SOME THOUGHTS ON "PLANTATION FORESTRY" IN NEW ZEALAND — MAINLY REMINISCENT

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1. EARLY DAYS

The planting of exotic forest trees began in New Zealand almost contemporaneously with the felling of the native forests, and, ironically perhaps, was begun by the same agent, the incoming freehold settler — the "private sector" in the current jargon.

Motivated by the clamant need for shelter from the wind, and by a nostalgic craving for a "homelike" surrounding, the homesteader on the open eastern side of the country began, as soon as he obtained possession, to develop a pattern of groves which was to become one of the most attractive features of our rural landscape.

Brought in as seed, or as seedlings, lovingly tended on the long voyage, and including practically every species known in Britain, the trees were set out to frame and protect the homestead, and were intended to be "things of beauty" rather than of use.

However, the need for shelter for crops and stock led to extension of planting beyond the homestead environs. From the mid-eighties onward, this was greatly facilitated by the availability of radiata pine.

The story of the coming of this species to New Zealand has been well told by Hocking (1930) so will not be repeated here. Suffice to say that its value as a hardy and quick-growing shelter tree was quickly recognised, and its widespread use for paddock-corner clumps and fenceline rows and belts became a characteristic feature of our land-use pattern. The aim of these plantings was frankly utilitarian. Beyond the pressing need for shelter, the trees provided fuelwood and the promise of rough timber for farm use in time to come. We might say with some truth that plantation forestry began here.

Closer settlement shifted the emphasis from pasture toward cropping, and accentuated the need for shelter. "If you want to go bankrupt, plough up your tussock."

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The matter was naturally most serious in Canterbury, where the reservation of public lands for plantation reserves became a regular feature of land settlement policy. As these reserves were handed to the counties to administer, the "local body sector" entered the forestry scene. Its entry was definitely oriented by economic motives, with dual use in mind.

While initially quite a wide range of species was tried, including eucalypts, regarded as "good farmers' trees", there was an increasing tendency to concentrate on the highly adaptable and fast-growing radiata pine which gave almost instant shelter, with promise of a heavy volume of timber to follow. A small-scale variant of this theme was the planting of wattle, from which it was hoped to develop a tan bark industry. Unfortunately, the species had a low tannin content, and failed to thrive on the site chosen.

The vesting of the reserves carried an obligation on the counties to maintain a separate reserves account, and not to divert reserves income to general purposes; but as the only initial income was from leasing unplanted reserves for grazing, many reserves were still unplanted by the time of the First World War.

Others, however, by that time carried stands up to twenty-five years old, with considerable volumes of usable timber; and it was in these stands and under the stimulus of war that the Canterbury pine sawmilling industry arose. From this start it continued, under favourable conditions of access and topography, to supply the needs of Christchurch for boxing, crating and concrete forming.

In 1896 the Government set up the Afforestation Branch of the Lands Department, thus bringing the "Government sector" into the picture and completing the tripod of private, local body and State activity in plantation forestry. Its duties were to provide the future timber requirements of the country — purely utilitarian single-purpose forestry. Its efforts were to prove a minor contribution only to the timber needs of the future, though they made a signal contribution to the beauty of the countryside.

The Branch commenced with a brief and unsuccessful trial of native species — e.g., totara at Puhipuhi — and then settled down to develop a series of plantations, mainly on the drier eastern sides of both Islands, modelled closely on current practices in Britain, and using northern hemisphere conifers. Corsican, Scots and ponderosa pines, Douglas fir, larch, and a few cedars and spruces were all set out at meticulously measured close spacing, and all planting losses were carefully blanked up.

The location of these forests was unfortunate from the economic standpoint in that it was influenced by the penal and
land-use policies of the day. Thus I quote: “Forestry provides healthy outdoor work for prisoners, well away from settled areas”, and “Forestry is a good use for land that does not attract the settler”. The phrase “Wastelands of the Crown” is not often heard these days, but I still wince if I should hear it.

