ministry or in the exigencies of some political interest.

Systematic and scientific treatment has been proved and recognised as indispensable in the experience of every one of the older countries. Such treatment cannot be applied if the system is disarranged merely to oblige Jack, Tom, or Dick, who supposes that an elector's or miner's right gives him authority to burn, cut, or otherwise destroy timber at his own sweet will, and without any reference to the rights of the people as a whole, who really own the forests.

If, therefore, in these suggestions I have been able to throw any light on a somewhat difficult problem, and through my candid criticism on the position which forestry unfortunately occupies on this side of the globe, New Zealand reverts to real forestry, and takes it up this time in a large-hearted vigorous fashion, determined that there should be no faltering or turning back, then I am certain she will find her forests a blessing and means of employment to thousands, and the Government will never regret any money spent in insuring systematic scientific conservation.

EXAMINATION OF NEW ZEALAND FORESTS.

South Island.

In compliance with your request that I should inspect the colony generally, with the object of advising the New Zealand Government upon forest-conservation, I left Wellington on the 29th July for Picton, and on the following day travelled by rail and coach, *viâ* Blenheim, to Havelock.

Following the fine valley of the Wairau for some distance in the keen frosty air, the lofty peak of Tapuaenuku (9,462 ft.) stood out clearly, rising above other snow-clad mountains.

Doubtless, at one time, before civilisation reached this valley, the Wairau River ran its impetuous course through dense pine forests; now, bare hillsides and shelterless river-flats meet the eye on all sides. Along the main Nelson road, through the Kaituna Valley, traces of the old forest are seen here and there; but this valley, too, has been completely denuded of timber, and is now solely devoted to grazing purposes, yet twenty years or so ago numerous mills flourished here, and immense quantities of timber of excellent quality were obtained.

Pressing on, we arrived at the pretty town of Havelock, and the lovely waters of the Pelorus Sound suddenly revealed themselves. A day was spent in examining the forest of the Pelorus Valley, and the sawmill (named after the Sound) owned and worked by Mr. Brownlee, one of the pioneers and patriarchs of this district. This gentleman started sawmilling at Mahakipawa in 1864. Then the Kaituna Valley was invaded, and, to the incessant hum of the saw, the forest giants fell before the axes of civilised intruders. The forest was soon cleared, and as the timber disappeared the mills followed suit one by one, and, the *débris* being burnt off, the land was taken up for grazing and agriculture. Thus the Wairau Valley first, and then the Kaituna, under the combined efforts of the farmer, bush settler, sawmiller, and their followers, were denuded of timber, and in a very short time miles of forest were absolutely swept away, and the land devoted principally to grazing.

The fine valley of the Pelorus is now being subjected to similar treatment, and, with the torch of the small settler in full swing, its forests also will within a few years be things of the past.

Here, close to water-carriage, and within six hours' steam of the capital, are millions of feet of some of the best pine timber New Zealand possesses. Yet the Government is actually permitting settlement in the heart of the forests, and even ahead of the mills. The result is, of course, free use of the firestick, and the destruction annually of thousands of pounds' worth of timber—all for the sake of a few sheep.

In the years to come, and not far distant, when New Zealand has to import Baltic and Oregon clear-pine and American red-pine, a fierce regret will assail the heartstrings of those who have to pay the piper as they look back at the shameful waste and wanton vandalism of the early settlers.

Mr. Brownlee is a typical sawmiller, of a kind that New Zealand may be proud of. Of keen business intellect, he has gathered round him a mill plant second to none in Australasia. Everything is of the best, and up to date. His tramway, twelve miles long, is a marvel of sawmill engineering, and the bridges would do credit to any railway in New Zealand. One, over the Pelorus, is 320 ft. long by 16 ft. wide; the Wakamarina Bridge is 200 ft. long and 20 ft. above the water. Birch (beech) piles and iron girders are used in the construction of these bridges, which are solid and substantial. All through the line is properly constructed and well ballasted, including an embankment half a mile long and 20 ft. high. Mr. Brownlee uses a hauling-engine to bring logs from the bush on to the tram-line, whence they are drawn to the mill by a steam-motor. (This plan was copied from that adopted by Mr. John Hay, of Hastings, Tasmania, which I saw in operation during 1887.) The hauling-engine is practically a locomotive, with a pair of 9 in. cylinders, 18 in. stroke, gearing reduced to 14 to 1. The drums are of 5 ft. diameter and 12 in. wide, with 12 in. flanges. It works fore and aft, parallel to the tramway, to connect with which half a mile of wire-rope is used. For bringing logs across the river a curious contrivance is utilised. This is a hollow iron cone, torpedo-shaped, made of $\frac{3}{8}$ in. boiler-plate, in various sizes, strong strapped iron edges, and a ring at the point. These cones fit on to the end of the log, and an endless wire rope runs on pulleys into the river. The motor is hitched on, and the log is speedly hauled through the river and on to the tramway. Mr. Brownlee has also patented an automatic snatch-block, which is a marvel of simplicity and usefulness, doing all that is claimed for it with ease and celerity. The present mill was started in 1888, but the tram-line was constructed in 1878, ten years earlier. The output of the single mill then in use was about 2,000,000 ft. superficial annually. That of the present mill exceeds 3,000,000 ft., clearing an area of about 300 acres every year. The area, in all, so far cleared of timber treated by these mills is about 2,000 acres. Mr. Brownlee estimates the quantity of timber in the Pelorus Valley at about 50,000,000 superficial feet, though much of this is difficult of access.

The Rai Valley still contains about 130,000,000 superficial feet, chiefly rimu (red-pine) kahikatea (white-pine), mixed with matai and miro. With the demand as at present, and fair-play from the settlers, there is still thirty years' supply in this district. The altitude level of the timber trees is about 2,500 ft. above the sea, but the best are those in the river-flats and up to a level of 1,000 ft. Beech (the so-called birch of New Zealand) is the prevailing timber on hillsides and mountains above 1,500 ft., growing smaller and more stunted up to 2,500 ft., which is here practically the limit of tree-growth. The ranges from 2,500 ft. to 9,000 ft. are destitute of timber, and, as mountains of such altitude are very numerous, and form the whole central backbone of the South Island, there is

here an enormous area of useless and non-productive country. The timber generally hugs the littoral or maritime regions, but is somewhat patchy, and varies considerably in quality.

From the head-waters of the Pelorus Sound the coastal range, extending nearly to Nelson, contains fine timber, but a vast majority of the trees are beech (birch), with pines growing on the flats and hillsides at low altitude.

Leaving the Pelorus, the wooded slopes of the Tuamarina and Rai Valleys open up, and rimu and kahikatea, mixed with matai, miro, and totara, can be seen clothing the slopes of the hills fast closing in the narrow valley of Pelorus, whilst away in the distance, set in a frame of blue sky, with a foreground of shining river and a background of dark-green, almost purple, trees, Maungatapu's lofty head keeps lonely watch and ward over the scene of the brutal murders committed by the Sullivan gang.

From a forest point of view there is nothing calling for special attention to record from the Rai Saddle to Nelson, and the traveller on this route is successively struck with admiration by the skill of the coachman (Newman), the marvellous training of his horses, the engineering science exhibited in the making of these dangerous and hair-raising roads, and the courage of the men and women who travel over them.

The pretty town of Nelson was reached late on Saturday night, and Sunday devoted to inspecting its picturesque surroundings. The local Botanic Gardens were duly admired, and I cannot but compliment the curator on the excellent taste shown in laying out the ground, and congratulate the Town Council on the result of his work. Nelson has every reason to be proud of its Botanic Gardens, and on the *tout ensemble* of the environs of the city.

Leaving Nelson on Monday, a short stage was covered to Foxhill, and opportunity taken to note that in the early days of Nelson immense quantities of timber had been destroyed, used, and sold from the hills adjacent to the town. These, which encircle Nelson in the form of a crescent, were at one time—not so very many years ago—densely timbered with fine forest trees. But here again the theory that "a man who makes two blades of grass grow where only one grew before," no matter what he destroys to accomplish this, is a benefactor, was universally adopted. Hence thousands of thousands of acres for miles around in this fertile province were converted into pasturage for sheep by the sacrifice of millions of pounds' worth of timber destroyed to attain this worthy (?) end.

A large quantity of timber exists in the neighbourhood of Golden Bay and along the rivers debouching into it, more particularly on the Motueka and Takaka Rivers, while portions of the Waimea district appear to have been extensively wooded at a comparatively recent date. In nearly every instance the timber proper—*i.e.*, rimu, kahikatea (white-pine), matai, and miro—seems to hug the lower altitudes, while the higher elevations are covered with beech. A grave mistake in calculating the quantity of timber available in this district has evidently been committed here by persons not fully conversant with timber-supply. They saw apparently immense forests spread out before the eye, but quite failed to realise that by far the greater portion of the trees in sight were merely beech scrub on the high lands, while the good timber is confined to the flats and banks of creeks and other streams running into the main rivers.

The timber on the Motupiko River is somewhat scattered, with "bushes" of better timber in the lower parts than in the higher, where it is decidedly inferior. From this point—Motupiko—to the Lyell the timber is inferior, and, though patches of good bush doubtless exist, nowhere can they be said to be either plentiful or of extra good quality.

The Buller, with its wonderful gorge, shows large quantities of good timber, but the bulk of this is so inaccessible that it is useless to reckon this forest as a source of supply, except, perhaps, for mining purposes. Here the trees grow in picturesque profusion right up the steep precipitous cliffs, which neither man nor beast could climb. A few sawmills between Longford and the Inangahua Junction supply the miners with building and mining materials, but the "plants" are small, and the output in proportion to the machinery in use. The steep cliffs of the Buller are clothed with foliage right down to Westport, the light brownish-green of the rimu and the darker shade of the white-pine standing out amid the beech scrub, all beautiful to look at, though the last-named is commercially of little value.

Leaving Westport, a trip was made by rail to the terminus at Mokihinui, passing Millerton, Seddonville, and other stations, and visits paid *en route* to several sawmills. All the timber for these is obtained from flats between the coast-line and the mountains lying just back from the sea. This timber is of excellent quality, but not very abundant, the best of it being obtained from places a few feet above sea-level.

At Mokihinui a sawmill is situated in a good bush, the extent of which is not known. It apparently extends through a long valley of the river, and may run for many miles. The timber here is excellent, and there is no difficulty in getting it out, as the grades for tramways are easy, and the country fairly accessible. The forest included some large rata-trees.

There appears to be a considerable supply of timber in this district, and the Government would do well to proclaim the whole valley a State forest.

Returning to Westport, the journey through the Buller Gorge was safely negotiated, and the fine flats of the Inangahua River were inspected. Some splendid specimens of the white and rimu pines were seen, tall, straight, and of good girth, but in far too many instances the settler has "settled" the timber by burning it.

Reefton was reached on Friday, the 7th August, the following day being devoted to visiting the sawmills in the neighbourhood of this large mining centre. I visited Messrs. Erickson at their mill, and interviewed them on the quality and quantity of timber in their neighbourhood. The usual mixture of rimu, white-pine, matai, miro, and beech is found here. The last-named are unusually good, and very large trees are obtainable. For some miles along the river-flats timber of splendid quality is still available, but the bulk of it is beech of unusually good

quality and large size. On the clearings along the river great destruction of white-pine and rimu has taken place. Mr. Lockington's mill is situated about one mile and a half from Mr. Erickson's, and the same remarks apply to the neighbourhood of the latter as those made with reference to the former. At the time of my visit the trade in timber was very slack, but a very large quantity has been cut out in this district, both for the mines and the buildings in the Town of Reefton.

Leaving Reefton on the 10th August, I visited Mr. Perrotti's mill. It is situated about twenty miles from Reefton, in the head of the Grey River Valley. The country is flat, and timber easily got out by tramways, the grades being light, while there is a fairly large area available for supplies. The rimu obtained here is the best I have yet seen, the "figure" being particularly handsome. A great deal of valuable local information was obtained from Mr. George Baiteria, and this will be made use of in another section of my report. The timbers here are rimu, white-pine, miro, hinau, and rata (5 ft. diameter, up to 60 ft. long), also beech, which, as usual in this country, predominates. At present rate of output, averaging, say, 15,000 superficial feet per week, there should be here ten to fifteen years' supply. Silver-pine, sometimes called "yellow-jack" is also found here, but it is never a large tree. Parts of this district, near Capleston, on the lower levels of the Paparoa Range, are also heavily timbered with beech. A large area of bush is found at the head of the Grey River, but here again the beech is the chief timber tree.

As the valley of the Grey River opens out, near Arahura, the timber increases in quantity, and is of better quality. Some very fine forests exist on the Arahura River in the direction of Orwell, and also on the banks of the Little Grey River. This is undoubtedly one of the districts in which extensive State forests should be reserved. The land is poor, and only fit for growing timber; indeed, my observation generally leads me to the opinion that the best timber is grown on land which is not quite suited to agriculture. This, at any rate, is the case in the South Island, and therefore it is the less excusable to destroy valuable timber merely for clearing purposes. These forest lands, when cleared, will, of course, grow grass; but it does seem a pity, when better country is available, to sacrifice the greater value of the trees for the lesser gained by grazing.

The valley of the Grey at Arahura, and up the river of same name, is about thirty to thirty-five miles wide, in the direction of Bell Hill and Jackson's, another valley through which the Midland Railway now runs. Here a number of sawmills are at work, and their produce is sent *viâ* the railway to Greymouth. Patches of fine cedar (kawaka) up to 24 in. in diameter are found near Arahura, but these are by no means numerous. Reference to this cedar, however, will be found in the section dealing with "Timber Trees of New Zealand."

I reached Greymouth on the 12th August, and next day inspected Stratford, Blair and Co.'s mill there, and another belonging to the same firm at Kiata, finding the timbers in these localities very similar to those just described. The sawmills near Kumara, together with the timber (growing and in stacks) were also carefully examined, Messrs. Wilson and Gillen courteously supplying every information. The country here is flat, tramway grades easy, and timber of excellent quality, but patchy. Considerable quantities of silver-pine have been obtained from three or four miles back from the railway, but the timber is small and faulty, being used almost exclusively for sleepers on account of being too small for the miller. The silver-pine is a true *Dacrydium*, and is closely related to its congener in Tasmania, the famous Huon pine (*Dacrydium franklinii*). Associated with the silver-pine, but some distance back, is found the kawaka, a fine timber tree, very light, and of handsome appearance. The rimu and white-pine here are not very large, averaging in height 25 ft. to 80 ft., and girth 2 ft. 6 in. to 3 ft. 6 in. The silver-pine is probably the most durable of New Zealand timbers, vying in this respect with the Huon pine of Tasmania, though it does not grow to anything like the size attained by the latter.

After returning to Greymouth I inspected sawmills on the Jackson's line, Midland Railway, being enabled to accomplish this in detail through the courtesy of the Greymouth manager, who gave me special facilities of travelling by train and trolly. The mill at Lake Brunner (known as "The Swede"), owned and worked by Messrs. Nyberg, Mitson, and Franson, is provided with a 22-horse-power engine, driving twin circular saws. This mill is well situated for supply, and, being close to the railway, the timber can be sent to market at reasonable rates for carriage.

The whole of the Jackson's Valley is well timbered with rimu, white-pine, matai, and miro, a few silver-pines being also found here and there. A large area of bush or forest land, the greater portion belonging to the Midland Railway Company, with timber of good quality, especially near Poerua, Te Kinga, Moana, Kaimata, Kokiri, and Stillwater, runs back for miles towards Bell Hill and the Arahura River. Red-beech is obtained up to 20 ft. lengths, and is here known by its native name, kamahi.* It is not, however, a true beech at all, and belongs to a different genus.

The Te Kinga mill, owned by Messrs. Stratford and Son, next came under notice, and here I found a 30-horse-power engine and good working plant. The timber is drawn from the valley of the Crooked River. The bush is similar to that already described. At Moana, Messrs. Stratford and Blair's, and at Kokiri, Messrs. Butler's mills, were inspected, and most valuable information was supplied by the gentlemen named.

On the 15th August I returned to Greymouth, and next morning left for Hokitika.

On Monday, the 17th August, I made an inspection of the Westland Sawmill Company, Mr. John Hornby, manager. The engine in use is 25-horse-power, and the average output 1,000,000 ft. per annum. The tramway is two miles long, a hauling-engine being used to bring in logs from the bush. The company has rights over about 400 acres of fairly heavy bush. In the vicinity there are also about 200 acres on which the silver-pine grows in fair numbers; but great havoc has been wrought in this forest by the sleeper-hewers. The total extent of timber-country available from the mill to Kapitea Creek is about 5,000 acres. Good country is also found on the Waimea, and about

* This tree has a large thin leaf, toothed like the beech, light under-surface of the leaf, sometimes purple tint.—Kirk's "Flora of New Zealand," page 133.

2,000 acres beyond Podda's mill, the average quantity of timber—taking twenty trees each—being 20,000 superficial feet per acre. The forests here are principally rimu, white- and silver-pine, with rata and miro intermixed—not any totara, kawaka, or matai; and Mr. Hornby calculates that there is a twenty-five years' supply in the district between Greymouth and Hokitika.

The next mill visited was that of Mr. J. C. Malfroy—the Hokitika Sawmill Company. The engine here is 84-horse-power, 100 lb. pressure, 3 ft. 10 in. stroke, and 16 in. in diameter. The tramway is three miles in length, and Mr. Malfroy is having a new hauling-engine made in a Greymouth foundry on a design of his own. The timber operated upon is principally rimu and white-pine, with small quantities of black-pine (matai); and the area worked over is 400 acres. Two hundred acres of freehold have been worked out, and Mr. Malfroy has rights over 200 acres of mining and a similar area of railway reserves. The mill has been at work since 1875, and all the timber used has been obtained within a radius of three miles. Mr. Malfroy estimates that there are still available forests eight miles by five, from the Blue Spur to Bridge, and that these represent a thirty years' supply of timber.

Visits were paid to several large mining claims—Humphries Gully and Mont d'Or, at Ross, the forest country between Hokitika and Ross being examined *en route*, and notes taken of the timber available. It is generally agreed that here, at the present rate of consumption, there is thirty years' supply before the district is worked out.

The estimates recorded above, of course, point to the conclusion that within thirty years the whole forest country between Greymouth and Ross—one of the best timbered regions in Westland—cut out by the sawmiller and wrecked by fire, will have been utterly destroyed. Moreover, the forests of the West Coast are not so extensive as they appear. They consist of a narrow strip of from ten to fifteen, and in a few places twenty, miles wide between the sea and the Great Barrier Range, and from one hundred and forty to one hundred and fifty miles long. Of this, too, only about one-third covers medium to good timber, the rest being merely scrub. On the mountains, over and above the snow-line, the timber is generally stunted and worthless, though in places some good beech is found. About six or eight miles south-east of Ross there is some fine cedar (kawaka), the best on the West Coast.

After my return from Ross to Hokitika and Kumara, and inspecting Mr. Morris's sawmill at the last-named place, the overland trip to Christchurch, through the Otira Gorge, was commenced on the 21st August.

From Kumara, along the right bank of the Teremakau River, a fine forest extends for some miles in the direction of Jackson's, and thence to the entrance of the Otira Gorge. In the gorge itself the timber is stunted and poor, and from the summit at Arthur's Pass the treeless country commences from the boundary post between Westland and the Province of Canterbury.

A little timber is found near Bealey, and a few bushes along the Waimakariri River. Then, the timber country lies behind us, and, as we dash down the steep descents, through Porter's Pass and other dangerous elevations on the road, the plains of Canterbury gleam yellow in the strong sunlight.

The roads are steep and dangerous, but "Jack" handles the ribbons with such good results that we arrive safely at Springfield in ample time to catch the train for Christchurch, reaching that city in the evening of Saturday, the 22nd August.

Two days were spent here in inspecting the Gardens, Museum, &c.; also, the sawmills of Messrs. Edwards, Brown, and Walters, and the plantations in and around Canterbury; and on the 26th August I left for Dunedin. As I am devoting a special section of this report to tree-planting in Canterbury and Otago, I need not touch here upon that subject.

At Dunedin I saw some of the leading citizens, whom interest in forestry led to call upon me, and also examined with much appreciation the plantations and trees in and about the city, noting specially the growth of spruce firs, &c.

Leaving Dunedin on the 29th August, I noticed *en route* the treeless plains of Otago and the fine fertile lands through which the railway passes to Gore.

After spending Sunday at Queenstown, I next day visited the Upper Lake Wakatipu at Glenorchy, Diamond Lake, the foot of Earnslaw (9,260 ft.), making a hurried inspection also of the valley of the Dart, and the country of the fissure peaks, &c.; then returned to Queenstown, and on the 2nd September set out by steamer for Kingston, travelling thence by rail to Invercargill. No forests exist in all this country except limited patches on the Dart River, round the Cosmos Mountains, and bounding the lower slopes of the Southern Alps and about the foot of Earnslaw.

After a hurried visit to the Bluff, I set out next day from Invercargill to inspect the Woodlands Pine Company's mill, eight miles distant, being accompanied by the Forest Ranger, Mr. D. Campbell. The timber here is chiefly rimu, intermixed with some black-pine (matai); average output from the mill, 60,000 superficial feet per week. The forest or bush known as Seaward, consisted principally of red birch, mostly used for sleepers, and of very good quality, the trees in many instances attaining very large size. It is, however, now practically worked out, only a miserable blackened remnant marking the site of what once was a noble forest. It should, however, at once be proclaimed a State forest reserve, and an effort made to regenerate it. A gang of men to burn off rubbish and scrub would be required, and the reserve should be planted with totara, kahikatea, and rimu, 8 or 10 ft. apart. These would in time form a dense compact mass, and provide shelter for themselves. Then, if properly thinned out as necessary, the trees left would grow to become valuable for timber supply. By adopting this course it would be quite possible to regenerate any forest, which on account of proximity to populous centres would be of great value to the State. It is not necessary in burning off to clear away all *debris*, scrub, or forest growth. If the huge logs and heaps of rubbish are removed, the young trees can be planted beside fallen *debris* or stumps, and these, in decaying, would help to provide humus or soil for the young crop.

Though the bulk of the timber in the Seaward forest was red birch it included also rimu, totara, silver- and black-pine, and miro.

At the Woodlands Company's mill, timber of all sizes down even to 6 in. diameter is cut. Other mills visited were two owned by Messrs. McCallum and Usher; also Twopany's.

From Mr. H. A. Massey, of Invercargill, I obtained much valuable information as to the treatment and habitat of various timbers in this district.

Leaving Invercargill on the 4th September, and travelling *viâ* Riverton to Orepuki, I inspected Watson's mill, Wakapatu, and Perry's; also, at Colac, the Pine Company's and Fisher's. The timber here is patchy, but there is a considerable quantity of good rimu. The output of the Pine Company's mills is above 600,000 superficial feet per month in this district; and for the whole of Southland, 20,000,000 ft. per annum.

A rough-looking tree of small size—the kowhai, sometimes called "goai," probably a corruption of the Maori name—is met with here. Its timber is tough and durable, much sought after, and extensively used for fencing-posts. Totara is the most durable of timbers in this locality, but the trees are very limited in number, and small in size. The three beeches, *F. solandri*, *F. menziesii*, and *F. fusca*, are also represented in these forests. Another tree, resembling the beech, with large toothed leaf—the kahmai (? kamahi, Kirk)—is also found, and is extensively used for sleepers and fencing, for which purposes it is held in high esteem as specially tough and durable.

Leaving Invercargill for Dunedin and Christchurch on the 5th September, I visited, on the 8th, the Stockton Railway Department Nursery with the local District Engineer, to whom I was indebted for much courtesy and kindness during my stay.

The next day was devoted to the plantations in this neighbourhood alone, where I succeeded in getting much valuable information.

I also visited the Lincoln Agricultural College, and was most courteously received and shown over the grounds, and inspected the stock, trees, &c., and I need hardly say I was delighted with the college and its environment, and take this opportunity of thanking the Principal for his kind attention, hospitality, &c.

On the 10th September I completed my inspection of the forests in the South, and left Christchurch for Wellington.

Forests of the North Island.

Leaving Wellington on the 14th September by train I reached Wanganui, on the beautiful river of the same name, and after a delightful passage up the most picturesque stream in Australasia, arrived at Pipiriki, passing on the way numerous Native villages.

Starting thence on horseback (16th September), with a guide (G. Manson), kindly arranged for by the District Road Engineer, I travelled for the next four days, inspecting various forests under conditions of great difficulty, personal discomfort, and on several occasions considerable danger; the weather, which during the previous portion of my tour had been everything we could desire, having now changed, and drenching rains were pouring down incessantly. No way daunted, however, we pressed on through scenes indescribably charming, in the majestic beauty of the gorges and the wild weird grandeur of the mountains. The prevailing geological formation here is papa, which may be described as a soft volcanic mud rock.

Though I had passed through the Buller district and the Otira Gorges, and been impressed with the marvellous engineering skill which had constructed practicable roads over their perilous passes, rivers, and precipices, and the dexterity of the coachman who could travel safely over them, here, on the borders of the King-country, I had to trust to my own horsemanship to surmount the perils of roads far and away worse than any in the South Island. At this season of the year, too, no driver who ever handled the ribbons could get a coach through on these terrible roads. The waters cut new courses on every side through the rotten papa, as clearly defined as if with a knife, and the traveller is frequently brought face to face, at a moment's notice, with glimpses of a fairyland of ferns and shrubs, while hundreds of feet below can be heard the thunderous roar of falling waters.

My guide, with a confidence which speaks volumes for his acquaintance with the country, plunges downwards, and I follow, my heart in my mouth.

As originally cut, some years since, the track here was 8ft. wide, but neglect and flood-waters have so altered it that gaps appear every few yards, and heaps of mullock have to be negotiated, while precipices at every turn seem to beckon us to take shorter routes and end our journey and miseries at the same time by taking a leap into the awful chasms we are skirting.

The rain pitilessly drenched us all along, and under these depressing conditions we continued our journey, crossing a bridge which caused one to wonder how the heavy timber used in its construction could have been brought to the spot and placed in position over such a fearful gorge.

The hills, though not very high, are precipitous, especially on the side where the main creeks rush down to the Wanganui, here not far distant.

The trees in this locality are of fair size, rimu, white-pine, and matai. Here, too, for the first time in the North Island, I found the cedar (kaikawaka, but known in the South as kawaka).

At a road-makers' camp, which we found at this stage of our journey, we were fortunate enough to get some tea and other bush delicacies, and my attention was called to a hut built some eight years before of kaikawaka slabs, and shingled with a mixture of that timber and white-pine. The pine was rotten through and through, but the kaikawaka, or cedar, of which very fine trees are found here, was as sound as on the day when it was cut.

From Pipiriki our first stage was to the small bush hamlet of Raetihi. Continuing our journey next day, we toiled for twelve miles through such mud as I have never seen before. I had early experience of the track from Strachan to Mount Lyell, in Tasmania, before the success of the latter as a mining district led to a better condition of things, but, bad as that was, it was nothing like Field's Track from Raetihi to Waimarino. The rain, too, evidently meant business, and my guide became uneasy as to the state of rivers and creeks ahead of us. On both sides of the track there is fine timber, including rimu, totara, white-pine, kaikawaka, matai, and miro.

A number of village settlers are located in various places, and, in spite of the difficulty of ingress and egress, appear to be doing well. Most of them had had a good burn, and an abundant crop of magnificent grass followed. Nor could I avoid comparing the successes here with our Victorian failures at village settlement. In Victoria a clean burn off is difficult, and often the sole result is to sour the land, so that grass does not grow for a year or so. In New Zealand, on the contrary, it is light labour to fell the soft woods; a complete burn is easily accomplished, grass-seed scattered among the logs and other *débris*, and within a month there is grass 6 in. to 8 in. high, green and succulent, upon which the settler's stock thrives, and milk and butter are produced right away.

Beyond the settlements the road passes through a fine forest, containing splendid spars of all the timbers named above, and covering a large area of excellent sawmill material. At some points of this road the snowy summits of Ruapehu can be seen, distant only five or six miles, though, as we were enveloped in clouds of mist, our range of vision was limited to the mud under foot and the dank dark forest on either side.

After some hours of ploughing along through the mud we came out on the open plains of Waimarino, but to my great disappointment the volcanoes were hidden in mist and rain-clouds.

Our course from Raetihi was parallel with the Wanganui, but distant from twelve to fifteen miles from the river. We crossed the plain south-west of Ruapehu about two miles from its southern extremity, and we could see the timber-line stretching for miles in the direction of the river and Taumaranui.

We were now in the heart of the King-country, and crossed the survey-line at a spot where the surveyors were stopped and driven back by the Maoris some five or six years ago, passing an old pa now deserted. Crossing the plains, we passed two inhabited Maori whares, and, striking the timber at a point just opposite that of our entry, once more found ourselves in forest country. The track had just been cut by a Government party under Mr. Field, but had not yet been cleared or formed. To my surprise, I found a great improvement both as to quality and quantity in the timber, very fine totara, tall and of good girth, and splendid white-pine, rimu, and the silver-pine of the West Coast. This last appeared to be fairly plentiful, and is well distributed through the other timbers. I saw fine logs of all the pines mentioned, and the cedar (kaikawaka) is the finest I had yet examined.

Some four miles from the plain the country loses its level character, and, as we approach the main streams which, rising about the bases of Ruapehu, Ngauruhoe, and Tongariro, flow into the Wanganui or Wangaehu Rivers, the gorges again open up, and the papa reappears.

After leaving the pumice plain, the route lies along the newly-cut 6 ft. track until we reach the turn-off to Taumaranui. Here we note the large size of the totara, and from this point one of the best if not actually the best totara forests in New Zealand, containing many enormous trees, extends. Many of the trees are over-matured, and some undoubtedly hollow. Rimu and white-pine of splendid size and quality, many of them 6 ft. to 8 ft. in diameter, are also found here.

We had expected to find the road party in camp a few miles beyond the turn-off, and to find shelter for the night with them, but darkness set in and found us still plodding on through rain and mud without sign of the camp. Our horses by this time leg-weary, stumbled along the narrow track past the face of the cliffs and precipices till nearly 8 o'clock, when we struck the camp at Kaitiki, and were most hospitably received by the surveyor in charge.

Next morning, returning to Taumaranui, we realised the dangerous feat we had accomplished in the dark the night before. In one place half the road had slipped away, and a second slip from above had deposited a heap of earth and clay on the 3 ft. of track still left, while the creek rushed tumultuously along at the bottom of a steep precipice 400 ft. in depth. Such was the place we had negotiated through blinding rain and the darkness of a winter night, thanks to the sagacity and sure-footedness of Maori pack-horses, for which I shall ever entertain sincere respect.

It had been my intention to examine in detail the totara forest about Taumaranui, but the weather was so bad and our horses so much exhausted that I was obliged, though with great reluctance, to abandon the idea, and returned by the Waimarino Plains to Corlett and Robinson's station, where we proposed to spend the night in order to make Taupo the next day. Leaving Field's track in the plain, we struck northward to Whakapapuiti River. After crossing several streams in flood we reached the open "downs," rolling pumice plains, over which, with some difficulty, as the track-marks (thin wands stuck in the ground) had been knocked down, we made our way till we sighted belts of dense scrub interspersed with rimu, white-pine, and totara, reaching at last the hut of Mr. Thomas Allen, who entertained us hospitably for the night, thus missing the station in the dark.

We found that we were right under the northern end of Tongariro, only about half a mile from the source of the Wanganui, and seven or eight miles from the station we had been making for.

