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Program: Harvesting & Logistics

Task No:3.4

Report No. H061

Benefits of Individual Log ID to Forestry Companies in the Log Supply Chain

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**Research Provider:
Ministry for Primary Industries
for
Forest Growers Research**

Date: 23 June 2023

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EXECUTIVE SUMMARY

The project to commercialise and deploy the Otmotka punch-code individual log ID marker on all processor heads around the country was seen as an opportunity to increase supply chain efficiency in forestry companies, decrease injury risk, enable the possibility of removing paper dockets from the supply chain, and moving completely to digital dockets.

Development of the individual log identification marker and the reading system is being funded by MPI and Forest Growers Levy Trust through the FGR Automation and Robotics programme to help increase the development of forestry technology and productivity of the supply chain.

A survey was created during the summer months of December 2022 to January 2023 by a Forest Growers Research summer intern targeting as many forest companies/owners in New Zealand as possible. The aim was to determine if forest managers use the StanForD data created in the log processors, what data they use from StanForD, and their thoughts about the FGR log tagging project. A total of 15 companies were surveyed but 18 responses were recorded due to multiple people in the same company responding to the survey and providing their thoughts on the project.

Most of the responses received were from companies operating in the North Island but there were still many responses received from companies who operated in the South Island as well. With only 15 different companies surveyed, comments are missing from other forestry companies which either did not want to partake in the survey or FGR could not contact them. The 15 companies that were surveyed, however, made up approx. 19.4 million tonnes of the total log harvest, out of approximately 32.9 million tonnes as reported by Forest Owners Association (2021). The survey response group accounted for over half of New Zealand's total log volume harvested and was considered to be a representative sample of New Zealand forestry companies.

The survey asked questions about the forest managers' use of StanForD and then gave companies the opportunity to outline some of the benefits they felt that they may gain from installing the log marker into their operations. The key findings found from this survey were many companies believed that the marker could:

- Improve the traceability of logs from point of origin to destination.
- Provide useful information for yield reconciliation
- Lead to improvements in monitoring crew productivity, grade out-turn, and value recovery

The survey also gave companies the opportunity to state the issues they may encounter if they implement the log marker in their operations. Some key issues arising from the survey included:

- Regrading of logs after the logs have been stamped
- Reading the punch-code stamp if it has dirt and mud in it
- Cost of installing the log marker itself.

The survey indicated that there were divergent opinions on ownership of the data. However, a majority of companies wanted their data to be stored in an in-house database rather than in a national or international database.

This research project also aimed to see if companies knew about the FGR Automated Log ID project and if they would be willing to install the log marker onto their machines once commercialised. Most companies knew about the project and would be happy with installing the log marker once commercialised; although some companies indicated that this would depend on first trialling the system on one or two processing machines. Most companies that responded to this survey wanted to have a meeting with the project team to gain a deeper understanding of the Automated Log ID project before they made any major decisions about implementing the log marker into their operations.

INTRODUCTION

Virtually all timber harvested in New Zealand from plantation forests is tracked back to source at a batch level using log delivery dockets generated at the log landing and validated at weighbridges.

New Zealand companies currently individually tag, measure and track over 50 million logs per year which are exported to overseas clients. This activity largely takes place at marine ports or “inland ports”. The logistical and forest management benefits of tagging and tracking individual logs, for forest owners and wood users, at an earlier stage in the forest to customer supply chain, are being lost due to lack of a viable in-forest solution.

Murphy (2018) reported that international interest in in-forest, individual log tagging solutions was at least 30 years old. He also identified that punch-code tags, ink-jet printing of matrix codes and radio frequency ID tags were the three technologies that were most applicable for implementation on processor heads in Australasia.

One of Forest Growers Research Ltd.’s (FGR) projects to improve the log value chain is the development of an automated log tagging (ideally applied at the time log is made) and tag reading system (Murphy and Raymond, 2019). For the last three years, FGR have been developing a punch-code tagging and tag reading system in collaboration with a Swedish company (Otmekta) and local manufacturers. The goal of this project is to stamp individual logs, processed through processor heads and fixed processing plants, with a unique code which can be read and linked to all information collected along the supply chain, from the site of log manufacture to the market destination.

A useful benefit to the automated log tagging system is that it will allow the individual log ID to be linked to StanForD data. StanForD is an abbreviation for Standard for Forest machine Data and Communications. It is a de-facto data standard and file-structure standard for communication between computers in forest machines (Skogforsk, 2014). The StanForD standard handles hundreds of variables on the attributes of harvesting (and forwarding) machines (e.g., machine ID, machine brand, machine ownership, time utilization, location, bucking system, calibration), harvesting operators, harvested stems (e.g., length, species, diameters, locations), and logs (e.g., lengths, diameters, volumes, grades, prices, species, bark thickness functions).

Over the summer of 2021/22, New Zealand sawmill managers were surveyed to determine what benefits individual tagging of logs would bring to their business (Parker-Hay, 2022). Benefits for the mills included:

- it would be very beneficial for mill operations, giving the ability to validate logs received and compare to data from the log scanner in the mill
- access to accurate location and time of harvest would be important because logs can stain or rot with extended time since felling
- log data received beforehand or on arrival at the mill provided the opportunity to reject logs if they were not within specification or were damaged
- it would result in improvements to the mill operation.

