PRODUCTION OF NEW ZEALAND HAULER OPERATIONS

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ABSTRACT

A study was established to assess the current situation in the cable logging scene in New Zealand. A sample of the more productive crews working clearfell radiata pine operations was taken from across the country.

Data gathered was used to establish a picture of the industry in 1991 and to identify any changes which may have occurred over the previous decade.

Overall, production has increased during the period, extraction systems have changed with better use of skyline systems, and more systems are being used. Contractors appear to be better using the flexibility of systems their machines have to offer and the resulting productivity change has lead to a change in landing systems to cope with the increased throughput of wood.

A summary of research findings on systems changes and utilisation is discussed.

INTRODUCTION

In the latter part of the 1970's it was realised that there was to be a major expansion in the radiata pine resource to be clearfelled by cable hauler(Levack,1978). In 1978 the first cable logging seminar was held to draw together existing knowledge of cable logging, the systems, the machinery and technology from overseas. Donovan (1978) from a survey of the industry found that 18% of terrain clearfelled was by skyline and 82% by highlead.

The existing skyline systems used were Northbend, Southbend, and Slackline, (Bryan, 1978). Terlesk (1980) found a relationship between piece size and production and showed a trend which was used by Galbraith (1987) to compare production levels between New Zealand and the Pacific Northwest of the U.S.

As we move into the 1990's with demand increasing for haulers for clearfell operations on steep country, Olsen (1989) noted that the average age of our fleet of some fifty two haulers was twenty years. Changing conditions of site and stand parameters as the new crop forests of Marlborough, Nelson, Otago, and the east coast of the North Island came on stream suggested a need for machines with greater line capacities and speeds, more power, and flexibility of systems, (Prebble,1989)

In early 1991 a brief LIRA study was proposed to assess current productivity levels in New Zealand. The objectives of this study were to:

1. Assess the current situation for a sample of the more productive cable crews in New Zealand.

2. Identify any changes in production,

3. Describe some of the developments which have occurred within the industry.

METHOD

Thirteen crews were chosen from across New Zealand, all crews were working clearfell operations in radiata pine and were identified as being high performance crews. The study also included two operations using new generation haulers from the USA. The procedure of study took the form of two survey questionnaires, one being sent to the contractor and one to the company for each operation identified. Both companies and contractors were requested to restrict their responses to the one month period of March so as to get a snapshot of the industry in 1991.

Information sought was as follows:

CONTRACTOR INFORMATION

- Equipment at his disposal
- Layout of the operation
- Crew allocation
- Site and stand description
- Production information

COMPANY INFORMATION

- Production data
- Planning information
- Stand description
- Constraints imposed
- Processing data

RESULTS

Of the thirteen operations surveyed all contractors and all but one company gave returns. Only one contractor declined, preferring to keep information about his business private.

The average age of the haulers surveyed was 11.5 years with five machines under ten years old. The survey included five*, two drum haulers and eight haulers with three or more working drums.

Results have been summarised into three areas as follows:

1) SYSTEMS USED

Overall, skyline systems are most used (Fig 1) representing 62%, over highlead hauling at 38%. The summary of skyline systems only for all haulers (Fig 2) shows a good representation of three of the four systems commonly used today. Usage of Mechanical Slackpulling carriages is low. This is most likely due to the very limited ownership of these carriages in New Zealand today with only three of those surveyed owning such carriages. The application of dropline carriages in New Zealand will be influenced by such factors as whether the terrain is suited to the system, whether the planning has allowed for landing placement to take advantage of such a system and whether contractors and companies are willing to use such carriages.

