SYNOPSIS

After an appraisal of current timber use and potential based on recent literature which highlights the importance of radiata pine in the country's timber economy, the paper discusses species siting using Hawke's Bay as an example. Past attitudes and practices are discussed showing how they have affected the species distribution in the forests of the region. The risk factors of markets, biological risk, fire, nutrient loss and wind are discussed, indicating how they can limit siting.

Present siting practice is then described, relating this to the forest policy of the region, market requirements, risk factors, particular regional problems, future silvicultural operations, and logging considerations.

In addition to the wide use of pines and Douglas fir, the role of other species is briefly covered. The paper concludes with a plea for firm national and regional policies to aid rationalizing species siting.

INTRODUCTION

This paper discusses the factors being taken into consideration for planning species siting in Hawke's Bay District. In some instances, decisions may be readily made on the basis of a few major factors while in others a number of minor factors may, in the end, carry more weight in the decision.

A review of recent literature indicates that the New Zealand timber industry is becoming more and more based on exotic softwoods, particularly radiata pine, owing to its versatility in use and ability to grow rapidly on a wide range of sites (Foley, 1965; Travers, 1967). Planning for future demand both at home and for export is almost entirely based on this species and, with increased technological advances and more intensive tending for specific products, its importance may further increase.

The role of other special-purpose timbers can be fulfilled from planting on sites optimum for their growth. However, for reasons of economy, centralization, and continuity of supply, these resources should be severely limited in number and, because of localized population and demand, such sites should be in the Auckland region. Alternatively, for some uses it may be more satisfactory to rely on imports (Reid, 1965, 1966, 1968).

Of the other utilitarian species, the cypress and cedar group is most unlikely to be able to compete economically with radiata and the poplars will be grown for other reasons, such as soil conservation; but an endeavour should be made to use utilisable species where possible and also to try to record

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the potential yield in different areas (van Kraayenoord, 1968). The ash eucalypts, if limited to only a few similar species and planted on a large scale, may, because of their high volume production provide a suitable diversification from radiata (Barr, 1968; Bunn, 1968; Reid, 1957). They could also provide short-fibred pulp to mix with softwood pulp in the manufacture of better quality paper.

As a result of this review, I am left wondering more about the role of our “second string” Douglas fir than any other timber. Should it, in fact, have this important place at all? Nearly all of its roles can be fulfilled by radiata and, although it provides significant export earnings, more advertising and demonstrations may give a break-through on the Australian market for radiata pine, which has the potential of greater profits particularly if grown on short rotations (Fenton, 1967; Wilcox, 1968). Perhaps Douglas fir should be eclipsed by other and more utilitarian species.

This raises the question of risks, which are covered below. All economic activity contains some risk and generally the greater the risk to the investor the greater the profit expected. If the aim of afforestation in this country should be to provide only enough raw material to satisfy local demand, it might be argued that an internal economic loss would be more acceptable than using overseas funds for imports. Nevertheless, each segment of the industry from grower to retailer would still expect to trade profitably.

However, the national policy is to export for profit and an increase of overseas earnings. The economic facts, perhaps over-simplified, “boil down” to a proposition that without radiata there would be a much reduced income from forest-based exports — and for this reason we should accept the risks of growing this species.

To summarize, we are wedded to radiata pine. By all means plant other timbers for special purposes and other utilitarian species for diversification, but primarily we must plant on the basis of the best for utilization, the fastest growth and on a large enough scale for continuity of supply.

Ealier Development

Although land had previously been set aside for afforestation at Mohaka in 1931, there was no major planting by the State in Hawke's Bay District until large-scale establishment commenced at Gwavas Forest in 1947, followed by Esk Forest 1950, Mohaka Forest 1960, and Kaweka Forest 1964. Esk Forest was commenced primarily for conservation after major floodings of the Esk River. The others were begun as local supply forests but with Kaweka planned as a much smaller unit than that now envisaged.

Siting

Species were originally allocated on the basis of “approximately 50% radiata pine, up to 25% Douglas fir on sheltered sites, up to 20% Corsican pine on exposed sites and up to
15% of other species in accordance with their site requirements" (old working plans). The present distribution is shown in Table 1, correct as at 31 March, 1969.

