HARVESTING TECHNICAL NOTE

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Cost and Productivity Benchmarking Update: 2023-2024

Summary

The FGR Benchmarking system is in its 16th year of data collection and helps the New Zealand forest industry to track cost and productivity of harvesting systems. A further 107 entries were submitted from forestry companies between Feb 2023 and Aug 2024. Based on the entries, Grapple Skidder (39%) and Swing Yarder (37%) were the two most common harvesting systems used.
The average ground-based logging rate remained similar to that of the previous reporting period, only going up 50c to $32.90/t. The range (10th to 90th percentile) was $26.50 to $42.40, reflecting the wide range of operating conditions. The increase in costs associated with harvesting was offset by a 15% increase in average productivity, now at 41.1 tonnes per scheduled hour.
Average cable logging rates increased by $4.20/tonne from the previous reporting period to $46.80/tonne, which was a 9% increase. The range of cable logging rates was much greater than that of ground-based logging, with 10% of entries were less than $36/tonne, and 10% were greater than $56/tonne. Productivity increased marginally by 1.8 tonnes/hr to 33.2tonnes/hr (5%) – which relates to daily production of is approximately 280-300t/day. 84% of all yarder operations had access to winch-assist. Breaking the date down, there was a $5.40 difference between swing yarder and tower yarder ('hauler') rates, best explained by the difference in average production rates (34.1 and 30.0 t/hr respectively).
Mechanisation rates for both felling and processing remain high, only 14% of yarder operations were chainsaw felled, and only one ground-based and one yarder operations had manual processing. Average tree size continues to decline, down to 1.7 t/tree for ground-based and 1.85 t/tree for cable logging.

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INTRODUCTION

The FGR benchmarking system has been collecting and analysing harvesting productivity and cost data since 2008 (Visser 2009). This system is directly supported by New Zealand forestry companies, whereby they enter details of the harvest system, stand and terrain data for recently completed harvesting contracts.

This FGR nationwide benchmarking system remains relatively unique in the world in that companies voluntarily submit actual contracted rates on a sample basis. Based on the FGR data capture system, a one-off comparison of cable logging rates across central European alpine countries was published based on smaller datasets (Spinelli *et al.* 2015), as well as one for smaller harvest systems in the southern Alpine region with data collected from loggers (Spinelli 2017). More recently the University of Laval in Quebec have also instigated a benchmarking project modelled on the FGR system.

The Benchmarking entry form has had very few changes over time, allowing for effective tracking of trends in various parameters affecting production and cost. The request for 'Month' was dropped as no relationship between season and cost or productivity was able to be established. 'Winch-assist' was introduced to help define this significant change in harvesting practices over the last decade, especially the effect of changing levels of mechanisation on slopes.

At the end of 2023 one addition was made to the data collection form, in that the 'Daily Production Target' was requested as agreed by company and contractor. The reported 'Production Target' provides a comparison against the daily production calculated in the database (reported in tonnes/hour) that has been used since the inception of this benchmarking project. The calculated productivity is derived from the total volume harvested, divided by the total number of working days on site and the average work hours per day.

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It was sometimes noted that the reported productivity for a given crew / site did not compare closely to the Production Target. It was recognised that companies sometimes have difficulty to accurately determine:

- total volume harvested – as this is sometimes confounded through incomplete loadout or incorrect load delivery dockets and or a pre-harvest inventory estimate is used instead.
- the number of days a crew actually works at a given location – this might be based on first and last load-out days as reported in the weighbridge database.
- the average hours worked per day – as this is often set according to the agreed machine costing schedule, and not the actual hours worked.

Using a Daily Production Target was initially not preferred as feedback from companies noted that it was (a) deliberately set too low, and the contractor's profit was based on achieving production above target, or (b) deliberately set too high to encourage efficiency, and full profit is only realised when the ambitious target was met. Hence 'Target' and actual daily average production was often different. However, current company / contractor practice appears to favour being more accurate in setting a realistic target that can be consistently achieved, and hence capturing this can be a meaningful reference that is both well understood and in due time may overcome possible shortcomings of the current 'calculated' productivity method.