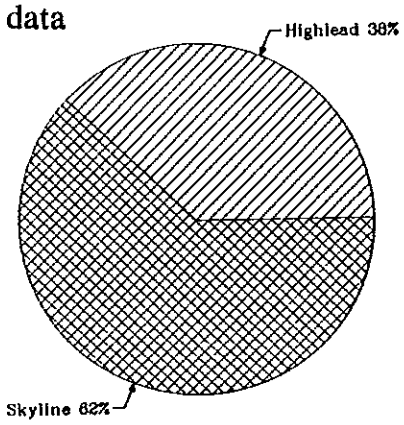

Figure 1: Proportion of Skyline to Highlead, all haulers

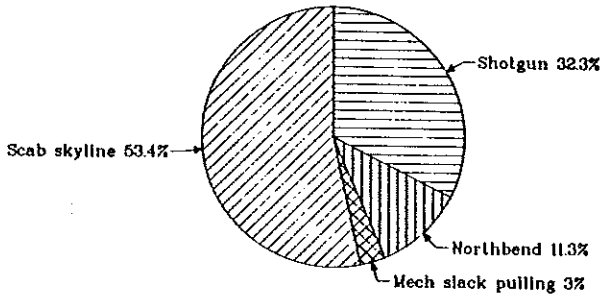

Figure 2: Summary of Skyline Systems, all Haulers

It is interesting to note that the proportion of highleading is similar between two drum haulers (Fig 3) and haulers with more working drums (Fig 4). Contractors owning two-drum haulers appear to be making the most of the other two more productive systems available to them. All contractors surveyed appear to use highleading only where the terrain conditions dictated, whilst making the most of the flexibility of systems available in order to maximise their productivity.

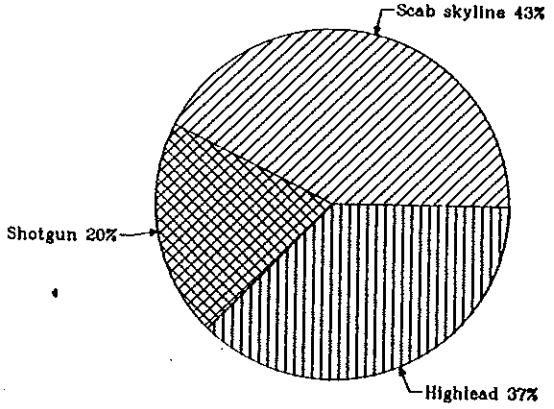

Figure 3: Systems Summary, Two Drum Haulers

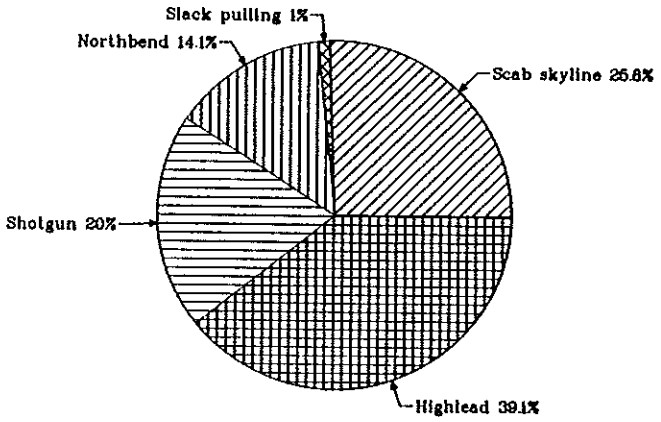

Figure 4: Systems Summary, Three or More Drum Haulers

2) PROCESSING DETAILS

Of the thirteen operations six processed the wood on a secondary landing. The most common secondary machine was the skidder (four operations) the other two operations used a dozer and an off road truck respectively. Average tree age was 32 years. Trees were cut into seven sorts by an average of two skiddies.

Table 1: Summary of processing data

	Mean	Max.	Min.
Stand age (yrs)	32	66	15
Number Sorts Cut	7	10	5
Percentage Sawlog	66	90	30
Number Skiddies	2	3	1

Other heavy machinery used on operations is shown in Figure 5. Wheeled loaders are still the most common for fleeting and loading. Bell Loggers are popular for clearing the chute area, as are dozers for use as mobile back anchors where appropriate.