Next morning we left for Lake Taupo, or Tokaanu, crossing the Wanganui where it issues from the sides of the mountains, and passing the bridge and pa where Te Kooti made his last big fight. The sun making his appearance for the first time in four days, I was able to see the dense forests on a range east and south-east of Tongariro, and reached Taupo on Saturday the 19th September.

I visited next day the Village of Waihi and the hot springs, and on Monday travelled by coach to Waiouru, about forty miles, very little timber being visible along this road. About ten miles beyond Waiouru some timber, though poor and thin, was met with, but good forests exist halfway between Waiouru and Ohingaiti.

The forest-lands on the Rangitikei River are good, and extend to the gorges and ravines of the Ruahine Range, a distance of twenty-five miles. The totara is specially good; rimu and white-pine of good quality is also abundant all the way from Ohingaiti to Hunterville.

Striking the railway once more at Mangaonoho I returned thence to Wanganui, and on the 25th September left for Napier, visiting sawmills at Dannevirke (Hawke's Bay Company).

Travelling by coach from Napier to Rotorua (29th September) I took note of the forests to Tarawera. The timber country has been extensively cleared to provide pasturage for stock, and in this, as in so many other districts, the destruction of valuable timber has been enormous. Good bushes are still left, but, as the inroads still continue, these too must disappear within a few years.

At Dannevirke the rata grows to an enormous size, and totara also to abnormal dimensions. I saw here many veritable giants of each species.

Passing through Wairakei and over more pumice country we reached Rotorua, and spent Friday, Saturday, and Sunday in inspecting Waiotapu and Whakarewarewa, and in the ascent of Tarawera.

Mr. A. M. Smith (of the Industries and Commerce Department) and the Manchester delegates were at the time visiting Lake Rotorua, Mokoia Island, and the Hamarana River, and I gladly accepted an invitation to join the party.

On Monday, the 5th October, I left Rotorua for Auckland, visiting the Kauri Timber Company's mill, where Mr. Trapp, the other directors, and Mr. Blair, the manager, courteously afforded me every facility for observing how the kauri timber is treated at their mill. Mr. Blair also kindly accompanied me next day to the Waitakerei forest to visit those veritable giants of the vegetable kingdom—the kauri pines—growing in their native habitat, and I was struck with admiration at the truly noble appearance of the tree—its vast size and great commercial value.

Next day was spent in visiting city mills, other than that of the company, and among these were the Waitemata, of Messrs. Smith, also Messrs. Goldie and O'Brien's, &c.

Leaving for the Thames on the 10th October I visited Coromandel Peninsula with Mr. Campbell, bush foreman to the Kauri Company, and inspected the kauri forest in that locality; also the dams for flushing timber down the river, and the various methods adopted for conveyance of timber by land or water, finding this day's trip most interesting and instructive.

Returning to Auckland on the 13th October, some of the mills were revisited, and information obtained from the Crown Lands Commissioner, Mr. Mueller, and to this gentleman I am indebted for much valuable information *in re* kauri and other timber; and on the 15th October I left Auckland for Sydney, being just three months on the tour of inspection, &c.

FOREST CONSERVATION.

First General Application of Scientific Forestry.

The recognition of forestry as a science is comparatively new to English-speaking nations, and in the early part of the present century was practically unknown, except in a limited degree among the landed proprietors of the British Isles. With the advent of steam-power, however, a great change took place, and the timber-supply necessary to meet the requirements of the civilised world was found suddenly to assume a magnitude never dreamt of in the days anterior to Stephenson's discovery. The previously available forests of the Old World rapidly decreased in area, and as railways opened up new tracts these in turn were speedily denuded of timber. Just, however, when the increased demand had caused the strain upon European forests to become acute, and timber grew scarcer and more difficult to obtain from these sources, the memorable "rush" to California set in, and gold—that mighty factor in causing the rise of new nations abroad—drew thousands of its votaries to the New World; great cities arose as if by magic in the wilderness, and the huge forests of America were opened up.

The unrivalled means of transit by floating enjoyed by the river States led to their forests being first opened up to foreign trade, ships from all parts of the world quickly made the merits of American timber as well known in the world's markets as those of the Baltic and other European forests. Ample supplies from this new source at once relieved the grave strain upon the forests of Europe, where the authorities had learned by the position in which they had been placed a useful lesson—one, too, that every country must learn sooner or later—that forests, however extensive or prolific, are far from being inexhaustible.

Necessity for Forest-culture Recognised.

No sooner, then, had American supplies come to the rescue of European markets than the authorities of the Old World took prompt and vigorous steps to conserve and replace their own forests. Nowhere, perhaps, was the task undertaken with more real earnestness than in France, where many hundreds of thousands of pounds have already been spent in replacing timber stupidly cut down on the mountains to improve the grazing capabilities of the lands. This became a national necessity, because the foolish denudation of mountain-slopes allowed the floods from winter rains and melting snows to tear away the soil, wear chasms and watercourses in all directions, and poured vast quantites of silt, *débris*, and broken rock over the plains, utterly ruining tens of thousands of acres of the finest available lands lying along the bases of these mountains.

In Germany, Norway, Sweden, and other countries, forestry was also undertaken. Schools were established at a great cost, and at the present time some of the ablest professors are available for forest teaching, and forestry is now recognised as an exact science.

The enormous sums of money expended by France, Germany, Austria, &c., on forest operations may possiby open the eyes of some Australian authorities to the supreme importance attached to such work in these countries, which employ large numbers of State officials in this department, three thousand being considered by no means a staff of uncommon strength. Yet, in spite of the cost, these countries, without exception, find that the greater the care taken of the forests the greater the net revenue from them.

India also employs an immense staff in conservation, &c., many of the officials being natives; and for several years past, according to late reports, the revenue exceeded £1,000,000 sterling annually. No country in the world can afford to be careless in the matter of forests—the sources of its timber supply.

Fifty years ago the vast forests of the Mississippi, Missouri, Oregon, and other timber States in America were of such enormous dimensions that the word "inexhaustible" commonly used to describe even less extensive areas, seemed in proportion ridiculously inadequate as applied to them. Yet what has been the experience of fifty years with regard to these sources of supply, that used to be graphically described as "sufficient to last a thousand years," and in other terms expressing the comfortable conviction that no possible strain could practically affect them? In this year of grace, 1897, after but fifty years of unrestrained vandalism—destruction recklessly with axe and fire—thousands of miles of country once covered by magnificent forests of splendid timber-trees, now lie a pitiable and desolate waste. This condition of affairs has at last been recognised, and the customary awakening has, so the newspapers inform us, caused the Government to take alarm, and commissions have been appointed with instructions to promptly suggest a scheme of drastic reform. Naturally, however, the usual shilly-shallying is likely to take place, and probably years elapse before anything really practical is done.

Serious Shortage Imminent.

Meantime it will possibly astonish the outside world to learn that within a very few years the apparently limitless timber resources of America will be so materially reduced by the heavy drain upon them, combined with waste and terrible destruction by fire, as to occasion a very serious shortage of supplies. Destruction by fire alone contributes in a large measure to the rapid disappearance of these forests, as may be seen from the cablegrams which so frequently report "Another terrible forest fire"; "Thousands of people homeless"; "Air so thick with smoke for leagues around as to create a darkness as of night," &c. Once, too, the shortage above referred to makes itself felt in the timber markets an immediate and heavy rise in values must result, for, even though America possesses other valuable forests than those now being drawn upon, the former lie "'way back" hundreds of miles from water-carriage, and even from railways, so that the cost of haulage, &c., would be so great as to prohibit the use of their timbers to make good the deficiency. Then, too, this coming shortage in American supplies must affect the forests of the Old World, which, in spite of jealous care and the best scientific treatment, as yet in most instances are barely equal to meeting the requirements of home markets, and in others—notably France—cannot nearly do even this. These statements of established facts may easily be verified. The lesson taught is plain: Prepare for a scarcity of timber in the immediate future.

Success of Forestry in Europe.

Actual results of operations in Europe are shown by the reports of the various countries, and these prove conclusively: First, that forestry, carried out on a scientific basis, is a certain method —and the only one—of keeping up the timber-supply of any country; secondly, that though such treatment involves great expense, it fully repays the outlay by giving work to a large number of employés, whose salaries are distributed among the public, and in more direct manner by returning a very high percentage of cash profit to the State. They prove, indeed, the contention of forest scientists that the more liberal the expenditure in dealing with forests on recognised principles the greater is the profit to the State—an experience which is invariable.

Forestry in Europe.

The following statistics of European forestry are culled from official sources, and may be relied upon. Though the reports in which they appear are ten years old they are authoritative, and even now of great practical value:—

Prussia.

	M.	£	s.	d.
Revenue	56,070,000 =	2,336,500	0	0
Ordinary expenses	31,062,200 =	1,294,258	6	8
Surplus	25,007,800 =	1,041,991	13	4
Extra expenses	2,450,000 =	102,083	6	8
Net income	22,557,800 =	939,908	6	8

The area of Government forests is 2,374,039 hectares, equal to about 5,757,047 acres.

Saxony.

	$	$
Revenue from 429,600 acres of area, and 799,000 forest yards of hardwood, including revenue of $5,000 from the chase ...		2,740,000
Expenses—		
Maintenance	551,000	
Management	372,000	
		923,000
	£378,541 13s. 4d. =	$1,817,000

Mannheim (Grand Duchy of Baden.)

The area of the Grand Duchy is 1,508,173 hectares = about 3,648,620 acres. Under official control are—

	Hectares.	Acres.
State forests	95,025·24 = about	237,562½
Town "	249,021·58 "	622,557½
Corporation	18,289·76 "	45,728
	362,336·58	905,848

	M.	£	s.	d.
The income in 1884 from Government forests was...	4,361,500 =	181,729	3	4
Expenses	1,615,885 =	67,328	10	10
Net income	2,745,615 =	114,400	12	6

Austria.

Area of State forests, 952,689·96 hectares = 2,281,729·96 acres.

	Florins.	£	s.	d.
Revenue	3,951,650 =	329,304	3	6
Expenses	3,546,240 =	295,520	0	0
Net profit	405,410 =	33,784	3	6

Italy.

Area of forests, 10,270,467 acres, comprising—

	Acres.
State forests	425,835
Communal, Corporation, and private forests	9,844,632
	10,270,467

Of the State forests, 145,393 acres are inalienable, and 280,442 acres alienable.

The revenue from inalienable forests is $46,320, and from alienable, $156,231: total, $202,551 = £42,198 2s.

The expenditure is about $510,285, of which the Government pays $165,600, and the Communes, &c., $344,685 = £67,809 7s. 6d.

In Italy, therefore, the forests cost more than they yield by £25,615.

Switzerland (1885.)

Total area of forests, 785,374 hectares = about 1,963,435 acres. Of these are—

	Hectares.	Acres.	
State forests	32,995 =	82,487½ =	4·20 per cent.
Communal forests	520,183 =	1,300,457½ =	266·23 per cent.
Private forests	232,196 =	580,490 =	29·47 per cent.
	785,374 =	1,963,435	

The Swiss Confederation does not hold directly any of the forests, and hence derives no revenue from these sources. It, however, undertakes the administration of forests laws in certain districts, but in most entrusts the enactment and administration of their own laws and regulations to State or other local authorities. The Cantons hold but a very small proportion of the forests, the rest being the property of Communes, Corporations, or private persons. It is estimated that the amount of timber which can be taken annually from the Swiss forests, with due regard to their efficient maintenance, is 2,759,000 cubic metres.

	Cubic Metres.
From State forests	156,000
Communal and Corporation	1,859,000
Private forests	744,000
	2,759,000

The amount of timber which it is allowed to remove from the forests per hectare, or for every 10,000 square metres, is 4·75 cubic metres. Of the total output, 40 per cent. is for lumber, and 60 per cent. for fuel. The first has an average value of 16 francs (about 12s. 8d.) per cubic metre, and the latter 9·25 francs.

The total value of forest produce is 33,179,000 francs (about £1,314,019 16s.) at 11·92 francs (9s. 5d.) per cubic metre, giving 42·13 francs (£1 13s. 5d.) per hectare (2½ acres).

The income from the State forests in the Canton of Berne, with a ground valuation of 13,500,000 francs (£534,653 9s. 4d.) is 700,000 francs. From this sum, however, must be deducted harvest expenses, 136,000 francs; supervision, 35,000 francs; cultivation, 21,000 francs; roads, &c., 28,000 francs; taxes to State and Communes, 86,000 francs; administration, 55,000 francs: total, 361,000 francs.

The net income is therefore 339,000 francs (about £13,425 4s. 11d.).

Forest Protection.—The destruction of forests is well safeguarded by the Federal law passed in March, 1876, though even before that date most of the cantons had in force rigid State enactments against any dangerous clearing of the forests. As a rule, any person, Commune, or Corporation wishing to make a clearing must obtain the consent of the forest director, or if the proposed clearing is included wholly or in part within a Federal forest, the assent of the proper Federal authority. Permission to make a clearing is only given on condition that the person or corporation obtaining it undertakes either to replant the area with shoots, or to pay a sum sufficient to cover the cost of having this done.

Swiss Imports and Exports.—Imports.

	Metres Cent.	Francs.
Firewood	965,750	2,414,375
Undressed lumber	212,816	851,264
Dressed lumber	351,996	2,500,341
Charcoal	56,010	504,090
	1,586,572	6,270,070

Exports.

	Metres Cent.	Francs.
Firewood	270,584	526,735
Undressed lumber	512,787	2,126,910
Dressed lumber	591,712	3,787,926
Charcoal	31,379	237,487
	1,406,462	6,679,058

Value of exports over imports, 408,988 francs = about £16,197 10s.

RISE AND PROGRESS OF FORESTRY IN SWITZERLAND.

Early in the Fourteenth Century inhabitants of the more thickly-populated districts in this country were forced by apprehensions of a deficiency in wood-supply to take measures for the preservation of forests. In the year 1314 Zurich forbade its foresters "to fell, raft, or sell wood from the Sihlwald." In 1339 Schyz issued a prohibition against charcoal-burning; and in 1438 Freiberg decreed that "no wood should be cut in the environs of the city." In Entlebuch it was forbidden in 1471 "to draw wood from forests high up in the mountains;" and in 1592 Berne called attention to the need of economy in the use of wood. Finally similar decrees became general.

These ordinances, however, though effective in preserving forest areas, hampered the progress of agricultural and wine-growing interests. Zurich, for instance, forbade, in 1503, the establishment of any new vineyards, and this prohibition was kept in force up to the beginning of the Eighteenth Century. At that period the dread of a deficiency of wood became so general that it was forbidden to purvey or export any even from one village to another. Contemporaneously with these prohibitions, others were issued forbidding the pasturage of cattle, sheep, or goats in the forests.

With the advent of the Eighteenth Century, Swiss forestry began—in an official sense at least—a more active existence. In 1702 Zurich—always foremost in this work—appointed a Commission to devise a general forestry system. In 1825 Berne followed suit, and later Freiberg, Lucerne, and Schyz took action in the same direction. From this time up to ten years ago (1875) the several cantons managed their forestry business as they wished, and entirely independent of each other. In 1875, however, the imperative necessity for combined action having become apparent, the matter was taken in hand by the Federal authorities, whose attention had been called to the pressing demand for legislative action to arrest the destruction of forests, especially in the higher mountain regions. Accordingly, on the 24th March, 1876, a law was passed establishing Federal control "over the forests in all high mountain regions of Switzerland," embracing eight entire cantons.

The Model Forestry System.

The system of Zurich is a model for example, and has been so used for over a quarter of a century. The area of private forests in Zurich is 2,813 hectares (7,033 acres), divided into 70,442 separate holdings, of which the largest is not over 80 acres and the smallest half an acre.

Rates of Supply.—The population of Canton Zurich is 308,593 persons, included in 63,863 households, an average of 4·8 per household. Consumption of wood per household, 5·79 cubic metres, or a total of 369·570 metres; yield of forests, 231,475 cubic metres: thus giving an excess consumption over supply of 138,095 cubic metres.

It may thus be seen that Zurich, the model canton of forestry, with all its well-kept forests, not only is not able to supply in full the demands for home consumption, but can barely produce two-thirds of the firewood required.

Similar conditions also prevail in other parts of Switzerland, where a wood famine is frequently imminent, and is only averted by the exercise of rigid economy and constant vigilance.

Organization of the Forestry Service.

The control of the Federal (protective) forests is vested in the Central Government; that of all other forests in the Government of the canton to which each severally belongs. The technical superintendence of Federal forests is vested in the Chief Inspectorate, which constitutes Division 3 of the Federal Department of Commerce and Agriculture.

In Zurich and most other cantons (Buselland, Buselstaadt, and Geneva excepted) the forests are under the control of an over-forestmaster, and in Zurich that officer is assisted by four district forestmasters. There exists also in most of the cities and in some of the largest towns a township forestry force, mostly comprised of men scientifically trained.

Further evidence of the great importance attached in Switzerland to forestry is found in the fact that at the beginning of 1886 there were employed in that country 151 trained forestry officials and from fifteen hundred to two thousand foresters and overseers, while the latest census (1880) shows that forest culture and kindred pursuits furnished employment for 5,851 and support for 9,095 persons.

Instruction in Forestry.

The course of study comprises a term or terms of three years, the Central Government paying the expenses of instructors engaged in the courses of training for subordinate employés in Federal forest territory, and also for the finishing courses. The former generally last for two months (in the terms, spring, and fall), the latter from eight to twenty-four days.

Subjects of Instruction.

First Year.—Mathematics, experimental physics, inorganic chemistry, introduction to forestry science, excursions, general botany, zoology, with special reference to animals useful or hurtful in agriculture and forestry, map-drawing.

Second Year.—Forest climatic influences, agricultural chemistry (first division), map-drawing, topography, roads and watercourses, general geology, pathology of plants, animal economy, microscopic practice, experiments in laboratory of agricultural chemistry, seminary exercises.

Third Year.—Protection of forests, with applied zoology, forest formation, instruction in management of forest excursions and experiments, general instruction in law, forest politics and police, history of forestry, geodatics, seminary excercises.

In addition to the above, during the summer "semester" instruction is given, as follows:—

First Year.—Organic chemistry, special botany, petrography, meteorology, experiments in laboratory, microscopic experiments.

Second Year.—Field measurements, study of ground, preservation of various kinds of wood, forestry statistics, increase in yield and increase of woods, in law.

Third Year.—Statistics and calculations of value of forests, forestry legislation, use of forests, technology, and general knowledge of business.

Comprehensiveness of European Systems.

The quotations above given show how comprehensive the European system of forestry really is, and how necessary it is that Australian Governments should take time by the forelock in adopting it. So far the various Governments have merely "tinkered" existing local systems, without adopting a complete scheme on recognised principles. As, indeed, very few people had any practical knowledge of the subject, it was nobody's business and nobody cared. Thus a shilly-shally policy has so far been the result.

Due Proportion of Forest Lands.

The following list of percentages will serve to indicate the proportion of forest lands obtaining in the countries named:—

Russia	40 per cent.
Sweden	34 "
Norway	29½ "
Germany	26 "
Turkey	22 "
Greece	14 "
Spain	7 "
Belgium	7 "
Holland	7 "
Portugal	5 "
British Isles	4 "
Denmark	3½ "
France	17 "

To preserve the balance of nature, at least one-sixth of the entire area in any country should be permanently devoted to forest purposes. This is necessary, not only as a safeguard against timber famine, but also in order to avoid decrease of rainfall and other injurious climatic changes—powerful factors in affecting the preservation and continuous productiveness of agricultural lands.

French Forestry.

A glance at the French scheme may be of use in considering the adoption of forestry suited to the requirements of Australia. In 1876 the timbered area in France covered 35,464 square miles, or a little more than 17 per cent. of the country.* In that year the extent of forests held under different corporations were as follows: The State, 3,734 square miles; communes and sections, 7,949 square miles; public institutions, 124 square miles; private individuals, 23,657 square miles. These forests are in situations up to 9,000 ft. or 9,500 ft. above sea-level, though those in private hands are rarely found above 6,000 ft., nearly the whole of the higher mountain areas belonging to the State or communes. In 1885 the Forestry Department controlled 3,910 square miles of State forests, and 7,598 of those held by communes, sections, and public institutions: 11,508 square miles in all.

The French adopt two systems in forestry—"coppice" and "high forest," the latter in producing heavy and the former lighter timber. Subdivisions of the "coppice" system are simple—"coppice," under which the young trees are felled in a face, and "coppice" with standard, when trees are left for the purpose of seeding while the others are cut out, perhaps four or five times in rotation, on a working-plan.

Revenue and Expenditure.

	£
Revenue for three years to 1885	1,297,748
Expenditure	571,347
Net profit	£726,401

These figures give, per acre: Revenue, 10s. 6d.; expenditure, 4s. 7d.; net profit, 5s. 11d., and apply to State forests only. If, however, the money spent in afforestation of mountains and on the purchase of additional forest areas be excluded, the actual expenditure on existing forests is reduced to about £480,000, raising the net profit to £817,748 or 6s. 8d. per acre. The profit, moreover, is really more, it appears, than even these figures show, as the amount expended includes State moneys devoted to the management of commercial forests, as well as those from which the revenue set down is derived. For such extra expenditure on their account the Communes are expected to recoup the State, but they rarely do so; and the total expenditure less such contribu-

* Major Bailey, R.E., "Transactions of the Scottish Agricultural Society," vol. ii.

tions as do come in, being charged to the State Forests Account, the actual profit, making reasonable allowance for sums so charged but not incurred upon these, would probably raise the net profit for the years named to but little short of 7s. per acre.

Reforesting Mountains.

The reclamation of mountain slopes on the Alps, Pyrenees, and Cevennes, resolved upon as a work of public utility, and in part already accomplished, includes the reforesting of an estimated area of 1,035 square miles, and the treatment of 1,900 linear miles of torrent-beds. Of the total amount, 152 square miles of the forest-lands and 375 miles of torrent-beds had been dealt with by the end of 1885, at a cost of £819,330, the rates varying from £3 2s. to £6 3s. 6d. per acre of surface, and from 2s. to 7s. 6d. per linear yard of torrent-beds. About 883 square miles of the slopes and 1,500 miles of the watercourses therefore still remain to be reclaimed under the scheme, which will consequently involve an expenditure of between £4,500,000 and £5,000,000 sterling. In addition, the State has paid £138,000, or half the cost of treating 212 square miles, on permissive works under the old law, and £12,000 towards pastoral improvements.

Forest Staff.

The officials include the Director-General of Forests, nine Inspectors-General, thirty-nine Conservators, 245 Inspectors, 234 Assistant Inspectors, 308 Sub-assistant Inspectors (Gardes Generaux), 3,532 Brigadiers, Head Guards, and Guards, the latter forming the subordinate branch of the staff.

Salary List.

Director-General	£800
Inspector-General (three classes)	£480 to £600
Conservators (four classes)	£320 to £480
Inspectors (four classes)	£160 to £240
Assistant Inspectors (three classes)	£120 to £152
Sub-assistant Inspectors (three classes)	£80 to £104
Sub-assistant Inspectors (on probation)	£60

The staff is maintained under military organization, and in time of war may be called out by the Minister if required.

Such facts as those above noted show that forestry is recognised in European countries as an important factor in the State economy. Having experienced the disastrous effects of letting things, so to say, "go by the board," the leading nations of the Old World vigorously grappled with the subject, and were not content with merely conserving the forests they still possessed, but have spent and are spending millions of money in repairing damages caused by official and private blundering in the past.

It will be well, indeed, if the various colonies of Australasia note the importance of the extracts above set forth, which, though brief and necessarily curtailed for this report, are of the utmost significance in their bearing upon our own circumstances, as they relate to forest conservation and culture.

Forest Reform in Australia.

Forest reform is urgently required in nearly all parts of Australia, but, though this important subject has for many years attracted very general attention, in only a few of the colonies has practical reform been attempted, and even by these in but a half-hearted and consequently futile manner. South Australia, however, represents an honourable exception to this rule.

New South Wales.

The mother-colony of New South Wales, it is true, led the van by proclaiming State forests in various districts, but only after several subsequent years of a do-nothing policy did the Parkes Government, in 1889–90, make an attempt—only spasmodic after all—to inaugurate a Forest Department, and formulate a scheme of conservation suited to the circumstances of the country. About this time Mr. J. E. Brown (who had been Conservator of Forests in South Australia) was appointed Director-General of Forests in New South Wales; but, after contending for two years or more against the opposition of private interests and the blocking tactics of politicians and their constituents, this gentleman's services were dispensed with, and forestry work was allowed to revert to its original condition of chaos. It is somewhat ludicrous, surely, that an attempt at reform commenced with so much *éclat* and promise as was the case here should have had so lame and impotent a conclusion.

New Zealand.

New Zealand, in like manner, undertook reform, but failed to maintain even the measure gained, and has since retrograded. As you are aware, a Department of Forestry was inaugurated, and about twenty years ago Captain Campbell Walker was commissioned to inspect and advise upon the condition of the forests. That gentleman embodied the result of his labours in a most valuable report, which was submitted to the Government. This document, however, shared the not uncommon fate of such reports, especially those which deal trenchantly with the subject in hand. It was pigeon-holed, and for a time forgotten, or, it may be, conveniently overlooked by the Government. But Forestry refuses to be dealt with in such childish fashion, and its claims to consideration are sooner or later forced upon the authorities by the rapid disappearance of timber. This was the experience in New Zealand; and some time later Professor Kirk, F.L.S., was appointed the first Conservator. During the few years this gentleman presided over the department he did yeoman service to the cause of forestry, and has left behind him a lasting memorial of his scientific attain-

ments in that splendid work, "The Flora of New Zealand," one of the most complete expositions upon the flora of any country ever published.

After a few years of good work the department collapsed, and since that time New Zealand has permitted her noble forests to be devastated, her valuable timber to be recklessly cut, burnt, and otherwise destroyed. The forest vandal here, as elsewhere in the Southern Hemisphere, has been allowed to "run amuck," and the splendid trees of the forest have fallen victims to the stroke of the reckless axeman and the torch of the kauri-gum seeker. Here again, in the heyday of timber prosperity, the sawmiller and splitter were allowed to mow down the forests, and the nondescript gum-seeker to burn down in thousands the noblest timber tree that ever graced a forest—that tree which Cook looked upon with delight, and which Banks described in such glowing terms to the wondering *savants* of his age. This tree—the kauri—the noblest the world has ever seen, has been ruthlessly destroyed by the vandal gum-digger for the sake of its resin.

Injuring the Cause of Forestry.

The lack of sustained effort on the part of Australasian Governments, which has been illustrated in these records of New South Wales and New Zealand, has done serious injury to the cause of forestry in these colonies. Men trained in the science naturally look askance at appointments which, under such conditions as have hitherto obtained, give them no chance of doing themselves credit, or their employers—the public—justice, and the tenure of which is so insecure. They find that they cannot utilise their knowledge to produce the practical results they aim at, and, if permitted, could easily attain, and the work of reform is thus stifled.

Government after Government have been warned by experts of the result inevitable if forestry is neglected. Curiously enough too, these warnings have been almost invariably recognised as fully justified, and the necessity for reform conceded—at the time—to be most urgent and important. There the matter is allowed to rest, and nothing is done; or if, as in the cases of New South Wales and New Zealand, an advance is made, a retreat soon follows. Again and again the rights of the public are subordinated to the clamour of the sawmiller and splitter, *et hoc genus omne*, who think nothing and care less about anything more than the best immediate profit they can make. Ministers, who should be active in the defence of public property, are quiescent, if not acquiescent; and though, as in New Zealand, young trees do not grow readily to replace those cut down, governing bodies are content to let matters run on till there is a fresh alarm at the state of the timber-supplies. This acts as a fresh application of whip and spur. Then once more a sudden rush of patriotism occurs. Leading politicians vie with each other in supporting a scheme of reform. This is adopted, the expert's plan of operations fully approved, and often made the subject of much laudatory comment. For a year or two he is permitted to fight his way against opposing interests, and make steady progress. Another turn of the wheel, and—Hey! presto! a new Minister, by a few strokes of his pen, undoes the labour of years, and the disgusted head of the department either resigns or is dismissed, or, if he elects still to struggle on, finds himself so "cribbed, cabined, and confined," that he can do little effective work. The Minister probably plumes himself upon saving a few paltry thousands, and strives to make political capital out of it, though his action generally involves an actual money loss to the public ten times as great as the saving effected.

South Australia.

South Australia, however, can claim distinction as the one Australian colony which has steadily supported forestry organization. This colony had the advantage of possessing an earnest and well informed forest reformer, Dr. Kruhauff, M.P., who brought the subject prominently under notice in the South Australian Legislature. A Forest Board, consisting of Dr. Kruhauff, the late Dr. Schomberg (Director of the Botanic Gardens), and Mr. Goyder (Surveyor-General) was appointed. These gentlemen went to work in a large-hearted spirit and framed the Act which has made forestry in South Australia so valuable a feature in the State economy.

In reference to the work set before them, it may be mentioned that in their colony the absolute necessity for forest conservation, and especially culture, was more apparent than in other places. The generally treeless character of the great plains of the interior caused the public to encourage the forester in conserving the few wooded areas the colony depended upon for timber, and extending the forests by plantation. Hence, the South Australian foresters enjoy the rare and enviable advantage of being exempt from hostile interference, political or other, at every turn. The department wisely gave at the outset special attention to plantation, and, after the Board had completed its labours, and a Conservator had been appointed, entered upon a useful career and continues to flourish, to the great advantage of South Australia.

Thus it is that this colony has a well-organized Forestry Department, under good supervision, with locally trained officers, practically unfettered in carrying out the details of forest management. The department is in a thriving condition, and makes solid progress year after year, as its forests are managed from an expert point of view, and not, as elsewhere, made subservient to political expediency.

Tasmania.

In 1886 Tasmania made a commencement at forest conservation, and the Government did me the honour of appointing me their first Conservator. The comparatively small revenue of that colony, however, prevented the allocation for forestry work of sufficient funds, and the progress made was small in proportion, though a scientific system was attempted. On my acceptance in 1888, however, of a similar office under the Victorian Government, a successor was appointed in Tasmania who had no forest training or experience. Hence in that colony also scientific treatment of forests has been inaugurated and then permitted to cease, without a chance of attaining its legitimate and certain end.

Victoria.

The first step in a similar direction taken by Victoria was in 1876, when an Act was passed dealing with the subject. As, however, no trained expert was appointed practical results were impossible. Bills were drafted in 1887 and 1890, but these were not even submitted to Parliament.

Finding it impossible to adequately protect the forests and to carry out their work of forest culture under the existing law, the officials of the department have appealed again and again to Ministers, pointing out that the enactments they suggest (which are practically those adopted in the Bills above referred to) are absolutely necessary to preserve valuable property of the public from the encroachment of private interests. The desired support has, however, not yet been granted.

Though, too, at the date of my appointment, and for some time after, the urgent necessity for adopting in Victoria the most approved system of modern scientific forestry was recognised by Ministers, members of Parliament, the public, and the Press, interest in the subject speedily died out; and when it was sought to enforce regulations framed to prevent waste, and especially the destruction of trees which had not reached maturity, the multitudinous claims of the sawmiller, splitter, sleeper-hewer, and especially the miner, found hosts of sympathizers in the Legislature, and the interests of the public were sacrificed in favour of private and selfish greed. Special favour, indeed, was shown to the miner, who had practically a free hand in the destruction of valuable young trees, and was allowed to wreck forests which were being specially conserved under skilled and scientific treatment. (*Vide* Inspector-General of India, in his report on Victorian forests.)

