A SHORT REVIEW OF THINNING PRACTICE IN VICTORIA

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ABSTRACT

This paper briefly reviews thinning practice in each of the main wood-producing forest types of Victoria. It is seen that thinning practice varies a great deal between, and to a lesser extent within, forest types.

Possible reasons for the variations in thinning practice are deduced, and the matter is further examined by reference to three case studies (ash-type eucalypts, pine, and box-ironbark.) It is concluded that in Victoria important determinants of thinning practice have been topography/access, various aspects of marketing, and the capacity of the forest resource.

INTRODUCTION

Aim

The aim of this paper is to review thinning practice in each of the main wood-producing forest types of Victoria, and to indicate the factors involved, as a basis for general discussion. In keeping with such a broad aim, the broadest interpretation of "thinning" has been adopted and includes virtually any practice that reduces stand density.

Forest Types

The main wood-producing forest types of Victoria and the thinning practices associated with them are described below.

1. Plantation conifers
Area: 100 000 ha (total, State and private).
Main Species: *Pinus radiata* on more than 95% of area.
Topography: various—plains, undulating to steep foothills, and steep ranges.
Access: generally good except in steeper areas.
Productivity: high — MAI 15 to 30+ m^3/ha.
Stand structure: even-aged.
Thinning practice: (*P. radiata* only). Almost all stands are treated by means of production thinning. There has been virtually no non-commercial thinning except on a trial basis.

In State plantations the thinning regimes vary somewhat between localities, but are generally of the following form:

(i) A first thinning at age 12 to 14 years reducing stocking from about 1600 to about 700 stems/ha at stand top height 17 to 20 m. This thinning is aimed to produce at

least 50 m^3/ha of saleable products, usually pulpwood and round timbers for preservation.

(ii) Two or three subsequent thinnings at five to seven year intervals, progressively reducing stocking to a final crop level of about 200 stems/ha. Pulpwood and sawlogs are the main products. Nominal rotation age is 35 years, at which stage the bulk of the yield is sawlogs.

NOTE: In some stands on steep slopes no thinning is undertaken.

The practice in the *P. radiata* plantations of A.P.M. Forests Pty Ltd in Gippsland is similar, except that thinning is more frequent and commences earlier (at age nine years on good sites). Subsequent thinnings are made at three to five year intervals; these commonly yield less than do the thinnings from State plantations.

2. Ash-type eucalypts

Area: 645 000 ha.

Main species: *Eucalyptus regnans, Eucalyptus delegatensis* and *Eucalyptus nitens.*

Topography: higher foothills, mountains and high plateaus.

Access: varies greatly, but is poor in most areas.

Productivity: high — MAI 15 to 25+ m^3/ha.

Stand structure: even-aged — some stands are overmature.

Thinning practice: This is relevant only to younger stands. The majority of these stands originated after wildfires, the largest fire occuring in 1939. In recent years substantial areas have been regenerated on harvested or scrub-covered sites. In some of the more accessible stands a commercial thinning is carried out between ages 30 to 40, to a residual density of 20 to 27 m^3/ha, depending on age and site quality. This yields pulpwood and small sawlogs. Only one thinning is envisaged, and the associated rotation is 50 to 80 years.

3. Mixed eucalypts

Area: 4 582 000 ha.

Main species: *Eucalyptus obliqua* in some regions, and *Eucalyptus sieberi* in others.

Topography: foothills, commonly with moderate slopes.

Access: varies a great deal.

Productivity: medium — MAI 5 to 15 m^3/ha.

Stand structure: Often complex — many stands are evenaged, but two-storied stands and stands consisting of a mature or overmature overstorey with regrowth of various age classes are common.

Thinning practice: The intensity of management varies considerably between regions, and in some cases virtually no thinning is undertaken. Perhaps the most intensive management of mixed eucalypts is found in the Wombat State Forest of west-central Victoria, and this is described below.