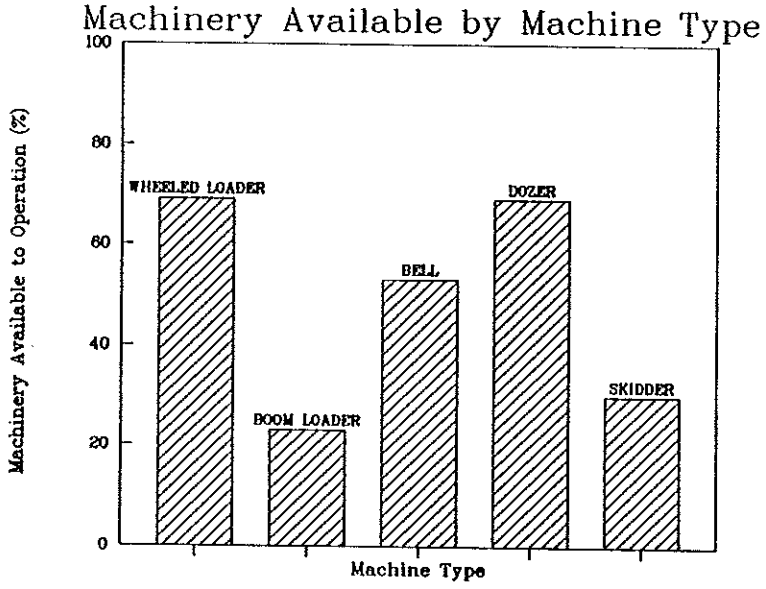

Figure 5: Machinery Availability by Machine Type

Knuckleboom loaders do not appear popular on the overall scene, however of the seven operations where extraction and processing occur on the same landing, Knuckleboom loaders are used on three.

3) PRODUCTION DETAILS

For the operations surveyed, all areas logged had been specifically planned for the hauler. Gross production included all social delays and operational delays (line and landing shifts) and was determined by dividing the total tonnage for the month by the number of days worked.

Average maximum haul distance was 360m which corresponds to 71% of average reach. Reach is defined as the proportion of mainline length used. Average piece size extracted was 1.9m^3 which gave an average production of 217m^3/day (Table 2).

Table 2: Summary of Production Data

	Mean	Max.	Min.
Maximum haul distance	360	550	200
Proportion of reach (%)	71	96	60
Piece Size (m3)	1.9	5.0	0.6
Production (m3/day)	217	332	115

A plot of average gross production against piecesize (Fig 6) suggests an increasing trend between the two variables. The contractors comment for Point A was that production was achieved from the most favourable conditions they had encountered for some time. The comment suggests a relationship which is not directly proportional between productivity and piece size and that other factors often have a large influence on daily production. Fitting a line using regression gave the following relationship.

Production = 85.18 + 110.55 x (piecesize (m3)) - 13.86 (piecesize (m^3))^2 (r^2 = 0.67).