This report extends Parker-Hay’s work and is based on a survey of the benefits of individual log ID tagging for forest owners and managers¹.

¹ At this point it should be noted that attempt was also made to include harvesting contractors and machinery suppliers in the survey but insufficient numbers of responses were received from these groups to be representative samples of their interests. The report, therefore, is limited to responses from forest owners and managers.

OBJECTIVES

The objectives of this study were to,

- investigate and determine the current usage by New Zealand Forest managers and harvesting contractors of site-specific and crew-specific StanForD data created in processor head computers during log manufacture,
- determine how the same New Zealand forest managers and harvesting contractors would envisage the potential use of this data if it was linked to a unique log identifier (Otmotka Log ID), and
- determine if companies would want to implement the log tag marker and tag reading system once it is commercialised.

SURVEY PARAMETERS

An individual log identification survey was developed, focusing on the forest owner's and/or manager's opinions (Forest Owner Survey) on the automated log tagging and tag reading system and usage of data linked to the unique log ID.

The Forest Owners survey had 5 parts and included both tick box and open-answer questions (see Appendix).

1. Company Background Information.
The first part of the survey collected general information about the forestry owner and how many contractors they use within their company operations.
2. Information about Load Delivery Dockets.
The second section focused on what the companies use their load delivery dockets for, where the information on the docket goes, and who uses the delivery dockets within their company and why.
3. Use / Usage of StanForD (Processor Data)
The third section of the survey gathered information on whether companies used StanForD, or not, and what they used that information for or if they knew what it could be used for. This section also focused on how they extracted the data, what software they used to summarise the data, and how frequently that data was used.
4. Linking StanForD to an Individual Log Identification System.
The fourth section of this survey focussed on the forest owner's opinions about the FGR project (linking StanForD data to individual logs IDs), whether the owners would want to see the new impact hammer marker implemented on their contractors' processor heads, and, if so, how this would benefit them, or not.
5. Data Security and Ownership
The final section revolved around data security and ownership; who they believed owned the data produced by the mechanized processor heads, if they would be happy with other forestry supply chain members using the information, and where they would they want the data to be stored (e.g., in-house versus a worldwide database)

Between early December 2022 and mid-January 2023, the survey was conducted via email and google forms and the results were recorded.

COMPANIES SURVEYED

Twenty-two forest owners from all around New Zealand were contacted and invited to participate in the survey. A total of 15 forest companies responded to the survey with multiple responses coming from some companies located in multiple regions around New Zealand. The total number of responses, therefore, sometimes exceeds 15.

The Forest Owners who responded to the survey are as listed:

- Aratu Forests Limited, Gisborne.
- City Forests Limited, Otago.
- Ernslaw One, Otago, Southland, Marlborough, Gisborne.
- Forest Management NZ (Ltd.), Hawke's Bay.
- Forest360, North Island.
- Juken New Zealand Limited, Gisborne.
- Manulife Investment Management Forest Management (NZ) Ltd., Northland, Central North Island, Bay of Plenty, Hawkes Bay.
- New Zealand Forest Management, Waikato.
- Ngāi Tahu Forestry, West Coast.
- Ngati Porou Forests Ltd, Gisborne.
- OneFortyOne NZ, Nelson / Marlborough.
- Pan Pac, Hawkes Bay.
- Rayonier Matariki Forests, Southland, Canterbury, Otago, Northland, Auckland, Hawkes Bay, Bay of Plenty.
- Timberlands Ltd, BOP, Central North Island.
- Wenita Forest Products Limited, Otago.

RESULTS – RESPONSES FROM THE SURVEY

Company background information

Total annual harvest production

The 15 companies participating in the survey harvest 19.5 million tonnes of the estimated total New Zealand annual production of 32.9 million tonnes.

Half of the companies had a total annual harvest of over 900,000 tonnes with four companies harvesting between 900,001 tonnes and 1,200,000 tonnes, and another three companies harvesting over 1,200,001 tonnes per year. Half had a total annual harvest of under 900,000 tonnes (Figure 1).

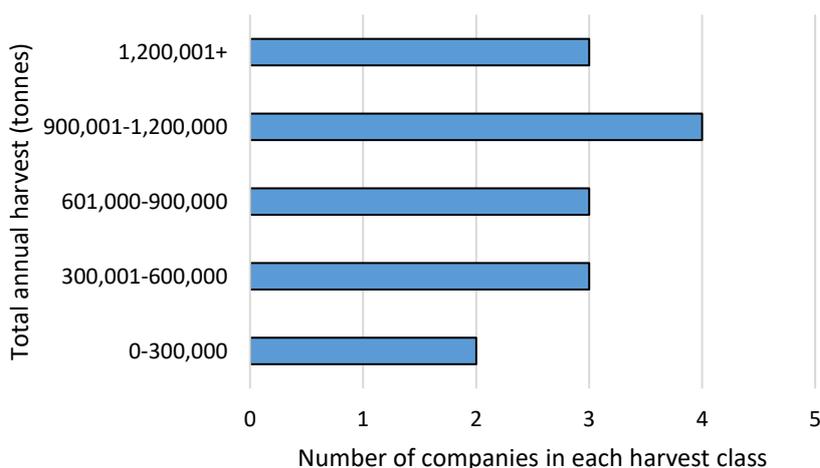


Figure 1: Company's Total Annual Harvest

Number of harvesting contractor crews used

Six companies surveyed had between 0 and 10 harvesting contractor crews, while the next most common response was between 11 and 20 crews. Two companies had 31-40 crews and two had 41-50 crews (Figure 2).