**TABLE 1: AREAS PLANTED IN HAWKE’S BAY, BY SPECIES AND FORESTS**

<table>
<thead>
<tr>
<th>Species</th>
<th>Gwavas acres %</th>
<th>Esk acres %</th>
<th>Mohaka acres %</th>
<th>Kaweka acres %</th>
<th>Total acres %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiata pine</td>
<td>4,122 58</td>
<td>2,538 52</td>
<td>2,323 50</td>
<td>1,650 63</td>
<td>10,633 55</td>
</tr>
<tr>
<td>Douglas fir</td>
<td>1,431 20</td>
<td>949 18</td>
<td>442 9</td>
<td>691 26</td>
<td>3,513 18</td>
</tr>
<tr>
<td>Corsican pine</td>
<td>810 12</td>
<td>770 16</td>
<td>584 13</td>
<td>—</td>
<td>2,164 11</td>
</tr>
<tr>
<td>Douglas fir/larch</td>
<td>353 4</td>
<td>219 5</td>
<td>546 12</td>
<td>124 59</td>
<td>1,242 6</td>
</tr>
<tr>
<td>Douglas fir/Corsican pine</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>White pine group</td>
<td>36 —</td>
<td>184 4</td>
<td>137 3</td>
<td>169 6</td>
<td>701 4</td>
</tr>
<tr>
<td>Douglas fir/lodgepole pine</td>
<td>68 —</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>68</td>
</tr>
<tr>
<td>Patula pine</td>
<td>40 —</td>
<td>25 —</td>
<td>—</td>
<td>—</td>
<td>65</td>
</tr>
<tr>
<td>Eucalypts</td>
<td>3 —</td>
<td>26 —</td>
<td>—</td>
<td>—</td>
<td>29</td>
</tr>
<tr>
<td>Lodgepole pine</td>
<td>—</td>
<td>20 —</td>
<td>—</td>
<td>—</td>
<td>20</td>
</tr>
<tr>
<td>Minor species</td>
<td>242 3</td>
<td>158 3</td>
<td>107 2</td>
<td>—</td>
<td>507 2</td>
</tr>
<tr>
<td></td>
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<td>20</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>507 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19,299</td>
</tr>
</tbody>
</table>

Note: A further 4,000 acres of company forests should be added to the total (70% radiata pine). No estimate has been made of farm resources, which are likely to be depleted in a few years by the export trade.

Some points of interest are:

1. Areas of patula pine planted earlier as species trials; volume growth is good, form reasonable and in sheltered areas less wind damage than normally associated with the species.

2. 3 row x 3 row Douglas fir/larch mixtures planted with the aim of preserving the identity of the mixture over a longer period than possible with an alternate row mixture. Presumably, larch had a brighter future at that time.

3. 3 x 3 row European/Japanese larch mixture; a large-scale trial with the hope of producing hybrids for the next rotation.

4. Fairly large areas of *Pinus strobus* and *P. monticola* which, because of their economic importance in the U.S.A., were widely planted at one stage. Under New Zealand conditions, these species produce low density weak timber, poor for nail holding, construction and machining.

5. Stands of *Eucalyptus delegatensis* planted for hauler poles.

6. Surprisingly little ponderosa pine has been planted and is too young for its growth to be observed.
In recent years, because of shortages of tree stocks and increased tending programmes, Douglas fir has been planted in alternate row mixtures with either larch, as self-thinning mixtures or with Corsican pine, which it is hoped to remove for round produce, or, if necessary, leave for self-thinning.

Because of the restricted area available of conventional Douglas fir sites at Kaweka and because of high prices being obtained at the time, large areas were initially planted with this species.

However, the most important feature shown by the table is that radiata pine occupies only 55% of the resource, although the figure is being bolstered by more recent plantings. Other species account for 45% of the available resource. Approximately 5,500 acres of this is made up of Douglas fir and could form the basis of a local industry.

**RISK FACTORS**

**Market Risk**

The possibility exists that timber may lose its place for some uses to substitutes, particularly plastics and metal alloys as a result of their decreasing costs from improved technology and higher output; however, this does not appear to give the planners much concern, and the likelihood of substituting for cellulose in the manufacture of pulp and paper seems remote (Fairbairn, 1969; Familton, 1969).

**Biological Risk**

This is probably the greatest risk, as has been re-emphasized by the advent of *Dothistroma pini*. Despite the criticisms raised over the use of large areas of a few species, this risk has been accepted in many countries. It appears that fast-growing species such as radiata pine can bear the expense of treatment. It has recently been advocated that concentration on a limited number of species, with consequent improved knowledge, allows easier intensification of effort when problems arise. Similarly, large-scale control efforts on a limited number of species is likely to be more economic than the application of a number of different techniques to cover a wider range (G. C. Weston, pers. comm.).

**Fire**

Although the risk of a large fire is always present, this has been minimized by the years of the “Keep N.Z. Green” campaign. Forest Service records show that less than 2% of wood grown has been lost by fire. There is also a very efficient organization to handle any outbreaks.