Protest after protest has also been lodged in vain against the wholesale alienation of areas which should form parts of the State forests. On the other hand, requests have been made—also in vain—for the granting for forest purposes of new areas, and for the permanent reservation of all lands under the control of the department.

These are a few of the difficulties under which the forest officials have laboured, but in spite of all obstacles good progress has been made. The value of work already done is gradually winning wider recognition, and there can be little doubt that in Victoria, as in other communities, forestry will ere long be recognised as one of the most important of State departments. Once the eyes of the people are opened to the enormous potentialities of a uniform and comprehensive scheme of forest conservation, no Government can ignore it or withhold hearty and generous support to its scientific exponents. To appoint officers who thoroughly understand their business, and then treat their profession as a mere "fad," is to act in a manner opposed to the dictates of common-sense, and could not fail to render inoperative the best efforts of even the ablest forest authority in the world.

Requirements of New Zealand.

If, then, it is desired to establish forestry in New Zealand on a permanent scientific basis, it must be borne in mind that this can only be accomplished by thoroughly trained and experienced officers—that no unskilled "tinkering" can be effective. Half-measures are of no avail, and must result in failure. Forest trees take many years to mature, and mistakes at the outset, even if detected before the mischief is altogether beyond remedy, can only be rectified at enormous expense.

Ignorant or Factious Opposition.

An error common in Australia appears to be the supposition that a man who knows how to fell a tree is a past-master in the science of forestry, and not a few officials of high standing in the colonies look upon forestry as "enthusiastic faddism," and ignorantly assume that exercise of scientific thought and practice in connection with it is a piece of pedantic humbug. Such men seem to think that the claims of forestry to rank as a profession should be sternly repressed, and therefore, when opportunity offers, actively oppose the adoption of principles which they cannot understand, and in this manner hamper forest experts.

The existence of such views as here referred to supports the contention that if the State wishes to get full advantage from the scientific attainments of a recognised expert in forestry, such an official should be made, as far as very special legislation can make him, free, not only from political or ignorant interference, but from official blundering.

Ample Powers Essential.

Conservation of State forests cannot be effectually carried on unless the chief officer of the department is endowed with special and ample powers, so that he may be free to class the timber, demarcate the forests, and decide as only an expert can decide on the manner in which each particular area shall be worked. Cast-iron rules or regulations cannot be made to suit all cases, and considerable latitude should be allowed in the discretionary power of the Conservator. Each forest has its own peculiarities of contour, of vegetation, of climate, and of accessibility, so that hard-and-fast rules cannot be applied. Here the skill and experience of the scientist comes in.

Treated after the slip-shod methods in vogue in Australia, no forests in the world could ever become practically valuable, but on the contrary must deteriorate, and hence the necessity, in order to secure more efficient development, that the authority of the Conservator should include power to check indiscriminate cutting of timber, and to control the movements of all who are licensed to use the State forests for any purpose whatever. The lack of such powers as the South Australian Government has had the foresight to confer upon the Conservator, in order that he may deal with the forests according to European method, is, I am convinced by an experience of over thirty years in the forests of Australia, the cause of the failure of more than one effort at forestry reform in these colonies. I cannot, then, repeat too often my conviction that without such powers successful and remunerative forestry cannot be maintained.

Had New Zealand followed the advice given by Captain Campbell Walker twenty years ago, in the report previously referred to, that colony would have been richer to-day by many millions of pounds, and her forests might have been models of forestal skill, instead of the wrecks they are.

One may be pardoned for describing it as nothing less than an act of folly to invite and pay for expert opinion, and then permit the information and advice thus obtained to be set aside without sustained effort to give it effect. Such a policy in this connection is merely playing at forest conservation, and the time for such a course is, or ought to be, long gone by.

Condition of New Zealand Forests.

The state of the New Zealand forests I found, during my recent tour, such as to urgently demand close and immediate attention. They are generally in a deplorable condition. Nothing short of drastic legislation and the prompt establishment of the department under such conditions as I have mentioned can save the timber reserves from practical extinction within the next thirty or forty years.

The settlement of people on some of the forest lands in the colony has, of course, resulted in wholesale burning, and such settlements have apparently been principal factors in the destruction of valuable timber.

The Great Difficulty in New Zealand.

By far the most serious aspect of the question involved in the maintenance of the timber-supply, however, is found in the comparative absence in New Zealand forests of regenerating powers—in other words, that there is but very slow natural growth of young trees to replace those which have been destroyed. Thus, unless steps are taken to counteract this disadvantage, the forest flora of the colony is doomed, like the native races, to extinction.

The late Baron Von Mueller has pointed out that numbers of genera and species, of certain plants indigenous to Australia, have disappeared within the few years during which the country has been occupied by our race; and it is remarkable that wherever in New Zealand the sawmiller enters a forest that forest as certainly disappears. The young trees linger a few years, only to die off, or remain miserable and stunted specimens of forest growth.

This failure to recuperate by natural growth is, I find, general, and not merely local. It is therefore a subject which should engage the attention of the Government at the earliest possible moment.

Many indications point to the probability that it will be found, in consequence of this defect, better and more remunerative to replant vacant lands with valuable exotics rather than attempt to reforest with the original stock.

Essentials to Successful Forestry.

In concluding this portion of my report, I desire to emphasize certain conditions which I consider absolutely essential to the rescue of the forests from the danger of extinction, and their successful maintenance.

These are:—

1. The equipment of your chief officer with full and ample power to utilise his special knowledge under the most favourable conditions.
2. That, since it is necessary to place implicit trust in him, the gentleman selected must be a fully qualified scientific and practical expert.
3. That he be officially commended to the loyal and active support of Parliament, the public, and the press.
4. That, even though it involve a present sacrifice, the funds placed at his disposal are as ample as circumstances will permit.
5. That once a scheme of reform has been agreed upon and adopted, it be faithfully adhered to, subject only to such modifications as practical experience of it or scientific progress may suggest.

If such conditions can be assured, it is certain, beyond the possibility of doubt, that the forests of New Zealand will become a most prolific source of wealth to her people. The state of the forests to-day fully bears out the opinions and prophecies of Captain Walker twenty years ago, and my arguments were his also. Of Professor Kirk's views I am unable to speak, as his reports are not at hand.

Report of Mr. B. Ribbentrop, C.I.E., Etc.

I append, however, a valuable report by Mr. B. Ribbentrop, C.I.E., upon the Victorian forests. It contains much important information which would be of service in drafting a Forestry Bill. I therefore make no apology for embodying most of it in these pages. Mr. Ribbentrop, I may mention, as Inspector-General to the Government of India, supervises the great systems of forest conservation in that country, and is one of the highest authorities upon forestry in the British dominions. He shows how forest operations have been hampered in Victoria, and sums up the situation in a few short pithy sentences. I need hardly say that I cordially indorse his arguments and conclusions, since the reforms he urges have been fought for by me for years, though hitherto without much success. The following is the report:—

"It would be useless on my part to give a general description of the forests of the colony, as they are sufficiently well known, not merely to the authorities invested with their control, but to a considerable portion of the general public. I gathered this from numerous conversations I had on the subject during my stay in Victoria. I also found that the importance of the forests and their maintenance was generally well understood, and that it was widely acknowledged that the permanent conservation of a sufficient forest area was, and always would be, an important factor iu the welfare and prosperity of the colony.

"In many countries where education (at the time forest conservancy was under consideration) was less widely spread than in the Australian Colonies, the above facts were frequently not so well understood, nor so generally acknowledged, and it became advisable to convince the public

(especially the rural portion), before seriously introducing practical forest conservancy, of the direct and indirect advantages a country derives from the existence of properly-managed forest areas, and in some cases it became necessary to override public opinion for the good of the community.

"Happily for the colonies, neither is necessary; the knowledge exists, but in spite of this widely-spread knowledge of the advantages of permanent and effective forest conservancy, yea, even of the necessity thereof, State forest conservancy and management are in an extraordinary backward state, as may be seen from the following facts: (*a.*) The forest laws of the country are inadequate; nevertheless, they contain some important practical points which might be applied with considerable advantage if such was the serious intention of the Government. They have, however, been allowed to lie fallow, and have sometimes even been superseded by contradictory and mischievous circulars and orders. (*b.*) The area of inalienable State forests has not been increased since Mr. Vincent's report of 1887 was written. (*c.*) No doubt additions have been made to the area of the timber reserves, but other forests of this kind were again thrown open, thus proving the inadequacy of permanent conservancy. (*d.*) The protection of the forests against fires has never even been attempted, and neglect and waste in their treatment are now as rampant as in the days when Mr. Vincent framed his indictment against this management in an able report to His Excellency the Governor, which should be wider known than is the case.* (*e.*) The income from the forests is ridiculously small, and quite out of proportion to the large supplies drawn from them; and the money spent on their protection, maintenance, and improvement is entirely inadequate.

"The reasons for the self-evident mismanagement of the forest property of the country are well known, and were, in fact, first pointed out to me by independent colonials; they are political, and centre in the disregard of the general public weal where this clashes with the monetary profits of individuals or classes who can exert a direct parliamentary influence. The smallness of individual interest raises no special defenders in the cause of the conservancy of State forest property, and the onus of moving in the right direction rests, to a great extent, on the shoulders of the Government.

"If the country will support the Government and remove once for all the management of the State forests out of the whirlpool of party politics, the Victorian forests will doubtless prove now, and even more so in the future, of great benefit and value to the country: whereas, if the existing system of management is allowed to continue, the reconstruction of the ruined forests will sooner or later become necessary at the cost of enormous sums, which might be more usefully spent than in correcting the effect of mismanagement and neglect on the part of the present generation. Without the support of the country the Government is powerless. It may carry on forest conservancy as an empty shadow, but no real progress can be made so long as it remains the watchword that the extraction and conversion of forest produce for private benefit is tantamount to an industry by which the national wealth of the country is increased, and that, for this reason, the Government should not merely be satisfied with nominal prices for the material removed, but also suffer without complaint any amount of mismanagement and waste in the extraction of the produce. But so it is at present. 'Little Jack Horner' must not be disturbed in his development of the Christmas pie, even if it should otherwise suffer by his method of extracting the plums. The cases are identical; in both instances it is Jack who reaps the sole benefit.

"This seems wrong. The forests of a country must be looked upon as a capital left in trust for the whole community, and though it may be quite right to divert a superfluity of the capital into other and probably more profitable channels, a sufficiency of the original investment must be maintained, and of this the interest alone should be consumed.

"When a country which lies within the forest zone of the globe, or, in other words, where the necessary degree of humidity and heat exists to favour arbor vegetation, it is, when first occupied and settled, more or less densely covered with forest growth. It is evident that civilisation, which in every instance is primarily founded on agriculture, cannot advance without the removal of the forest cover from the greater portion of the surface of the country.

"At the outset when labour and demand are scarce, and when the produce is of comparatively little value, the most wasteful and wholesale destruction by ring-barking and fire takes place, and is, under these circumstances, not only excusable but frequently advisable. It is, however, equally easy of proof, both by historical evidence gathered from all parts of the globe and by the results of modern scientific inquiries, that a certain proportion of a country must be maintained under forest cover in order to secure the permanency of national progress and prosperity. The percentage of forests which it is necessary to maintain varies considerably with local conditions, but the fact remains that it is easier to dis-forest the superfluity of forest lands than to recreate forests where they have been devastated and are found wanting.

"It is consequently a matter of great importance that the Government of a new country should make up its mind as early as possible both with regard to the extent of permanent forest reserves and their final situation, that the areas selected should be made inalienable, safe for serious special reasons of State, and that they should be treated for the one purpose of permanent retention under forest cover. This action is certain to pay its way sooner or later, even in a direct manner, and the indirect advantages of judicious conservancy are incalculable.

"To judge from Mr. Vincent's report, and from conversations I had on the subject, which are supported to some extent by my own personal observations, the opportunity of securing the most advantageously situated and best adapted forest areas has, in many cases, already been missed, and is almost everywhere in the colony of Victoria a question of urgency and importance.

* This is not quite correct. Very considerable efforts were and are still made to keep fires out of the forests, and at one time miles of fire-breaks were annually constructed, but as the forest vote was lessened year by year, so this very necessary work had to be abandoned.—G. S. PERRIN.

"The present forest laws of the country seem to me to be sufficient for the primary selection of the areas required, but they do not adequately protect the forest chosen either from alienation, the growth of adverse rights, or against other interference by men; and I would consider it advisable if the laws were improved in this respect. It is evident to me that the protective clauses were, even in the latest Bills, never seriously considered; and the fact that the penalty for fraudulently altering the marks on timber (which is an offence tantamount to theft of an aggravated kind) has been met by a mere trivial fine seems sufficient proof of this assertion. The alteration of a boundary line of a State forest, the firing of a forest, &c., become offences only when the Governor in Council has exercised his powers for making regulations to that effect. On the other hand, mere executive and management rules form integral portions of the existing law, or of the Bills under consideration.

"In my opinion, it would be advisable to revise the Bills thoroughly, and, if I might venture to do so, I would suggest the Upper Burmah Forest Regulations as a pattern for the general lines of a Forest Bill. The Upper Burmah Act is the most practical of Indian forest-laws, and is, so to say, the outcome of the experience gained during nearly thirty years of forest legislation in the different provinces of the Empire. It will be understood that I recommend the adoption of the above Act as a pattern only in a very wide sense, as the circumstances, especially those connected with the extraction and transit of forest produce vary enormously. The whole of Burmah is intersected by water-ways, and the most valuable species of timbers and all bamboos are sufficiently light to float, and thus the creeks and rivers form innumerable export lines for timber in the log, and allow the establishment of large central saw-mills near the seat of consumption, which frequently draw their material for conversion from forests many hundreds of miles distant.

"In Victoria no water-ways of any importance exist.* The most valuable timbers are of high specific gravity, and there are no bamboos by which the heavy logs could be buoyed up. The consequence is that conversion must take place in or near the centres of production. The sawmill owner can, under such conditions, establish a mill of any importance only where permanency of supply can be guaranteed—a monopoly, so to say, of the forest produce of a certain area. Circumstances render this unavoidable, and the fact must therefore be accepted; but it would seem to me to be a matter more conveniently settled by an executive contract than by rules prescribed on the authority of His Excellency the Governor, rules that are not likely to fit every individual case.

"In my opinion it will be quite sufficient if the enactment gives power to the Government: First, to declare any area belonging to the State a State forest, alienable only under the authority of Parliament; second, to demarcate such State forests, and to prevent within them the springing up of private rights adverse to the State; third, to provide for the proper protection of such State forests from fire or unbounded interference by men; fourth, to provide for their systematic management; fifth, to provide for the protection of forest produce in the forests and in transit; sixth, to provide for the adequate punishment of persons breaking the forest laws or regulations framed under its provisions.

"I hardly think it will be necessary to provide for the protection and management of Government forest property which is not declared State forest, provided the work of constituting such inalienable areas is started at once in the right direction, and proceeded with seriously, energetically, and systematically. If this, however, is considered impossible under existing circumstances, an intermediary protection must be provided. It would be a pity, because this choice of measures leads but too easily to delay in the real work of permanent reservation, and tends to create two separate classes of forests, which is most undesirable. The time has hardly as yet arrived when it becomes necessary to provide for the preservation of private or communal forests.

"I have pointed out on a previous page that the existing forest law, if seriously and honestly used, would suffice for the creation of State forests, and progress in this respect should in no wise be delayed pending the enactment of a more comprehensive forest law, because a simple clause in the new Act can give legal effect to selections made under former enactments. When permanent State forests have been created, and have been placed in trust of the Government, it will, in my opinion, be advisable that they should be worked rationally and systematically. There can be no two opinions that this is quite impossible under the present license system, which does not allow of such control as it is necessary to exercise in order to keep the annual or periodical utilisation within the possibility of the forest—*i.e.*, within its productive power. To insure that this is being done it will be necessary to frame a preconsidered working-plan for each forest unit. Such plan must be based on the conditions of each such unit, and be framed with regard to the main purpose which the forest is intended to serve, for, to give an example, it would be useless to treat a forest as a high timber forest when mine-props are chiefly in demand. In framing a working-plan, both the conditions and the purpose should be shortly recorded in one chapter, and the proposals for the future working should be laid down as concisely as possible in the second.

"When the facts are taken into consideration that forest trees take generations to grow to a workable age, and that the forests themselves form a living organism which is constantly producing, growing, and ripening according to fixed laws of nature, and that consequently a constant harvest can be gathered from them, it needs no argument that a plan is necessary which respects such laws of nature, and that any haphazard and irrational utilization will usually result in the ruin of the forests.

"In India it has been found advisable, chiefly in order to facilitate control, to stereotype the arrangements of working-plans. A *resumé* of the requirements which, in the whole or in part, will be found suitable for any purpose may be seen in the last edition of the Indian Forest Department Code.

"A working-plan once framed should be carefully considered by competent authority and formally sanctioned. When this has been done, no major deviations should be permitted without

* The Murray River is most valuable for water-transit, but this river is claimed by New South Wales.—G.S.P.

an inquiry of at least as searching a character as that on which the original plan was based. In regard to this, I would again invite reference to the Indian Forest Department Code, the last edition of which contains the outcome of our experience in this respect. Working-plans in India were first introduced and framed by Sir Dietrich Brandis, the real founder of scientific forestry in that Empire. These plans extended mostly over large areas, and served their purpose brilliantly, but they were naturally very general in their scope; too much so to make them of permanent utility. Hereafter we went, owing to the arrival in the country of officers of high theoretical training, through periods of over-elaborated plans which cost too much money and time, and offered difficulties in regard to control. It was only when practice had mellowed our theory that the happy medium was struck.

"My visit to the colony has given me many opportunities of observing how necessary permanent working-plans are in certain localities, and I may be permitted to give a few of the many instances I have seen. The State forests between Creswick and Ballarat were years ago thoroughly ruined by entirely uncontrolled fellings on the part of the mining population: trees and poles were cut at all heights from the ground, which prevented the springing up of a healthy coppice, which, to a certain extent, would have grown on a self-established root system. An unsatisfactory pollard growth infested the ground. The mining industry collapsed, but luckily a limited demand remained for small timber. Mr. Perrin had at this period the well-conceived idea of taking a severe improvement felling through the forests, removing all diseased, badly-grown, and pollard trees. He had to open out the forests to what I should, without colonial experience, have considered a risky degree, more especially on a soil not naturally vigorous. The recuperative power of the *Eucalyptus*, however, in its natural habitat is something extraordinary, and the results of the operations have been thoroughly satisfactory. Near the 'White Horse,' however, we came to several areas through which Mr. Perrin had taken a very radical improvement felling, leaving only the best and most promising stems on the ground. These—it is almost incredible—the miners had appropriated, felled most recklessly, and partly removed under cover of Sir John McIntyre's Miners' Circular, which was shown to me on my expressing doubt as to its existence. I saw a repetition of the same vandalism in the Linton and Scarsdale Forests. Now, nothing would be easier than to frame straight away a rational plan for the working of these forests, and they would pay more than their expenses from the very outset.

"The present license system, which permits a scramble for the forest produce so long as it can be found anywhere, is at the bottom of much of the disorder which exists. It must disappear when a regulated utilisation of the forest is introduced, but otherwise when once the possibility of a given forest area has been fixed, and the exploitation has been arranged accordingly; it is a matter of no great consequence as regards forestry in what manner the forest produce is disposed of so long as the possibility is not exceeded. This question of disposal becomes a purely financial one. The trees may be sold singly or in blocks or compartments at a fixed royalty, or by auction, or they may be given away, if the State thinks fit.

"A lease for a number of years is especially adapted for sawmill industry, but a fixed royalty does in such cases frequently not represent the real value of the standing produce. This value is greatly influenced by the situation of the forest, its nearness to the market and other conditions, and a competitive tender with a minimum rate per 100 cubic feet will probably be the best gauge of the actual market value.

"I have met no instances myself, but have been credibly informed that many well-established sawmills had to be abandoned because the supply of timber payed out unexpectedly. This, of course, could not have happened if sufficient area of forest had been set apart for them under a preconsidered plan. Permanent sawmills create a constant demand on the forests, and may be relied on to pay a constant and considerable income on their output. Their establishment should consequently be encouraged, not by special or low rates, but by certain security of finding a permanent supply of raw produce within a reasonable distance. This is of much greater importance to the industry than favourable rates.

"In my opinion, sawmills should be established only in or near sufficiently large and well-situated forest areas from which a constant supply may be expected, under the provisions of preconsidered and formally sanctioned working-plans, the Government guaranteeing to the owners that such plans shall not be altered or deviated from during the time for which they have been sanctioned without the consent of the interested parties. Government should, however, never guarantee the actual permanency of the supply, as the best-considered working-plan may have flaws, or may be upset by unforeseen accidents.

"It is frequently argued that the forests of the colony are inexhaustible, or will at least meet the demand for hundreds of years to come. It is true that as yet no general scarcity is felt in the timber-supply of the country, but it cannot be gainsaid that the red-gum forests on the left bank of the Murray have practically disappeared within late years, and that the local demand for timber can in many instances not be so readily met as in former years. At present the fuel markets of Melbourne and other big towns, and of many agricultural districts, are to a considerable extent supplied from ring-barked trees, the remnants of former forests. I grant that there are enormous supplies of this timber; but it is, after all, dead material, and the wood that has not been consumed within the next twenty years or so will probably have rotted away. When this has happened the living forests will have to meet the whole of the demand, which during the same period must have grown considerably. It needs no great foresight to predict that with a growing population even the remote forests will gradually be indented upon and become valuable in their turn.

"I have as yet written only of the treatment of the natural forest areas, and in this the chief efforts of the State must centre.

"Planting on a large scale is costly, and it will be found that if an accurate ledger is kept of the original outlay and all its incidental expenses, artificial forest cultivation will repay the money and time spent on it only under very exceptional circumstances, and it is only in such circumstances

that I would recommend the planting of indigenous trees. It is different with the planting of exotics. There are no light-wood trees in Victoria of any value, and the cedar of New South Wales, and other trees having similar qualities, are reported to disappear rapidly, owing to large demand and uncontrolled working. To what extent the light-wood forests of New Zealand are protected is beyond my ken, but under any circumstances it is undoubtedly a step in the right direction to introduce woods into Victoria which have qualities not found in the indigenous timber, for that a demand exists for material of this kind is proved by the large annual imports. The choice of trees to be introduced should be made with the greatest care and circumspection, and, if decided upon, rapidly and systematically pushed. The introduction of oak is excusable only for reasons of sentiment or for the improvement of the landscape, for, as regards the technical qualities of the timber, it like 'carrying coals to Newcastle.' The broadcast introduction of *Pinus insignis* has no excuse whatever, for, though it is doubtless one of the fastest growing pines, its wood is of a low character.*

"I have great sympathy with the plantations which have been established with a view of the broadcast distribution of useful exotic plants, and I have taken steps to secure for them for some time to come an annual supply of seed from India of such trees as I think may be useful. These central plantations have been established by the Victorian Forest Department, and are worked with great success, upwards of one hundred and fifty thousand trees per annum being distributed free of charge.

"I cannot speak too highly of the officers in charge. They are men who have gained their experience in practical work, and know their business thoroughly.

"I have often been asked my opinion as regards the prospects of an export of timber from the colonies, and I have given considerable thought to the subject, which has been for years in my mind with reference to our Indian heavy woods. We have in India a considerable number of timbers which do not compare unfavourably with the best of the *Eucalypti*. I need only mention *Fragraea fragrans*, *Shorea robusta*, *Mesua ferea*, *Xylia dolabriformis*, and *Pterocarpus indicus*, but there are many others. We have, however, succeeded only in establishing an export trade in *Pterocarpus indicus*, and that, not on account of its exceptional strength, but for its richness of colour and capacity for taking a high polish. It is used for panelling, parqueting, staircases, &c. In the same way I think an export trade might be established in Australian blackwood. There is, in my opinion, no hope of placing any of the Australian or Indian heavy timbers on the European or American market for purposes of superstructure or ship-building. Their use as paving-blocks is all we can expect as regards those which are not sufficiently handsome in design or colour for parquet, veneering, or other decorative purposes. The demand, however, for paving-blocks may at any moment assume gigantic proportions.

"I cannot conclude this letter without paying a tribute to your eminent scientist, Baron Ferdinand von Mueller, who, as far back as 1871, and probably earlier, recommended the rational treatment of the Victorian forests."

THE INDUSTRIAL AND COMMERCIAL USE OF THE TIMBER-TREES OF NEW ZEALAND.

Kauri (*Agathis australis*), Salisbury.

Among the timber-trees of New Zealand, and, indeed, of Australia, for manufacturing purposes the kauri stands pre-eminent. All writers concur in placing this noble tree *facile princeps*. No one, indeed, entering a kauri forest for the first time could fail to be struck with astonishment and admiration at the height and majestic proportions of this timber giant. Straight, massive boles carry aloft great branches that tower above the surrounding vegetation, imparting to the beholder the impression at sight of great height rather than of bulk.

I have been among the giants of Cape Otway, of Gippsland, of Yea River, and of Sassafras Gully, in Victoria. I have explored the habitat of giant trees in Tasmania, at the Huon, Port Esperance, Hastings, and the west coast; and have assisted in measuring *Eucalypti* in both colonies up to 330 ft., and seen scores of over 300 ft. Yet none of these so impressed me with the sense of great height as did the kauri, and it took some consideration to realise that these trees appear taller than others of twice their height; solely because of the beautiful proportions of their cylindrical and massive boles—which are carried up like the tubular column of a substantive bridge—and the absence of knobs or excrescences.

Now, many of our tallest gums are not solid in the butt. They are generally supported by buttresses. At, say, 30 ft. the bole tapers rapidly, and at 60 ft. from the ground is not more than half the diameter at 8 ft. Then an even diameter is preserved for the next 100 ft. or so. It is a quite common thing to see gum saplings of, say, 3 ft. to 5 ft. diameter run up from 100 ft. to 200 ft., straight and slender.

Now, the kauri is essentially a timber-producing medium, and in the proportion of convertible wood to the height of the tree emulates the *sequoias*, or giant trees of America. The kauri puts on wood year after year, each foot of growth in height marked by a regular and well-proportioned increase in girth, so symmetrical and so beautifully balanced that the tree would almost stand unsupported when sawn through. The quality of its timber, is of course, too well known all over Australasia to need comment here.

Professor Kirk's fine work on "The Flora of New Zealand" gives every information. It may briefly be mentioned, however, that for furniture and general cabinet-work kauri is much used; for flooring it is unrivalled, and is in great demand for engineering works of construction. Tough, elastic, buoyant, and easily worked, it is, *par excellence*, the timber, not only for use in New Zealand, but in all parts of Australasia.

* For the last four years these have only been planted for shelter purposes.—G.S.P.

Singularly, the kauri is only found in quantity in the northern parts of the North Island, and generally about Auckland.* Some few "bushes" are also found between Auckland and the Waikato River, at Coromandel Peninsula, and in the Thames District. Captain Cook first saw the tree at Mercury Bay, and his practised eye at once recognised its value for masts and spars, &c.

I regret very much that I was unable to visit the most extensive kauri forests, and had only time to inspect those in the Waitakerei Bush and on Coromandel Peninsula. I am indebted however, to the directors of the Kauri Timber Company for much valuable information as to supplies and disposition of timber; also to the Commissioner of Crown Lands at Auckland, G. Mueller, Esq., who furnished me with statistics as to extent and quantities on the timbered lands of this district.

The kauri country commences at Te Aroha, and extends to the north end of the Auckland District, and the total available amount of timber is 1,371,405,080 ft., of which 371,405,000 ft. is growing on Crown lands, and on Native or private properties 500,000,000 ft. These figures were compiled and supplied to me by Mr. Mueller up to date, 10th October, 1896. This, of course, represents an immense quantity of kauri still at command for trade purposes; yet, when the annually increasing output is considered, and allowance made for destruction by fire and the slow growth of young trees, it is calculated that the supplies—subject to variation by increasing or decreasing output and losses by fire—will not last more than forty or fifty years. This means, if the authorities are correct in their theory that regeneration of the kauri forests is hopeless, that within about the period named the trade will become extinct. I do not, however, believe in this theory of non-regeneration, but, on the contrary, am satisfied that if undertaken and carried out in a systematic and scientific manner the kauri forests can be renewed and maintained. But as I shall deal more fully with the subject in another section I need not further discuss it here.

Rimu (*Dacrydium cupressinum*), Solander.

This is the most widely distributed of New Zealand trees, and, with the white-pine, constitutes the foundation of the chief forests in both North and South Islands. The rimu is extensively used, though only in New Zealand itself, for furniture and building, the export trade being insignificant as compared with that of kauri. It is a handsome tree, varying in height from 40 ft. to 90 ft., and averaging in diameter 2 ft. 6 in. to 3 ft. It is thus easily worked and trucked, and of a size that makes it convenient for conversion off the skids. The foliage is pendant, and at some stages of growth not unlike that of the weeping willow, producing the male and female flowers on separate trees. It is non-gregarious, and generally found associated with white-pine, matai, miro, rata, &c., flourishing most on river-flats or in littoral situations, between 300 ft. and 1,000 ft. above sea-level. So far as foliage is concerned, the rimu is certainly one of the most striking of New Zealand flora, and its light-green blends harmoniously with the darker tints of the trees usually found in the same forest, from which, owing to the colour of its leaves and its "weeping" habits, it can easily be distinguished even at a great distance. The timber is variable in quality, and the tree subject to "heart-shakes," which cause resin to accumulate in considerable quantities. When, however, this does not occasion "faults" it indicates great durability, and the heart of rimu is therefore much esteemed for work in which this quality is of special importance.

Figured rimu is in much request for cabinet-making; is also extensively used for ceilings, and when carefully disposed presents a very handsome appearance. It provides material for dados and office furniture in most parts of the colony. The figure-marks in the wood are caused by compression, probably through swaying in the wind.

A serious defect in rimu, common in the genus *Dacrydium* elsewhere, and notably in Tasmania, is the milky oleaginous sap which seems to permeate the wood, and after manufacture exudes, dulling, and in time destroying varnish or French polish, and giving a dead look to furniture made from it. The Huon pine of Tasmania has exactly the same characteristic. As a set-off, however, this oily matter is one of the most effective germicides known, and also preserves the timber.

Rimu is most extensively used locally for building purposes, but, though fairly durable for indoor work, cannot be depended upon to last if exposed to wind and rain. When used for heavy works in bridge-building, &c., it is often found necessary to piece rimu at the joints with other timbers—generally Australian gum—as rimu invariably commences to decay at the points of contact unless thus joined with other timber. Heart-rimu is of course superior to timber cut from other parts of the tree. The sapwood is especially unreliable, hence should be carefully cut away before the timber is converted for use. This sapwood varies in proportion to the rest of the timber in different trees, and, owing to the lack of due supervision in New Zealand, sawmillers are apt to cut those in which it predominates. These are young trees which have not reached maturity.

There can, indeed, be no doubt that this indiscriminate cutting has been the cause of the bad name many leading New Zealand timbers have in Australian markets. Were none but trees fully matured brought into use, a great deal of the ill-repute in which rimu, white-pine, matai, and miro are held would be removed. Careless selection, and the cutting of trees not yet matured, invariably lead to loss of trade and wasteful destruction of forests. Tests made by Balfour and Blair (*vide* Kirk's "Flora of New Zealand," page 30), place rimu as equal in strength to English oak; but I think these tests refer to matured, and not to mixed timber.

In specific gravity, rimu varies from 0·590 to 0·644; in weight, from 34·28 lb. to 40·11 lb. per cubic foot. The breaking-point for a piece 2 ft. long and 1 in. square, supported at both ends and loaded in the centre, is given by Blair at 350·88 lb.

