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NEW ZEALAND.

NEW ZEALAND TIMBERS, BARK, AND SECONDARY FOREST PRODUCTS

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

A CATALOGUE OF NEW ZEALAND TIMBERS.

A DESCRIPTIVE work on the indigenous timbers of the colony is now being prepared, so that it is not desirable to present detailed descriptions in this report. The enumeration here given shows the systematic name of each kind, also the names commonly applied by the Natives and settlers.

I.—TIMBERS OF GREAT DURABILITY.

Native Name.	Settlers' Name.	Systematic Name.	Family.
	Section 1.—Suitable for General Building Purposes.		
Kauri	Kauri ...	Agathis australis, *Lam.*	Coniferæ.
Totara ...	Totara ...	Podocarpus Totara, *A. Cunn.*	"
Matai	Black-pine ...	Podocarpus spicata, *Br.*	"
Kawaka ...	Cedar ...	Libocedrus Doniana, *Endl.*	"
" ...	" ...	Libocedrus Bidwillii, *Hook. f.*	"
Tanekaha ...	...	Phyllocladus trichomanoides, *Don.* ...	"
Manoao ...	Manoao ...	Dacrydium Colensoi, *Hook.*	"
" ...	" ...	Dacrydium Kirkii, *F. Mueller*	"
	Westland pine...	Dacrydium Westlandicum, *T. Kirk* ...	"
	Yellow silver-pine	Dacrydium intermedium, *T. Kirk* ...	"
	Section 2.—For Constructive Works and Special Purposes.		
Puriri	N.Z. teak ...	Vitex littoralis, *A. Cunn.*	Verbenaceæ.
Tawhai-raunui ...	Tooth-leaved beech	Fagus fusca, *Hook. f.*	Cupuliferæ.
Tawhai ...	Entire-leaved beech	Fagus Solandri, *Hook. f.*	"
Rata	Rata	Metrosideros robusta, *A. Cunn.* ...	Myrtaceæ.
"	Ironwood ...	Metrosideros lucida, *Menzies*	"
Pohutukawa ...	Pohutukawa ...	Metrosideros tomentosa, *A. Cunn.* ...	"
Maire-raunui ...	Black maire ...	Olea Cunninghamii, *Hook. f.*	Jasmineæ.
Maire	White maire ...	Olea lanceolata, *Hook. f.*	"
"	Mountain maire	Olea montana, *Hook. f.*	"
Kanuku ...	Tea-tree ...	Leptospermum ericoides, *A. Rich.* ...	Myrtaceæ.
Maire tawhake ...	Maire-tawhake	Eugenia Maire, *A. Cunn.*	"
Kowhai ...	Kowhai ...	Sophora tetraptera, *Aiton.*	Leguminosæ.

II.—Timbers adapted for General Building Purposes or Special Uses, but of Less Durability than the preceding.

Native Name.	Settlers' Name.	Systematic Name.	Family.
Rimu ...	Red-pine ...	Dacrydium cupressinum, *Soland.* ...	Coniferæ.
Kahikatea ...	White-pine ...	Podocarpus dacrydioides, *A. Rich* ...	"
Miro	Miro	Podocarpus ferruginea, *Don.*	"
	Mountain beech	Fagus cliffortioides, *Hook. f.*	Cupuliferæ.
	Silver beech ...	Fagus Menziesii, *Hook. f.*	"
Pukatea ...	Pukatea ...	Laurelia Novæ-Zelandiæ, *Hook. f.* ...	Monimiaceæ.
Hinau ...	Hinau ...	Elæocarpus dentatus, *Vahl*	Tiliaceæ.
Pokaka ...	Pokaka ...	Elæocarpus Hookerianus, *Raoul* ...	"
Tawa	Tawa ...	Beilschmiedia Tawa, *Hook. f.*	Laurineæ.
Taraire ...	Taraire ...	Beilschmiedia Taraire, *Hook. f.*... ...	"
Titoki ...	Titoki ...	Alectryon excelsum, *De C.*	Sapindaceæ.
Tawari ...	Tawari ...	Ixerba brexioides, *A. Cunn.*	Saxifrageæ.
Mangeao ...	Mangeao ...	Litsea calicaris, *Hook. f.*	Laurineæ.
Rewarewa ...	Honeysuckle ...	Knightia excelsa, *Br.*	Proteaceæ.
Kaiwhiria ...	" ...	Hedycarya dentata, *Forst.*	Monimiaceæ.
Kohekohe ...	Cedar ...	Dysoxylum spectabile, *Hook. f.* ...	Meliaceæ.

III.—Timbers chiefly of Small Dimensions, adapted for Various Purposes.