**Nutrient Loss**

Growing successive crops of coniferous plantations on short rotations carries the risk of soil deterioration and eventual
loss of nutrients. However, recent work by Will and Knight (1968) suggests there is no immediate risk on the central North Island pumice plateau, but investigations are continuing to further clarify the position. Even if such work provides pessimistic results, the benefits of aerial fertilizing must be taken into account.

**Wind**

Over recent years, with the increasing height of plantations, there has been much damage from wind. At present this question is exercising the thoughts of many foresters, particularly where it is necessary to try to hold older stands to fill gaps in age class distribution. Similarly, thought is also being given to modifying silvicultural practice both on the second rotation and on the more difficult and exposed sites that are being planted in some areas.

**PRESENT SITING**

*The Effect of Policy*

This District is fortunate in that, over the last lustrum, the end-use requirements have become more clearly defined, with the evolution of policy climaxing to the development of a large wood-based industry as soon as sufficient resources are available. Hence planting targets have increased from 1,600 acres in 1967 to 2,500 acres in 1968 (3,200 achieved) and now to 5,000 acres per year. A further increase could result from acceptance of the Forestry Development Conference’s recommended crash planting programme. It is thought that the proposed industry will be an integrated pulp mill which could commence in the mid 1970s if produce is available from the Rotorua surplus (Familton, 1968); otherwise development is expected between 1980 and 1990.

*Market Requirements*

In my opinion, the end use for which the trees are being grown is the most important consideration in species selection and siting. Radiata pine is the most important species in the forest economy of the country and the proposed industrial development is based on it. It is, therefore, essential to plant as much as possible of this species, in spite of the risks often propounded. Current planning is based on planting approximately 80% of the species.

Although I query the role of Douglas fir, it will make up the greatest part of the balance — to provide continuity of supply to existing industry. It grows well, producing a large volume, stands have remained healthy, the timber is proven, and there is considerable flexibility in tending. From limited observations and from reports of planting in other regions, it appears that this species could be planted on more difficult sites and to higher altitudes than has been local past practice. Site trials have been recently set out and it appears that, under these conditions, establishment is better than radiata pine.
Siting Problems

In common with most areas, establishment is gradually being forced back to more difficult country, particularly at Gwavas which is nearly planted up. Here, planting is being carried out on the steep sides of the Wakarara Range, and will soon be moving into cutover forest on the Ruahine foothills. At Kaweka, in order to utilize fully land the Forest Service holds, establishment is being undertaken on land which a few years ago would not have been planted. Much of this land on the Kaweka Range foothills has suffered from past erosion, has little depth of good soil and is at higher altitudes than previous planting. Small areas of frost flats are also present in both these forests.

Selection of species suitable for these more difficult sites poses the most difficult problem. Corsican pine, despite its high tolerance to difficult sites, has been eliminated primarily because of *Dothistroma pini* which has infected all older stands of the species at Gwavas. Other factors against using this species are its slow growth, with consequent small size and production of narrow boards; pruning is of doubtful economics; close whorls reduce factory grade; resin pockets and resinous knots lower its potential for some uses, including pulp. These factors cancel out its value for producing round material and framing grades.

Ponderosa pine, although perhaps not as tolerant to difficult sites, is a strong contender. On an exposed site with shallow soil on the Wakarara Range, this species appears to have the edge on Corsican pine in the same mixture. It grows faster than Corsican pine and produces good pulp. It is not very suitable for framing grades because of large knot clusters and is more prone to animal damage. However, it has been rejected because of its susceptibility to *Dothistroma pini*. Its slow growth makes it uneconomic to treat compared with radiata and it could allow a build-up of inoculum potential.

Lodgepole pine will stand severe climatic and soil conditions and thus enable the limits of economic forestry to be extended. It can be used for timber and pulp and is less susceptible to *Dothistroma pini*. Also in its favour is the considerable benefit believed possible by provenance selection, particularly for growth rates. The species has been chosen for these difficult sites (about 5% of the annual programme) although it tends to suffer from animal damage and wind instability when mature.

Logging Considerations

In the past, species were frequently changed on contour levels, generally along roadlines. This has resulted in areas being sited to Corsican pine which would now be considered radiata pine sites — e.g., Corsican less than 10 ft across the road from 40 ft radiata. For economic reasons, the tendency now is to “push” radiata pine on to some of these more difficult areas where, although form could suffer, much greater
volumes will be produced. In some of these upper areas, lodgepole pine could be planted but, because of logging difficulties, radiata has been planted further than normally desirable. However, if access is available both species are used. Similarly, natural topographic units are generally planted in one species.