Like most of the other New Zealand trees, rimu is of very slow growth; but I am of opinion that, properly cultivated, the rate of growth would be accelerated. Hitherto, however, experiments in tree-growth have been carried out in public gardens, &c., under unfavourable conditions, and nearly all the records refer to isolated trees, grown amid surroundings foreign to the natural habits

* Professor Kirk states that kauri is found in one or two places in the South Island.

of the trees, and often under adverse conditions of soil and climate. The best means of determining the average rate of growth would be to select in the forest several trees of the same age, and note their progress and development on a certain day annually for a series of years. If this were done systematically, I am satisfied the rimu would be found a faster grower than it is now supposed to be.

As observed by me, rimu grows luxuriantly in the north of the South Island, near Havelock, Nelson, Westport, and in Southland. Rimu of splendid quality is also found in the Pelorus Valley, on the Buller, on the coast around the coal-mines of Westport, on the Grey and Arahura Rivers, along the railway to Jackson's, and between Greymouth and Hokitika. Very fine figured rimu is also found at the mills about Kumara; while some of the best I have seen grows in the forests between Waimarino and Taumaranui. Still another extensive rimu forest extends back from the Wanganui at Pipiriki, right through to the volcanic plains beyond Raetihi to Waimarino.

If this country is thrown open for settlement the forest must be sacrificed, and I therefore strongly advise the Government to have it permanently reserved as a State forest.

Rimu, white-pine, matai, totara, miro, and beech are found associated all over New Zealand, and at Dannevirke, Hawke's Bay District, rimu and white-pine grow to very large dimensions. Here also I saw some of the largest rata and totara—immense trees, both as regards bulk and height.

Rimu is not good material for fencing-posts, as it decays quickly in the ground—generally first at the surface; it is, however, the most extensively used of native trees in New Zealand for building and decorative purposes.

White-Pine: Kahikatea (*Podocarpus dacrydioides*), A. Richard.

This magnificent tree, with its massive bole running from 40 ft. to 130 ft. in height, ranks next to rimu in distribution and utility. As a general rule, the trees run to 60 ft. or 70 ft., and give mill-logs a little larger than the average rimu, but, like it, easily handled.

The proportion of sapwood is even greater in young white-pine trees than in rimu, and it is therefore the more undesirable that these should be utilised in the building or manufacturing trades before they have matured. To the cutting of trees when full of sap and without regard to age may be ascribed the distrust entertained as to the durability of both rimu and white-pine.

In these days of education, the buyer of timber is much more particular as to the quality of his purchase than was formerly the case. It is, therefore, necessary that sawmillers should abandon the old slip-shod methods, and adopt up-to-date systems in treating timber for the market. This is especially necessary with reference to timber sent to London and other of the world's markets, since Home and foreign buyers are most particular on the very points upon which Australasian sawmillers have been apt to lay little stress.

Now, white-pine has the reputation of being non-durable for outdoor purposes. Yet, if due attention were paid to the selection of mature trees, the cutting of these trees only during the proper season, and possibly the seasoning of the timber by either steam or simple drying, this, like the rimu, would probably be found at least equal to many others that are now held to be of greater value. It is tolerably clear that sawmillers will not be able for much longer to ignore the opinions of experts in this connection, and that the question of the proper season for felling particular species will determine the success or failure of any attempt to establish an extensive export trade in timber with the world's markets.

The white-pine, unfortunately, is very often the victim of a small but persistent foe in the shape of a borer, which tunnels through the wood in its manufactured state. In New Zealand the ravages of this insect are very formidable, but possibly it may be destroyed in the process of seasoning, either by steam or otherwise. If the eggs or larvæ can be so destroyed, and the timber is exported immediately, it is quite possible that under other climatic conditions this pest may be destroyed or escaped from. A similar borer infests the *Eucalyptus* in both Victoria and Tasmania, but is by no means so injurious as to this timber. Though mischievous, in so far that its tunnels admit water, the *Eucalyptus* borer rarely affects the strength or general utility of the timber, though it possibly to some slight extent may reduce its durability. Professor Kirk, I notice, recommends carbolic acid as destructive of this pest, and probably creosote would be equally effective.

Kahikatea, like rimu, is extensively used for cabinet-making, and in the building trade. The timber is light coloured, sometimes pale-yellow, and has been compared by Professor Kirk to the yellow deal of Europe (*Pinus sylvestris*). I concur with the Professor in the comparison, though it must not be forgotten that the New Zealand timber is of much slower growth and more difficult of regeneration than its European prototype.

On account of its toughness, white-pine is extensively used for boat-building, and of late years very large quantities have been shipped to the other colonies for conversion into butter-boxes—a purpose for which it appears to be better suited than any other timber. The fact that the wood is absolutely free from any taint or odour makes it specially valuable for the conveyance of so perishable and easily affected a commodity as butter.

My remarks as to the quantity available, and distribution of rimu, apply also to the white-pine.

According to Blair's "Building Materials of Otago," and Balfour's experiments, the specific gravity of kahikatea varies from 0·459 to 0·557, and Mr. Blair gives the weight of two specimens (green) as 38·921 lb. and 43·899 lb. per cubic foot, and (seasoned) 28·636 lb. and 29·505 lb. Four specimens from Banks Peninsula, Balfour finds, averaged 29·11 lb. The breaking-weight of pieces 2 ft. long and 1 in. square, supported at both ends and loaded in the centre, is set down by Blair, as the result of four experiments, at 308 lb. to 358 lb.; and Balfour states that for pieces 1 ft. long and 1 in. square, supported at one end and weighted at the other, the breaking-point ranges between 90 lb. and 155 lb.

White-pine, like the kauri, is free from ring- or heart-shakes, and is a sound timber-tree. Unlike the latter, however, it has a large percentage of sapwood, and when this predominates over the heartwood the timber decays rapidly.

Like all other timbers, white-pine of extra good quality is found in particular districts, and I am of opinion that the humidity or dryness of the atmosphere in different localities accounts for the variety in quality of New Zealand woods.

Totara (*Podocarpus totara*), A. Cunningham.

This fine tree ranks next in value to kauri, and for certain purposes is even superior to that timber. It is a handsome tree, running from 60 ft. to 90 ft. in height, with clean straight stem, of handy size for milling. The timber cuts mellow on the saw, is of a reddish colour, with clean straight grain, and is extensively used as building material. It is one of the best timbers in the colony for railway-sleepers, and also for piles, its immunity from attack by the teredo and other marine insects being only equalled by that of the puriri and pohutukawa (T. Kirk). Totara is also most useful for wood-paving, and has been found very effective for this purpose on crossings at the intersections of streets in Wellington, and elsewhere. The timber has the defect of being rather brittle, but, nevertheless, in heavy logs for large construction-works and for sleepers is found so far reliable that it is in general use.

The best totara I found was at Dannevirke, Hawke's Bay, and in the forest near Taumaranui. Its specific gravity is 0·559'; weight per cubic foot, 35·17 lb.; average breaking-point, 133·6 lb., as given by tests of seventeen pieces.* Blair's tests of the timber in its green state give weights per cubic foot varying from 49·783 lb. to 56·715 lb., and when seasoned, from 36·21 lb. to 42·228 lb.; breaking-point, 142·5 lb. for ten specimens.

Mottled or figured totara is in great demand for cabinet-making, and the burrs of this tree, when cut into veneers, are very handsome, and most effective for inlaid work. Indeed, kauri (mottled), puriri, rewarewa, totara, silver-pine (knot, or burr), worked up in combination into designs represent the handsomest timbers known to the cabinet-making trade even in Europe. As yet, however, the excellent beauty of these timbers so used is but little known to the trade outside of New Zealand.

The mottling of these trees is produced naturally in a curious fashion. The tree has numerous fissures, which often remain open for many years, till they are overgrown, and the bark caught by this growth is enclosed. At the rising of the sap the enclosed bark becomes a source of irritation, exactly in the same manner as the presence of a splinter sets up inflammation in the human body. With each year's growth the enormous compressive power of the tree squeezes the bark patch smaller and smaller, irritation of the sap continuing all the time. This process in the case of the *Dacrydium* gives the satin-like waves or undulations—the lighter or darker shades according to distance from the source of irritation. The pressure continuing makes the wood so dense and hard that it becomes darker in colour, assuming at the same time the figures and wavy lustre that are so prized for cabinet-making in kauri, totara, Huon pine, &c. Mottling is also caused by burrs formed through shoots or sprouts growing into the sap and setting up irritation and gangrenous growth of wood. These burrs are sometimes the results of injury to the tree through insects or other causes.

Totara is well distributed over the colony, and, like other New Zealand trees, is usually found associated with other woods. As a rule, to which there are, however, notable exceptions, totara is smaller than either rimu or white-pine. It is occasionally gregarious, though not usually so. Cut into blocks for wood-paving, 3 in. by 6 in. by 9 in., the contract price for the City of Wellington is 14s. 4d. per 100 superficial feet, and the wood is estimated to last for twenty years. The timber is also used very generally for beams, joists, wall-plates, and other heavy construction-works.

As in the case of most other New Zealand timbers, there is already threatened a scarcity of totara, more especially as the forests are not allowed the chance of regenerating themselves.

Totara shares with kauri, rimu, and kahikatea a preference for low altitudes, rarely flourishing more than 1,500 ft. above sea-level.

This timber has always been a special favourite of the Maoris, who use it to large extent in the construction of their canoes, and also in building wharepunis and patakas. Some of the largest canoes in the Wanganui and Taranaki districts are made from totara obtained in the forests above the head-waters of the river near Taumaranui. In Southern New Zealand the Natives distinguish between two kinds of totara—red (taihuro), and white (taitea). ("The former is the most durable." —Professor Kirk.) This gentleman also points out in "The Flora of New Zealand," page 13, that *Podocarpus hallii* is a distinct species from *Podocarpus totara*, though there is a strong resemblance between the two, and they are found associated from the Bay of Islands to South Cape. Totara is, however, the superior timber.

Podocarpus hallii differs from the totara in having a thin papery bark, larger leaves, and pointed fruits. The Maoris on Stewart Island are the only Natives who have recognised the two species as distinct trees, and this fact—only recently discovered by Mr. Hall—indicates what close observers these Maoris are.

Toothed-Leaf Beech, Tawhai Raunui (*Fagus fusca*), Hooker.

This useful tree—the birch of New Zealand—is very widely distributed all over the colony, and, with the several kindred species, constitutes the bulk of the forest timber and sub-alpine growth upon the mountains in both North and South Islands. The toothed-leaf variety—a fine tree with average growth in sheltered valleys to 60 ft. or 70 ft.—takes its name from the serrated edges of the leaves, which, with its corrugated and crenulated form, enable the bushmen to recognise it, though Professor Kirk describes another tree so nearly resembling it that mistakes might easily be

* Professor Kirk's "Flora of New Zealand," page 229.

made. He has therefore described it in "The Flora of New Zealand" as *Fagus fusca*, var. *dubia*, nearly resembling *Fagus solandri*. Serrations of the leaf are confined to the upper portions; the veins are not prominent, and the texture is rather thicker.

The customary vagueness of the bushman's vocabulary gives the same tree the names of black-birch in Auckland, North Otago, and Southland; red-birch in Wellington, Nelson, and South Otago. Other species indigenous to New Zealand are *Fagus solandri* (the entire-leaved beech), *Fagus menziesii* (the silver-beech), *Fagus cliffortioides* (the mountain-beech), and *Fagus apiculata* (the pointed-leaved beech). The English names given to these varieties by Professor Kirk so accurately describe them that they may easily be distinguished by laymen, and the misleading terms red-, black-, and white-birch set aside, to the great advantage of sawmiller, timber-hewer, and others, even though they have no knowledge of botanical lore.

The *Fagus fusca*, *F. solandri*, and *F. menziesii* are the most valuable varieties of beech for industrial purposes. They are also the most ornamental, are easily transplanted, and will thrive anywhere. They average 70 ft. in height, some reaching 100 ft. in altitudes up to 2,500 ft. Above that the *Fagus cliffortioides* (mountain-beech) takes the place of the better-known forms of this useful tree.

The pointed-leaved beech is rare, and only found about Matamau and Dannevirke, Hawke's Bay. It averages 40 ft. high, with entire pointed leaves, though but little is known of the timber. It approaches the *F. fusca* in its entire form, and might easily be mistaken for that tree, but grows at the highest altitude of any New Zealand tree (4,800 ft.—Professor Kirk). It is, however, of little value save for firewood, and for protecting the soil of mountain-tops from being swept away by torrents and from land-slips.

The tooth-leaved beech is especially useful to the digger, selector, or settler, as it is fissile, makes good fencing, shingles, boards for sluice-boxes, &c., is easily worked, and, though not so durable as some better-class woods, is generally found of large size, and can be converted with a minimum of waste.

Timber obtained from trees of large size is generally found to be of the best quality, and most durable; while that grown upon mountains, at an elevation between 1,000 ft. and 2,500 ft., is stronger than that in the lowlands and in moister localities. The tests have been somewhat variable, but Professor Kirk (page 811) speaks with no uncertainty about the great value and durability of the beech, an opinion confirmed by many representative sawmillers during my tour of New Zealand.

Extensive forests of this beech are found in Southland, in parts of Otago, in the mountain districts in the gorges of the Southern Alps, at elevations between 2,000 ft. and 3,000 ft. Above Auckland Isthmus it is scarce in the North Island; also at Te Aroha, and on the West Coast, between Waikato River and the sea. At Hawke's Bay are considerable forests of *F. fusca*, mixed with *F. solandri* and *F. menziesii*, which extend along the slopes of the Tararua and Rimutaka Mountains to Cook Strait. It is generally plentiful throughout the South Island, but very scarce in the Province of Canterbury; and there can be no doubt that the beech forests will form a stand-by for the people of New Zealand, since these trees are so easily regenerated from seed that the forests can be renovated and maintained at comparatively small expense.

The disparity shown in tests of New Zealand timbers can be explained by the fact that specimens were taken from trees of different ages and growth. Trees of varying ages, taken from different sites, and at different seasons of the year, must, of course, show widely differing results. It is therefore quite certain that to obtain reliable and satisfactory tests of timber must involve long and patient research and extensive scientific knowledge.

Timber for testing purposes is frequently submitted by different persons, instead of being carefully selected by an expert. In this manner many trustworthy and painstaking examiners are misled, and their testimony is conflicting, the samples submitted to them for observation differing so widely in age, climatic influences, &c., that the results are inevitably confusing, and very different from those which would be obtained by systematic expert testers.

In Australia, as, is well known, many *Eucalypti* have been tested under incorrect names, and with data supplied in good faith, but, through ignorance, misleading. Through such circumstances the information supplied even to some standard works is by no means reliable.

In making tests the questions of timber being cut at the proper time, and of seasoning, must be carefully noted and taken into account, and especially in the former connection sawmillers will be forced to deal with the matter in a very different spirit from that in which it was approached by the members of the Timber Convention held at Wellington in July, 1896. In a moist climate like that of New Zealand the season for cutting has a most important bearing upon the value of all timbers as to strength and durability. Kauri, perhaps, represents the sole exception to this rule, or, at any rate, is least affected by the season of cutting. Blair gives from ninety-nine tests a mean breaking-point at 158·86 lb., the maximum being 262·5 lb. and minimum 105 lb. Forty of these specimens (*Fagus fusca*) were from the west coast of the South Island, and fifty-nine from the interior of Otago. The mean for both lots was almost identical—viz., 156·91 and 156·83—but the maximum of the West Coast was only 186 lb., and that of the Otago specimens 262·5 lb. On the other hand, the minimum—105 lb.—was that shown by Otago specimens (Professor Kirk, page 180). Balfour records, of seven tests, mean breaking-point 202·5 lb.; maximum, 250 lb., and minimum, 122·5 lb.; while the mean for Lake Wakatipu timber was 232 lb., against Blair's 192·79 lb. Blair's tests, however, were made of timber from the South Island only, and nearly one-half of this was obtained from low levels. Blair ("Building Materials of Otago," p. 224) gives the weight per cubic foot (green) from 39·62 lb. to 68·909 lb.; seasoned from 34·124 lb. to 40·648 lb.; and records that boards 12 in. by ½ in. shrank from 0·92 in. to 1·17 in.

It will be seen from these records that the various tests present a conflict of testimony, and this applies so much all along the line that engineers and architects attach very little value to timber tests, though they are useful as a general guide in approximately gauging the strength of timber for important construction-works.

While the *Fagus fusca* is the best of New Zealand beeches for manufacturing purposes, the *F. solandri*, or entire-leaved species, runs it close. The principal source of supply for the latter is the Oxford Forest, Province of Canterbury. The timber is heavy, tough, and strong, but unless carefully selected is not durable. The tree is found in both islands, and grows from 60 ft. to 100 ft. in height, the wood pale-red or greyish, often with black streaks, the figure-marking particularly handsome, and the heart-wood black.

Fagus menziesii (silver beech) grows also from 60 ft. to 100 ft. The tawhai, a handsome tree of large size, the bark white and silvery, of a pale-grey colour, differing in this appearance of the bark from the *Fagus cunninghamii* (Tasmania) and *F. mooreii* (New South Wales), which it resembles botanically, having the glandular involucres, &c. The wood is of deep-red colour, straight-grained, hard, dense, and plain. It is tough and elastic, but not durable when exposed to the weather. Its fissile character causes it to be used extensively for shingles and fences, though it does not last when placed in the ground. It, with other of the beech timbers, should be shipped extensively to Australia, being well adapted for conversion into wine-casks and butter-boxes. The silver-beech is the strongest of the beeches, and is very useful for works under cover (Professor Kirk). Blair gives the weight per cubic foot (green) at 52·62 lb.; and seasoned, at 38·99 lb.; breaking-point, 175·50 lb. The tree affects mountain country, generally to an altitude of 3,000 ft., is well distributed over the North and South Islands, and should certainly command a market in Australia for casks, boxes, and also for flooring.

Silver or Westland Pine (*Dacrydium westlandicum*), Kirk.

This tree, well known in the South Island, is much prized in the Railway Department for its lasting qualities, and is extensively used for sleepers. Owing to its small size, the silver-pine is not in much demand among sawmillers, rarely exceeding 3 ft. in diameter. It is therefore looked upon as the special property of the hewers, and hewn silver-pine sleepers are highly prized. Unfortunately, sleeper-hewing entails much waste of timber, and, in view of the probability of scarcity of silver-pine at no distant date, it is a grave question whether hewing should not be altogether discontinued. However, selection fellings have left chiefly inferior trees, which would not suit the miller, and possibly the hewers are now doing good work in removing the matured trees remaining. This pine rarely attains any great height, running as a rule from 40 ft. to 50 ft. Its principal habitat is in the neighbourhood of Hokitika and Kumara, on the west coast of the South Island; but it is also found in limited numbers at Whangaroa North, and near Ngauruhoe (Professor Kirk). During my trip in the volcanic country about Ruapehu and Tongariro I saw some of the finest silver-pines in the island, on Field's Track to Taumaranui. These were much superior to those of the same species in other localities, and, so far as I was able to observe the country between Waimarino and the Wanganui River, considerable quantities of silver-pine exist in these forests, interspersed with rimu, white-pine, matai, and other trees. This is not far from the totara forest mentioned previously. The silver-pine is noted for its great durability, and is specially valuable for use as in piles and marine construction-works requiring stability and staying-powers. This timber owes its immunity to attack from marine and other insects to the fact that the wood contains a fine volatile oil, very powerful and also very lasting. This oleaginous secretion is most distasteful to insect-life, and it is only when it is exhausted from the wood through age or other circumstances that decay sets in.

The Tasmanian Huon pine (*Dacrydium franklinii*) is characterized by a similar secretion, and hence was in the past much in vogue in Tasmania for ship and boat-building. It is a much larger tree than the silver-pine, though the latter, being hardy and easily transplanted, could probably, under favourable circumstances, be grown to greater girth and height than is usual under present conditions. Unless, however, steps are taken to check the destruction of the forests now in progress the silver-pine will within a few years be a thing of the past. In some places this tree is called the yellow-pine, the confusion of names for the same species probably arising from the fact that timber cut from mature trees is deeper in colour than the white or whitish-yellow of those cut young.

The mottled silver-pine is most handsome, the marking on some of the knobs or burrs being strikingly effective for use in cabinet-making. The tree is closely related botanically to the rimu, both belonging to the genus *Dacrydium*, while another, the *D. bidwillii*, is an alpine form. Its botanical designation was fixed in 1876 by Professor Kirk, who describes the wood as dense, compact, of great strength, toughness, and elasticity, though of low specific gravity.

Yet another of the genus *Dacrydium*, the mountain rimu, or *D. laxifolia*, has no commercial or economic value, though of botanic interest.

Matai, the Black Pine (*Podocarpus spicata*), R. Brown.

This fine tree is also well distributed over the North and South Islands, though rarely met with on Stewart Island. A rounded head of bushy thick-set foliage, dense dark-green leaves, with beautiful silver-white underleaf when stirred by the wind, gives a peculiarly light and graceful appearance to the black-pine. The average height is about 50 ft., and, as it rarely exceeds 3 ft. diameter, the logs are of convenient size for transport and for handling on the skids. The matai produces a berry-like fruit; which, owing to the absence of the usual cones, tests the faith in botany of the unlearned observer, who is informed that this tree is one of the Conifers. That it really is so, however, the authority of Professor Kirk and Mr. R. Brown goes to show; and though sawmillers and fellers may laugh at the idea that the luscious plum-like fruit is in point of fact analogous to the cone of a pine, science proves conclusively that *Podocarpus spicata* is actually of the natural order *Coniferæ*. A "weeping" habit at times suggests the idea of a distinct species, but is really that of the young trees, which, as they reach maturity, assume the erect bushy form described above.

Matai grows up to an altitude of 1,800 ft. above sea-level, and the timber is valued for its strength, its close-grained, smooth, and even texture. It is, however, one of the most slowly-growing trees in the colony. Blair's tests give the following results: Weight per cubic foot (green), 75·534 lb. to 77·798 lb.; seasoned, 46·862 lb. to 47·508 lb.; breaking-point, 384·03 lb. for piece 2 ft. long, 1 in. square, supported at each end and weighted in centre. Balfour gives specific gravity 0·572 to 0·792; weight per cubic foot, 34·97 lb. to 49·36 lb. This timber is in general use for bridge and heavy construction-works, also for house-building and flooring; but, being harder than kauri or white-pine, it takes longer to lay down than these timbers. The fact that though formerly used for sleepers, matai is not now in demand for this purpose, seems to indicate that when brought in contact with the ground, or exposed to damp, matai is not durable. In this, as in other cases, however, the unreliability of the timber may be due to the cutting of trees during the sap season, or before it has reached maturity, or to its not having been properly seasoned before being used. Matai is more or less subject to heart-shakes.

"The genus *Podocarpus* includes sixty-three species, of which four are indigenous to Australia, and seven to New Zealand" (Professor Kirk).

PAHAUTEA (*Libocedrus bidwillii*), Hooker f.; KAIKAWAKA (North Island), KAWAKA (South Island), (*Libocedrus doniana*), Endlicher.

These trees are so closely allied that their points of difference could scarcely be detected by a layman, and are only recognisable by a scientist on careful examination and comparison of specimens. *Libocedrus bidwillii*, however, differs from *L. doniana* in its lower stature and narrower conical habit, in its tetragonous branchlets, in the smaller size of its leaves, and especially the fruit ("Flora of New Zealand": Professor Kirk). The leaves of the latter, on the other hand, are large, as also are the seed-vessels; the matured branches are compressed, and never tetragonous; the seeds have shorter and broader wings.

On the West Coast, where I observed this tree, it is generally known by the name given to it by both Maoris and bushmen—kaiwaka, or kawaka. The species *bidwillii* is the more plentiful in the North Island. Some fine specimens are also found in the Grey Valley near Arahura River, and in the neighbourhood of Kumara, while a splendid belt or bed exists some twelve miles beyond Ross, in the direction of Mount Cook, not far from the sea-shore (Cedar Creek). Within two or three miles of the Kumara Railway-station I saw trees which I believe to be *L. doniana*, but through lack of time to obtain and examine specimens was unable to verify my conclusion. I found, however, *L. bidwillii* on the Lake Kanieri Road, about ten miles from Hokitika, but the trees were small.

Professor Kirk fixes the habitat of *L. doniana* in the North Island only, while the *L. bidwillii* is widely distributed over both islands, with strong affinity for mountain altitudes, attaining to largest dimensions between the levels of 1,200 ft. and 2,500 ft. In some districts the *L. bidwillii* is plentiful, in others so rare that only isolated single trees are found.

I notice here the strong resemblance between this species and the *Arthrotaxis* of Tasmania (three species), not so much botanically as in the wood and in choice of habitat. There is very great similarity in the texture and colour of the wood. The Tasmanian tree is known on the north-west coast, on the west coast, on the Pierman and the Collingwood Rivers as the River Forth pine, and it would be interesting to compare closely the habit of these genera, which botanically must be closely allied.

The wood of *L. doniana* is dark-red, with streaks of even darker hue and great beauty, straight and even in grain, stronger and of greater durability than *L. bidwillii*. The timber, according to Professor Kirk, is most used for posts, palings, shingles, &c. Its southern limit is placed by Mr. Buchanan, F.L.S., as at Mount Egmont.

The wood of the *L. bidwillii* is of a pretty light-red colour, very fissile through its straightness of grain, very light, and, though rather brittle when cut small, very durable. It is used for bridge-work piles, blocks, railway-sleepers, palings, shingles, telegraph-poles, &c.

During my tour through Otago I heard of the existence of large numbers of dead kaiwaka trees and logs,* standing or buried in the mountain-sides, and was much struck with the occurrence of timber under such conditions, the dead forest bearing silent testimony to the wonderful durability of the wood. There is little doubt that these mountains could be replanted with these fine trees with less difficulty than would attend the planting of other indigenous growth.

In the volcanic country of the North Island I came across magnificent specimens of *L. bidwillii* on both sides of Waimarino Plain, in the forests about Raetihi and Taumaranui, associated with totara, rimu, white- and silver-pine, all of these trees unusually good in both quality and size.

Valuable testimony as to the durability of kaikawaka I recognised in connection with a hut on the road to Waimarino. In its construction, shingles of both white-pine and kaikawaka were used. The white-pine shingles had rotted, whereas those of the kaikawaka were as sound as on the day, eleven years ago, on which they were cut. The slabs of totara, which formed the frame, were also showing signs of decay. This experience enables me to indorse Professor Kirk's estimate as to the great durability of the kaikawaka. Blair gives the weight per cubic foot, seasoned, from 26·306 lb. to 28·611 lb.; green, from 47·750 lb. to 61·405 lb.; breaking-point, 99·98 lb.

TREE-CULTIVATION IN THE PROVINCES OF CANTERBURY AND OTAGO.

When the pioneers of Christchurch took possession of the broad open plains of the province, and founded the city above named, the treeless character of the country proved a serious hindrance to progress. For miles and miles nothing met the eye but the open undulating country, fertile in other respects, but barren of timber. Nothing daunted, the old pioneers set manfully to work, and with dogged perseverance fought the elements, and successfully established exotic trees. In view,

* The effect of unusually severe frosts probably. The same thing occurs with the *Arthrotaxis* trees of Tasmania, in southern Tasmania; also with *Eucalypti* in Victoria; but here the trees are dead *in situ*.

too, of the limited knowledge forty years ago of forestry, as compared with the advances made during that period, it is a matter of keen surprise that they succeeded so well as to produce results —which speaks volumes for their grit—such as the plantations which are now the pride of the community.

Chiefly owing to Canterbury, New Zealand takes first place in Australasia in the extent of area planted with trees. Necessity early taught the people the value of trees for firewood, as also for shelter of stock and crops; and the experience of Canterbury in this matter has ever since represented a great object-lesson to the people of New Zealand on the advantage of forest culture. The many thousands of acres planted over the bare plains have made numberless converts to the science of forestry as a practical aid to successful stock-raising and to the cultivation of farms. There can be no question as to the great increase in both stock and agricultural produce resulting from the improved carrying- or producing-powers of land sheltered by trees, groves, or hedges as compared with those of bare, open plains. On the latter, stock driven by wind and cold are always on the move, destroying, with their trampling, more grass than they eat, and crops exposed to every wind that blows cannot compare in quality, size, or value with those sheltered by rows or belts of timber, hedges, &c., which cut off the cold blasts of winter, and grazing or growing under the warm air or vapour given off by trees in mass, which mitigate to a large extent the severity of frost and cold. That trees have this effect forestry science has demonstrated again and again beyond the possibility of doubt. The people of Canterbury have, I take it, so clearly proved this fact for themselves in practical results that, in their case at least, the scientific proofs of this theory (and they are easily obtainable) are not required. I may venture, however, the broad statement that the Province of Canterbury has more than double producing-power in farm and stock produce in the tree-planted areas than in the open parts of the country. Stock, when grazed in sheltered places, lie about more in the sun, consequently are not eternally nibbling at the grass and treading it to dust as they travel about. Stock, in fact, are more contented under shelter (because more comfortable) than when exposed, fatten quicker, and, what is more, retain their fat longer. Crops in the same proportion, grown in sheltered situations, give better results both as to quality and quantity.

When the pioneers of planting in Canterbury battled with strong winds and bitter frosts it may be presumed that if their knowledge of forestry had included sufficient scientific training to make judicious selection of the best trees to plant it would have been of immense value to them and their successors. Grave errors in this direction may be detected all over the province, and but for the fortuitous selection of the blue-gum heavy losses must have been incurred. The extraordinary adaptability of most of the *Eucalypti* is now well known. The blue-gum is, thanks to the late Baron von Mueller, grown in many parts of the world. In the Pontine Marshes and other places in Italy this tree, recognised as a most valuable anti-malarial agent, has been extensively planted. It is grown successfully in California, and tropical India has no terrors for it, while the snow-clad heights of the Simla hills tower over large plantations. In Algiers it is extensively planted by the French; while in South Africa the same *Eucalypti* seems destined to become the staple timber tree of the Rand and Veldt.

The blue-gum, therefore, though probably chosen by chance, was an excellent selection for Canterbury, and the tree was wisely brought over from Tasmania. Many a planter of these trees, however, must have felt bitterly disapppointment at finding them time after time cut down by frosts, for, although adapting itself readily to so many climates, the *Eucalyptus* is unusually susceptible to frosts.

In Victoria and Tasmania—the native habitats of the blue-gum—it rarely grows above 1,500 ft. above the sea-level, and, excepting a few dwarfed and stunted snow-gums, the *Eucalypti* generally follow this rule. A new genus was found on the ranges between New Norfolk and the Huon River by Mr. Thomas Moore, and reported by him to Baron von Mueller, but through lack of full information this species has not, I think, been classified. A fine timber-tree—*Eucalyptus sieberiana*—grows in Gippsland, and was one of the best on the top of Mount Macedon in the old sawmilling days. This tree is certainly frost-proof, and grows to large size at 3,000 ft. above sea-level. The habitat of the blue-gum in both Victoria and Tasmania is generally littoral. In the latter colony it is extremely so, but in Victoria a curious variation of this rule occurs, for the blue-gum grows in several inland districts, far away from sea influences. In the Mount Cole State Forest, near Ararat, the Stanley State Forest, near Beechworth, in places along the Mitta Mitta Valley, and on the table-land of the King River district, near Hedi, this gum is found and produces timber of most excellent quality at altitudes of 2,000 ft. to 2,500 ft. These facts indicate the special adaptability of certain *Eucalypti* to particular localities other than those to which they are indigenous, and serve as a guide in selection. I am of opinion, indeed, that by obtaining good seed from the forests named above, tree-planters would be able to grow hardy Eucalypts in Canterbury and Otago.