Native Name.	Settlers' Name.	Systematic Name.	Family.
Horopito ...	Pepper-tree ...	Drimys axillaris, *Forst.*	Magnoliaceæ.
Tarata ...	Tarata ...	Pittosporum eugenioides, *A. Cunn.* ...	Pittosporeæ.
Karo	Karo	Pittosporum crassifolium, *Banks* and *Sol.*	"
Kowhiwhi ...	White matipo ...	Pittosporum tenuifolium, *Banks* and *Sol.*	"
Mahoe ...	Mahoe ...	Melicytus ramiflorus, *Forst.*	Violaceæ.
Houi	Ribbonwood ...	Plagianthus betulinus, *A. Cunn.* ...	Malvaceæ.
"	Lace-bark ...	Plagianthus Lyallii, *Hook. f.* ...	"
Wharangi ...	Wharangi ...	Melicope ternata, *Forst.*	Rutaceæ.
" ...	" ...	Melicope simplex, *A. Cunn.*	"
Kaikomako ...	Kaikomako ...	Pennantia corymbosa, *Forst.*	Olacineæ.
Akeake ...	Akeake ...	Dodonæa viscosa, *Forst.*	Sapindaceæ.
Karaka ...	Karaka ...	Corynocarpus lævigata, *Forst.* ...	Anacardiaceæ.
	Native lilac ...	Quintinia serrata, *A. Cunn.*	Saxifrageæ.
Putaputa-weta ...		Carpodetus serratus, *Forst.*	"
Makamaka ...	Makamaka ...	Ackama rosæfolia, *A. Cunn.*	"
Manuka, Kahikatoa	Manuka ...	Leptospermum scoparium, *Forst.* ...	Myrtaceæ.
Ramarama ...	Ramarama ...	Myrtus bullata, *Banks* and *Sol.* ...	"
Rohutu ...	Rohutu ...	Myrtus pedunculata, *Hook. f.* ...	"
Kohutuhutu ...	Fuchsia ...	Fuchsia excorticata, *Linn. f.*	Onagraceæ.
Horoeka ...	Lancewood ...	Pseudopanax crassifolium, *Benth. & Hook. f.*	Araliaceæ.
" ...	Toothed lancewood	Pseudopanax ferox, *T. Kirk*	"
Puka	Broadleaf ...	Griselinia lucida, *Forst.*	Corneæ.
Kapuka ...	" ...	Griselinia littoralis, *Raoul*	"
Karamu ...	Tree-karamu ...	Coprosma arborea, *T. Kirk*	Rubiaceæ.
Akeake ...	Akeake ...	Olearia Traversii, *F. Mueller*	Compositæ.
" ...	" ...	Olearia ilicifolia, *Hook. f.*	"
" ...	" ...	Olearia dentata, *Hook. f.*	"
Heketara ...	...	Olearia Cunninghamii, *Hook. f.* ...	"
Neinei ...	Neinei ...	Dracophyllum latifolium, *A. Cunn.* ...	Epacrideæ.
	Grass-tree ...	Dracophyllum Traversii, *F. Mueller* ...	"
Inaka ...		Dracophyllum longifolium, *Br.* ...	"
Mapau ...	Mapau ...	Myrsine Urvillei, *A. De C.*	Myrsineæ.
Tipau ...	"	Myrsine salicina, *Heward*	"
Pau	Pau ...	Sapota costata, *A. De C.*	Sapoteæ.
Maire	Sandalwood ...	Fusanus Cunninghamii, *Benth.* and *Hook. f.*	Jasmineæ.
Manawa ...	Mangrove ...	Avicennia officinalis, *L.*	Verbenaceæ.
Ngaio ...	Ngaio ...	Myoporum lætum, *Forst.*	"
Toro	Toro ...	Persoonia Toro, *A. Cunn.*	Proteaceæ.
Turepo ...	Milk-tree ...	Epicarpurus microphyllus, *Raoul* ...	Urticeæ.
Toatoa ...	Toatoa ...	Phyllocladus glauca, *Carr.*	Coniferæ.
" ...	Mountain toatoa	Phyllocladus alpinus, *Hook. f.*	"

A detailed classification showing timbers available for piles, fencing, ship-building, furniture inlaying, &c., will be given in the descriptive work.

BARK.

The growth of bark for tanning purposes will be discussed when treating of conservation. It is, however, desirable to consider in this place the indigenous barks capable of being utilized by the tanner, the extent to which they are available, and the best methods of placing them on the market at profitable rates.

In past years large quantities of the bark of the kamai, tawhero, and tooth-leaved beech were used by the local tanners, especially in the North; usually the bark was collected in the most wasteful manner, the trees being barked, standing, as high up as a man could reach, the upper portion of the trunk and the branches being simply wasted, and the tree left to die. With the development of steam communication between the colony and Australia, large quantities of mimosa bark were imported at low rates, and the indigenous barks fell into disuse.

Recently the bark of the tanekaha has been discovered to possess a special value as an organic mordant in the preparation of basils, and has realized from £30 to £50 per ton in London; the demand for it, however, is largely dependent upon the caprice of fashion with regard to particular shades of colour. In 1883 the quantity exported was 196 tons, valued at £2,177; but the following year it dwindled to nine tons. A larger quantity could have been obtained, but the Hokianga Natives declined to collect it at the rate of £4 per ton offered by the merchants.

The chief New Zealand trees which yield tanning barks are the following:—

1. Tanekaha *(Phyllocladus trichomanoides)*.—An elegant tree, from 40ft. to 70ft. high, with trunk from 1ft. to 3ft. in diameter; almost confined to the Auckland District. The bark contains from 23 to 28 per cent. of tannin, and is specially valued in the manufacture of leather for kid gloves.

In all probability the bark of the toatoa *(P. glauca)*, also peculiar to the Auckland District, and the mountain toatoa *(P. alpina)*, which is abundant in the South Island, where it ascends to 4,000ft., would possess similar properties in a lower degree. The coriaceous phyllodia, which take the place of leaves in these trees, probably contain a large percentage of tannin; but, so far as am aware, have not been tested at present.

