

# INDUSTRIES BASED ON NEW ZEALAND'S EXOTIC-SOFTWOOD FORESTS\*

T. A. FOLEY†

## SYNOPSIS

*This paper describes the development of industries whose raw materials are primarily exotic softwoods, and in particular radiata pine. The scope and nature of these industries and a forecast of future trends in production, manufacture, and marketing are discussed.*

## INTRODUCTION

The history of the acceptance by the timber trade and by the general public of the products of the extensive commercial forests of radiata pine established by the State and by private companies between the mid 1920s and late 1930s will no doubt be written around the introduction of new methods of timber conversion, processing, and marketing made necessary by the near maturity of these forests, and the inevitable reassessment of standards by the specification writers and timber users. In other words, the successful substitution of radiata pine, regarded at that time as of doubtful quality, for indigenous softwoods of known high quality has been a matter of tailoring one's coat according to the cloth.

A new product or material is invariably treated with suspicion by the consumer when it is first introduced to the market. It is not surprising, therefore, that the New Zealand sawmiller, merchant, manufacturer, and consumer with one accord adopted a negative, almost hostile attitude, towards radiata pine when it became a timber of commercial consequence (production-wise) in the early 1930s. Apart from its little understood properties, the sawn timber had many more defects per unit area than the customarily used indigenous softwoods like rimu, matai, totara, kahikatea, and kauri. Furthermore, the defects were larger and more variable, and the heartwood content of the merchantable logs was so small as to be of little consequence. Compared with these indigenous species, radiata pine logs were small, they tapered excessively, and the yield of good salable grades was small. It was small wonder that sawmillers clung tenaciously to the hope that the Forest Service prognostications about fast-diminishing resources of merchantable indigenous bush were misplaced or overly pessimistic.

From the merchant's and consumer's point of view, the timber had little to commend it. It did not yield clear grades of heart quality as did the native species. It was knotty, prone to sapstain, and of low durability: as a framing timber it seemed to lack the requisite strength. These factors combined to condemn in the eyes of the timber industry at large the future prospects of exotic forestry based on radiata pine. Added to this, the stringent material

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† Timber Utilization Officer, N.Z. Forest Service, Wellington.

specifications that had been, and still are, a national feature of New Zealand building industries were to prove a most difficult barrier to break through.

Notwithstanding the vicissitudes arising from the replacement of indigenous woods by a totally different class of raw material, radiata pine is now the bulwark of the timber industry—and in fact is the basis of a multi-million-pound investment, sustaining several allied industries (including pulp and paper) and making a considerable contribution to overseas funds.

## SAWMILL AND MERCHANDISING INDUSTRIES

Sawmilling equipment and methods had developed to suit the conversion of the indigenous softwood forests yielding relatively large logs that contain a high percentage of defect-free timber around a relatively small defective core, and in which there is a high price differential between heartwood and sapwood. Constantly receding forest edges, difficult logging conditions, and small capital investment had restricted operations to a small scale and to small simple units typified by either vertical or twin-saw table equipment to handle big logs, and breast benches for resawing for grade.

When planted exotic forests reached the stage of utilization in the late 1930s, the Forest Service realized that the typically small logs with numerous defects which the forests would yield required different equipment and better handling and marketing methods. Thus the Forest Service proceeded with the establishment of a mill at Rotorua in 1939, using Swedish log frames, and introduced anti-sapstain dipping facilities, kiln-drying units, and radically different handling methods. Subsidiary band-saw equipment has been added since to handle big logs and to allow a greater measure of selective cutting. The several big mills which have subsequently been established have also incorporated a combination of log frames for small logs and American-type equipment for the bigger logs and more selective cutting.