With trees, as with live-stock, grain, &c., improvement in quality depends upon judicious selection of the original stock. I strongly recommend the *Eucalyptus sieberiana* for the Middle Island, for the reasons given above, and have no doubt that seed may be obtained at Mount Macedon from young trees. Care should be taken, however, to see that the seed is botanically correct, and stipulation should be made that capsules, or seed-vessels, with a few leaves, buds, and flowers, should also be sent for the purpose of scientific identification. The absence of scientific knowledge or direction, of course, fully accounts for many mistakes in the methods of planting and cultivation adopted, such as I noticed during the course of my hurried examination of the plantations in and around Christchurch, where many planters, having put in the trees, often too far apart, simply left them to grow as they could. Others, again, planted pines—chiefly *Pinus insignis*—among gums—a very grave error, because the essential oils and vigorous growth of the Eucalypts invariably injure other trees planted among them.

On account of the superior climate of Australasia, I advocate the planting of trees in separate sections, and not in association with other varieties. Blue-gums, for instance, always thrive best

in a plantation by themselves. The natural habit of this tree is gregarious, and it is found mostly in "beds" in Tasmania, Gippsland, and Cape Otway, a rule which applies to most of the Eucalypts.

In Europe various trees are used as "nurses"—*i.e.*, fast-growing trees are planted alternatively with superior kinds of slower growth. The latter are intended to form the standard or matured crop, and the former, after serving their purpose as shelter, are cut out at six or eight years. Many persons in Canterbury, no doubt, mixed their plantations with this in view, but as they mixed incorrectly they made a mistake. They got shelter certainly, but at the expense of timber. Again, in planting Eucalypts no regard was paid to the fact that the several varieties of this tree affect widely differing soils and situations. For example: To plant blue-gums on a dry stony ridge, with little or no soil or moisture, or on a dry upland exposed to winds on every side, must be fatal to a tree which is native to deep sheltered valleys and sandy and moist subsoil. It is equally a mistake to plant stringy bark in low wet places, since this variety requires a dry sandy heathy soil with clay bottom, or deep rich soils of vegetable humus. Then, I noticed the *Eucalyptus amygdalina*—the giant tree of Australasia—our mountain ash, or, as it is sometimes called in Victoria, blackbut*—planted in schist formations, whereas it is only suited to the deep mountain soils of the lower valleys of Gippsland and Cape Otway, where exist the rich vegetable humus in which it flourishes.

These examples illustrate the necessity for scientific knowledge and special care, not only in the selection of trees for planting in New Zealand, but also in determining the suitability of soil and situation to each particular variety. When these have been determined, trees should be planted only in the localities where the conditions agree with their natural proclivities. In order that mistakes of the kind referred to may be avoided in future, I give hereunder a list of Eculypts and the soils they affect in their natural habitats. The list, of course, embodies merely general rules, to which there are equally, of course, exceptions.

—	Localities.	Habit.
Eucalytus rostrata (red-gum) ..	Victoria, South Australia, New South Wales, Western Australia	River-banks, swamps, and flooded lands; silt and alluvial deposits; sandy or vegetable soils, with clay bottom.
„ *teretecorius* Gippsland red-gum) ..		
Eucalyptus globulus (blue-gum) ..	Victoria, Tasmania ..	Littoral; deep sheltered gorges; vegetable humus, or sandy soil, with clay or moist bottom.
Eucalyptus amygdalina (giant tree, mountain ash, or blackbut)	Victoria, Tasmania ..	Two forms, lowland and mountain. Former is useless; latter, with Tasmanian stringy bark and Victorian blue-gum, assumes giant size. Schistose soil, with vegetable humus.
Eucalyptus leucoxylon (ironbark)—		
Var. *siderophloia*	New South Wales, Victoria	Auriferous quartz gravel; generally following known leads of gold; dry lands. In South Australia it affects quartzite formations and dry lands.
„ *sideroxylon**	Victoria, New South Wales	
„ *leucoxylon*	South Australia, Victoria	
Eucalyptus goniocalyx (grey-gum)..	Victoria, Tasmania, New South Wales, South Australia	This tree is a good grower in poor soils, quartz gravel, with clay subsoil; a fine useful timber tree.
Eucalyptus obliqua	Victoria	Poor sandy soils in mountain districts; grows to large size; requires deep ground.
„ *macrorhyncha* ..	Tasmania	
„ *capitelata*	Victoria	
„ *piperita*	„	
„ *muelleriana*†	„	
Eucalyptus sieberiana (white-gum, silver-top: in Gippsland, white-ironbark)	Victoria, Tasmania ..	Mostly good soils, top of mountains, up to 3,500 ft.; vegetable humus or alluvial deposits in lower valleys; a lowland form, with clean straight stems, not unlike stringy bark in Gippsland; grows in sandy soils.
Eucalytus marginata (jarrah) ..	Western Australia ..	Sandy, loamy, heathy soils, deep, with clay subsoil; affects coastal or littoral situations.
Eucalyptus diversicolor (yate-tree, or karri)	Western Australia ..	Sandy loam, coastal districts.

* Red ironbark. Dry ironstone gravel and quartz reefs, mostly following, in Victoria, auriferous leads or the strike of gold-bearing reefs, and is therefore an indicator of gold-bearing lodes.

† Yellow stringy bark of Southern Victoria. A valuable timber tree for wood-paving, sleepers, piles, and marine work generally.

The greater number of these trees could be successfully grown in New Zealand. Those best suited for the open plains of Canterbury and Otago I place in the following order:—

Eucalyptus globulus (blue-gum).
„ *sieberiana* (white-gum top, ironbark).
„ *goniocalyx* (grey-gum).
„ *leucoxylon* (white ironbark)
„ „ var. *sideroxylon* (red ironbark).
„ *obliqua* (common stringy-bark).
„ *muelleriana* (yellow stringy-bark).
„ *marginata* (jarrah): North Island only.
„ *diversicolor* (karri): North Island only.

These timber-trees are among the very best of the genus, which contains 170 species. I am satisfied that if planters will select from the above list they will obtain satisfactory results both as to timber and shelter.

There are, of course, other gums in New South Wales and Tasmania which might do well, but those named represent, from a commercial point of view, the very best timber-trees; and it should

* This is not the New South Wales blackbut, which I believe is our ironbark.

be borne in mind that, the climate in New South Wales being warmer than in Victoria and Tasmania, trees from the mother-colony are less likely to thrive in New Zealand. I have, therefore omitted from my list trees specially indigenous to New South Wales.

Successful plantation demands careful consideration of the natural habit of the trees dealt with, so that, as before stated, they shall have the advantages of conditions as nearly as possible similar to those which they affect in the forests naturally. During my inspection I noted extensive planting of the larch and other European trees, especially along the railways. I am not satisfied that it is advisable to plant these trees in such situations. The larch, for instance, rather affects naturally the hillsides than the plains. However, all of those I saw growing in New Zealand appeared to flourish amazingly, and it is certainly one of the trees best suited for planting on the foothills of the Southern Alps and in Otago. In the plantations of Canterbury I noticed growing pines, which have a fair reputation in the Old World, but which I have no hesitation in condemning utterly on my experience of them in Victoria, South Australia, and Tasmania. These are the *Pinus halepensis* (Aleppo pine) and *Pinus pinea* (stone pine). In comparison with other and better pines they do not grow timber of fair size, and though useful for shelter, and most effective as sand-breaks, are a failure in Australia as timber-trees.

The *Pinus insignis* is condemned by experts on account of its inferior timber, but, admitting the correctness of this verdict, I find it invaluable for shelter purposes on account of its rapid growth. It has a good appearance, and stands extremes of climate very well, though, as its branches are easily broken and will not bear weight like other pines, it is not a good "snow" tree. This pine thrives best in deep, dry sandy soil.

Spruce Firs.

Undoubtedly the best trees for extensive plantation in New Zealand are the spruce firs, all of which, if I may judge by specimens I have seen, thrive amazingly in your colony. They are as follow:—

Spruce Firs.

Abies smithiana (Smith's fir), Himalaya.
" *douglassi* (Oregon).
" *menziesii* (spruce).
" *excelsa* (Norway spruce).
" *nigra* (black spruce), America.
" *canadensis* (hemlock spruce), America.
" *alba* (white spruce), America.
" *rubra* (red spruce), Nova Scotia and Newfoundland.

Silver Firs.

Picea balsamen (small ornamental fir).
" *amabilis* (silver fir).
" *grandis* (California silver fir).
" *nobilis* (noble silver fir).
" *nordmaniana* (Nordman's silver pine).
" *pinapo* (Spanish silver pine).
" *wellbiana* (Indian spruce).

Such trees as these should thrive in New Zealand, and each of these varieties should be planted extensively both by the Government and by private individuals. I feel that I cannot but strongly recommend the spruce. It is a tree destined in the course of years entirely to supplant the native trees on account of its adaptability, freedom of growth, hardy character, and, above all, the superior quality of timber it yields.

The native timber-trees seem to have run their course, and, like inferior races of mankind, are predestined to extinction. Without doubt, the indigenous trees of New Zealand cannot stand intrusion on their ground, as do others. Once the shade is diminished by curtailment of their density these trees begin to fail, and the experience of the last forty years proves unmistakably that under such circumstances the growth naturally of young trees is too unsatisfactory both in number and in quality to maintain the forests as a source of timber supply. As has been previously mentioned, this special defect in New Zealand forests constitutes the most serious difficulty of the forest problem. The Government is face to face with the fact that wherever the forest is entered by the pioneer with axe and firestick they cease to reproduce, and that hence throughout New Zealand entire forests are gradually disappearing. It is thus simply a matter of time when, unless remedial measures are adopted, the forests will cease to exist. Nor does it need a mathematician of great ability to calculate the period, if destruction is allowed to continue as during the past forty years. Forestry, therefore, is one of the chief concerns of New Zealand, both financially and otherwise. It is, in point of fact, a question of natural life and progress.

The timber trade of New Zealand is carried on at enormous cost, and thousands of people are employed in the transit of forest produce and other branches of the industry. The revenue possibly benefits little as yet, but the people of the whole colony are deeply concerned, monetarily and otherwise, in the speedy adjustment of the forests question.

The pioneers of Canterbury have set an example to the Government, tens of thousands of pounds expended by private persons in experimental planting have provided object-lessons without end. These experiences, to the Province of Otago, should prove of enormous value in determining the most suitable trees for commercial and other purposes to plant in various localities, including the pumice plains of Tongariro, and the Waikato River district, in the North Island.

With reference to the lists given above, I may remark that the soils of Otago and Canterbury

are admirably suited to the species named, also to pines. Care, however, must be taken to select, for spruce, not necessarily rich but fairly deep soils, if timber production be the object rather than ornament. This question of deep soil has a most important bearing on tree-culture for timber. To get size of bole the roots must go down. In a large number of the Canterbury plantations this fact has been lost sight of, in some cases unavoidably; and the result of tree-growth in shallow soil, with shingle deposit but a foot or so below the surface, is apparent in the spindley character of the gums and other trees—weakly specimens, of use neither for timber nor ornament.

In the forests of Victoria and Tasmania is what is locally termed "spar" timber. This description is applied to young trees which have shot up among the more vigorous grand specimens of their kind, and in the race for supremacy "the survival of the fittest" resulted. The stronger saplings shot ahead, and took possession of the sky space, leaving their weaker brethren struggling below. When the large timber is removed these "spars" remain, but they are useless for forest-renovation purposes, being old young trees which have become attenuated in the struggle for existence, and have matured in their half-grown or apparently young state. I mention this peculiarity of Australian forests because it may account in a large measure for the fact that in the bushes of New Zealand a similar state of things exists in the local pine groves, and has probably given rise to the idea that the pine is a very slow-growing tree, or that it will never be worth replanting. The true explanation is, however, found in the fact that forests need thinning. The practical value of a forest is enormously increased by judicious thinning; though Nature unassisted does this work in the manner described above, the process is very slow. The skilful forester can, however, assist Nature by removing such trees as can be dispensed with, thus giving the standards more vigorous growth, and bringing them to maturity in less time than under the natural conditions. The knowledge of how to thin a plantation is by no means common, and an unskilful person may easily cause sad havoc in a plantation for lack of practical experience in this work.

In starting a plantation care should be taken to study the character of the trees it is proposed to grow. The larch (*Larix europea*) is a tree which thins itself, or is self-pruning. Hence it may be planted 8 ft. to 10 ft. apart. Eucalyptus may with safety be planted 8 ft. apart. The first thinning at eight or ten years, according to growth and intermixture of branches, follows in due course, leaving the trees 16 ft. apart. Then at next thinning alternate trees come in for piles or telegraph-poles, and the standard crop, 32 ft. apart, is left to attain maturity. In plantations of valuable trees "nurses" may be used, allowed to grow for three or four years, and then cut out.*

Spruce firs, with "nurses," should be planted also 8 ft. apart—that is, an *Abies*, then at 8 ft. a "nurse," and so on alternately. The "nurses" should be trees of quicker growth than the standard crop. By adopting a uniform distance—say, 8 ft.—thinning is made easy, because in our climate most of the trees grow and few gaps occur, while if these are filled up in the following year the substituted trees readily overtake those a year older. This question of uniform distance is most important, and should be steadily adhered to by planters. The tendency to overcrowd trees has been very prevalent in Australia, the result being that as the trees grow they have not sufficient room to expand and assume the form Nature intended for them. In botanic gardens and private estates this stupid error is very common, and has caused untold loss and general unsightliness. In such cases, when thinning becomes inevitable, it is found that all of the trees are hopelessly crippled, such thinning having been too long delayed. In too many cases it is now impossible to rectify blunders caused by overcrowding, without making a clean sweep of the standing crop. All Conifers require at maturity a space apart of 32 ft. when grown for timber, but if required solely for ornament should have 45 ft. to 60 ft., to allow for expansion of the branches.

The Plains of Otago.

There can be no doubt that plantation of the plains and foot-hills of Otago would be attended with success equal to that attained in Canterbury. The people of Otago, indeed, should do something better, seeing that they may profit by the experience of their neighbours, and avoid many errors committed by the earlier planters of that province.

Exotic Trees Recommended for Plantation.

The following exotics will, I think, be found most suitable for planting in New Zealand:—

Pinus austriaca (Austrian pine). }
" *laricio* (Corsican pine). } All hardy good timber trees.
" *ponderosa* (American pine). }
" *excelsa* (red pine), American. Valuable wood.
" *maritima* (common maritime pine), Italy.
" *mitis* (sturdy free-growing pine), California.
" *stribus* (clear pine), America.

These comprise some of the best known and most valued commercial timbers in use all over the world. They are all hardy, and would grow well in a climate like that of New Zealand. I very strongly recommend the trees named in this list for any Government plantations which may be formed in either North or Middle Island, adding for the north the following:—

Eucalyptus corynocalyx† (sugar-gum).
" *goniocalyx* (grey-gum).
" *obliqua* }
" *macrorhyncha* } (stringy barks).
" *capitalata* }
" *rostrata* and *teretecorius* (red-gum) two species.

* This depends upon the height and growth of the young trees, and judgment must be used in determining the proper time to thin out.

† Nearly allied to *Pinus insignis*, but better quality of timber.

Deciduous Trees.

On deciduous trees little comment is necessary, as mistakes can scarcely be made. All genera, species, and varieties, such as oaks, elms, chestnuts, lindens, planes, &c., should do well in both North and South Islands.

Government Plantations.

For such plantations in Otago, or in the pumice districts of the North Island, I should recommend areas of from 10,000 to 20,000 acres. The blocks should be laid off in squares, with roadways or fire-breaks running through and crossing each other, so as to form 500-acre sections. These fire-breaks should be at least 1 chain wide. Intersecting roads, or fire-breaks, round each 500 acres should be 1½ chains wide, and broad roadways of 2 chains should intersect at right angles, so as to bisect the entire plantation from north to south and east to west. These serve the double purpose of providing means of access for thinning and removing timber, and of fire-breaks, especially effective in the latter capacity if furrows are ploughed along each side of the track and grass, &c., burnt off in between.

The plantation being thus marked out on a working-plan, the officer should, according to the quality and disposition of the soil, allot trees to suit each particular section. Then should follow the holeing or ploughing of the sections. Some advocate ploughing as a matter of economy. Economy is good, but this, in my opinion, is false economy, and hence in Victoria I never plough. Gangs of men are set to work in the winter months, and holes put in 15 in. wide to same depth, 8 ft. apart, in which the trees are planted. Ploughing encourages trees, especially those of a surface-root habit, to run their roots along the pan of the furrows, instead of making into the clay subsoil. Further, ploughing involves hand-sowing the seed, resulting in unsightly and uneven growth. For these reasons I much prefer the holeing system. The men are paid 6s. 6d. per day, wet or dry, and work is continued on wet days, because those are the best times for planting. The holeing system, moreover, gives uniformity of growth and of distance between the trees, with greater facilities for thinning later on. An experienced superintendent or nurseryman is in charge, and every care is taken to see that the roots of young trees are never exposed to dry or cold winds or to the sun. Also, that every tree, before being planted in the hole, is carefully puddled at the roots.* I strongly recommend that this precaution should never be omitted. In the case of private holders, the system could be modified, so as to come more in line with small holdings.

Objections to Blue-gum.

I was much surprised to learn at Christchurch that the blue-gum was not regarded as a durable timber. This is remarkable, as in Victoria, Tasmania, and elsewhere blue-gum has an excellent reputation for strength, elasticity, and lasting properties. The New Zealand opinion is probably due to the fact that the timber has been taken from trees not fully matured, or grown in unsuitable localities. At Reefton I saw a blue-gum which had been felled at that town on the day of my arrival. I traced it next day to a local sawmill, and examined the log, which was 3 ft. in diameter at the butt, and as sound, solid, and heavy as any I have seen in Victoria or Tasmania. This tree was twenty years old.

In Conclusion.

In concluding my remarks upon tree-plantation in Canterbury and Otago, I desire to express my high admiration of the manner in which the early settlers went to work and clothed with trees the open country for miles around their city of the plains—Christchurch. But I could not help remarking that while the pioneers of the district so nobly did their duty by the community, yet in so large and handsome a city as Christchurch such apathy exists as to the state of the Botanic Gardens. This is decidedly not creditable to such a city. The curator no doubt does his best with the funds at his disposal, but it is a reflection on the authorities, and represents neglect of a manifest duty to the community, that the funds provided are totally inadequate to permit of these fine gardens being properly kept. Christchurch is famed for its University and Museum, the latter especially well found and under most efficient direction; but the gardens are very far from being such as one might expect in close proximity to one of the chief cities of New Zealand.

With a river like the Avon—"A thing of beauty and a joy for ever"—at hand, the landscape gardener and arboriculturist should have a chance to immortalise himself in the beauty of floral colour and design, but here he has not. The curator is not to blame; but when a man is stinted in money and consequently labour, and has to work so large an area of ground, he cannot produce satisfactory results. The people of Christchurch should wake up, and provide sufficient funds to bring their Botanic Gardens more into line with their splendid Museum and other public institutions.

TREE-PLANTING ON THE PUMICE PLAINS OF WAIMARINO, TONGARIRO, LAKE TAUPO, AND THE UPPER WAIKATO RIVER.

The volcanic regions of the North Island are an interesting study to both forester and geologist. This strange land is invested, owing to violent upheavals at various periods, with a misticism which as time rolls on only intensifies the curiosity of the inquirer, and spurs him to renewed efforts at unravelling the secrets of Nature under novel and awe-inspiring conditions. These pumice plains are much more extensive than is generally supposed. They commence from a point six miles south of Ruapehu—the country here including three partially active volcanoes—Ruapehu, Ngauruhoe, and Tongariro—which occupy a commanding position in the centre, whence the pumice plains radiate to distances varying from eight to twenty-five miles, the southern portion being known as Waimarino. The areas of these plains have been determined by the varying force of different eruptions, distributing pumice sand and mud to greater or less degree in distance and quantity.

* That is, dipped in mud and water made of the consistency of soup, &c.

When first these volcanoes, in fierce wild activity, poured forth from numerous vents a constant flow of lurid molten matter over the whole of the northern parts of New Zealand, in prehistoric days, there can be no doubt that all of the timber, scrub, &c., perished under the fiery showers rained upon them far and wide. Then, later on, as the Titanic forces expended themselves and the volcanic fires slackened and finally ceased to belch forth the destroying agent, during the course of subsequent ages, tree-growth crept gradually back nearer and nearer to the mountains. By this means the extent of barren pumice lands has been gradually reduced, until in the present day the plains of Tongariro and Lake Taupo are comparatively limited in area. Such area has, of course, been varied from time to time as the eruptions of later years emitted matter in greater or less volume, force, and extent, so as to bring more or less of the surrounding forests under their devastating influence.

The plains extend from the Waimarino country west and east of the range, including the three sister volcanoes referred to: south to the forests of Waimarino and Taumaranui on the Wanganui (which takes its rise under Tongariro), north to Lake Taupo, and north-west to the Waikato River. They are dotted in places with small timber bushes or clumps—little oases attractive to the eye, and sources of more practical pleasure to the lonely shepherd and his flock. There is here, therefore, a large area, comprising hundreds of thousands of acres of Crown or Native lands, unproductive save in supplying scanty feed for the cattle and sheep of the pastoralist, and the thousands of wild horses that roam at will round the base of the volcanic range, and on the undulating country about Lake Taupo.

This pumice country is totally unfitted for agriculture, owing to the newness of the surface-deposits spread over it by Ngauruhoe, the most recently active of the fiery triumvirate above named. Age is required to develop into soil the raw pumice of these lands, and Nature effects the change by clothing them with rough, coarse grass and scrub, and mixing a detritus of decomposing pumice and volcanic sand.

Where a volcano emits mud in large proportions with the other materials of the *dèbris*, soil is speedily produced, and vegetation soon clothes the hillocks, ravines, gullies, and watercourses. Eruptive matter of this description was thrown out in the early throes of volcanic action over the papa cliffs of the Wanganui, Raetihi, Taumaranui, and Pipiriki. Hence these are now dotted with forests of fine timber.

I am not a geologist, therefore do not attempt a scientific argument on the causes of the interesting divergence of component parts in volcanic matter from different craters. I have, however, reasoned out the explanation I have given from close observation of the country dealt with, during a four days' trip round and about these mountains. It is singular too, that the papa or volcanic-mud country is situated at distances of twenty to fifty miles or more from the sources of volcanic action. The question naturally arises in most cases, what is the exact source of this mud? So far as the country round Auckland is concerned, the answer must be Rangitoto and his satellites; but this answer will not account for similar deposits on the Upper Wanganui. Even Mount Egmont, the Fusiyama of New Zealand, can scarcely have vented such enormous masses of volcanic mud distributed over the country round Pipiriki, nor does the configuration of Ruapehu, Ngauruhoe, and Tongariro, suggest the idea of these having been the sources from which came the stupendous deposits of papa in the upper and lower Wanganui districts. Possibly, however, observation of the effects resulting from the eruption of Tarawera, ten years ago, may help to elucidate the problem. In this instance the mud which now covers Wairoa, and miles of the country round this illfated township, undoubtedly came from Lake Rotomahana. We may look then to bodies of water as covering the sources of the papa deposits before mentioned.

Following this line of argument Lake Taupo is invested with fresh interest, and it is tolerably clear that this lake fills the huge crater, sixty-three miles long by twenty-five broad, of an extinct volcano of great activity, and the origin of stupendous volcanic erruptions in prehistoric times. Probably from the bottom of this lake came the mud which forms so curious a feature of the timber-lined banks of the Wanganui, and the dense bush around Raetihi and Taumaranui. The plains are simply deposits of pumice in all shapes and sizes mixed with volcanic sand, either thrown up with it, or by subsequent eruptions, distinct layers being formed, from which the force and volume of each eruption can be accurately gauged. The surface of pumice-lands is therefore such as the agriculturist shrinks from, and vast areas of this unpromising country (mostly Native lands), represent a difficult problem to the Government. The question arises, how can this problem be solved?

A great deal of this country is in the hands of squatters, Native and European; but though sheep manage to eke out a bare subsistence, and hordes of wild horses roam over its inhospitable surface, the grass is coarse and scanty, the situation bleak and wet.

Will such country grow timber trees? To this question, I answer, without hesitation, Yes. I have no doubt whatever that trees, both indigenous and exotic, would thrive well on these pumice plains. The pines, spruce, firs, and gums at Tokaanu; the Terraces Hotel, Taupo; at Wairakei, Rotorua, and other places, show unmistakably that timber growing in these localities can be made most profitable, provided that means of access and transit are made available. And here Lake Taupo suggests a starting-point. Timber grown on the undulating flats and on the hills for miles back from the lake could easily be conveyed to its shores, floated to Taupo, and then sent down the Waikato.

I do not regard the rapids culminating in the Huka Falls, or other obstacles in the river, as insuperable difficulties. In such places as floating logs could not be shot over the falls they could be trucked to points lower down, and then sent on their journey. It is true my trip was necessarily so hurried that I was unable to investigate thoroughly the condition of the river, but judging by the numerous parts of this fine stream which I saw, and the statements of Natives and others that the river falls gradually, I have formed the opinion expressed above. If this opinion is borne out by careful investigation, the Government have in the Taupo and Waikato districts a great area for

timber-growing unsurpassed in Australasia. In any case, the matter can be tested at small expense prior to the adoption of an extensive system of plantations. Small areas could be fenced off and planted with exotic trees, which, after being carefully watched and tended for a few years, would furnish reliable data upon which to decide as to future operations. There is no reason why some of the more valuable indigenous trees also should not be grown in this district. Totara, kaikawaka, rimu, white-pine, silver-pine, and even kauri, all of which (the last named excepted) grow luxuriantly at no great distance away, would no doubt do equally well here. Of totara, for instance, I feel sure from my observation that the young trees would grow well, as I find in the forests of Wanganui and Taumaranui some of the finest trees of this species in the colony grow freely to large size. In this locality, indeed, the Maoris obtained almost from the date of their arrival in New Zealand timber for their large war-canoes. Mixed plantations of totara, kaikawaka, white-pine, silver-pine, and rimu should be profitable here, and thrive well once the young trees established themselves.

For plantations of indigenous trees on these pumice-lands no doubt some sort of shelter would be required, and the manuka, which grows freely here, could be planted with the better classes of timber, and utilised for "nursing" purposes (*vide* "Tree-planting in the Provinces of Otago and Canterbury"); *Leptospermum scoparium*, *Melaleuca squarrosa*, and other tea-trees common in Australasia, might also be used as "nurses."

The adaptibility of the *Pinus insignis* to pumice-lands has been proved, and this tree could also be grown as shelter, with belts and cross-belts of tea-tree and manuka.

Many of the Pittosporums, Olearias, and rewarewa could also provide cover for other trees, and by planting these thickly—that is to say, 8 ft. apart, "nurses" included—the trees would in a short time form their own cover, when the "nurses" could be cut out. Totara, silver-pine, and kaikawaka are trees, it may be noted, that stand transplanting remarkably well.

Considering all the circumstances of the case, I have great hope that the pumice plains will one day be covered with fine forests, and, assuming that such lands as are now in the hands of the Maoris will revert to the Government, that these tracts of country will become a valuable asset.

The question of tree-planting is specially a commercial matter: "But will it pay?" Unquestionably Yes, provided always that it is undertaken on an extensive scale by the Government, and dealt with in a statesmanlike manner. Individuals who plant trees rarely see the result of their forethought and public spirit, though their sons and daughters may do so. Hence tree-planting as a commercial matter does not commend itself generally to private persons. With a Government it is very different, for, though the statesman who inaugurates the enterprise may not live to see its consummation, there is a public always existing, and it knows that money judiciously expended in plantations will enrich the country a hundredfold. It is merely a question of time. If one Government does not gain revenue by such expenditure, another later on will, and the people reap the advantage in the long-run. Apart from the question of direct profit, the means of employment provided by such work must be considered as of some present value. In no case can the money spent in tree-planting be considered as thrown away or wasted, since it provides for an asset growing year by year more valuable, until it becomes marketable at substantial profit, or, properly conserved, continues ever after a source of steady and considerable revenue.

In locating plantations in New Zealand, as elsewhere, the following points *must* be considered: (1) Ready means for transit of timber at lowest rates by water or rail; (2) selection of sites which command one or other or both of these; (3) depth and character of soil, also climatic conditions; (4) protection by fences and fire-breaks; (5) careful supervision of each plantation; (6) method of cultivation to be adopted, whether ploughing or holeing or both; (7) grouping or sectional disposition of growing trees, according to soil, aspect, &c.; (8) the formation of roadways or fire-breaks; (9) contour survey or working-plan; (10) the supply of trees from nurseries. All of these are matters of the greatest importance, which can only be effectively dealt with by an expert.

So far, I have discussed principally the character of the land, the planting of trees (exotic and native) and the transit of timber when grown. Regarding exotics, I think I am quite safe in stating that the Conifer family or order alone point to a great future for timber-growing in this portion of the Auckland Province. I find, as a matter of fact, that the pine already flourishes in and around Taupo, Rotorua, and Wairakei, in which localities spruce firs also thrive.

The altitude of the pumice plains does not exceed generally from 1,700 ft. to 2,000 ft. above sea-level even in the higher portions. The climatic conditions are therefore not severe, and I am satisfied by the success already achieved, albeit on a small scale, that plantations of exotics, especially spruce firs (*Abies*), larches (*Larix europea*), and other American and European woods—the timbers most in demand all over the civilised world—will return handsome profits, while such trees can be grown more readily than the native trees, and will give better results even than the regeneration of existing forests.

Recognising the difficulty of such regeneration, there is little doubt that the cultivation of exotic timber superior for building purposes to white-pine, rimu, and other native woods (such as spruce firs, Baltic pines, and others, which invariably command a ready market) would be much more profitable. Moreover, the climatic conditions of New Zealand are specially favourable to the production of first-class timber, and if exotics such as those referred to are extensively grown, that colony has every prospect of being the timber-producing centre of Australasia. American supplies will not last for ever, and, as mentioned elsewhere in this report a serious shortage is imminent. This must occur within a shorter time than that calculated by experts as the limit of existence for American forests—unless remedial measures are adopted—that is, thirty years. Clear pine is already getting scarce, and has increased in price, results which must shortly be experienced with reference to other American timbers in general use.

Since, then, crass ignorance in America, as in Australia, has resulted in woful devastation of the forests, and American supplies have been further reduced by the terrific fires that have so frequently swept clean thousands of acres of splendid timber, there is, as previously pointed out, all the more reason to seize the occasion, and make such provision as is possible to take advantage of the opportunity for profit to New Zealand which will certainly occur at no distant date.

Baltic, American, and Indian timbers can be grown all over Australasia quite as quickly as in their native habitat, and, owing to specially-favourable climatic conditions, in many cases much more quickly. All kinds of pines, for instance, can be raised in Australasia to sawmill size—*i.e.*, 24 in. to 30 in. diameter—in a like number of years, or 1 in. in diameter for every year of growth. Under such circumstances, it appears strange that Australian Governments should hesitate to spend from £15,000 to £20,000 a year in planting and forest conservation work (which would give profitable employment to their own people) while they allow capital expended on imported timber to leave the colonies year after year at the rate of £250,000 sterling. This money, too, going to support an army of workmen sixteen thousand miles away, while our own people are starving for lack of employment. There are few trees of commercial value which (tropical flora, of course, excepted) cannot be successfully grown in these colonies, and it is therefore a simple matter to select those which are most profitable, by taking such as are invariably held in most esteem in the markets of the world. Such selection can be applied in dealing with the pumice-plain country; and, as the railway now in course of construction from Auckland to Wellington passes through the Waimarino end, and will thus increase facilities for transit, I hope to see systematic efforts undertaken to plant these plains with suitable and profitable timber, to the great advantage of this district in particular and the colony in general.