2. Towai *(Weinmannia silvicola)*.

3. Tawhero *(W. racemosa)*.

The first of these is most plentiful in the Auckland District, but occurs in other parts of the North Island, forming a tree from 30ft. to 60ft. high, with a trunk from 1ft. to 3ft. in diameter. The second is found from the Waikato to Stewart Island, and attains similar dimensions. In their extreme state they are easily identified, but some forms approach each other so closely that they can only be distinguished by the fruit. The bark of each contains from 10 to 13 per cent. of tannin, and can be procured in vast quantities.

4. Hinau *(Elæocarpus dentatus)*.—This is found to a greater or less extent in forest districts throughout the colony. It attains similar dimensions to the towai, and affords a bark of much higher value, as it contains over 21 per cent. of tannin.

5. Maire tawhake *(Eugenia maire)*.—A small tree common in swampy districts in the North Island. The bark contains 16·7 per cent. of tannin.

6. Pokaka *(Elæocarpus hookerianus)*.—Closely related to the hinau, attaining similar or larger dimensions; rare and local north of Port Waikato, but abundant and of large size in some parts of the South Island. Bark contains 10 per cent. of tannin.

7. Northern rata *(Metrosideros robusta)*.—A large tree, abundant from the North Cape to Greymouth. The bark yields 18·5 per cent. of tannin.

8. Tooth-leaved beech *(Fagus fusca)*.—A large timber tree distributed from Kaitaia to Southland, often in vast abundance, and affords 7·6 per cent. of tannin.

9. Rimu, or red-pine *(Dacrydium cupressinum)*.—Common throughout the colony; percentage of tannin low, being only 4·3.

10. Tutu *(Coriaria ruscifolia)*.—A shrub or small tree common throughout the colony; percentage of tannin, 16·8.

Leaving out of consideration the tanekaha as an exceptional tree, on account of its special value and limited application, the hinau and rata may be considered by themselves. Both afford tanning bark of high value, and both are common in districts under process of settlement: it may fairly be assumed that bark yielding from 18 to 22 per cent. of tannin would realize £6 per ton at the local tan-yards, but, so far as I am aware, it is never utilized in this way. Settlers clearing their land would find it profitable to peel these trees after felling, and sell the bark to the nearest tanner. The proceeds would in most cases prove a welcome contribution towards the cost of felling and clearing. In Auckland and Wellington there are numerous localities in which both the hinau and rata could be treated in this way, and the Takaka and Aorere Valleys, in Nelson, would afford large quantities of rata.

Tutu is abundant, but of too small size to allow of the bark being profitably utilized at present rates, although, I believe, the bark of the root possesses a special value in Europe.

This leaves the towhai, kamai, rimu, and tooth-leaved beech for consideration. They are generally abundant: the towhai and kamai will shortly come into demand for sleepers, while the others are in general conversion through the colony, so that thousands of tons of bark can be had at small cost.

Rimu bark, containing only 4 per cent. of tannin, is practically valueless when compared with the imported wattle-bark, as one ton of the latter would give results equal to from five to seven tons of the former. The mere handling of five or seven tons instead of one is alone sufficient to prevent the profitable use of red-pine. The same difficulty in a reduced degree occurs with regard to beech containing 7 per cent. of tannin, pokaka 9 per cent., and kamai 12 per cent., although in all probability kamai, if supplied to the local tanners at £4 per ton, might compete successfully with wattle.

Still it is most desirable that all these barks with a low percentage of tannin should be utilized instead of being wasted to the extent of thousands of tons yearly, and it seems probable that by devising some cheap plan of preparing an extract the bulk and weight may be reduced, and a mere waste product converted into an important article of export.

The Americans have successfully achieved this result with their extract of hemlock *(Abies canadensis)*, the bark of which contains about 9 per cent. of tannin; rather less than pokaka, and considerably less than kamai. The extract is produced to the extent of nearly 120,000 barrels per annum, and the manufacture is found so profitable that nearly 200,000 acres of hemlock spruce are cleared annually to supply the demand in the United States alone; fears are freely expressed that in a short time the hemlock spruce forest will be destroyed. The extract is largely imported into England, and the demand is increasing.

During the year ending 31st December, 1884, the imports of tanning bark into New Zealand amounted to 4,129 tons, valued at £43,578. A large portion of this outlay might have been kept in the colony had the extent of our resources been properly understood.

So far back as 1876, extract of towai was exhibited at the United States International Exhibition, Philadelphia, by Mr. Grayling, of New Plymouth, who was awarded a certificate of merit by the judges in 1879. Mr. Grayling obtained a similar award at the Sydney Exhibition, and was equally successful at the Melbourne Exhibition in 1880. Mr. Kingsland, of Invercargill, uses large quantities of rimu for tanning, and pronounces it excellent for certain qualities of leather, although it imparts a red colour to the skins. He is now carrying out a series of experiments with the view of placing it on the market in the form of an extract. Mr. Tyer, of Ngahauranga, has, I believe, taken out a patent for a process of manufacture. Mr. Godsif, of Havelock, has recently produced an extract of tooth-leaved beech containing 22·51 per cent. of tannin by a simple method.

At my request, Mr. Kingsland kindly experimented with pokaka bark, and has favoured me with the following statement of results:—

"From 22lb. bark to 10 gallons of water, boiled for two hours, the barkometer registered for the following different barks: Rimu, or red-pine, 7°; kamai, 10°; pokaka, 12½°; mimosa, 16°. The red-pine tested was from a parcel that had been stacked outside all the winter, while the pokaka was fresh; if the others had been fresh they would have registered another 1½ degrees. Basils tanned from pokaka bark are good firm leather."

