

1903.  
NEW ZEALAND.

FORESTS - CONSERVATION  
(FURTHER REPORTS RELATIVE TO).

*Return to an Order of the House of Representatives dated the 23rd October, 1903.*

*Ordered, "That there be laid before this House a return showing the outline of the scheme for more vigorous conservation of our remaining forests, and extending planting operations, prepared and submitted for approval as mentioned in the Chief Forester's report, C.-1, 1903, Appendix IV., page 89."—(Mr. McNAB.)*

NOTES ON FOREST-CONSERVATION AND AFFORESTATION.

Department of Lands and Survey, State Forests Branch,  
Rotorua, 23rd July, 1903.

THE rapidity with which this colony is being denuded of its forests has again been emphasized by the Acting-Premier in the last Financial Statement, wherein he says, "Additional information has been obtained as to the area of the remaining forests suitable for milling purposes, and a rough estimate has been made of the quantity of kauri and other timbers in the Auckland, Poverty Bay, and Westland Districts, which, though more satisfactory than previous estimates, points to the conclusion that in a comparatively few years' time the great natural resources of the colony as represented in its wealth of forest will fall lamentably short of requirements." The same opinion was expressed in 1887 by Captain Campbell Walker in his report to Government on "The Organization and Working of the State Forests Department."\* In 1879 Mr. A. Lecoy, M.A., LL.B., published a most exhaustive report on "The Forest Question in New Zealand,"† in which he called attention to the wholesale destruction of forests, while their renewal was being entirely neglected. Mr. G. S. Perrin, Conservator of Victorian Forests, also reported on "The Conservation of New Zealand Forests" in 1897. That gentleman stated, "Unless forest reforms are inaugurated speedily the timber famine which already threatens your colony must come."

Since 1885 ordinary Crown forests have been under the control of Crown Lands Boards, who issue licenses for timber-felling and act generally as conservators. State forests are under the immediate control of the Commissioner of State Forests, who acts on the recommendations of the Conservators of State Forests for the various land districts, these Conservators being also Commissioners of Crown Lands. The direction of forest-tree planting is undertaken by the State Forests Branch of the Department of Lands and Survey, which has no connection whatever with native forests. There are thus practically three branches of the service connected with our forests, controlled generally by the Surveyor-General.

The following table shows the revenue derived from State forests and the expenditure on forestry operations, including management and supervision of State forests:—

Year.	Revenue.†			Expenditure.§		
	£	s.	d.	£	s.	d.
1896-97	...	...	...	6,504	4	10
1897-98	...	...	...	10,995	13	1
1898-99	...	...	...	5,844	6	6
1899-1900	...	...	...	8,845	18	10
1900-1	...	...	...	14,915	5	3
1900-2	...	...	...	17,118	11	5
				10,334	13	7

The credit balance on State Forests Account at 31st March last was £49,011 13s. 8d. The receipts from timber licenses and sales of timber on ordinary Crown lands are paid into the Consolidated Revenue Account.

\* Transactions of the New Zealand Institute, Vol. ix., pages 27, 187.  
Institute, Vol. xii., page 3.

† Includes rent from State forests let for grazing purposes.

‡ Transactions of the New Zealand Institute, Vol. xii., page 3.

§ Includes management and supervision of State forests.

The importance of the timber industry to the colony is shown in the following :—

TABLE showing Number of Sawmills in Operation, Hands employed, Wages paid, Quantity and Value of Timber Sawn, Value of Posts and Rails, and Total Value of all Manufactured Timber for 1900; also Comparison with 1895.

Year.	Number of Mills.	Hands employed.	Wages paid.	Sawn Timber.		Value of Posts and Rails.	Value of all Manufactures.
				Quantity.	Value.		
1900 ..	334	6,085	£ 514,088	Ft. 261,583,518	£ 971,048	£ 19,277	£ 1,268,689
1895 ...	299	4,055	323,223	191,053,466	627,959	10,998	898,807
Increase during five years	35	2,030	190,865	70,530,052	343,089	8,279	369,882

TABLE showing Quantity and Value of Timber exported from 1888 to 1900, inclusive.