As much of this work with new species on new sites was a matter of trial, some failures could have been pardoned. However, most of their plantings thrived in the new surroundings — so much so that, with their close spacing, they soon became congested. The scope of the work, however, was quite inadequate to promise any significant contribution to timber needs. In the 24 years of operation, the total area established by the Afforestation Branch was only 12 000 hectares.

As the second decade of the current century opened, the Government gave some thought to the future, and in 1913 a Royal Commission was appointed to report on the position. Its main recommendations were for the setting up of a separate Forestry Department, headed by a professional forester to be obtained from overseas, and for a greatly expanded programme of plantation forests.

Consideration of the report was delayed by the First World War, 1914-18, and it was not until 1920 that implementation was given to its major recommendations.

The political scene is succinctly portrayed by Allsop (1973) so there is no need for me to elaborate on those aspects. However, some of the points of the report may require elucidation for present-day readers.

The Commission, which had been dominated by Leonard Cockayne, in recommending a greatly expanded afforestation effort drew attention to the rapid growth and successful acclimatisation of radiata pine, and suggested that it be given prior consideration. This caused some surprise in timber industry circles, for the species had no commercial background. “Cockayne is a botanist. What does he know about timber?” and “Fancy using that rubbish as timber” were perhaps the mildest comments in trade circles.

It is therefore interesting to set out in some detail the steps by which this major decision was reached.

2. ARGUMENTS PRO AND CON RADIATA PINE

Examination of the stands of all types as they had developed in New Zealand seemed to justify the following conclusions: Radiata pine had revealed itself as unique in its rapidity of growth, and its ability to thrive on a wide range of soils, and under a wide range of environment. It seeded early and profusely, and required only the simplest of nursery and planta-
tion techniques. So far it had been free of any significant insect or fungal attack. A susceptibility to heavy frosts in the seedling stage was its only limiting factor.

Only the eucalypts could vie with radiata for volume growth, but the species so far extensively planted were difficult to establish, were proving restrictive as to site, were of poor form, and were already cursed with a plethora of insect and fungal pests. Also, the timber they yielded was too hard and heavy for building and general use, and lacked sufficient natural durability to permit entry into the field of heavy construction.

Comparison with the conifers which formed the standard building and general softwoods of the northern hemisphere was heavily in favour of radiata pine in rate of volume growth, in ease of establishment, and in site requirement; in addition, seed was available locally in ample supply.

However, radiata was a pine of no established commercial reputation. In its own country it was a minor member of a large group of intermediate pines which suffered by comparison with the white pines on the one hand, and the yellow pines on the other. Like the mule, it could take no pride in ancestry. A criticism voiced at the time was that its very rapidity of growth would, *ipso facto*, result in an “inferior” timber — that it was a “weed species”. But comparison of radiata timber with that of Corsican, ponderosa, etc., as grown in New Zealand was not wholly in its disfavour. Radiata tended to have large knots widely spaced, while the other major pine species tended to have smaller knots, closely spaced; but all were knotty, soft, weak and non-durable, compared with rimu, totara and kauri.

The sawn volume of exotic pines had by 1925 risen to 5% of the total annual cut, but the timber went into boxing, crating and concrete forming. Before pine could replace podocarp in the housing field, new standards would be required, of which added durability, particularly with reference to the *Anobium* house borer, was an obvious “must”.

It appeared that radiata pine would prove more amenable to treatment than the others and the case for it as the dominant species in a greatly expanded planting plan was thus generally accepted.

The term “monoculture” was not yet on everyone’s lips but the Empire Forestry Conference in 1928 drew attention to the risks in excessive dependence on a single species. Actually, considerable thought had been given to complementary or alternative species, but, unfortunately, few species could compare on level terms with radiata.

An attempt to grow redwood, based on its premium value as a joinery timber, and the spectacular development of the
Memorial Grove at Rotorua, failed as a result of frost and wind damage. Only Douglas fir seemed to promise a timber complementary to radiata, though its silvical requirements were to prove more exacting.