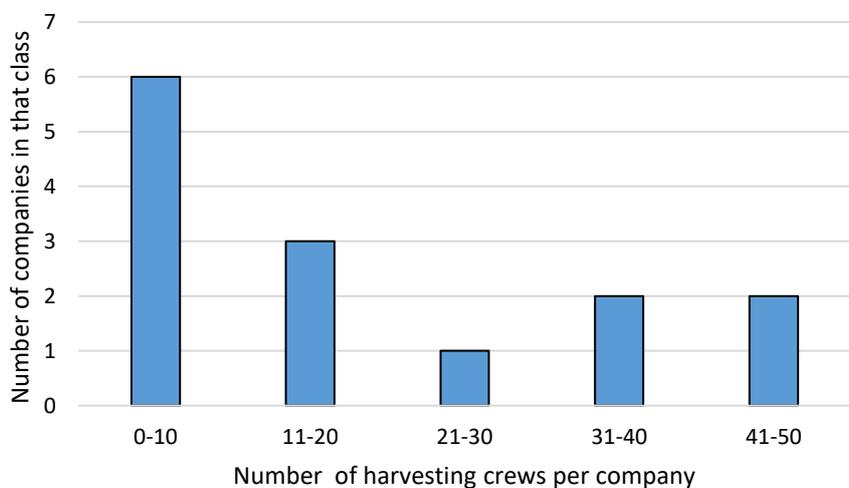


Figure 2: Number of Contractor Crews Companies Use

Number of mechanized processing heads used

More than half of the forest companies had between 0 and 10 processing heads. About a quarter had 11 to 20 processing heads and another quarter had over 40 processing heads (Figure 3). A total of 283 processor heads were used in the surveyed forest companies' harvesting operations. This means that there is a potential for at least 283 Otmetka punch-code log markers to be installed onto processing heads once the automated tagging system is commercialised.

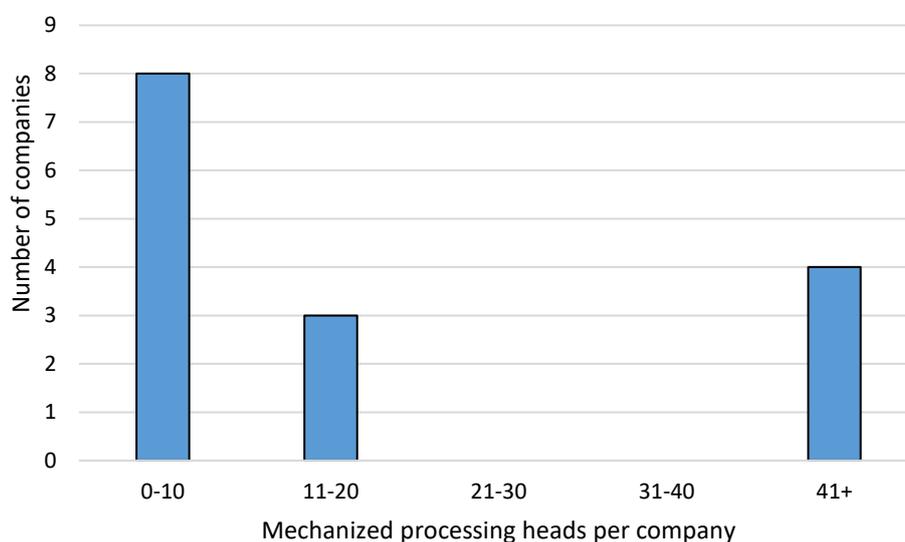


Figure 3: Number of Mechanised Processing Heads Companies Use

Information about load delivery dockets

Company's current usage for load delivery dockets.

Different forest companies had different uses for their load delivery dockets:

- Conversions for JAS scaling.
- Customer reference.
- Customer invoicing.
- Managing wood age at wood yard (felling date).
- Monitoring grade out-turn and value recovery.
- Monitoring of change in the area harvested.
- Operational logistics planning. (e.g., for truck scheduling).
- Operational monitoring of productivity by crew.
- Operational monitoring of productivity by stand.
- Operational monitoring of productivity by the operator.
- Payment of harvesting contractors, cartage, and forest management fees.
- Reconciliation of weights to loads.
- Tactical planning for the next crop.
- Monitoring machine calibration.
- Tracking wood.
- Yield reconciliation.

However, the most common answer to this question was that the load delivery dockets were used as the basis for invoicing customers and paying harvesting contractors, cartage contractors, and forest management fees. Some companies were already in the process of phasing out paper dockets and using electronic dockets for domestic and export sales.

Where does the information on the delivery docket go?

Information on the load delivery docket was sent to a range of different places:

- Company Production Plants.
- Contractors.
- Customers.
- Financer.
- Logging truck drivers.
- Logistics.
- One copy remains in the docket book.
- Port.
- Stored and processed through PS Log.
- Shared with stakeholders within the field.
- Stored in Trimble (Daily data extracted from Trimble into hosts servers).
- Weighbridge.