Year.	Quantity.		Value.	
	Superficial Feet.		£	
1888 ...	...	43,474,434	...	177,877
1889 ...	...	42,568,600	...	176,608
1890 ...	...	42,098,863	...	181,689
1891 ...	...	42,824,365	...	182,431
1892 ...	...	22,860,551	...	87,581
1893 ...	...	26,718,046	...	101,082
1894 ...	...	31,901,415	...	116,116
1895 ...	...	38,297,905	...	141,892
1896 ...	...	34,984,414	...	133,511
1897 ...	...	39,326,396	...	156,289
1898 ...	...	40,721,632	...	167,510
1899 ...	...	50,425,741	...	199,231
1900 ...	...	57,517,085	...	233,659

The value of the timber imported into the colony from 1890 to 1891 was £104,927.

The foregoing figures show that the forests are at present yielding timber to the value of over a million and a quarter sterling per annum, one-fifth of which is exported, and we are importing timber which could well be grown in the colony to the value of £100,000 per annum.

The four nurseries at present established will produce sufficient trees to plant approximately 700 acres per annum, and allowing sixty years for the trees to mature we cannot reasonably expect that more than 20,000 superficial feet of timber will be produced per acre, or about 14,000,000 ft. in all. This is probably a low estimate, but as no artificial forests have yet matured in this colony we must be guided by results obtained in Europe, where forestry operations have been conducted under scientific principles for some hundreds of years, and where records have been kept of the produce from first thinnings to the matured crop.

Take, for instance, the Hanoverian forests, containing a mixture of oak, larch, beech, spruce, scots pine, and alder. Here we find that an acre has produced on an average 30,000 superficial feet of timber per century, equal to 300 superficial feet per annum. Of course, the thinnings from the above area will be available as fencing-posts, sleepers, and other purposes where large diameter is unnecessary from, say, the fifteenth year up to the fortieth; but this cannot be considered as milling-timber, of which we are now (1900) cutting 261,500,000 ft. per annum. No allowance has, however, been made for possible destruction through fires, disease, or non-success of these artificial plantations during their period of rotation—viz., sixty to eighty or even one hundred years, depending on the variety of tree, class of soil, and aspect of the plantation. In order, therefore, to maintain the present output of timber, an area of over 13,000 acres would require to be planted annually, necessitating the establishment of thirty-five nurseries of a producing-capacity of a million trees each per annum. We have therefore only made provision for a continuous supply of timber amounting to 14,000,000 superficial feet per annum—about one-nineteenth of the quantity at present being milled; or, in other words, we are denuding 20,000 acres of forest, reckoned at 10,000 superficial feet per acre, for our annual supply of 200,000,000 ft. (during the last nine years), and have made provision for the planting of only 700 acres, estimated to produce 14,000,000 ft. in from sixty to a hundred years from the time of planting. The above figures show the gravity of the situation and the rapidity with which the colony is being stripped of its forests without a corresponding increase of planting operations. We cannot too soon take active and vigorous measures to prevent—or, at least, to mitigate—the calamity which will befall this colony should our natural forests become exhausted before artificial plantations are matured for felling.

One great evil that exists in the timber business is over-production, and there cannot be a greater waste of any marketable commodity than through this cause. In the face of glutted markets we persist in our over-production as if we expect to relieve the market by glutting it still more. Over-production in the timber trade is a greater evil than in any business, as the raw material cannot be replaced for generations. Each one is ready to admit that he—or, rather, his neighbour—is milling too much timber and that more profit would be made by putting through a less quantity. The fact is we are encouraging this over-production by selling our timber for many times less than the price at which it can be produced artificially. Take the Pelorus Valley, for instance. According to Mr. Perrin's report one mill is producing 3,000,000 ft. per annum from 300 acres, equal to 10,000 superficial feet per acre. The royalty on this timber—principally rimu—

is 3½d. per 100 ft., equal to £2 per acre, an amount that would not even dig the holes for replanting, to say nothing of the cost of trees, planting, fencing, maintenance, thinning, or allowing for rent of land occupied or interest on capital.

It has often been said that there would be a substitute found for wood, but up to the present no suitable material has been discovered. The great majority of all buildings are made of it, and it is an essential necessity in all those which are nominally built of stone or brick. It is indispensable in the building of vessels, vehicles, railway rolling-stock, furniture, sleepers, bridges, and in many places as fuel. Entering as it does into the multifarious uses of civilisation as a constituent of so many of our manufactures, and nearly all our structures, it forms an element in our industries which cannot be gauged by mere statistics.