Nevertheless, on the principle of “spreading the risks” the Forest Service for many years was to continue planting significant proportions of all its areas to conifers other than radiata; though the private companies were less inhibited, and, with few exceptions, plumped solidly for radiata.

The close planting of the earlier stands had been defended on the grounds that it accelerated height growth, and would develop clear timber on the lower bole. However, the stands so established, now up to twenty-five years of age, revealed clearly that neither object was being attained, but rather that diameter growth was being markedly inhibited.

It was also becoming obvious that the practice of planting small unit areas to diverse species and age classes, laid out often with little reference to topography or extraction routes, was destined to cause difficulty in utilisation. Someone coined the phrase “a silvicultural slum” with reference to these stands.

3. THE TWENTIES

The greatly expanded programme for the Forest Service was therefore based on 2.4 m × 2.4 m spacing, and acceptance of a small planting mortality without blanking-up.

Compartments were of a single species, and were greatly expanded in size — up to 150 ha. In rolling country they were laid out with consideration for future extraction routes.

Strenuous efforts were made to bring down the costs of forest establishment. Nurseries were centralised. Planting stock was reduced from a three-year seedbed-transplant bed regime to an 18-month growth in drill-sown lines. Mechanisation began to replace hand labour. Direct establishment was tried with line drilling, spot sowing, and broadcast sowing, though without great success.

Pressure to obtain cheap land meant that the forests continued to be planted on “waste lands”, usually at some distance from future markets. The use of prison labour had been discontinued, but initially the supply of seasonal rural labour was adequate for the winter planting season.

“Spin-off” effects from the Forest Service programme were: In the local body sector, an invigoration took place, particularly in the south. Christchurch and Dunedin City Councils each developed city forests of significant size. Ashburton and MacKenzie counties moved to market mature stands, to re-plant cutover areas and to extend the planting to previously
unplanted reserves. The well-known plantations at the summit of Burkes Pass, flanking the monument, "Oh ye who enter the portals of the MacKenzie... plant trees for your lives...", date from this period.

The Selwyn Plantation Board, set up specifically to secure unified management of the plantation reserves when the old Selwyn county was dismembered, had secured a superintendent from the old Afforestation Branch. It was planting up to 150 ha per year, with some innovative measures such as ploughing sodbound grassland prior to planting (successful) and underplanting poor wattle and eucalypt stands with radiata (not successful).

On a wider scale the "washing-up bills" of the twenties provided for the vesting of areas for plantation purposes in a wide range of local bodies throughout the country. In some cases the vesting Act required that forest working plans be prepared and submitted to the Forest Service for approval, a stipulation repealed in the early years of the McGavock regime.

In the private sector, the Forest Service generated wide interest among landowners through its extension officers and its sales of cheap mass-produced trees. There was a marked renewal and extension of plantation areas, particularly for purposes such as suppression of gorse, and control of soil erosion.

The Burkes Pass monument has been mentioned in a previous paragraph. It is fitting to mention here that the erector of this and other monuments in the MacKenzie Country, Tom Burnett, took his own advice, and planted several blocks near the homestead of his Mt Cook station, revealing his Scots ancestry not only by use of the Gaelic on some of his monuments, but by the use of larch as his principal species. Others of the MacKenzie runholders planted similarly. The resulting stands are a striking picture from the Hermitage road in autumn.

Then in the mid-twenties a wave of forest planting companies took forestry and financial circles by surprise, though it was a logical enough development from the Forest Service publicity in support of its own activities. While forestry companies were formed in all parts of New Zealand, and aimed at products as diverse as tung oil and flax, the majority tended to follow Forest Service practice, concentrated largely or wholly on radiata and stated their object as the production of pulpwood. (There was at that time one paper mill in New Zealand, using imported materials.)

The companies also tended to concentrate on the volcanic plateau of the central North Island, where lack of the trace element cobalt in the soil had caused pastoral occupation to
fail over large areas of mainly easy topography, covered with bracken or light scrub, and available at almost nominal prices. Here a centre of activity developed which in the period 1925-30 saw some 300 000 ha of forest company land planted in the upper Waikato valley, matching the Forest Service effort on the Kaingaroa plains to the east. Both these major efforts were concentrated on non-forested lands.