A common answer was that the data was sent to their PS Log database where it was stored for later use.

Who uses the delivery docket internally within the forest company, and why?

Most companies had the same users for the delivery docket, as listed below. The most common answer to this question was that the accounts team use the docket to pay harvest and cartage contractors and to reconcile log production from each harvesting area.

- Administration for reconciliation purposes.
- Distribution.
- Harvest team to assess production, grade outturn/value recovery, and payments.
- Sales and Finance for sales information.
- Timber sales to reconcile against weighbridge and scaling reports.
- Accounts team to put revenue back into the forest and pay harvest and cartage contractors.

Use/usage of StanForD

Many of the companies did not currently use StanForD data (Figure 4). This finding is based on 17 responses and has implications for the automated log tagging project since linking the unique log ID to StanForD data is one of the claimed benefits of the project.

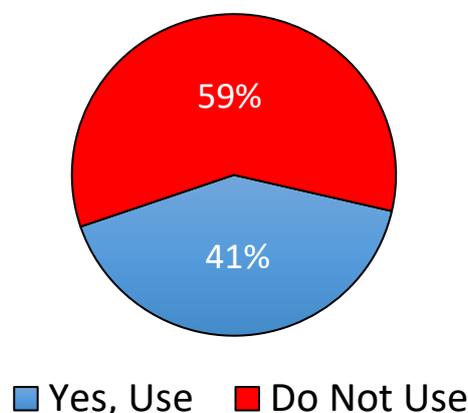


Figure 4: Percentage of companies who use StanForD data

Knowledge, by companies that do not use StanForD, of what StanForD data can be used for

Although 60% of the companies did not use StanForD data, all these companies identified an average of 8 activities the data could be used for. Three potential uses were identified by all companies; yield reconciliation, operational monitoring of productivity, and monitoring grade out-turn and recovery (Figure 5). Only a third of the non-usage companies identified use of StanForD data as a basis for paying harvesting contractors.

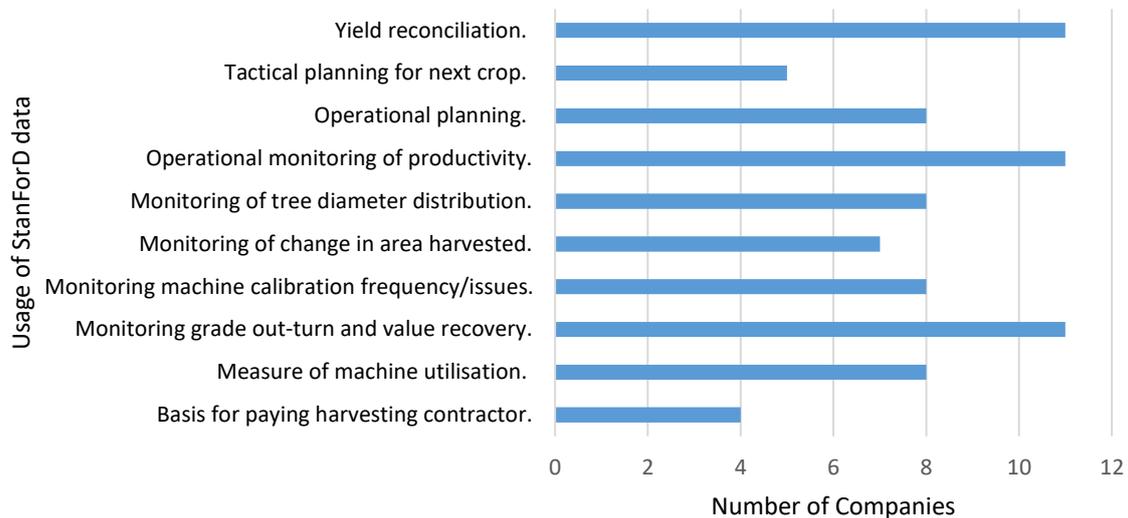


Figure 5: Knowledge of StanForD data uses by companies who do not use StanForD.

Comments on why some companies do not use StanForD.

Companies provided a range of different reasons for why they did not use StanForD data. Some reasons included the cost (\$2,000 to \$5,000 to install StanForD into machines), the small size of some operations, and the capture of all the information they need through other software without using StanForD. The full list of comments for why they did not use StanForD are as follows:

- "We are already getting all of the information we need for our company without having to use StanForD."
- "Do not have the software."
- "We are underway with rolling it out."
- "We did collect .pri files for a time to monitor processor production - processing through Silvia and Excel. However, we found the data cumbersome to collect (Waratah Mate app or operators emailing weekly from other systems) and didn't really give much information. E.g., the only thing the .pri file tells you is what the processor thinks it is cutting - log grade out turn can be deemed from docket/PS Log which is actually what has left the skid. A difference in grades from the .pri file only tells you that either the processor is calibrated incorrectly or someone else in the crew is re-grading. Ultimately found little to be gained from monitoring StandForD data."
- "Reliant on the contractor to pay for retrofit gear? We don't know the advantages yet."
- "Harvesting/marketing: Small number of contractors makes it relatively easy to manage wood flow, the complexity of changeable cut (China, Korea & domestic somewhat in parallel), the large amount of data already available for export (majority of cut). Forest asset/technical: lack of resources to analyze and use the information?"
- "Cost of StanForD."
- "We have only been using processor data (not felling, forwarder, etc), so there is scope to improve the usefulness."
- "We haven't had exposure to the technology and applications of it as yet - most of our crews are woodlot operations so not a lot of value for small single harvest operations."