It is too early to give meaningful feedback on the outcome of the different production measures based just on the 2024 data. However, it is encouraging that for the majority (40 out of 56 entries) that had a 'Target' recorded, the calculated productivity was within 10% of the company/contractor target. For 23 cases the calculated productivity was at least 10% lower, and for only 3 entries the calculated productivity was higher than target. While neither approach to measuring productivity is entirely accurate, results show that the Daily Production Target is on average higher than the Calculated Productivity.

CURRENT DATA

The FGR Benchmarking data summary is normally reported annually and a target of 100 individual data entries is set to be able to establish reasonably precise and meaningful averages. With the typical approximate split between ground-based and cable logging systems being even, this represents approximately 50 entries for each harvesting category.

For the '2023' data set, January and February data were already included in the 2022 dataset to provide 103 entries for that reporting period. For the remainder of 2023, insufficient data entries were submitted so the collection period was extended until August 2024 by encouraging mid-year contributions from companies that had not yet submitted data – hence also improving overall regional representation. This collection period for this report therefore covers March 2023 until August 2024, with 8 companies supplying data. Of those 8 companies, three had multiple regional offices, making a total of 12 company locations.

A total of 107 entries were submitted in this reporting period, with 52 for ground-based (49%) and 55 for cable logging systems (51%). In terms of the origin of the data, 44% came from the South Island (SI), 13% from the East Coast / Hawkes Bay (ECHB), 25% from Central North Island (CNI) and 22% from the Rest of the North Island (RNI). These regional groups were established to ensure the database had multiple entities in each Region. In comparison to early Benchmarking participation, there has been a shift with fewer actively participating companies in the ECHB region, but an increase in entries from CNI and RNI. As per the previous report (Visser 2023), there is significant regional variation in factors such as Logging Rate and Productivity.

The breakdown by harvest system type (designated by the primary extraction system) is shown in Table 1. Proportionally more data

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coming from the CNI region helps explain the increase in Grapple Skidder data, whereby by percentage the biggest drop was for shovel systems (down from 9% to 5%).

Table 1 – 2023/24 data by system type

Harvest System	Frequency
Grapple Skidder	39%
Swing Yarder	37%
Tower Yarder ('Hauler')	14%
Forwarder	5%
Shovel	3%
Cable Skidder / Tractor Arch	2%

Clearfell operations represented 93% of the data, with 5 road lining and 3 thinning entries all associated with Ground-Based systems. Radiata accounted for 94% of the data, with the remaining 6% being from harvesting Douglas Fir. Extraction to a primary landing for processing remained by far most common (89%) option, 5% was processed at the stump (all associated with forwarder operations) and 6% was extracted to either a secondary landing or a sort yard.

Of total entries, 24% were two-staged, which is a comparably high proportion, compared to past benchmarking reports. The average two-stage distance was 320m. 19 operations were associated with cable logging systems, and 6 were with ground-based systems. The entry forms do not record the type of two-stage equipment used, but this higher number of two-stage operations warrant further investigation (Best and Visser, 2024).

GROUND BASED HARVESTING

For ground-based operations a total of 52 new entries were received for the period Feb-2023 to Aug-2024 and the averages are reported in Table 2. The average logging rate only increased \$0.50/t compared to 2022 data, a surprisingly low increase given the increases in machine and operating costs. However, this small increase in logging rate is very much balanced by a substantial increase in average productivity by more than 15% to 41.1 tonnes/hour.

The 10th to 90th percentile range was \$26.50/t to \$42.40/t, reflecting a large range of operating conditions. A few entries from large clearfell stem operations (producing >1000t/day) came in below \$20/t, whereas the thinning entries average above \$50/t. There continues to be a clear Regional effect, with the average ground-based rate in the Central North Island t \$5/t lower than the Rest of the North Island and the South Island (so \$29/t compared to \$34/t). This difference is consistent with the findings from 2022 data. This year there were too few ground-based data from ECHB to make a meaningful average, but that region typically has the highest logging rates for ground-based harvesting.