Efforts at this time by a few sawmilling firms to plant exogenous pines on their cutover native forest blocks were short-lived owing to the heavy cost of clearing, the rush of competition by native second growth, and heavy loss of planted stock, owing to Armillaria.

No further efforts were made to utilise native-forest cutovers until non-forested lands were fully taken up.

The human effort involved in this major programme in the central North Island was considerable, for nursery work, site preparation and planting were all still largely done by hand. The labour force was almost wholly Maori, and, being coincident with a rapid upsurge in Maori population, the employment in forest work contributed markedly to an economic base for the people of the central plateau.

By the end of the decade the world was in the grip of the depression. Government expenditure was greatly curtailed, so that Forest Service planting was reduced to filling out unfinished areas. In any case, the Forest Service had more than fulfilled the targets set in the Ellis regime, and was no longer under pressure.

However, the urgent need to find work for the unemployed led to the provision of funds, eagerly seized upon by the Minister of the day, Taverner, to initiate a programme of thinning the overcrowned stands inherited from the old Afforestation Branch. For much of the product of this work no profitable use was found, but it led to establishment of the first commercial plants for the preservative treatment of posts and poles.

The private forestry companies were in worse position, for the flow of investment capital dried up, and they were literally stopped in their tracks. From then until the post-war recovery, their activities were “mothballed”.

4. THE THIRTIES AND FORTIES

These two decades were a period in which the forests grew almost unaided, while in laboratories and wood-using plants throughout the world a widespread programme of research and testing was carried out, looking to their profitable use.

Within the forests, growth and development were on the whole excellent. Health was good, and losses of forest area
had been surprisingly small considering the reduced standards of protection and maintenance which operated over the years of the depression and the war. Massed windthrow was beginning to cause significant losses in Canterbury but so far the vitality of radiata had permitted partial retrieval of loss where the windthrown boles drew sufficient nourishment through the unsevered roots to remain green and sound for up to 2 years until they could be utilised — Arthur Cooney's "*Pinus horizontalis*".

This was only the beginning, of course. Tawhiri-matea had yet to reveal his full strength in his eternal war against the children of Tane, and devastation beyond conception was yet to fall upon the forests of Canterbury and Nelson; but that is getting ahead of the story.

Fire had proved less a threat than had been feared. Outbreaks had resulted from carelessness at times of gale-force winds and had thus proved more frequent in the South Island than in the North. In the central plateau of the North Island the one major fire, that of 1946, was a stunning psychological blow. But actually, coming as it did, before large-scale activity began in the forests, it was a blessing in disguise. It highlighted the risk in permitting fires to burn on adjacent lands, and led to the passage of the Forests and Rural Fires Act. Under the system of Rural Fire Committees thus set up, fire is now a manageable hazard, provided vigilance is not relaxed.

This fire was also significant in its revelation of the extraordinary power of regeneration of the radiata pine. The 15- to 16-year-old stands had been completely killed, but from the ashes arose, over the whole 12 000 ha, a crop of seedlings measured at stockings of hundreds of thousands per hectare.

While this utter prodigality was a matter of concern in the next decade, the problem eventually resolved itself, largely through a disease-free period of intense self-elimination until thinnings for fence posts, etc., could begin. The upshot thus was a new self-originated stand, in no way inferior to the planted stands, and of an age which went some way toward correction of the abnormal age-class distribution in the forest.

At this point we can record the entire success of the long and widespread programme of research and trial, leading to the profitable use of the exotic pine timbers.