Use of a third-party company to extract and summarise StanForD data.

All seven companies, who used StanForD data, used a third-party company to extract and summarise the data on their behalf. STICKS software² was used to extract and summarise data for six forest companies, and Silvia software was used for one company.

What companies use their StanForD data for and how frequently do they use it.

The three main activities companies used their StanForD data for were monitoring grade out-turn and value recovery, operational monitoring of productivity by crew, and monitoring harvesting machine calibration (Figure 6). Five of the seven companies used their data daily, while the other two companies used their data weekly.

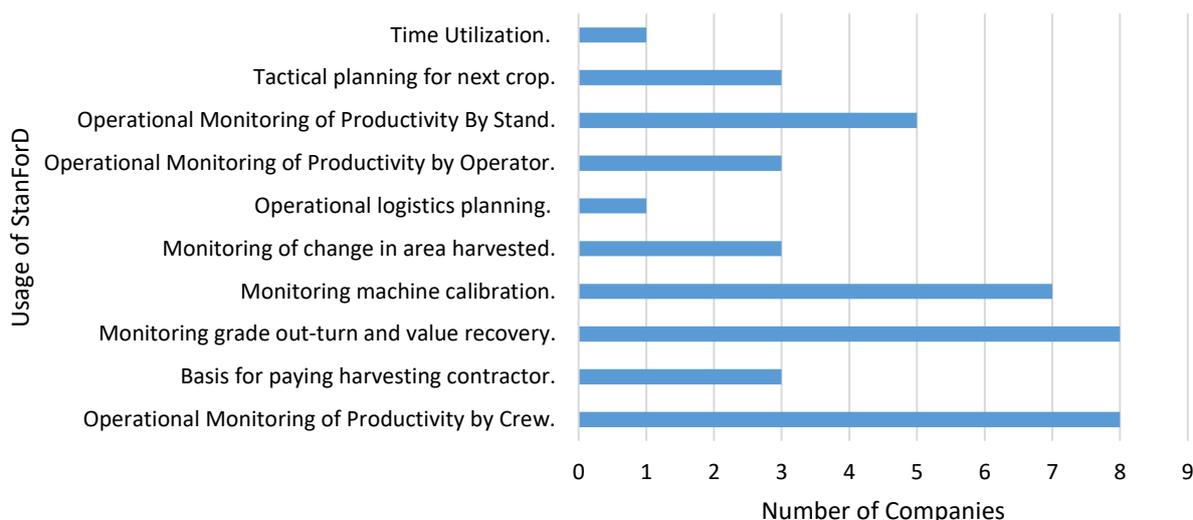


Figure 6: What companies use their StanForD data for

Comments on the usefulness and benefits of StanForD data.

The responding companies that used StanForD data provided the following comments:

- "Been using processor data a while now. Just starting to use felling machine data (2 machines) and would like to start getting yarder information."
- "It is crucial to our supply chain."
- "Starting to become very useful as our data bank is increasing."
- "Data is very comprehensive. We don't find Sticks the easiest system to use to analyse the data, but that might be a relatively easy improvement."

Comments on how companies thought StanForD could improve.

The last part of this section of the survey focused on gaining more information about how all the companies thought things could be improved to help make StanForD data collection and reading easier, or any other general improvements they wanted to see. The improvements companies would like are listed below:

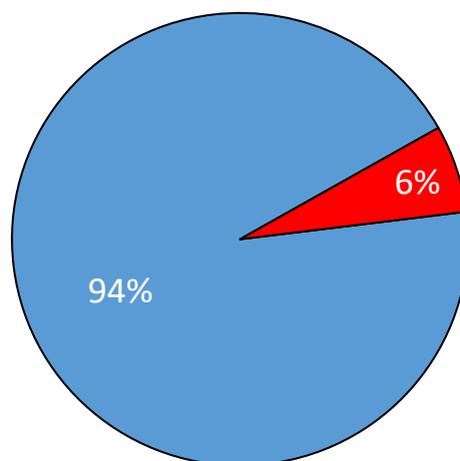
- "All machines/vehicles need to be connected to leverage the technology available."

² STICKS provides a secure online facility for receiving, processing, reporting and analysing StanForD data to help manage production and wood flow for an organisation – a contractor with one or many machines, a small or large forest owner or a manager, (Interpine, 2018.)

- “The real problem we have is with contractors reliably sending their files in. It would be great to get full/easy/cheap satellite connectivity in all machines so that files could be automatically sent each day. Would also be great to be able to receive the data in real-time so that we could monitor and manage production at any point in a day.”
- “Make it easier to transfer from the machine into the Sticks website.”
- “Analysing the data out of Sticks is not very user-friendly - could be improved.”
- “We have only been using processor data (not felling, forwarder, etc), so there is scope to improve the usefulness.”

