IMPRESSIONS OF NEW ZEALAND FORESTS AND FORESTRY

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The difficulty of writing about the forests of a new country, for the edification of foresters residing and working in that country, is that it must be obvious that the readers know far more about the subject than the author can acquire in a brief trip. The only merit in such an article lies in the fact that first impressions are always vivid and as such may be of interest to those who have grown up with New Zealand conditions.

Since every species of indigenous growth was new and unknown to me it was most fortunate that I had the constant companionship of Mr. C. M. Smith, Chief Inspector for New Zealand State Forest Service and was thus able rapidly to acquire a visual acquaintance with the more important native timber trees. I was also plunged at once up to my neck in the problem of the remnant kauri forest, its preservation versus its management. My first sight of kauri was at the Trounson Kauri Park, followed by Waipoua. When the "grandfather of the forest" was revealed after a short walk through the dense sawgrass and ferns, on a footpath, I felt that I was in the presence of a natural phenomenon that defied description. This giant with its breadth of over 14 feet, trunk like a pillar of Hercules, massive spreading crown, and dense population of epiphytes of many kinds is breathtaking and alone would repay one for the entire trip.

But unlike certain other American scientists, who, because they are specialists in soils, anthropology or other lines, feel competent to pass judgment in the sphere of forests and forestry without consulting their colleagues in this field, I sought the key to kauri history, which means, how is the forest perpetuated by regeneration and how is it destroyed ? Man's influence was easily discernible. The great expanses of former kauri forests now reduced to weather-beaten stumps, or grass paddocks, told the story of the initial pioneer logging, with its clear cutting and inevitable repeated fires, until nothing but scrub was left except where modern methods had conquered the bush by cutting the tea-tree, burning, fertilizing, and intensive pasturing by cattle and sheep.

Yet in this same tea-tree growth, wherever the seed of the kauri could be blown from remaining trees I found abundant young kauri reproduction, from seedlings up to vigorous saplings. In older cuttings these had grown into tall straight shafts or rickers, some of which were already showing the ultimate branching out of the

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final crown, at the top of a cylindrical stem that had cleared itself completely of branches by a process of excision that may be peculiar to this species—at least it was new to me.

Then I observed that kauri reproduction was entirely absent from the areas occupied by mature kauri trees and was shown a fenced and cleared plot where thousands of tiny seedlings were springing up annually only to die without developing. In other numerous instances I found large kauri that had started as seedlings on the top of old overturned trees where they were lifted above the grass and ferns and could establish themselves. Then it dawned on me that the kauri, as a conifer, did not differ materially from other conifers despite its very great span of life. It did not naturally reproduce itself under its own shade, but came in readily on any land that had been opened up by wind, fire, volcanic activity, or logging, provided seed was within reach, the soil was exposed, and the seedlings given partial shade, for which purpose the tea-tree bush was ideal. I saw groves of kauri rickers on old dumps formed on sidehills in railway construction, and absent elsewhere because of fires. Many young kauri were found on the exposed flanks of the road through the Waipoua forest, which created the required conditions of partial light and freedom from dense grass competition. It thus appeared probably that the removal of large dead kauri with consequent opening of trails and patches in the forest might be followed by kauri regeneration. All these observations led to the conclusion, first, that the public interest demanded the absolute preservation of an adequately wide belt of kauri forest bordering the access road through Waipoua on both sides (the proposal of the Forest Service is for an area varying from 3/8th to a mile in width) with no cutting or disturbance, the administration of which, as in similar cases in America, should remain with the Forest Service to ensure adequate fire protection and elimination of grazing ; second, that the remainder of Waipoua should be placed under forest management for the gradual salvage of dead kauri and the release of the larger trees by removal of competing vegetation including suppressed kauri, and third, the securing and protection of kauri reproduction in all openings and burns, thus extending the area of kauri and insuring its future perpetuation.

