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FOREST CULTURE IN ITS RELATION TO INDUSTRIAL PURSUITS.

A LECTURE,

DELIVERED BY BARON FERD. VON MUELLER, C.M.G., M.D.,
Ph.D., F.R.S.

(Government Botanist for Victoria, and Director of the Botanic Gardens of
Melbourne),

On 22nd JUNE, 1871.

"The toils of science swell the wealth of art."

BULWER LYTTON, from Schiller.

STRANGE as it may appear, an impression seems to be prevailing in these communities, that our forests have to serve no other purposes, but to provide wood for our immediate and present wants, be it fuel or timber. For even after the warning of climatic changes, and after the commencing scarcity of wood, no forest administration—at least, none adequate, or regularly organised—has been initiated in any portion of Australia; and thus the forests, even in districts already very populous, remain almost unguarded, become extensively reduced, and in some localities are already annihilated; indeed, the requirements of the current time alone are kept in view. Under such circumstances it cannot be surprising, that neither an universal forest supervision, nor a judicious restraint of consumption, nor an ample utilisation of *all* the various collateral resources of our woodlands, received that serious attention to which such measures became more and more entitled.

During the earlier years of our colonisation, while the population was but thinly scattered over the territory, or

The Lecture was illustrated by pictures of some Californian and Himalayan Pines, by various diagrams, by a number of specimens of the more generally used timber, accompanied by many kinds of young trees of the corresponding species; likewise by a copious display of other species recommendable for forest culture; as also by numerous technologic forest products and phytochemic preparations, by nets and baskets prepared from forest grasses and rushes (Poa Australis and Xerotes longifolia).

densely concentrated in a few places only, all demands on the wood resources were comparatively so limited as to cause, perhaps, nowhere vast destruction of the timber-vegetation, much less any alarm for meeting the requirements of the future. Then followed the first gold period, with all its bustle, turmoils and agitations, preventing reflection on almost anything except the immediate wants of that stormy time. Subsequently, when the commotion and excitement of the earlier gold era had calmed down, other obstacles arose, which in their conflicts brought much sadness on this young country, and retarded for years its full progress. But now, when apparently also these difficulties have been surmounted, it will be all the more incumbent on our statesmen and legislators, to exclude no longer from their consideration and watchfulness that remaining portion of a bequest, which bountiful nature, in its rich woods, has entrusted to our care. The maintenance of these forest riches should engage not only the loftiest forethought, but also a well-guided and scrupulous vigilance.

How forests beneficially affect a clime, how they supply equable humidity, how they afford extensive shelter, create springs, and control the flow of rivers: all this the teachings of science, the records of history, and, more forcibly still, the sufferings or even ruin of numerous and vast communities, have demonstrated in sad experiences, not only in times long past, but even in very recent periods. In what manner the forests arrest passing miasmata, or set a limit to the spreading of rust-spores from ruined cornfields; in what manner their humid atmosphere and their feathered singers effectually obstruct the march of armies of locusts in the Orient, or hinder the progress of vast masses of acrydia in North America, or oppose the wanderings of other insects elsewhere—all this has been clearly witnessed in our own age. How the forests, as slow conductors of heat, lessen the temperature of warm climes, or banish siroccos; how forests, as ready conductors of electricity, much influence and attract the current of the vapours, or impede the elastic flow of the air with its storms and its humidity far above the actual height of the trees, and how they condense the moisture of the clouds by lowering the temperature of the atmosphere, has over and over again been ascertained by many a thoughtful observer. In what mode forests shelter the soil from solar heat, and produce coolness through radiation from the endlessly multiplied surfaces of their leaves, and through the process of

exhalation; how, in the spongy stratum of decaying vegetable remnants, they retain far more humidity than even cultivated soil; how they with avidity re-absorb the surplus of moisture from the air, and refresh by a never-wanting dew all vegetation within them and in their vicinity, has been explained, not only by natural philosophy, but also often by observations of the plainest kind. How forest-trees, by the powerful penetration of their roots, decompose the rocks, and force unceasingly from deep strata the mineral elements of vegetable nutrition to the surface; how they create and maintain the sources for the gentle flow of watercourses for motive power, aqueducts, irrigation, water traffic and navigation; how they mitigate or prevent malarious influences—of all this we become cognisant by daily experiences almost everywhere around us. We have to look, therefore, far beyond a mere temporary wood supply, when we wish to estimate the blessings of forest vegetation rightly; and our mind has to grasp the complex of causes and sequences originating with and depending on the forests, before their value as a total can be understood.

“Here, in the sultriest season, let us rest:

Fresh is the green beneath those aged trees;

Here air of gentlest wing will fan our breast—

From heaven itself we may inhale the breeze.”

BYRON.

Let us then take timely warning; let us remember that denuded earth parts with its warmth by radiation, and is intensely heated by insolation; that thus in woodless countries the extremes of climate are brought about in rendering the winter-cold far more intense and boisterous, and the summer-heat far more burning and oppressive. Let us remember why the absence or destruction of forests involves periodic floods and droughts, with all the great disasters inseparable therefrom. Let us bear in mind that even in our praised Australia many a pastoral tenant saw his herds and flocks perish, and even the very kangaroos off his run; how he looked hopefully for months and months at every promising cloud which drew up on the horizon, only to dissolve rainless in the dry desert air; whereas when the squatter's ruin was completed, the last pasture parched, and the last waterpool dried up, great atmospheric changes would send the rain-clouds over the thirsty land with all the vehemence of precipitation, and would convert dry creeks into foaming torrents, or inundate with furious floods the very pastures over which the carcasses

of the famished cattle and sheep were strewn about! Picture to yourselves the ruined occupant of the soil, hardly able to escape with his bare life from the sudden scenes of these tragic disasters! Fortunately, as yet such extreme events may not have happened commonly; yet they did occur, and pronounced their lessons impressively. Let it be well considered, that it is not alone the injudicious overstocking of many a pasture, or the want of water storage, but frequently the very want of rain itself for years in extensive woodless districts, which renders occupation of many of our inland tracts so precarious. Let it also not be forgotten, how, without a due proportion of woodland, no country can be great and prosperous! Remember how whole mountain districts of Southern Europe became, with the fall of the forests, utterly depopulated; how the gushes of wide currents washed away all arable soil, while the bordering flat land became buried in debris; how its rivers became filled with sediment, while the population of the lowland were at the same time involved in poverty and ruin! Let us recollect that in many places the remaining alpine inhabitant had to toil with his very fuel for many miles up to the once wooded hills, where barrenness and bleakness would perhaps no longer allow a tree to vegetate! It should be borne in mind that the productiveness of cereal fields is often increased at the rate of fully 50 per cent. merely by establishing plantations of shelter-trees; that the progress of drift-sand is checked by tree plantations; and that a belt of timber not only affords protection against storms, but also converts sandy wastes finally into arable meadows, thus adding almost unobserved, yet unceasingly, so far to the resources of a country.

Shall we follow then the example of those improvident populations, who, by clearing of forests, diminished most unduly the annual fall of rain, or prevented its retention; who caused a dearth of timber and fuel, by which not solely the operations of their artisans became already hindered or even paralysed, but through which even many a flourishing country tract was already converted almost into a desert. Should we not rather commence to convert any desert tract into a smiling country, by thinking early and unselfishly of the requirements of those who are to follow us? Why not rather imitate the example set by an Egyptian sovereign, who alone caused, during the earlier part of this century, 20,000,000 of trees to be planted in formerly rainless parts of his dominions.

Dr. H. Rogers, of Mauritius, issued this year a report "on

the effects of the cutting-down of forests on the climate and health of Mauritius." Still in 1854 the island was resorted to by invalids from India as the "pearl" of the Indian Ocean, it being then one mass of verdure. When the forests were cleared to gain space for sugar cultivation, the rainfall diminished even there; the rivers dwindled down to muddy streams; the water became stagnant in cracks, crevices and natural hollows, while the equable temperature of the island entirely changed; even drought was experienced in the midst of the ocean, and thunder-showers were rarely any longer witnessed. The lagoons, marshes and swamps along the seaboard were no longer filled with water, but gave off noxious gases; while the river waters became impure from various refuse. After a violent inundation in February, 1865, followed by a period of complete dryness, fever of a low type set in, against which the remedies employed in ordinary febrile cases proved utterly valueless. From the waterless sides of the lagoons pestilential malaria arose, exposed to which the labourers fell on the field, and in some instances died within a few hours afterwards. But scarcity of good food among the destitute classes, and inadequate sewage arrangement, predisposed also to the dreadful effect of the fever at the time. As stated by myself on a former public occasion, marshes should either be fully drained, or the means of continuing them submerged should not be withdrawn. Dr. Rogers very properly insists that the plateaux and highlands of Mauritius must be replanted, alone on sanitary reasons. The small island of Malta requires at this moment to make strenuous effort for wood culture, to render tillage further possible and the climate more tolerable. The once forest-covered hills, which bordered the rich garden country of Murcia in Moorish times, are now masses of arid rocks; while Spain now-a-days is even helpless to obtain its very fuel, and thus all its technologic industries must languish. No wonder, then, if our here much-disregarded eucalypts are called there the trees of the future.

But I have, on this occasion, dwelt already long enough on the stern necessity of securing a due relation of forest to territory, of woods to climate, of timber to industries. These great questions have been discussed by able men through time long passed in all countries of civilisation. The details, moreover, of such discussions demand a special and fuller teaching, for which, perhaps, opportunities may yet arise in this hall. But to those who wish early to devote fuller attention to vital considerations of this kind, I would recom-

mend the perusal of the admirable work of Geo. P. Marsh (*Man and Nature; or Physical Geography as modified by Human Action*: London, 1864). That author studied the scattered and largely foreign literature pertaining to this subject with singular care, observed very many original facts, and argued on them with great ability. A smaller still more recent publication (*Disastrous Effects of the Destruction of Forest Trees in Wisconsin*, by Lapham, Knapp and Crocker, published in 1867) is also deserving full attention, inasmuch as it brings before us the difficulties and losses which the destruction of the forests has already caused in one of the younger of the American States; while, again, Indian experiences in regard to forests may be traced in the valuable volume issued by Dr. Cleghorn (*Forests of the Punjab and Western Himalaya*; Roor Kee, 1864). Some observations of my own, applying to countries like North Africa, have been recorded two years ago in the *Bulletin de la Société d'Agriculture d'Alger*.

One of the main objects, however, of my address this evening, is to show in what manner a well-organised and yet inexpensive system of forest administration might check the indiscriminate destruction of the woods, without, perhaps, lessening the rate of the present yield; in what manner numerous latent industrial resources of our ranges might be speedily and successfully developed, and a higher revenue thus be raised by the state; in what manner this increased income could be best employed, to maintain or enrich the forests, or to raise woods where naturally none existed; and by what new means prosperous occupation might be afforded to many a happy family in the still and salubrious sylvan recesses of this country.

And here I would at once remark, that for any administrative organisation to watch over our forest interests we must follow an independent path of our own in this young country, because the systems of forest management adopted with so much advantage in Germany, France and Scandinavia, are here applicable only to a very limited extent. This must be at once apparent to any one, who will reflect on the disparity which exists between our clime, our native tree vegetation, our present ratio of population and value of labour, as compared with similar conditions of the older and far more densely inhabited countries of middle and northern Europe, not to speak of the very much wider scope, which for the selection of trees for our future use the isothermal zone of

Victoria allows. On the latter subject our Acclimatization Society has recently published the views, which I entertain in reference to the many various trees, eligible for the geographic latitudes of a colony like ours.* Next I proceed to give, though very briefly, only an outline of the special system of administration, which I would advise to be adopted in the first instance, as well for the supervision, enrichment and utilisation of our native forests as for creating also new ones. On various occasions I have alluded to such a plan of surveillance before. More recently, though only passingly, in a lecture delivered at this hall, I advocated the formation of local Forest Boards in the different districts of our colonial territory. Various considerations led me to recommend this system. The administration, as an honorary one, would involve no direct expenditure to the State. It would bring to bear in each locality special watchfulness and local talent. In each district could readily be found a few inhabitants, who not only possess some knowledge of tree culture in general, but who also, by their direct interest in the present and future welfare of the locality, in which they live, in which they gained experiences, in which they hold property, and in which they reared a family, would be induced, as much for the sake of direct and lasting advantages as from patriotic motives, to devote the needful time for serving on a local Forest Board. But there are still other weighty advantages, which claim support for this proposition. Various tracts of the Victorian territory are—as might be imagined—very unlike in climate and geologic structure. Each locality shows peculiar adaptabilities for special trees to be selected. One district can afford, by the possession of more extensive primeval forests, to be far more heavily taxed in its timber resources than another; one tract of country can produce remuneratively certain trees, which it would be hopeless to attempt raising in another locality. Some extensive areas have no forests at all, and in others they have all but succumbed already. Hence each Forest Board can best frame its own bye-laws or local regulations, subject to the approval of ministerial authority; each can best judge of its own particular requirements, not only for the present generation, but also of such as will be urgent at a time when the children and grand-children of the earlier colonists will have to form their

* Appendix to the Annual Report of the Vict. Acclimat. Soc., 1870-1871.

judgment on the wisdom or shortcomings of their ancestors here at a time, when the want of foresight may fall most crushingly on the vitality or progress of many an industry or even the whole prosperity of the colony, or when otherwise the early operations of thoughtful local residents will prove to posterity an incalculable benefit. It will then become apparent, whether the present colonists have done their duty to their descendants, and have been faithful to the future interests of their adopted country; or whether they sunk all their ideas and efforts in temporary gain, regardless of all consequences. Each forest district, thus guarded by local administrators, will be able to produce a far larger income than now is raised from any of our wood areas; while the removal of timber will be brought within more reasonable bounds, and the wants of the future no longer be disregarded. Means of disposal of the wood, different to the regulations now in force, would be adopted, to save, in places much denuded already of wood, the rest of the timber from complete destruction. Thus, for instance, trees might be sold by numbers, at certain sizes, with saving of the youthful trees; or the wood might be removed by the square mile, with a view of replanting. The reckless ringing of trees (merely to obtain a little more grass) and stripping of bark would be brought within stringent laws, and many other losses be obviated.

