1917.

NEW ZEALAND.

KAURI-GUM INDUSTRY.

REPORT FOR YEAR ENDED 31ST MARCH, 1917; TOGETHER WITH STATEMENT OF ACCOUNTS.

Presented to both Houses of the General Assembly pursuant to Section 5 of the Kauri-gum Industry Amendment Act, 1914.

REPORT BY THE KAURI-GUM SUPERINTENDENT TO THE MINISTER OF LANDS.

SIR,— Auckland, 1st June, 1917.

I have the honour to submit a report on the work of this Department for the past year. As the Department is comparatively a new one I will again briefly refer to the special circumstances which brought it into existence and led to the Government entering into the kauri-gum business. In March, 1914, a Royal Commission was appointed for the purpose of inspecting and classifying the kauri-gum reserves in the Auckland District. The Commission reported in June of the same year and, *inter alia*, recommended that the State should break in and develop the gum lands, and that a Department should be set up to take charge of the gum lands and the kauri-gum industry generally. Shortly after the Commission's report was presented came the war, which brought about a great slump in the industry. In order to deal with the situation thus created and carry out the Commission's recommendations the Kauri-gum Industry Amendment Act of 1914 was passed. This enabled the Minister to make advances up to 50 per cent. of the value of the gum on the basis of the values ruling on the 1st July of that year, and also contained provisions for the working and general improvement of the gum lands.

In 1915 a further amending Act was passed enabling the Minister to make direct purchases of kauri-gum, and making provision for setting apart areas of Crown land within a kauri-gum district for the purpose of promoting the systematic recovery of kauri-gum and other valuable products contained therein.

Up to the end of the financial year payments amounting to £7,718 16s. 4d. had been made to gum-diggers, under the authority of section 2 of the Act, as advances and final payments.

In order to meet the requirements of the diggers who had received advances of the 50 per cent. on the value of their gum before referred to, a further advance of 20 per cent. was made as a final payment free of all charges. Most of the diggers have been settled with on this basis. There remained at the end of the year a liability under this heading estimated at £275.

The Act of 1915 authorized the Minister to make outright purchases of gum, and since January, 1915, all purchases have been so made. Up to the end of the year the value of gum purchased outright was £4,129 17s. 9d., and the sales amounted to £10,889 1s. 10d.

Full particulars of expenditure under other headings are given in the statement of accounts on another page.

NEW ORGANIZATION.

Towards the end of March, 1916, it was decided by Cabinet that the business arising out of the Kauri-gum Industry Acts, 1914 and 1915, should be carried out by the Kauri-gum Superintendent in conjunction with the Imperial Supply Branch. In order to facilitate the working of the new arrangement a conference of the officers concerned was held, and subsequently a memorandum was drawn up setting out the respective duties and functions of each Department. The new organization came into force on the 1st April of last year.

IMPORTANCE AND VALUE OF THE INDUSTRY TO THE STATE.

There is no doubt that the entry of the Government into the kauri-gum business has had a beneficial effect on the industry, and this fact is generally recognized and appreciated by the producers—the gum-diggers and the small farmers. "The pity of it" is that this Department was not set up twenty-five years ago. Here we have had a valuable national asset which has been in a large measure wasted, and the lands which have produced the vast sum of eighteen million pounds left in a wilderness condition.

I have before pointed out that in regard to kauri-gum New Zealand possesses an absolute and unique monopoly, and that the State is by far the largest shareholder in this monopoly, for the reason that more than half the gum-producing lands still belong to the Crown. It is well known that the gum lands have been in a measure laid waste owing to the methods practised in digging for gum.

Besides having a large interest in this monopoly I am thoroughly convinced that in the gum lands the State possesses an asset of very high value. It is now well established that there is not one product of the kauri-peat swamp which cannot be profitably utilized. But in order to get the best results machinery must be used in all stages in the process of production, saving, cleaning, and in the preparation of the gum for export.

Kauri-gum exported.

Up to the 31st March, 1917, the value of kauri-gum exported was £17,919,255, and of this large sum perhaps fifteen millions would represent money expended in labour.

The average quantity exported for the twenty years 1895 to 1914 was 8,493 tons, and the average value £499,613. The following table gives particulars of the export for the last eleven years:—

Particulars of Kauri-gum exported from New Zealand from 1907 to 31st March, 1917, inclusive.

Country to which exported.	1907.		1908.		1909.		1910.		1911.		1912.	
	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£
United States of America	5,171	381,566	2,855	215,291	5,127	375,126	4,149	263,375	3,514	209,216	3,894	232,566
United Kingdom	2,468	162,121	1,799	123,011	2,290	140,235	3,253	151,319	2,378	130,767	2,468	114,640
Germany ..	936	27,473	667	23,841	639	24,111	913	28,016	1,142	34,062	1,053	32,964
Canada ..	53	4,512	21	1,646	24	2,555	66	7,687	9	1,061	40	3,370
Australia ..	42	2,216	155	6,458	149	8,576	66	4,465	75	2,559	39	2,487
Belgium ..	21	821	22	1,572	17	1,770	29	1,899	78	3,990	123	5,088
France ..	9	918	10	875	1	85	19	1,656	75	5,774	37	3,037
Austria-Hungary	..	..	1	104	1	68	124	3,011	131	3,968	159	4,611
Russia ..	..	..	..	..	..	..	15	1,976	80	1,859	2	184
Netherlands ..	1	114	..	..	..	..	6	133	55	1,206	42	974
Sweden ..	7	147	..	..	2	172	30	720	35	803	35	952
Italy	..	..	..	..	..	..	23	779	15	417	15	410
Japan	..	..	..	..	..	..	..	..	..	25	1	22
Fiji	..	..	..	..	..	..	..	..	..	..	..	..
Argentina ..	..	..	..	..	..	..	..	8	..	..	..	..
Totals ..	8,708	579,888	5,530	372,798	8,250	552,698	8,693	465,044	7,587	395,707	7,908	401,305