Between the two world wars, merchants dealt almost exclusively in indigenous softwoods and imported timbers under conditions where supply was generally in excess of demand, and where the price played a predominant part in deciding sizes, grades, and species of timber which should be bought and stocked. The merchant often had the choice of what he would accept from the local sawmiller, a practice which led the sawmiller to supply above grade. These conditions led to further undesirable trade practices which upset orderly marketing. The Second World War, however, rapidly depleted stocks and accelerated the cutting of accessible indigenous stands, and thus brought about a timber-sellers' market never before known to New Zealand. This type of market has persisted up until very recently and has involved in many instances a complete re-orientation of ideas of policy among merchants and sawmillers. Before the last war the sawmiller-merchant combination was not common. In fact, the structure was comparatively simple in that the three main sections—sawmilling, marketing, and building—confined their activities almost exclusively to their respective spheres. Most of the larger merchants depended on privately owned sawmills for timber supplies. Since that time merchants and some builders have realized that dependence on pre-war sources of supply would threaten their livelihood. Consequently

the trend has been for them either to acquire or to establish sawmills: even some furniture manufacturers have obtained their own production resources. The greatest contribution to accelerated timber production since the war has been made by merchants and other wood users who of necessity entered the sawmilling industry in order to protect their investment and trade. The attractive features of merchandising also encouraged sawmillers to enter this field.

In more recent years, with the progressive and substantial increase in the sawing, processing, and preservative treatment of radiata pine, and with the more diversified use being made of preservative-treated indigenous sapwood timbers, supplies generally have become adequate for most purposes. This situation has desirably allowed the user a greater degree of selectivity in his buying than he has had since before the Second World War and consequently has sharpened competition in the sawmilling and merchandising field and improved standards of sawing, grading, and service.

Concurrent with this competition for markets and a bigger share of the building industry has been the tendency for some of the larger sawmilling-merchandising firms to develop pre-cut housing businesses. This trend towards large and comprehensive business enterprises has encouraged the expansion of a few well capitalized conversion and processing units based either on radiata pine or radiata pine plus indigenous timber. These sawmills either have their own marketing outlets or obtain long-term contracts at the expense of the smaller under-capitalized mills with small outputs and insecure markets.

This trend towards integration, although extremely complex, offers considerable advantages from the viewpoint of utilization. Heavily capitalized with high-production units, and with considerable mature exotic resources awaiting harvesting, these larger companies have competed keenly for available markets, both at home and abroad.

Responsible members of the timber trade have recognized the importance of maintaining high standards of sawing, trimming, grading, and branding of their products. These merchandising techniques which are commonly seen today are in contrast to earlier practices in which little attention was paid to uniform standards of quality and none to appearance or presentation. The improved merchandising of radiata pine has done much to win the confidence of the user and the authorities responsible for specifications. Industry has assumed its rightful responsibility for exercising its own prerogative in quality control. Whilst this is so in general, many smaller operatives still find it expedient to sell cut-of-the-log or ungraded timber to builders at reduced prices in the mistaken belief that it pays them to do so. This is a constant source of concern to the more responsible members of the industry and building authorities alike, and gives rise to disharmony between customer and supplier and to frequent requests for the Forest Service to check-grade.

### *Background to the Use of Radiata Pine (Sawn Timber)*

Prior to the Second World War, about 90% of the annual production of radiata pine was used for box making, concrete form-work,

and similar commodities. The timber's reputation inevitably became linked with these uses, and for many years the association proved a hindrance to expansion of its use for house construction. In the post-war years, however, demand considerably exceeded indigenous-timber production and imported timbers were so expensive and difficult to procure that the building industry had little choice but to turn to the large resources of radiata pine. Initial progress was made mainly in grades which could replace lower grades in indigenous timber. Thus, radiata pine became progressively an acceptable substitute for rimu in house framing when the latter species could not be obtained by builders. With the passage of time, coupled with an awareness that it was no less suitable for the purpose than rimu and in fact that it was easier to handle and fabricate, it gradually became the preferred framing timber. Today radiata pine represents the bulk of framing used in house construction and in many fields of heavy construction, particularly in the North Island, which is unfavourably situated for supplies of rimu and where the main exotic forests and large timber-production units are concentrated.

The popularity of radiata pine with carpenters greatly facilitated its later acceptance for flooring, interior joinery, and a host of manufactured items. Whereas conservatism and custom have tended to retard its acceptance for some purposes, its availability at prices comparable with indigenous-timber prices and its cheapness compared with imported timbers have influenced the timber's use in a large number of industries and products.