A gentleman at Hillesley counts, as late as this very month, five splendid trees on an acre, cut down by the splitters, while only about one-tenth of the wood is used; nine-tenths being left to be swept away sooner or later by bush-fires. This improvidence goes on within a few hours' drive from Melbourne. The stately sea-coast banksias (*Banksia integrifolia*), so rare near Melbourne, and hardly occurring further westward, have been nearly exterminated within this month, as near to us as Brighton. On all this, local forest surveillance can form far the best opinion. Each board should have its cultivator, who, simultaneously, could perform the duties of forest ranger. A few unprovided orphan boys might be occupied in the simple nursery or planting work for the forests. The officer entrusted with forest duties on behalf of the Government, might aid, by frequent visits to each forest district, the various boards with much advice. The expenditure for such an organisation in each instance would be most moderate, would be productive already of early remunerative gain, and cause large and immediate savings. No statesman, I feel assured, would wish to impoverish our woods at the expense of the next genera-

tion, just as little as any legislator would hesitate to revote annually, for each forest administration, at least a portion of the revenue raised from the woods under its control. A sound economy of the State will not expect from a forest in populous localities any more than to devote its means for self-support. One of the first duties devolving on any forest department would undoubtedly be to cause in each district some fertile, sheltered valleys, readily accessible to good lines of traffic, to be selected, where, from springs or rivulets, water could be obtained for inexpensive irrigation, in order to reserve such spots for forest nurseries before they are all alienated from the Crown. The transit of the millions of seedlings, needed for forest plantations, from remote spots would not only be one of enormous and unnecessary expenditure, but, in the many instances of evergreen and even some deciduous trees, it would be next to impossible to convey living plants for long distances. The union of Forest Boards to road boards or shire councils, I regard inadvisable, because their scope of action is so different. The predilections of a member of a municipality will often be in building operations and kindred objects, while for culture processes he may have neither inclination nor experience. It is never wise to burden too heavy responsibilities on a few honorary administrators, whose leisure in this youthful country, where so much work is yet under the first or early process of creating, is almost sure to be but limited.

But there are instances in which—as, indeed, a thoughtful legislator has suggested—the Mining Boards might exercise in their vicinity supervision also over the woods. On many professional questions, such as the renovation of forests, the best utilisation of their products, the increase of their riches, I would myself very gladly afford advice, and thus maintain a consulting position to the Forest Boards; for, need I add, it has ever been my aim to serve, as far as it was within my means, the best interests of my fellow-colonists; and while official responsibility rests on me in this direction, I would wish to meet it in such a way, that those who will live after us shall never be able to tax me with blindness to any important interest of our colony, so far as such were entrusted to my charge. But, then, the views of a professional officer should be received with that consideration, and be seconded with that support, to which they have fair claim.

I pass the subject of the incalculable value of the native woods, such as we still possess in our own forests, whether

viewed in their relation to arts, or as mercantile export commodities. It is a matter far too large to dwell on it, even cursorily, on this occasion. Were I to enumerate all the uses already practically known of our native trees, I would have to compile a goodly volume, even were I silent on the still far ampler subject of the introduction of the thousands of different foreign trees, which I should like to see here for the use of future artisans and of those who are to benefit by their services. A work bearing on the nature of the forest trees of India, by Dr. Balfour, was kindly placed in my hands by Col. Sankey, whose stay among us we at present (22nd June, 1871) enjoy for advice on our waterworks. Major Beddome, of Madras, issues a kindred illustrated work.

I may, however, be allowed to point to the enormous consumption of indigenous wood in some localities, as this expenditure is utterly out of all proportion to the existing supply, or its present natural renovation. This question presents itself all the more gravely as no rich coal-seams are as yet discovered, by which the fuel-supply could be augmented from short distances, at a moderate price. We have also to be cognisant, that we cannot think of coal-fields as inexhaustible, even in the richest coal countries; and although it is to be hoped, that the day is very distant, when the cheap results of colliery work will be marred by the much-increasing depth of the coal mines, or their partial exhaustion, yet we cannot altogether discard the idea that, so far as coals are concerned, we are working on a capital, however large it may be, without ever adding to it. In Victoria, we can neither augment the supply of burning material by peat, such as is so extensively utilised for fuel in the countries of the north, except we bring a very similar and equally useful peat from the distant and rugged heights of our Alpine mountains.

Although science has promised us prophetically other sources for applied heat—and, I may add, motive power—in gases not yet within our technic reach or of universal application, we have, nevertheless, to deal with the stern realities of the day until new scientific achievements in this direction shall have been accomplished. At best, and looking ever so hopefully forward to the successes of the future, we cannot substitute in an endless array of purposes air or coal for the ever-wanted living wood, even if all that concerns climate and health could be left out of our contemplation. As an instance, then, of our present consumption, or almost immediate requirements of wood, I would like to quote one or two examples.

The able Engineer-in-Chief of the Railway Department—T. Higinbotham, Esq.—has obligingly supplied me with the following data in reference to the timber at present consumed for the Government railway lines; this gentleman explains also what will most likely be needed within the next few years for this purpose.

“The number of sleepers, which are used annually on the existing lines of railway to replace decayed sleepers, is about 40,000; and there can be no doubt that renewals at this rate at least must be continued for many years to come. Each sleeper contains $3\frac{1}{8}$ cubic feet of timber, and for renewals red-gum timber is used exclusively, the principal supplies being obtained from the Murray River.

“The length of fencing, which is renewed annually on the existing lines, may be taken at 18 miles, and the quantity of timber in a mile of fencing is about 3000 cubic feet; the timber used in renewing fencing is messmate, peppermint and stringy-bark, and the durability of these timbers when used for fencing may be taken at ten years.

“There are at present nearly 120 miles of new railway in course of construction, and 60 miles more will be undertaken before the close of this year. The new line of railway, the North-eastern, will be 181 miles long, and for each mile 2000 sleepers are required, which at $3\frac{1}{8}$ cubic feet per sleeper gives 6250 cubic feet per mile; or, for the whole length of 181 miles, 1,131,250 cubic feet will be required for sleepers. The timber to be used in these sleepers will be red-gum, ironbark, or box. I have no actual experience of the durability of these timbers when used for sleepers; but I believe that it will be quite safe to reckon on their lasting for eighteen years. The ordinary gums, when used for sleepers, will not last more than half that time.

“The quantity of timber required for fencing the North-eastern railway will be 1,086,000 cubic feet. The fence-posts will be of red-gum, ironbark, blue-gum, or box, and the rails of stringy-bark. I think that a fence of these materials will last for eighteen years. As to projected railways, it seems to be probable that on the average from 30 to 40 miles will be made for the next ten years, in addition to the North-eastern railway already in progress.”

I am further told, by a gentleman conversant with our railway affairs, that the engines on the present Government line use about 3000 tons of wood a-year, while about 800 tons more are consumed on the stations. The Government line

requires 150,000 blackwood keys annually. On inquiry, I have also learnt that the breakwater at Williamstown will take 400 piles, equal to 18,000 cubic feet, and for the superstructure of the piers 10,000 cubic feet more. The Melbourne Gas Works required in 1870 not less than 40,000 superficial feet of red-gum timber. The quantity of red-gum wood required for these and other purposes cannot be increased by supplies from Tasmania, as the tree does not exist there. Again, the true blue-gum tree does not naturally occur beyond Victoria and Tasmania. If complete wood statistics could be collected, both of our daily requirements in town, on land and on sea, and statistics also as to what really sound and straight timber is still available, some serious realities would be brought before us.

At Ballarat, Creswick, Beechworth, Yackandandah, Sandhurst, Heathcote, Maryborough, Avoca, Castlemaine, Fryer's Creek and Ararat, some of the timber for the mines has to be brought already from distances as remote as 10 to 16 miles, according to returns of the Mining Surveyor, kindly furnished by Mr. R. Brough Smyth. At Pleasant Creek the miners have to go every year a mile further for their wood.

I quote the following important statement from Mr. R. B. Smyth's Mineral Statistics of Victoria for 1870:—

Table showing approximately the Quantity and Cost of Timber consumed annually for Mining Purposes in the several Mining Districts, from Returns made by the Mining Surveyors and Registrars.

			£	s.	d.
BALLARAT	Firewood, &c.	320,601 tons	203,024	4	7
	Props and Cap-pieces	1,650,555 pcs.			
	Laths and Slabs	4,274,798 pcs.			
	Sawn Timber	5,772,110 feet			
BEECHWORTH ...	Firewood, &c.	45,600 tons	33,639	17	4
	Props and Cap-pieces	155,778 pcs.			
	Laths and Slabs	566,050 pcs.			
	Sawn Timber	706,200 feet			
SANDHURST	Firewood, &c.	129,750 tons	91,551	8	4
	Props and Cap-pieces	290,300 pcs.			
	Laths and Slabs	1,174,500 pcs.			
	Sawn Timber	614,800 feet			
MARYBOROUGH...	Firewood, &c.	98,373 tons	53,647	4	3
	Props and Cap-pieces	193,071 pcs.			
	Laths and Slabs	809,182 pcs.			
	Sawn Timber	786,987 feet			
CASTLEMAINE ...	Firewood, &c.	68,190 tons	29,581	14	5
	Props and Cap-pieces	142,791 pcs.			
	Laths and Slabs	109,143 pcs.			
	Sawn Timber	456,100 feet			

ARARAT	{	Firewood, &c.	91,360 tons	£	s.	d.
		Props and Cap-pieces	19,302 pcs.			
		Laths and Slabs	70,021 pcs.			
		Sawn Timber	250,000 feet			
GIPPS LAND	{	Firewood, &c.	12,744 tons	9,508	4	3
		Props and Cap-pieces	37,656 pcs.			
		Laths and Slabs	18,802 pcs.			
		Sawn Timber	202,581 feet			
Total Cost.....				£444,886	14	1

As a further evidence of the imperative necessity of finding wood by a mode different to the present means of obtaining it, I translate and condense a portion of a letter from an accomplished mining engineer at Clunes (Wolfgang Mueller, Esq.), a spot which once boasted of forest scenery:—The fuel required for the steam-engines alone at the mines of Clunes amounts at the present rate of working to not less than 1,308,000 cubic feet annually. The nearest forest is ten miles distant; the price per cord (of 128 cubic feet) is 27s. The cost of transit of the above engine-fuel amounts alone to, approximately, £10,000 pro anno, the whole expenditure being about £15,000. The round wood, for subterranean use in the mines of Clunes, now annually comes to 160,000 running feet, at a value of £2400; and this round wood cannot now be obtained nearer than from 20 to 25 miles. The sawn and split timber for the Clunes mines has to be carried quite as far, adding about £700 to the wood expenses for these mines, the total being probably not less than £20,000 annually! No allowance is, however, made in these calculations for the domestic fuel of the miners. The price of wood is trebled already by cartage at that spot.