The suitability of radiata for pulping had been established by pilot tests, and plans for large combined sawmill-pulpmill-papermill complexes were taking shape. Cardboard was already being produced at Whakatane. Impregnation plants to treat poles, posts and sleepers with creosote were functioning, and now the establishment of clean treatments with various proprietary salts was enabling the exotic pines to enter the building field.
The State Advances Corporation approved the use of treated pine in the Government housing programme, and the Carpenters Union received the new, softer, lighter and less fissile timber with enthusiasm. Drying kilns were built to turn out timber to fixed moisture content, and framing timbers were supplied gauged to exact dimension. Manufacture of veneer and plywood was well advanced.

In all this wide-ranging series of trials, the general result was the same, that radiata was a most amenable timber for almost all major lines of wood use.

5. THE FIFTIES

Recollections of the “decade of realisation” opening in 1950 are these:

Within the stands, reduction in stocking through mutual competition had been less than anticipated. From the original planting survival of, say, 1500 stems per hectare, the stands, now aged 20 to 25 years, had reduced to an overstocked 500 live trees per hectare.

There was a surprisingly high proportion (5 to 15%) of forked trees — a visitor coined the phrase “the phenomenon of the forked tree”. These, however, were tending toward elimination, through their higher susceptibility to sporadic wind break — which was at this stage the chief factor operating within the stands to reduce the stocking. Boles of eliminating due to earlier suppression stood gaunt and bare throughout, so when logging exposed these snags to view passers-by mistakenly thought them to have been fire-killed. Some years were to pass before snagfelling became standard practice on all logging operations.

Health was surprisingly good, considering the overstocked conditions which had applied since the sapling stage. No active pathogens were present. Huhus were in the snags and windfalls. Sirex, which had been known as a minor factor in Canterbury for at least three decades, was, in the central North Island, just following the logging into the stands as they were opened up. There was some indication of a developing epidemic, but the threat was removed by a co-operative effort (financed by all major timber owners) to breed up and liberate various natural enemies of the Sirex, and by the gradual elimination of the overcrowded stands in which the trees in the subordinate crown classes were predisposed to attack.

One conspicuous minor feature in the early fifties was the sporadic occurrence of patches up to 20 m or so in diameter in which all trees were recently dead. This condition was
traced to lightning strike. A central tree carried the characteristic streak of ruptured tissue down the bole, while the surrounding trees were evidently killed by root contact.

At this stage — i.e., the early fifties — a thick carpet of needles covered a layer of black organic soil several inches deep, overlying the pumice. There was no second or third tier vegetation, and visibility was restricted only by topography, and by the trees themselves. Swales of mesophytic ferns were beginning to establish in damp situations. Five years later, however, a rush of ground fern and tree fern species became general throughout.

The trees ran from 30 to 50 cm in dbh with milling-lengths up to 18 m.

By 1950 sawmills were operating in practically every forest ownership as the various companies strove to bring in some cash after the lean years of the thirties and forties. These mills were in the main small units of the type still standard in indigenous forest operations — a table-top breakdown, and one or two breast benches producing about 20 to 40 m³ per day. However, the Forest Service was already operating its Swedish gang mill at Waipa, and N.Z. Forest Products was just opening the first side of a gang and band mill unit whose output would be upward of 230 m³ a day.

In the bush, felling was still by axe and crosscut saw, with ground snigging by small tractor. Log transport was already by lorry. The bush tram, which had been the mainstay of the native bush operations, had had a very brief life in the exotic plantations, and the formation of roads for log lorries was already an integral part of every operation.

Chainsaws were soon to appear, and the use of the hard hat was to make a significant impression on the accident rate. Larger tractors followed, and larger trucks called for better internal roading. As rougher country was dealt with, spar trees and high leads of various types made their appearance.

As logging proceeded, the future use of the land had to be decided. With the State forests, it was accepted that the land would be continued in forest, but with various plantation companies this was not necessarily the case. The application of cobalt had eliminated "bush sickness" and the pumice lands were being developed as farms.

Settlers who had clung to their holdings during the bad years were now doing well, and the Land Development branch of Government was bringing in thousands of hectares annually for new settlement. There was a general assumption that, as farms had followed the felling of the native forests, so also would farms now follow the harvest of the exotic plantations.
Several of the small companies did arrange to release their land for development to pasture as they were logged. The timber royalties had been sufficient to clear their accumulated costs and leave a fair capital gain, but they were not prepared to meet the responsibilities of single-ageclass forestry for a second time.