Other factors which have secured a prominent place for radiata pine in the building and other wood-based industries are its ease of seasoning, preservation, machining, fixing with mechanical fastenings, gluing, and its high strength/weight ratio. Apart from these natural qualities, the introduction and universal adoption of anti-sapstain dipping of green sawn timber, and preservative treatment of the bulk of timber intended for exterior use, good seasoning practices, uniform grading and grade marking, combined with attractive presentation of the products, have all enhanced the appearance and serviceability of a species whose natural growth habit and limitations would otherwise restrict its use.

Growth conditions impose limitations on the production of the higher grades of radiata pine from unthinned and unpruned stands: but, despite the frequency of objectionable holes caused by the stems of persistent cones adhering to the trunk of the tree and of bark-encased knots (which are the principal defects), quite considerable quantities of boards are run into flooring, mouldings, some weatherboards, and other finishing lines.

The potential over-supply of lower grades of limited utility have constituted a threat to the economic welfare of the sawmilling and merchanting interests. The outlet for chipping and conversion of low-grade timber to fibre and pulp is available only to, at the most, three major producers. A factor which has discouraged re-manufacture of lower grades of timber is the narrow spread of price values between the lowest and highest grades. Further, this has resulted in an excessive demand for higher grades. Nevertheless, some devices for improving the utility of low-grade boards have been introduced. One of the first was knot plugging with semi-automatic machines, several of which have been installed in the

country after success with knot boring and plugging in central Europe and Scandinavia. The process has not proved economic in New Zealand. Conservatism has been an additional factor in prejudicing its future. End jointing of short clear lengths of timber is now quite a common practice. Singular success has been achieved by at least two firms that have installed high-production capacity finger-jointing machines, turning out clear grades of flooring in the main. One of the two North Island firms engaged in finger jointing has also installed an edge-bonding unit for the manufacture of wide boards in long lengths out of finger-jointed, short length, narrow "clears". It also manufactures laminated beams intended for use in load-bearing structures and mill-work. Edge bonding integrated with finger jointing is proving to be a versatile and satisfactory operation. It is quite clear, however, that, with the high costs involved in salvage recovery and with the narrow spread of retail values that pertain at present, it is extremely difficult to operate economic finger-jointing units on their own but there is evidence to indicate that finger jointing associated with edge bonding in the production of long wide panels can yield substantially higher returns to the producer than will the direct sale of low-grade timber.

Radiata pine is a most ubiquitous species. The uses to which it has been successfully put are many and varied. In fact it would be much easier to list those uses for which it is not suitable than those for which it is. Research findings and technological advances that can be applied to preparation of timber before use and to its fixing and finishing have provided the means of improving the quality and serviceability of radiata pine, which is deficient in many respects when left to develop its natural growth habit. Notwithstanding this and the extensive resources within the country, New Zealand imports a large percentage of the exterior joinery and weatherboard requirements and some of the furniture timbers, and supplements locally-grown timbers with Australian hardwoods for poles, marine piles, and heavy construction. Some Douglas fir is imported for joinery and heavy construction. The seemingly indispensable portion of the timber imports comprises long-length clears of redwood and cedar for exterior joinery and weatherboards to offset the fall-off in the production of high-grade totara and heart rimu, and some furniture timbers to supplement rimu, beech, and tawa and to provide variety for furniture and feature work where natural finish demands attractive grain and wide defect-free boards amenable to shaping, bending, etc. Although radiata pine is fulfilling a significant proportion of the demand for utility or functional-type furniture and has proved popular as knotty panelling, it will never be a substitute for mahogany, teak, Japanese oak, etc., all of which can logically be classed as specialist timbers by virtue of their high price.

Thus far, New Zealand has been slow to exploit radiata pine for exterior joinery — as distinct from kitchen fittings and built-in furniture — which is one of the most demanding of specialist uses, requiring straight grain, defect-free, medium-length timber, light weight, good working and painting properties, durability, and stability. With the exception of the last two properties, radiata pine can fulfil the requirements satisfactorily and naturally. Durability can be readily achieved with preservatives, but the question of stability has not so far been faced up to by the joinery trade.

However, there is little doubt that it will be achieved with water repellents, or the use of bulking compounds, or by chemical modification of the wood — apart from painting. There is an appreciable margin between the present costs of imported cedar and preservative-treated dry radiata pine Factory grade (clear cuttings) which should be adequate to accommodate one of these treatments. The sapwood of pine timbers treated with pentachlorophenol plus water repellents is widely accepted through the United States for external joinery.