No natural local upgrowth, even if not destroyed by fire or traffic, I am confident can come up to this rate of consumption; and it is evident that annually the price for wood at these mining works must increase; for many a mine this may become a question altogether as to the possibility of its further remunerative working. The mining operations, moreover, are generally at a yearly increase through new gold discoveries in the district spoken of and elsewhere. Although on the Clunes mines the price of wood has not materially risen during the last six years, it must be borne in mind that remuneration of labour has sunk, indicating in reality a considerable increase in the price of the fuel. New railway lines may certainly bring wood for a time at moderate prices to the miners; but this measure copes not with the real difficulty of the wood question, but only defers it, as such sources of supply will

also become exhausted, while carriage from an indefinite distance will become a financial impossibility. The present price of coal at Clunes is far too high to allow it to be substituted for wood. Now let us pass on to still other considerations bearing on this question. It so happens that the decrease of timber in our colonies is hastened by other agencies than those of sacrifice for utilitarian supply. Irrespective of the ordinary causes, by which in many countries the virgin forests became devastated, there are additionally others which operate in our colony to augment the extensive destruction of woods. The miner ignites the underwood, with a view of uncovering any quartz-reefs, or tracing mineral riches of other kinds. Although he desires only to force thus his way through a limited space of scrub, or uncover for inspection a small extent of ground, he really sets sometimes the whole forest on fire, unchaining the furies of the fiery element, which, in its ruinous and rapid progress, consumes innumerable stately trees, requiring the growth of one or even several centuries to attain their spacious dimensions. The burning trees, a prey of the flames, carry with them many others in their fall; others become partially scorched, and linger gradually to decay; others become at least so far impaired as to offer no longer a sound or superior timber. Very aged eucalyptus trees are almost always suffering already from natural decay in the central portions of the stem. It is far from me to wish to impede the operations and progress of the miners, to whose intelligence and hard-working activity this country owes so much; but the advantages of gold-mining in our ranges may sometimes be too dearly bought at the expense of very extensive forest-destruction, with all the evils concomitant to it, or sure to follow it. Many other causes—such as the carelessness of travellers—set also frequently portions of the forest on fire, while the control over the devastation is lost.

The answer to remonstrances amounts usually to an opinion that more wood is springing up again than has been destroyed; but let us ask, how long will it be until the suckers, saplings or seedlings, which undoubtedly in many instances occupy the burned ground, forming perhaps impenetrable thickets, until they will really have advanced to the size of timber trees, fit for the saw-mill? In other localities, less densely wooded, where the trees were so dispersed as to give to the natural scenery, before it was disturbed, a park-like appearance, in such localities, which impressed on many of the

original Australian landscapes so much peculiarity, the growth of bushy plants becomes, as a rule, by occupation of the ground, quickly destroyed; the shelter and shade, which kept the mostly rather horizontal roots of the eucalyptus trees cool and moist, becomes largely withdrawn; the pendent leaves and lax or distant ramifications of the tree itself, giving but partial shade. The soil, moreover, remains no longer porous and permeable to moisture—it gets hardened, bare and consolidated by traffic and heat; the necessary moisture is wanting to keep the bark pliable, and to maintain the circulation of the sap active or normal; bark and wood are getting fissured and partly lifeless; and now places of seclusion, as well as a wood fit for their ready attack, are given to numerous kinds of coleopterous and other insects, which, by boring the lignous tissue, are sure to complete the destruction of the trees. Pictures of absolute misery of this kind may be noticed around our city in all directions. I have succeeded in saving many a venerable tree on the ground under my control, and in arresting the incipient decay by merely surrounding the base of the stem with earth turfed over, serving as seats; or by removing the endless quantity of mistletoe, which sucks the life-sap out of the branches, the invader perishing with its victim, there being no longer a multitude of native birds in populous localities to devour the mistle berries. In many low localities again, the ground, indurated by traffic, collects a superabundance of moisture, which becomes stagnant, and detrimental to the trees of such spots. Various other peculiar causes tend to the decay of our trees: to allude to all is beyond our present object.

How to provide, therefore, in time, the wood necessary for our mines, railways, buildings, fences, and as well as for the ordinary domestic and other purposes, becomes a question which from year to year presses with increased urgency on our attention, the consideration of which we have already far too long deferred. It may certainly be argued that in the eastern portion and some of the southern parts of the Victorian territory abundance of forests still exist, enough to supply all wants for many years to come. This is perfectly true in the abstract; but how does this argument apply, when we well know, that such timber occurs in secluded places, mostly on high and broken ranges, without roads. And even if the latter were constructed, which certainly will be required gradually, at what price can such timber be conveyed to the required distance? Suppose, however, that all these difficulties

had been overcome, whence are we to obtain the deals of northern pines, the boards of the red cedar, and the almost endless kinds of other woods, which future artisans will require? For, assuredly, neither Europe nor North America can sustain the heavy call on their indigenous and even planted forests for an indefinite period to come. Tropical woods might for a time be brought from the jungles of three continents, but certainly not at a small cost. Besides, tropical trees, as a rule, are not gregarious; we cannot judge beforehand in every instance of their durability and other qualities; we cannot recognise their extraordinary variety of sorts specifically from mere inspection of the logs, and we should find ourselves soon surrounded by endless difficulties and perplexities, were we to depend on such resources alone. Would it not be far wiser timely to create independent resources of our own, for which we have really such great facility? With equal earnestness another aspect of the timber question, as concerning our national economy, forces itself on our reflection. The inhabitable space of the globe is not likely to increase, except through forces which would initiate a new organic creation, or at all events bring the present phase in the world's history to a close; but while the area of land does not increase, mankind, in spite of deadly plagues, of the horrors of warfare, and of uncountable oppressions and miseries, which more extended education and the highest standard of morals can only reduce or subdue—mankind, in spite of all this, increases numerically so rapidly, that before long more space must be gained for its very existence. Where can we look for the needful space? Is it in the tropic zones, with their humid heat and depressing action on our energies? Or is it in the frigid zone, which sustains but a limited number of forms of organism? Or is it rather in the temperate and particularly *our* warm temperate zone, that we have to offer the means of subsistence to our fellow-men, closely located as they in future must be? But this formation of dense and at the same time also thriving settlements, how is it to be carried out, unless indeed we place not merely our soil at the disposal of our coming brethren, but offer with this soil also the indispensable requisites of a vigorous industrial life, among which requisites the easy and inexpensive access to a sufficiency of wood stands well-nigh foremost.

I may be met with the reply, that the singular rapidity of the growth of Australian trees is such as to bring within the scope of each generation all that is required, as far as wood is

concerned; and as a corollary it would follow that each generation should take advantage of the facility thus brought locally within its reach. I can assure this audience that enlightened nations abroad do far more than this, and would not rest satisfied with the greater facilities here enjoyed; they provide, with keen forethought and high appreciation of their duty for their followers, that beforehand which cannot be called forth at any time at will. If we examine this part of the question more closely, we shall find much to think about, much to act upon. Not even all our eucalypts are of rapid growth; they further belong to a tribe of trees with a hard kind of wood, which, though so valuable for a multitude of purposes, cannot supply all that the needs of life daily demand from us for our industrial work.

The quick-growing eucalypts, among which the blue-gum tree of this colony and Tasmania stands pre-eminent, are comparatively few in number, nor are these few all of gigantic size. They are, moreover, restricted in their natural occurrence to limited tracts of country, from which they must be established by the hand of man in other soil for the necessities of other communities—for the gratitude of other populations. Then, again, the pines of foreign lands, often impressing a splendour on their landscapes, must be brought to our shores—to our Alps—with an intention of utilising every square mile of ground, however unpromising in its sterility; for, after all, that square mile represents a portion, albeit so small, of the land surface of the globe. Look at the picture on this wall; see how the Norway spruce (which gives us so much of our deals and tar) insinuates its massive roots through the fissures of disintegrating rocks, or, failing to penetrate the stony structure, sends its trailing roots over the surface and down the sides of the barest rocks until they have found a genial soil, however scanty, on the edge of a precipice. Nature—ever active and laborious, ever wise and beneficent—allows the tree thus to live, thus to convert the solid boulders finally into soil, and all the time adds unceasingly to the treasures of the dominions of man. But just as time with its measured terms in fleet course passes irresistably onwards and irrevocably away, so also have we to await the approaching time, which all our wishes cannot accelerate in its unalterable measure.

“Onward its course the present keeps,
Onward the constant current sweeps
Till life is done;

And did we judge of time aright,
The past and future in their flight
Would be as one.

“Let no one fondly dream again
That hope and all her shadow-train
Will not decay;
Fleeting as were the dreams of old,
Remembered like a tale that's told,
They pass away.”

LONGFELLOW (*from “Manrique”*).

We have, therefore, to await with patience these measured terms before the child in its youthful impetuosity can reach the age of its highest hopes and supposed glory—but, alas! leaving often a far happier phase behind; or before a tree, from its youthful grace, can have advanced to sturdy strength or lofty height, to fulfil also its destiny and offer us its gifts. We cannot call forth age at pleasure; at best there is involved a lapse of years before a timber tree can yield a plank, a beam, or even as much as a solid post.

I have endeavoured to arrive at some idea of the real age of the larger trees, which are sinking daily under our axes, often sacrificed unnecessarily. On this occasion, as an apt one, I may then explain, that a period of a quarter or even half a century must elapse before a solid plank, hardened by age, can be obtained from even a rapid-growing eucalyptus tree. It is estimated to require 20 to 25 years before even a sleeper of blue-gum wood can be obtained from a tree planted in ordinary soil; and that double the time will elapse before a sown tree of the still more durable red-gum eucalyptus will furnish sleepers, such as hitherto have been in use for our railway works. But a supply of fuel from these trees may be obtained much earlier. Mr. Adam Anderson, a timber merchant of this city, concurs in this estimate.

Yet for forest operations we enjoy here advantages of two-fold kind, for which in Middle Europe we are justly envied. We can disseminate quickly-growing eucalyptus trees in the most arid districts; we can add to them, as a first shelter, many of the native casuarinas and acacias, and thus gain cover for less hardy trees of other countries. On the other hand, we find in the moist and rich valleys of our ranges a vast extent of space, where, under the mild influence of the clime, sub-tropic trees could be reared million-fold; where, for instance, whole forests of the red cedar might be originated. Besides, we do not stand at any disadvantage if we want to raise a belt of sea-coast pines all along the shores, or if we

wish to rear the Norway spruce, or silver fir, or larch, or Weymouth fir, or the Douglas pine, or any of the pitch pines of North America; because we can call forth, if we like, whole forests of them on sub-alpine heights never yet thus utilised.

Suppose we reckon that one hundred forest trees would be required to be planted on an acre, allowing for periodic thinning out; and assuming that for climatic and hygienic considerations, as well as for the maintenance of wood supply, we should require finally one-fourth of our Victorian territory kept as a forest-area, we would expect to possess 1,568,000,000 trees, and to provide for their timely restoration in proportion to their removal or natural loss.

Most of us are lulled into security by seeing that we receive as yet our foreign woods in the course of ordinary traffic, and we are not easily inclined to think, that the supply may cease suddenly, or be obtainable only at an exorbitant expense. Even in the United States of America there are places where the price of fuel and timber has already risen fourfold. We are told that recently, in the States of Wisconsin and Michigan alone, during one single year, 2,000,000 of pine-trees were cut for lumber; and it is estimated that at the present rate of destruction no timber trees will be left in those states after fifty years, while it will take a century to replace them, if even this be possible. Quebec exported in 1860 not less than 70,000,000 cubic feet of squared or sawn timber, equal to about a million tons of wood—a large share yielded by the Weymouth pine (*Pinus strobus*)—not taking into account the current local consumption. This tree, yielding the white American pinewood, requires fully sixty years of growth before it can be sawn into timber of any good size. During the first two years of the recent civil war in North America, 28,000 walnut trees were felled to supply one single European factory with the material for gun-stocks, demanded for this fratricidal war. Is it not right to reflect timely on the vast extensions of railroads, manufactures, mines, ship-building, dwellings, and so forth, and then to ask, where is the wood-supply to come from? The requirements in this direction must necessarily rise with the increase of the population and the augmented refinements of civilisation, yet the area of supply we see constantly decreasing. The loss on wheat crops during four of the more recent years in the State of Michigan alone, for want of shelter against cutting winds, was estimated at

£5,000,000, and this is regarded as the mere sequence of the removal of the forests, and not traceable to exhaustive culture. Cereal crops and vines were destroyed in many parts of South Europe also, through the complete want of shelter.

“ More bleak to view the hills at length recede,
And less luxuriant, smoother vales extend;
Immense horizon-bounded plains succeed—
Far as the eye discerns, without an end.”

BYRON.