Country to which exported.	1913.		1914.		1915.		1st January to 31st March, 1916.		1st April, 1916, to 31st March, 1917.	
	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£
United States of America	3,995	308,456	4,531	316,200	3,312	222,856	974	60,010	3,158	218,214
United Kingdom ..	3,390	187,547	3,335	148,370	1,172	48,585	336	13,548	1,484	68,378
Germany	833	27,880	373	21,193	..	..	..	..	..	..
Canada	62	4,618	70	2,114	56	4,550	118	8,972	133	7,718
Australia	80	3,933	19	1,720	9	594	5	314	29	1,982
Belgium	126	5,120	34	1,519	..	..	..	..	..	..
France	45	3,995	42	3,599	5	430	..	..	..	..
Austria-Hungary ..	112	2,617	14	329	..	..	..	..	..	..
Russia	53	1,725	3	225	21	2,118	..	..	50	3,440
Netherlands	60	2,495	8	664	..	..	..	..	..	..
Sweden	15	420	20	560	..	..	..	..	..	..
Italy	9	300	23	855	..	..	..	..	..	..
Japan	..	..	1	96	..	..	..	..	..	..
Hong Kong	..	..	..	..	..	..	..	..	8	539
Argentina	..	..	..	..	..	..	..	..	..	..
Totals ..	8,780	549,106	8,473	497,444	4,575	279,133	1,433	82,844	4,862	300,271

It will be noticed that the quantity of gum exported for the year 1915 was only 4,575 tons, of the value of £279,133, being a little more than one-half the normal output. A good recovery has taken place for the past financial year, the quantity exported being 4,862 tons, of a value of £300,271.

The Number of Men employed in Gum-digging.

It was estimated by the Royal Commission before referred to that in 1914 there were 6,000 men employed in gum-digging, the majority of whom devoted the greater part of their time to the work. In that year the number of gum-diggers' licenses taken out was 3,538, of which 534 were taken out by aliens. The Commission, explaining the disparity between the number of licenses—viz., 3,538—and their estimate of 6,000 men engaged in gum-digging, said, "It is well known that in the northern districts there are a good many diggers on the Crown lands who do not take out any license, so that the number of licenses issued does not give the actual number of diggers on the Crown lands alone. In addition to the men digging on the Crown lands there are those working on privately owned gum lands the number of whom it is estimated amount to about 3,000." (C.–12, 1914, p. 18.)

Much misconception exists as to the nationality of the gum-digger. Some think all diggers are of Austrian origin (Dalmatians, Croatians, &c.); others think that the gum-diggers are Austrians and derelicts sent out of Auckland by the Magistrates. Both these ideas are very wide of the truth. My experience enables me to say that the gum-digger compares very favourably with the worker in any other industry, and it could probably be shown that in the Mangonui County a larger proportion of men from among the gum-diggers have enlisted than from any other section of the people.

The fact is that the majority of the gum-diggers are men of British origin and Maoris. For the year ending 31st December, 1916, the number of licenses issued was 1,651. Of this number 878 were issued to British-born and Maori subjects, 773 to men of the Dalmatian race, 430 of whom had become naturalized British subjects, and the remaining 343 being aliens. So that even in this—the third year of the war—with so many gum-diggers gone to the front, the so-called Austrians still constitute the minority of the gum-diggers.

Visit of Kauri-gum Superintendent to Canada and United States.

In April of last year it was decided by the Government that I should visit Canada and the United States of America with the object of ascertaining the marketable conditions of kauri-gum, and of obtaining information of interest and assistance to the Government in connection with the kauri-gum business.

In order to give effect to this decision I was appointed Special Commissioner, and His Excellency the Governor graciously accredited me to His Excellency the British Ambassador at Washington and to the British Consul-Generals at New York and San Francisco. I was also accredited by the Right Hon. the Prime Minister to the Minister of Trade and Commerce, Ottawa.

I left New Zealand on the 12th May, and returned on the 12th November.

During my stay in America I visited the works of the principal varnish and linoleum manufacturers in various parts of the States and Canada, and was able to obtain much useful information concerning the kauri-gum trade, a full report of which I had the honour to submit to you on the 8th December last.

It was one of my duties on arrival in New York to complete arrangements in connection with the appointment of Messrs. G. W. S. Patterson and Co. as Government agents for the sale of kauri-gum in Canada and the United States. This matter being soon satisfactorily concluded I was able to devote myself, in co-operation with the agents, to the question of the sale and disposal of the Government stocks of gum and to other matters affecting the industry, full particulars of which I refer to later on.

I desire here to place on record my opinion that a wise choice was made in the appointment of Messrs. G. W. S. Patterson and Co. as Government agents. Mr. E. H. Patterson, the president of the firm, is a man of high commercial standing in New York, and, added to an all-round knowledge of the gum trade, is possessed of great energy and keen business ability. I am confident that under the firm's direction the Government business will be conducted in a thoroughly satisfactory manner.

Position of the Kauri-gum Trade in America.