**Effect of Post-planting Operations**

Releasing costs can effect siting, particularly at Mohaka and to a lesser extent at Esk, as the rapid growth of bracken and tutu can necessitate up to four releasings of Douglas fir. This occurs most commonly on southerly faces, the conventional Douglas fir site, and for this reason such sites are now being sited to radiata pine, whose rapid growth rate overcomes the problem. Douglas fir is now sited where regrowth is not expected to be a major problem.

With the need to establish large areas of radiata pine, tending will have little effect on its siting. However, with such large areas some flexibility is anticipated. Although suggestions have recently been made that pruning may be economical for pulp production, it is felt that large areas may not be pruned because of low site index, slow clearwood production and labour shortages. Stands with good site indices will be pruned and thinned by top height 40 ft. If pruning falls in arrears, I believe thinning should be delayed until about top height 65 ft, when the branch characteristics of the bottom two logs have been formed. Such material could be sawn for framing, exported or used for pulp. It is also possible that, in order to have sufficient supplies available early for industry, some of the better sites should be set aside for the fast growth of pulpwood on a 15-year rotation.

Tending can affect the siting of other species with Douglas fir for self-thinning mixtures. For improved selection and early yields on easy country, it may be better to establish pure stands. However, tending could be reduced with self-thinning mixtures of larch whose high survival should ensure good form is maintained. Because of the *Dothistroma* risk and the lack of roundwood markets, Corsican pine should not be used.

**Conversion of Less Economic Stands**

The treatment of slow-growing species (larch, Corsican and strobus pines) on radiata sites is a problem. This is exemplified by the illustration above and similarly by a 20-year-old stand of Corsican at Gwavas, infected with *Dothistroma* and only about 40 ft tall, adjacent to radiata of the same age over 100 ft. Should conversion with its problems be carried out now, in preference to establishing on new ground? Should it be left until stands are older when a market may be available, although the operation could be more difficult and more expensive? Other considerations are a lack of expertise and a reluctance to use fires within the forest surrounded by older stands; and a need to plant available land and to avoid excessive holdings of unused land.
Protection Species Siting

Large-scale protective revegetation began three years ago, using direct seeding of lodgepole pine. Work has recently commenced in stream stabilization using lodgepole and mountain pines in the headwaters and poplars and willows in the lower reaches. The species used are the best currently available in sufficient quantities.

Some criticism has been levelled at the use of prolific seeding varieties of lodgepole pine of slightly poorer form than those normally used for production. Where protection areas abut productive forest, endeavours will be made to plant the better types if stocks are available. However, rather than continually postpone this type of operation, the prolific seeder is being widely used even on protective areas which may eventually have some productive role as pulpwood. A variety of willows and poplars is being used to find the best species; productive species are being tried even though areas currently being planted are thought to have little productive potential.

Other Possibilities

Because of the need to establish as much radiata pine as soon as possible, little consideration has been given to alternative species, other than to ensure supplies of Douglas fir for the local sawmills. Besides the proposed major industry and local sawmills, the only other potential markets envisaged at present are based on poplars — a match factory and a woodwool plant. Apparently these schemes could afford to establish relatively small areas close to the factory, worked on a 15-year rotation. Furthermore, a large volume would be available from farm planting.

I believe there could be scope for the establishment of small areas of ash type eucalypts, provided sufficient continuous supplies are ensured. A small industry could be based on this utilitarian hardwood or the short fibres could be used for blending with the softwood pulp. However, specialist timbers or supplies for small industries could be grown by farm foresters, provided much more effort is expended than at present on collective planning, planting and marketing. A heterogeneous mixture of small areas of varied ages is unlikely to encourage industrial development.

Amenity and fire risk have been considered in establishment along roadsides but, other than using Douglas fir, larch, poplars or mixtures, little has been done up to now.

CONCLUSIONS

Past siting has been primarily concerned with three main species, with siting based on a scale of increasing site difficulty. Further species were planted as species or site trials, for diversification (on account of biological risk), possibly to provide for special uses and, in addition, the personal whims of past foresters has doubtless had its effect.

Today, Corsican pine has been replaced by lodgepole pine, but radiata pine and Douglas fir are still planted although the proportion of the former has been considerably increased
and it is being planted on more difficult sites. Other species have a very minor role and will be used mainly for amenity planting.

Unless Government soon ratifies the priority rating recommended by the Forestry Development Conference the present planting programme, including its high proportion of radiata pine, could create difficulties with resources exceeding local requirements. Similarly, the sooner a firm date is available for the utilization plant the quicker will tending be adjusted to fit any special requirements. Finally, the preparation of regional planning models with allowances for both State and private resources should be expedited to ensure that all forest development is in the best national and regional interest.

ACKNOWLEDGEMENT

I am grateful for the constructive criticisms made by E. H. Bunn and J. G. Groome during the course of preparing this paper.

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