The Commissioner of the Lands Office of the United States (Report for 1868) considers the live oak (*Quercus virens*)—one of the best for ship-building—nearly exterminated for all practical purposes, at least as far as native forests are concerned; while the walnut timber of North America, so much prized for cabinet-work, has well-nigh shared the same fate. The transit of walnutwood from Missouri to New York renders it already nearly as expensive as mahagoni, whereas the latter has become likewise in West India and Central America an article of great scarcity, and therefore this important tree should be copiously planted in the forests of tropical Australia. In the earlier part of this century the supply of Saul timber of Lower India (*Shorea robusta*) was thought inexhaustible; but now already this heavy and durable wood is hardly any longer procurable for ship-building and engineering work, for which it is so much sought. The axes of the woodmen will also soon make such an inroad into the comparatively limited yarra forests of West Australia, that also this timber, which for saltwater works is almost incomparable, will cease to be available long before a new and sufficient supply can be raised by regular culture.

The Lands Commissioner of the United States further reports, in 1868, that the frequent excessive droughts, and the occasional destructive inundations experienced a quarter of a century ago in Iowa, Kansas and Nebraska, have much diminished since the regular settlement brought tree plantations and other cultures into the extensive treeless prairies. Iowa planted in 1867 about 76 square miles of forest, and 1884 miles length of hedges. On the other hand, it is estimated already, in 1864, by Mr. P. T. Thomas, of New York, that the whole regions east of the Mississippi would be stripped of all really useful timber within twenty or thirty years; while even for fuel great inroads are constantly made into the American forests, coal not being everywhere accessible

in the States. The Hon. T. M. Edmonds (*Report of the Department of Agriculture of U.S. for 1868*) foresees the exhaustion of the timber resources of the United States in half a century under existing circumstances, whereas by that time the demand will be quadrupled. Mr. Simmonds calculates the importation of wood into France during 1865 at 154,000,000 francs, or about £6,000,000, the ratio of import being at an increase, notwithstanding that the forest area of that empire was reduced, within a century, to one-half—namely, from one-third, in the latter part of the last century, to hardly more than one-sixth now. But if the population of Middle Europe consumed proportionately as much native wood as the inhabitants of the United States, then, in less than half a century, no forest whatever would be left in Europe. These conclusions are borne out by the U.S. Commissioner of Lands, the Hon. Jos. S. Wilson. In the states east of the Mississippi, 6,000,000,000 cubic feet of wood were consumed for timber and fuel in 1860, at a time when no war laid hand on the forests. Hence 1,000,000 of acres of forest-land must be cleared, in the eastern states of the Union, to find the wood for a year's local requirements. The shipment of lumber, in one of the latter years, from Chicago, was 1,400,000,000 cubic feet, besides 217,000,000 laths and 928,000,000 shingles. In 1866, the products of the Californian lumber trade were 190,000,000 of cubic feet, and 38,000,000 shingles; in 1867, about 200,000,000 cubic feet. Quebec exports about 100,000,000 of cubic feet since a long period annually, irrespective of home consumption. In the Pacific States exists only a supply adequate to the prospective wants of their people. The West States of the Mississippi import already timber that formerly existed in their own native forests. Likewise so in North America an enormous lot of trees is destroyed by girdling, and subsequent burning, for clearing agricultural lands or pastoral runs. Thus, in the earlier part of the next century every natural forest east of the Mississippi will have disappeared, if, with an increasing population, the same rate of consumption is going on. For the states west of the great river, in which forest-land is much less extensive, the prospects are still more alarming. Hence Australia cannot indifferently look forward for softwood from these places.

To give some idea how long a time will elapse before actual timber, not merely firewood, is obtained from planted trees, I subjoin a brief list of the more common Middle European

forest trees, together with notes of their age when eligible for various timber purposes:—

Beech	...	...	60-110 years.
Hornbeam	...	...	70-100 "
Oak	...	...	70-120 "
Alder	...	...	30-80 "
Birch	...	...	40-70 "
Silver Fir	...	...	60-150 "
Norway Spruce	...	...	60-150 "
Scotch Fir	...	...	30-60 "
Larch	...	...	30-80 ,*

That, however, in our winterless zone, such of these trees as will endure a warmer clime would advance with more quickness to maturity, must be readily manifest. The accurate Customs returns for the last year show an importation of foreign woods to the value of £223,769; there was scarcely any export. This very month the imported building wood sent to Sandhurst alone has cost £58,000. Some countries have not been altogether unmindful of the conservation of their forests. Germany, already much devastated at the time of the Romans, received its first forest laws as far back as the reign of Charlemagne—indeed with the commencement of agriculture and the settling of the nomadic hunter on fixed habitations. The forests thus discontinued to be common property, and in the fourteenth century commenced already a forest economy. Full legislation, regular management and actual cultivation of trees on an extensive scale, date back 150 years. Venice formed its forest laws already in the fifteenth century. Although the desire for ample hunting territory gave a great impulse to the restrictions placed on the encroachment of the Middle European forests, this at the same time saved them to the country.

Within the operations of wood culture may also be included that of subduing drift-sand, and solidifying the latter finally

* It should be remembered that most of our forest ranges are naturally devoid of pinewood, only one species of callitris occurring in a few limited mountain districts, while our second callitris is a desert species. Without coniferous trees of our own we shall finally experience difficulty of obtaining the required supply of deals, pitch, turpentine and pine-resin. Doubtless for many wood-structures now iron is substituted, but even a ship or a house cannot be built entirely of iron, and the very production of the iron is dependent on fuel. In the absence of coal, the use of iron, involving here an expenditure for heavy freight, must necessarily be limited.

by plantations. For this purpose can be chosen the Haleppo pine, Cluster pine, Scotch fir, or our own less arboreous so-called seashore teatrees (*Melaleuca parviflora* and *Leptospermum lævigatum*), further the drooping Sheoak (*Casuarina quadrivalvis*), the coast Honeysuckle (*Banksia integrifolia*), and also our desert cypress, or so-called Murray pine. As not only in close vicinity to our fine city one wilderness of shifting sand exists, but as also in other places of our shores the sand is invading villages, towns and perhaps harbours, and as, moreover, many a desert spot inland may be reclaimed, I would remark, that to arrest the waves of the sand some wickerwork or cover of brush is needed on the storm side. Large seaweeds help to form such covering. Sods of *Mesembryanthemum*, to which the unpoetic name of "pigfaces" is here given, and which abounds on our coast, should copiously be scattered over the sand ridges; wild cabbage, celery, seakale, samphire, New Zealand spinach (*Tetragonia*), chamomile and various clovers and broom plants should be sown, and creeping sand-grass (*Festuca litoralis*, *Triticum junceum*, Buffalo-grass, *Agrostis stolonifera*), &c., should be planted, particularly also sand sedges and sand rushes, among the best of which are *Carex arenaria*, and here the Sword Rush (*Lepidosperma gladiatum*). *Psoralea pinnata* and *Rhus typhinum*, *Prunus maritima* (the Canadian sea-coast plum), *Ailantus glandulosa*, proved also valuable in this respect. As eligible, I may add also the native couchgrass (*Cynodon Dactylon*), the South African *Ehrharta gigantea*, the European *Psamma arenaria*, *Elymus arenarius* (or Lyme), even the live-oak (*Quercus virens*); as also another American oak (*Quercus obtusiloba*), and the Turkey Oak (*Quercus cerris*), and perhaps Poplars, some Willows, and among firs, the *Pinus insignis*, *Pinus edulis*, *P. rigida*, *P. Australis*. The common Brake fern helps also much to conquer the sand. The New Zealand flax covers coast sand naturally, within the very exposure of the spray.* It is needless to remark that exclusion of traffic from the sand is imperative, as also security against ingress of goats and domestic animals of any kind, otherwise the effort is hopeless. Fencing of the area and stringent

* Dr. Jam. Hector calculated that in New Zealand an acre of good flax land contained about 100,000 leaves of the *Phormium tenax*, and yields about ten tons weight of dry leaves; or if only the outer leaves are taken, four tons. The yield of clean fibre is about 23/100 of the green leaf.

municipal laws will make, however, any operations of this kind, even without great expense, a success, as in consequence of my advice has been shown at Queenscliff. Wood-culture on drift-sand carries with it also the recommendation of providing the needful belt of shelter, which each coast should possess. There are a few other pines—for instance, *Pinus Taeda*, the loblolly pine of North America, and several other trees which grow fast in sand whenever it is no longer moving; they endure the sea-storms, gradually consolidate the soil, and render it in course of time arable. In South Africa some *Protea* and *Leucospermums*, the *Virgilia*, also *Myrica*, grow in coast sand. All these planting operations must be performed very early and in the cool season. The grasses and herbs must precede the pines and other trees. Technic industries will gain from these pines in due time.

I now beg to offer some brief data in reference to the present consumption of wood in Victoria.

After the perusal of various official returns, I am inclined to assume that twenty tons would be a fair average of the quantity of fuel consumed in each household. This would amount to rather more than three millions of tons of wood as the present annual requirement of domestic fuel in this colony. In the city and suburbs the consumption is considerably less than in the farming districts, on account of the use of coal. In reference to the return of mining wood, quoted on this occasion, a large allowance must yet be made for the enormous mass of wood from the felled trees, which is left unutilised in the ranges, the distances in many cases being too great to convey the off-fall of the timber for the purpose of fuel. The following data convey some information on the annual consumption of wood in various districts.

				Tons.
Ararat (under license)	...	...	...	13,146
„ (without „)	...	...	...	13,146
Blackwood Mining Division	...	...	...	12,000
Buninyong	...	...	...	40,000
Colac (for saw-mills, 6000 tons; posts and rails, 6000 tons; shingles, 2000 tons; fuel, 30,000 tons)	...	...	...	44,000
Creswick (sawn timber for Clunes, 15,000 tons; sawn timber for Amherst, 2000 tons; sawn timber for Creswick, 2500 tons; fuel for Clunes, 30,000 tons; fuel for Creswick, 20,000 tons)	...	...	...	69,500

	Tons.
Castlemaine	37,500
Casterton	14,000
Daylesford (mining timber, 20,000 tons; fuel, 50,000 tons)	70,000
Dunkeld—Sawn timber, 800,000 feet; rails, 20,000 pieces; red-gum posts, 10,000 pieces.	
Eltham	13,600
Fryerstown	57,200
Geelong	52,000
Grant	4,600
Maryborough	200,000
Nunawading (cut under license)	10,000
„ („ without „)	190,000
Sandhurst	300,000
(Another informant gives the approximate quantity used solely for fuel at 160,000 tons.)	
St. Arnaud	6,500
Talbot (Shire of), and Borough of Amherst— Domestic fuel for 2887 houses, at 6 cords or 19½ tons, 55,430 tons; mining timber, 18,368 tons; mills, 3200 tons; charcoal, 3328 tons; public institutions, 2560 tons; bakers, &c., 1600 tons; fencing and building, 6400 tons	90,886
Taradale (two-sevenths for mining and five- sevenths for fuel)	8,750
Tarnagulla 20,000 to	30,000
Tylden (for fuel, 3890 tons; saw-mills, 15,500 tons; for splitters' use, 2476 tons)	21,466
Villiers, County of (approximately)	150,000
Whittlesea—As much as 1800 trees are an- nually used for palings, shingles, &c.	
Winchelsea	28,600
Wood's Point	8,700
Woodend (for firewood and split or squared timber cut under license, wholly exclusive of that used by saw-mills)	41,181

On the modes of raising or renovating forests, not much can be said on this occasion. For natural upgrowth, perfect clearing and fencing is recommendable. Subsequently, the removal of young crooked trees and the surplus of saplings is

needed. Seedlings may be transferred from spots where they stand too densely, to more open or bare places. Suckers should be destroyed where the gain of good timber is an object. Periodic clearing of young trees is effected according to the rate of growth of the particular species; lopping of branches is advisable should they densely meet. For broadcast sowing, the ground should be completely cleared and burnt. By breaking the ground a great acceleration of growth of the trees is attained, even to a tenfold degree. Planting in rows affords the best access for subsequent thinning and successive removal of the timber; the quincunx system will give approach in three directions. Pines are planted in Germany only about 7 feet apart, as they require least room of all trees; but 15 feet is a fair distance at an age of 40 years. The New Hampshire pine stands only 5 to 6 feet apart at an age of 50 years, and yet is not prevented by this crowded growth to be then 100 feet high; the stems are then very straight, 18 inches in diameter at the base. If pines and oaks are promiscuously planted, then the former, which act as nurse-trees, are moved in ten or twenty years, and the ground is left to the oak, or any other deciduous tree, at distances at first 10 or 12 feet apart, and subsequently wider still. No decayed wood is left in planted forests, as it would harbour boring insects. Pines are considered not to increase much in value after 80 years, when most of them have attained full maturity, and grow only afterwards slowly. Sometimes as many as 1200 pine-trees are set out on an acre, with a view of early utilisation of a portion of the young trees. The rate of growth may be much accelerated in most trees by irrigation; hence mountain streamlets should be diverted into horizontal ditches where forests are occupying hill-sides. The best-cultivated forests of Germany are worth from three to five times as much as native woods.