Nature has wisely provided that timber will flourish on lands either too poor to yield profitable returns under cultivation or too steep even for grazing purposes. Lands of these descriptions should be for ever devoted to the purposes for which they are naturally adapted and intended. Deprived of their forest covering they are not only rendered valueless, but through their natural barrenness so far as regards herbage landslips are formed—at first comparatively small, but subsequently increasing in size until whole hillsides are on the move to the lower levels. Nothing that man has yet devised can prevent even in a small measure this ever-increasing waste of property. Examples are frequent throughout the colony, notably on the Manawatu Railway-line and around Picton and the Kaituna Valley. The conserving of forests for the wants of the future have been entirely overlooked during past years in the anxiety to satisfy the current wants of the present, and it is undeniable that something should at once be done to protect our forests, if only to guard against their exhaustion. Legislation, however much it may aid, will not alone prove adequate; care under skilled direction is necessary. If remedial measures had but kept pace with destruction the resources of our forests would continue to supply legitimate wants without evil consequences ensuing. To husband the gifts which nature has provided is a matter of extreme importance, and there is perhaps no more effectual way of accomplishing this end than by striving to create a sense of the intrinsic value of our forests. It is not without outlay that the evil consequences of a too extensive encroachment on nature's gifts can be warded off until a state of equilibrium is brought about by a more liberal expenditure in afforestation. Delay means that destruction will continue, and total extinction be reached at a rate proportionate to the increase of settlement. If our annual output of timber, now (1901) over 261,500,000 ft., is to be maintained until artificial plantations are ready for the axe precautionary measures by protection and greatly increased planting operations will have to be adopted; otherwise there will eventually be a period of complete cessation of our timber industry. With an export trade averaging £200,000 per annum during the last ten years, a wages bill of over half a million for the payment of 6,812 hands employed, and a total value of manufactures for the past year of £1,268,689, surely our remaining forests are worthy some attempt by way of conservation.

One of the chief difficulties that forestry has to contend with in widening its sphere of operations is the scarcity of men acquainted with its practical details. It may be said that competent foresters could be obtained from Europe or elsewhere, but experience has shown that such men require several years of colonial experience before they can be placed in positions of responsibility. The system of nursery-management and methods of plantation-work in practice in Europe, where the cost of labour is less than half that ruling in New Zealand, are quite unsuitable for the altered conditions of labour, as well as of soil and climate, in this colony. Here horse-labour is used to cultivate the soil, and even turn the furrows against the young trees in the nursery rows; but in Europe all work of this description is done by manual labour. This is merely an instance amongst many to show that if continental methods were practised in New Zealand the cost of growing two million trees per annum would be £2,000 instead of £1,000, the sum they are now produced for. It is a matter for serious consideration whether an attempt should not be made to afford facilities for the education of colonial youths in forestry-work in connection with one of the already established State nurseries.

#### ARBOR DAY.

The celebration of Arbor Day was introduced into this colony by the Department of Agriculture in 1892, and during the ten years that have elapsed the movement has not been as successful as was anticipated. One or more pamphlets have been prepared and distributed setting forth the advantages likely to be attained by tree-planting on reserves, school-grounds, &c.; and an exhaustive list of trees and shrubs suitable for planting in various situations was also presented. Personally, I venture to express the opinion that the time is not yet ripe for the success of this movement in New Zealand. The energies of the Department should, I think, be confined to the publishing of pamphlets on tree-raising from the seeds through the various stages until fit for permanent planting; another publication might be prepared dealing with the planting of trees for both ornament and utility, their suitability for different soils and situations; and possibly a third publication on after-management of plantations.