## INDUSTRIES BASED ON SAWN TIMBER

### *Consumption of Sawn Timber*

The saw log has always been — and is likely to continue to be — the most important item of forest produce in New Zealand.

The *per capita* consumption of sawn timber in New Zealand over the past five years has averaged 275 bd.ft per year. This is not excelled in any other country. Of the total of 666 million bd.ft of timber produced last year, 60% was exotic softwoods, of which 90% was radiata pine. Exactly where the exotics are used has been exercising the minds of the Forest Service Planning Section, in particular the Statistician, but roughly speaking the distribution is: building 180 million bd.ft, industry 80 million bd.ft, dunnage 20 million bd.ft, farm use and "do it yourself" 120 million bd.ft.

### *Domestic Building*

Single storeyed wooden units dominate the residential areas of New Zealand and, although the expected trend (in keeping with European development) is for people to be housed in multi-storey blocks of concrete flats in main centres, with a decline in the unit demand for sawn timber, the sawlog will without doubt continue to be the most important product of our forests for a long time to come. As far as the local market is concerned, an abundant supply of relatively cheap timber accounts for its traditional use in building, and, unless there is a very marked increase in timber prices in the future, it is confidently expected that timber will continue to be the principal basic material in house construction and that exotic softwoods will be the predominant timber species.

Radiata pine has already become the preferred framing timber in the North Island, and with the declining production of rimu in the South Island radiata pine will logically supersede it in that part of the country. The timber's light weight and ease of handling and fabrication make it eminently suitable for pre-cutting of houses and pre-fabrication. These methods of building have rapidly gained favour with users because of the advantages of quick erection at competitive prices as well as the attendant house planning and other services which efficiently managed pre-cut and pre-fabrication businesses provide. As previously mentioned, enterprising saw-millers and merchants either in combination or as separate but nevertheless integrally interwoven complexes, have moved into the house-building field, and, apart from earning additional and attractive profits, they are in general ensuring that optimum usage is made of radiata pine, which yields a multitude of qualities in the sawn condition but at the same time provides (very profitably)



for judicious selection, re-cutting and upgrading and the servicing of the general building trade with cut-to-length studs and other framing members. With the current high building rate, competition seems to be mainly in the procurement of building sites, especially in the North Island centres.

With regard to framing, it should be mentioned that radiata pine has won approbation in the building industry despite the fact that sustained high demand for timber over the last 15 to 20 years has discouraged, and in fact physically prevented, the sawmilling and merchanting industries from drying the timber, and despite the inevitable distortion and shrinkage problems and other side-effects which have resulted from this practice. However, it is almost certain that, with the market changes that are taking place at present and with production promising to outstrip demand, producers will be obliged to increase their timber-drying capacity and to market framing dried to a moisture content below fibre-saturation point, or to a point where little subsequent movement in the timber is likely to take place. Discerning buyers are already insisting upon this, and some enlightened producers and retailers are supplying dry framing. The need to install framing in a dry condition is particularly important in pre-cut houses and mass-produced buildings, where there is insufficient time for framing components to lose "free" water before being covered in. Since more and more radiata pine is being used for heavy construction as beams and other large section members, spanning wide distances, and in truss construction, moisture content has become a critical factor from the point of view of strength within the piece and at joints. The paucity of dry timber has limited radiata pine's usefulness as a substitute for imported oregon in heavy construction and as a competitor of steel.

Apart from the demand for dry timber for both light and heavy construction which the industry cannot ignore, it is an inescapable fact that economics will dictate the introduction of machine grading, which in turn will make it both sensible and profitable to partially dry (to at least 30% moisture content) both light framing and large cross-sectional timber for engineering design work.

## PULP- AND FIBRE-BASED INDUSTRIES

Prior to the Second World War there was no large-scale pulp industry in New Zealand. Since that time a vigorous pulp and paper industry has been developed and its rate of growth is one of the most spectacular in the development of the country's economy. The industry is based exclusively on radiata pine, which yields an outstanding fibre for both mechanical and chemical pulping.