It was found that the kauri-gum trade was in a rather unsatisfactory position owing to the following reasons:—

(1.) The decrease in the demand for kauri-gum caused by the war.
(2.) The decrease in the demand owing to the increase in prices and the deterioration of quality during recent years.
(3.) The competition of other varnish gums and of China wood-oil.
(4.) Speculative dealings in gum and other harmful practices.
(5.) Absence of a system of standard gradings.

(1.) *Decrease in the Demand caused by the War.*

The discontinuance of shipment to Germany and Austria has resulted in a very considerable reduction in the demand for the cheaper grades, while the general disorganization of trade has had the effect of greatly reducing the demand for all varieties of gum.

(2.) *Decrease in the Demand owing to the Increase in Prices and the Deterioration of Quality during Recent Years.*

There has been a gradual but steady decline in the demand for kauri-gum in the United States and Canada since the year 1907, when, owing to the loss of a very large cargo of gum by the wreck of the barque "Viking," prices reached a very high level. It was about that time also that the deterioration in the gradings had begun to give trouble to the varnish-manufacturers, who found it had become necessary to use a larger quantity of gum to produce former results, so increasing the price of the manufactured goods. It was then the manufacturer began to look for substitutes for kauri-gum.

(3.) *The Competition of other Varnish Gums and of China Wood-oil.*

The gums which may be classed as competitors of kauri are Congo, Manila, Pontianak, and Koro. The chief of these at the present time is *Congo*, a hard fossil resin produced in the Belgian Congo. Prior to 1914 probably not more than 500 tons of Congo per annum was used in the United States, while last year the consumption increased 300 per cent. It may be added that the prevailing prices for Congo were in October last 50 per cent. lower than those ruling

before the war, and during that month a shipment of about 400 tons arrived in New York. This gum was formerly almost exclusively marketed in Belgium and London, but lately was being shipped direct to the United States in large quantities. Even now the use of Congo is not as general in the United States as in Europe, being confined to a few of the large manufacturers. What effect the cessation of hostilities will have to the trade in this gum cannot be foreseen.

Manila gum is a product of the Dutch East Indies. It is a semi-fossil, and has been in general use in the manufacture of cheap varnishes, both in Europe and the United States, for many years. It is a competitor of kauri only in the respect that it produces a more lustrous varnish and is better adapted for inside use. Manila is a much cheaper gum than kauri. Lately it has shown a great deterioration in quality, which has resulted in a lesser demand for it and to its being replaced by some of the cheaper grades of Congo.

Pontianak is found chiefly in Borneo. It is a harder gum than Manila, and is sold for about half the price of the medium grades of kauri. Its use is chiefly confined to the manufacture of furniture and other household varnishes. The output of this gum is not great, hence it is not regarded as a serious competitor of kauri.

Koro.—This gum is known and sold in the United States as "East India." It is produced in large quantities in the Straits Settlements. The gum is used to a certain extent in conjunction with kauri-gum in the manufacture of outside varnishes. The use of this gum is steadily increasing, and the mixing of it with kauri has the effect of reducing the consumption of kauri, and also the cost of the varnish. Koro is a very brittle gum, and unless mixed with a gum like kauri could not be profitably used.

The gums known as "Damar" are not regarded as competitors of kauri, inasmuch as their use is mainly for the purpose of giving a lustre to various colours of enamel paint, for which purpose kauri is unsuitable.

China Wood-oil.—This is extracted from the nut of the tung-tree of China. It was first offered for sale in the European markets in the year 1898, and in the American market about three years later. The oil, besides containing a high percentage of resin, possesses natural drying qualities, and is adaptable for mixing with other oils, especially linseed. It has now become a prime necessity in the manufacture of all varnishes regardless of the kind of gum used therein. The oil also gives to the varnish made from kauri and other hard gums an elastic or binding quality absent from the gums themselves. The use of the oil in the manufacture of varnish has resulted in the elimination of a large proportion of the kauri and other varnish gums previously used. The trade in wood-oil has increased from about 1,000 barrels of 400 lb. each in 1901 to 150,000 barrels in the year 1915. The oil has been used by the Chinese for centuries past, 25,000,000 gallons being used in China annually, while the consumption for the rest of the world does not probably exceed 15,000,000 gallons per annum. The tung-tree grows luxuriantly in a wild state, chiefly in the middle and the southern regions of China, and it would seem that the supply of wood-oil is practically inexhaustible.

(4.) *Speculative Dealings in Gum and other Harmful Practices.*

During periods of dullness in the trade some of the New York dealers try to develop business by cutting prices and selling "short," in many instances making contracts to sell extending over a whole year, knowing full well at the time that they had no assurance of their being able to obtain the gum required to fulfil their obligations. These speculators then have recourse to many devious devices to aid them in getting off with a "whole skin," such as the substitution of inferior grades, short weighing, "watering the pile," and other abuses. These harmful practices are responsible for the oft-repeated complaint of the varnish-manufacturer as to the deterioration in the gradings of gum. Such practices are obviously detrimental to the industry as well as to the legitimate trader.

(5.) *Absence of a System of Standard Grading.*

The lack of uniformity of grading is unsatisfactory both to the buyer and to the legitimate dealer, but particularly to the latter, as it enables the buyer to play one seller off against the other. The seller is often in the dark as to the quality of the sample being offered by his rival, while the buyer has no assurance that he will get the gum he contracted for. A Government standard grading would at once put an end to such a state of affairs, and would be very beneficial to the industry.