The Department of Agriculture suggest that the direction of Arbor Day celebrations should be taken over by the Forestry Department on the grounds that "interest has been awakened and is dying for lack of tangible help in the shape of trees," and "that trees be grown and given gratuitously to all who may apply for and satisfy the Department that they have suitable land for planting them." As I pointed out in my reply, the suggestion is an excellent one in theory, but a difficult and costly one to carry out in practice. To carry out the proposal with any likelihood of success would necessitate the establishment of one or more nurseries in each provincial district in order to grow trees in similar soil and climatic conditions to the locality for which they are intended. For instance, trees grown in the pumice lands of Rotorua would be an utter failure if transferred to the clay lands around Auckland and other similar formations, and in the same way trees for planting in Central Otago must be grown within that region, owing to the extremely rigorous climatic conditions obtaining. If every person in New Zealand who has suitable land and was willing to plant trees were provided with his requirements at Government expense, the outlay would be enormous within a very few years. Beyond producing shelter around homesteads and beautifying

the landscape I doubt if the assets of the colony would be commensurately increased. Tree-growing for timber requires to be learnt like any other business, and very few people have the necessary knowledge how to plant or maintain plantations, so that if it is desirable to expend more money in this direction it may as well be done by increasing the annual vote for tree-planting by the Government under the present system. Free distribution of trees by Government would also be ruinous to nurserymen who have invested their all in purchasing and cultivating lands for this purpose, to say nothing of the cost incurred in working up stocks and keeping them up to date as the trade requires. Had the nurserymen of this colony been negligent in keeping up their stocks to public requirements, or charging an exorbitant price for same, the matter would present a very different aspect. The ruling rates for trees of all descriptions are lower in New Zealand than in any other British colony, and if it is necessary to supply trees gratis to settlers in order to make a success of Arbor Day the subject had better be allowed to rest until the people begin to appreciate the advantages of planting. The feeling that the Government should do everything is yearly increasing, and the next proposal we may expect to have submitted is that the planting as well as supply of trees should be undertaken by the Government on private lands. In fact, this proposal was actually made by a settler in Otago, who offered to allow this Department to supply trees and plant them as a shelter-belt on his farm provided the work was done according to the special requirements of the owner.

I might, however, suggest that a more practical way of encouraging tree-planting throughout the colony would be to carry trees, no matter to whom consigned, free by rail. The cost to the country would only amount to a few hundreds per annum as compared with free distribution, which would certainly run into thousands, while the tree, being paid for, is more likely to be taken care of than if supplied gratis. The very fact that trees could be had for nothing would tend to carelessness, as they could be replaced for the asking during another season. Tree-planting might be further encouraged by the free railage of wire netting for protecting plantations, as of late years (especially in the south) settlers have almost given up the formation of plantations owing to the rabbit-pest. Settlers might also be encouraged in this direction if the increased value of land from tree-planting during the first ten years were exempt from taxation provided that not less than twelve hundred trees per acre were planted and maintained in a proper manner.

Legislation seems desirable to prevent the planting of forest trees on the northern side of any street or road running in an easterly and westerly direction at a less distance than 2 chains from the boundary-line. Plantations in such positions are common in this colony, and not only is the cost of maintenance of roads by local bodies greatly increased, but a positive danger to traffic is caused during frosty weather through exclusion of sunshine.

#### REPLANTING OF NATIVE TREES.

In consequence of nearly all New Zealand timber trees being surface rooters, their adaptation for general afforestation in open land is practically prohibited through the damaging effects of exposure to sun and wind. The principal exceptions are totara, kowhai, puriri, broadleaf, and three varieties of *Fagus*, all of which are easily raised from seeds or cuttings, transplant well, and make comparatively fast growth up to a certain age, when their further progress is almost unnoticeable.

Other trees of commercial value, such as rimu, rata, miro, matai, kahikatea, kauri, kawaka, and silver-pine, have been suggested by Mr. Perrin and others as suitable for extensive planting, especially on the pumice lands of the North Island, but I fear such recommendations have been made through want of practical knowledge as to the special treatment necessary for their success. From an experience of over twenty years in cultivating native trees and shrubs I unhesitatingly assert that to plant any of the above-named trees in open situations will result in total failure. All the varieties mentioned require considerable shade, from the seedling to the adult stage, and this can only be afforded by planting them amongst partially cleared forest lands, where the natural undergrowth affords them the requisite amount of protection.

The prevailing class of under-scrub, or second growth, in our bushes is unfortunately of exceedingly rapid growth compared with the trees under notice, so that unless constant clearing was undertaken to prevent the crushing-out of the permanent trees by their natural protection they would be suppressed within a comparatively short period. This work would be of a very costly nature owing to the necessity of continually clearing over a long period, this period being limited only by the permanent trees reaching a height above the undergrowth where their leading stems would be free from further suppression, while their sensitive roots would still have the necessary protection from the damaging influences of exposure to sun and wind.

