MANAGEMENT AND COST IMPLICATIONS OF MECHANISED SMALLWOOD HARVESTING

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Introduction

Forest managers have, in theory, a wide range of options available when choosing a logging system. (12,13) In practice, this range may be considerably limited, and may in fact be restricted to the machinery and men present in the area at the time required. Whatever combination of machines and men is chosen, there will be managerial and cost implications. This paper looks at some of these implications, based on the experience of a number of harvesting operations.

There are many reasons for choosing a mechanised system to harvest smallwood, although the reason most often quoted is one of costs. Pressure to mechanise is largely directed towards harvesting small-sized trees for pulpwood because this is the sphere in which the cost/price squeeze is most acute.(20) Recent costs of "small-wood" production have increased far more rapidly than other logging costs. This is due mainly to the high labour content of "small-wood" operations. Productivity per man has not kept up with the escalation in wage rates and using the same methods can not be expected to improve.(10) Other reasons given are that smallwood will form a greater proportion of the total wood used in the future, the demand for this type of wood will increase, as will the supply from forest owners, and there is a shortage of adequately trained and motivated labour.(6)

Before proceeding, it is necessary to recognise the problems that are present when discussing this topic. Firstly, "smallwood" may mean different things to different people. Researchers in the northwest states of the U.S.A. have classified smallwood as any tree under 50.8 cm d.b.h. or logs averaging less than 0.7 cubic meters in volume.(4) One New Zealand author defines smallwood as "roundwood in which most of the individual pieces would fit into a diameter range from 7 cm to 25 cm".(10) An Australian author has suggested that smallwood be defined as "wood with dimensions smaller than those of wood of normal market use" (8), and this may be quite suitable for our use.

"Harvesting" is another term that may have various meanings, as there are distinct differences between salvage logging in cutover areas and the primary logging or thinning of standing small trees. Thinning may be carried out in a number of ways as well. The implications of mechanisation will change in degree, depending upon which specific operation is being discussed.

The degree to which a system is mechanised is another variable which should be clarified. The conventional chainsaw/skidder operation of today was a great step forward in mechanisation in the late 1950's and early 1960's. Logging systems in use today may be completely mechanised, or may have various inputs of machinery and men interspersed along the production line. The implications of mechanisation will depend on the degree of mechanisation adopted.

In many ways, New Zealand is much more suited to mechanised smallwood harvesting than many other countries with a longer history of logging mechanisation:large areas of plantations, a history of intensive silviculture, stands with very little variation in tree size, suitable terrain in many areas, a limited number of species to be harvested, etc. In discussing one species, Terlesk stated that "mechanised harvesting of ponderosa pine has great potential. The piece size is suitable, terrain causes little restriction to machine movement, a large resource and high demand are present. The processing plant is geared to accept material poorly prepared by traditional standards. Labour is keen to make the transition from the forest floor to the cab, managerial expertise is present, and back-up maintenance facilities are provided. Virtually all the ingredients for implementing a highly mechanised system are available."(19) The fact that the mechanised system introduced to carry out this operation is no longer in use, and has been replaced by the more conventional chainsaw/skidder operation, is reason enough to look into the managerial and cost implications of mechanising smallwood harvesting.

