

sympathy in their bereavement goes out to Mrs. Anderson, her daughter and two sons, one of whom is a trainee with the Forest Service.

DEVELOPMENT IN OUR EXOTIC FORESTS

(PRESIDENTIAL ADDRESS BY G. H. HOCKING)

More than half of New Zealand's exotic forest estate lies within 50 miles of Rotorua. So it seems an appropriate place to take stock of our exotic forests, see in what ways they are unsatisfactory and how their shortcomings can be remedied. I do not presume to don the prophet's mantle or offer a panacea but in all trepidation make some suggestions in the hope of drawing forth other views.

THE PRESENT POSITION

The history of our exotic forests must be fairly well known to you all. I do not propose to go over in detail the ground which has been well covered in recent years by Foster (1) in his paper to the 1947 Empire Forestry Conference and by Kennedy (2) at our 1951 Annual Meeting, but only to repeat the salient features necessary to an appreciation of the present.

The figures below are not quite up to date but are sufficiently accurate for our present purpose :

	Acres	Per cent
State forests ...	470,000	53
Company forests ...	310,000	35
Other forests ...	100,000	12
	880,000	100

Foster has distinguished three phases in the planting of State forests ; bringing his figures up to 1951 these are :

- (1) 1898-1922 46,700 acres : first period of intensive forestry.
- (2) 1923-1936 376,500 acres : period of intensive forestry.
- (3) Since 1937 45,500 acres to 1951 : second period of intensive forestry

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468-700

Nearly all the 310,000 acres of company forests fall within the second period. The 100,000 acres of forests of all other ownerships are very varied in kind and age ; perhaps half should be disregarded in considering production.

The characteristics of the exotic forests can best be considered under the three main periods mentioned above.

PERIOD OF INTENSIVE STATE FORESTRY, 1898-1922

A wide range of species, mainly European, was planted with high standards of establishment and high initial stocking. While

some of the species proved unsuitable, the main defect was the later neglect of thinning leading to stagnation and unbalance in stands which might now have been of the highest quality. Considering their limited extent, these early plantings were fairly widely distributed with a natural emphasis on the treeless eastern side of the South Island. However, proximity to markets does not seem to have been given much consideration.

PERIOD OF EXTENSIVE STATE AND COMPANY PLANTING, 1923-36

To enable enormous annual plantings to be made standards of establishment were lowered and spacing was increased. Other silvicultural defects were the use of some very poor sites and unsuitable species, use of seed of unsatisfactory type and provenance, poor nursery and planting methods, and neglect of blanking and release cutting.

More than 600,000 acres were planted, of which two thirds was *Pinus radiata*. This tree became the principal species on State forests and formed 90% of the company forests; it was used over a wide range of sites. About 60% of the State planting was on one forest—Kaingaroa, and the great majority of the company planting was also on the pumice lands of the central North Island. In view of the fetish of low costs and, particularly, of cheap land for State planting, there was little attempt to cater for the main centres of consumption by developing local supply forests. Except for a few notable exceptions with more favourable markets, tending of the well established stands of the earlier period was generally limited to pruning.

SECOND PERIOD OF INTENSIVE STATE FORESTRY, 1937 TO DATE

This has been marked by a reaction against the excesses and grosser faults of the boom planting period, and a scaling down of forest operations due to increasing costs and a reduced labour supply. Large scale company planting is a thing of the past, while State planting has averaged little more than 3,000 acres per annum. Silvicultural standards have improved; land acquired for planting has been more suitable; more consideration has been given to the siting of species and the predominance of *P. radiata* has been reduced; seed, nursery and planting standards have been raised; higher initial stocking has been insisted upon.

On new forests an establishment period of 20 to 30 years is planned; this has so far allowed tending to keep pace with planting with a more or less stable labour complement. Though the need for decentralisation of exotic forests was recognised at the beginning of this period, the establishment of local supply forests in timber-

deficient districts is substantially a post-war development. The limitations of this period have been economic rather than technical. Planting in many of the timber-deficient districts has not yet reached a level at which the now inevitable deficiency can be arrested. Treatment of stands originating in the two earlier periods is falling increasingly in arrears.