For shelter plantations, intended to yield ultimately also timber and fuel to farming populations, it is recommendable to adopt the American method, according to which belts of trees are regularly planted at about quarter-mile distance; the belts, according to circumstances, to be from four to ten rods wide, and to be formed in such direction as to front the prevailing winds. These timber-belts are usually fenced. Such shelter-trees are likely to rise to thirty feet in ten years, and have proved so advantageous as to double the farm crop, while judicious management of these tree-belts will supply the wood

necessary for the farm. There are 1,400,000 square miles of treeless plains in the United States, which in due course of time will necessarily be converted to a great extent into agricultural areas on account of the generally excellent soil. The locust tree is much chosen for shelter purpose. Denuded woodland of poor soil, left undisturbed to natural renovation, has become in some populous localities five times as valuable as the adjoining inferior tillage or pasture land. For the greatest profit in fuel the trees in some parts of North America are cut about every sixteen years. We here, commanding eucalypts, acacias and casuarinas, would gain wood-harvests still speedier. The increased value of less fertile lands through spontaneous upgrowth of timber is estimated at $\frac{1}{100}$ of simple interest annually in woodless localities, no labour being expended on this method of wood-culture. Judicious management in thinning-out enhances the value of such forest land still more. Wet and undrained grounds can be made to yield a return in elms, willows, cottonwood, swamp cypresses and other swamp trees, or stony declivities in pines and eucalypts, at a trifling cost. For details, the forest literature, which is in Germany particularly rich, should be studied. Capitalists would likely find it safer and more profitable, to secure land for timber growth, than to invest in many another speculation. After the example set at Massachusetts, our agricultural societies might award premiums and medals for the best timber plantations raised in their districts. We have societies for the protection of domestic animals, native or introduced birds, young fish, &c.: why could not a strong and widely-spreading league be organised for the saving of the native forests? Might not every child in a school plant a memorial tree, to be entrusted to its care, to awaken thus an interest in objects of this kind at an early age?

Reverting to the importance of shelter, let me remark that fifty years ago the peach flourished in North Pennsylvania, in Ohio and New York, where it cannot any longer now be grown, in consequence of the now colder and far more changeable climate, after the forests became extensively removed. Even ordinary orchards and cereal fields suffer there now. Yet poor land will yield a better return in wood than in corn crops, and it is not too much to say, that the favourable effect of a young forest on climate may be felt already after a dozen years. Even on ordinary sheep-runs trees are of the greatest importance both for shelter and shade.

Having endeavoured to explain forest value as it presents

itself in its primary aspects—namely, in reference to its importance to nature's great economy, and in reference to its timber resources, as viewed in the abstract—I now proceed to enter on a new field of consideration, which, though secondary in importance, is well deserving of our calm attention, and this all the more since this field of industrial enterprise remained yet almost bare or unharvested, whereas any utilisation of this new ground must have to inquiring minds more than ordinary charm.

I therefore now proceed to explain some of the technologic features of woodlands.

A leading industry in all forests is the production of charcoal. It may be made in mounds, caverns or ovens. The method most frequently adopted is that in mounds or meilers, and to this I may devote a few explanatory words, as not every one in this hall may be conversant with the process; for, simple as the process does appear, it is, after all, not performable without some skill, if coal of superior quality is to be the result. The wood is closely packed around a central post in regular form, the pieces either all horizontally, or oftener the lower vertically. Only such wood should be used as is unfit for timber; it must, however, be of one kind only, or of such various sorts as require the same degree of heat for being converted into a perfect coal. It must be sound and almost air-dry. A loamy sandsoil forms the best base for a mound; and this soil requires to be broken up, levelled and pressed, also dried by branchlets being burnt on the ground. The form of the mound or meiler is usually hemispherical, and support is given to this mound in the manner indicated in the sketch here presented, the outer support consisting of short logs of wood.

The inner part of the cover is formed of sods of grass, branchlets, rushes and similar substances; over this is placed the outer portion of the cover, consisting of moist forest soil, particularly fresh humus. The united covering must permit the vapours of the glowing meiler to escape. Shelter against wind is absolutely requisite; the operation of burning coal can therefore only be well performed in still air. The ignition commences from an opening left purposely either at the base, or less frequently at the summit of the structure, but either opening is closed again during the burning process. Caution is needed to prevent the expansive vapours and gases causing explosions during the glowing of the wood. To promote combustion on places where it may have been suppressed,

holes are forced through the covering on the second or third day, particularly on the lee side.

A bursting forth of gases of a blueish hue indicates active burning, and under such circumstances the access given to the air must be closed, while new perforations are made in any yet inactive portion of the meiler.

Over-great activity of fire is suppressed by water applied to the covering, or by adding to the thickness of the latter. Strong sinking of the cover during the earlier burning proves more or less complete combustion of the coal, and it may then become necessary to refill hurriedly the holes with wood or coal, underclosure of all openings, and careful restoration of the cover thus temporarily removed on one spot. This refilling in large meilers may be required for five days in succession; but the more carefully the mound has been built, and the more watchfully the early glowing process has been conducted, the less necessity will arise for the troublesome and wasteful process of refilling. A final additional covering becomes frequently needful. The operation closes by the sinking of the cover, or by its being partially forced downward, and the ready coals are removable one day afterwards. Partial withdrawals of coal can be effected from the lee side while the meiler is still active.

[The lecturer here described the process of charcoal-burning.]

The specific gravity of charcoal stands generally in a precise proportion to the specific weight of the wood employed. Drier wood realises a heavier, moister wood a lighter coal. Slow combustion also renders the coal heavier than a more rapid burning process, because in the latter case more carbon is consumed for various volatile products formed from the wood. As a rule, the quantity of coal obtained is about a quarter of the weight of wood employed. Good coal has a slight metallic lustre, is firm, not friable, causing a clear sound when thrown on the ground. It must burn without flame and smoke. For trade purposes coal must be kept dry, as its absorption of humidity is considerable.* The heating power of coal as compared to wood is ascertained to be as 100 to 55 or 60. An equal volumen of wood produces less heating effect than the same space of coal. For technic operations the equable and more lasting heat, and the great power of

* For extensive details consult Von Berg's *Anleitung zum Verkohlen*; also Muspratt's *Chemistry*.

radiation, give to charcoal its special value. Igniting wood for charcoal in caverns is wasteful, through the great access of air.

By the method of carbonising wood in ovens, tar and other volatile products can be secured. The wood chosen for coal, intended for gunpowder, is chiefly that of willows, poplars, alder and lime. It must be healthy, and is preferred from young trees. Woods which contain a good deal of hygroscopic salts—such as that of elms, firs, oaks—are not adapted for the purpose. Extreme degrees of heat in producing coal for gunpowder or blasting powder should be avoided, otherwise the best wood will not serve the purpose, because the powder would be less ready to ignite. The yield of this coal is 16 to 17-100ths from the wood. Local powder-mills are sure to be established here, especially as sulphur is readily obtainable from New Zealand. The increase of manufactures is also certain to augment the demand for wood and coal hereafter. For many industrial purposes charcoal is far preferable to fossil coal. Coals from various kinds of Victorian woods are placed before you.

It was my intention, while explaining the industrial resources of the forest, to show also how tar, vinegar and spirits might be obtained by heating wood in close vessels, at a temperature of 300 to 350 centigr., under a process called dry distillation. But I must reserve this subject for another occasion; for however simple the procedure may be regarded, as far as the actual performance of this artisan's work is concerned, yet the chemic processes, which are active in this form of decomposition, are of the greatest complexity; they present, moreover, according to the wood employed and according to the degree of heat applied, some peculiarities, which as yet have not been fully investigated, holding out hope for the discovery of some new dyes and other educts. It will be scarcely credited by most of this audience, that the paraffin, which now largely enters into the material for the candles of our households, is not only obtainable from bituminous slates, turf and fossil coal, but is also produced by the heating of wood under exclusion of air. This substance is furthermore a hydrocarbon of great purity; and its cheap preparation, along with other substances from our native wood, may possibly become a local source of immense wealth. For obtaining information on the products from heated wood, and the various apparatus employed in dry distillation, reference may be made to the great work, *Chemistry Applied to Arts and Manufactures*, by

Professor Muspratt, a man of genius and industry, whose death within the last few months we had so deeply to deplore.

Presented to you here are samples of tar, acetic acid and alcohol, from several of our more common woods; also pieces of pinewood, coated with eucalyptus tar, the black colour with its fine lustre having remained unimpaired for a series of years. Our wood-tar would for many industrial purposes be equal in value to the best kinds of other tar, and may prove in some respects superior to them.

Among the undeveloped wood-resources we must not pass that referring to Potash, particularly as this alkali can be obtained without sacrifice of any valuable timber, and from localities not accessible to the wood trade.

For the preparation of potash the wood, bark, branches and foliage are burnt in pits sunk three or four feet in the ground; the incineration is continued till the pit is almost filled with ashes. Young branches and leaves are usually much richer in potash than the stem-wood; hence they should not be rejected. The ashes thus obtained are placed in tubs or casks on straw, over a false bottom.

Cold water in moderate quantities is poured over the ash, and the first strong potash-liquid removed for evaporation in flat iron vessels, while the weaker fluid is used for the lixiviation of fresh ashes.

While the evaporation proceeds, fresh portions of strong liquid are added until the concentrated boiling fluid assumes a rather thick consistence.

At last, with mild heat and final constant stirring, the whole is evaporated to dryness. This dry mass represents crude potash, more or less impure, according to the nature of the wood employed.

A final heating in rough furnaces is needed, to expel sulphur combinations, water and empyreumatic substances; also, to decompose colouring principles. Thus pearlash is obtained.

Pure Carbonate of Potassa in crude potash varies from 40 to 80 per cent. Experiments, as far as they were instituted in my laboratory, have given the following approximate results with respect to the contents of potash in some of our most common trees. The wood of our sheoaks (*Casuarina suberosa* and *Casuarina quadrivalvis*), as well as that of the black or silver wattle (*Acacia decurrens*), is somewhat richer than wood of the British oak, but far richer than the ordinary pine woods.

The stems of the Victorian blue-gum tree (*Eucalyptus*

globulus) and the so-called swamp tea-tree (*Melaleuca ericifolia*), yield about as much potash as European beech.

The foliage of the blue-gum tree proved particularly rich in this alkali; and as it is heavy and easily collected at the saw-mills, it might be turned there to auxiliary profitable account, and indeed in many other spots of the ranges.

A ton of the fresh leaves and branchlets yielded in two analyses $4\frac{3}{4}$ lbs. of pure potash, equal to about double the quantity of the average kinds of pearlash. The three species of eucalypts spontaneously occurring close around Melbourne—the red-gum tree (*Eucalyptus rostrata*); the manna-gum tree (*Eucalyptus viminalis*); the box-gum tree (*Eucalyptus melliodora*)—produced nearly 3 lbs. of pure potash, or about 5 lbs. of pearlash, from a ton of fresh leaves and branches; while a ton of the wood of the red-gum tree in a dried state gave nearly 2 lbs. weight of pure carbonate of potassa, whereas the wood of the blue-gum tree proved still richer. A ton of the dry wood of the erect sheoak (*Casuarina suberosa*) furnished the large quantity of $6\frac{1}{2}$ lbs. of pure potash. This result is about equal to that obtainable from the European Lime-tree or Linden-tree, which again is one of the richest of all European trees in this respect.

Such indications may suffice to draw more fully the attention of forest settlers to an important but as yet latent branch of industry. For further details I refer to elaborate tables of the yield of potash in native trees, as the result from analysis made under my direction by Mr. Chr. Hoffmann, these tabulated statements being appended to my departmental report, presented to Parliament in 1869. The wholesale price of the best pearlash is about £3 for the cwt. in Melbourne.