PROTECTION FROM FIRE OF STATE FORESTS AND OTHER CROWN LANDS.

Protection from damage by fire is without doubt the most urgently needed of all measures for forest reform in New Zealand, since fire has been responsible for more injury to the timber reserves than the sawmillers and all other causes combined. There must be something wrong when the Government of a country, with eyes wide open to what is going on, stands idly by while millions of pounds' worth of valuable soft woods are destroyed by this agent year after year. It is most deplorable to note, as I did during my tour in New Zealand, the ruinous destruction by fire from one end of the colony to the other. The waste of timber in this way has been simply astounding, and no country in the world could stand for any length of time such a drain upon its forests. In some districts—Hawke's Bay, for instance—vast quantities of timber have been destroyed, chiefly by fire. In this respect the greatest sinner by far and away is the pastoralist, and the insensate destruction of birch forests on hilltops and about the head-waters of rivers has been carried on to an extent which is simply amazing.

It is no wonder, under such circumstances, that flooded rivers wash out the poor unfortunate settlers miles away in the lower reaches and flats, that the Public Works Department is obliged to spend enormous sums in repairing roads and bridges, and that landslips occur not in a few isolated cases only, but in tens of thousands all over the colony. I have no desire to pose as an alarmist, but I feel bound to assert that for the Government to permit squatters or others to burn timber off from the hilltops and above the head-waters of rivers is a crime against the nation. Nature is never slow to avenge herself, and such reckless disregard of her natural conditions results in flooded farms and ruined settlers, who find not only their homes devastated, but frequently—by a sudden change in the course of a river—their land itself carried away and deposited by flood-waters in the shape of silt and shingle twenty or thirty miles below. The landslips of the Buller and other rivers attest the injury done, it may be many miles above, by firing the forests about their sources, and this firing has been done in most instances solely for the selfish reason that the sheepowner may gain a little more grass.

No doubt a great deal of such destruction is done in absolute ignorance of the national loss and flood calamities which such a course of action must entail sooner or later, and I feel that I cannot too strongly condemn the apathy of the authorities who, better informed, have permitted so cruel a wrong to national interests, or to have even, by foolish enactments, encouraged the clearing-off of bushes as improvements.

If the people of New Zealand need proof that the relations of effect to cause have been correctly stated, let the sceptical study the present conditions of forestry in France, and they will learn that hundreds of thousands—nay millions—of pounds are being spent to reforest mountain-slopes simply to save the rich arable lands below from utter ruin; that some of the first engineers in the country have been engaged to erect extensive masonry works to keep flood-waters within fixed limits; that the most talented officers of the departments have been backed by the French Treasury in spending enormous sums upon this work. And why? Because at a former period just such a system as that now prevailing in New Zealand was permitted to denude the slopes of the Alps and other ranges; even the scrub which escaped other hands being stripped for firewood by the peasants. Miles upon miles of the richest land in France, in the beautiful agricultural country of the Gironde district, was covered many feet deep with silt, rubble, and shingle, and thousands of people ruined. Great gullies appeared in the slopes where none had existed before, and watercourses were opened up all over the mountains, down which the torrents of water carried billions of tons of silt, &c., over the farm-lands below, till at last the Government grasped the position, and the works above referred to were undertaken, to control the water and prevent further landslips. And France represents only one of many instances in which early neglect of forest conservation has resulted in tremendous material loss and enormous expenditure to repair damages.

Colonists in the Middle Island of New Zealand have indeed only to use their eyes, and they can see for themselves the evil effect of the system I condemn so vehemently. It is surely unnecessary in this case, then, to quote authorities, since object-lessons by the thousand lie before the eyes of the observer. But if the treatment of bush-lands in the Middle Island has been bad, that in the North Island, with its warmer climate and semi-tropical vegetation, has been criminal.

In this report it is of no use to shirk or pass lightly over grave wrong, for those who know me best are well aware of my predilection for plain speaking, whenever such is necessary. Therefore, I make no further apology for using strong condemnatory language in dealing with the fire question in the kauri districts of the North Island. Here the gum-digger is permitted to roam at will under cover of a license. This engaging person, strong in possession of his right and his vote, is permitted to light fires at his own discretion at such times and in such places as he may choose. If he sets fire to a kauri forest, including timber to the value of £20,000 or £100,000, and is found out and fined a paltry £1 or £1 10s., he thinks himself an injured individual.

At the recent Conference it was a generally expressed opinion that the kauri is doomed, its anticipated extinction being ascribed principally to fire. Here, then, we have an industry which in the case of a single company employs over two thousand men, whose wages-sheet amounts annually to £150,000, threatened with extinction, since it is solemnly announced at a Conference that there is no hope of its continuance, because the kauri forest is doomed, through gross carelessness and the fires of the gum-digger and others.

It seems to be universally conceded that the gum-digger is responsible for two-thirds of the fires which occur in this district. A shameful state of things in a climate like that of New Zealand, where for only perhaps three months in the year is the forest inflammable, that a great national industry in the chief product of the Island is to be absolutely ruined in the course of from thirty to fifty years, because the Governments are afraid to grasp the nettle of regulations for the gentleman armed with the gum-spear, lest this mild mannered selfish gum-seeker should be hampered with —to him—irksome conditions. A grand industry, forsooth, is to be absolutely smothered and rooted out, so that he may live unfettered and untrammelled by the laws of the land. Although, however, the gum-digger is justly credited with being fire-raiser in chief, others come a good second, both sheep-farmer and pastoralist adding their spokes to the wheel of destruction.

Now, for the remedy. Briefly this: Let the Legislature of the colony pass a stringent Act making the clauses relating to fire penal. Proclaim the best timber lands as State forests, and make these permanent, placing every impediment possible in the way of their alienation once so proclaimed. Appoint foresters, with forest firemen under them, in charge of the more valuable forests.

1. In the Fire Act proclaim fire districts, and enact that no fire shall be lighted in any State forests or on other Crown lands during the months of December, January, or February in the open air. Fires should only be allowed within houses, huts, or tents, or in the case of the latter only in fireplaces approved by the Forest Inspector in charge of the district—either a deep hole, or ground enclosed by stone, clay, sod, or any other material except wood.

2. It should be an offence punishable by imprisonment to set fire to any green tree or log, standing or fallen tree, or stump *in sitû*, dead or alive; also for any person having lighted a fire in the open to have left the same unextinguished, or permitted it to spread and ignite the bush.

3. The use of any other matches than "Patent safety," or of any inflammable material for gunwads or other purposes, should be absolutely prohibited under heavy penalties.

4. Smoking in the forest whilst at work, or during working-hours, by sawmill employés*, gum-diggers, sleeper-hewers, &c., should also be prohibited.

5. Substantial rewards should be offered for information leading to conviction for breaches of these regulations.

6. Licensees convicted of malicious offence or gross carelessness to forfeit their licenses and be refused renewal for all time.

7. Gumdiggers' licenses should only be issued for a limited period, and for certain specific places or districts.

During the summer months above specified (especially in the kauri districts) extra temporary assistance should be allowed the officer in charge, and in the more valuable forests these officers should have men put on to clear and burn off fire-breaks in such places as the proximity of settlement made causes of anxiety.

The kauri-gum digger might also be dealt with by closing such fire districts as might be from time to time proclaimed against his entry during the summer months, or by limiting his operations to certain specified portions of the forest. The provisions suggested as clause 2 might stand good for the whole year, varied only under special permit of the officer in charge, in order to allow necessary clearing for building, cultivation, or other purposes formally approved by him.

Every gum-digger should register with the local forest officer his license, name, and occupation, and should be allotted a specified camping-place within the State forest. He should not be allowed to move his camp to another place, either within the forest or outside of it, except under direction of the officer, whose duty it would be to see also that the camp regulations are carried out.

A fine of £5 should be imposed for breaches of clauses 3 and 4. Fine and imprisonment should be imposed for infringement of clause 2.

It will be urged, no doubt, that these suggested regulations would be too stringent. It will be no use, however, to tinker with so important a subject by mild legislation. The case is desperate, and therefore drastic measures are the only effective remedies.

In case of fire, the forest officer should be empowered to call, in the name of the Queen, upon all sawmill employés, gum-diggers, and other residents holding licenses to assist in subduing it, refusal, except with valid excuse, to be punishable before the nearest Magistrate by fine, withdrawal of license, or both.

In the case of pastoral tenants, cancellation of lease and heavy fines should be inflicted for the burning of mountain-tops or bushes, and, with this in view, all pastoral lands should be proclaimed fire districts.

Shepherds found raising fires should be prosecuted *ipso facto*, and be fined not less than £10 for first and £20 for each subsequent offence.

* Except at stated times and under supervision of responsible foremen.

Such prosecution and fine of the employé should in no way absolve the pastoral tenant of his liability to similar fine and forfeiture of license. The action of the servant to be the action of his employer, and separate prosecutions to lie against both as co-offenders.

I have here indicated roughly the measures I think necessary to protect the forests of the colony, more especially that grand national source of wealth and employment, the kauri of New Zealand.

THE REGENERATION OF THE KAURI FORESTS.

There is no subject in the State economy of New Zealand of more vital importance than the conservation and perpetuation of the immense kauri forests of the North Island. Unfortunately, the major portion of these forests has passed out of the hands of the Government, and is held by syndicates and private individuals—a terrible mistake, since, being sources of great wealth to the colony, these areas should have been permanently reserved many years ago. Nor is there the slightest excuse for the alienation of these forests, because Captain Campbell Walker twenty years ago pointed out the course which should have been adopted, and indicated even then the disastrous results which must follow neglect to conserve these valuable timber-trees on scientific lines. Professor Kirk has, I feel assured, done his best to carry out the principles laid down in Captain Walker's report, and if he has not been successful in achieving a full measure of success I am equally sure he is not to blame. The fact, however, being as stated, unless the Government adopt the French, Swiss, or German system of State control over private forest-lands, the measures I am about to suggest can only be applied to such portions of the kauri forests as still remain national property; unless, indeed, the Kauri Timber Company will themselves adopt a rational scheme of forestry on similar lines to the system proposed for the State.

At the Wellington Conference of sawmillers and others it was stated, quite as a matter of course, that it was only a question of time when the kauri forests would be exhausted, and, though opinions differed as to the period when this would take place, the main fact that "the kauri is doomed to total extinction" was unanimously accepted.

The principal factors in menace of the kauri forests are these: (1.) The slow and uncertain growth of young trees when deprived of their natural shelter of scrub and forest cover, consequent upon the opening-up of the forest. (2.) The carelessness of sawmill employés in lighting fires and clearing the bush in operations connected with the transit of logs down creeks and watercourses, also in guarding against the spread of fires lit for cooking purposes, and the habit of smoking in the bush during working-hours. (3.) The firing of trees for the purpose of obtaining resin, or by accident, through the carelessness of the gum-digger and bush-hands.

I have no means of estimating the number of persons employed in the kauri timber trade, but it must be considerable; and possibly not less than five thousand people are directly, and one thousand more indirectly, concerned financially in the continuance of this industry. It is therefore no light matter for the Government to stand idly by, and with a go-as-you-please policy shirk the proper control and encouragement of so extensive and profitable an enterprise as the kauri trade. During the past forty years the waste and destruction of these trees has been enormous, and has resulted, for the most part, from fires for which the gum-digger must be held mainly responsible.

It is, indeed, very evident that any attempt to put matters right must commence with a measure to control this arch-destroyer of forests, and teach him that the property of the State must be respected in the interests of the people who really own the forests, which apparently he imagines belong solely to himself and the sawmiller, because they hold a license at a small royalty. Next should be undertaken control of sawmill operations, and here I may remark that my experience in four colonies has shown the sawmillers as a body are quite willing, and even anxious, to conform to reasonable regulations, though chafing under those of a harassing and irritating character. The sawmill hands, perhaps, are not so amenable to control, but in New Zealand these are a splendid body of men, and in most cases more intelligent than the average bushman. If, then, the arguments in favour of forest conservation and the grave interests at stake are explained to and understood by these men they will readily fall into line with regulations honestly framed to control waste, extravagance, &c., and to insure proper conservation of valuable property. Yet any Government taking in hand forest reform must be prepared to face at the outset opposition more or less strong, according to the voting-power of the interests which such reform will be imagined to assail. Nor do I doubt that the gum-digger will be the loudest in complaint, whenever his particular industry is brought more into line with the usages of modern forestry. It is better though, however loud the complaints of individuals, or however much the interests of individuals may actually suffer, that these should be endured rather than that five or six thousand people should be thrown out of employment by the extinction of the kauri, which must result unless the present wanton destruction by gum-diggers is checked.

The operations of the gum-digger and sawmiller having first been regulated, those of minor forest vandals can easily be dealt with in a scheme of reform.

The kauri-forest lands appear to me fairly open—*i.e.*, comparatively free from the undergrowth so common in New Zealand generally. This is a great factor in the question of regeneration, as it makes easier and less expensive the work of the forester.

I may say here that I do not agree with the "great age" theory, as applied to the kauri and other New Zealand timber trees. Counting the rings to calculate annual growth cannot be depended upon. Very often the growth is checked by frost, and exceptional rainfall is a factor which affects "ring" production. Severe frosts are also factors to be reckoned with. There is, of course, no doubt that many kauri-trees of large size are three or four hundred years old, but when these hundreds are stated by *savants* to run into thousands then I am sceptical. I was only, however, three months in New Zealand, and three days in the kauri forests, so that I tremble at my own temerity in thus attacking fables of hoary antiquity.

I noticed in the forests visited that the young trees were healthy and of strong growth. Judging, then, from the character of these, I am sure that if planted close—in rows, say, 8 ft. apart —with "nurses," very fine plantations could be formed within a few years. Close planting would provide the shelter or cover which is so absolutely essential to the production of well-grown specimens of New Zealand forest flora.

In forming plantations of kauri it would not be necessary to clear the existing bush, because the undergrowth could be utilised as "nurses" until the young kauri-trees were of sufficient size to form their own cover. Overhead cover or shade is another indispensable condition of forest growth that must be looked to, and this is particularly the case with reference to New Zealand timber. Successful kauri, and, indeed, all New Zealand tree cultivation, depends upon strict attention to this primary condition as to "shade" being observed; as the removal of overhead cover (as gaps and clearings are made whenever a forest is opened up by sawmiller, sleeper-hewer, or others) is the real cause of that lack of self-regenerating or recuperating power which is leading to the decadence of New Zealand forests. Shade is absolutely necessary to the growth and propagation of young trees, so that when, as at present, the forests are opened up to an undue extent and the young trees deprived of shade, natural reproduction ceases.

Nature's teaching, then, in this respect must be borne in mind when the culture of young kauri-trees is undertaken, and, as Nature has been teaching the people of New Zealand this and other lessons for forty years or more, they have only to open their eyes and they will see how these lessons bear out the opinions of the experienced forest scientists whom various Governments have in the past wisely consulted, but whose suggestions they have unwisely disregarded. They will see in the landslips of the Buller, the floods of Napier, and in many other instances the effects of that reckless denudation of forest country which is so strongly condemned. They will recognise that following the ravages of destroying agents the extinction of the forests is so imminent that the Government is appealed to to save the people from themselves, and I trust that my plain speaking and vigorous denunciation of the existing state of affairs will not be permitted to sink into oblivion without effect, as has been the case with the comments of my predecessors, since actual experience has proved the correctness of the conclusions we have unanimously arrived at.

The kauri-forest question is an exceedingly lively one for any Government to enter upon, since vast interests are involved. One of the principal industries of the colony is threatened with extinction, and it is not, then, too much to ask the earnest attention of the Ministry and the Legislature to so important a subject, and the promulgation of such a measure as will check the reckless vandalism which has been rampant for so many years, and has worked havoc in so many instances; damage to the Town of Napier to the extent of £100,000 through the flooding of the Clive and other rivers being a case in point, since this heavy loss is directly traceable to the denudation of the valleys through which these streams run. In such fashion Nature has avenged in many places the disregard of her laws by early settlers, and sheep-graziers will possibly recognise now that wholesale destruction of timber, which has so seriously injured their fellow-citizens in the case of Napier, must produce like results elsewhere under similar conditions. As in this case the many have been injured to benefit a few individuals, so with the kauri—an industry that gives profitable employment to thousands is being sacrificed for the mere temporary advantage, or simply convenience, of a few gum-seekers and sawmill employés.

It is then surely worth while to change all this, to conserve the valuable kauri which is still available to supply commercial demands, and to assist in maintaining a supply, and further, to take vigorous steps to insure the propagation and protection of young trees in order to provide for the permanence of the industry. There are thousands of acres of gum-lands about Auckland and on Coromandel Peninsula upon which plantations of kauri could be formed. When, too, the existing crop has been removed from the Waitekauri Bush, plantations of young trees could be formed there, which, if enclosed, and carefully tended for a time, would grow and develop well. I mention these places specially, because the gum-digger has already removed from them all the deposits of gum, hence the plantations would not be liable to injury through his presence and operations. All the gum-lands, however, will again grow kauri if replanted under the conditions previously described.

The Government should at once: (1) Make permanent State forests on Crown lands upon which kauri is found; (2) in suitable places, accessible by water, reserve worked-out Crown gum-lands for plantations of kauri; (3) protect by a repressive Fire Act all the kauri forests of the North Island.

The permanent reservation of all kauri-lands, is, however, a matter of the first and gravest importance, since no time should be lost in adopting a strict system of conservation if it is desired that the kauri timber industry shall continue—as it should—for all time a prolific source of revenue to New Zealand.

In support of my arguments and suggestions, I may here quote from the report of Captain Campbell Walker (1877), and, comparing the conditions therein described as obtaining at that time—twenty years ago—with those of to-day, we can recognise how little, if any, improvement has been made in dealing with the kauri forests. Captain Campbell Walker says:—

"There remains but little doubt that the sawmillers, hand-sawyers, and splitters have made the most they could out of the forests for their own advantage, and doubtless also that of the purchaser. 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 or blame them. On the contrary, I think they deserve the highest praise for their energy and enterprise, and the manner in which they have and are supplying the markets. . . .

"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 district to the smaller

descriptions at the Seaward Bush in Southland, are excellent, and the same may be said of the breaking-down and converting machinery, which is as a rule the best of its kind produced, and specially adapted to the description of work it has to perform. . . .

"There is, be it understood, great waste—or, more properly speaking, neglect—in utilising 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 manner in which the timber-trees have been felled and worked at all seasons of the year, the timber being made use of for construction-works without any attempt at seasoning. The results of such a system are everywhere apparent in the warping, contraction, and deterioration of the timber in houses, bridges, wharves, and other buildings, and in furniture. It has done much to give New Zealand timber 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 to induce sawmillers and timber merchants to allow for seasoning before placing the timber on the markets. The advisability of some such measure is admitted on all hands, and the sawmillers on the West Coast have to a certain extent set an example in the right direction, and limit the felling—especially of silver-pine and 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 thus 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 sawmills, in a rather depressed state, especially in Southland, the rates ruling very low indeed, especially in Southland, where pine from the Seaward Bush, delivered at the mill, generally alongside the railway, realises only from 6s. 6d. to 7s. 6d. per 100 ft. superficial, leaving scarcely any margin of profit even under the most favourable circumstances to the sawmiller. The reasons generally given for this state of things are general dullness of trade and stagnation in building operations. I am inclined rather to ascribe it to over-competition; the low rates at which forests can be acquired, and the little value set upon them, 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 it be gradually brought about, will in any way paralyze or cripple the timber industry, nor will the rise be such as to be severely felt by the consumer, and thus 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 have of necessity a disastrous effect on our trade.

"I see no reason to anticipate any such movement. The timbers of Australia are of an entirely different character to 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."

That these reflections of Captain Walker upon the state of affairs in 1877 applies with equal force in 1896, few people acquainted with the forest will dispute. Matters are much worse now than they were in the former year, and what he has written so forcibly twenty years ago I now reiterate—let him again speak for himself:—

"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 satisfactory results. Once place the conservancy of the forests and their management under officers specially responsible for them, and duly authorised 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. . . . The interests of sawmillers are I consider, really identical with our own, that is, with those of a State Forest Department. . . . A continuance of the present system of waste, burning, and devastation of 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 objection from a financial point of view. . . .

"The history of *reboisement* in France is most instructive, and peculiarly applicable to the circumstances of New Zealand, where the tendency is to clear the hillsides in order to provide grazing for sheep and cattle. This is exactly what was done in France, with the result that the vegetable soils disappeared, and 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 super-abundant waters."

"This is exactly what I fear may be the case in New Zealand if steep hillsides, such as those of the Buller and its tributaries, are cleared of forests. 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 have it cleared."

These extracts serve to show that the same waste, carelessness, and neglect of the forests is as rife to-day as when Captain Walker penned the above. Could that gentleman now see the forests and Buller Gorge as I saw them in 1896, he would gaze with astonishment at the devastation

worked in them during a short twenty years. If, then, conservation be followed up on systematic lines, the replanting of kauri must of necessity form an important feature of forest reform. There is no necessity to spend money rashly—a few experimental plantations, not necessarily costly, could be started in places named, and other suitable localities. At the same time, care must be taken that forest trees are not planted in uncongenial soil, or in positions antagonistic to their natural habitat; and in order to effect this it is necessary to study the various trees as they grow in the forest naturally, and note their surroundings—the soil, position of forest as regards shelter or exposure, altitude, and aspect. When these are determined, apply all such conditions to the plantations so far as is possible. This is the true secret of the forester's art, and success must attend intelligent work of this nature.

In conclusion, the work of replanting the kauri should be made a national undertaking. Just as the Government of France took in hand the *reboisement* of the Alps (Cevennes) of that country, so New Zealand should now awaken, and by vigorous action reforest the worked-out gum-lands of Auckland, and so cause the bare bleak lands to again flourish in forest flora with the tree which has done so much to enrich New Zealand, so that future generations yet unborn may live to see the noble kauri flourish and become a blessing instead of a mere remembrance.

THE MAINTENANCE AND PROTECTION OF POPULAR TOURIST RESORTS.

The "beauty spots" of New Zealand are so many that it would be impossible to refer to them all in the brief space at my disposal. It is, however, a matter of so much public interest that I should like to mention the most beautiful and popular of those in both islands, and suggest in general terms what I think should be done to preserve for all time these natural glories of the New Zealand Wonderland.

Queen Charlotte and Pelorus Sounds, for instance, at once arrest the attention of a visitor by their picturesque and graceful surroundings. The former—lovely sheet of tranquil water, bounded by hills of no great altitude, yet here bold and abrupt, there sloping gently to the water's edge, with every variety of artistic contour and fascinating outline, which serve as an emerald setting to the bright shining water—is one of the most charming bits of scenery it is possible to conceive. Yet this picture is blurred already by signs of fire in the scarred summits and slopes of the serried ranges, and without doubt, unless guarded against, fire will in course of time rob this delightful scene of its natural beauty. In the Pelorus Valley the progress of settlement is rapidly changing the wild fierce solitude of the deep blue hills, so that unless reservation of the State forests are made on a large scale, and stringent regulations enforced to protect them, the present weird grandeur of the Pelorus Sound views will be destroyed, and with it all the detailed charms of forest-clad hills and fairy dells, of fern gullies and shady glens—victims alike to that scourge of the forest, fire. Conservation of such spots should be undertaken by the Government, as well from the point of view of maintaining a supply of timber as from an æsthetic standpoint, seeing that this latter has also a commercial aspect which cannot be ignored.

Supposing such "beauty spots" are robbed of their attraction, charred and blackened stumps substituted for the setting of forest that lends charm and character to the scene, they must cease to induce, as now they do, tourists from all parts of the world to spend money in the colony in order to gratify artistic tastes by seeing the natural beauties of a picturesque country unfolded before their admiring eyes. Thus a source of revenue must be lost to the colony; so that even in this direction judicious expenditure is a mere matter of business foresight and prudence.

It would surely be a disgrace to New Zealand if such jewels as these inland seas, with their present superb forestal environment, were permitted, through neglect or wilful misuse, to be diverted from the purposes for which Nature has evidently intended them—at once valuable sources of timber-supply, and tourist resorts—and laid waste by fire, which can be guarded against, or by settlement, for which other more suitable and profitable localities are available. Though I had no opportunity of visiting Milford and other Sounds, these remarks apply equally to them.

Then, the lakes—Kanieri, Mahinapua, Pearson, and Wakatipu in the South; Taupo, Rotorua, Tarawera, Rotomahana, Roto-iti, and others of the volcanic region in the North Island. What "beauty spots" are found in all of these localities! Lake Wakatipu, and the northern lakes of Rotorua, Tarawera, and others, on account of railway communication, are perhaps the best known of New Zealand waters.

In length sixty-three miles, with an average width of from four to six miles, on every side of Wakatipu ranges rise abruptly, with snow-clad peaks, to 3,000 ft. and 4,000 ft. In winter, especially, the lofty mountain-tops, scarred rocks, and steep precipices, in their white mantle of snow, present a scene of indescribable magnificence and grandeur; yet in summer the bare rocks and bald hills, destitute of forest vegetation, if still grand, look dreary and desolate. Some steps have indeed been taken by the Government to reforest these hills, but the work was not carried out systematically. I am informed, moreover, that the slopes of the mountains down to the water's edge were once covered with a fine forest of beech, but here again the fire fiend was introduced at the instance of the squatter and prospector, or the passing traveller lit his fire and left it to spread at will; and thus the forest scenery of Lake Wakatipu is represented only by a memory of what has been. It is, of course, possible, and certainly desirable, to reforest the country and give back its pristine beauty to this even now unrivalled lake scenery, but it will, of course, entail heavy expense.

European tourists are, as a rule, satiated with the more artificial beauties of older centres of civilisation, and hence the rugged, forest-clad mountains and the wild grandeur of the Lakes, the sublime scenery of the Sounds, the dangers of Mount Cook, and the wonders of the Hot Springs have for them the attraction of novelty. Such attractions as these, too, and others that New Zealand possesses, are such as no old tourist-resort in more civilised countries can boast.

It must surely be a suicidal policy to neglect such precautions—of value on other grounds also—as will rehabilitate where necessary, and in every case jealously preserve the natural advantages both for timber and scenery so bountifully bestowed on the frontages to these exquisite lakes, rivers, and sounds.

For reforesting, the most suitable timbers are undoubtedly the native beech (which is easily propagated from seed), the blue-gum, and the better-class pines and firs, such as *Pinus excelsa, P. strobus, P. laricio, Abies smithiana, A. menziesii, Picea balsamea, P. nordmaniana,* which could be grown in fenced enclosures to protect them from stock, with fire-lines or breaks, say, every 20 chains.

The banks of the Wanganui should also be most carefully preserved. Should this territory —now in Native hands—fall into those of the pastoralist or small grazier, æsthetic effect will speedily be sacrificed to the desire for more grass, and the forest-clad cliffs, the mossy slopes, and the fern-tree gullies of this, the Rhine of New Zealand, will soon be shorn of their natural attraction. Let the lover of sylvan beauty imagine the banks of this noble river denuded of foliage, and in its place miles upon miles of blackened stumps, and use his best endeavours to prevent such sacrilege. When these river-lands fall into the hands of the Government, ample provision to avert such a calamity can be made by reserving frontages on both sides for some distance back, thus securing to future generations for all time a continuance of the wild and beautiful native flora in variety and abundance as at present. Moreover, the Wanganui is peculiarly the favourite home of the Maori race, and has thus an historical interest. Its legends, indeed, like those of the Rhine, of hoary antiquity, will long outlast the extinction of its former possessors. Such a river, with such a history, surely deserves a better fate than to be robbed of its most striking features by the fire-stick—its inevitable destiny unless the authorities step in to save these frontages, which would form the grandest national park in the Southern Hemisphere.

Then, again, perhaps nowhere in New Zealand is the expenditure of State funds for improvements justified than in the country about the lakes district—Taupo, Rotorua, &c.—and it is pleasant to observe the efforts already made at Whakarewarewa by Mr. Malfroy, the engineer in charge, in judicious planting, and in the construction of roads to enhance the attractiveness of this district. As a rule, the country above the hot springs is uninviting, but by clearing off the manuka scrub and systematically planting more ornamental and useful trees, it could be made both more attractive and less dangerous than at present.

Whakarewarewa, Waiotapu, and other places offer splendid fields for the work of the landscape gardener, but so much public money might easily be wasted by the adoption of inconceived plans and haphazard methods, that the greatest care should be exercised to see that such operations as are necessary in these and other places should be entrusted only to first-class men. For instance, a common error in Australia is that of planting trees too close to each other; and for such landscape purposes as those above referred to special pains are necessary to avoid this, and to so arrange the trees that when matured they shall not hide the natural beauty of configuration which should form the back-ground of each view. Trees of strong growth should therefore be planted only in small numbers and at long distances apart, and the intervening spaces filled in with shrubs of graceful shape and handsome foliage.

I note here my regret that since leaving New Zealand the death has been announced of Mr. Malfroy, in whom the Government has lost an intelligent and useful member of the service.

In planting the country of the hot springs it must not be forgotten, of course, that the trees must be so placed as to be beyond reach of the destructive influence of sulphurous gases. The mud-covered (papa) areas about Tarawera might even more easily be reforested. Here a liberal sowing of beech and blue-gum seed on the slopes and foothills would very soon insure a vigorous forest growth, and in course of time restore the sylvan beauty which distinguished this region prior to the great eruption of 1886.

CULTIVATION OF THE WATTLE AND OTHER TREES FOR TANNING MATERIAL.

This subject is of the greatest importance, and the selection of trees and plants best adapted to the production of tannin must materially increase the commercial progress of New Zealand. At the present time the barks of several kinds of trees are used for tanning. In New Zealand the beech is perhaps in most general use. Different species vary in the strength of the tannic acid, and as a general rule the *Fagus fusca* will be found the best for the tanner. This tree affects low altitudes, flourishing most in the littoral regions of the colony.

Information as to beech-bark is scanty, as it is used principally by local tanners, who probably mix with it Australian wattle-bark. For heavy leather there can be no question in comparing these, the wattle being immensely superior, though beech is the better for light and delicate skins, furs, &c.

The tanekaha (*Phyllocladus trichomanoides*) is also valuable for the tannic properties of its bark, which is used with remarkable success to preserve canvas or sail-cloth from the ill-effects of sea-water. A Tasmanian species, *Phyllocladus rhomboidalis,* is also used for the same purpose with excellent results. Though beech-bark is extensively used locally, however, it has never become an article of general export.

Next in importance for tanning purposes are the *P. glauca,* and *P. alpinus,* the *trichomanoides* (celery-leaf pine) being much more generally used than either. Beech- or birch-bark has been exported to London, but its lower grade tannic properties must always subordinate it to other barks, though for some purposes, such as tanning glove-skins, it may yet attract attention, and become an important article of export.

There are other tanning barks, but these as yet are practically untried.

The principle object of this section of my report is to discuss the introduction into New Zealand of the wattle-bark as a marketable commodity and prolific source of income. The North Island is admirably suited to the purpose of wattle-growing, and I was particularly struck with the pumice-plains of Lake Taupo, also the immense area along the Upper Waikato, stretching to Ruapehu and Tongariro, as country specially adapted for plantations of this tree. The bare hills around Wellington and Nelson, as also the waste lands of Auckland, too, might be profitably used for this purpose.