In connection with the planting of the aforementioned trees for timber purposes, it must be considered whether this would be a successful undertaking from a financial point of view. Our knowledge of the age of mature trees of this class, although limited, is nevertheless probably sufficient for present purposes. The following table, taken from the "Forest Flora," and the late Mr. W. N. Blair's "Building-materials of Otago," will show the approximate ages of our commonest timbers.

Name.	Approximate Ages. Years.	Name.	Approximate Ages. Years.
Manuka ... ..	100 to 250	Rimu ... ..	400 to 650
Rata ... ..	200 to 450	Yellow-pine ... ..	300
Broadleaf ... ..	340 to 700	Silver-birch ... ..	150 to 330
Pohaka ... ..	200	White-birch ... ..	80 to 180
Miro ... ..	150 to 300	Kauri ... ..	600 to 3,600
Totara ... ..	470 to 800	Cedar ... ..	150 to 400
Matai ... ..	270 to 400	Red-birch ... ..	130 to 300
Kahikatea ... ..	370 to 600		

The ages of the above-mentioned trees were ascertained by counting the number of annual growths on recently cut sections of the trunks. This method of arriving at an approximate estimate of the age of a tree, although accepted by the leading authorities on vegetable physiology,



not been collated either for the benefit of the Department or for the information of the public. Nevertheless the publication of such would be of considerable interest, as well as of some practical value to colonists, if only as a guide to lessen the possibility of failure by settlers who may be desirous of improving their holdings by the formation of plantations either for shelter, ornament, or profit. This apparent negligence is due to the absence of a properly organized and efficient staff for carrying out these and similar duties that are now attempted in a perfunctory manner by a single officer.

Amongst imported conifers *Pinus austriaca* has succeeded well on almost any class of soil or situation. In deep heavy loam, in poor pumice land, on rocky faces, or on marshy grounds this pine has alike flourished luxuriantly. The yellow-pine of America (*Pinus ponderosa*, and its variety *Pinus benthamiana*) has also been successful wherever planted. On cold clay-bottomed lands in south Otago, the warm limestone country of central Canterbury, the exposed pumice plains of central Auckland, or the dry rigorous climate of central Otago its success has been phenomenal. *Abies douglasii* (the Oregon pine of America) and the European larch may also be mentioned as desirable trees worthy of extensive cultivation in the future. The former, however, will not withstand the frosty winds experienced during early spring in Central Otago, nor is the latter suitable for situations with a northern aspect in any portion of the colony. The home of the larch is on southern slopes, from the lower foothills to the snow-line on stony or gravelly soils, where there is constant moisture without stagnation. No tree promises better results than the Californian redwood (*Sequoia sempervirens*), especially on the heavier class of low-lying pumice lands of the hot-lakes district. Its growth here is exceedingly vigorous in deep and porous soil, the surface of which is kept cool by a light growth of fern. This tree is peculiarly adapted for extended cultivation in the North Island, where the burning of fern lands is of frequent occurrence, through its capability of withstanding fire without sustaining permanent damage. Amongst the deciduous trees the oak, ash, sycamore, plane, birch, alder, chestnut, and walnut will undoubtedly take a prominent place in the future as timber-producers. All the varieties mentioned are easily raised from seed, obtainable in the colony in great abundance, whereas for the supply of coniferous-tree seeds we are chiefly dependent on Europe and America, from whence there is no certainty of obtaining our annual requirements owing to frequent failure of the seed-crops.

Although experiments have been carried on at the various nurseries and plantations with a comparatively large number of trees of reputed sylvicultural value, there remain a vast variety of species available for further trial—notably amongst the Australian eucalypti and American hardwoods. Something is being done in this direction during the present season at the Rotorua Nursery and also at Starborough Nursery in Marlborough. Sufficient knowledge has, however, been obtained as to the suitability of the trees at present being grown in quantity to warrant a continuance of their propagation on an extensive scale.