Based primarily on radiata pine forests located in the central part of the North Island, pulp- and fibre-based industries comprise five pulp and paper mills, a fibreboard mill, and two particle-board mills. Of the five pulp and paper mills, three are integrated units producing sawn timber and between them chemical and mechanical pulp, newsprint, kraft paper, fibreboard, and paperboard. Two other plants are producing paper and tissue from purchased pulps (one produces its own mechanical pulp), both imported and home produced.

At present, some 300,000 metric tons (296,000 long tons) of pulp products, including newsprint, kraft and other paper, paperboard, and fibreboard are produced yearly. The exports during 1963 were 63,000 tons of pulp, 108,000 tons of newsprint, and small quantities of fibreboard, paperboard, and other papers, to a value of over \$8.5 million.

Forest development in the next decade will logically include at least one medium-sized pulp and paper industry in the South Island, and in the North Island further expansion of paper production.

## PLYWOOD INDUSTRY

New Zealand is not well endowed with supplies of decorative woods suitable for peeling or slicing for plywood and veneer production, and, with the inevitable curtailment of logging in indigenous softwood forests, it seems clear that expansion of the industry will be dependent upon the future yield of peeler-quality logs from intensively pruned exotic forests. At present, peeling of radiata pine is limited in the main to the production of cross-band material and short-length face-quality veneer from short defect-free bolts, obtained from between branch nodes of the log; one-third of the total volume of logs used for peeling are of radiata.

## GLUE LAMINATION INDUSTRY

Glue lamination is in its infancy in New Zealand; yet there are extensive building programmes and ample wood resources, which are essential to the promotion of the laminating industry. Radiata pine provides the best immediate prospect for the establishment of a stable glue-lamination industry. Several firms have experimented with glue-laminating techniques, and a number of buildings, including churches, schools, and grandstands, incorporating glue-laminated beams and portals, are to be seen about the country. The indications are that a vigorous and profitable industry capable of expanding the use of timber in commercial and industrial fields will develop.

## PRESERVATION INDUSTRY

Since 1947 the timber-preservation industry has developed technically and in magnitude to a remarkable degree. New Zealand's *per capita* consumption of preservative-treated building timber is the highest in the world. The paucity of naturally durable timbers gave impetus to the initial growth of the industry, which is now an essential ingredient of the timber economy in this country, and ever-increasing quantities of non-durable exotic timber are being used in place of durable Australian hardwoods for such exacting purposes as poles, piles, posts, railway sleepers, and bridge decking. In 1963-4, 44% of the total exotic sawn timber production was treated with preservatives.

A further factor in the economics of afforestation is the profitable utilization of thinnings since the advent of large-scale commercial treatment.

Since 1947, the use of pressure treatment with water-borne multi-salt preservatives has increased rapidly and today there are 97



pressure plants in the country using water-soluble wood preservatives (such as the commercial preparations Boliden S25 and K33, Celcure A, and Tanalith C and CA). The other major process used for the treatment of building timbers is diffusion-impregnation with boric acid-borate solutions of high concentration. For ground-contact purposes, treatment is mainly by pressure impregnation using coal-tar creosote or pentachlorophenol, although recently some water-soluble preservatives have also been used. The preservative treatment of poles has developed to a stage where a large part of the needs for short and intermediate length poles (up to 30 ft) is being met with preservative-treated softwoods, principally European larch, Douglas fir, and species of pine.

Quality control of timber preservation is exercised by a Timber Preservation Authority, which authorizes preservatives, specifications, and processes and polices treatment standards.

### CO-OPERATION WITHIN THE TIMBER INDUSTRY

Since this paper is slanted towards suggesting how New Zealand experience can help other countries which may have similar problems, mention should be made of the relationship of the several segments of the industry. Co-operation amongst exotic-softwoods producers and the sinking of individual differences in a common objective have materially assisted the successful development and expansion of enterprises based on radiata pine and the utilization of the timber. The Forest Service takes pride in the example it has set in co-operation. It has been Government policy to undertake responsibility for some degree of sawmilling (of exotic softwoods), processing, and manufacture, and to undertake developmental and demonstrational work in these fields of operation. It has pioneered both the local and export trade in radiata pine, Corsican pine, and New Zealand-grown Douglas fir, and has actively assisted in the procurement of shipping and cargoes and promotion of the timber generally in Australia, the Pacific Islands, and Japan. It conducts regular training courses (for operatives) in kiln drying, preservation, and timber grading, and the near future will see the fulfilment of industry-supported plans for trade training in saw doctoring, machining, sawing, etc. Detailed information on any phase of the Forest Service's activities has been furnished to representatives of private firms, and the results of research and developmental work are published. The provision of information in this way is by no means unilateral despite the many-sided interests of the larger firms in indigenous sawmilling and exotic sawmilling, in merchandising, in manufacturing, and in building.