While the demand for many grades of kauri-gum still keeps up with the supply, in consequence of a decreasing supply keeping pace with a decreasing demand, conditions in the trade are not satisfactory for the reasons above recited; and it is a regrettable fact that, although kauri-gum is still in favour with some of the varnish and linoleum manufacturers, others have discontinued its use altogether. The placing of the trade on a sound basis is quite a feasible proposition, but in order to do so it is necessary either—

(1.) That the Government should take control of the whole industry (this would mean the establishment of one standard of grading, with the result that at this end there would be one buyer and one seller, and that all practices which have proved so harmful to the industry in the past would be eliminated and the trade placed on a proper footing); or

(2.) That a system of Government grading be inaugurated, such as is adopted in connection with the frozen-meat, dairy-produce, and phormium industries.

Full legislative authority is provided in the Kauri-gum Industry Act for giving effect to either of the proposals. Subsection (3) of section 2 of the Kauri-gum Industry Amendment

Act provides that "in any special or ordinary gum-digging license hereafter issued or renewed under the principal Act the Commissioner issuing or renewing the same may insert a condition that the Minister shall have the right, in priority to all other persons, to purchase all kauri-gum obtained by the holder of such license at not less than the current market price, and on the breach of any such condition the Commissioner may, with the consent of the Minister, cancel the license." And section 10 of the Kauri-gum Industry Amendment Act, 1910, empowers the Minister to make regulations for "the grading of kauri-gum."

"FACE-DIGGING" OPERATIONS.

The "face-digging" operations were continued during the greater part of the year. The various works are situated at Mangawai, Waiharara, and Waihopo

Mangawai is a small township on the east coast, on an inlet of the same name, situated about seventeen miles south of the entrance to the Whangarei Harbour. The Port of Mangawai is navigable for boats drawing about 6 ft. of water. The works are about three-quarters of a mile from the village, on what is known as the Mangawai or Coal Hill Kauri-gum Reserve. The reserve comprises an area of 3,669 acres, of which about 800 acres is rich gum-bearing swamp land. The face-digging works were started on the eastern boundary adjoining Mr. Hogan's property. The swamp area being dealt with contains about 200 acres, and the whole of this area had been dug over and extensively potholed for the past forty years.

Waiharara is a kauri-gum settlement on the western shores of Rangaunu Bay, about twenty miles west of the Town of Mangonui. The port of Waiharara is Kaimaumau, which lies about three miles and a quarter to the north-east. Goods are transported from Waiharara to Kaimaumau by launch and punt. Two areas were worked at Waiharara: one at Pausina's Swamp, about a mile from the Waiharara boat-landing, and the other at the Big Flat, a mile farther to the westward. Pausina's Swamp comprises about 300 acres, of which 165 acres is rich swamp and the balance consists of gentle slopes of sandy clay soil. The Big Flat contains an area of 900 acres, and is all land of good quality. The flat is surrounded by an amphitheatre of low sandstone hills nowhere exceeding 250 ft. in height above sea-level. This area of land, when all the gum has been recovered from it, offers exceptional facilities for intense cultivation for fruit and general farming purposes. Lying to the south of Big Flat, and separated from it by a low range of sandstone hills, lies Waiparera Lake, which covers an area of 265 acres. The lake has an average depth of about 12 ft., and the surface of the water is 65 ft. above the level of the Big Flat. A tunnel of 7 chains long through a sandstone ridge is all that is necessary to make the waters of the lake available for irrigation of the Big Flat and several thousand acres of land adjoining.

Waihopo is situated at the northern end of the Houhora Harbour, about twenty-five miles from the North Cape. The port of shipment is Pukenui, on the southern side of the harbour, about two miles from the entrance. There is a boat-landing at Waihopo, from whence goods are transported by launch and punt to Pukenui, the distance being about four miles. The locality of the works at Waihopo is the Bulldog Flat, situated within a half a mile of the boat-landing. The flat comprises an area of 800 acres of peat swamp; the land is fairly good, and will prove suitable for farming when it has been brought into a fit state for cultivation.

Owing to the wetness of the season, and to the fact that many of the best workers had left the works for military duty, the results obtained were not as satisfactory as for last year. For these and other reasons on my return from America I advised that the works should be discontinued until arrangements could be made for the introduction of labour-saving machinery for the production and saving of the gum. In response to my recommendation this proposal was given effect to, and the works were closed down at the end of December.

An area of about 250 acres has been turned over since the "face-digging" works commenced, the land has been left with a fairly level surface, and all timber (with the exception of a small area at Pausina's Swamp) has been thrown up on the surface.

It was necessary to drain the lands before they could be dug and the gum recovered. The drainage has been carried out systematically, and is a permanent improvement to the land.