In spite of the need to clean up the logging debris, the land had a distinct value, and met with a ready market. There was therefore some consternation, and even resentment in farming circles, when the major company made it clear that the whole of its area would be returned to forest for the continuous nourishment of its complex of wood-using industries upon which a whole new community now depended.

Initially, management assumed that it would be necessary to replant the areas. Then, when the extraordinary capacity of radiata was recognised, it was hoped that natural regeneration might be relied on for a complete restocking. However, various factors such as competition from the swales of fern, and from the inrush of native shrubs, operated to cause an inadequate survival of pine regeneration over significant proportions of the area, while on the balance the pine seedling stocking was so dense that an early thinning-to-waste treatment was essential to avoid stagnation. As the cost of this could be equated with that of replanting, it became the practice to clear and replant all areas on which natural seeding could not be depended for a complete and immediate restocking. The proportion of such areas tended to increase steadily.

As the second-crop stands grew in area and in stature, regimes of silvicultural treatment were applied to ensure their best development. An early brushing treatment cleared the bole to head-height, allowing internal access, while subsequent treatments provided for pruning selected stems at least to one-log height, and thinning to 200 or 250 stems per hectare while the stands were still in the pole stage.

The exact regime applied on any tract varied somewhat depending on its local characteristics, and the expected feasibility of making an early utilisation thinning for fence posts or pulpwood. Different forest managers held differing views as to the precise form and timing of these regimes. There is still difference of opinion on these points, but there is general agreement that such treatments are not only conducive to best stand development, but are profitable.

The day of the “silvicultural slum” is now over.

These regimes gave rise to the recruitment of a specialised class of forest labour — the “silvicultural gangs” characterised usually by young men as compared with those forming the “bush gangs” engaged in felling and removal. Their numerical
strength on any forest gradually rose to approximately equal
that of the loggers.

6. THE SIXTIES

For plantation forestry the sixties brought both good news
and bad news.

The bad news was the increased loss due to gale-force winds.
These affected Canterbury and Nelson, where rugged topo-
graphy, impacted soils, and the increasing height of the stands
combined to cause catastrophic loss from a series of cyclonic
storms. Precautions such as deep ripping of subsoil gravels,
orientation of planting rows, and early thinning, proved
puny defences against the veering, twisting and flattening
power of the gales.

In a few cases fires were swept through the stands by these
gales, and added to the loss. There is perhaps a need for a
closer link between the fire protection organisation and the
weather forecasters, looking to a more effective clampdown
on all outdoor fires when such winds can be expected.

While losses were minimised by efficient salvage of logs
for export, and by priority cutting at local sawmills, the ad-
visability of further planting in the most exposed areas is open
to some doubt.

Two items may be cited under the heading of good news,
both concerned with man’s increased mastery of the air. First
was the demonstration that unthrifty stands which had gone
into check on certain soils such as the gumland clays of North
Auckland could be restored to health and vigour by applica-
tion of superphosphate. This was followed by advance in two
directions — one, that application of appropriate fertilisers
would correct unthriftiness on other “problem soils”; and the
other, that aerial topdressing offered a cheap and effective
means of application to large areas of varied topography.
Such applications are now standard practice in many areas,
thus bringing radiata silviculture even more closely into line
with agriculture.

The second item concerns the Dothistroma pine needle-cast
disease, and one may wonder why it is not considered “bad
news”. The point is that in spite of our excellent quarantine
systems the eventual introduction of such a pathogen may be
regarded as one of the hazards of life. The good news lies
in the facts that, since the introduction of Dothistroma, (i) it
has been shown that it can be effectively controlled by aerially-
applied spraying; (ii) the Forest Service and Forest Owners
Federation have combined in a regular spray programme to
cover forests of all ownerships; and (iii) radiata, our main
pine, has proved less susceptible to the disease than other
pines in our plantations. Shades of an early president of our Institute, who told us on his return from a visit to Monterey, "The tree is inherently soft. It is a bad risk. . . ."