The present forest arose in the form of extensive stands of more or less even age following the clearfelling of large areas for mining timber last century. As the result of thinning from below, cull felling, some harvesting of larger trees, wildfire and salvage cutting, many stands now carry a good quality overwood of low density, together with regrowth of various ages, either in patches or individually. The silvicultural system now in use could be loosely described as shelterwood, with two stage removal of overwood.

("Loosely" because shelterwood here describes the form rather than the intent of the system.) Regeneration is from seedlings or lignotubers in gaps caused by fire or logging The more vigorous young trees are liberated both by removal of overwood and by a limited amount of non-commercial thinning of regrowth patches and commercial thinning for pulpwood. In decadent stands liberation of vigorous young trees by poisoning cull overwood and non-commercial thinning of regrowth patches is practised when finances permit.

4. River Red Gum

Area: 190 000 ha.

Main species: *Eucalyptus camaldulensis.*

Topography: river flood plains.

Access: excellent except during flooding.

Productivity: low — MAI 1 to 5 m^3/ha.

Stand structure: complex—often a mixture of small even-aged patches.

Thinning practice: In view of the defective nature of many stands, the current strategy is to harvest as much of the overwood as possible in order to liberate advance growth, and to regenerate where advance growth is insufficient. When finances permit, cull overwood is poisoned. A very limited amount of non-commercial thinning of patches of advance growth has been carried out.

5. Box-Ironbark

Area: 370 000 ha.

Main species: *Eucalyptus hemiphloia, Eucalyptus sideroxylon* and *Eucalyptus leucoxylon.*

Topography: flat.

Access: generally excellent.

Productivity: low — MAI 1 to 3 m^3/ha.

Stand structure: complex — commonly an old low-density overstorey, with patches of regrowth of seedling or coppice origin of various ages throughout.

Thinning practice: In general the silvicultural system is based on group selection. Harvesting is carried out selectively so as to liberate the better regrowth stems. In some of the more decadent stands the overwood is virtually clearfelled. Liberation of regrowth by poisoning of overwood is practised as finances permit. Very little non-commercial thinning of regrowth patches is carried out.

DISCUSSION

The brief review above has concentrated on what is actually happening in thinning practice in the main forest types of Victoria, and many of the important conditions that may be influencing such practice have either been given but brief mention or have been left unstated. Even so, at least the following conclusions can be drawn at once:

1. Forest productivity has apparently not been an important determinant of whether or not some form of thinning is carried out.
2. Thinning of some sort is carried out wherever access is favourable, but where access is difficult, thinning is seldom undertaken.
3. Fairly elaborate thinning regimes are implemented where there has been a high capital outlay on establishment, except where access is difficult.
4. Non-commercial thinning other than release by poisoning of cull overwood is seldom undertaken.

These conclusions should be viewed with caution. In the comparison of forest types several factors of possibly great importance were confounded. For example, the forest types with low productivity tend to be associated with flat topography, easy access, durable wood, flexible silvicultural characteristics, part-time licensed operators, low capitalization in processing, and diffuse markets (i.e. mainly the surrounding rural population). On the other hand, the forest types with high productivity tend to be associated with steeper topography, poorer access, less durable wood, less flexible silvicultural characteristics, full-time licensed contractors, highly capitalized manufacturing processes, and concentrated major markets.

Obviously some further discussion is warranted. The case studies that follow are not intended to provide an exhaustive and definitive examination—the intention is merely to highlight some of the main issues involved in the Victorian scene.

Case Study 1: The ash-type eucalypts

Research into the thinning of ash-type eucalypts has been carried out in the Forests Commission principally by Webb (1966) and Incoll (W. D. Incoll, Research Branch, Forests Commission, Victoria; internal reports). Economic analysis on a stand basis suggests that for sawlog production in dense stands the following two regimes may be superior to the no-thinning regime:

a. At least one commercial thinning, say between ages 30 and 40, as described earlier. This appears to be profitable despite certain undesirable effects of the thinning operation on the residual trees, namely a high sensitivity to damage and a high incidence of epicormic shooting.

b. One heavy early thinning, to waste if necessary. A typical treatment, carried out at top height 10 m so as to leave the best 200 trees/ha, apparently has little ill effect on the residual crop, though the effect on wood quality is not yet known.