The process adopted in face digging was to turn over the whole of the soil from the surface down to the solid sandstone formation. The areas treated were shallow swamps averaging about 3 ft. deep, though very much deeper in places. Only what appeared to be gum-bearing soil was taken out for treatment, together with the gum that was disclosed in turning the ground over. These lands had during the past twenty-five years been worked by the gum-diggers, and had been intensely potholed. Careful tests which have been made by Dr. Maclaurin of the soil in one of the areas of land which has been turned over by face digging clearly proved that there is still a large amount of gum remaining in the land which has not been saved in spite of the care taken in the digging operations. It is therefore essential that methods should be adopted in the future for treating the whole of the soil so that practically the whole of the gum will be recovered. It will have to be determined what is the best type of appliance for achieving this end; it may be found that some form of dredge is best adapted for the purpose. The face-digging operations have demonstrated that the gum lands of New Zealand are not only of great value, but also that they can be converted from a wilderness condition into lands suitable for successful settlement, and that the process of reclamation may be made a source of profit. Last autumn Mr. Rowan, Fields Inspector of the Department of Agriculture, made an inspection of the lands which have been turned over at Mangawai, Waiharara, and at Waihopo, with a view to finding out what areas could be prepared for fruitgrowing and other farming. The following is a synopsis of Mr. Rowan's reports, which are dated 14th and 15th June, 1916:—

Mangawai.—About 50 acres has been dug, and of this an area of 25 acres could be turned into immediate use. There was one difficulty in the great quantity of kauri stumps and other timber which had to be disposed of. After the timber has been removed shelter-belts should be planted, and for this purpose black-wattle (*Acacia decurrens*) was suggested as the most suitable. He did not consider it would be advisable to burn the timber on the land, as the soil, being of a peaty nature, would be liable to catch fire. The land is well drained by several open drains, spaced about 2 chains apart, and connected with a main outfall drain. It would be necessary to tile the drains before the land could be ploughed. The land adjoining the swamp is partly flat and partly hills, with gentle rising slopes; the soil is of a peaty, sandy nature, with a clay subsoil. This land could be easily worked, and he was confident it could be brought into cultivation and by the application of lime could be made to grow almost anything. The swamp lands are well adapted for fruitgrowing and an ideal place for growing forage crops, such as lucerne, mangels, carrots, turnips, maize, and grasses. A crop of Algerian oats had been sown on an area of 10 acres of the land turned over; a good crop was obtained, successfully harvested, and subsequently cut into chaff. Pumpkins, cabbages, peas, and beans were also grown with good results. There is no doubt a great future for these lands if properly cultivated and limed.

Waihopo (Bulldog Flat).—About 40 acres had been turned over. The land is of good quality, the soil being a black loam intermixed with a little sand. If it is properly cultivated and manured (lime being essential) it could be made to grow almost anything. The land has been well drained by drains cut at 2-chain intervals, discharging into an outfall drain. The land is well adapted for growing grasses and forage crops, and he thought that fruit could also be grown. Shelter-trees would have to be planted before the fruit-trees were put in. Bulldog Flat is within half a mile of a boat-landing, and is about four miles from the Houhora Wharf at Pukenui. The timber lying on the surface would have to be got rid of before any cultivation could be done.

Waiharara (Big Flat).—An area of about 60 acres has been turned over here. The land is of good quality, the soil being a good black peaty loam with a little sand intermixed. The land is situated two miles from the Waiharara Landing, and is about six miles from the Kaimaumau Wharf. The land which has been dug has been well drained, like the other areas, and the timber is stacked on the surface. With proper cultivation and manuring the land would grow almost any variety of crops. *Acacia decurrens* should be planted for shelter, as was done at the Albany demonstration area. After proper shelter has been provided he thought fruitgrowing could be made successful in the Waiharara district. A small area of the dug land has been planted in oats; no lime was used, and the season was a dry one; all things considered a fair average crop was obtained.

Waiharara (Pausina's Flat).—This is a very good swamp: the soil is a rich, black, heavy loam, and once the land is cultivated it will be very productive. It is situated near the main road, and within a mile of the Waiharara Landing. It would be a suitable place for a demonstration area. About 12 acres has been dug and the timber thrown up on the surface; good drains have been cut, and a large outlet drain made. The land in this swamp compares favourably with the best lands in the Dominion.

Mr. Rowan also visited some of the kauri-gum swamps in the Northern Wairoa district. Referring to the swamps at Scarrott's, near Te Kopuru, he says, "There are three good swamps in close proximity to each other. This land, like other swamp areas, is of rich quality, and if thoroughly dug over the value of the gum recovered would probably pay for the cultivation if the digging is done in the same manner as it is being done at the Government face-digging works. The land could be cultivated and made to grow anything. Some of the Aratapu Swamp lands give a good illustration of what can be done by cultivation and manuring on gum lands. A good proportion of the hill lands adjoining the swamps could be worked with the swamps. I am confident if these lands were taken in hand and dealt with like the lands in the Far North they would prove a valuable asset to the Dominion."

Mr. Rowan also refers to "potholing" by the gum-diggers. He says, "It is a pity to see this land 'potholed' by the Austrians and other diggers. The diggers should be compelled to dig the land as the Government are doing, and so leave it in a fit state for cultivation later on. As it is now the land is so much potholed and left in such a bad state that it is practically of little use to any one."

The Gum Lands of New Zealand.

The kauri-gum lands lie scattered throughout that portion of the North Island lying between latitudes 34° 20′ and 38° 20′ south, approximately north of a line drawn from Kawhia on the west coast to Tauranga on the east.

The total area of the gum-bearing lands was estimated in 1898 at 814,000 acres; of this area 435,000 acres were then Crown lands, the balance being made up of privately owned lands and Native land which had not then been through the Court. Of the Crown lands 276,000 acres were set aside in 1898 as kauri-gum reserves; since then about 120,000 acres have been withdrawn from the reserves for settlement and other purposes, the greater proportion of the land having been found to be not gum-bearing.

The gum lands are of two different classes—namely, the peat swamps and the clay lands.

The Clay Lands.