These general impressions were confirmed by observations extending over many other areas within the natural range of the kauri ; the process can be speeded up by planting seedling kauri, which to the number of 300,000 has been successfully raised in the headquarters nursery at Waipoua. Should the Waipoua Forest be taken from the Forest Service, these essential forestry operations would have small chance of success and the whole future of this forest might be imperilled.

I found by examination of the growth rings on logs at various small mills that, although kauri develops rather slowly in its sapling stages, yet if given adequate space for crown spread, it outgrows

other native species at a rate of least 5 to 1, its only native competitor being the species of *Nothofagus* or native beech.

I was impressed by the excellent quality both of the kauri lumber and that of the other prominent indigenous species of which the most imporant and widespread was the rimu or red pine, a podocarp, and, originally, the white pine or kahikatea, with totara, matai and celery pine, the whole forming a body of native timbers of quality probably superior to that of any other indigenous timbers in the world. But, with the exception of kauri and beech, of which more later, the problem of perpetuating these species presents great difficulties. The kahikatea seems doomed to extinction—in fact it has already largely disappeared from the market—from the fact that it grows naturally on swampy lands that have been or will be needed for agriculture. It is found on mountain slopes in the south central portion of the North Island, but its growth is extremely slow. As a future species it must be largely written off.

Rimu, probably the most widely distributed and valuable native species next to kauri, is a miracle tree, in that it starts as a seedling under dense shade, persists in its growth for perhaps 100 to 150 years before becoming dominant in height over its scrub competitors, and finally is able to form stands that will yield up to 80,000 board feet per acre, containing two kinds of heart wood of great durability and value for many purposes. That a tree of such slow growth should persist to become the giants of the forest is a striking example of the perfection attained by the slow evolutionary processes of nature, indifferent to the time element so important in human affairs.

But when it comes to man's effort to replace the rimu as a component of future indigenous forests, it is little that he can do to speed up this process. The seed of the rimu, a small berry-like form, is borne singly on the foliage and collecting it in any quantity is most difficult. Its natural spread is by birds, which eat it and distribute it in their droppings. In an even-aged 80-year-old stand of second growth beech I found numerous healthy rimu seedlings up to 10 feet in height which, given another 150 years, would overtop the beech, as it has done in that vicinity in past ages. What can be done for rimu ? The only answer is to keep fire out of the forest, preserve numerous mature seedbearing trees, and await the future without regard for immediate profit. This is not so unreasonable as it might appear. There are very extensive areas of relatively inaccessible forest land in the mountainous portions of the Dominion, on which logging operations are relatively unprofitable except for trees of high individual value. Yet these areas, entirely outside the range of commercial production of exotic conifers, and requiring only fire protection, can be steadily but slowly growing a future forest of rimu and associated species, insuring soil protection and ultimately a second crop of rimu. Commercial forestry is indispensable, but it is not the whole picture. Protection forests, with future potential

values, must go hand in hand with the production of exotics for immediate future use.

Due to the depletion of kauri, the future of indigenous forests in the Dominion lies with the five species of native beeches forming a reserve of merchantable timbers, especially in the South Island, that has merely been scratched. Unfortunately much of this beech forest has been deliberately burned or cut to rid the land of forest for the development of sheep ranges. In large portions of the northwest part of the South Island these ranges have proved unprofitable and are reverting to scrub. Yet there remains a notably extensive area of mature beech forest, the yield of which produces, according to species, durable wood for posts and lumber of superior quality for construction and other uses. Beech may be said to be the predominant hardwood timber of the Islands. The preservation and present large volume remaining of these species of *Nothofagus* is undoubtedly due to lack of appreciation of their high intrinsic values, by reason of the preference for kauri, rimu, kahikatea and other indigenous trees to which the market was accustomed.