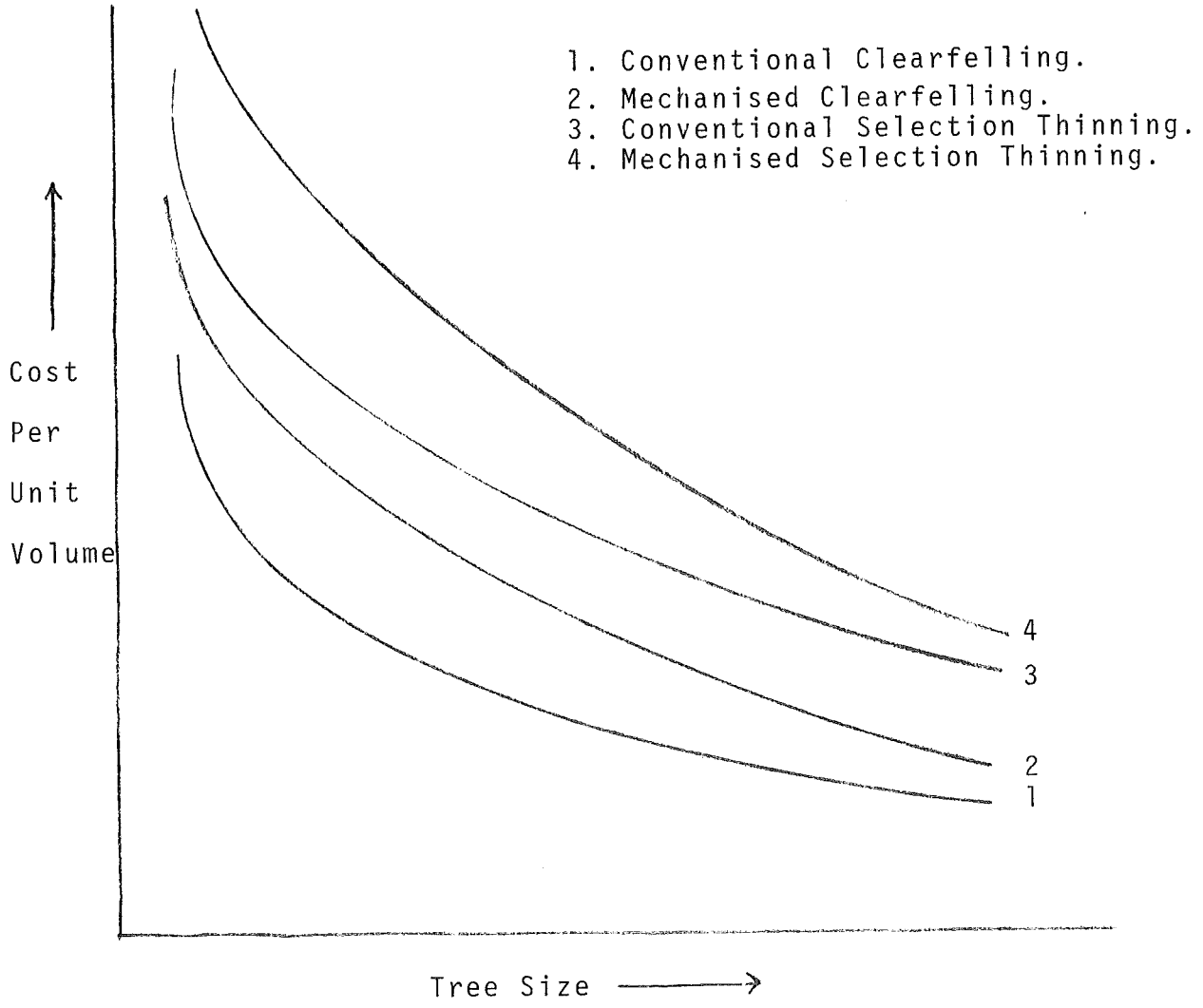
Implications

1.For Costs:

As stated earlier, the escalating cost of harvesting smallwood by the conventional chainsaw/skidder (or forwarder) system is one of the main reasons for choosing to mechanise. In fact, it is usually a combination of economics and labour shortage that makes mechanised systems appear attractive. "The introduction and promotion of sophisticated logging equipment was based on cost reduction. The one man who was not convinced of this was the wood production manager -- when the equipment assigned to him failed to produce as advertised. However, he was committed to eventual mechanisation because of a decreasing labour force and the need for year-round production independent of the weather."(3) "The factor limiting the degree of mechanisation is not the state of technology but economic feasibility. In some cases, the labour shortage is forcing employers to use mechanised methods even though labour-intensive methods would be more economical if the labour were available."(15) These quotations should bring home the fact that, generally speaking, mechanised operations are <u>not</u> cheaper than conventional methods, and the experience of many companies would bear this out.