This does not mean we can relax our vigilance, but it does give us some hope that if calamity strikes its effects may be ameliorated.

7. THE SEVENTIES

Most conspicuous development of the seventies has been the rise of a new wave of expansion of plantation forests, affecting both the Forest Service and the major companies.

Current growth and the surplus growing stock accumulated over the thirties and forties have now all been committed, and further areas will be required to nourish the expanding requirements confidently predicted for the future.

Search for suitable areas for new plantations has led to some interesting developments. First has been the renewed interest in native bush cutovers. Development of larger-powered tractors and specialised land-clearing attachments has made it practicable to clear such areas of rubbish and second-growth; and aerial application of seed, weedicides, etc., has made it economically feasible for many areas lying derelict since cutting of the native stand to be returned to profitable forest growth, albeit with a different species.

Second is the emergence of long-term leasehold as an alternative to freehold title to forest lands. This movement began with the Forest Service as a means to secure unified action to afforest—e.g., drifting sand tracts which include Maori lands, without extinguishing Maori ownership and interest in their ancestral domains.

The arrangement here is usually for the establishment, maintenance and protection of the forest by the Forest Service, the payment to the owners of a nominal interim ground rent, a percentage sharing of all royalty values, and an ultimate decision as to whether the lease is renewed to the Forest Service or whether the owners take over the forest on agreed terms. This has been applied to several west coast North Island areas where control of sand drift is important; and is also being applied to central North Island areas where Crown and Maori ownerships are interspersed in an area having hydro-electric and runoff-control aspects. However, in addition to leasing areas for its own planting, the Forest Service has itself leased some of its own State forest holdings to a major forestry company.

This is an area of cut over native forest, containing scattered remnants of the original stand and some steep country. Steps to convert it to planted pine have already brought the com-
pany face to face with the problems of soil erosion in a critical watershed, and the opposition of the conservation school to any cutting of vestigial native cover.

Third is the movement towards farm forestry, where efforts are in train to develop trees over grass, or grass under trees, as a harmonious combination of timber and livestock production, looking towards maximum production from the soil. The potentialities of this have still to be explored.

Fourth is the movement to recreate forest on lands from which it has once been cleared. This began in a small way in the sixties when lands logged for the first crop of pines in the south Waikato were disposed of, cleared and grassed, and then within the decade were repurchased by sawmilling interests, and replanted to a second crop of pine.

However, current proposals envisage the acquisition for forestry of up to 60,000 ha in the central King Country. This is an area from which the native bush was cleared for pastoral settlement from 25 to 50 years ago, but on which farming has proved distinctly marginal, with abandoned holdings and paddocks reverting to scrub and noxious weeds. As soil, topography, and climate are essentially the same as those on the open lands on which the south Waikato forests have developed so successfully, there is no reason to doubt that pine plantations on these lands will similarly succeed, and buttress the economic basis of the community.

8. THOUGHTS FOR THE FUTURE

The essence of these reminiscences so far has been the successful acclimatisation of the radiata pine. The decision in the twenties to base a major afforestation project on this species has been vindicated both silviculturally and economically. It might be asked to what limits might we safely expand its range.

My own thought is that, if radiata has an Achilles heel, it will be found on the West Coast of the South Island, with its excessive rainfall and refractory soils. I would therefore be very hesitant about any extension of commercial radiata plantations south of the Buller until much more testing and proving have been done than is now the case.

As an alternative, I would come back to the pine-podocarp-beech tripod I have mentioned previously (Hutchinson, 1972). I suggest the time is now ripe for a purposeful effort to develop the beech and podocarp legs of the tripod to dimensions where they can sustain a fair share of the load.

Is this heresy, or is it a keeping open of all our options for the ultimate safeguarding of our forest wealth?
REFERENCES

