ALTERNATIVE SILVICULTURAL REGIMES: EFFECT OF OVER-ALL MANAGEMENT POLICY ON OPTIONS

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ABSTRACT

Softwood Holdings Limited have developed silvicultural schedules which are varied according to both site quality of the plantation and manufacturing requirements of the Company's processing plants. The median regime involves four thinnings before clearfelling at age 35 years, with a total volume production of 685 m^3/ha. It is considered that cost to mill door cannot be isolated from product manufacturing costs and the opportunity to manufacture a broad range of products.

INTRODUCTION

Softwood Holdings Limited has a forest estate of some 22 000 ha located in the south-east of South Australia and the south-west of Victoria. Plantation establishment by the Company commenced in 1950 when 50 ha were planted, and at present annual planting has a target of 550 ha net. The Company's roundwood conversion plants include sawmills of varying capacities, plus associated plants such as kilns, planer mills, laminating and finger-jointing plants, chemical preservation treatment plants, three particleboard plants using the "flat press" system, and a plywood plant. Total raw material intake into these operations annually is in excess of 496 000 m^3. As an integral part of the Company's industrial development, consideration has been given to the increasing volumes of wood being grown in the forest estate owned by the Company as it contains a large imbalance in age classes. This imbalance is reflected in the thinning programme being undertaken and requires considerable manipulation of the forest resource and the supplementing of this resource by external purchases.

COMPANY THINNING POLICY

The Company objectives in the management of its forest estate may be summarised as follows:

(1) To produce sawlogs for use within the Company's conversion plants (*see* Appendix 1 for ideal log specifications);

(2) To produce these logs over a nominal rotation of 35 years;

(3) To grow high-quality sawlogs using commercial thinning regimes and so provide small-diameter wood for pulping, timber preservation, and the various products of small logs;

(4) To optimise wood production within the biological limits of the species and the dynamics of the plantation;

(5) To optimise the financial returns as allowed bv the market place.

At the same time, biological constraints must be considered. Shepherd (1976) classified these into three groups:

"(1) Inherent factors of the species, including growth pattern, tolerance, stem form and rooting habit.

(2) The problems of susceptibility to disease and insect attack.

(3) Site factors, including such diverse aspects as climate (including wind), soil water regime, soil physical and chemical factors."

These biological factors, along with other considerations of stand dynamics, were incorporated into a thinning guide by Lewis (1963). His more recent work (Lewis *et al.* 1976) provides a guide flexible enough to allow for the thinning of the diversity of stands of all ages and stages that occur within the region.

Company policy emphasises growing sawlogs of as large a diameter as possible within the constraints of the thinning guide. However, the policy also advocates a shorter rotation (35 years) so there is a tendency to remove the maximum allowable number of trees at each thinning operation so that the selected retained trees can make maximum use of available moisture and nutrients to produce large-diameter sawlogs early. In Table 1 a Company thinning regime is compared with a standard regime of the South Australian Woods and Forests Department (Lewis *et al.* 1976). In practice the Company stocking figures are generally a little lower than those quoted, and the volume figures should be taken as being conservative because of the unavailability of reliable figures from areas thinned according to current schedules.

Thinning schedules are varied to meet individual plantation needs. The schedule in Table 1 relates to the median level that could be anticipated for the region in terms of site quality (determined by visual assessment of volume at age 9½ years). Variations of thinning schedules above and below the median level of volume production are summarised as follows.

High site quality (SQ II–III): Generally, first thinning occurs earlier than given in Table 1. The interval between thinnings is shorter and the number of thinnings is increased, but the number of trees removed at each is reduced. Volume removed at each thinning is similar with the exception of first thinning, and total volume production is higher than for Site Quality IV.

Low site quality (SQ V–VI): First thinning is later than for the Site Quality IV stand because volume production would not make it an economic proposition to harvest. As a consequence, the thinning interval is longer and the number of thinnings reduced. The total volume production is less than that for Site Quality IV.

