become impaled on it, it will rush down the cone and grip it with enormous force. These cones may be taken as of all degrees of fineness or thickness. When very short and thick, the corpuscle gripping it might easily, as by a sudden blow, be thrown off. Owing to its extreme tension it would revolve with extreme rapidity in the direction opposite to what it had when it rushed down the cone. It would therefore expand with great and sudden force, which is the action of an explosive.

Art. XI.—*On the neglected Forest Products of New Zealand.*

By T. Kirk, F.L.S.

[*Read before the Auckland Institute, 25th October, 1880.*]

Tar.	*Burgundy Pitch.*
Creosote.	*Kauri Resin.*
Oil of Tar.	*Turpentine.*
Pitch.	*Oil of Turpentine.*
Lampblack.	*Potash.*
Resin.	*Charcoal.*

Woodware.

The value of the tar, pitch, resin, turpentine and varnish, etc. imported into New Zealand during the year 1875, was declared to be £13,587, and it has increased at the rate of £850 per annum, the value of the imports for 1879 being close upon £17,000. It is not too much to say that nearly the whole of this large sum might be retained in the colony and expended in producing the articles from native products, which are either entirely neglected or are exported in the raw condition to be manufactured in other countries and returned, after incurring heavy charges for commission, outward and inward freight, and (so far as varnish is concerned) an *ad valorem* duty of 15 per cent. The object of the following paper is to draw attention to the profitable outlet for labour presented by our abundant supply of raw material suitable for this class of manufactures.

Tar and pitch can be produced from material which at present is not only wasted but is a constant source of danger—the tops, branches, and other small timber which is usually left on the ground after falling and which often leads to the destruction of the forest by fire.

To what extent a substitute for turpentine may be furnished by our native pines can only be determined by actual experiment; there can, however, be no doubt but that the *kauri*, *rimu*, and *kahihatea* may be made to yield considerable quantities.

With our large supply of *kauri* gum, a substance of such value as to take the place of the costly gum mastic, there can be no valid excuse for continuing to import large quantities of manufactured varnish. We may advantageously use a portion of our *kauri* resin for manufacturing purposes within the colony, instead of sending it abroad to be manufactured for us.

Fifteen years ago varnishes manufactured from both *kauri* and *rimu* resin were exhibited at the New Zealand Exhibition, held in Otago, but the subject has been allowed to drop without receiving the attention it merits, and it is a matter for congratulation that efforts are now being made to establish this industry in Auckland.

Tar.

Tar may be extracted from many of our native trees, especially from the pines, the *kauri, totara, kahikatea, rimu, miro, matai, tanekaha,* etc., 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, etc., 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 downward, 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, etc., 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 on the outside. The hole is filled with wood cut in 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.

Creosote.

Although this paper is concerned chiefly with products requiring at most a very simple process to prepare them for market, I venture to include creosote, as there can be no doubt that it will be greatly in demand as a preservative for timber used on our railways and other large works. The high rates paid for labour render the durability of timber of far greater importance in New Zealand than in Great Britain, where railway-sleepers are almost invariably saturated in creosote, on account of its antiseptic properties.

Creosote is distilled from wood-tar, chiefly from the tar of beechwood, which yields a larger proportion than other kinds. The chief supplies are obtained from the White Sea, the Baltic, and North America. It might be obtained in unlimited quantity from the beech forests of the sub-alpine parts of the colony.

The so-called creosote of coal-tar is simply "more or less impure carbolic acid," which does not occur in wood.

Amongst the products obtained from the destructive distillation of wood are acetic acid, wood-spirit, paraffin, anthracene, etc.

Pitch.

This is obtained by boiling wood-tar until nearly one-half of its bulk is 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 four feet in length and two and a half feet in width, is set in brickwork; on each side of the furnace near the bottom is an opening furnished with a close-fitting door. The chimney, which is nearly horizontal, conducts the smoke into the centre of a small wooden chamber about twelve feet square and ten feet in height, with a hole in the roof about six feet square. The chamber is entered by a door working in a groove, and fitted so as not to allow of 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 used in the manufacture of the 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 on the boards and 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 shipments.

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 resin. In May, a piece of the outer bark about five inches wide and twenty inches 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 four inches and the height of six. 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 six inches in width and eighteen 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 fifteen feet 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 two inches 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 away 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 six inches 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 of from 100 to 200 pounds in weight.

The straw and waste material are utilized in the manufacture of lamp-black, as already stated.