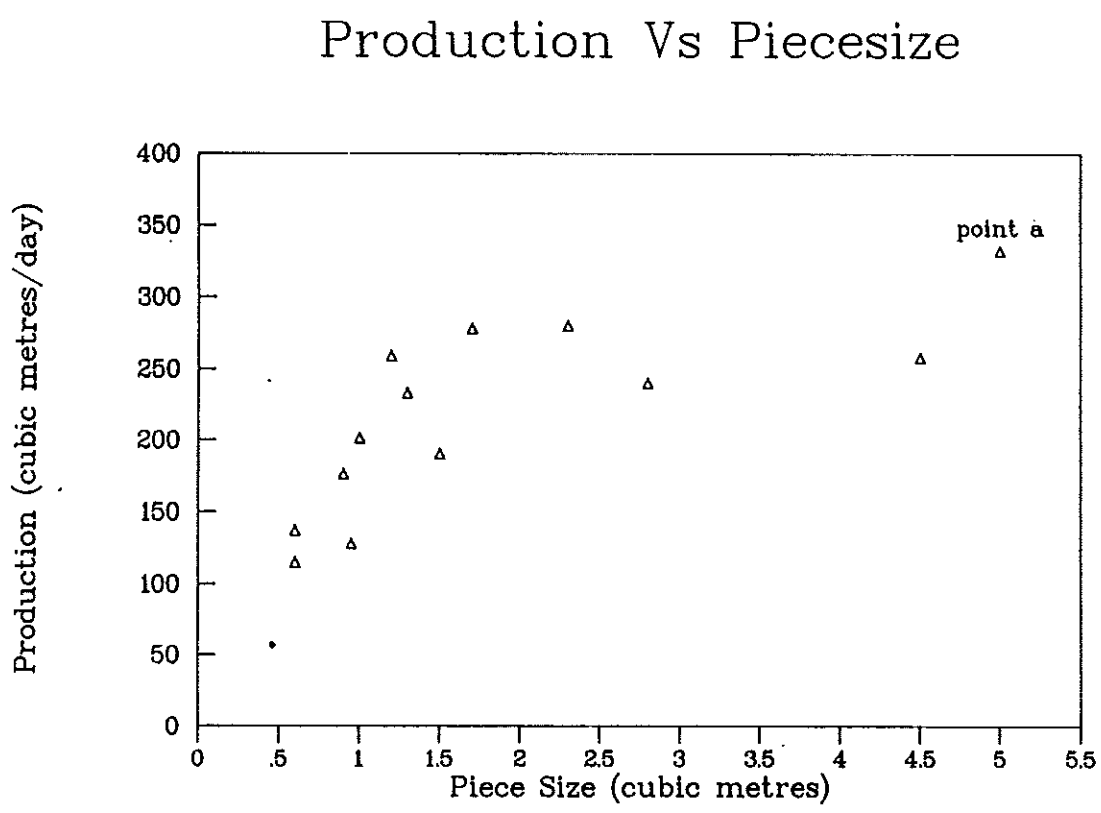

Figure 6: Production by Piece Size

This indicates that production for tree length logging finds a plateau as piecesize increases. The resulting line suggests that there is an upper limit to production attained by the combination of machinery used and systems used. This warrants some further investigation as data used is taken from a small (uncontrolled) non-random sample of the industry and does not include many operations working in wood of piecesize over 2.5m^3.

DISCUSSION

Due to the complex nature of logging steep country by cable systems there are a number of areas where improvement and innovation can improve production. Terlesk (1980) found a relationship between piecesize and production from a series of studies on a Madill 009 which was considered to be one of the more productive units operating in New Zealand at the time.

Figure 7 shows production levels for both 1980 and 1991. It is apparent that significant improvements in production have occurred over the last ten years, for example operations working in 1.5 m3 are producing double the volume today from ten years ago. Comparative studies of steep country logging are very few making the task of quantifying the effect of changes difficult. This discussion shall therefore limit itself to reviewing some of the successful innovations introduced to the cable logging field during the 1980's.