Despite this evidence of economic advantage, thinning in the ash-type eucalypts has not yet become general practice, a situation we will now discuss.

a. Commercial thinning: There is in fact a substantial demand for the thinning yields (pulpwood and small sawlogs) though as in any thinning operation harvesting costs are relatively high. One obstacle is that suitable stands (accessible, easy topography, and sufficient yield) make up but a small proportion of the total area. There is also considerable doubt as to the merit of mounting a major programme of commercial thinning in the immediate future for the following reasons. In attempting to determine the optimal strategy for harvesting the ash-type eucalypts of the central highlands by means of MASH (Gibson *et al.,* 1974), which is a model for maximising the present net worth of a wood resource subject to constraints on woodflows and cashflows, the option of a commercial thinning was included for all suitable stands. This option did not feature in the optimal schedule, which in short was to clearfell, commencing with the more valuable and better roaded areas close to the main markets. The exclusion of commercial thinning is believed to be due to the inter-relationship of the age-class distribution (most of the resource is regrowth due to the wildfires of 1926, 1932 and especially 1939) and the woodflow constraints. Rigid application of any regime (with or without commercial thinning) involving a fixed rotation age would in this case

have produced an absurdly fluctuating woodflow. The woodflow constraints became virtually all-important. This applied even for the early part of the planning period, because some of the main regrowth stands were close to financial maturity. Once the woodflows were constrained, the question of stand optimisation, as opposed to regional optimisation, became irrelevant. This may not have been the case had the resource been either more balanced in age-class or very much younger.

MASH is, of course, a highly simplified model, and its results have properly been regarded only as general guides. Commercial thinning might still be justified in certain situations. For instance, thinning can provide pulpwood without yielding significant volumes of sawlogs, and thus might be used where markets for sawlogs are yet to be developed. Thinning can also lessen the area of clear felling required to meet a given commitment — a factor of possible importance in relation to environmental considerations, or where there is insufficient seed for regeneration.

It is suggested that, while it may be normative at present to limit commercial thinning in the central highlands, the situation may change as access improves, as the age-class structure becomes more balanced, and as the situation evolves in other respects. b. One heavy early thinning: This regime is still in the trial stage. Even if it proves to be as successful at producing high quality sawlogs on a short (30+ year) rotation as its advocates claim, its place is still unclear. If it is necessary to thin to waste, it will present a nice problem in cost-benefit analysis. On one hand there are such difficulties as the rapidly escalating costs of treatment, the fire hazard of the abundant slash, and any environmental disbenefits that may accompany such intensive wood production. On the other hand there are such benefits as the ability to greatly increase production close to major markets, and accordingly to release other forested land, less well placed for commerce, to purposes other than wood production.

If the thinnings (numerous very small saplings) can be utilised, for example by on-site chipping, the profitability of the regime could well be unsurpassable — rather like a New Zealand clearwood regime without the treatment costs.

Case Study 2: Radiata pine: Ballarat plantation zone

This resource consists of over 9000 ha of conifer plantations, mainly *P. radiata.* Stand age ranges from 1-50 years, with most of the area in either the 1-10 or the 35-40 year classes. Site quality is low, but topography is easy and access is good. Stands are managed on a nominal rotation of 35 years with three or sometimes more commercial thinnings. Thinnings are generally maintained on schedule, but actual rotation age varies so as to even out woodflows.

The forests supply a highly developed and closely integrated group of local industries with pulpwood and round timbers from early thinnings, and sawlogs, veneer logs and pulpwood from the later fellings. A particleboard plant, three sawmills and a preservation plant are almost wholly dependent on continuing wood supplies from these plantations, and a veneer mill is partially dependent. The particleboard plant has been developed on the long term guarantee of pulpwood, the bulk of which is supplied from thinnings. Without a major change in management strategy, which would almost certainly disrupt supplies of sawlogs and round timbers, pulpwood must continue to be supplied from thinnings.