The swamps still contain valuable deposits of kauri-gum and other products, but the clay lands are practically exhausted as far as the gum-digger is concerned. Large areas of these

lands could be profitably dealt with by the State and brought under cultivation. It has been clearly proved by the Department of Agriculture, through the medium of the various demonstration areas on gum lands, that the lands are highly productive under proper treatment. The Albany area well establishes this fact. I think it very desirable that the breaking in and cultivation of these lands preparatory to their subdivision into fruit and other farms should be undertaken on a fairly large scale. As a commencement I suggest that an area of, say, 2,000 acres should be at once handed over to the Department of Agriculture in order that it may be made ready for settlement. The value of the gum recovered in the course of ploughing and harrowing the land will generally yield a good contribution towards the cost of the work, while in some cases it will be sufficient to pay the whole cost. It is from these lands that the valuable range gums are obtained, and special attention could be profitably given to the recovery of the gum as the work of cultivation proceeds. It would be wise as a preliminary to ploughing to test the area to find out the average depth of the gum, and then to work the ground sufficiently deep to expose all the gum; in places it will be found profitable to have the land rooted to a much greater depth than an ordinary furrow in order to get out the gum. In harrowing the land some appliance for collecting the gum could be advantageously used.

I have no doubt about the success of this project, being confident that the land will respond freely to proper and sympathetic treatment.

Kauri Peat Swamps.

The successful development of the kauri peat swamps depends on the proper utilization of all their products. Our experience has shown that in the shallow swamps similar to the areas where the face-digging has been carried on there is 2s. worth of kauri-gum in every cubic yard of soil. In regard to the gum there is, of course, no difficulty in turning it to account; the only problem here is the separation of the gum from the soil. In previous reports I have referred to the large quantity of kauri timber in the swamps, and to the question of finding a profitable way of utilizing it. That the timber contains a high percentage of gum is evident from the most cursory inspection, but tests made by Dr. Maclaurin in 1915 place the matter beyond doubt. A sample from the Mangawai Swamp was tested and gave the following results: A—Dust and fragments of bark which composed about one-tenth of the whole; B—Portions of wood and bark on which gum was plainly visible, cut from larger pieces; C—Bark which showed no gum; D—Large pieces of wood which showed no gum. The results obtained were—A, 31·1 per cent.; B, 41·8 per cent.; C, 16·5 per cent.; D, 16·8 per cent.: the average of the whole being about 19·4 per cent. Dr. Maclaurin says, "These results, although probably too high, are sufficiently accurate to show that the timber forwarded contains a large amount of kauri-gum."

In January last Dr. Maclaurin visited the Mangawai face works for the purpose of inspecting the timber taken out of the ground during the digging operations, and in order to examine more closely matters affecting the cleaning of the gum, the treatment of the timber, and other waste products of the gumfields. He has since continued his investigations with encouraging results.

When I was in America I discussed the timber question with Mr. H. S. Betts, Engineer, Forests Products Laboratory, United States Department of Agriculture, Washington, D.C., and subsequently with Dr. Schorger, Chief Chemist, and Mr. H. E. Surface, of the same Department, at the Forests Laboratory, Madison, Wis. As a result of my inquiries and of the investigations made I am satisfied that the whole of the timber, which at present is a waste product and the chief obstacle in dealing with these swamps, can be dealt with and put to a profitable use.

KAURI SWAMP PEAT.

The question of extracting oil from the kauri peat on a commercial scale is securing attention by private enterprise. A company called the Trevor Oils (Limited) has been formed with this object, and an application has been made for an area of 2,000 acres of peat land near Kaimaumau, under the provisions of section 3 of the Kauri-gum Industry Amendment Act, 1915, for the purpose of establishing the works.

Associated with this company is Mr. S. Rosse Trevor, of Auckland, who has during the last fifteen years devoted himself almost entirely to the investigation of the problem of the best method of utilizing the products of the kauri peat swamps. His experience has led him to the conclusion that the kauri peat is the richest in oil of any peat in the world. He has invented a process for the extraction of oil and other products from the peat; this he has been demonstrating at Kaimaumau, where he has had a small plant at work during the last eighteen months. Up to the present he claims to have extracted 1,200 gallons of oil from the peat. It has been said by other investigators that the lower layer of the peat swamps is always richest in oil. Mr. Trevor says that his experience does not support this; on the contrary, he has found that the lowest layer is seldom rich in oil, although it often appears so. Having had the advantage of being on the ground when the peat for his experiments was obtained he has been able to satisfy himself that he is correct on this point.

The peats treated by Mr. Trevor were obtained from various swamps in the North of Auckland Peninsula under his personal supervision, the thickness of the layers varying from 12 in. to 14 ft. He is of opinion that most of the kauri peat swamps will pay to treat for the oils they contain, which he estimates to be almost 14 per cent., or approximately equivalent to 30 gallons of oil for each ton of air-dried peat.

Mr. Trevor affirms that destructive distillation is not the proper method of extracting the oils; he has found this from the tests he has made on a commercial scale. The kauri-pine yields probably more resinous matter than any other tree. The following are some results obtained by Mr. Trevor:—

Sample 1.—Total weight of sample as taken from swamp, 16 tons 12 cwt.:—

	Tons	cwt.	qr.	lb.
Loss of weight after being stacked in the open	3	2	0	0
Water extracted by machine	5	7	3	12
Ash	6	4	1	12
Oil	1	17	3	4
	16	12	0	0

Sample 2.—Weight tested, 1 ton. This was taken from about 10 tons of peat from one locality. The peat had been stacked to dry under ordinary atmospheric conditions. Results: Water, 895 lb.; ash, 1,032 lb.; oil, 313 lb.