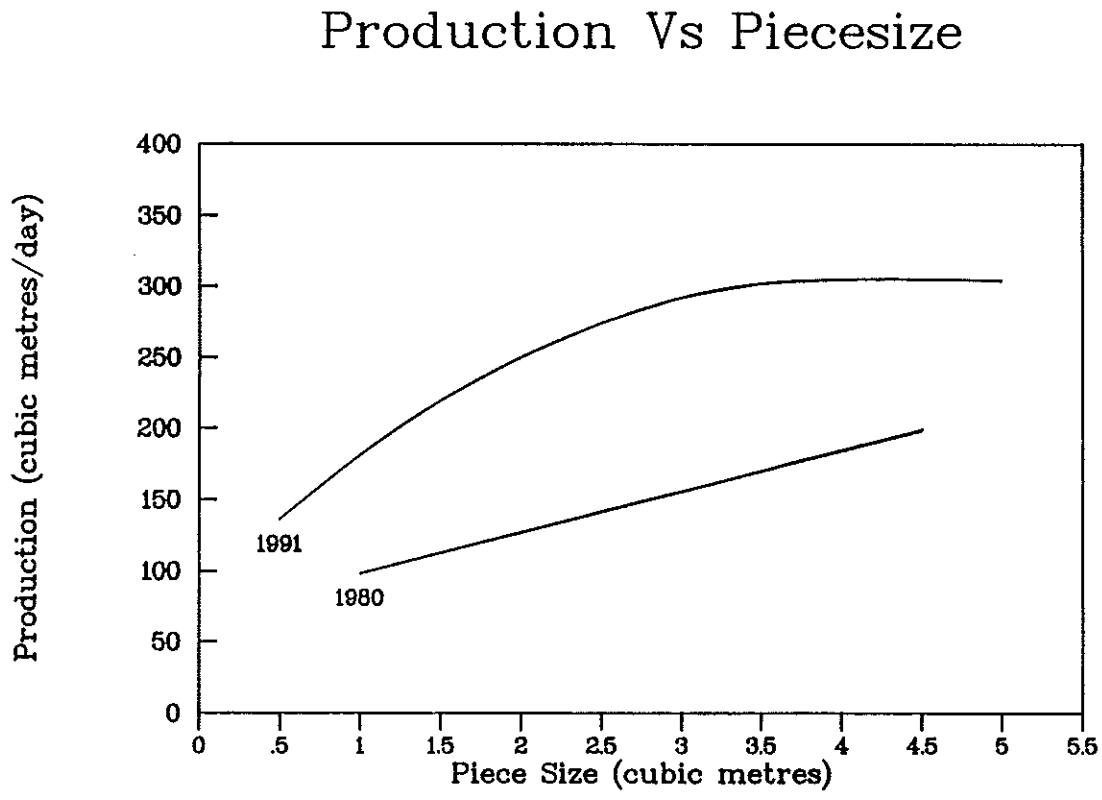

Figure 7: Changes in Production Between 1980 and 1991

SYSTEMS

1) EXTRACTION

Highlead hauling is no longer the predominant method of extraction, dropping from 82% use in 1978 to 39% use in 1991. As a result the use of skyline systems has increased. Not only this, the number of skyline systems in use has increased after the description by Bryan (1978) of the shotgun system and the running skyline. As can be seen (Fig 1, Fig 2) shotgunning and the use of running skyline are very popular and particularly common amongst the operations using two drum haulers of limited flexibility.

The influx of four drum haulers during the 1980's may also have some contribution toward increased use of skyline systems, but more importantly it is the willingness of contractors to use the flexibility their machine has to offer. Kellog (1987) stressed the importance of using the haulers flexibility of systems as a means to maximise production.

Murphy (1983) cited the use of mobile back anchors and directional felling as important additional methods to reduce line shift and breakout times respectively. Increases in production by as much as 15.5% were suggested. These simple ideas reduce delay times allowing more time to pull wood during the shift. Such ideas were the product of one innovative contractor and are now widely used throughout New Zealand.

2) PROCESSING

Wood has traditionally been processed under the ropes while the logs are being hooked up. Increasing productivity of the extraction phase has required greater productivity on the landing as a greater throughput of wood is required. As a result landing operations have evolved in a number of ways to meet this requirement and reduce any bottleneck effect.

Murphy (1983) investigated a secondary extraction phase where wood is pulled to a secondary landing for processing.

This created a safer workplace and reduced interference to the hauler. Murphy found two staging became a viable option when the most productive conditions prevailed. These included:

- The use of two breaker outs.
- Cross slope felling.
- Mobile back anchors.
- Setting boundary at optimum haul distance.

The alternative to moving logs to another landing was to continue to process on the same landing but to get the wood away from under the ropes. Duggan (1989a) found that this method using a heel boom loader reduced landing interference to an average of 1% of the total cycle time, down from 9.5% for the traditional method. This gave a corresponding increase in production of just over 9%.

Kellog (1987) also found interference on small landing operations using knuckleboom loaders (0.07ha) to be low at less than 1% and noted the efficiency of the knuckleboom loader due to its ability to work in a confined space.

Duggan (1989b) found that the combination of wheeled loader and a Bell 220 to clear the chute area was also highly successful in keeping interference to the hauler low.

UTILISATION

Murphy (1978) stated that cable logging was characterised by high mechanical availability and low utilisation. Utilisation may be defined as the time the hauler is working to produce wood. Studies for five operations indicated utilisation levels were as low as 45%.

McConchie (1989) suggested that the key to boosting production levels was to increase utilisation by reduction of operational and

social delays. McConchie after a study of three operations for 487 days found 1989 utilisation was 70% a large increase from the situation in the early 1980's. He suggested these changes were due mainly to the shift from company crews to the contract situation causing reductions in social delay times.

In the light of developments made in extraction and landing phases of operations it is suggested that a reduction in the associated operational delays has had its part to play in the improved utilisation levels.

CONCLUSION

The most apparent change has been in production levels, these changes have been brought about by innovations and improvements in the systems used both in the extraction and the processing phases of the more productive operations.

Use of skyline systems has increased, and with the introduction of the shotgun and running skyline systems skylining is more common especially amongst the two drum haulers.

Landing systems have changed to keep up with increased production. The most notable change being the clearing of logs away from the tower for processing. A result of this shift has been the introduction of Bell Loggers to clear the chute area and reduce interference to the hauler.

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