I wish it distinctly to be understood, that I do not advocate an indiscriminate sacrifice of our forest-trees for any solitary one of its products, such as the potash; because by any such procedure we would still more accelerate the reduction of our woods. On the contrary, good timber, fit for splitting or for the sawmill, ought to be far too precious for potash or tar preparation. But branchwood, bark, roots, crooked stems and even foliage, might well be utilised for this industry, wherever the place is too remote to dispose of this material for fuel. The recommendation carries with it still more weight, if we remember how on many places the close growth of suckers or seedlings has to be thinned to allow of space for the new and unimpaired upgrowth of actual timber; whereas, moreover, now the remnants

at places where trees have been felled, often block by impenetrable barricades the accessible lines of traffic through the forests, and are frequently the cause of the extensive conflagrations of the woods, by placing so much combustible, dry and mostly oily material within the easy reach of the current of flames. Should, unfortunately, the fiery element have anywhere swept through the forest, it may then prove advantageous to collect the fresh ashes before they are soaked by rain, with the object of extracting thus large quantities of potash. The whole process of potash preparation being one of the simplest kind, and involving only a very trifling expense in casks and boiling-pans, can be carried out anywhere as a by-work, the profit thus being not reduced by skilled or heavy labour or by costly plant. The demand for potash must always be considerable, as it is required for the factories of nitre (particularly from soda saltpetre), one of the three principal ingredients of gunpowder and blasting powder; it is needed also for glass, alum, various kinds of soaps, dyes and many chemicals.*

Potash, although universally distributed, is best obtained in the manner indicated. I may remark, however, though deviating from my subject, that it is one of the most potent constituents in all manures, being especially needed in the soil for all kinds of root-crops, for vine and maize; nor can most other plants live without it altogether, although the quantity required may be small; but I must add, for manuring, potash by itself would be far too valuable.

Almost every kind of forage affords potash salts, these being among the necessities for the support of herbivorous animals. Their undue diminution in food is the cause of various diseases both in the animal and vegetable world; or predisposes, by abnormal chemic components of the organisms, to disease.

The muscles of the human structure require a comparatively large proportion of carbonate of potassa; it is also absolutely required in blood, predominating in the red corpuscles. Plants grown in soil of rocks containing much felspar—such as granite, gneiss, syenite, some porphyries, diorite—are always particularly productive in potash, potassium entering largely into felspatic compounds. The latter mineral yields in most cases from twelve to fourteen per cent. of potassa, which, if

* Flint-glass contains about a fifth pure pearlash; crown-glass, the best of window-glass, rather more than a quarter. Some potash-nitre is wanted also in either case.

changed to carbonate, would become augmented by nearly one-half more. It is fixed chiefly to silicic acid in felspar, and thus only tardily set free through disintegration, partly by the chemic action of air, water and various salts, partly through the mechanic force of vegetation.* The importation of potash into Victoria during 1870 was only 170 tons, but with the increase of chemic factories we shall require much more.

It has justly been argued, that the chemic analysis affords a very unsafe guidance to the artisan, as regards the quantity of potash obtainable from any kind of tree or other plant, inasmuch as necessarily the percentage must fluctuate according to the nature of the soil, this again depending on geologic structure and the quality and quantity of decaying foliage on any particular spot. It should, however, not be quite forgotten, that most plants have a predilection for that soil which contains, in regions otherwise favourable to them, also due proportions of such mineral particles as are essentially necessary for the normal nutrition of the peculiar species; for, otherwise, in the wild combat for space it would succumb or cede before the more legitimate occupant of such soil. Hence, at a glance, even from long distances, we may recognise in many of our forest-regions an almost abrupt line of demarcation between the gregarious trees, where one geologic formation meets or replaces the other. Thus, trees richer in potash, or oils, or any other product, may often be traced with ease over their geologic area, for which purpose the admirable maps of Mr. Selwyn and his collaborators afford us here in Victoria also in this respect already so very much facility.

I have often been led to think, that many an indigent person might find employment by collecting the wood-ashes, which, as a powerful manure, or as material for a local potash factory, ought to realise a fair price. Such an employment would be probably as lucrative as collecting glass, or bones, or substances for paper-mills; while the ashes, now largely wasted, would be fully utilised.

It may be assumed, that at an average the ash of our ordinary eucalypts contains 10 per cent. of crude potash, equal to about 5 per cent. pure potash. A bucketful of wood-ash such as we daily remove from our domestic fire-places, contains about 25 lbs., from which accordingly about $2\frac{1}{2}$ lbs. of inferior, or $1\frac{1}{4}$ lb. of superior potash, may be obtained; the

* The proverb of chemistry—" *Corpora non agunt, nisi fluida*"—is here also applicable.

former being worth about 6d. per lb., the latter double the price. For ascertaining the contents of carbonate of potassa in crude potash or pearlash, certain instruments, well known as alkali-meters, are constructed. The heaviest ashes, as a rule, contain the greatest proportion of potash. The brake-fern, so common on many river banks and sandy tracts of the country, is rich in this alkali.

Apart from my subject, I may however say, that there are other sources of potash salts than trees alone. Chloride of potassium is obtained from some large salt-beds, for instance, in Prussia: from this source it was supplied to British manufactories in 1869 to the extent of 154,468 cwt., valued at above £60,000. This chloride is besides obtained, under Mons. Balard's process (Report of Juries at the International Exhibition for 1862), in considerable quantities from sea-water, as one of the contents to be utilised. From this chloride the various potash salts, otherwise largely obtained from pearlash, can be also prepared. Chlorides and sulphates, if they occur in crude potash, can, in the process of purification, almost completely be removed through crystallisation from the greatly concentrated solution.

Let us now approach another forest industry, one quite unique and peculiar to Australia—namely, the distillation of volatile oil from eucalyptus and allied myrtaceous trees. While charcoal, tar, wood-vinegar, wood-spirit, tannic substances and potash, are obtainable and obtained from the woods of any country, we have in Australia a resource of our own in the eucalyptus oil. In no other part of the globe do we find the myrtaceæ to prevail: in Europe it is only the myrtus of the ancients, the beautiful bush for bridal wreaths, which there represents this particular family of plants; and although copious species of *Eugenia* and other berry-bearing genera, including the aromatic clove and allspice, are scattered through the warmer regions of Asia, Africa and America, all pervaded by essential oil, they do not constitute the main bulk of any forests as here, nor can their oil in chemic or technic properties be compared to that of the almost exclusively Australian eucalyptus. This special industry of ours exemplifies also, in a manner quite remarkable, how from apparently insignificant experiments may arise results far beyond original anticipations. When in 1854, as one of the Commissioners for the Victorian Industrial Exhibition, held in anticipation of the first Paris Exhibition, I induced my friend, Mr. Joseph Bosisto, J.P., to distil the oil of one of our eucalypts, I merely

wished to show, that this particular oil might be substituted for the comparatively costly oil of cajuput, obtained in some parts of India, and rather extensively used in some countries for medical purposes. For the exhibition of 1862 about thirty different oils were prepared by the same gentleman, chiefly from various eucalypts, and from material mostly selected by myself for the purpose. This led not merely to determining the percentage of yield, but also to extensive experiments, here chiefly by Messrs. Bosisto and Osborne, and in London by Dr. Gladstone, in reference to the illuminating power, the solvent properties, and other special qualities of each of these oils. The principal results of these experiments were recorded in reports of the exhibition jurors at the time. Mr. Bosisto, with great sagacity and a commendable perseverance, but also at first with much sacrifice of capital, carried his researches so far as to give to them great utilitarian value and mercantile dimensions; moreover, he patented a process, by which he was enabled to derive from the eucalyptus foliage the greatest amount of the purest essential oil with the least consumption of fuel and application of labour. Under this process it became possible to produce the oil at a price so cheap as to allow the article to be used in various branches of art—for instance, in the manufacture of scented soap, it having been ascertained that this oil surpassed any other in value for diluting the oils of roses, of orange-flowers and other very costly oils, for which purposes it proved far more valuable than the oil of rosemary and other ethereal oils hitherto used. Suddenly, then, such a demand arose, that our thoughtful and enterprising fellow-citizen could export already about 9000 lbs. to England and 3000 lbs. to foreign ports, though even now this oil is as yet but very imperfectly known abroad. The average quantity now produced at his establishment, for export, is 700 lbs. per month. Alcoholic extracts of the febrifugal foliage of *Eucalyptus globulus* and *E. amygdalina* have also been exported in quantity by the same gentleman to England, Germany and America. Similar substances from various *melaleucas* might be added. Originally an opinion was entertained, that all the eucalyptus oils have great resemblance to each other; such, however, proved not to be the case when it came to accurate experimental tests. Thus, for instance, the oil, which in such rich percentage is obtained from *Eucalyptus amygdalina*, though excellent for diluting the most delicate essential oils, is of far less value as a solvent for resins in the fabrication of select varnishes. For

this latter purpose the oil of one of the dwarf eucalyptus forming the Mallee Scrub, a species to which I gave, on account of its abundance of oil, the name "*Eucalyptus oleosa*" nearly a quarter of a century ago, proved far the best. It is this Mallee oil, which now is coming into extensive adaptations for dissolving amber, Kauri resin and various kinds of copal. Mr. Bosisto's researches are recorded in the volume of the Royal Society of Victoria for 1863; Mr. Osborne's, in the Jurors' Reports of the Exhibition of 1862. For alluding so far to this oil distillation, I have a special object in view. I wish to see it adopted near and far as a collateral forest industry, now that the way for the ready sale of this product is so far paved. The patentee is willing to license any person to adopt his process, and he is also ready to purchase the oil at a price, which proved remunerative to the producer. If it is now considered, how inexhaustible a material for this oil industry is everywhere accessible in our ranges, how readily it is obtainable, particularly at saw-mills and at splitters' establishments, and how easily the process of the distillation can be performed, it would be really surprising should these facilities not be seized upon, and should under such favourable circumstances not a far larger export of this mercantile commodity be called forth. Those eucalypts are the most productive of oil in their foliage, which have the largest number of pellucid dots in their leaves; this is easily ascertained by viewing the leaves by transmitted light, when the transparent oil glands will become apparent, even without the use of a magnifying lens. Mr. Bosisto is also a purchaser of scented flowers, indigenous as well as cultivated, including even the wattle flowers, for the extraction of delicate scents, under a clever process discovered by himself; and it is astonishing what an enormous demand for these perfumes exists in European markets. This may be a hint to any one living in or near the forests, where the extraction of the scent could be locally accomplished from unlimited resources, with little trouble and cost.

There exists another special industry in its incipient state among us, which might be regarded as essentially Australian, and which also might be widely extended: I mean the gathering of seeds of many kinds of eucalyptus, and also of some acacias and casuarinas, for commercial export. No doubt the collecting of seeds is effected among the forest-trees of any country, and very important branches of industry these gatherings are, in very many localities abroad. But what gives

to our own export trade of forest seeds such significance, is the fact, that we offer thereby means of raising woods with far more celerity and ease, than would be possible through dissemination of trees from any other part of the globe, it being understood that the operations are instituted in climatic zones similar to our own. Trees with softer kinds of woods, such as poplars and willows, even though they may rival some of the eucalypts in quickness of growth, cannot be well drawn into comparison, as most of them do not live in dry soil, nor attain longevity, nor assume gigantic dimensions, nor furnish timber of durability. But there are still other reasons, which have drawn our eucalypts into extensive cultural use elsewhere—for instance, in Algeria, Spain, Portugal, Italy, the south of France, Greece, Egypt, Palestine, various uplands of India, the savannahs of North America, the llanas of South America, at Natal and other places in South Africa, and even as near as New Zealand.* One of the advantages offered is the extraordinary facility and quickness with which the seeds are raised, scarcely any care being requisite in nursery works, a seedling, moreover, being within a year, or even less time, fit for final transplantation. Another advantage consists in the ease with which the transit can be effected, in consequence of the minuteness of most kinds of eucalyptus seeds,† there being besides no difficulty in packing on account of the natural dryness of these seeds. For curiosity's sake I had an ounce of the seed of several species counted, with the following results:—

Blue-gum tree, one ounce—sifted fertile seed grains,
10,112.

Stringy-bark tree (unsifted), 21,080.

Swamp-gum tree (unsifted), 23,264.

Peppermint Eucalypt (unsifted), 17,600.

According to this calculation we could raise from 1 lb. of seeds of the blue-gum tree 161,792 plants. Let us suppose, for argument's sake, that only half the seeds of such grew, the number of seedlings would be enormous; and even if only the seedlings of one-quarter of the seeds of 1 lb. finally were

* The seeds of *Eucalyptus rostrata* (our red-gum tree) are available for all tropic countries, inasmuch as this species, which is almost incomparably valuable for its lasting wood, ranges naturally right through the hot zone of Australia.

† The seeds of the West Australian red-gum tree (*Eucalyptus calophylla*) and the East Australian bloodwood tree (*Eucalyptus corymbosa*) are comparatively large and heavy.

established, they would suffice, in the instance of the blue-gum tree, to cover 404 acres, assuming that we planted at the rate of 100 trees to the acre (allowing for thinning-out). The following notes for comparison may be of interest:—

	Grains.
1 oz. of seed of <i>Pinus Pinaster</i>	contains 730
1 " " " <i>Pinea</i>	" 38
1 " " " <i>Haleppensis</i>	" 940
1 " " " <i>Alba</i>	" 10,080
1 " " <i>Cupressus sempervirens</i>	" 4,970
1 " " <i>Fraxinus ornus</i>	" 316
1 " " <i>Betula alba</i>	" 34,560
1 " " <i>Acer pseudoplatanus</i>	" 183

It seems marvellous that trees of such colossal dimensions, counting among the most gigantic of the globe, should arise from a seed grain so extremely minute.