Many species of eucalypti of known value cannot be grown in any of the nurseries or plantations already established, owing to their impatience of frost. Jarrah, ironbark, and sugar-gum may be mentioned as instances. During the last few years I have frequently brought this matter under the notice of my superior officers, pointing out the value of these timbers for extended cultivation for the supply of bridge and sleeper timber, which forms fully 75 per cent. of present imports. An excellent site for a nursery was obtained near Whangarei, and plantation-areas were selected in every way desirable for the timbers mentioned, on the Puhipuhi Forest Reserve, but here the matter rests awaiting further instructions. I venture the assertion that no more profitable undertaking could be entered upon than the extensive planting of the eucalypti mentioned. Should it be decided to establish plantations in the future, the selection of the sites is of paramount importance. Every mile distant from a railway, harbour, or river means increased cost of haulage from the plantation; or, in other words, the value of the timber is increased when grown in close proximity to convenient and cheap means of transit.

The choosing of nursery-sites also requires mature consideration, otherwise this work will be carried on at a disadvantage. Take, for instance, the Starborough Nursery in Marlborough. Although the soil, water-supply, and general surroundings are in every way suitable for the purpose intended, the Crown does not possess more than 100 acres of land fit for plantation purposes within a radius of twenty miles, and none of the areas are accessible by rail. Every thousand trees grown in a nursery to the required size for permanent planting means 2s. 6d. added to their cost for transit of, say, twenty miles (or a day's journey by wagon), besides additional expenses in stable accommodation and travelling-expenses of officers and workmen to and from. In certain districts, however, the long distance between a nursery and plantation is unavoidable, on account of climatic conditions, soil, water-supply, &c., not being suitable for the raising of young seedlings. Such an instance occurs in Rotorua district, where a plantation is some twenty-two miles from the nursery. The ideal site for a nursery is the centre of proposed planting operations, but, of course, such positions are not always available. If the present system of employing prison labour in tree-planting is to be extended (and I can see no reason why the whole of this class of work should not be undertaken by the Prison Department) the necessity for concentration of works is doubly desirable.

#### STATE FORESTS, TIMBER AND CLIMATIC RESERVES.

No record of the area or quantities of timber remaining in these reserves is at present available. The last report from the Commissioner of Crown Lands, Auckland, however, gives an approximate estimate of the kauri timber on Crown lands at 715,000,000 superficial feet; on Native lands, 540,000,000 superficial feet; on private lands, 124,776,000 superficial feet: total, 1,379,766,000 superficial feet. The average annual output is given at 70,000,000 ft. per annum, so that in less than twenty years these forests will be exhausted. The possibility of enormous destruction by fire, however, is not taken into account, and judging by losses during previous years from this cause the probable shrinkage may be set down at 10,000,000 ft. per annum. There are comparatively large areas of mixed bushes practically untouched in both Islands, but with the advance of settlement comes the axe of the bushfeller, the destruction wrought by stock in eating and trampling the under-scrub, and the careless lighting of fires by adjoining settlers in clearing their land.

The protection of these virgin forests for future use seems to be one of the most urgent matters requiring the attention of Government. The total area of forest land reserved at the 31st March, 1901, was 2,552,067 acres. A very small proportion of this area, however, comes under the heading of "State forests," the major portion being reserved for the purpose of preserving vegetation at the sources of rivers and crests of ranges.

It is hardly necessary to refer to the destructive influence consequent on the indiscriminate clearing of forest lands, especially at the sources of rivers. Spain, at one time noted for its salubrious climate and the richness of its soil, is now one of the poorest and driest countries in Europe, with a rainfall of only 9 in. per annum, owing entirely to the denudation of her forests. Other instances of the disastrous results caused by the reckless destruction of forests may be found in the island of Cyprus, St. Helena, Mauritius, Egypt, India, and many other countries, including our own colony, where periodical floods frequently occur, doing immense damage to bridges, roads, and low-lying country.

Cattle, sheep, rabbits, and the wild pig are the chief agents in the destruction of our Alpine vegetation, and their efforts are ably seconded by the shepherd, who during the spring months is constantly burning not only the coarse herbage to obtain fresh succulent growth for his flocks, but every year his fires encroach further and further into the wooded valleys, and in time leave only isolated patches in some of the damper situations. Cattle and sheep assist in the general destruction by practically clearing all the under-scrub within their reach. Rabbits and hares peel and bark the young growth of many sub-alpine plants, and when feed is scarce eat down the herbage on steep hillsides to such an extent that further growth is arrested—a bare patch occurs on which the sun and wind have full play—gradually the barren area extends, and heavy rains soaking into the open unprotected soil cause a landslip, which is carried down to the lower valleys by successive floods.