Mr. Kingsland further remarks: "The trial was not a scientific one, but it probably shows fairly enough the relative value of the different barks. I think you will agree with me that the experiment has been worth the trouble, and, I think, fairly shows a good percentage of tannin: pokaka might be largely used for 'dressing goods;' whether it would be useful or not in dressing 'sole' leather could only be determined by an extended trial on a larger scale." I have to express my thanks to Mr. Kingsland for the valuable information he has placed at my disposal.

In November last "tannin extract" was selling in London at from £16 to £21 per ton; oak-wood extract, £18; larch extract, £14; chestnut, £10 10s. to £15 10s.; oak bark, £6 to £6 10s.; and sumach, £13 to £18 per ton.

I may express the opinion that in such low-class barks as rimu, tooth-leaved beech, and towai, we have the material for replacing the greater portion of the imported bark and forming a valuable article of export; or—to put the statement in another form—of increasing the wealth of the colony to the extent of from £70,000 to £100,000 per annum by the utilization of waste material.

It will probably be found that most of the indigenous barks named afford the greatest amount of tannin when peeled during the last four months of the year, but actual experiments will be necessary to determine this point.

SECONDARY FOREST PRODUCTS.

Next in importance to the utilization of our "tanning barks," must be placed the utilization of the waste branches and sawmillers' refuse, which hitherto have not attracted the slightest notice; but, left to decay, have not unfrequently led to the destruction of a large amount of standing timber by fire.

At the present time the value of the imports of turpentine, resin, tar, pitch, and varnish is upwards of £19,000 per annum. No efforts have been made at present to extract turpentine and resin from our native pines, although several species afford them in considerable quantities. Tar and pitch can be produced to any extent from the tops and waste branches at present left to rot on the ground. Varnish is manufactured to a small extent in Auckland, but the quantity imported is far too large, considering the abundance of raw material at our command. It certainly cannot be considered economical to export kauri resin to the United States, and import it in the form of varnish, paying outward and inward freights, with the addition of a heavy duty, and allowing another country the profit arising from the manufacture.

It will be advisable to describe the chief methods employed for the extraction of tar, pitch, and resin, so as to demonstrate the facility with which the waste tops, &c., may be converted into a source of profit, at once affording employment to a considerable amount of labour, and minimizing one of the greatest risks to which our forests are liable.

Kauri Resin.

The so-called kauri "gum" will occasionally have to be treated as a forest product, since it is found abundantly on open spaces in many kauri forests, sometimes in situations where it may be profitably extracted, under restrictions calculated to prevent damage from fire or other causes.

As kauri resin was exported during the year ending the 31st December, 1884, to the value of £342,151, it is important that its production should not be needlessly diminished; but it is of still higher importance that standing kauri should not be destroyed by the recklessness of gum-diggers. As a standing rule no unlicensed gum-digger should be allowed to carry on operations in a kauri forest: the interests at stake are too large to allow of a vast risk being incurred for the sake of a comparatively small benefit. Three years ago the Auckland Waste Lands Board called for tenders for the exclusive right to dig gum within certain well-defined areas, the purchasers being held responsible for all unnecessary injury to the standing timber. On the whole this plan was found to work beneficially; the leaseholders erected stores at convenient places and exercised a general supervision over the diggers employed by them, so that, while a certain amount of revenue was obtained by the Crown, injury to the forest was reduced to a minimum, and the convenience of the diggers was consulted to a considerable extent. On the other hand, it was urged that leasing gum land tended to create a monopoly and reduce the earnings of the diggers. It is scarcely possible for a non-resident to determine how far these allegations were supported; it is sufficient to state that the plan was gradually abandoned, and gum to the value of many thousands of pounds has been taken from Crown lands without any payment for royalty, while a large quantity of standing timber has been recklessly destroyed.

As it will be necessary to plant open areas in kauri forests as soon as arrangements can be made, it becomes a question as to how far permission to dig gum may be granted, and under what restrictions. In areas of some extent and sufficiently level to permit the use of the plough, digging might be carried on during such period as the ground may be lying fallow, but holes must be filled up and the surface soil levelled. Any clearing of fern or undergrowth must be made by cutting or grubbing up, and the use of fire for this purpose absolutely prohibited. The sole right to dig for gum or to employ diggers on special blocks might be leased to some responsible person, and every digger employed by him should carry a pass signed by the Forest Officer of the district. Any person found digging in a State forest without holding a pass should be dealt with in the manner prescribed in the State Forests Act. Under no circumstances whatever will it be possible to allow indiscriminate digging in kauri forests; the area must be sharply defined in every case, and the restrictions laid down must be rigidly enforced. On no account can digging be allowed after vacant spaces have been planted.

Licenses may be granted to persons desirous of extracting turpentine and resin from the leaves and waste branches of the kauri and other pines, under suitable conditions as to time and place. Every encouragement should be afforded to this and similar efforts to utilize waste forest products.

I am particularly desirous of drawing attention to the enormous waste of kauri resin which is continually going on. Whenever a kauri-tree is cut down the bark and chips become more or less covered with exuded resin in a few days' time. Even the leaves, while still green, exhibit numerous rounded particles, or minute "tears," of the so-called "kauri gum." Taking into account the vast amount of kauri timber converted annually, the value of the resin thus allowed to waste must be enormous.