Linking StanForD data to an individual log identification system

The great majority of respondents believed that linking StanForD data to individual logs would be useful to them and their company (Figure 7).



■ Yes, would be useful ■ No, would not be useful

Figure 7: Usefulness of linking StanForD data to individual logs

Comments on why companies think linking StanForD data to individual logs will be beneficial, or not, to their company.

Many comments were supplied by the respondents on the benefits of linking StanForD data to individual logs. These are shown below:

- “To help with quality control (e.g., SED of 20 from the Waratah was actually 18.9cm when scaled).”
- “Individual log ID will be beneficial for log customers.”
- “Traceability from point of origin to destination.”
- “Data for possible customer complaints, ability to track individual logs from crew to customer. Removed the need for carbon copy dockets.”
- “Yes, it can be beneficial, but the question is, is it worth the effort to implement this process and to not get much out of it as we already getting all the information, we need without using StanForD.”
- “The only benefit I can see is as a replacement for docketing logs. A skid could process wood from multiple forest owners, so if the forest could be changed and imprinted on the LED during processing it could improve tracking. To replace docketing, the processor operator would have to update the site settings for Forest and Setting/Skid. It would also need to tag log grade, length, date, and customer. The customer is probably impossible to tag at the log processing end making it unlikely to be fit for purpose as a docketing tool. Will the impact marker give a visual aid for crews on the skid? That could replace the requirement for stencilling.”

- "Diameter/JAS reconciliation."
- "Easier to track it back to the setting it came from."
- "If used for scaling as well then that would be useful- avoid doubling up."
- "Positive: potential for volumetric sales of domestic logs. Better ability to evaluate inventory v actual recovery & cut strategy volume/value recovery. Productivity mapping in CTL operations (not applicable to CFL). Negative: The majority of our production is exported and goes through a JAS scaling (& manual ticketing) process, unless the process can be streamlined additional log identification is likely to be of limited value to our business (more valuable to larger forest owners and where there is a higher % domestic log sales)"
- "Accurate conversion factor information between true cubic meters as recorded by the processor and JAS as scaled for export, and tonnes at the load level."
- "Log tracking and in-forest scaling."
- "Increased stock and production accuracy. Improved knowledge of the crop, i.e. diameter distribution within a stand - precision nutrition/genetics for future crops. H&S - fewer people on the ground, less paint use. Cost efficiencies - labour and paint. Traceability is more important for markets in the future. Eliminate tagging at the port, and data for scaling to be added. Improved "NZ Pine" story in offshore markets."

The main benefit identified by most forestry companies was the increase in traceability; being able to see where that log has ended up when scanned further down the supply chain, ensuring that their logs were delivered to the right place and on time, and decreasing the chance of log theft along the chain.

Not all the comments related to benefits. Non-benefit comments are shown below:

- "Already obtaining all the information we need without the use of StanForD."
- "Majority of our production is exported and goes through a JAS scaling process (& manual ticketing) unless the process can be streamlined additional log identification is likely of limited value to our business (more valuable to larger forest owners and where there is a higher % domestic log sales)."

Company's awareness of the FGR Automated Log ID project and interest in implementing the automated tagging system when available.

This section of the survey gathered information on the company's opinions on the FGR automated log tagging and tag reading project, if they would add the punch-code marking mechanism to their processor's heads, and the implication/benefits they thought could be obtained from doing so.

The majority (72%) of responding companies was aware of the FGR Automated Log ID project, while the rest had no or little knowledge about the project.

A minority of companies would not implement the punch-code marker on their processing machines when it became available. The majority responded that they either would, or maybe would, implement the punch-code marker. Some of the "maybe" companies commented that they would like to have a trial run on one or two machines first.

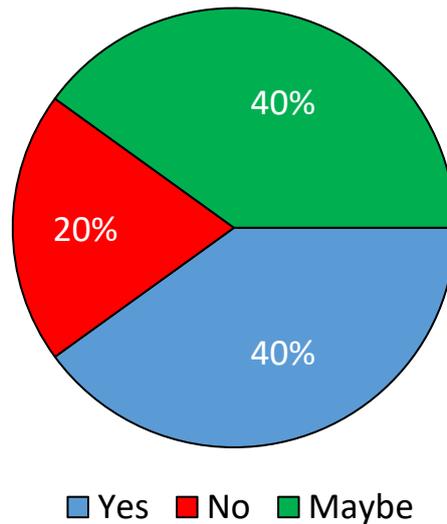


Figure 8: Companies' likelihood of implementing the punch-code marker when StanForD data can be linked to the unique log ID created by the marker.

When companies were asked how many of their processors would they implement the individual log ID marker on, 10 responded. All responding companies said they would like to see it on all their processors, but, as noted above, some said they would like to trial it on one or two machines first before fully committing to the system; to see if the expected benefits did occur.

Issues Companies felt they may encounter with individual log IDs.