It must also be borne in mind that in the areas where mechanisation has had a long period of development, labour tends to be the most expensive component of the man-machine system, and this has given the surge to mechanisation an extra boost. Whether this is true of New Zealand has not been clearly determined;there are indications, however, that machine costs are rising at a more rapid rate than the cost of labour. (19)

The problem with harvesting smallwood by chainsaw/skidder system is the low return for time invested. In other words, low productivity and thus high cost per cubic meter -- a reflection of the importance of tree size. Once this is understood, it must be accepted that mechanised systems are also very sensitive to tree size, and for many reasons, perhaps more sensitive than conventional systems. The graph below illustrates the approximate relationships involved.



Generally speaking, attempts to substitute a mechanised system in place of a more conventional system, without altering the operational or managerial characteristics, has only resulted in higher costs, and the failure of many systems. These operational and managerial changes are discussed in the next section.

2.For Management:

(a)Expensive, sophisticated machinery will result in expensive wood unless production is at a maximum. It is not enough for loggers to produce more with the new system than with the old; they must produce at the maximum for the new system, even though it means two 8-hour shifts per day, 5 or 6 days a week. Many overseas operations are sheduled to work this way, in order to get the most out of the machinery.(17)

(b)To maintain this pace, and reduce downtime, field workshops have been necessary in some instances to carry out repairs (and maintenance) when required, on the spot. Thus competent mechanics and welders become part and parcel of the logging system, and in some cases become involved in the gang bonus scheme. Service groups generally become more important in mechanised logging. Regardless of the woodlands accounting system, these back-up services add to the cost of the wood produced, and must be taken into account as such.

(c)Machine availability* and utilisation** must be kept high in order to keep costs down, and everyone, from top management to field supervisor to mechanic must support the operation in order to increase productivity and reduce downtime. (14) Low machine availability and utilisation have been responsible for many sophisticated logging systems being phased out, but it must be remembered that availability and utilisation are not diseases, only symptoms. The real problem lies with management organisation and operator conscientousness. Planning and control of the operation must be intensified. More and better records of the operational details will be required.

(d)Spare parts availability may become increasingly important, and for very sophisticated machinery,this may involve a considerable storehouse of parts. Research by the Pulp and Paper Research Institute of Canada (5), has shown that sophisticated logging equipment may not follow the usual trend of increasing repairs