I venture to suggest that it would prove highly remunerative to extract it by distillation. At present this raw material is valueless, but, if a cheap mode of extraction could be devised, it would add largely to the wealth of the Auckland District. I do not despair of seeing even the sawdust of the kauri become of value on account of the resin which it contains.

The leaves of the hemlock spruce-fir of North America are made to yield a volatile oil of great value by distillation, and the industry is yearly assuming larger proportions.

Although the recent resin of the kauri is considered of less value than that found in a fossil condition, it does not follow that its extraction from our waste tops, leaves, and chips would not prove remunerative. The recent resin always finds a market, and the difference in price is but small. Something would, at any rate, be gained by lessening the demand for dry resin, and so deferring the period of total exhaustion. It was, in 1878, exported to the value of £132,975, and in a few years will become less easy to procure than at present.

In Formosa camphor is extracted by a rough mode of distillation, from a description of which our bushmen may perhaps derive a useful hint in connection with our neglected forest products.

Water is boiled in a wooden trough or hollow trunk, protected from the direct action of the fire by a coating of clay; the upper portion of the trough is covered by a board having numerous small perforations. Chips of camphor-wood are placed on the board and covered with earthen pots, so that the steam passing through the apertures extracts the camphor and deposits it on the upper surface of the pots.

Tar.

Tar may be extracted from many of our native trees, especially from the pines, the kauri, totara, kahikatea, rimu, miro, matai, tanekaha, &c., also from the tooth-leaved and other beeches, which form such vast forests in many districts, and in all probability from the large kinds of rata and tea-tree. The waste tops and branches of trees felled for timber, crooked pieces, knots, roots, &c., can be utilized for this purpose, so that the manufacture of tar and allied products would not only afford a profitable outlet for labour, but would remove a great source of danger, and materially reduce the serious loss arising from forest fires.

In the forests of the White Sea and the Baltic tar is extracted from the Scotch fir *(Pinus sylvestris)* and the Baltic spruce fir *(Abies communis)*, the wood and roots being cut into short billets and then subjected to a process of slow combustion. A funnel-shaped cavity of any convenient size is excavated in the side of a sloping bank; an iron pan is fitted tightly into the bottom of the hole, and communicates with the exterior by a pipe or tube which passes through the side of the bank, and allows the tar to be drawn off as fast as it is extracted. The billets are

now tightly packed in the cavity, ends downwards, until it is completely filled, when the surface is covered with turf, which is compactly beaten down by two men, one of whom uses a wooden stamper, the other a wooden mallet, so that the outer surface is sufficiently firm to prevent the escape of the volatile products. It is absolutely necessary that this part of the process should be efficiently performed. A small portion of the turf is now removed and fire applied to the stack: as soon as it is kindled the turf is replaced. The exuded tar is received into the pan at the bottom of the hole, and is discharged by the spout into casks, which are at once bunged and made ready for shipment.

The quantity of billets subjected to slow combustion at the same time is frequently enormous, amounting to 50,000 or 60,000 cubic feet. In this case the pile rises considerably above the surface of the cavity, but the whole must be carefully covered with sods, &c., as already described. A pile containing 50,000 cubic feet requires a fortnight for the process of combustion. It need scarcely be remarked that the wood must be dry before the operation is commenced.

In the highlands of Scotland tar is sometimes extracted by a somewhat rougher method. A hole is dug in the side of a hill, a gutter being formed at the bottom of the hole, and terminating in a small aperture outside. The hole is filled with wood cut to proper lengths, and the top is covered with tiles or sods. The tar gradually drains into the gutter, and is discharged by the external aperture, which must, of course, be very small, or air will be admitted in such quantity as to burn the entire mass.

Pitch.

This is obtained by boiling wood-tar until nearly one-half of its bulk has evaporated, when the remainder is allowed to cool and harden into pitch. The process is usually effected in copper boilers set in brickwork, to diminish the risk of accident.

Lampblack.

This is merely the fine soot given off during the manufacture of tar or charcoal. It is deposited on the sods which cover the billets, and must be scraped off. If, instead of the rough processes described above, closed ovens were used, the lampblack would be deposited on the roof.

A superior kind is manufactured in a more systematic manner from the straw and other waste material used in the preparation of the resin of the pinaster. A small furnace, about 4ft. in length and 2½ft. in width, is set in brickwork; on each side of the furnace, near the bottom, is an opening fitted with a close-fitting door. The chimney, which is nearly horizontal, conducts the smoke into the centre of a small wooden chamber, about 12ft. square and 10ft. in height, with a hole in the roof about 6ft. square. The chamber is entered by a door working in a groove and so fitted as not to allow the escape of smoke at its joints. The walls and roof are lined with boards on the inside. The opening in the roof is covered by a double thickness of coarse flannel sewn into a conical or pyramidal shape, and supported on a light wooden framework.

The straw and waste material from the manufacture of tar and resin is placed in the furnace in small quantities, merely sufficient to keep the fire alight, the supply being constantly maintained. The smoke passes into the boarded chamber, and the soot is deposited partly on the boards and partly on the flannel cone, while the lighter portion of the smoke filters through the latter, which also allows the heated air to escape. The lampblack is detached by striking the boards and flannel with a stick, when it falls to the ground, and is collected into small casks for shipment.

In some parts of Germany the furnace and chamber are constructed in a large shed; but in Bordeaux the whole is exposed, the chamber being covered with a tiled roof. It is obvious that a chamber of this kind might readily be constructed of corrugated iron.