It is also of interest to record the lively interest being displayed by sawmillers, merchants, and manufacturers in forest-products research undertaken at the Forest Research Institute. This appreciation of the importance of research, particularly as it applies to exotic softwoods, is manifested in the representation of industry on the Forest Products Research Advisory Committee, whose members are almost entirely outside the New Zealand Forest Service. One of the more tangible examples of co-operation between organizations engaged in timber pursuits is the provision of a sum exceeding £100,000 from the timber industries for improved facilities for forest-products research at the Forest Research Institute.

Although the several facets of the timber industry are not federated except in the sense of wood promotion through the medium of a timber-development association, sawmilling and merchandising fraternities are closely knit and strong. With the growth of the exotic-sawmilling sector, a Radiata Pine Division of the Dominion Sawmillers' Federation was formed several years ago to promote the optimum use of radiata pine and the export trade in this timber. It is noteworthy that this dichotomous arrangement within the parent body has functioned very satisfactorily despite separate and, indeed, complicated sectional interests. The sinking of individual differences and the rationalization of problems besetting both indigenous and exotic sawmilling and marketing have been a feature of industrial relations.

## CONCLUSION

This kaleidoscopic review of the part exotic timber is playing in industry does not pretend to be exhaustive, but has endeavoured to bring out a few features or trends which are perhaps deserving of further brief review; for three-quarters of the total production (182 million cu. ft in terms of roundwood) is from the exotic forests.

Radiata pine is the type timber of its group in New Zealand and, therefore, only passing reference has been made to other *Pinus* species. With the aid of manufacturing resourcefulness and a virile preservation industry, the range of uses for radiata pine has developed almost to the maximum for general purposes with very satisfactory results. The timber has also been used for specialist uses such as furniture and uncovered floors, for which it is not entirely suited. On the other hand, it has not yet been exploited for such critical uses as exterior joinery and weatherboards. This has been due to the enforcement of high standards of acceptance, to the availability of imported timbers (albeit at very high prices) for these purposes, and, in part, to the limited availability of radiata pine of suitable grade. New Zealand-grown Douglas fir and larches are characterized by uneven texture with all its implications, by excellent strength and stiffness, by relatively high heartwood content, and by difficulties in preservative treatment. The bulk of sawn timber produced in these species is outstandingly useful for structural and scantling sizes that admit small but numerous defects.

Balance in grade production has been impossible to obtain, but the larger integrated units are meeting this problem in part by the recovery of short clear lengths of timber suitable for many manufacturing uses and for end jointing to build up long clear lengths of timber. Management of forests is facilitated by the relatively easy disposal of thinnings for pulp and paper and as rounds for preservative treatment.

Past marketing conditions have discouraged the universal application of sound principles of quality control, product presentation, and service by the industry to the consumer. Improvements and enlightened thinking in this regard are becoming more and more apparent. These trends augur well for the future of exotic softwoods, which demand effective marketing and most careful quality control of products from the growing point to the ultimate stage of use.

There is increasing recognition by industry of the importance of well-organized and comprehensive research as essential to planning

for economic and informed utilization. To assure continued progress and to achieve full economic use of the available wood substance for the production of goods acceptable and satisfactory to the consumer in the home and export markets, full use must be made of the expanding knowledge of wool and technological advances to improve quality and serviceability.

The plantations are of such size as to have encouraged integrated utilization to a high degree. This is providing the key to optimum forest development. Furthermore, it can be said quite definitely that of equal importance with integration is the concentration of production in a relatively few large plants. Trends in this direction in both exotic and indigenous forest-based industries are very apparent, and the beneficial results to both forestry and the country at large are becoming manifest.