The exportation of eucalyptus seeds has already assumed some magnitude. Our monthly mails conveyed occasionally quantities to the value of over £100; the total export during the last twelve years must have reached several or perhaps many thousands pounds sterling. For the initiation of this new resource, through his extensive correspondence abroad, the writer can lay much claim; and he believes that almost any quantity of eucalyptus seeds could be sold in markets of London, Paris, Calcutta, San Francisco, Buenos Ayres, Valparaiso and elsewhere, as it will be long before a sufficient local supply can be secured abroad from cultivated trees.

Monsieur Prosper Ramel, of Paris, stands foremost among those, who promoted eucalyptus culture in South Europe.

Facts, such as just alluded to, may give an idea with what ease the eucalyptus can be disseminated over extensive areas. Although the first cost of seeds, or the facilities for their transit, preservation and germination, can only enter to a small extent into consideration, when an object so important as that of raising or restoring forests is to be attained, yet the data thus far given in reference to some of the best eucalypts cannot but tend towards encouragement of culture here and abroad. Indeed, among nearly all the trees of the globe, most of our eucalypts, together with species of the allied genera—*tristania*, *angophora*, *melaleuca* and *metrosideros*—produce seeds the most minute and the most copious. The seeds of the birches and of most species of *ficus* are, however, also remarkably light and numerous.

At sawmills and splitters' establishments, the gathering of seeds, particularly through the aid of children, might be carried on most conveniently and most inexpensively, the sums realised therefrom being clear gain. The same may be said of collecting the abundant gum-resins of various eucalypts, which for medicinal and technologic purposes are now in much demand for export. Purchasers in the city offer about 1s. per lb. The liquid very astringent exudations of the eucalypts are also saleable. The precise quantity of tannic substance to be obtained from saplings and foliage of various eucalypts, acaciæ and casuarinæ, remains yet unascertained; but it is likely large enough, to base on their yield of tannic acid special forest industries.

For belts of shelter-plantations, again, no country in the warm temperate or subtropic zone could choose trees of easier growth, greater resistance, rapidity of increment, early and copious seeding, contentedness with poor soil, and yet valuable wood for various purposes, than some of the Australian acaciæ and casuarinæ. They exceed much in quickness of growth the coast shelter-pines of South Europe—*Pinus halepensis* and *Pinus pinaster*; but are not all equally lasting. The trade in seeds of this kind is also not unimportant, and the sources of it are at least partly in our sylvan lands.

Still another forest industry might be viewed as especially Australian—namely, the supply of fern-trees for commercial exportation. Though about 150 different kinds of fern-trees are now known, they are mostly children of tropical or subtropical countries, and these again nearly all restricted to the humid jungles or the shady valleys meandered by forest brooks. Very few species of these noble plants extend to a zone so cool as that of Victoria, Tasmania and New Zealand. Again, among this very limited number the stout and large *Dicksonia antarctica* is not only one of the tallest of all the fern-trees of the globe, but certainly also the most hardy, and the one which best of all endures a transit through great distances. Indeed, a fresh frondless stem, even if weighing nearly half a ton, requires only to be placed without any packing in the hold of a vessel as ordinary goods, to secure the safe arrival in Europe,* the vitality being fully thus retained for several months, particularly if the stem is occasionally moistened, and kept free from the attacks of any animals. Through my unaided exertions these hardy fern-trees became, like many other

* No fern-tree is indigenous to Europe.

of our resources, fully known in many countries; and while their value became established, a market for them has now been gained. I would, however, not countenance the vandalism of denuding every one of our fern-glens of its pride, as, even with all care, in half a century the pristine grandeur of the scenery could not be restored; yet when we consider, that hundreds of gullies are teeming with these magnificent plants, we can well afford to render them accessible also to all the conservatories of the winterly north, in order that the inhabitants there may indulge in admiration of such superb forms of vegetable life—even though a fern-tree group in a glass house can convey but a very inadequate idea of the wild splendour of our fern ravines. Not without pain I have seen constructed the base of whole tramway lines in some of our forest-gullies almost exclusively of fern-trees, for the conveyance of timber. A watchful Forest Board would prevent such sacrifice, and would save also the tall palm-trees of East Gipps Land from sharing the fate of those princely trees at Illawarra and elsewhere. [Since writing this, our Livistonas or fan-palms, have been protected by Government interdiction; the law forbids also the indiscriminate removal of red-gum trees from the banks of the Murray River. In Queensland, every bunya-bunya tree and native nut-tree is secured against being felled. The very local and circumscribed Kauri forests, known only in two limited spots, would also need some protection.] To the facilities of exporting the huge, square todea ferns—a commerce initiated by myself—I alluded on a former occasion.

Having dwelt on some of the technologic or mercantile products obtainable from the native forests—few, it is true—I now pass on to some brief observations in reference to enriching the resources of our woods.

Among new industries, which by introduction from abroad are likely to be pursued in sylvan localities, that of the cultivation of the tea-shrub of China and of Assam stands, perhaps, foremost. It is a singular fact, that even in the genial clime of Southern Europe, and under advantages of inexpensive labour, the important and lucrative branch of tea-culture has received as yet no attention whatever. This is probably owing to the circumstance, that hitherto the laborious manual process of curling the fresh tea-leaves under moderate heat has never yet been superseded by adopting for the purpose rollers, worked and heated by steam, though such contrivance was suggested here by me many years ago.

The tea thus obtained could always be brought to its best

aroma by such a mode of exact control over the degree and duration of the heat. Tea-culture in the ranges would show us which soil, or which geologic formation, produced here the best leaves. The yield of the latter would in the equable air of the humid forest-glens be far more copious than the harvests which we obtain from the tea-bushes planted in poor soil or exposed localities near the metropolis, while localities in the ranges are often not accessible to ordinary cereal culture. But I do not speak of tea-cultivation as an ordinary field industry, but rather as a collateral occupation in forest-culture of the lower ranges.

Foreseeing the likelihood that this branch of rural culture would be adopted in many favourable warm spots of this colony, I have distributed during the past dozen years the tea-bush rather extensively among country residents, partly with a view of directing attention to a plant which, even for the sake of ornamental value, is so eligible and easily grown; partly with an intention of seeing thus independent local supplies of seeds forthcoming. In the same way the cork oak was also very generally distributed by myself, in order that their acorns might, in due time, become locally accessible in very many places.

The tea, in its commercial form, will however, here, not likely be manufactured by the grower. It is more probable that whenever plantations are formed in any forest region, an enterprising man will establish, amidst the tea-farms, a factory for preparing the tea-leaves, and purchase the latter from the producers. This is the system, by which in many parts of South Europe the multitude of small lots of silk-cocoons pass into the central reeling establishments; and this is the manner in which, from numerous peasants, the beet-root is obtained for the supply of sugar factories. In the same way the branches of the Sumach, a shrub which with care could be reared in our ranges, would be rendered saleable at a central sumach mill.* The demand for tea being so enormous, and geographic latitudes like ours being those which allow of its growth, it will be fully apparent that it must assume a prominent part in our future rural economy, particularly as the return for capital and labour thus invested and expended will be quite as early as that from the vine. The

* An essay by Professor Inzenga, on Sumach-culture in Sicily, translated by Colonel H. Yule, C.B., is published in the Transactions of the Botanic Society of Edinburgh, vol. ix. 341-355; and was, on my suggestion, transferred to a local journal.

importation of tea into Victoria during 1870 has been valued in the Customs returns at £496,623; whereas Victoria might largely export this highly-important and remunerative commodity.

The simple process of gathering the leaves might be performed by children.

In the foregoing pages I alluded cursorily to the Cork Oak; let me add my opinion, that in any locality with natural boundaries, such as abrupt sides of ranges, deep watercourses, where fences could be largely obviated, the cork-tree might well be planted as a forest-tree, and thus estates be established at little cost, with hardly any expense of maintenance, from which a periodic yield of cork might be obtained for several successive generations. The investment of a limited capital for raising a cork forest in any naturally defined locality, would, as I said, create a rich possession for bequest. Even if by new inventions an artificial substitute for cork was found, the wood of the cork oak would still be of some value. The State might also reserve any forest area with natural boundaries for its various wood requirements.

Many other cultural resources of forests are as yet very inadequately recognised. The dye-saffron might be grown as much for amusement as for the sake of its pretty flowers (just as an ordinary bulb), wherever juvenile gatherers are to be had. Equally lucrative might be made the culture of another plant, the medicinal colchicum, a gay autumnal flowering bulb, worthy of a place in any garden. In apt forest spots both would become naturalised. Amidst the forests, in glens which skirt the very base of alpine mountains, on the M'Allister River, opium was produced without any toil, almost as a play-work, to the value of £30, from an acre. Mr. Bosisto, who on that particular locality called forth this industry, found on analysis, that the Gipps Land opium proved one of the most powerful on record, 10/100 of morphia being its yield. Small samples of opium, prepared in the Melbourne Botanic Garden, were exhibited some years ago at the International Exhibition. The Hon. John Hood, of this city, promoted much the opium industry in this country by the extensive distribution of seeds of the Smyrna poppy; he found the yield here, in favourable seasons and by careful operation, to be from 40 to 50 lbs. on an acre, worth at present 30s. to 35s. per lb. The value of the opium imported into Victoria during 1870, according to customs returns, was £150,681. The banks of many a forest brook,

and the slopes within reach of irrigation from springs, might doubtless in numerous instances be converted into profitable hop-fields, the yield of hop in Gipps Land having proved very rich. Mr. A. M. M'Leod obtained, in one instance, 1500 lbs. hops from an acre of ground at Bairnsdale. Messrs. A. W. Howitt, F. Webb and D. Ballentine had there also large returns from their hop-fields. As an instance how large a revenue might be realised from forest land in a variety of ways, quite irrespective of wood supply, I adduce the fact, that the income obtained by the Forest Department of Hanover from the mere gathering of fruit—chiefly bleeberries—amounted to £21,750 during one of the late years. The Hanoverian forests comprise an area equal to the county of Bourke, our metropolitan county, and occupy one-seventh of the territory. Speaking of Hanover, let me add, that the laws promulgated this year in that country render it compulsory on each district to line its roads with trees, the widest distance allowed from tree to tree being 30 feet; similar laws were in force long since in other parts of Germany; fruit-trees are among the trees chosen for these lines. Would it not, therefore, be advisable to naturalise along our forest-brooks and in our shady vales such plants as the raspberry bush, the strawberry plant and others, which readily establish themselves. In one of my exploring tours, when it fell to my lot to discover the remotest sources and tributaries of the River Yarra, and to ascend first of all Mount Baw Baw, I scattered the seeds of the large-fruited Canada blackberry along the alpine springs; and I have since learnt that this delicious fruit is now established on the rivulets of that mountain. We may hear of equal successes of experiments which I elsewhere instituted. The truffle, though not an article of necessity, might be naturalised in many of our forests, especially in soil somewhat calcareous. Would any one imagine, that during one recent year (1867) the quantity collected in France was valued at £1,400,000 (35,000,000 francs). The time allotted to my address is not sufficient to add much to these instances.

On various occasions I drew attention to the likelihood of Peru-bark plants being eligible for culture in the sheltered and warmer parts of our woods, inasmuch as in brush shades of the Botanic Gardens the cinchonæ endured a temperature two or three degrees under the freezing point. Last year cinchona plants given by me to Mr. G. W. Robinson, of Hillesley, near Berwick, for experiment, passed quite well

through the cool season without any cover. The lowest temperature at Harmony Valley, Blackwood Gully, in the Dandenong Ranges, observed during 1866 by Mr. Jabez Richardson, who on my request kindly undertook the thermometer readings there during that year, was still one degree above the freezing point, while the temperature at the Melbourne Observatory sunk to 28 degrees F. Let me note, however, that simultaneously frost occurred in the open flats of Dandenong; hence the great importance of forest shelter in cases like this. East Gipps Land, with its mild temperature, is likely to prove the aptest part of the Victorian colony for Peru-bark cultivation. Who does not remember the deep grief into which a small insular colony sunk within the last few years, when its population became actually decimated by fever, and when, after 150 years of existence of that unhappy colony, only just the first cinchonas had been planted.

In some of the uplands of New South Wales, where it was desirable to clear away bush vegetation—such, for instance, in which Daviesias or native hop, predominated—angoras proved very effectual for the purpose. Doubtless there are many forest tracts, where this measure could be adopted with advantage to gain grass pasture, without any injury being done to large native trees; but the smaller trees are likely to suffer, while the underwood might in many instances be better utilised for potash or oil. At all events, goats are among pastoral animals the most destructive to vegetation, and much of the forests on the Alps of Switzerland and Tyrol were destroyed by the indiscriminate access given to goats. The angora, with its precious fleece, can therefore be only located in some forest regions; it thrives, moreover, in the desert.