Resin.

Resin, or rosin of commerce, is obtained from various pines in Europe and America. The kauri resin, popularly called kauri gum, is one of the most valuable known, and it may be partly due to the fact of its value, and its abundance in the northern districts of the colony, that no attention has been paid to that produced by the rimu, the kahikatea, and other trees. The greater part of the kauri-gum sent into the market is found in a fossil condition, a very small portion being the produce of living trees, although occasionally it occurs in recent masses or "tears" of several pounds' weight at the junction of a large branch with the stem.

Although a "shake" or fissure of any kind in the trunk of the red-pine *(rimu)*, or white-pine *(kahikatea)*, is always found to be compactly filled with resin, no attempt has been made to collect it for commercial purposes; it may therefore be worth while to describe the mode of extraction practised in Southern Europe.

In the Landes of Bordeaux the pinaster has been largely planted to fix the blown sand; the plantations thus formed not only yield a supply of useful timber and firewood, but afford support to a large portion of the population engaged in the collection of the resin. In May, a piece of the outer bark, about 5in. wide and 20in. long, is stripped from the trunk just above its base; a cavity sufficiently large to hold a half-pint of sap is cut in the trunk at the bottom of the place thus laid bare, or a trough may be attached on the outside. Above the trough or cavity the inner bark is removed to the width of 4in. and the height of 6in. The resin escapes from between the inner bark and the wood, and is conducted to the trough, which is emptied at regular intervals. The surface of the wound is lightly chipped over once a week until the close of September so as to expose a fresh surface; by this means its dimensions are gradually increased, but it is not allowed to exceed 6in. in width and 18in. in length. The following spring a new piece of bark is stripped off immediately above the old wound, and the process is repeated yearly until the incision is carried to the height of 15ft. or thereabouts, according to the strength of the tree, when a new incision is made at the base parallel with the old one, but leaving

about 2in. of bark between the two, and continued to the same height. This is repeated until the entire circumference of the trunk has been wounded, when the old incisions are found to have become sufficiently healed to bear a repetition of the process. When it is intended to remove the trees for firewood or for the manufacture of tar, incisions are made all round the trunk at the same time and regardless of length.

The resin which hardens on the surface of the wounds is very white, and is scraped off to be used in the manufacture of wax candles; it is termed "barras." The liquid resin is termed "galipot:" when collected it is placed in wooden vats sunk in the earth. In this state it contains fragments of bark, earth, and other impurities. In order to purify it, it is placed in large copper boilers, with brick flues or chimneys to carry off the smoke; it is kept boiling, and is constantly stirred. In order to ascertain when it has been sufficiently boiled, a small portion is poured on a piece of smooth wood; if, when cool, it crumbles freely on pressure between the fingers, it is considered ready for filtering, which is effected by pouring it over a layer of straight straw or rushes about 6in. in thickness, when it is allowed to run into casks, and becomes the brown resin of commerce.

Yellow resin is manufactured by frequently adding cold water, a few drops at a time; this causes the resin to expand, when it is allowed to pass through a tube, previously fixed in the side of the boiler, into another vessel. From this it is ladled back into the boiler, the operation being continued until the resin becomes perfectly clear, when it is filtered into sand moulds, forming cakes from 100lb. to 200lb. in weight The straw and waste material are utilized in the manufacture of lampblack, as already stated.

As it is not thought advisable to make any wound of greater length than 18in. to 20in. during one season, from eight to ten years will usually be required to operate upon the trunk to the height of 12ft. or 15ft. A short pole, with sloping notches to receive the feet, is used by the operator when the incisions are more than 6ft. or 7ft. from the ground. An expert operator does not require more than two or three minutes to ascend the tree, form a new surface to the wound, and descend. He is expected to attend to between two hundred and three hundred trees per diem, and to take the entire management of from fifteen hundred to two thousand trees each season. It need scarcely be remarked that eight hours does not constitute a working-day in the district under notice.

Burgundy Pitch.

This was formerly manufactured in Finland, Austria, Switzerland, and the Grand Duchy of Baden, by boiling the crude resin of the Baltic spruce, straining and evaporating until the proper consistency was attained. The manufacture of the pure article has greatly diminished of late years, so that now it is not easily obtained.

The substance usually sold as Burgundy pitch is a compound made by melting Bordeaux or American resin, and mixing it with palm oil, a little water being added during the process of mixing to render it opaque. It is obvious that the local demand for an article of this kind could be readily supplied from local resources, as the manufacture can be carried on in the colony at a very small cost.

Turpentine.

Turpentine may be regarded as resin held in solution in a volatile oil. It is produced by numerous pines and other trees, but varies considerably in value, some kinds being used chiefly for the manufacture of resin—as that of the pinaster, for instance; while the turpentine obtained from the silver fir simply requires straining to free it from accidental impurities, and render it fit to be used in the manfacture of clear varnishes.

Mastic and Chian turpentine are obtained from *Pistacia lentiscus* and *P. terebinthus*, but the quantity is inconsiderable when compared with that obtained from various pines. In Europe common turpentine is extracted from the Scotch fir, Baltic spruce, larch, pinaster, and silver fir; in North America from the loblolly pine *(Pinus tæda)* and the Georgian pine *(Pinus australis)*.