Mr. Trevor says that altogether he has now tested over 200 tons of kauri peat. He says the crude oils obtainable by him will yield—Spirit (similar to benzine), 15 per cent.; medium oils, 40 per cent.; heavy oils, 30 per cent.; pitch, 15 per cent.

He is of opinion that the oils are not suitable for use as lubricants unless after special treatment.

Visit to the Forests Products Laboratory of United States.

In connection with inquiries I was making relating to the utilization of kauri swamp timber and the tapping of the live trees for resin (questions referred to in another part of this report) I visited the Forest Products Laboratory at Madison, Wisconsin.*

I may explain that the Forest Products Laboratory is a laboratory of practical research conducted by the Forest Service in co-operation with the University of Wisconsin, at Madison, Wisconsin. "Its aim is to promote economy and efficiency in the utilization of wood and in the processes by which forest materials are converted into commercial products. In carrying this out the purpose is—

"(1.) To secure authoritative information on the mechanical and physical properties of commercial woods and products secured from them.

"(2.) To study and develop the fundamental principles underlying the seasoning and kiln-drying of wood, its preservative treatment, its use for the production of fibre products (pulp, paper, fibre-board, &c.), and its use in the manufacture of alcohol, turpentine, rosin, tar, and other chemical products.

"(3.) To develop practical ways and means of using wood which under present conditions is being wasted.

"(4.) To co-operate with consumers of forest products in improving present methods of use; also in formulating specifications and grading rules for commercial woods and materials secured from them, and for materials used in the preservative treatment of wood.

"(5.) To make the information secured available to the public through publications, correspondence, and other means.

"Any one is at liberty to correspond with the laboratory about particular problems dealing with the utilization of wood, and will receive an answer based on whatever information is available on the subject. Such information is furnished free. The staff of the laboratory is also available for consultation work, provided the problem under consideration has some bearing of general interest."

Some questions relating to the utilization of timber products receiving attention at the laboratory are of interest to a timber-producing country like New Zealand, and of special interest in respect to the utilization of kauri swamp timber: these are the distillation of hardwoods and resinous woods, and the production of "naval stores"—rosin and turpentine. The investigations in regard to the hardwoods embrace—

(1.) Determining comparative yields from various species.
(2.) Methods of increasing the yields of valuable products.
(3.) Improved methods of refining the products.

In the United States in 1910 the hardwood distillation industry consumed over 1,250,000 cords of wood, costing over £823,045, and producing products valued at over £1,790,524. The industry is well established, with fairly well standardized processes. Two of the main products, acetate of lime and wood-alcohol, are regularly quoted market articles. The third, charcoal, is usually sold to iron-furnaces or in other local markets for fuel. In many of the plants wood cut specially for the purpose is used, while others operate either wholly or in part on sawmill waste. Small-sized material, such as sawdust and shavings, is not suitable, because the charcoal produced from such material is too fine to be of commercial value.

The species most extensively used are birch, beech, and maple. The amount of valuable products that can be obtained from these woods (in mixture) is comparatively well known, but very little information is available for other species.

In resinous woods the investigations being made relate to—

(1.) The efficiency of the methods applied to the various species and classes of material.
(2.) The quality and value of the various products which may be secured.

* For full particulars of this Department see manual issued by Department of Agriculture, U.S.A., by Henry S. Graves, Forester.

Of resinous wood, 192,000 cords were distilled in 1910, which cost £837,000, and resulted in products worth about £1,791,000. While the industry is comparatively new in the United States, and methods are not well standardized, it is attracting much attention, and promises to play a very important part in utilizing the waste occurring in the lumbering of southern pines. Two general classes of processes are used.

Destructive Distillation.—The largest portion of resinous woods at present used in the destructive distillation processes consists of "lightwood" from the long-leaf pine. Stumpwood from the same species has been used also to some extent, but the lightwood from dead trunks is commonly used, since the stumpwood is more difficult to collect and prepare.

Extraction.—Not only the highly resinous "lightwood," but also material such as sawdust, slabs, and other mill waste from long-leaf pine, which on account of its comparatively small resin-content cannot be economically used in the destructive distillation processes, may be extracted with steam for the recovery of turpentine and other volatile oils. Another method which has recently attracted considerable attention is extraction with a volatile solvent after steaming: this method recovers the rosin in addition to the volatile oils.

"Naval Stores," or Turpentine and Rosin.

Here the study of new species and the refinement of operations is the main purpose of the investigative work. The production of turpentine and rosin continues to be an important industry in the long-leaf pine region, the value of the products annually produced being in the vicinity of £5,000,000. Under the methods of operation most commonly used there is a considerable loss of possible products owing to unscientific methods of tapping the trees and collecting the gum. Other species than long-leaf pine may prove of value for the production of naval stores.

Other products which are derived from forest material are being investigated, such as the production of ethyl-alcohol, which is considered as one of the most promising means for profitably utilizing wood waste. It has long been known that wood cellulose can be converted into fermentable sugars by treatment with acids, and a number of attempts have been made and are being made to apply this principle commercially in the production of commercial alcohol from sawdust. From the commercial standpoint such a venture is highly speculative at the present time. For the purpose of ascertaining whether the production of ethyl-alcohol from sawdust is feasible commercially, and what are the best methods of procedure, apparatus has been installed to conduct experiments on a semi-commercial scale. A number of difficulties are encountered in the design of such apparatus because of the corrosive action of the chemicals which are employed, especially at the high temperatures necessary in the process.