For 2023/24, 35% of ground-based operations had access to winch-assist, which continues the increasing trend over the last 5 years. This is also reflected in the average slope for the harvest areas increasing to 26% (or 14 degrees), reinforcing previous indications that winch-assist is allowing more steep terrain to be harvested using ground-based systems.

The average number of machines increased again, building on the increase seen in 2022. For the first time, the number of machines was equal to the number of workers in the crew. That is, the ratio of machines (6.3) to workers (6.3) indicates a 100% level of mechanisation.

With regard to winch-assist harvesting in ground-based operations, the average logging rate was just \$1.30/t higher, but system productivity was about equal. As would be expected, average terrain slope was higher (32% for winch-assist versus 24%).

As only 6 entries related to two-staging in ground-based operations, they were combined with the previous 5 years data. The average logging rate for two-stage was \$3.50/t higher on average, also matching that they were considerably less productive (13 tonnes/hour lower on average). This still provides a strong indication that two-stage is still mainly being used on the most

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difficult sites. This was also backed up with the average stand volume being 80 t/ha. less, and piece size being lower (1.55 t/tree compared to 1.7 t/tree).

Table 2: Summary of ground-based data over time (total n=1037)

Attribute	2008-10	2011-12	2013-14	2015-16	2017-18	2019-21	2022	2023-24
Scheduled Hours/day	8.4	8.5	8.5	8.4	8.3	8.75	8.6	8.8
Piece Size (t)	2.1	1.8	2.0	2.1	1.9	1.9	1.8	1.7
Extraction Dist. (m)	205	206	205	221	250	215	235	283
Slope (%)	14.5	19.5	15	15.1	16.7	16.3	19.5	26.8
# Machines	3.6	4.3	4.6	5.0	4.7	4.9	5.6	6.3
# Workers	7.9	7.1	6.7	6.8	6.3	5.8	6.3	6.3
# Log Sorts	11.2	10.8	11.2	10.2	11.5	9.9	13.5	11.2
Harvest Area (ha)	13.8	14.2	12.1	11.9	13.7	12.3	10.4	11.8
Stand Vol. (t/ha)	511	505	546	572	559	595	595	563
Productivity (t/hour)	30.5	28.2	31.6	34.1	34.4	34.8	35.9	41.4
Logging Rate ($/t)	22.70	24.70	25.60	23.90	27.60	28.30	32.40	32.90

*Note: data from 2008 through to 2021 have been averaged over 2-yearly periods.

CABLE LOGGING OPERATIONS

There were 55 yarder entries in the Feb-2023 to Aug-2024 data with averages reported in Table 3. Fifteen operations used tower yarders (27%) and the remaining 42 entries came from swing yarder operations (76%). The more extensive use of swing yarders over time has been a clear trend, increasing from less than a third a decade ago.

Average cable logging rates increased by $4.20/t from the previous reporting period to $46.80/t, which is a 10% increase. As might be expected, the range is much greater than that of ground-based logging with 10% of entries at less than $36/t, and 10% of entries greater than $56/t. There was a $5.40 difference between swing yarder and tower yarder (‘hauler’) rates, best explained by the difference in average production rates (34.1 and 30.0 tonnes/hour respectively).

Productivity for cable yarding operations only increased by 3%, up to 33.2t/hr. The stand parameter ‘Average Tree Size’ has continued its downward trend, now at 1.85 tonnes/tree. While it will continue to reflect the change in silvicultural regime (i.e. clear wood to structural), again some of this change may be reflecting a change in regional data submission. ECHB historically had the highest average tree size and stand volume (tonnes/ha). Fewer data from that region can affect these averages. When considering the other stand and terrain parameters over the last five years, all have remained relatively constant.

Like ground-based logging, there was an increase in machine numbers, with crews averaging 8.5. Number of workers per crew has remained steady at 8 over the last 5 years. Cable logging systems will typically operate a mobile tail hold, a winch-assist anchor machine, and may

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use spare equipment to support yarder guy lines. These machines are unmanned and can help explain why these logging crews have more machines than workers.