The reservation of watershed-areas is but the first step towards conservation. What is being done towards their protection from trespass by man, stock, and the disastrous effects of fires? None of the areas are fenced, no fire belts have been cleared around the boundaries, and but for the occasional visit of a Crown Lands Ranger they are practically unprotected. Owing to the surface-rooting nature of most of our forest trees they are particularly sensitive to any damage occasioned through trampling by stock. The New Zealand bush in a virgin state is, with the exception of kauri forests, practically impervious to fire, owing to the natural carpet of moss, fern, and other growth being kept constantly moist by the overhead canopy formed by the tops of evergreen trees. Once stock is admitted, however, a year or two of trampling and browsing soon shows its effects. The more sensitive varieties begin to lose their leaves and branches, and gradually perish for want of root-protection and insufficient supply of moisture. One tree after another falls, and carries with it numerous lesser trees and saplings, the foliage of which is eagerly devoured by stock. The sun and wind find an entrance through the gaps thus caused; the fallen *débris* is shrivelled up and rendered highly inflammable; trees, deprived of their natural shelter (both in root and branch), gradually succumb to the altered conditions, and in time become also a mass of easily ignitable material, requiring only the careless dropping of a match to complete its destruction.

In kauri forests the danger from fire is even in the natural state decidedly great, owing to the accumulation of fallen leaves, bark, and particles of gum around the base of each tree. The gum-digger enters, and finds a tangled mass of undergrowth impeding his work. A match is applied, and hundreds of acres may vanish in smoke within a very few hours. No tree is more susceptible to fire than the kauri, the slightest scorching of its roots being sufficient to prove fatal within a very few months. Not only is the whole forest destroyed by fire, but owing to repeated burnings of second-scrub growth the top soil is frequently converted into ashes, which are blown away by the wind, leaving only the bare subsoil of pipeclay, thus rendering reforestation practically impossible.

The functions of the forest trees in shading the soil and preventing excessive evaporation, and of the spongy floor in retaining moisture and giving it out subsequently as required, may be briefly mentioned. First of all, the surface is covered with a thick layer of dead leaves and a carpet of moss and lichens, which develop rapidly under the shade trees. This spongy covering imbibes the water and performs the function of an immense natural reservoir, from which plant-life draws its supply. Any excess of moisture infiltrates into the ground in proportion to the degree of its permeability to supply springs, and the residue is prevented from rushing to the lower valleys by encountering on its journey the thousand obstacles of which a forest soil is composed. If the forest be cut off, then opposite agencies come into action and cause reverse effects—heavy rains wash away the soil, torrents rush down the watercourses with great rapidity, whilst streams and rivers overflow their banks, devastating large areas of low-lying parts under cultivation.

Our four principal cities are at present engaged with the question of extending their water-supply for domestic use and power purposes. Numerous municipal authorities throughout the colony are securing extensive areas for watersheds. The development of water-power was until recently confined to locations close to streams, but recent advances in the application of electricity permit of industries being placed at points convenient for transportation and labour. These conditions open up a wide field for the utilisation of streams as a source of power. In various parts of the colony extensive water-power plants are in operation or contemplated, and it is probable that the number of these will be considerably augmented as time goes on. Irrigation is also becoming a recognised feature of successful farming in many parts.

Accepting the almost universal testimony that forests are conservers and regulators of water-supply, the importance of protecting the sources of streams is apparent. The purity of water-supply, the prevention of destructive floods and consequent periods of drought, and the continuous supply of water-power for mechanical purposes are all dependent on the forest covering being maintained as nature provided it. No country in the world has been so abundantly supplied by nature as ours with generous and varied forests, or with permanent and well-distributed streams, for the many uses of man. *Æsthetic* and other reasons could be advanced in favour of forest-protection, but probably these would not have so much weight as the more pressing demands of a permanent supply of timber and water.