Actual experiments are necessary to determine to what extent the pines of New Zealand can furnish a substitute for the turpentine of Europe and North America; but there can be little doubt that large quantities can be obtained from the kauri, rimu, kahikatea, and others, by incision of the outer bark in a similar manner to that practised in North Carolina and other Southern States.

In some countries the resinous matter obtained from the trunk by excision is collected in baskets, which are placed over earthenware jars, so as to allow the fluid portion to drain off, forming the common turpentine of commerce. The solid portion is boiled in order to purify it, when it becomes ordinary resin.

The process of extracting the turpentine from the pinaster has been already described under the head "Resin." Turpentine obtained from this source, however, is of inferior quality to that obtained from the Georgian pine, and until the diminution of the American supply, caused by the civil war in 1863, it was chiefly used for the manufacture of resin; but during the continuance of the struggle it was imported into Britain in large quantities, which gradually diminished as the yield of the American product again increased, until at the present time it forms only one-tenth of the entire quantity imported; it is sold under the name of Bordeaux turpentine. In North Carolina, Georgia, and Alabama turpentine is extracted from *Pinus australis* and *Pinus tæda* in large quantities. During the winter months small cavities, termed "boxes," are cut in the trunk of the tree at about 12in. above the ground. The boxes slope inwards, the bottom being from 4in. to 5in. below the lower lip, and of sufficient width to hold from one and a half to three pints of fluid sap. From one to four boxes are made in a trunk, according to its size and diameter. A trunk 15in. in diameter should have three boxes, each holding about a quart. The boxes are cut with a long narrow axe, and require from eight to ten minutes each to make.

In the month of March the flow of sap commences, and continues to the end of August. In the former month the bark and sap-wood are cut or hacked for a few inches above the box, which is gradually filled, the flow increasing in quantity as the weather becomes warmer, so that the box is filled in about two or three weeks. The surface of the box should be lightly chipped over once a week, and the bark hacked afresh, the wounded portion being slightly increased in height each time until, in the course of years, it is carried 15ft. or more above the box. The turpentine is removed as often as necessary, and the resin that has dried on the surface of the boxes is carefully scraped off and often mixed with it.

If the process be carefully conducted, trees may be profitably treated in this manner for forty or fifty years. The first year's produce is always the most highly valued, and is called "virgin dip." The resin scraped from the surface of the wound forms the common frankincense, or "gum thus," of the druggists, and is the chief ingredient in the incense used in Roman Catholic places of worship, serving as a substitute for the expensive *Olibanum*, or true frankincense of Arabia.

Turpentine is obtained from the larch by boring auger-holes in the trunk ¾in. to 1in. in diameter, taking care not to reach the centre of the tree. The holes are slightly inclined upward, and have a tube or small gutter tightly fitted into each, with a tin canister or small bucket suspended from the outer end to receive the turpentine. The buckets are examined every morning, and the turpentine removed. A mature tree will yield from 7lb. to 8lb. of turpentine yearly for forty or fifty years. The turpentine is often found collected in small cavities in the larch exactly as in the New Zealand "red-pine." In some cases the cavities are closed with a plug, and the turpentine allowed to remain until it assumes a pasty condition, when it is removed with an iron spoon. The yield is, of course, greatly reduced, but the durability of the timber is preserved. Turpentine from the larch was formerly known as "Venice turpentine."

In some pines, as the silver fir, in which the wood is destitute of resin ducts, the turpentine is contained in small cavities formed beneath the bark. In the months of July, August, and September it is collected by Italian peasants, who visit the alpine districts for that purpose. Each carries a small sharp-pointed tin cone or flask, with which he punctures the bladders in the bark, and extracts the turpentine, which he pours into a tin bottle carried at his belt. The loftiest trees are ascended by the aid of climbing-irons, so that the work of collection is extremely laborious. The turpentine is strained, to free it from fragments of bark, leaves, and other impurities, when it is ready for sale. It is known in the market as "Strasburg turpentine," and formerly commanded a high price.

The barbarous plan of cutting boxes in the trees would not be adopted in New Zealand, at any rate, when it is desired to continue the process of extraction for a lengthened period. Tin or zinc troughs or boxes could be readily fixed to the trunk, or even sunk in the ground at its base, and the turpentine conducted to them by grooves, or some other simple contrivance. In this way even the kauri might be made to yield a supply of turpentine for some years without material injury to its timber. Of course, where a clearing is about to be made, and it is not thought worth while to convert the timber, the object is simply to obtain the greatest yield in the shortest time; in this case incisions may be multiplied and cavities deepened without taking ulterior results into consideration.

The amount of turpentine and resin which our native pines are capable of yielding involves several points of direct interest to the botanist as well as to the merchant and settler; I therefore venture to suggest to settlers in forest districts, and especially to the proprietors of kauri and kahikatea forests, the desirability of ascertaining the yield of the different species by actual experiment, which might be commenced at once. In any case the results would be of great value, and their publication would confer a boon upon the community. The rate of flow should be carefully noted, and the variations caused by changes in temperature observed. It would be advisable to try different methods of extraction with the same kind of tree, giving the preference to those which cause the least injury to the timber.

The Westland pine appears to merit particular attention: in common with the red silver pine it would probably afford turpentine of special value for certain purposes, although the yield of either would, in all likelihood, be comparatively small.

Oil of Turpentine.

This is manufactured by distillation on a large scale in the Southern States of America. The turpentine is placed in copper stills of large capacity and is distilled without water; the volatile oil is received into barrels direct from the still, and is ready for market.