We have recognised 1923 and 1937 as marking major changes in the extent and nature of establishment and tending of exotic forests. But the year 1940 is equally noteworthy as the beginning of large-scale timber production from exotic forest stands. Previously supplies of *P. radiata* had come mainly from farm shelterbelts, but now both State and company forests were producing this species, which the war time demand was helping to establish as a general purpose building timber. No further exotic is yet available in large quantities, but thinnings are yielding sufficient to enable their properties and uses to be demonstrated.

The development of this utilization phase is advancing as spectacularly as did the planting of the mid-twenties. In particular the great integrated industrial development for the production of timber, pulp and paper from both State and company forests in this district are very much in the public eye. So much so that there seems to be a danger that the man in the street may regard these great industrial undertakings as the objective in all our exotic forests rather than the natural accompaniment of an aggregation of forest bearing no relationship to the requirements of the surrounding district. He may be apt to mistake successful integration in the engineering field for the optimum economic development of the exotic forest estate in general, and accept the existence of an export trade in forest produce as *prima facie* evidence that New Zealand's own requirements are adequately and economically provided for an indefinite time to come.

PROBLEMS OF THE PRESENT EXOTIC FOREST SITUATION

It has been truly stated that New Zealanders of this generation are fortunate beings. They have participated in the liquidation of an indigenous forest estate of unparalleled excellence but have been forced to admit their inability to perpetuate it. But even now their substitute exotic forests are presenting problems of plenty. Nine hundred thousand acres of exotic forest with an immediate productivity such that we are preoccupied with the diversification of its products and the development of overseas markets. On the face of it surely good cause for satisfaction. But a closer look will dispel any complacency. Let us see what the main faults have been and how they can be corrected or alleviated.

POLICY—One is at once struck by the erratic distribution of the exotic forests in relation to that of population and industry. Historically this stems from the Government policy after World War I.

At that time and through the depression there was much waste land and it was considered that forestry should not compete for land with any farming potentiality. If idle Crown Land were available the Forest Service could avoid the initial outlay for land purchase. Often the forests established in the earlier period served as nuclei for more ambitious planting. The administration was obsessed with the fetish of low costs and, in particular, cheap land.

And so we find the great extension of State planting on pumice country in this district. By the standards of the times it was ideal. It was unsuitable for farming—cobalt and improved techniques were still in the future—much Crown Land was available, the land was easy, tussock and scrub were little obstruction to planting and the nuclear forests had already shown the suitability of the better parts for exotic conifers. Under these conditions it is perhaps not surprising that more than half of all State afforestation is here. Elsewhere these same factors applied in varying degrees; low costs were generally given more consideration than the ability of the land to support a forest or proximity to markets, though in some cases these factors were not too bad. Thus areas were selected on the Auckland gumlands, on the Moutere gravels of Nelson and on the stony plains of North Canterbury. In Otago there was expansion around the earlier plantings, and where altitudes were not too great, the sites were satisfactory. The lower half of the North Island seems to have been deficient in available wildernesses and only Karioi was launched on high Crown-owned tussock country far from the main centres of population.

The company forests tended to follow the Forest Service, but some minor ones in other districts now serve to show what might have been achieved by a better distribution of State forests.

Even after 1930 the launching of new afforestation schemes was determined more by the presence of problem lands than by considerations of forest economics.

Since 1937 the aim of the Forest Service has been to increase the number of medium-sized local supply forests but, understandably, little could be achieved until after World War II. A number of new schemes have been started and, in a few districts previously unprovided, sufficient land is now held to meet the planting requirements for many years to come, but in others much remains to be done.

Let us consider the provinces of Wellington, Hawke's Bay and Taranaki, by far the biggest deficient area in New Zealand. It has 29% of the country's population but less than 6% of its exotic State forests. Indeed the position is worse than the figures suggest because most of this State forest is in long rotation species, some is lightly stocked interplanting of indigenous forest; moreover there is no great quantity of private and local body forests.