TABLE 1—Comparison of a Company thinning schedule with a Woods and Forests Department schedule

Operation	Age (years)	Stocking (stems/ha)	Yield (m^3/ha)
Softwood Holdings Ltd (35-year rotation, Site Quality IV)			
T1	13	850	100
T2	20	567	75
T3	25	340	90
T4	30	257	120
CF	35	—	300
Total volume production			685
*Standard Woods and Forests schedule** (50-year rotation, Site Quality IV)			
T1	12	865	90
T2	19	555	78
T3	26	410	80
T4	34	270	127
T5	42	175	160
CF	50	—	522
Total volume production			1057

* Lewis **et al.** (1976)

These principles generally apply to rotations of either 35 or 50 years. In all situations total volume production is greater for the longer rotation, as is the total monetary return. However, with the shorter rotation the log size produced by the higher intensity thinning at an early age is generally greater and produces a raw material which offers increased flexibility to an industrial forestry company.

COSTS ASSOCIATED WITH THINNING

Direct Costs

Royalty

(a) Pulpwood – a uniform single royalty negotiated between forest owners and users.

(b) Preservation and sawlog material – royalty determined by State Government Departments and then negotiated with the end-user.

The general trend is for an increase in royalty with increasing log diameter.

Felling

(a) Pulp rates are uniform within a given range for the region.

(b) For sawlog and preservation material, the industry as a whole has attempted to maintain uniform felling rates. Naturally, assessment of the work value of each operation varies between the persons responsible and the organisation, and occasionally large significant variations do occur.

On-truck logging cost

This is the forwarding cost from the place where the raw material is cut to the site from which it will be hauled to the mill. For pulpwood and sawlogs, rates are fixed within set ranges. These rates vary according to terrain, the presence of hardwood residue, forwarding distance, and the over-all difficulty of forwarding to the transporting unit. For preservation material there is a fixed rate.

Hauling

Rates are negotiated between the log hauler and the end-user. Similar negotiated rates apply across the industry in the region. The trends are shown in Fig. 1.

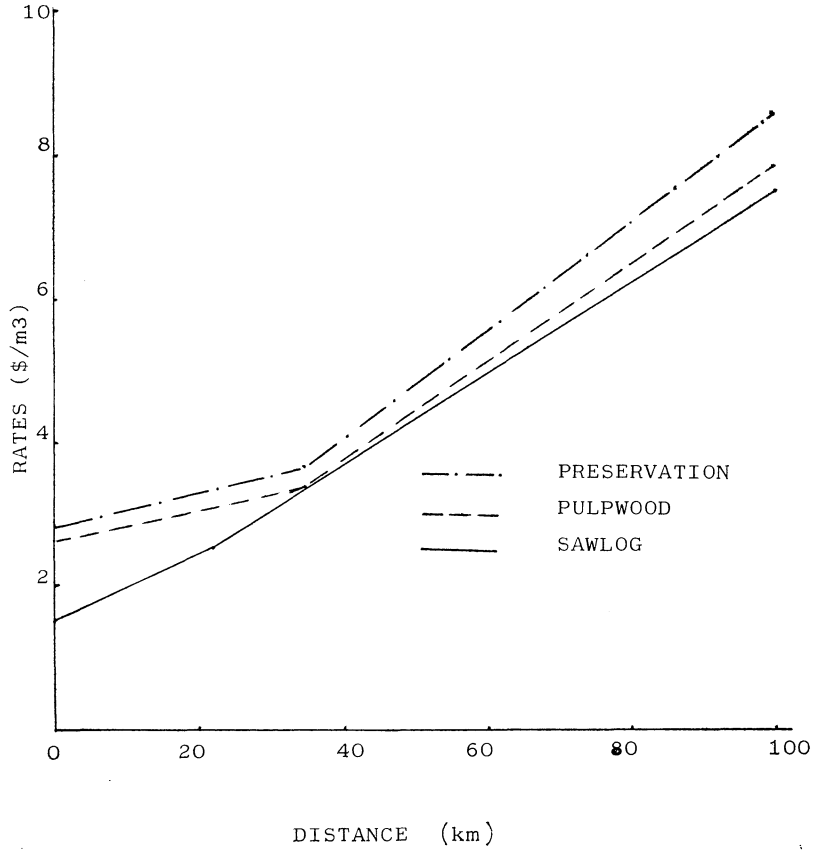

FIG. 1—Haulage rates.

Indirect Costs

Indirect costs are more difficult to measure and are simply listed here:

(1) Cost involved in purchasing land to maintain the net area planted annually at a similar level for a longer rotation.

(2) Additional management costs, particularly administrative and financial, necessary to manage the longer term project.