It follows that the opportunity for sound forest management of beech forests, largely lost for kauri, and so difficult for other indigenous species, is still available and presents a challenge to foresters that must be met without delay. Most fortunately, the various species, the red, silver, black, hard, and mountain beeches are each adapted to different ranges of climate, rainfall and soil, and in their optimum regions show great vigor of reproduction and capacity to overcome competition of inferior growth. Beech reproduction usually appears in dense thickets wherever the forest canopy is broken. Hence it lends itself to silvicultural management fully as readily as do the famous beech forests of Europe, and can be handled largely along similar lines. While it occupies areas bared by land slips or other accidents, in dense even-aged stands which require careful thinning, it also can be reproduced in patches and groups by selectively removing the mature trees in logging, and ring-barking the overmature defective veterans. It has already been demonstrated in one pilot operation south of Nelson that logging on these principles is commercially practicable with no serious damage to the forest. Clear cutting followed by fire has the usual destructive results. If the soil is occupied by dense fern growth, removal of this cover in strips by uprooting the ferns results in the usual dense seedling stand. I know of no such large areas of beech forest anywhere in the world that hold such adequate promise to foresters for their perpetuation and renewal by sane management. I have seen beech logs 24 inches in diameter showing but 80 annual rings. Early thinning gives immediate response in increased growth and the early production of large sizes. Needless to say, fire is anathema in beech forests.

Undoubtedly, deer graze on young beech seedlings. This may require efforts to keep the deer population within bounds. Yet in Germany, beech and deer are grown together under control, and

I believe they can be in New Zealand. As for deer producing an "open" forest free from undergrowth, the testimony of at least one early explorer is to the effect that, long before deer were introduced, mature beech forests had very little undergrowth. While the deer problem is serious, I do not feel that it will constitute an insoluble obstacle to the reproduction of beech under management.

So far I have not discussed the question of exotic conifers and their relation to forest economy in New Zealand. From the standpoint of national welfare now and in the immediate future, this subject takes precedence over all others. Due to the moderating influence of the ocean on climatic extremes, and the consequently prolonged growing season, it happens that many species of exotic conifers continue their growth in height and formation of wood for a much longer period in this region than is possible in their native habitats. This is strikingly illustrated by the behaviour of the Monterey pine, *Pinus radiata*. Its natural range in California is confined to a few hundred acres in two restricted localities on the sea coast, where it is capable of rather fast growth, but is checked by prolonged summer droughts. In New Zealand, the growth of summer wood in the North Island continues for at least ten months, and somewhat less in the South Island, while average height growth may be as much as 5 feet per year continuing for 35 years. Heights of 185 feet may be reached and a rotation of 35 to 40 years is sufficient to produce mature timber yielding 50 to 60,000 board feet of lumber per acre. Previous to about 1922, the planting of exotic conifers in the Dominion was sporadic and in small quantities. But these earlier plantations revealed the possibilities inherent in this species, when, as a relief measure, large scale planting was undertaken by the State in the vicinity of Rotorua in the North Island, the areas reforested exceeded any similar operations, as far as I can determine, in the world. Undoubtedly the planting of such large areas within so few years, largely with this one species poses a pressing problem in management, first as to the possibility and need for the thinning of these plantations, and next, as to their utilization and reproduction. The magnitude even of thinning trees and stands can be realised when the initial cost of planting, which was about one man-day per acre, is compared with a thinning that takes four man-days, even when the increase in wages since 1922 is not considered. Obviously thinnings should, if possible, return the cost of the operation. But I do not hold with those who may feel that because *radiata* thinnings are beyond the manpower and financial capacity of the State, it was a mistake to have gone into this programme on such a huge scale. And this is for one very significant reason. I found that, especially at Rotorua, *Pinus radiata* had a marked tendency to differentiate in the growth of individual trees in the stand, or, in other words, to express dominance. Deaths from suppression, usually delayed in plantations by this very lack of differentiation, sets in early in these stands, and the surviving trees range in diameter from a maximum

of 24 inches at 27 years of age down to 4 or 5-inch trees about to die. Due to this tendency, *Pinus radiata* plantations tend to thin themsselves so effectively that the final yield of saw timber bids fair to approximate within a reasonable range that which could be produced from stands given proper repeated thinnings. Naturally the loss of these "thinnings" could be saved by installation of pulping processes, and from 30 years onward there may be considerable retardation of diameter growth. In the second rotation with ages staggered to a more complete series, and markets developed for thinnings, this loss can be salvaged, resulting in a possible doubling of the total yields. But if final cutting, even without thinning, can occur any time before 60 to 70 years of age, I do not feel that the operation will be unprofitable !