Table 2: Fifteen years of cable yarding data (total n=1023)

Attribute	2008-10	2011-12	2013-14	2015-16	2017-18	2019-21	2022	2023-24
Scheduled Hours/day	8.6	8.6	8.7	8.6	8.6	8.6	8.6	8.9
Piece Size (t)	2.2	1.9	2.2	2.3	2.1	2.0	2.0	1.85
Extraction Dist. (m)	204	202	110	216	238	202	268	228
Slope (%)	48	39	49	45	43	44	40	47
No. of Machines	4.0	4.6	4.7	4.9	5.6	6.5	7.5	8.5
No. of Workers	9.3	8.2	8.9	7.9	7.8	8.0	8.2	8
No. of Log Sorts	10.6	10.8	9.9	9.6	10.4	9.2	12.0	11.2
Harvest Area (ha)	13.5	14.2	11.2	12.8	13.9	11.7	12.5	13.5
Stand Vol. (t/ha)	510	504	517	553	590	601	661	630
Productivity (t/hour)	23.5	24.9	24.8	28.1	28.0	31.9	31.4	33.2
Logging Rate ($/tonne)	32.50	33.20	36.30	37.40	40.30	41.25	42.6	46.80

*Note: 2008 through to 2021 averaged over 2-yearly periods.

Mechanised felling is present in 86% of cable operations. This is being supported by 85% of cable crews having access to winch-assist, which is the same as for the 2022 data and may indicate the market is reaching a level of saturation. Note that the threshold an entry to be recorded as 'winch assist', only 20% of the area needed to be felled with winch-assist support.

Like the ground-based logging rate being higher for two-stage operations, it was for cable logging as well, being a $2.40/t higher. This is very consistent with the analyses done in 2014. More tower yarders are used to two-stage with, and they are used on poorer stands (stand volume is 140t/ha. less, and tree size is only 1.55 t/tree). Two-staging does however reduce the extraction distance, being 200m compared to 235 for single-staged cable logging systems.

LOGGING RATE OVER TIME

Logging rates for both ground-based and cable yarder systems have increased by $10/t over the last 15 years as shown in Table 2 and 3 for respectively. However, when these rates are adjusted using the producers price index, the Logging Rate has in fact remained very constant (Figure 1). It indicates that improved efficiency is keeping pace with increasing costs.

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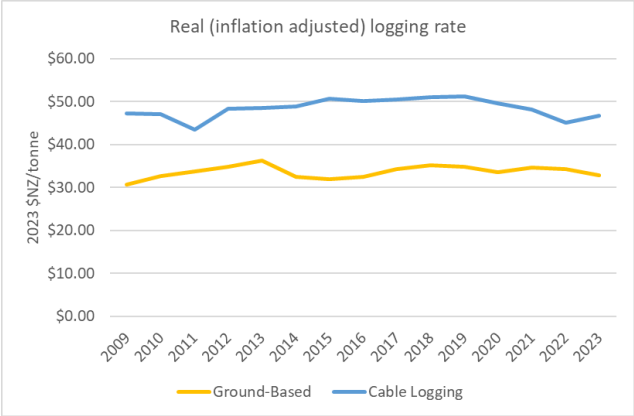

Figure 1: Price adjusted (to 2023) logging rates for all Benchmarking entries, as divided by Ground-based and Cabel logging systems.

The 2023 report presented both the productivity and logging rates by Region and by System – as well as providing regression equations highlighting both the significance of the individual stand and terrain parameters, as well as their scale. These have not changed significantly by including the 2023/24 data and are not replicated in this report.

SUMMARY

A total of 107 new harvest area entries were received in March 2023 to Aug 2024 period (52 ground-based entries and 55 yarder operations). The data continues to show the increase in mechanisation, with benefits in terms of productivity; for this period especially for ground-based operations. As such logging rates remained rlatilvey

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