Some companies feared they may encounter issues and problems if they implement the technology developed by the log tagging project. They were concerned about the potential cost of installing the punch-code log marking device on their processors' heads, and a potential loss in revenue if they fail or break down. Other issues they felt they may encounter are shown below:

- "How do you handle re-grades due to logs not meeting specifications."
- "Cost and maintenance of the impact hammer."
- "What level of information is useful - how is information processed?"
- "Missing IDs and the loss of data"
- "Dirt/mud making it impractical to read the ID."
- "We are not convinced the Otmeka stamping will work. Keen to explore scale ticketing on skid site, using batch data analysis and timestamps to relate processor data to the ticket."
- "Over-riding present grades leading to a possible inaccuracy in grade out turn, particularly in thinning."
- "Slower processing as crews adjust."
- "Significant variability in conversion factors, problems with lost tags, etc."
- "Readability, mud, data management.
- Need critical mass to move forward."

Comments/questions companies had surrounding the FGR Log ID project.

It has been three years since the FGR Log ID project was first touted and a project steering team assembled. The forest industry has been kept aware of progress with the project through meetings with the project steering team and the larger harvesting technical steering committee. Nevertheless, most companies that responded to this survey wanted to have a sit down with the project team to gain a deeper understanding of the Log ID project before they made any major decisions about implementing this marker into their operations. Questions and concerns they had are shown below:

- “Can we automate a scale ticketing system in a head instead of the log stamping?? (will take out the need to ticket at the port, removing delays).”
- “I think it is a good idea. However, my contractors are unlikely to take it up for fear of damaging it or unnecessarily complicating current operations.”
- “I would like to sit down and run through the project before I commit.”
- “I need a lot more information to understand what the Log ID project is.”
- “I only know a little about the project but would be keen to learn more.”
- “Industry likely to head to volumetric sales so scaling individual logs may become non-relevant in the future. If you can make the log ID work at the scaling sheds so no tickets need to be applied and the Robotic scaling machines can scale the logs with no or minimal human interaction, then this may solve having to change from the current manpower and cartage time-consuming costs involved in scaling.”
- “It's huge. Otmetka Sweden has a big view on how the entire system works together which needs to be kept in consideration.”

Data security and ownership

Thoughts on who is the rightful owner of the StanForD data produced by the processor's head.

There were divergent views on ownership. Many of the companies believed the forest owner was the rightful owner of the data, but some believed that the contractor was either the owner or co-owner of the data, depending on what the data was to be used for. The thoughts provided are shown below:

- “Forest owner/manager for log resource information.”
- “Harvesting supplier for machine performance information.”
- “Owner of the processor (Contractors usually obliged to share information with forest owner/manager).”
- “It depends on the purpose - Forestry company for log resource info, Harvesting supplier for machine performance information.”
- “Rightful owner: Owner of the processor. Contractually they are obliged to share with the Forest owner/manager.”
- “Under our current contracts, data provided and collected belongs to us.”
- “The contractor - they pay for hardware and software. If we paid, then us.”
- “Forest owner & logging contractor. Forest owners firstly as the data could be considered part of the logging service provided as is somewhat commercially sensitive. Co-owned with the contractor”
- “Owner/ operator of the machine with the management company as a vested interest. Potentially subsidising the cost of installation or purchase to allow them access to the data.”
- “STICKS takes the view that the forest owner is the rightful owner of the volume, grade mix, sed/length distribution info, etc, but the contractor is the rightful owner of the productivity, utilisation data, etc. We don't disagree.”
- “Ownership of the tree data collected from the proposed stamp, processor's head, or other sensor technology is owned by the forest management company or simply the owner of the trees.”

Thoughts on making the information available to other forestry supply chain members.

There were mixed opinions on sharing the information gathered through their processing heads with other companies along the forestry supply chain. Some said “yes”, if no name or marker from their company is included with the data. Some said it depends on the purpose and would need to be considered on a case-by-case basis. Some companies said “no” as they believed that their own data could be used against them in terms of price negotiations. Thoughts provided by the respondents are shown below:

- “No due to how it could be used against us for price negotiations.”
- “Yes, but with identifying names and markers removed.”
- “Yes, but only if there was complete anonymity.”
- “Depends on the purpose and would need to be considered on a case-by-case basis.”
- “Within our own supply chain, likely happy to contribute to research, etc.”
- “Yes, if it improves the overall efficiency and commercial sensitivities are respected.”
- “No, not without aggregating information from multiple sources to maintain the anonymity of the operator and crew.”
- “Data would be encrypted and the parties who need the data need to be able to access what they need for their systems and planning should be able to do so.”
- “Under the appropriate agreement – yes.”
- “We would share within our supply chain relevant data to support our business operations. There would be the need to ensure that each party only has access to the information relating to their supply chain activities. We would not share data with an external party unless under strict data-sharing agreement for a specific purpose.”

Preferred location for storage of company data collected from StanForD.

The majority of companies wanted their data to be stored in an in-house database rather than in a national or international database (Figure 9). Only one company would be willing to see its data stored offshore.