Present effort cannot significantly relieve the local shortage before 1980 when, we are told, the population of these provinces will have reached the million mark and passed that of the whole of the South Island. After making allowance for declining supplies of indigenous timber and such increase as can be expected in local exotic production, it is apparent that as early as 1960 this region will have a deficit of almost 70 million board feet per annum. By 1980 the imports from other districts will have had to increase to about 160 million board feet per annum. Up to that date those imports will, on present rates, have cost nearly £30 million in freight. I think it is not overstating the position to say that £20 million of this freight could have been saved by the establishment of reasonably distributed forests in this region during the past 25 years.

Supposing all the forests now in the course of establishment or projected in the region are developed as planned, the deficit of exotic timber will still continue to increase. It will have risen to about 175 million board feet per annum by the end of the century and perhaps 240 million 70 years hence when it will still be necessary to bring in more than half the region's timber requirements at an annual freight cost of more than £1½ million. I know that others will arrive at different figures, because no two persons will give identical values to the several variables involved—population increase, per capita consumption, rotations, yields and so on, but I do not think these figures are exaggerated.

So far as this and other deficiency areas are concerned we cannot but be thankful that this central pumice region is so lavishly endowed; Nelson too must soon achieve a production beyond her own requirements. But there can be little justification for perpetuating this state of affairs. Apart from the freight costs involved it seems doubtful whether these two sources will always have an adequate surplus after providing for their own needs, including their forest products industries, and their nearer neighbours.

There are of course other reasons why we should disperse our exotic forests. Apart from the heavy transport costs necessitated by centralisation, there would be a heavy burden on the transport system, a burden that might well prove too heavy in an emergency. Moreover, in another war dispersed forests would be less vulnerable to enemy action. Recent years should have taught us that the risks from disease, insect depredation and climatic hazards are accentuated by having our exotic eggs in too few baskets.

It must be conceded that the new forests will often be more difficult to establish and, in comparison with the boom planting years, much more expensive. But surely we have had enough experience to know that low initial costs are no assurance of ultimate financial success; and it is unlikely that the increased costs will wipe out the advantage of eliminating several hundred miles of transport.

I have referred particularly to the exotic forest deficiency in the southern half of the North Island. But there are others, fortunately smaller. Even in those districts which have been better served in the past, further planting is necessary in most to achieve a sustained yield adequate to meet the needs of a growing population. For example McKinnon (3) has estimated that the present 25,000 acres of exotic State forest in Otago and Southland will have to be increased by 40,000 to 50,000 acres before the end of the century. Canterbury faces a substantial shortage largely due to the low productivity of the forests established there in the period of extensive planting.

Allowing that unsuitable species and tree types were often used in the period of large-scale afforestation, results have amply demonstrated that the planting of cheap land of no farming value can often be a very costly way of producing timber. Some of the country planted, such as the more impoverished gumland, must be regarded as sub-marginal for forestry. Ironically we are now seeing the gumlands, where forestry has failed, being reclaimed for farming. The formerly despised pumice country is undergoing a most spectacular transformation, though admittedly most of it has proved suitable for forestry too.

With the outward advance of farm settlement and the accumulating evidence of the unsoundness of exotic forests on the more extreme sites, the two land uses are coming into increasing competition in the marginal zone. Fortunately the bionomic and economic factors in farming and forestry differ. Some land of fairly high forestry potential still has a comparatively low farming value. Conversely there is much land which can be farmed economically which is definitely sub-marginal for timber production for reasons of climate, soil, topography or accessibility. The integration of farming and forestry is a challenge to both the forester and the land development officer. The forester must surrender some of his best sites but resist the inevitable suggestion that he should be content with the scattered discard of barren tops and inaccessible corners.