There are many species—mostly Australian—of the genus *Acacia*, but of these it is only necessary to mention three. These are: *Acacia decurrens*, var. *mollissima* (the black feather-leaf wattle), *Acacia dealbata* (the (silver) feather wattle), and *Acacia pycnantha* (the broad- or golden-leaf wattle). *Acacia decurrens* is a tree reaching to 20 ft. or 30 ft., with rounded form of head and branching in habit. The leaves are small, decurrent, and folding, with golden tips to the young shoots, and yellow or golden tinge to the branches and twigs. The flower is a soft ball, yellow, and not very crowded on the stalks. The silver wattle (*A. dealbata*) is so called from the silvery white of its bark and leaves on the underside. The leaves are decurvent, pinnate, and glaucous, somewhat larger than those of *A. decurrens*. The bark closely resembles that of *Fagus solandri* (silver-beech). In Australia this is the first wattle to bloom, coming out about July or August, the black feather-leaf wattle following in September. The flowers of the silver wattle are smaller and lighter in colour than those of *A. decurrens*. Both are feather-leaved, but the bark of the last named is dark-brown, and often—in old trees—of a rusty black colour. Trees of all three species range in height from 20 ft. to 35 ft., and mature from seven to nine years, when they should be stripped and cut down. *A. pycnantha* (broad-leaf wattle) is in Australia a most valuable tree. Though it does not produce so much bark as either of the other two *Acacias* named above, its proportion and strength of tannic acid are much greater.

The habit of all these trees is littoral, and they should be grown well within the influence of sea-air. There is little difficulty in distinguishing *A. pycnantha* by its broad leaf, not unlike that of a gum, lanceolate in form, with prominent veins and midrib. The tree is well named the golden wattle. Its bright fluffy golden balls are most striking and beautiful in appearance, and give off a delicate though powerful perfume. The upper branches and twigs are tinted with a brownish-yellow colour, which gives the whole tree that golden look that suggests its Australian name. The brilliant blossoms are much admired by all lovers of flowers. Of the three species, the first and third are most in favour with tanners and buyers, *A. dealbata* having a small percentage of tannic acid. This tree, moreover, is apt to become a troublesome scrub, sending up suckers from the roots very freely. In its mountain form, however, it becomes a fine tree, and in moist cool gullies often runs up to 80 ft., producing timber very valuable for cask-making and other purposes. *A. decurrens* and *A. pycnantha* thrive best in undulating fern (bracken) country and deep sandy loam.

In Australia the price of black or broad-leaf wattle-bark ranges from £5 to £7 per ton, and sometimes 1 cwt. of bark is obtained from a single tree of *A. decurrens*.

All of the Acacias are valued by bakers and confectioners as firewood, because they make a quick fire, and throw out great heat.

Methods of Cultivation.

Acacias are cultivated under several different systems:—

1. By ploughing the ground, sowing the seed broadcast—2 lb. to 3 lb. to the acre—as is done with wheat and other grains. The seed should be prepared by pouring boiling hot water upon it, and letting it stand to cool before sowing. Care should be taken, however, not to thus prepare more seed than can be sown on the same day. After being prepared, the seed should be mixed with dry sand, in the proportion of 1 lb. of seed to half a bushel of sand, and the mixture broadcast over the ploughed ground.

2. Another method adopted is more suitable for land on which are stumps and fallen timber. This is, lining out rows of spit-holes 8 ft. apart each way, and dibbling two or three seeds into each hole.

In forming wattle plantations ample provision should be to minimise the danger from fire. Hence plantations should be laid out in blocks of from 25 to 50 acres, bounded on all sides by broad roadways as fire-breaks.

Trees, as a rule, may be stripped at the age of eight or nine years, as they then attain maturity, and if left longer may be attacked by grubs and die. In Australia the stripping season begins in September, and lasts until January. The bark when taken from the trees should be carefully stacked, and protected from wet. The trees, of course, perish after being stripped.

The wattle is a very heavy seeder, and tons of seed are scattered each season over the ground. To reproduce a plantation nothing more is necessary than to cut down the dead timber and burn off grass and rubbish, and the young trees will then spring up in great profusion. These, of course, require thinning about the second or third year to a standard distance of 8 ft. *Acacia decurrens*, being the largest, showed be thinned to 10 ft. apart.

The broad-leaf wattle and the black feather-leaf grow best in dry uplands, the former in sandy soils or granite detritus, but will not thrive in low-lying wet soils. The bark is highly valued in England and Germany, and generally commands ready sale at high rates. It is prepared for export by being chopped or ground in a mill, and is shipped in sacks.

I noticed some flourishing wattle plantations on the railway between Rotorua and Auckland, and from the appearance of these I formed the opinion that there is a splendid opportunity for profit in the culture of wattles in New Zealand.

The enemies of the wattle are not numerous, but when they do appear they are very injurious. The first and worst is a very small green beetle. This attacks the feather-leaf wattle only, swarms

in myriads, and eats off every leaf till the wattle dies, or becomes so debilitated that grubs easily complete the work of destruction. A minute grub also attacks the leaves, and causes glandular swellings on their surface. These form galls, and when present in large numbers seriously affect the growth of the tree. The broad-leaf wattle is not affected by the beetle, but in old age the grub and borer both attack it. This wattle will not stand severe frosts, and hence should be planted in low elevations, and at no great distance from the sea—say, within twenty miles or so.

A valuable experiment might be tried at the wattle plantations at Rotorua and on Auckland railway-line by sending samples to me in Melbourne, and testing the value by analysis against an equal weight of best Victorian-grown bark. The comparison as to relative strength of tannic extract of the two barks could be tested in this way.

Copy of Minute of Conservator of Forests in Victoria (Mr. G. S. Perrin) in connection with an Application for Information *re* Wattle Cultivation.

1. *The Climate and Soil most suitable for its growth.*—Wattle-culture is best carried on within a twenty-mile radius of the sea-coast. The wattle being indigenous to Victoria, and in fact to Australia generally, there can be no difficulty as to climate, provided the cultivation of the wattle be confined to the coastal districts. Sandy heathy soil, with clay subsoil; dry sandy ridges on hillsides.

2. *Where is the best place to obtain reliable Seed?*—Messrs. Lang and Co., Bourke Street, Melbourne; or Messrs. Law, Somner, and Co., Swanston Street, Melbourne; or, better still, select trees and gather yourself. Two varieties are planted—viz., (*a*) the broad-leafed (gum-like leaf) wattle, *Acacia pycnantha*; (*b*) the feather-leaved wattle (decurrent form), *Acacia decurrens*. The former is the better; it is more tractable under cultivation, yields a much higher percentage of tannic acid, is eagerly bought in the best markets, and stands pruning. The price of the first is 1s. or 2s. per pound for seed, according to quantity on the market. The latter runs up from 2s. to 3s. per pound, and is not always obtainable in quantity.

3. *The estimated Cost per acre for Sowing and attention during progress of growth.*—If on cleared land which has been cultivated, the cost is merely that of ploughing the land and sowing by hand a few seeds, three or four, about 5 ft. apart for (*a*), and 8 ft. apart for (*b*). The seed in each case must be placed in boiling water and let cool for, say, twelve hours; it should then be "sweated" by placing it in a small bag drained of the water and placed near a fire (not too near), care being taken not to soak more seed than can be used the following day. Another plan is to sow wattle broadcast like wheat. You prepare the seed as above, and then mix sand (dry), half a bushel of sand to every pound of seed or more, at discretion. A light harrowing should follow, to cover the seed, otherwise the soft pulpy seed would dry up and fail to germinate. I prefer the dibbling system—*i.e.*, putting in seed by hand; it is quicker, and more certain, and insures regularity of growth, and the wattles are easily attended to when in rows. The costs depends upon the soil, locality, and whether timber, heath, or cleared lands. No estimate can be given which would apply to all cases. About 15s. per acre is a guide to first cost, after which pruning has to be considered. This will depend upon the care taken in sowing; if wattles are thin they will not want much pruning out, but if thick and dense as a crop they will.

4. *The estimated Yield of a good Crop under favourable conditions, and value per ton or acre.*—Depends entirely upon circumstances. No defined answer could be given to this query.

5. *Where is the best Market to be found, and in what state should the bark be sent, crushed or in liquid?*—London, undoubtedly. The Germans are, however, going in greatly for wattles; and a local market may be found anywhere. Chopped or ground is best; saves freight.

6. *What Machinery is the best?*—The Echunga Wattle Company, in South Australia, has machinery which pulverizes wood, leaves, and bark, and they manufacture in a liquid form.

I believe there is a great future in the wattle industry if undertaken in a right manner, but it will take seven years to mature a crop of (*a*) wattles, and eight or nine years for (*b*) wattles, and therein lies the difficulty to poor men, the length of time required before a return is obtained being beyond the means of many.

LATEST FOREST STATISTICS FOR NEW ZEALAND.

The number of sawmills in working-order at the date of the census of 1891—a year of intense depression, when many mills were closed and others working half-time—was: North Island, 119, employing 1,996 persons; Middle Island, 124, employing 1,270 persons.* To these regular hands must be added the bushmen, contractors, tramway-men, loggers, &c., to the number of 1,750, bringing the total for the year named to 5,016 persons making their living out of the forests of New Zealand ("Official Year-book," T. Kirk, F.L.S.).

The figures quoted do not, however, give any adequate idea of the importance of the industry in 1896. The kauri trade had languished for a time, but at the period of my visit last year gave employment, directly or indirectly, to at least five thousand persons, and at certain seasons to considerably more. The revival of the kauri trade, of course, brought about greater activity in the sawmills, and it may be assumed that the number of persons who could be employed in this industry would be doubled—that is, to ten thousand—in more prosperous times.

* For 1896 the statistics were: North Island, 155 mills, employing 2,652 persons; Middle Island, 144 mills, employing 1,407 persons.—Ed.

The following statement of forest areas is taken from the Year-book quoted above, and was published in the report of the Survey Department for the year ending the 31st March, 1893 :—

	Acres.
North Island—	
Auckland Land District—	
North of Auckland	1,800,000
South of Auckland	3,420,000
Taranaki	1,850,000
Hawke's Bay	1,900,000
Wellington	3,400,000
Middle Island—	
Marlborough	400,000
Nelson	3,240,000
Westland	2,394,000
Canterbury	492,000
Otago	1,182,000
Southland	500,000
	20,578,000

The State forests reserves, including those made for climatic reasons, comprised 1,164,382 acres.*

From the report of the Lands and Survey Department, issued by the Surveyor-General, S. P. Smith, Esq., F.R.G.S. (1895–96), the following information *re* State forests is given :—

"State Forests.

"At the date of last report the area that had been reserved for all classes of timber reserves amounted to 1,150,918 acres. During the current year 60 acres in Marlborough and 4,980 acres in Southland have been withdrawn from reservations for settlement purposes. On the other hand, 18,504 acres have been reserved for forest purposes to preserve native fauna and flora, as also for scenic effects, so that the total now stands at 1,164,382 acres. The largest areas reserved are on the shores of Lake Waikaremoana and the Little Barrier Islands. A good deal of timber scorched by fire has been disposed of during the year, especially from the Thames district, where disastrous fires occurred in past years in the kauri forests, destroying large quantities of valuable timber, and leaving much other timber in a state that necessitated sale to avoid total loss. The principal sales have been in the Auckland District, where, on account of the greater dryness of the climate and the inflammability of the kauri, the greatest damage to the forest occurs. Last summer having been exceptionally dry, the forests have suffered in consequence, and in the Puhipuhi State forest especially a considerable amount of kauri timber has been injured. Since the returns were made up on the 31st March all this damaged timber, together with that injured by the great fire some years ago, has been disposed of at remunerative prices. The extension of the railway-line from Whangarei towards Puhipuhi has rendered the sale possible. Large fires have occurred in other parts of the colony also, so that besides the denudation of the country of its forest clothing by the operations of settlement considerable areas have been rendered waste by accidental fires. Where the country is otherwise useless for settlement it would seem to be a wise policy to replant these areas with useful timbers, selected for their ability to withstand fires. Something is being and has been done in the past in sowing the burnt areas with grass, and the Commissioner of Crown Lands, Southland, is taking in hand some of the bush areas from which the timber has been cut out, and replanting them with young timber-trees. The result of this experiment will be looked forward to with interest. Preparations are also being made to try tree planting on the bare Kaingaroa Plains, in the Auckland District, as well as in Otago, and such operations might be extended with great advantage to the country, for the timber supply is fast diminishing through the progress of settlement."

Output and Labour.

The value of the total output of sawn timber in 1890 was £832,959, which, owing to the depression in that year, is no less than £344,754 below that of 1886. When the census was taken in 1891 twenty-five mills had been closed, and the number of persons employed had fallen from 5,042 to 3,266, many of the mills at work being on less than half time. Of the total output for 1890, the forty-seven Auckland mills contributed more than one-half, the value of their output being £416,978, whilst the manufactures of the 196 mills in the other provincial districts were valued at £415,951.

The sum paid in wages during the same year is stated at £271,783, but this includes only a portion of the amount paid to the bushmen, fellers, and others engaged in preparing the logs for conversion, as many mills purchase logs from settlers, or employ contractors, also deliver the logs at the mill at fixed rates. The approximate value of land, buildings, machinery, and plant was returned as follows: Land, £160,750; buildings, £92,848; machinery and plant, £246,674; total, £500,272.†

* Now (1897) 1,172,750 acres.—Ed.

† The Year-book for 1896 gives £898,807 as the value of the output of 1895 from 299 mills. The wages for the same year were £323,223; and the total value of land, buildings, machinery, and plant, £586,422.—Ed.

Timber Export.

The following table shows the gradual development of the export trade and its present position:—

Sawn and Hewn Timber.

	Superficial Feet.	Value. £
1871	3,214,742	14,200
1875	5,225,627	26,914
1881	13,180,280	65,119
1888	43,474,434	177,877
1889	42,568,600	176,608
1890	42,098,863	181,689
1891	42,824,365	182,431
1892	22,860,551	87,581
1893	26,718,046	101,082
1894	31,901,415	116,116
1895	38,297,905	141,892
1896	34,984,414	133,511

By far the greater portion of exported timber consists of kauri, the proportion of other timbers being almost insignificant. Thus, in 1887 the quantity of kauri exported was 30,230,084 ft. superficial, valued at £124,347, and of all other timbers 1,104,380 ft. superficial, valued at £4,475. The export of rimu and kahikatea is, however, increasing, though not very rapidly. Up till now the greater part has been shipped from the Bluff, but the recent completion of the Hokitika to Greymouth Railway will lead to considerable shipments from the latter port. Figured rimu, which is plentiful in the Westland forests, could be placed on the London market at a low price, either in selected board or in logs, and if shipments were regular would command a ready sale. The remarkable falling-off of the export trade in 1892 was caused, of course, by the terrible commercial depression that year throughout Australasia.

Kauri Resin.

Gum-digging employs nearly seven thousand persons, including Maoris and aliens. In the fossil state it is found in lumps, varying in size from that of a walnut to 100 lb. weight. It is used in the manufacture of oil-varnishes, and is exported to England and the United States. In 1860 the export was only 1,046 tons, valued at £9 per ton. In 1894 it amounted to 8,338 tons, valued at £48 10s. per ton. The following statement, taken from the Customs returns, shows the quantity exported in each year from 1884 to 1894 with the total value and average per ton:—

	Quantity.	Total value. £	Average per ton. £ s. d.
1884	6,393	342,151	53 10 4
1885	5,875¾	299,762	51 0 3
1886	4,920¾	257,653	52 7 1
1887	6,790	362,434	53 7 6
1888	8,482	380,933	44 18 4
1889	7,519	329,590	43 16 8
1890	7,438	378,563	50 17 11
1891	8,388	437,056	52 2 1
1892	8,705	517,678	59 9 4
1893	8,317	510,775	61 8 3
1894	8,338	404,567	48 10 5
1895	7,425	418,766	56 7 11
1896	7,126	431,323	60 10 6

The digger's equipment is of a simple character. A gum-spear is used to test the ground, and when found beneath the surface the gum is dug out with a spade. The total area of the gum-fields is variously estimated at from 1,500,000 to 1,800,000 acres.

For statistics specially prepared for my use at the close of my tour through the colony by G. Mueller, Esq., Commissioner of Crown Lands, Auckland, see Appendix A, at end of report.

MINING TIMBER SUPPLIES.

In New Zealand the question of supplies of timber for mining purposes is not as yet a burning one, as in Victoria, inasmuch as mining in the first-named colony is chiefly confined to hydraulic sluicing, in connection with which the demand for timber is not great, On those fields, too, where timber is a matter of expense and difficulty, mining-props may readily be grown at comparatively small cost. The blue-gum thrives in both North and South Islands, and no better tree could be selected for plantation in places where mining requirements are likely to be large and permanent. This question of permanency, I may mention in passing, is one of the greatest importance where State forests are concerned. Blue-gums can be grown to 8in., 10in., or 12in. props in a number of years equal to the diameter measurements—*i.e.*, approximately, 1in. in diameter for each year. Under these circumstances, it is quite feasible for any company with spare land round their claim to grow blue-gums for their own use if native timber be not available. In large mining centres, of course, such private planting would not be sufficient, and Government should start plantations to keep up the necessary supply of timber.

So far as I was able to observe during my recent tour, mining as stated above is principally carried on by sluicing; but if at any time there is extensive demand for mining timber the *Eucalyptus* family will be found of great value, and has the special advantage of being a rapid

grower. If size and strength of timber is required, then the gums must be grown on dry and not on moist lands. The different results obtained from the same varieties of trees grown under different conditions is surprising. Trees on the sunny side of a range are better in quality than those on the shady side. Trees near the top of a hill are stronger in texture and sounder in grain than those grown in the moist valleys or flats below. The timber even on the sunny side of a tree is better than that on the shady side, and so on. If the forester, therefore, works upon these known data he can produce with almost certainty the particular quality he desires. Much, however, depends on skilful and judicious treatment of the plantation in the matter of thinning.

Among native timbers most suitable for mining purposes, fortunately for the industry, generally found in auriferous regions, the beech stands pre-eminent. My knowledge of this timber is not extensive, but I think, for works requiring great stability and lasting properties, very few of the native trees are equal to it except kauri, silver-pine, kowhai, and rata. The first-named is too valuable for use except in high-class work; the second and third are scarce, and confined to certain districts; and the fourth, though universal in growth, is not sufficient in quantity to supply any heavy demand. The white-pine rots too quickly; rimu is good, but very variable in quality. The chief drawback to all these timbers, however, is their non-reproductive character and excessively slow growth.

Now, most species of the gum reproduce from stools; hence a plantation once formed may be cut out at any age required, according to the nature of the crop fixed upon. Trees may be cut for 8 in. props at about eight years, 10 in. at ten years. When a complete clearance of the entire area has been made, if the trees are cut quite close to the ground, a new crop comes up with great vigour. Many stools come up strong and healthy. These, of course, require thinning out, and then the young trees replace the old, and the supply may continue for many years in rotation. Of course, in time the crop grows smaller, weedier, and grub-infested, and eventually dies out. Then seedling trees should be introduced, and thus the supply is carried on *ad infinitum*. The stringy bark is probably the most useful tree for mining purposes that we have (three species: See list given under "Tree-growing in Canterbury").

It seems a pity that in the kauri districts that specially valuable timber should be used for mining purposes when other suitable woods are at hand, and I am of opinion that such use of it, except in a sawn or manufactured state for special work, should be prohibited. As, however, the question of timber-supply for mining purposes did not, in consideration of the present limited demand, call for any very great attention on my part, what I have written may be regarded as intended chiefly to insure the matter being considered and dealt with in good time, as in any comprehensive scheme of State forest conservation all interests must be considered. Such a scheme ought to provide for dealing firmly and even severely with forest offenders, and at the same time secure the interests of all who depend upon forest produce for their living, or for use in their trades or business, be they miners, sawmillers, or gumdiggers. Those, however, who use the produce should remember that the State rights of the forest are vested in the nation, and that wanton destruction by fire or otherwise, and wasteful extravagance, are or should be serious indictable offences.

STATE NURSERIES AND FREE TREE-DISTRIBUTION.

In Victoria there are four nurseries for growing trees—viz., Macedon State Nursery, the principal distributing centre for State plantations and the general public; Creswick Nursery, used principally for raising trees to supply the local plantation; Havelock and Gumbower, also for local supply. The three last-named—Creswick, Havelock, and Gumbower—are worked economically, only one man being permanently employed, and though extra men are occasionally put on, the annual cost is merely nominal. Nurserymen in charge are paid from 8s. to 11s. per day; foremen, 7s. to 7s. 6d.; and labourers, 6s. 6d. per day.

The trees raised in all these nurseries are for the most part those generally recognised as specially valuable for particular purposes. The best pines and spruce firs, for instance, are grown and sent for plantation in State reserves, the grounds of public institutions, the surplus being distributed free to the general public on application.

The Macedon State Nursery is, however, the chief centre of tree-cultivation and distribution. It is situated about 1,700 ft. above sea-level, within a quarter of a mile of the Macedon Station on the Bendigo line, so that trees can be sent to almost any part of the colony in a single day. The staff consists of a superintendent (nurseryman), one foreman, and five labourers, the latter being paid 7s. and 6s. 6d. per day respectively. The area of the nursery proper is 39 acres, of which 20 are under trees in all stages of growth. The annual output of trees varies from 50,000 to 120,000, of which at least one-half are planted in permanent lines in the various plantations of the department. The results of free distribution may be observed in the public reserves, gardens, and streets of every town throughout the colony. By adding to the comfort and beauty of localities, especially in hot districts, these trees not only make life endurable by their grateful shade, but have increased the value of neighbouring properties. Tree-planting by municipal authorities and by private persons is yearly increasing in Victoria, which may well be called "the garden colony" of the group.

Should the Government of New Zealand undertake forest reform, replantation is a matter of urgent necessity which must be grappled with promptly. New Zealand forests, unfortunately, do not easily renew themselves, as do those of Victoria. Plantations must therefore be a prominent feature of forestry in New Zealand, and the question of nurseries will therefore call for early attention. In choosing sites, geographical situation, variety of soils and climate, and many other matters must be carefully considered, contiguity to railways being an important factor in the calculation. Without laying down hard-and-fast lines, I would suggest Gore as a central position for a State nursery to supply the Provinces of Otago and Canterbury; also, when the projected railway

through the Otira Gorge is completed, Westland. Other nurseries would be well placed at Havelock, Palmerston, Auckland, and Lake Taupo. These five nurseries, if worked energetically, and under skilled control, would supply all the trees required in the colony for both State planting and for distribution to the public. As proved in Victoria, such nurseries can be maintained on economical lines. As for the growth of forest-trees, there is no necessity for the expensive glass-houses and other buildings used by the ordinary nurseryman in conducting his business.

All trees supplied from a State nursery should be grown as hardy as possible, and to this end should not be grown in rich soils. It is a great error of judgment to select rich soil as the site for a nursery to grow forest trees. Trees originally grown in such soils are heavily handicapped when sent away probably to a great distance and replanted in poor soil. Nurseries, and especially those for State purposes, should therefore be established in poor soils, as under such circumstances the young trees are hardy, and when transplanted there is little, if any, check in their growth in similar soil; and if transplanted to richer ground they "get away" at once and vigorous growth results. When grown on rich soil for transplanting a forced growth is generally the result. This, no doubt, suits the nurseryman because it enables him to more quickly realise his stock, and he is satisfied, though his customers find in the long-run that the plants do not make headway after being transplanted, and very often perish. The forcing of the trees by chemical manures, too, one of the little tricks of trade, may be productive of business, but proves annoying to the man who purchases young trees and hopes to see them flourish. The State, however, can have no object in forcing, and all trees grown under State supervision should be as hardy as the skill and experience of the nurseryman can make them.

In distributing trees to the public, care should be taken that the trees are hardy, well rooted, taken out with plenty of the small fibrous roots attached, and the tap-root uninjured. Before being sent from the nursery the roots should be well puddled with a thick mixture of mud. Neglect of this precaution has caused the death of multitudes of trees. The puddling should be done immediately after the tree has been raised from the nursery-lines, and if properly carried out will enable the plants to stand without injury a week's journey by train, coach, or water. It should therefore never be neglected. Great care is necessary to see, in packing with grass, straw, or rushes, that the trees are not packed too closely, as they are liable, if kept so for a couple of days, to "sweat" and become scorched or heated. If, therefore, trees are packed for transmission to a distant part of the colony, occupying some days on the journey, the straw packing should be as light as possible, and care taken to keep it from contact with either rain or moisture.

The selection of nursery-sites (should the Government decide to resuscitate the Forestry Department in New Zealand) must have an important bearing on the success or failure of the enterprise, and I trust the suggestions and remarks here made may be of service. As stated, however, in earlier sections of this report, it will be of no use to undertake forest reform in a half-hearted or niggardly fashion. It will cost money to restore the New Zealand forests; but surely the development of such a timber trade as may be created into a huge industry is worth the expenditure of £15,000 or £20,000 a year. Such an industry, besides providing employment for thousands, would very soon yield an annually increasing revenue as a set-off to the cost. New Zealand has to face—and there can be no use blinking the fact—the extinction of her native forests within a very short time, unless preventive measures are adopted. It will in such case be necessary to import foreign timber at the cost of hundreds of thousands of pounds, as is the case now with the Australian Colonies, and has been for the past half-century. This money goes to support the sawmillers, bush-hands, shipowners, seamen, &c., in Europe and America, for lack of local timber, which, under other circumstances, would give a means of livelihood to our own people, and enable them to improve their position and acquire a stake in the country.

COMMENTS UPON MATTERS DISCUSSED AT THE TIMBER CONFERENCE HELD AT WELLINGTON ON THE 17TH JULY, 1896.

As my unavoidably late arrival prevented me from taking part in the proceedings of the Conference, I may perhaps be permitted here to comment upon the proceedings as detailed in the published report.

Though forced to disagree with many of the conclusions arrived at, I heartily congratulate the delegates on the earnest and business-like manner in which they approached the various questions at issue, and the practical value of their support to the Government in seeking to place matters connected with the timber trade upon a legitimate and mutually satisfactory footing. The Conference, indeed, has done yeoman service to the colony, in that it has done much which should convince the Legislature that it is of vital importance to the community to place forestry at the earliest possible moment on a systematic and scientific basis. Naturally, however, from its composition, and the direct object of its meeting, the Conference as a whole dealt with the business in hand more as it affected the collective or individual interests of members in the timber trade than as a matter of State policy. But to me, as a forest expert, who, sympathising with each phase of the question, looks first of all to general principles, the proceedings of the Forestry Committee appeal most strongly, and I have much pleasure in congratulating its members upon the general result of their work.

The opening address, in which the Hon. the Premier placed the main questions before the Conference, indicated that the speaker had recognised and carefully considered the important issues at stake before summoning the Conference, and this fact leads to the expectation that his colleagues are, with Mr. Seddon, resolved to act in this matter vigorously and promptly. It is, indeed, as fortunate for New Zealand as it is rare to find a leading politician like the Premier so well versed in the matter at issue and of such practical money-value to the colony. His address was the key-

note to all the labours of the Conference, and during my tour I was able to recognise the correctness of the statements made and the conclusions drawn by Mr. Seddon in the course of his brief but masterly address.

A propos of the operations of sawmillers, which I have again and again referred to as alike prejudicial to their own and public interests, Mr. Seddon pertinently asks, "Then, again, those who are engaged in the industry: What is their position? Why, they have gone on year after year. Large sums of money have passed through their hands it is true; they have cut millions of millions of feet of timber; but, as far as they were concerned, there was no margin of profit left; and I have found them very little better off to-day than when I knew them years ago. Well, I say that, that being the position, there is something wrong. If it is wrong to the miller it is wrong to the State, and the State has not been getting the value it should." That this is an absolutely true statement of the position cannot be denied, and it emphasises the main contention that "the methods of the sawmilling trade in dealing with the forests have done vast and well-nigh irreparable injury to the national property without giving any adequate or permanent advantage to the millers themselves." Men there are who have spent their lives in hardship and incessant heart-breaking toil for years and years, and yet are no better off to-day than they were twenty-five years ago. Scores and scores of sawmillers can vouch for the accuracy of the Premier's statement; but even this does not convey a full sense of the national loss. This involves not only the loss of annual revenue, which should have been returned in the past under a proper system, but what is even more important, the loss of capital value in forest lands, a most serious indictment this of the methods hitherto prevailing.

But, again the Premier: "Has it done good to those engaged in the timber industry? I allude to the workers—the mill-hands, the log-getters. No. The competition has been so keen, everything has been cut down so often, that they have made very little, probably no more than a bare living, during the time they have been engaged in this very hard work. That is the position of the mill-hand in New Zealand." Just so; and that, too, is the position of the mill-hand all over Australasia. But with forestry operations conducted on scientific principles all this could be changed. The controlling influence of the State would regulate the supply by limiting the output to such produce of each forest as can be removed as annual revenue without affecting the capital value of the property. The moment that more than the legitimate annual produce is removed, the destruction of forests—that is, entrenchment on capital value—commences. Under proper systems of forestry every one is a gainer: the Government, by reason of royalty charges made on equitable lines, a source of revenue which the due conservation of forests would make available for all time. The sawmiller would gain by regulation of the supply, which would prevent the markets being glutted. The mill-hands, log-getters, fellers, and bushmen generally would gain in better wages, more constant work, and less toil. All would gain through the check a regular State control would put upon that cut-throat competition which has brought about starvation prices for the miller, and has left him unable to pay fair wages, while his tramways, his plant, and his horses represent so much unproductive capital.

Fair competition is the soul of business, but in the timber trade has been carried to such an undue extent that it has proved a bane, and practically ruined the industry. Associations have been formed in every colony to regulate the trade, but these have all collapsed through the disloyalty of members, and the mischievous system of cut-throat competition still continues, leaving whatever small profit there is to the middleman, while the mill-owner and his hands toil from daylight to dark for a bare subsistence without prospect of improvement.

Again quoting Mr. Seddon: "I say it is a matter of intercolonial concern as to whether this keen competition, this cutting-down of everything without any advantage either to the millers, to the workers, or to the State, whether or not that shall continue. My answer is, No; and you are called together on this occasion to see whether some steps cannot be devised to remedy this most unfortunate state of affairs. Now, I will tell you where the sore spot lies. While mills have been increasing in number your markets have not been extending. It has been simply a question of supply and demand. The supply has been greater than the colonial demand, and you have been competing with each other for this trade. You do no good for yourselves, and you are certainly not profiting the colony. In the meantime our timbered lands are getting smaller day by day. That is the unfortunate position in which you are placed; and what is the remedy? You must have foreign markets." This, of course, is most true, but of what use can the foreign markets be if the sawmiller, sleeper-hewer, and gum-digger, with axe and fire-stick, keep on reducing the forest areas of New Zealand by thousands of acres annually in both North and Middle Islands. If the colony had ten times the area of forest country it now possesses, the ruin and havoc wrought under existing conditions must soon reduce the forests to such meagre proportions that an export trade will very soon be out of the question.