The thinning strategy in this case is determined essentially by market requirements.

Recent economic analysis suggests that the present strategy is possibly close to optimal under the conditions of growth, topography, access and market that currently exist. This is fortuitous, as the strategy was developed not on cost/benefit criteria, but on the basis of providing a continuing and regular supply of various wood products, and maintaining healthy and fast-growing stands without investment in non-commercial thinning.

Case Study 3: The box-ironbark

This case study of a much less productive type in a low rainfall area has been chosen because it highlights some interesting points. The area of this type, which occurs mainly in north-central Victoria, is 370 000 ha, much of which is readily accessible. In view of this, and the relatively small market for the wood produced (mainly sleepers, fencing material and short poles) it would appear at first glance that land is not a limiting resource. Further, in view of this apparent abundance of accessible land, the low productivity, the relatively small market and the wide occurrence of commercial thinning, one would expect that this type would have a very low priority for capital investment in stand treatment. And yet in the past a considerable investment was made for non-commercial thinning and control of dodder-laurel, at present there is a modest investment in the form of tree marking for harvesting (one objective being to facilitate release of the better young stems) and for poisoning of cull overwood, and studies in the release of regrowth by poisoning or felling poor regrowth are under way. These past and present investments seem to be open to criticism. The earlier investment was aimed at the production of durable poles, which were in high demand until the development of preservation techniques, and therefore may have appeared to be a sound strategy at the time. But what of the present investment? Some relevant facts are as follows: The box-ironbark forests together with river red gum and a few lesser types are the sole local forests to serve about half the area of Victoria, and the demand is appreciable. Further, because of low productivity, the forest area is barely sufficient to meet this demand. Again, because the Forests Commission is required to control and protect these forests, the means for administration must be provided in the form of staff, labour and capital equipment, and some flexibility exists in the deployment of this. It can be argued, therefore, that contrary to first impressions, it may be land rather than capital that is limiting. It is relevant to record, too, that benefit-cost studies by Edgar[1] for poor quality mixed eucalypts and by Gorman[2] and Squire[3] for box-ironbark suggest that non-commercial thinning may be a sound investment for these forests — individual trees show a marked response to heavy release, and this is not easily accomplished by commercial thinning alone.

It is possible that the same amount of money would return more if invested elsewhere, but the interests of a large region such as is served by the box-ironbark type are surely worthy of consideration regardless of what a state-wide cost-benefit analysis might indicate. In any case, it would be difficult to transfer the capital, because it is tied to the infrastructure.

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[1] J. G. Edgar, Research Branch, Forests Commission, Victoria; internal reports.
[2] R. J. Gorman, Heathcote Forest District, Forests Commission, Victoria; unpubl. data.
[3] R. O. Squire, Research Branch, Forests Commission, Victoria; unpubl. data.

CONCLUSION

In this brief review of thinning practice in Victoria we have merely touched on some of the main issues in this most complex and wide-ranging topic. We have made little or no mention of many factors that may be important either locally or generally — such factors as environmental issues, the impact of certain fungi (*Phytophthora, Armillaria*) and insects (*Didymuria, Sirex*), improved technology, marketing trends, overseas trade, the state of the economy, and so on.

Our brief review does suggest, however, that important determinants of thinning practice in Victoria have been:

1. Topography, which influences access and cost of procurement.
2. Various aspects of marketing such as the demand for small sizes, commitments to industry and woodflow considerations.
3. The capacity of the forest resource in relation to local demand.

As noted earlier, these factors are not independent.

The question remains as to whether the various thinning practices described above are reasonably normative or not. A good deal of work on benefit/cost evaluation is currently being undertaken, and this will doubtless lead to modifications of thinning practice in certain cases. But we suspect that, because of the dominating influence of certain of the factors noted above, drastic modifications of thinning practice will not be required generally, at least until there are substantial alterations in technology, markets or socio-economic conditions.

REFERENCES

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