Experience seems to indicate the possibility of securing natural reproduction from either clear cutting and the scattering of the tops, or from a few seed trees. It is more adequate in the Nelson district than in the North Island and cannot be depended on at all on the Canterbury Plains. Its success would tend to reduce or eliminate the initial costs of planting.

Pruning the lower limbs to a height of 7 to 8 feet appears to be a necessity as a measure of fire protection. At the ages to which these stands are grown, the persistence of the lower limbs, with festooned needles, creates a fire trap that induces crown fires. With these limbs removed, a fire travelling on the ground, protected from wind, is comparatively easy to control. Neglect of this operation appears to have contributed heavily to the destruction of 30,000 acres of private plantations in 1946. Inability to prune probably constitutes the most serious threat to the plantations, irrespective of its possible value in improving the grade of lumber.

By beginning the clear cutting and regeneration of the plantations of *Pinus radiata* at 20 to 25 years and continuing the operations for 35 to 40 years, a new and practically complete series of age classes can be established in a single crop rotation, a feat never before accomplished in forest management. This is another reason why wholesale planting of vacant land within a short period was justified rather than a more protracted schedule, which in this case would probably have meant discontinuance of planting due to advancing wages, cessation of unemployment, and inability to obtain sufficient funds. Although so large a proportion of the forestry eggs have been placed in the one basket of Rotorua *radiata*, fortunately this is not the whole story. Of other species planted in that forestry block, the Douglas fir of Oregon has shown a development that, while not as rapid as this pine, gives much promise. It should be capable of continuing growth to a considerably greater age and size than *Pinus radiata*, and will not be subject to the same insect pests or diseases, always a a danger in large areas devoted to a single species. European larch is also free from imported diseases so far and has merits for creosoted poles and post timber.

The principal experiments with the three southern pines from America have been wisely staged in the northern State forests, whose total annual temperature is more in keeping with their demands. Of these, the loblolly pine (*P. taeda*) and the slash pine (*P. caribaea*) appear to give excellent promise, and to be as dependable, if not more so, than *P. radiata*, which, North of Auckland, is manifestly out of its optimum range and shows a tendency to die out on the stiff "gum" soils formerly the abode of kauri. Of the future of the longleaf pine (*P. palustris*) I am not so sure. It does not kill out the scrub as do the other two pines, nor will it yield here as heavy a crop in the same length of time. It may have a place in these warmer northern latitudes, just as the Corsican pine (*P. laricio*), the Mexican pine (*P. patula*), the Ponderosa pine and perhaps others may have, to aid in reforesting harsh soil and difficult sites. Experience is the best instructor in dealing with these introduced species.

I would not wish to end this article on a note of pessimism, but it seems to me that the future of the plantations of *Pinus radiata* on most of the flat areas of the Canterbury plains is precarious, due to effect of hardpan in confining the roots to a surface layer of sometimes less than 2 feet, and the occurrence of violent winds that will show an increasing tendency to blow down these pines as they increase in size. By contract it would appear that the peculiar river deposit soil in the Nelson area, combined with a more generous rainfall, give rise to a form of *P. radiata* distinctly superior in growth habits, smallness of limbs, and abundance of natural reproduction (completely lacking on the plains) that make this one of the most promising areas for exotic forestry in the Islands, an advantage increased by nearness to a local market for container cases, and to tidewater.

My final comment is that New Zealand by reason of its climate and soils is peculiarly favoured as a region in which to grow large quantities of pine timber for export to a world in which there is an increasing shortage of this commodity. This is the final reason why I believe that no vital mistake was made in planting such large areas to conifers. It should be obvious, however, that the nearer to the shipping points that timber can be grown, the less will be the cost of transportation and the greater the profit. The same rule applies to local markets, and justifies the policy of creating planted forests of exotics adjacent to the larger centres of consumption.