## SCENIC RESERVES.

I am not aware that any of these are at present being conserved as their importance demands. My duties necessitate a good deal of travelling throughout the colony, and I have frequently found considerable damage being done on scenic reserves both by illegal cutting of timber and trespass by stock. Unless these reserves are protected and properly conserved they will undoubtedly become of little value for the purpose for which they have been set apart.

Much good work is being done in various parts of the colony by beautifying associations, amenities societies, and Domain Boards by planting and improving reserves both in towns, suburbs, and country districts. Such work deserves the most liberal encouragement from the Government by supplying trees and shrubs gratuitously, as well as by affording advice from experts on the varieties of trees, &c., that should be planted, mode of planting, and generally by assisting in mapping out a scheme for the attainment of the object in view. Many scenic reserves could thus be improved and waste places made beautiful by intrusting their care to such societies, the members of which are usually enthusiastic arboriculturists.

## SUGGESTED MEASURES FOR PROTECTION OF NATURAL FORESTS.

Any scheme that can be suggested for the protection of our forests must necessarily be an expensive one, and in many cases difficult of application, owing to their large extent and to their being scattered over the whole colony. Fencing to exclude stock of all kinds would be all that is necessary, and the rest could be left to nature but for the trespass of man. No doubt in districts infested with rabbits and hares the erection of wire-netting fences would be found necessary to cope with these pests. For the prevention of damage by man the existing regulations at present in force are probably sufficient, provided that active supervision by Forest Rangers is attended to.

Where Crown forests join agricultural areas wide fire belts should be cleared, and these either planted or sown with varieties of non-inflammable shrubs or trees, such as wattle. In many parts of the colony the mere clearing and burning of, say, 100-link-wide fire belts around the forest would form a sufficient safeguard against the spread of fire from adjoining lands, as the native fuchsia, tarata, mahoe, putaputa-weta, makomaka, mapau, karamu, &c., appear immediately after burning in such profusion that they provide naturally a most efficient barrier against the spread of fire. This is but nature's method of guarding against encroachment on her preserves.

Each separate forest-area will probably require special treatment by way of conservation, so that no general scheme can be laid down as applicable alike to all. Walker, Lecoy, Perrin, and others have already furnished the Government with their views on this important subject, and from these reports and the available records and regulations connected with forest-conservation in Europe, India, and America the proposed Commissioners of Forestry could select such measures as they consider necessary to the colony's requirements.

## SUGGESTIONS REGARDING THE REORGANIZATION OF THE STATE FOREST DEPARTMENT.

1. That the entire control of all Crown forests, whether State forests, ordinary Crown forests, or plantations, be placed under a Board of, say, three Commissioners, consisting of the Surveyor-General, Chief of the Forest Department, and a practical sawmiller.

2. That all scenic reserves be placed under a Board, consisting of the head of the Tourist Department, the Commissioner of Crown Lands for the district, and the Chief of the Forest Department.

The first duties of the Forestry Commissioners would be to have detailed surveys made of all Crown-land forests, State, ordinary, or timber-preservation reserves by competent rangers, who would estimate the quantity, quality, and area of such. General and index plans should be prepared, showing the boundaries of all reserves, scenic, climatic, timber reservations, and State forests. Reports might be obtained from Commissioners of Crown Lands regarding any desirable reservations at present in the hands of private persons. Reports should also be obtained regarding any Crown or private lands suitable for afforestation. Such lands should, if possible, be easy of access either by rail, river, or sea. With this information the Forest Commissioners would be in a position to determine whether the present planting operations are sufficient to provide timber for future use, also if the remaining native forests will continue to supply the present demand until artificial ones are mature. The Commissioners would also consider whether the existing timber regulations are suitable to the altered conditions consequent on the extraordinary demands made on our resources during late years.

Special reports should be made on all properties acquired by Government under the Land for Settlements Act, with the view of reserving any lands that may be considered suitable for afforestation should portions of such lands be unfit for either pastoral or agricultural purposes.

Legislation may be found necessary in order to resume lands for afforestation, in the same manner as for other public purposes. Probably the encouragement of planting by private enterprise should receive attention by way of the publication of literature on this important subject.

Many other matters could be mentioned as worthy of consideration by the Commissioners, but the more pressing necessities only are given, leaving minor details to be dealt with later, when the question of direction is determined.

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