(3) The need to possibly forego other projects to achieve this or raise money by alternative methods.

(4) A fluctuating market could significantly alter the product range and requirement for very large-diameter raw material. Hence it is possible that down-grading of this material may be necessary to manufacture products that require a lower standard specification.

These are but a few of the costs that may influence the choice of silvicultural regimes.

DISCUSSION

In this broad outline of Softwood Holdings Limited's policy on the thinning of its plantations, specific cost figures have not been detailed because of Company policy regarding the release of such material. The variable costs between first, second, third, and later thinnings associated with royalties, felling, loading, and hauling could result in a total mill door cost from any of these operations being very similar except for thinnings after third thinning and for clearfelling (Table 2). For example, in first thinning a lower royalty value is compensated for by a higher on-truck cost and a significantly higher felling cost; at third thinning a higher royalty is payable but it attracts lower felling and on-truck costs.

TABLE 2—Cost comparison of operations for sawlog harvesting*

Cost component	First thinning	Third thinning
Royalty	Low	High
Felling	High	Low
On truck	Marginally higher than T3	Lower than T1

* Haulage distance has been made constant for the purposes of this comparison

In the Company's experience the cost of raw material to the mill door is reasonably constant for early thinnings because of the cost structure outlined. Thus the variation in costs of the silvicultural operations is not reflected in the cost of delivery of the raw material to the mill door. However, there is a much greater product range achievable from third thinnings than from first thinnings (Table 3). If first thinning is delayed to 17 years or beyond, the extra products can include flooring, heart-in studs, and, to a lesser degree, linings. However, it does not pay to delay thinnings as early first thinning is essential to achieve the best growth and sawlog quality from the plantation. The

sawlog cost to the mill door for later thinnings and clearfelling is significantly higher but, within certain limitations, this additional cost to the sawmiller can be recovered because of the range of products that can be cut and the improved recoveries that may be obtained from an increase in the number of sawing patterns that can be used.

TABLE 3—Guidelines to feasible and/or economic production according to tree age groups*

Products	First thinning, 12–15 yr, 12–25 cm	Second thinning, 18–20 yr, 15–35 cm	Third thinning, 24–26 yr, 15–45 cm	Fourth thinning to clearfelling, 28–40 yr, 15–60 cm
Flooring		X	X	X
Linings		X	X	X
D A R	X	X	X	X
Claddings		X	X	X
Fascia/Barge			X	X
Structural				
HI studs		X	X	X
Studs		X	X	X
Light framing			X	X
Heavy framing				X
Packaging (sawn & moulded)	X	X	X	X
Mouldings			X	X
Furniture			X	X
Fencing materials (sawn & moulded)			X	X

* Source: Roughana (1981)

Profit indexes from company mills consistently demonstrate that the most profitable operation from the sawmillers' point of view is production of third-thinning sawlogs in the range 15–45 cm s.e.d. (small end diameter); from 45 to 60 cm s.e.d. the profit index declines (E. J. Roughana, pers. comm.). Also, the more specialised equipment necessary for larger logs could not be justified on the basis of the quantities of raw material that would be available to the Company in this region. Therefore, the thinning regimes that the Company has developed are designed in the best interests of the total enterprise since no operation is completely divorced from another.

There must be flexibility in the management of the resource and in the broad product range of the manufacturing operations to take advantage of the interaction between the resource base, manufacturing operations, and the market place. The need for flexibility is reflected in the silvicultural options that have been developed to meet

the Company management objectives, and hence the rotation length considered most desirable for the Company's successful operation.

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APPENDIX 1

SPECIFICATION OF IDEAL LOGS CURRENTLY REQUIRED BY COMPANY SAWMILLS

A. Appearance Grades

(1) Low taper

(2) Knots small in size, tight, and green

(3) For higher qualities, knots few in number

(4) Diameter range of 150-350 mm, mean 250 mm. Normally obtained from second and third thinnings.

B. Structural Grades

(1) Low taper

(2) Knots can be larger, and dead or loose knots are acceptable

(3) Reasonably even ring width

(4) Diameter range 200–500 mm, mean 330 mm. Normally obtained from fourth thinnings and clearfelling.

C. Poles

Poles have a limited but important market. We are gaining the required numbers from our normal forestry practices, in particular from slower growing areas.