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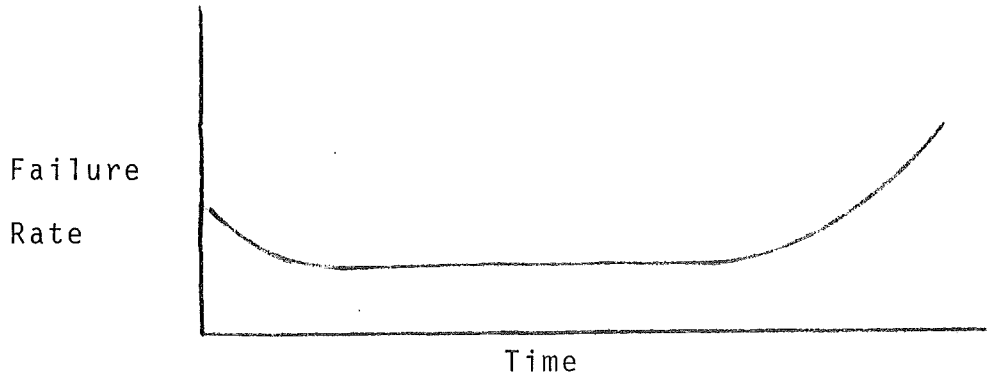
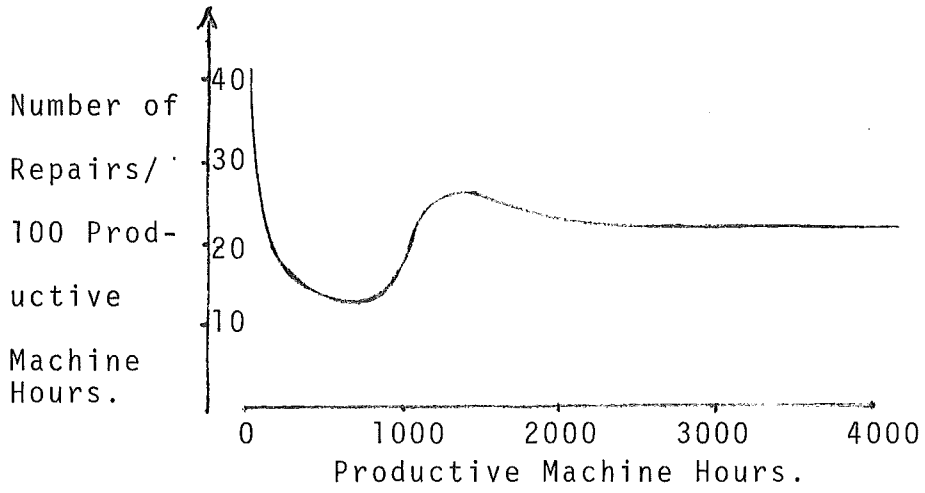
*$\frac{\text{Scheduled machine-hours - Maintenance Downtime}}{\text{Scheduled machine-hours}} \times 100$

** $\frac{\text{Productive machine-hours}}{\text{Scheduled machine-hours}} \times 100$

with age (bathtub curve), but may require considerable attention very early in its operating life, with impressive but short-lived results, followed by a short period of more frequent repairs which level off and stay relatively constant for a much longer period.





(e)Operating flexibility may be reduced with the adoption of a mechanised system. The cost of shifting machinery from one work site to another will be higher. Once a system is operating, it is unwise to stop or alter it to deal with changes in tree or stand characteristics. The percentage of cull wood which passes through the process can increase markedly. (16)

In order to make mechanised systems economic, they tend to be put in the best stands. This may result in relocation of the more conventional systems to the poorer stands, and this will only aggravate the problems these conventional systems have at present.

(f)Most mechanised thinning operations have been carried out in plantations as geometric or row-thinning systems, as opposed to a true selection thinning,(1,2,18), and it is certain that the adoption of mechanised thinning operations will bring the logging planner and the forest planner much closer together than in the past. The work done by FRI on planting stands with mechanised harvesting in mind is a prime example of what can be done in this regard. The conflict between harvesting aims and silvicultural techniques is a full topic in itself, and has been discussed at length by a number of authors.(7,11,21,22)

3.Pertaining to Labour:

Mechanising harvesting operations has, as one of its aims, a reduction in the labour input required. Ironically, the replacement of manual methods by mechanised systems have shown how important the human element is, for studies have shown that operators can differ in their output by as much as 100%, when using the same machine under identical conditions. Operator characteristics such as coordination and depth perception, and labour motivation, become even more important than in more conventional operations.

As well, it should be remembed that switching to a totally mechanised harvesting system will not ensure an end to a labour shortage. Some companies in Canada, because of the remoteness of their operations, have failed to attract enough labour to man their sophisticated machinery.

Lastly it is important to note that one of the present attractions of logging to the labour force is the fact that the men can work at their own pace, without the pressure of close supervision (9). This attraction may be lost with a switch to a sophisticated mechanised system, especially if operating it involves a great deal of repetitive motions. A highly-mechanised logging system may require a different type of worker, and the logging industry may find itself in direct competition with other industries for operators with appropriate motivation and skill.

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