I think it is dangerous to try to lay down hard and fast rules about what should and what should not be available to the forester. Each geographic unit has a different set of conditions which will call for a different allocation of land between farm and forest. The ideal of complete regional self-sufficiency in timber requirements will not always be possible nor economically justifiable. It will often be unwise to try to produce in one district the full range of general and special purpose woods that the market may require. The extent to which private and local body forests can assume the burden of local supply will also vary from district to district. In some deficient localities a substantial extension of farm woodlots would be a logical trend in an intensifying land use. There are obvious difficulties in

this course including conflict between short-term and long-term interests.

SILVICULTURE—The silvicultural shortcomings of the past are well enough known to you and must have already been mentioned : planting on bad sites, faulty siting of species, bad tree types and provenances, short-cut establishment methods leading to low and irregular stocking, neglect of subsequent tending, a great preponderance of one species (*P. radiata*) and irregular distribution of age-classes (85% of planting within 10 years). These faults have been substantially reduced in the greatly curtailed plantings of the last 15 years. But corrective measures on the huge areas of the boom planting period and the excellently established stands of the earliest plantings have been pitifully small. The main reason for this neglect is of course that, with the lifting of the depression, the abundant source of cheap labour dried up. In the case of the companies, the basis of taxation also discouraged tending. Ever since forestry has had to operate under a much higher cost structure and a chronic labour shortage. As this state of affairs is unlikely to be reversed, we would do well to adjust ourselves to it rather than plead it as an excuse for further procrastination. Twenty years ago it was said we could not thin for want of markets ; now we are prone to excuse ourselves on the grounds of cost.

Foresters are traditionally conservative. There has certainly been a strong reaction against the unorthodox practices of the twenties and early thirties, but I think there is a danger that we may become too conservative in some respects. We have highly unorthodox forests which call for no ordinary treatment if they are to be developed to best advantage at this late stage. To address you in this vein may be preaching to the converted. At our annual meeting two years ago Kennedy suggested that the whole future of our exotic forests might be summed up in the two words "timely thinning" and pleaded for a vigorous programme of thinning to waste. At last year's meeting the symposium was on increasing the productivity of our exotic forests. We heard papers on such subjects as thinning by poisoning and selective contract pruning—devices to enable vigour of growth and quality increment to be maintained with the minimum of labour. Mistakes will certainly be made in devising methods to circumvent high costs and labour shortages, but they will not be as great as the mistake of ignoring all that cannot be done by traditional methods.

In common with other countries we are finding it necessary to mechanise our work to the utmost to make reasonable progress under present conditions. Many changes in nursery practice have been made with the primary object of reducing labour. In the forest itself, machinery has been associated mainly with logging in the past, but it is now becoming necessary to adopt mechanical aids to land

clearing and even planting. There is wide scope for ingenuity in circumventing the bottle neck of limited and costly labour without sacrificing our standards. I may call down the wrath of our fire protection experts in suggesting that fire is still one of our best tools when used properly.

After half a century of planting we may be prone to assume we have thoroughly tested all the exotic species worth considering. But are there not some niches inadequately filled: a sufficient range of species for the areas of highest rainfall, and tolerant trees that might be introduced into some of our inferior pure pine stands? Insects, diseases and soil deterioration will necessitate our reconsidering mixtures.

We are apt to deride the work of our predecessors, though they created great assets. Their errors were mainly in policy, for which the field man could not be blamed. We are much better off than they: there is a vast accumulation of evidence in the forests themselves, while we also have the aid of organised research and training. But we have a long way to go in bringing New Zealand's exotic forest estate to the stage where it can best serve the needs of the country as a whole.

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SOME VEGETATION CHANGES FOLLOWING A CROP OF 23 YEAR OLD *PINUS RADIATA*.

By J. E. HENRY

(Paper read at Annual Meeting)

Plant succession is normally a slow process, but occasionally interruptions occur which upset the normal trends. Such an interruption took place when pine trees were planted in the pumice areas, and the purpose of this paper is to put on record a change of vegetation that occurred following the growing and harvesting of a twenty three year old crop of *Pinus radiata*. The change has influenced the re-establishment of pines on the areas concerned and for this reason is of interest.

On the pumice soils of the Rotorua-Taupo area three site classes for *Pinus radiata* have been defined. These are Site Class I—tall