The experiences of the past fifty years show that without an export trade the forests have decreased 50 per cent. Given, then, even moderate exportation to London, *plus* the present local and Australian output, and what will be the condition of the New Zealand forests and timber trade, say, thirty years hence? A consensus of opinion among the sawmillers of both Islands answers this question by stating that within thirty or forty years for other timbers, and perhaps fifty for kauri (owing to its greater value and the care now exercised by private owners to protect it), the forests of New Zealand, and consequently the local timber trade, will have ceased to exist. The possibilities of a profitable export trade loom large. The available supply may be gauged from the remarks made, or quoted, above. The fact of the matter is that nowhere in Australasia does the timber supply warrant the expectation of continuous and large export to foreign markets unless scientific systems of forest conservation and reproduction are adopted at once; and the sooner the various Governments recognise this fact the better. The world's market for wood-paving material alone would more than exhaust Australasian supplies, should, as is most probable, other European capitals follow the example of London in utilising our timbers. Our forests would melt like wax

before the enormous demand from these cities, and also from America, which will probably follow suit. Mr. Seddon, it is true, correctly states the immediate beneficial effect of export to the New Zealand sawmillers; but how long would the advantage continue?

Unless a better system of regulating the allotment of timber areas to sawmillers were adopted, new mills would be started by the score on the least increase in prices, and, without Government supervision and direction, the bushes would be rushed by speculators, and the evils of the present cut-throat tactics would be perpetuated and intensified. The Government must go further than merely encouraging an export trade. It must conserve and maintain the means to meet such a trade by restricting the number of mills in each district, and by insisting that no timber is cut before being properly matured. The right to cut timber should be let by tender, and provision should be made for regular and continuous supply by allotting to each mill such areas of forest-lands as would enable the owner, by cutting out in rotation blocks, to keep it going steadily for a given number of years, say for the lifetime of a rimu, white-pine, or kauri, as the case may be. The timber should be cut not under a specified diameter, at, say, 2ft. from the ground. When these and other precautionary measures, which have already been indicated, have been adopted, and not before, it will be time enough to develop extensive exportation of timber.

It is no use blinking the fact that the New Zealand forests are not now in a position to meet the demands of an extensive and continuous export trade. How long would it take to cut out the Pelorus Valley? Mr. Brownlee says thirty years. How long would it take to regenerate the same forest? I say from fifty to eighty years. The Westland sawmillers, again, give thirty to forty years, with present demand, as the period within which supplies in their districts will be exhausted; while in Southland, especially in places accessible by rail, the outlook is gloomy in the extreme. If therefore, a large export trade were established, it would mean that with such output over and above the local demand the forests would be exhausted probably in half the time quoted above. Of course, I do not wish it to be inferred that there is no natural regeneration in progress. In the virgin native bush such regeneration is always going on, but the growth is *very slow*. On such areas as have been operated upon by sawmillers, the process of regeneration is practically stopped by the removal of overhead cover or shade, by the cutting of undersized timber, and by fire. Under these circumstances, it is idle to expect in New Zealand, as we can do in Australia, a rapid recuperation of the forests. In Australia the trees reach maturity in from thirty-five to forty years. In New Zealand they must take twice as long, in my opinion.

It is a trite saying that "a little knowledge is a dangerous thing," and the danger was exemplified in the discussion by the Conference of the question of seasoning, the two or three gentlemen who expressed views in favour of seasoning coming in for rather rough handling; while the Conference, in its wisdom, decided that the question of summer or winter cutting is sheer nonsense and humbug. Yet, seeing that seasoning, and the proper preparation of timber for the market, is the rule in all great timber-producing centres of the world, and that many millions of pounds have been spent in perfecting apparatus and materials used in these processes, the millers and timber merchants of these nations must be considered (if the Conference is right) no less than fools to have spent so much time, intellect, and money, in seeing that timber is only cut when the sap is quiescent and is properly seasoned before being placed on the market. This construction, at all events, was put upon the decision of the Conference with reference to this important subject by a few of the practical men present. Now, if the systems of seasoning and cutting in proper season are wrong or unnecessary, then local mills can afford to go on cutting sappy 6in., 8in., or 10in. diameter trees, as is done, I am informed, in Seaward Bush, near Invercargill, and in other places, with impunity. The opinion of cabinetmakers with regard to such timber would be valuable, or the opinion of householders who find their houses tumbling about their ears. This easy, slipshod sort of philosophy may go down with the local buyer; but try the export trade in London, and the keen, sharp timber-buyer—the man who "spots" a fault with his eyes shut. These are the men who rule with an iron hand the destinies of the huge cargoes of timber which pour into London docks by shiploads. Let New Zealand send a few cargoes of sappy, badly-cut timber, and note the result. The competition with other countries is so keen that unless timber is put into the London markets in an absolutely first-class condition it stands no show whatever—careless cutting on the bench or unevenness of the gauge is a serious drawback to the timber, and makes all the difference in its classification price.

The sawmiller of New Zealand, with all his knowledge of bush craft and machinery best adapted to his requirements, would do well to note the teachings of science—let him even remember that those teachings are practically the result of hundreds of years of observation, and therefore not the opinion of a single expert. The time is not far distant when the seasoning of timber and the cutting of mature trees only will have to be faced by the miller, and the sooner he looks around and faces the inevitable the better able will he be to withstand the shock of such innovation when it comes. The question as to how this shall be brought about is one for future consideration. The numerous methods in use are far from being perfect, and many have proved harmful. In Tasmania the mill boards are placed on end, with spaces to let the wind pass through; these boards dry rapidly, as the sap has a natural tendency to run down the wood channels in the tissue, and, so to speak, drain naturally. In New Zealand the practice is to place the boards flat. The sap has thus a tendency, where boards are close together, to ferment and cause discolouration. In Victoria the Rieser process has been tried at Wandong. This is a process by which the sap is driven out of the wood by steam-pipes—*i.e.*, dry-air; but this process causes brittle ends, and consequent loss of strength. Creosoting seems to be the favourite method in the United Kingdom with soft woods. The experiences of Australasia in the matter of seasoning are few, and as yet uncertain.

In connection with the bad milling commented upon by Mr. Napp, it is to be hoped that his words of warning did not fall upon inattentive ears. This carelessness at the bench is common all over the colonies, and the manner in which the local timber is placed in the timber-yards of the

local trade in Australia is in many instances a positive disgrace, and is a pregnant cause of trouble in house-building and construction works.

A good deal of indignation was caused among the sawmillers by the statement that the timber-supply was not so plentiful as it had been made out to be by the committee appointed for that particular section, of which Mr. Bell was the chairman. Well, I was prepared to accept the disclaimer in all good faith; but after visiting the West Coast and other forests I have formed the conclusion detailed elsewhere, though I qualify such conclusion by giving a longer date than the committee, and by supposing that fire and settlement will still be a huge factor in the destruction of the forests. I do not deny that large areas of forest-land still exist, nor do I seek to decry the quality of the timber. No doubt I passed by large areas of forest, and unseen by me, but nevertheless the waste and ruin I witnessed in the forests now worked gave me much food for reflection, and material for founding the opinion I have so freely expressed in the report. In short, I disagree with the conclusion of those gentlemen who seemed to think that the forests of New Zealand are practically inexhaustible, and at the same time I do most heartily agree with their views on the protection from fire and settlement, as expressed at the Conference.

The admirable paper read by Mr. Mathews at the Conference is worthy of praise, and I agree with the statements and deductions made therein. The writers of other papers deserve credit for the various views given therein.

NOTES UPON THE FORESTS OF AMERICA.

In connection with the figures and extracts dealing with European forest statistics, it will be instructive to learn how the forests of America are treated, and to what extent they are protected. From a report for 1892, issued at Washington, by the Chief of the Division of Forestry, B. E. Fernow, Esq., we learn:—

"In consequence of the various destructive agencies, not only has the forest area dwindled down to less than 480,000,000 acres, but a large part of this area believed to be under forest is in a more or less devastated condition. If, therefore, the map of the State of Massachusetts by the United States Geological Survey, for instance, exhibits over 50 per cent. of the area of the State in forest, this has but little meaning for the question of future supplies, for fully one-third or more of the so-called forest is useless brush and waste land, which will not be productive in this or the next generation.

"An exact census of the forest area in existence has never been made. The figures given have been approximations from various sources of information, more or less reliable, and hence much larger areas have been claimed to be in existence by those who deny the necessity of a conservative forest policy. It will, however, be found that, deducting the so-called treeless area—which does not contain forests of extent or value—the farm area not in forest, and as large a percentage of waste land as is reported in farms from the total area of the United States, the area that could possibly be in forest will not exceed 850,000,000 acres. Any one familiar with the condition of the culled-over and burnt-over forest areas, and, at the same time cognisant of what the lumber-producing capacity of a growing woodland may be, will readily admit that 50 per cent. of this area may, to all intents and purposes of lumber production for the next generation at least, be considered unavailable. It may, then, be safely assumed that we have hardly 25 per cent. of our area in producing forest—a proportion that is reported for Germany; but our drafts for material exceed the consumption of Germany at least eight-fold.

"The ownership of the forest area is for the most part in the hands of private individuals. The policy for the single States or the United States to own lands, except for building, &c., and for eventual disposal, has not been germane to the spirit of the institutions of this country. Schools lands, indemnity lands, swamp-lands, and other lands which the General Government has given to the States, or which they have owned otherwise, have never been held for an income, except by their sale. The State of New York seems to be the first to make an exception, having set aside an area of nearly 1,000,000 acres in the Adirondack and Catskill Mountains as a forest reserve; and a movement to extend this reserve over a larger area—3,000,000 acres, more or less—is strongly advocated. The administration of this reserve is, however, confined to protection without utilization, and forest management in any sense does not as yet exist, although the staff of the three Forest Commissioners includes, besides a Secretary with assistants, a Superintendent with assistant, inspectors, and surveyor, and eleven foresters, who constitute, in fact, however, only a police force.

"The General Government has also within the last two years been committed to a change of policy by the enactment of a law permitting the reservation of forest areas for permanent ownership by the Government. This policy will be discussed further on. Before this enactment several areas of public lands, besides the Indian reservations, had been reserved as military, timber, and water reservations, and as natural parks—the former for temporary occupancy by troops, to supply them with fuel; the latter for permanent ownership on account of natural wonders and scenery, for the benefit of pleasure-seekers, or for health resorts, but not with the express purpose of preserving and improving forest conditions. These parks are at present: Yellowstone National Park, Wyoming, 2,288,000 acres; Yosemite National Park, California, 960,000 acres; Sequoia National Park, California, 100,000 acres; General U. S. Grant National Park, 3,000 acres; Hot Springs Reservation, Arkansas, 2,529 acres. The area of the permanent forest reservations proclaimed by the President of the United States will, before the close of the present administration, amount to nearly 13,000,000 acres; while the total area of public lands, classed as timber lands, may be in the neighbourhood of 50,000,000 acres, the last estimate made in 1883 making the area 73,000,000 acres.

"There are three classes of private forest-owners: The farmers, who have wood-lots connected with their farms; the speculators, among whom may be included all those who hold forest property temporarily for the purpose of selling it to obtain the 'unearned increment' from; the third-class—

viz., those who develop and utilise the forest resources—lumber-men and manufacturers. The first class should be considered a safe and conservative one, holding forest property to the extent of from 35 to 40 per cent.; and we might feel safe regarding the fate of this part of the forest area. Whatever attempt at rational forest management exists in the United States is found among the farmers. It is probable, however, that a large part of their forest property is held only for speculative purposes, and the opportunity of paying off indebtedness by sacrificing the wood-lot is not unfrequently embraced. The forest-land is not treated in a conservative manner, which arises from lack of conception of the true value of this part of the farm."

And in another place in the report the same authority says:—

"*Situation.*

"This division [Forestry] has now been in existence for more than a decade [*i.e.*, 1882], during which time it has been engaged in an endeavour to teach the people of this country that the present methods under which our forest resources are managed are uncivilized, undesirable, and destructive, not only to the resources themselves, but to many other interests depending upon the material as well as upon the indirect influence of the forest. Although there seems to exist a considerable amount of public interest in the subject, we can nevertheless feel no great satisfaction at the result of the work. There must be some strong reason which is antagonistic to a change of methods, for the fact that the slaughter of timber lands without any regard to the future, and the burning of square miles without any reference to the destruction of values, continue. Remedies have been suggested, and discussed to satiety, but of practical application we have had as yet but little. It seems therefore proper that we should once more look over the field, investigate the situation, and find the reasons for a continued absence of more rational treatment of our woodlands; in fact, make a review in this centennial year of what we have done with and for our forest resources, state what their present condition is, and what we hope for the future.

"*Original Condition of Forest areas.*

"When Columbus discovered America, the territorial distribution of forest areas in the United States, and, indeed, on the whole continent, could be divided with more or less precision iuto three grand divisions:—

"(1.) The Atlantic forest, covering mountains and valleys in the east, reaching westward to the Mississipi River and beyond to the Indian Territory, and south to Texas, an area of about 1,361,330 square miles, mostly of mixed growth, hardwoods and conifers, with here and there large areas of coniferous growth alone—a vast and continuous forest.

"(2.) The mountain forest of the West, or Pacific forest, covering the higher elevations below timber-line of the Rocky Mountains, Sierra Nevada, and coast ranges, which may be estimated at 181,015 square miles, almost exclusively of coniferous growth, of enormous development on the northern Pacific Coast, more or less scattered in the interior and to the south.

"(3.) The prairies, plains, lower elevations, and valleys of the West, with a scattered tree-growth, on which, whether from climatic, geologic, or other causes, forest growth is confined mostly to the river-bottoms, or other favourable situations - an area of about 1,427,655 square miles, of which 276,965 square miles may be considered under forest cover of deciduous species east of the Rockies, and of coniferous and deciduous species in the west of this divide.

"Until the present century, and, in fact, until nearly the last half of it, the activity of man on this continent has practically been confined to the eastern portion, which, as stated, was originally covered with a dense, or at least, continuous forest. The substructure of the entire civilization of the United States was hewn out of these primeval woodlands. Out of the vast virgin forests of the eastern half of the country there have been cleared for farm use during this time 250,000,000 acres, or 400,000 square miles, leaving about 961,330 square miles covered actually or nominally with forest-growth or waste.

"Timber being a great obstacle to the settlement of the land, and the market for it until recently being confined and limited, a large amount had to be wasted and disposed of in the log-pile, where the flames made quick work of the scrub as well as of the finest walnut-trees. The settlement of the western mountain country, although emigration to Oregon began in 1842, assumed proportions of practical importance only when the gold-fever took many travellers over the plains and mountains to California in 1849 and the following years.

"If only the legitimate need of the population of this region for cleared land and for timber had made drafts upon the forest resources, the change in forest conditions would have been insignificant, but the recklessness which the carelessness of pioneer life and seemingly inexhaustible resources engender has resulted in the absolute destruction by fire of many thousand square miles of forest-growth, and the deterioration in quality and future promise of as many thousands more. The third region, the so-called treeless area, has experienced, since the advent of the white settlers and the driving-out of the Indians, changes which are almost marvellous. The prairies were reached by settlers in any considerable number only as late as the third and forth decades of this century, but they and their successors have not only occupied a farm area of 80,000,000 productive acres, but they have also dotted the open country with groves, smaller or larger, either by planting them or by keeping out fire and cattle, aiding the natural reforestation.

"*Causes of reduction in Forest Areas.*

"While the requirements of the settlement of agricultural lands have necessitated the removal of forests, their principal destruction has come from two other causes—fire, and wood consumption. The latter has assumed proportions which no other country of the earth can equal, for the annual consumption of wood in the United States for all purposes reaches the enormous amount of over 22,000,000,000 cubic feet,* or about 350 cubic feet *per capita* as against 12 to 14 cubic feet *per capita* in Great Britain, or about 40 cubic feet in Germany.

* Mostly firewood split from first-class trees.

"The present sawmill capacity (inclusive of shingle-mills) of the United States is between 140,000,000 ft. and 270,000,000 ft. B.M. daily, which would indicate, at the very lowest, an annual product of 30,000,000,000 ft. B.M. (requiring 4,000,000,000 cubic feet of forest-grown material), an increase of over 35 per cent. in the last five years. Only a small proportion of this is exported either as lumber timber or manufactures—namely, less than 150,000,000 cubic feet, or hardly 6 per cent. of the total output of lumber; and since we import about 95,000,000 cubic feet of wood material (less than 1 per cent. of our consumption) outside of fine cabinet-woods (of which we import about one and a half million dollars' worth), the consumption of sawn wood products is over 40 cubic feet *per capita*. If we add the consumption of hewn timber and that used in railways, the requirements for sizable timber increase readily to 50 cubic feet *per capita*. To produce such amounts, the annual growth of not less than 500,000,000 acres of well-managed forest in good condition would be necessary, while the consumption in mining, fences, and especially for firewood, for which in this country body-wood hardly inferior to sawn-timber wood is chiefly used, would swell the necessary acreage to more than double that amount [*i.e.*, 1,000,000,000 acres].

"We have now less than 500,000,000 acres in forest-growth, but even that is neither in good condition nor well managed. We have, therefore, long ago begun to use more than the annual growth, and are cutting into the capital which we inherited at a rate which must sooner or later exhaust it unless we adopt recuperative methods. These figures are approximate, and without fine distinctions, but they will be found by those who study the subject conservative rather than extravagant.

"A computation by one of the journals representing lumbermen's interests makes the amount of timber standing in the United States 1,200,000,000,000,000 ft. B.M., and the present annual consumption 10,000,000,000 ft., or one-third of the above figures. There exists, to be sure, no reliable basis for such computation, but even with these figures the supply would be exhausted in less than a hundred years, for our consumption during the last three decades has increased at the rate of about 30 per cent.

"While there are still enormous quantities of virgin timber standing, the accumulation of centuries, the supply is not inexhaustible. Even were we to assume on every acre a stand of 10,000 ft. B.M. of saw timber—a most extravagant average—we would, with our present consumption, have hardly one hundred years of supply in sight—the time it takes to grow a tree to satisfactory log size.

"Certain kinds of supplies are beginning to give out. Even the white-pine resources, which a few years ago seemed so great that to attempt an accurate estimate of them was deemed too difficult an undertaking, have since then become reduced to such small proportions that the end of the whole supply in both Canada and the United States is now plainly in view. The annual product of this pine from the sawmills has reached the enormous total of over 8,000,000,000 ft. B.M., which, if we assume a pine stumpage of 5,000 ft. to the acre—a high average—would require the cutting of 1,600,000 acres annually of their white-pine supplies. Since the three white-pine States (Michigan, Wisconsin, and Minnesota) have a total reported forest-area of altogether 60,000,000 acres, it is evident that, even if we allow two-thirds of that area to be in the white-pine belt, and consider this area fully stocked—which it is not—twenty-five years would suffice to practically exhaust the supplies. These figures, crude though they may be, leave no doubt that the end of this staple is practically much nearer than we have supposed, and all opinions to the contrary may be set down as ill-founded."

In *re* Forest Fires.—Inquiry made by the Forestry Division shows that 12,000,000 acres of woodland were burnt in 1891—the return showed log timber killed, 473,387,000 ft. B.M., and damage from forest fires to other than forest property to the extent of $503,590, besides injury to valuable forest growth difficult to estimate. The loss from prairie fires to buildings and other property was reported as $1,633,525.

APPENDIX.

NAMES OF FORESTS, SOUTHLAND.

	Approximate Area. Acres.	Virgin Bush. Acres.
Seaward Bush	30,000	10,800
Winton Bush	5,100	800
Longwood Bush	100,000	50,000
Grove Bush	1,600	500
Spar Bush	1,300	200
Omaui Bush	400	50
Croydon Bush	1,400	100
Woodlaw Bush	4,700	3,000
Waikawa Bush	10,000	5,000
Oteramika Bush	250	50
Forest Hill Bush	3,000	1,000
Hillend Bush	1,000	200
Makarewa Bush	400	50
Waimatuku Bush	200	None virgin.
Otatara Bush	100	None virgin.
Titipua Bush	1,600	100
Dunsdale Bush	11,000	1,000
Hokonui Bush	22,000	2,000
Blackmount Bush	3,000	1,000
Bellmount Bush	2,000	1,000
Caroline Bush	980	None virgin.
Wakaia Bush	19,000	10,000
Heale Ridge Bush	1,000	400
Tuturau Forest	25,000	*
Dean Forest	170,000	*
Takitimo Forest	24,000	*
Letham Bush	1,900	1,000
Tautuku Bush	9,000	1,000
Slopedown Forest	10,000	5,000

* Principally virgin.

George S. Perrin, Esq., F.L.S., F.R.G.S., Conservator of State Forests,
Grand Hotel, Auckland.

Re timber within the Auckland Land District and south of Auckland City. There are about 3,771,000 acres of forest-lands, most of which are Crown lands, and the rest likely to become Crown lands before long, to the south of the City of Auckland within this land district. Over this area of densely wooded lands are scattered immense quantities of matai, rata, maire, rimu, miro, hinau, taraire, mangaio, and puketea, together with a considerable quantity of totara and some puriri. It is quite impossible to estimate the quantities of timber from our office records, but the supply at present seems practically inexhaustible.

To the north of Auckland City the records as to timber are more reliable: Of totara we have 9,400,000 superficial feet; of kahikatea, 43,800; of puriri, 3,000,000; and of manoao (found in Hokianga County only), 2,000,000 superficial feet.

The kauri lands commence at Te Aroha and extend to the north end of the Auckland District. The total quantity of kauri amounts to 1,371,405,000 ft. Of this quantity, the kauri growing on Crown lands amounts to 871,405,000 superficial feet, and the kauri growing on Native and other private lands to 500,000,000 superficial feet.

GERHARD MUELLER,
Commissioner of Crown Lands.

Department of Lands and Survey,
District Office, Auckland, 12th October, 1896.

G. S. Perrin, Esq., Conservator of State Forests,
Grand Hotel, Auckland.

PLEASE receive herewith return of timber within the Westland Land District, which our Department promised to furnish you. In his memo. the Surveyor-General requests me to point out to you that the quantities must be taken as only a very rough approximation.

I also forward four sheets comprising the Auckland Land District, on which the whole of the timber-lands are show in green. An index-map is enclosed to guide at the fitting of the various sheets when being mounted as one map. A litho. of Hauraki Peninsula also enclosed.

GERHARD MUELLER,
Commissioner of Crown Lands.

Department of Lands and Survey,
District Office, Auckland, 9th October, 1896.

ESTIMATE OF TIMBER STILL AVAILABLE IN WESTLAND FOR SAWMILLING PURPOSES.

Class of Land.	Red-pine.		Silver-pine.		White-pine.		Totara.	
	Acres.	Estimated Quantity.	Acres.	Estimated Quantity.	Acres.	Estimated Quantity.	Acres.	Estimated Quantity.
		Super. ft.		Super. ft.		Super. ft.		Super. ft.
Crown lands ...	685,400	6,854,000,000	23,100	115,500,000	43,500	522,000,000	14,800	118,400,000
Midland Railway Company's Blocks 26 and 28, B1 map	14,900	149,000,000	300	1,500,000	4,000	40,000,000	...	...
Land alienated from Crown (freeholds, reserves, &c.	91,000	910,000,000	1,000	5,000,000	7,000	84,000,000	2,000	16,000,000
Total ...	791,300	7,913,000,000	24,400	122,000,000	54,500	646,000,000	16,800	134,400,000

Class of Land.	Black-pine.		Black-birch.		Rata (Firewood Timber).		Kawaka.	
	Acres.	Estimated. Quantity.	Acres.	Estimated Quantity.	Acres.	Estimated Quantity.	Acres.	Estimated Quantity.
		Super. ft.		Super. ft.		Super. ft.		Super. ft.
Crown lands ...	9,500	95,000,000	11,800	177,000,000	24,500	...	1,300	6,500,000
Midland Railway Company's Blocks 26 and 28, B1 map	200	2,000,000	...	...	200	...	...	...
Land alienated from Crown (freeholds, reserves, &c.	2,000	20,000,000	2,000	30,000,000	2,000	...	...	...
Total ...	11,700	117,000,000	13,800	207,000,000	26,700	...	1,300	6,500,000

Summary.

——	Acres.	Quantity.	——	Acres.	Quantity.
		Super. ft.			Super ft.
Red-pine	791,300	7,913,000,000	Black-birch ...	13,800	207,000,000
Silver-pine ...	24,400	122,000,000	Rata	26,700	...
White-pine ...	54,500	646,000,000	Kawaka ...	1,300	6,500,000
Totara	16,800	134,400,000			
Black-pine ...	11,700	117,000,000	Total ...	940,500	9,145,900,000

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SKETCH MAP OF THE

NORTH ISLAND, NEW ZEALAND,

To accompany Report of G. S. PERRIN, F.L.S., F.R.G.S., F.R.H.S., London,

CONSERVATOR OF STATE FORESTS, VICTORIA.

JULY TO OCTOBER, 1896.

English Miles.

40 30 20 10 0 20 40

C. Maria van Diemen
North Cape
C. Karikari
Doubtless Bay
Whangaroa Har.
Reef Pt
OKAEA
Bay of Islands
C. Brett
RUSSELL
Poor Knights
Hokianga R.
Bream Hd
Whangarei Har.
Bream Tail
Lit. Barrier Is.
Aiguilles Pt
Great Barrier Is.
Rodney Pt
C. Barrier
Kaipara Har.
Kawau I.
HAURAKI GULF
WAIWERA
C. Colville
D'Haussez Group
Waiheke Is.
Mercury Bay
AUCKLAND
E. of Thames
Aldermen Is.
Manukau Har.
THAMES
Mayor Is.
Waikato R.
OMERE
Tauranga Har.
White Is.
Motiti Is.
C. Runaway
BAY OF PLENTY
MORRINSVILLE
Hicks Bay
Waihi R.
Whangaroa Har.
HAMILTON
MAKETU
East C.
Whakatane R.
Roto Rua
Ohiwa R.
Kawhia Har.
Tarawera L.
Motu R.
Waiapu R.
Open Bay
Rua Pt
ATEAMURI
Waikare
Tolago Bay
Mokau R.
TAUPO
Rangitaiki R.
Ongarue R.
Taupo Moana
North Taranaki Bight
Tuahine Pt
Poverty Bay
NEW PLYMOUTH
Roto Aira
KAANU
TARAWERA
RUNANGA
Wanganui R.
CLYDE
Wairoa R.
Cape Egmont
Table Cape
Mahia Peninsula
Mt Egmont
OPUNAKE
PIPIRIKI
RAETIHI
WAIOURU
PETANE
HAWKE BAY
NAPIER
MANAIA
Waitara R.
Ngaruroro R.
South Taranaki Bight
MOAWHANGO
C. Kidnappers
Patea R.
OHINGAITI
Tuki Tuki R.
WANGANUI
TAKAPAU
Wanganui R.
MARTON
Paonui Pt
Wangaehu R.
DANEVIRK
Rangitikei R.
PALMERSTON
WOODVILLE
C. Turnagain
Manawatu R.
Ohau R.
LEVIN
OTAKI
Kapiti I.
WAIKANAE
Castle Pt
Manaia
Flat Pt
WELLINGTON
Pahaoa R.
Port Nicholson
Palliser B.
C. Palliser

REFERENCE.

Kauri District	.. ..	shown thus
Totara District	.. ..	"
Red-pine District	.. ..	"
Kauri frequent	.. ..	"
Totara	.. .. ..	"
Red-pine	.. .. ..	"
White-pine	.. .. ..	"
Black-pine	.. .. ..	"
Beech	.. .. ..	"
Tawa	.. .. ..	"
Silver-pine	.. .. ..	"
Westland-pine	.. .. ..	"
Conservator's Route (Land)	.. ..	"
" " (Sea)	.. ..	"

Lithographed at the Head Office Department of Lands and Survey, Wellington, N.Z. September 1897

SKETCH MAP OF THE

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JULY TO OCTOBER, 1896.

English Miles.

40 30 20 10 0 20 40

C. Farewell
Light Ho.
Golden Bay
C. Stephen
Separation Pt
Kahurangi Pt
CLIFTON
D'Urville I.
French Pass
COOK
Pelorus Sd
Tasman Bay.
Kohaihai Bluff
MOTUEKA
Tory Ch.
NELSON
STOKE
HOPE
PICTON
ST
WAKEFIELD
HAVELOCK
BELLGROVE
Wairau R.
MOKIHINUI
WESTPORT
BLENHEIM
C. Foulwind
Buller R.
TOPHOUSE
C. Campbell
CHARLESTON
BRIGHTON
REEFTON
Rainbow Acc. Ho.
KEKERANGU
Razorback
Clarence R.
KAIKOURA
Grey R.
AHAURA
HATTERS
BRUNNER
L. Hochstetter
Ahaura R.
GREYMOUTH
KUMARA
L. Brunner
Conway R.
HOKITIKA
JACKSON
L. Kaniere
Arthur's Pass 3109
Hurunui R.
ROSS
Waitaha R.
BEALEY
AMBERLEY
Abut Head
OKARITO
Ashley R.
RANGIORA
Waiho R.
SPRINGFIELD
SHEFFIELD
Waimakariri R.
KAIAPOI
Gillespie's Pt
ALPS
CHRISTCHURCH
DARFIELD
KIRWEE
ROLLESTON
Lyttelton Har.
WELD
Mt Cook 12,349
SELWYN
LINCOLN
LYTTELTON
East Hd
Moeraki R.
The Hermitage
AKAROA
Banks Peninsula
HAAST
8703
ASHBURTON
SOUTHBRIDGE
Jackson's B.
TINWALD
DROMORE
Rakaia R.
Akaroa Har.
Cascade Pt
TEKAPO
HINDS
Ashburton R.
L. Pukaki
FAIRLIE
L. Ohau
ALBURY
TEMUKA
Rangitata R.
Big Bay
Mt Aspiring 9960
CAVE
WASHDYKE
TIMARU
L. Wanaka
L. Hawea
OHARAMA
OTAIO
L. Mc Kerrow
Milford Sd
GLADSTONE
NEWCASTLE
STUDHOLME Jn
PEMBROKE
Mt Earnslaw
HAKATERAMEA
WAIMATE
Bligh Sd
George Sd
DUNTROON
GLENAVY
ONGAPARA
Waitaki R.
L. Hayes
ARROWTOWN
CROMWELL
NASEBY
PUKEURI Jn
QUEENSTOWN
Caswell Sd
3850
Kawarau R.
CLYDE
OAMARU
HAMILTON
HERBERT
Charles Sd
L. Wakatipu
HAMPDEN
Secretary I.
L. Te Anau
HYDE
Doubtful Sd
KINGSTON
PALMERSTON
Shag Pt
Dagg Sd
3045
ATHOL
ROXBURGH
HAWKSBURY
MANAPORI
Waikaka R.
Clutha R.
Otago Har.
Breaksea Sd
L. Manapori
LUMSDEN
PORT CHALMERS
Resolution I.
Mataura R.
C. Saunders
Dusky Sd
L. Monowai
WAIKAKA
LAWRENCE
DUNEDIN
4120
L. Hauroto
Jacobs R.
Oreti R.
L. Waihola
MOSGIEL
West C.
GORE
Taieri R.
L. Poteriteri
WAIPAHI
Chalky Inlet
OREPUKI
THORNBURY
BALCLUTHA
Puysegur Pt
(Light Ho.)
MAKAREWA
Clutha R.
RIVERTON
INVERCARGILL
Sand Hill Pt
Centre I.
FOVEAUX STRAIT
Solander Is.
Bluff Har.
Long Pt
Ruapuke I.
Chaslands Mistake
WAIKAWA
Mason B.
OBAN
Stewart Is.
East Head
S.W. Cape
Port Pegasus

REFERENCE.

Southern Lowland or Red Pine Rimu District	shown thus	
Southern Upland or Fagus ..	"	
Kauri frequent	"	
Totara	"	
Red-pine	"	
White-pine	"	
Black-pine	"	
Beech	"	
Tawa	"	
Silver-pine	"	
Westland-pine	"	
Conservator's Route (Land) ..	"	
" " (Sea) ..	"	

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