ORCHARDING THE KAURI-TREE FOR RESIN.

In last year's report I gave it as my opinion that the bleeding or orcharding of the kauri in the State forests under proper management and on scientific lines offered a field for profitable exploitation. When in America last year I made it my business to acquire information having a bearing on the subject. I had also the opportunity of fully discussing the matter with the expert officers of the United States Department of Agriculture, who gave me the fullest information of what was being done in the orcharding or tapping trees in the United States for the production of rosin and turpentine. The result of my inquiries confirms the opinions expressed in my last report, and I propose during this year to submit for your consideration definite proposals with a view to giving the system a trial.

In another part of this report I have referred to the magnitude of the "naval stores" industry in the United States. Pitch and tar were the chief products of the industry up to the middle of the eighteenth century, and the extensive use of these products in the construction and maintenance of sailing-vessels caused them to be called "naval stores," the distinctive term now applied to the turpentine and rosin industry which has supplanted the production of tar and pitch.

The business of producing naval stores is somewhat unique among American industries, in the respect that there has been practically no change in the methods of production since the commencement of the industry over a hundred years ago. In this particular the industry bears resemblance to our kauri-gum industry.

Resin suitable for the production of naval stores is found only in coniferous trees; moreover, only pines yield resin abundantly, and of these only two species, long-leaf (*Pinus palustris*) and slash-pine (*Pinus heterophylla*) are "tapped" in the United States.

"No universally accepted theory dealing with the formation of resin has yet been advanced. It is generally conceded, however, that resin is formed as a *by-product during the transformation of food materials, such as starch, into woody tissue.* The resin is stored in two systems of elongated passages or resin-ducts. In one system the ducts are parallel to the pith of the tree; in the other they lie horizontally in radial planes. The ducts form in the growing tissue or cambium layer just beneath the bark, the two systems intersecting to form a continuous network of resinous passages." Here we have in the words italicized a declaration by eminent authorities that the resin is only a by-product formed during the transformation of food materials into woody tissue. This is of great importance in the consideration of the question of tapping the kauri for its resin.

It is often stated that bleeding the kauri would injuriously affect the timber if used subsequently for building purposes. The United States authorities before quoted in regard to this

say, "Tests have shown that the strength of the wood is not altered by turpentining." Again, in discussing French methods and experience it is stated, "The wood is used for mine timber, boxes, cross-ties, telegraph-poles, &c. Turpentined timber is preferred over unturpentined, since it is very resinous and resists decay for a longer time." It may be mentioned that a large proportion of the French forests exploited for resin are situated along the coast, where the shifting sand-dunes have been planted with maritime-pine (*Pinus maritima*). In discussing French methods of collecting gum it is remarked that "up to the year 1860 practically all resin was collected in holes scooped out of the sand at the base of the trees. This method was wasteful, and the gum was badly contaminated with sand and other debris. The use of an earthen pot with a gutter was suggested in 1840 by M. Hugues, of Tarnos, but was not taken up until 1860. At present the Hugues cup-and-gutter system has almost superseded the old method." (See Bulletin 229, Department of Agriculture, United States, by Schorger and Betts.)

I wish here to place on record my appreciation of the cordial reception given to me as an officer of the Public Service of New Zealand by the gentlemen here mentioned and by other officers of the Forests Products Laboratory, both at Washington and Madison. Everything possible was done to facilitate my inquiries and to supply me with information likely to prove of value in connection with the matters I was interested in.

I have, &c.,
R. P. GREVILLE,
Kauri-gum Superintendent.

The Right Hon. W. F. Massey, P.C., Minister of Lands, Wellington.

STATEMENT OF ACCOUNTS (AS REQUIRED BY SECTION 5 OF THE KAURI-GUM INDUSTRY AMENDMENT ACT, 1914) FOR THE YEAR ENDED THE 31ST MARCH, 1917.

Receipts.	£	s.	d.	*Expenditure.*	£	s.	d.
To Balance	2,694	3	9	By Wages and bonuses to workmen engaged upon face-digging and store, Auckland	7,494	1	10
Debentures issued under the Kauri-gum Industry Amendment Act, 1914	15,000	0	0	Wages of overseers and gum-buyers ..	933	13	6
Sales of kauri-gum	10,889	1	10	Machinery, plant, &c.	645	13	9
Miscellaneous receipts	143	10	3	Advances to gum-diggers and purchases of gum	5,166	14	6
				Travelling-expenses of Superintendent, staff, gum-buyers, and overseers ..	812	18	6
				Office expenses, administration, &c. ..	1,511	12	7
				Freights, &c.	983	8	6
				New Zealand Loans Act, 1908,— Kauri-gum Industry Amendment Act, 1914— Charges and expenses	0	10	6
				Balance: Cash in Public Account ..	11,178	2	2
	£28,726	15	10		£28,726	15	10

Examined and found correct.
ROBERT J. COLLINS,
Controller and Auditor-General.

R. P. GREVILLE,
Kauri-gum Superintendent.

Loan Account.

1917.	£	s.	d.	1917.	£	s.	d.
March 31. To Balance	47,000	0	0	March 31. By Debentures issued under the Kauri-gum Industry Amendment Act, 1914	47,000	0	0
	£47,000	0	0		£47,000	0	0

Examined and found correct.
ROBERT J. COLLINS,
Controller and Auditor-General.

R. P. GREVILLE,
Kauri-gum Superintendent.

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