As it is not thought advisable to make any wound of greater length than eighteen to twenty inches during one season, from eight to ten years will usually be required to operate upon the trunk to the height of twelve or fifteen feet. A short pole, with sloping notches to receive the feet, is used by the operator when the incisions are more than six or seven feet 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 200 and 300 trees per diem, and to take the entire management of from 1500 to 2000 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.

Kauri Resin.

I am particularly desirous of drawing attention to the enormous waste of this substance, 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 the 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.

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 manufacture 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 twelve inches above the ground. The boxes slope inwards, the bottom being from four to five inches 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 fifteen inches 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 fifteen feet 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 augur holes in the trunk $\frac{3}{4}$ inch to 1 inch 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 seven to eight pounds 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 three to five feet in depth, and of any convenient size. The ashes are placed in tubs 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, without any commensurate 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 Müeller estimates that a bucketful of ordinary wood-ashes contains about two pounds and a half 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?

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 two to four feet in length, and dried by exposure to the air; when dried it is closely stacked in conical mounds from six to twelve feet high, and from ten to forty feet in diameter.

The ground is first cleared and levelled; a small framework is erected in the centre of the space, about three feet square, and consisting of four forked-sticks standing two and a half feet 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, 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-shapad 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.

Woodware.

It may be admitted that manufactured articles can scarcely be included under "Neglected Forest Products," without using the phrase in a very elastic manner; but before closing this short series of papers, I may be permitted to refer to the importation of certain kinds of woodware requiring a very limited expenditure of labour, and that of a very simple character, such as rolling-pins, washing-boards, clothes pegs, tubs, buckets, pails, etc., etc.

It is to say the least a singular anomaly that simple articles of this kind are imported from the United States of North America and other countries to the amount of £10,000 per annnm, while material that could be utilized in their manufacture is burnt in enormous quantities, or allowed to rot on the ground, and our artizans are unable to obtain employment.

Tawa, one of our most common timbers, is specially adapted for the manufacture of all the articles named; for the smaller kinds, such as clothes pegs and rolling-pins, it can be procured in almost unlimited quantity at little more than the actual cost of carriage.

There must be something radically wrong when simple manufactured goods of this kind, weighted as they are with heavy charges for freight and import duties, can be placed on the New Zealand markets in the face of the unlimited supply of raw material at our command. The cause of this anomalous condition of matters cannot be discussed here, but I may allude to it in order that the attention of settlers may be drawn to the subject.

In country districts intervals of wet weather might often be profitably utilized in manufacturing the simpler kinds of woodware. In most cases timber could be had for cutting and carting to the workshed, so that beyond the small sum required for the purchase of tools, etc., the sole outlay would be the cost of carriage to the merchant's warehouse, which, from the northern settlements, in any case must be much less than American freight rates, while the import duty of 15 per cent. *ad valorem* would be altogether in favour of the settler, although this of itself may be a disadvantage to the community.

Art. XII.—*On the Growth of Sugar-Beet in New Zealand.*

By S. M. Curl, M.D., F.L.S.

[*Read before the Auckland Institute, 25th October*, 1880.] *

It is some years ago since I wrote in the public papers and otherwise to advocate the introduction of the sugar-beet industry in this colony, being thoroughly satisfied by the experiments I made of the growth of various beets from different countries under test culture, and the large percentage of sugar by analysis, that the establishment of sugar-beet manufactures would greatly enrich this country. Had my plans been adopted and carried out, this colony would have been rich and prosperous, instead of being deeply in debt as it now is, and in place of the farmer working his land, as he now does, at a loss, by the introduction of the sugar-beet industry quite a different state of things would quickly arise, and the farmers might every year make a profit of from ten to fourteen pounds per acre for every acre they had in beet culture, and still leave six pounds for working and manuring each acre, thus, at the same time, increasing their capital, paying good interest upon that invested, employing more labour than they can now afford to do, and meanwhile the capital invested in the manufacture of sugar and spirit would be profitably introduced, and more labourers would be employed.

That these are facts and not fancies the history of the beet industry in all countries proves beyond a doubt, and having formerly had the advantage of seeing the beet culture and manufacture in France, in Russia, in Germany, in Austria, and other countries, and seeing the profit it brought to the farmers growing it, and to the manufacturers who obtained from the roots sugar, spirit, and the waste products used for cattle feeding, &c.,—

* [This paper was first read before the Wellington Philosophical Society on the 22nd November, 1879, and its publication was postponed by direction of the Board, as the author might wish to acquaint himself with the voluminous Parliamentary papers on the subject (App. Journ. H. of R. 1876, H.-2 and H.-2A ; 1877, I.-4), especially as these papers include analyses of New Zealand grown beets, showing much less favourable results.—Ed.]