I might allude on this occasion also to the great productiveness of bees in our forests, the flowers of so many of our native plants, and among them those of the eucalypts, being melluginous, blossoms of some kind or the other being available all the year round. Cuba, with an area less than half that of Victoria, exported in the year 1849 so large a quantity of honey as 2,800,000 lbs., and about 1,000,000 lbs. of wax. I believe the export has since increased. A forest inhabitant might devote a plot of ground near his dwelling to the earthnut or pea-nut, an originally Brazilian plant, of which latterly about 900,000 bushels were produced annually in the United States for the sake of its excellent table oil. In *Harper's Magazine* of 1870 it is stated, that of the earthnut in 1869

not less than 235,000 bushels were brought to New York. It is estimated that Virginia, Tennessee, Georgia and Carolina have conjointly sent over 1,000,000 bushels to market in 1870. The yield, it is said, is from 80 to 120 bushels on an acre. The seeds are slightly roasted for the table, or pressed for a palatable oil. As much as 10s. to 12s. is paid for the bushel in New York. The plant seems well eligible for forest farms, particularly in a somewhat calcareous soil. In the garden under my control I have reared it with ease.

I intended to have spoken of the various implements especially designed for wood-culture; but time will not admit of it. Thus, merely by way of example, I place before you one of those utensils—the hohlborer, or, as it might be called, the “bore-spade”—brought into use nearly fifty years ago by a scientific forester, Dr. Heyer of Giessen. Several thousand plants of the Scotch fir and of other pines can be lifted with this bore-spade in a day by one forest labourer, the object being, that each seedling should retain a small earth-ball, to facilitate the success of the moving process. About 10,000 such seedlings are conveyed at a time in a forest waggon.*

As yet, it must be confessed, our colony, with others in the Australian group, has accomplished but very little in any branch of sylvan maintenance, or forest-culture, or the advance of industrial pursuits in our woodlands.

One precursory step, however, has been made, and this is likely to be followed. I allude to the extensive gratuitous distribution of plants to public grounds in most parts of our colony—a distribution which has been in operation under the authority of Government from ground under my control for the last twelve years. I should think it not unlikely, that this raising of trees in masses will soon become also a special object of attention to the Railway Department within its own areas, to re-supply its own wants.

While a divine may withdraw some of his slender means, or a teacher may devote a share of his scanty earning, to enclose the ground of his dwelling, with a view of protecting a few trees on spots not really their own, we may be sure that the authorities do not wish to see hundreds of miles of railway fences long left unutilised, so far as planting of trees is concerned, particularly as such fences for this purpose affords

* Since this lecture was delivered, a short account of the bore-spade has appeared in the Melbourne *Economist*.

much ready inducement. The average width of the railway area is two and a-half chains, both on the Ballarat and Echuca lines, therefore far wider than that of European lines, and spacious enough for tree plantations at least of some kinds. The length of the N.E. Railway line will be 185 miles, giving consequently 370 miles length for plantations. The slower-growing or less lofty trees would there be on their place, such as our red-gum tree, the iron-bark tree, the W. A. yarrah, the blackwood tree, the British oak, the Quebec and live oak, the corkoak, the elm, the ash, the totara, the chestnut tree, the walnut, the hickory, and many others which do not suffer from exposure; for while the railway loan will last for an indefinite period, the railway material, such as the fences, sleepers, cars, will not last for ever, and for these the wood might thus inexpensively become reavailable in due time. Even where the railway space is narrow, the operation of lopping the planted trees along its lines might most readily be resorted to, and dangerous encroachments thereby be avoided.

No one ever expected our most serviceable Railway Department to be burdened with the additional heavy task of entering on cultural pursuits, and I see no way of attaining the object here specially indicated unless purposely financial means and administrative organisations were provided by the State.

In a special work (*Die Bepflanzung der Eisenbahn Dämme*, &c., by E. Lucas, second edition, 1870), the methods adopted in Germany for utilising the railway dams, and the free space within railway fences, for wood and fruit culture, is amply discussed. With the increasing value of culture-land, this question of utilising the spare ground along railways becomes more and more important. Where the space proves too narrow for rearing timber trees, hazel, olives, figs, mulberries, almonds, osiers, sumach, myall, ricinus, blackberries, and such other lower trees or bushes as require no great attention, could doubtless be grown with profit. It might also be possible to establish advantageously permanent hedges of hawthorn, opuntias, Osage orange, and other not readily inflammable and easily managed bushes. Luzern and sainfoin are much cultivated along continental railway lines as fodder herbs.

In North America 650 walnuts or hickories are planted on an acre; though standing so close, they are worth twelve shillings in twenty years for a variety of purposes. If wanted for heavy timber or nuts, they are thinned out so as to

keep them twenty feet apart. This may serve as an indication how spare places on railways might be utilised. Our regular and quick communication with California is giving now easy opportunity for importing nuts of the various American hickories and walnut-trees in quantity; while of the ordinary Persian walnut-tree seeds can already be obtained both here and in Tasmania. Resinous pine-trees may possibly increase any danger of conflagrations on railway lines. Nurseries for sowing seeds of hardy utilitarian trees might at once be established on all the railway stations at comparatively little cost.

The only effective public effort hitherto made to anticipate the necessities of forest culture consists in the planting of public reserves, parks, churchyards, school-grounds, cemeteries, and the area of many of our public buildings. The trading horticulturists have also largely aided in the importation and raising of foreign trees.

In this effort, as already remarked, I took a prominent share, or perhaps in many instances it originated from impulses or supports given by myself.

Undoubtedly, it was a primary object to cover the dismal barrenness of public grounds, to help in mitigating thereby local dryness and heat, to afford shade and shelter, and to render many a barren spot a pleasing retreat.

But this was not my only object. I had a second, and, to my mind, higher one in view.

I wished that, locally, many nuclei for forest culture should be formed; that, within comparatively few years, seeds should almost everywhere become available in masses from local tree-plantations; and that thus the efforts now made for parks and pleasure-grounds should be enlarged for creating more or less extensive forests.

These ideas may perhaps excite some surprise, yet I feel confident that they will and must be acted on, before, in frightful truthfulness, the terrors of a woodless country in *our* zone, and settled with a future *dense* population, will be encountered.

Should, however, my warnings fail to impress the public mind, then at least I have placed my views on record, and should not be held responsible for interests, however vital, which the trust of my position must largely bring under my reflection and care.

My effort in supplying merely material for raising local

plantations all over the colony is, however, but the first step in a great national work of progress; and I think we may reflect, not without some pride, that this public step was made in Australia here first of all.

Half a million of plants, distributed by me to public institutions, is, after all, but a trifle in a country that requires hundreds of millions of foreign trees, if it really is to advance to greatness and the highest prosperity; a greatness that will be retarded in the same degree as attention to this, as one of its most urgent interests, is deferred.

The gifts of plants from the establishment under my control have provided the country with many a species that otherwise would not have existed here yet. Many of the magnificent or quick-growing Himalayan and Californian pines, not to speak of others, became through my hand first dispersed by thousands and thousands; and although I may have incurred the displeasure of a few of the less thoughtful of my fellow-citizens, who wished the slender means of my young establishments appropriated for the ephemeral glory of floral displays, and who wished to sacrifice lasting progress to unproductive gaiety, yet I feel assured, that the fair feelings of the inhabitants of Victoria in general will approve of the path of predominant utility, which I struck out for myself, and will respect the considerations which prompted me, in an equitable spirit towards town and country, to attend in the first instance to pressing necessities, leaving the unnecessary or less useful for the exertions of a later time.

If a census of the trees, which are to furnish us much seed for forest culture, could be held all over the colony, perhaps my early efforts would be viewed with more justice and gratitude.

“They did of solace treat,
And bathe in pleasure of the joyous shade,
Which shielded them against the broiling heat,
And with green bough decked the gloomy glade.”

SPENSER.

In passing through a demolished forest, how saddening to us its aspect! What mind capable of higher feelings, can suppress its sympathy, when we see stretched and withering on the ground a princely tree, which but a few hours previously was an object of our admiration, and a living monument of magnificence and glory. Do you think it had its

enjoyment? Does it send mere automatically, without animation or sensibility of any kind, its crown to the sunny sky, or drinks joyless the pearly dew? Do you think it closes its flowers but mechanically, or unfolds them again to imbibe light and genial warmth, absolutely without gladness or pleasure of any kind? What is vitality, and what mortal will measure the share of delight enjoyed by any organism! Why should even the life of a plant be expended cruelly and wastefully, especially if, perhaps, this very plant stood already in youthful elegance, while yet the diprotodon (a wombat of the size of a buffalo) was roaming over the forest ridges encircling Port Phillip Bay—when those forest ridges on the very place of this city were still clothed in their full natal garb. Do not assume that I lean to transmutation doctrines; or that to my understanding there is an uninterrupted transit from the thoughts which inspire the mind to the faculties of animals and to the vitality of plants! Yet that individual life, whatever it may be, which we often so thoughtlessly and so ruthlessly destroy, but which we never can restore, should be respected. Is it not as if the sinking tree was speaking imploringly to us, and when falling wished to convey to us its sadness and its grief? Like the nomadic wanderer of the Australian soil passed away before us, so I fear most of the traces of our beautiful and evergreen forests will be lost ere long.

. . . "It is a goodly sight to see
 What heaven has done for this delicious land;
 What flowers of fragrance blush on every tree,
 What glad'ning prospects o'er the hills expand!
 But man would mar them with an impious hand."

BYRON.

Beyond the plainly utilitarian purposes of our forests (some of which I endeavoured briefly to explain), and beyond all the important functions which the woods have to perform in the great economy of nature, they possess still other claims on our consideration, such as ought to evoke some feeling of piety towards them. It was in the forests where the poetic mind of Schiller, during his early boyhood,* first of all awoke to its deep love for nature; where his strong sense for noble rectitude was formed; where he framed his ideals of all that is elevated and great. This influence of nature we see reflected in other lofty minds; it leads true genius on its luminous

* *Sketch of the Life of Schiller*, by Sir Edw. Bulwer Lytton, p. 2.

path. Contrast the magnificence of a dense forest, before the destructive hand of man defaced it, with the cheerless aspect of wide landscapes devoid of wooded scenery—only open plains or treeless ridges bounding the horizon. The silent grandeur and solitude of a virgin forest inspires us almost with awe, much more so than even the broad expanse of the ocean. It conveys also involuntarily to our mind a feeling as if we were brought more closely before that Divine Power by whom the worlds without end were created, and before whom the proudest human work must sink into utter insignificance. No settlement, however princely—no city, however great its splendour, brilliant its arts, or enchanting its pleasures—can arouse those sentiments of veneration which, among all the grand works of nature, an undisturbed noble forest-region is most apt to call forth. I never saw truly happier homes of unmingled contentedness than in the seclusion of the woods. It is as if the bracing pureness of the air, the remoteness from the outer world, the unrestricted freedom from formal restraint, gives to forest life a charm for which in vain we will ever seek elsewhere. The forest inhabitant as a rule sees his life prolonged; an air of peace on all sides surrounds him; even with less prosperity he is glad to break away from the turmoils and enmities into which elsewhere he is thrown by the bustle and struggle of the world, and to seek again this calm retreat in forest mountains. The existence of many an invalid might be prolonged and rendered more enjoyable, while many a sufferer might be restored to health, were he to seek timely the patriarchic simplicity of forest life, and the pure air, wafted decarbonised in delicious freshness through the forest, ever invigorating strength, restoring exhilaration and buoyancy of his mind. In this young country new lines of railway are early to disclose some of the almost paradisiac features of sylvan scenery, hitherto known to most of us only through the talent of the illustrious landscape-painters of this city.

“To sit on rocks, to muse o’er flood and fell;

To slowly trace the forest’s shady scene,
Where things, that own not man’s dominion, dwell,

And mortal foot has ne’er or rarely been;

To climb the trackless mountain, all unseen,

With the wild flock, that never need a fold;

Alone o’er steep and foaming falls to lean—

This is not solitude: ’tis but to hold

Converse with nature’s charms, and view her stores untold.”

BYRON.

I regard the forest as an heritage given to us by nature, not for spoil or to devastate, but to be wisely used, reverently honoured, and carefully maintained. I regard the forests as a gift, intrusted to any of us only for transient care during a short space of time, to be surrendered to posterity again as an unimpaired property, with increased riches and augmented blessings, to pass as a sacred patrimony from generation to generation.

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