The resin remaining after the oil has been extracted is drawn off into a vat containing water, which separates it from all impurities, when it is packed for export.

Potash.

This is extensively prepared from wood ashes in the forest districts of Germany, Russia, and other European countries, also in Canada and the United States of North America, where it enables the settler to defray a large proportion of the heavy cost of clearing forest land. Potash salts are found in varying proportions in all plants, and are most abundant in the young branches and leaves.

The process of extraction is simple and inexpensive. All parts of the plant, including the leaves, are burnt in dry pits dug in the earth from 3ft. to 5ft. in depth, and of any convenient size. The ashes are placed in tubes or vats, each having an orifice near the bottom secured by a plug, and a false bottom covered with straw or rushes. The ashes are saturated with water, and after standing about twelve hours the potash liquor is drawn off and taken to the evaporating pans, usually shallow iron vessels, sometimes with corrugated bottoms. It is now kept in a boiling condition and constantly stirred, fresh liquor being added from time to time as required, until the whole

becomes of a pasty consistence, when the heat is gradually reduced and the dry residuum allowed to cool.

In Canada the crude potash thus obtained is usually sold to the nearest storekeeper, but it requires to undergo a process of calcination to free it from certain organic matter before it becomes the potash of commerce. After the first potash liquor has been drawn off, water is again poured over the ash in order to remove all soluble matter, and the weak solution thus afforded is used to lixiviate a fresh supply of ashes. The insoluble portion of the ash is used in the manufacture of certain kinds of glass, and is of great value as manure on account of the phosphates which it contains.

In this colony thousands of acres of forest are burnt annually, but I am not aware that the slightest effort has been made to utilize the ashes. Although produced in such large quantities, they are simply wasted, being for the most part blown away by the wind or washed by the rain into the nearest streams, and carried to the sea. It is obvious that, by collecting the ashes immediately after "burning off," especially where much "logging" has been necessary, the settler has the means of defraying a considerable portion of the cost of clearing, at a trifling outlay. As the majority of settlers commence their clearings with but slender pecuniary resources, this is a matter which possesses a direct interest for a large class.

In Britain, potash is employed in numerous manufactures, and the consumption increases year by year, so that no doubt can be entertained as to the possibility of finding a market. The greater portion of the supply is obtained from wood ashes, for, although it is also procured from mineral sources, the process of extraction is comparatively costly.

In populous districts, where wood forms the chief fuel, it might prove remunerative to collect the ashes for the sake of the potash which they contain. Baron von Mueller estimates that a bucketful of ordinary wood ashes contains about 2½lb. of crude potash, worth sixpence per pound.

In Europe, furze, broom, and common fern are often burnt for the sake of the potash contained in their ashes. Might not our local Road Boards derive a hint from this to assist them in defraying the cost of clearing the miles of furze and fern by which traffic is impeded upon some of our roads, and at the same time open a new outlet for labour?

It is matter for regret that no attempt was made to utilize the vast quantities of ashes caused by the extensive bush fires in Taranaki and Hawke's Bay during the past season.

Charcoal.

At present charcoal is manufactured to a small extent only, and its cost is so high as greatly to restrict its application. The ordinary process of manufacture, although extremely simple, requires great care and attention. The wood is cut into billets from 2ft. to 4ft. in length, and dried by exposure to the air. When dried it is closely stacked in conical mounds from 6ft. to 12ft. high, and from 10ft. to 40ft. in diameter.

The ground is first cleared and levelled. A small framework is erected in the centre of this space, about 3ft. square, and consisting of four forked sticks standing 2½ft. out of the ground, and connected at the top by four stout rods. The billets are compactly stacked round the frame until the entire area is covered, all the billets sloping towards the centre. The stack is then completed to the desired height by billets arranged horizontally, and the whole covered by a layer of earth, finished off with sods when it is practicable to obtain them. The heap is kindled by an opening made at the top and others near the base. After burning for three or four days these are closed and other holes are made in the sides about half-way between the base and the apex. The holes must be closed whenever it is seen that combustion is too rapid, and care must be taken to fill up any depression that may arise from this cause. When smoke ceases to be given off all the holes are closely stopped, and the heap is allowed to cool for three or four days longer, when the cover is removed and any charcoal that may still be in a burning condition is extinguished by water.

In many places the site of the mound is formed into a funnel-shaped depression, with a hole in the centre which communicates with a ditch dug on the outside to enable the tarry matters to be drained off.

Charcoal intended to be used in the manufacture of the finer kinds of gunpowder is subjected to combustion in large iron retorts furnished with refrigerating condensers, by which means nearly the whole of the volatile products can be readily obtained.

Wood Pulp for Paper Manufacture.

This material is extensively produced in Norway, and is largely exported to England; but at present no information as to the cost of production and selling rates is available. The logs and large branches are ground to pulp on large grindstones driven at a high rate of speed, the logs being kept in their place by self-acting machinery.

It is obvious that this process affords the means of utilizing a large quantity of waste timber; but in the absence of more detailed information it is not easy to form a definite idea as to the possibility of effecting this at a profit.

Note.—Since the preceding was written I have received from Dr. Hector the following table, showing the percentage of tannin in various extracts analyzed at the Colonial Laboratory:—

Mimosa	34·69 per cent.	Spruce	16·94 per cent.
Valonia	42·64 "	Tooth-leaved beech (Godsif) ..	22·51 "
"Birch"	26·20 "	Towai (Grayling)	23· "

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