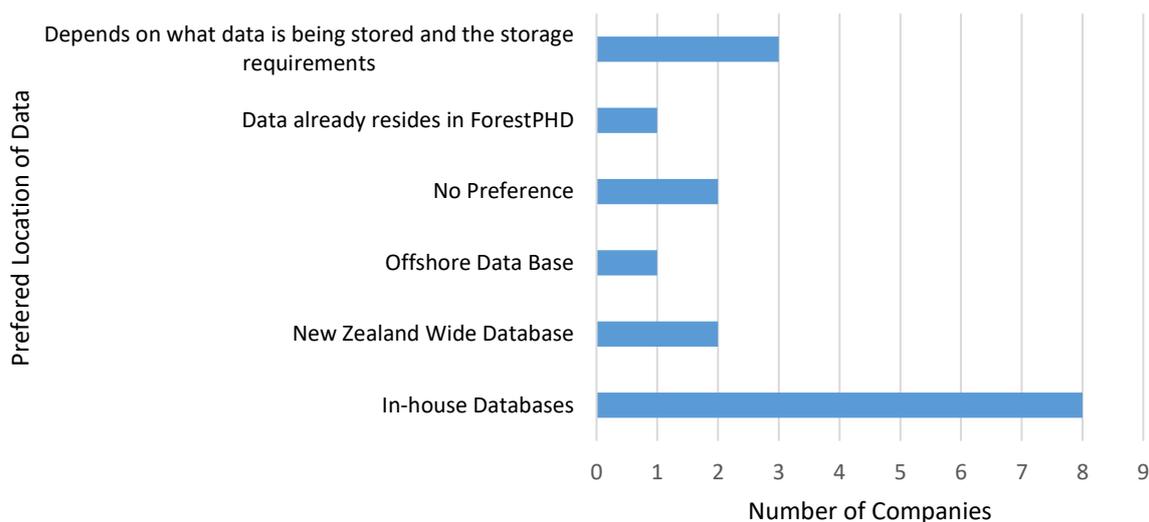


Figure 9: Where companies would prefer their data to be housed.

DISCUSSION AND CONCLUSIONS

The individual log tagging project has the potential to increase productivity in the log supply chain, improve log traceability, and decrease health and safety risks around sites. The goal of this project, which sits within the Automation and Robotics research programme, is to contribute to the automation of the harvesting and processing of the logs at the skid, thereby getting more boots off the ground, decreasing injury risk, and increasing productivity rates. Successful commercialisation can increase productivity through a reduction in the number of people required to scale and mark logs.

The 15 companies, who responded to the survey, harvest more than half of the estimated total New Zealand annual production of 32.9 million and utilise over 280 processor heads in their operations. The survey can, therefore, be considered as a representative sample of New Zealand’s forest companies’ interests.

Log traceability is one of the main performance measures forestry owners want to improve as it will allow them to know if they are providing accurate and timely delivery of logs to their customers, identify if logs are being lost, and support forest-to-market traceability for certification purposes. The survey by Parker-Hay (2022) identified that mill owners believed individual log tagging would provide them with accurate information related to log deliveries.

Some companies were in the process of phasing out paper docketing and using electronic docketing for domestic and export sales. Individual log tagging was expected to facilitate this move. Australian forestry owners/harvesters have already moved to electronic docketing and found that there many benefits from doing so. Some benefits of using electronic docketing were outlined by Acuna et al. (2022) and included improved data accuracy, improved customer production planning, improved logistics scheduling, reduced labour requirements, improved workforce safety, improved cash flow, reduced oversupply, spoilage, and shrinkage of log products. Changing over to electronic docketing also means that harvesting contractors may no longer be paid by the weight of logs carted away from their operations but by the volume of logs that are processed through their processor, meaning they have the potential to be paid for all logs even if they do not get transported off the skid.

Over 80% of respondents said that they would find linking StanForD data to individual logs would be useful for their operations. Of those, half said they would implement the log marker on all processors in their operations and half said they may implement it on all processors after a trial run with one or two machines; to see it in action, that it works as expected, and improves their operations before they make any major decisions about fully implementing this marker throughout their whole operations. Based on the assumption that the survey is representative of the forest industry, it can be calculated that, given a total harvest volume of 32.9 million tonnes, about 200 log markers would be implemented on log processors, and about 400 log markers could be implemented on processors if forest owners were satisfied with the results of the trial runs. The author of this report believes that the goals of the project will not be fully achieved if not everyone takes part in adding the log marker to their processor's heads. Partial success may require ports and other receiving sites to operate duplicate scaling, tagging, and reading solutions.

The survey was mainly focused on the perceived benefits of auto-log labelling and potential impediments to its uptake. Many benefits were identified and included:

- Improved traceability of logs from point of origin to destination.
- Provision of useful information for yield reconciliation
- Improvements in monitoring crew productivity, grade out-turn, and value recovery
- Faster and more accurate log scaling
- Reduced need for workers operating on landings, lowering health and safety risks.

Potential key impediments identified included:

- Regrading of logs after the logs have been stamped
- Reading the punch-code stamp if it has dirt and mud in it
- Cost of installing and operating the log marker itself.

It is believed that some of these issues could be addressed and resolved easily.

Data security and ownership has been identified as an important issue by stakeholders providing oversight of the automated log tagging and tag reading project. The survey showed that there were divergent views on data ownership with the main responses being the data belongs to the forest owner, the data belongs to the harvesting contractor, and the data is, or could be, co-owned by the forest owner and the harvesting contractor. There were strong support for the data being stored in in-house databases rather than in a national or international database. This finding has implications for Otmetka NZ who believe the data should be stored in their international database.

is also much discussion needed to be made about where the data will be stored that is collected by StanForD in each company as many companies wanted the data to be stored in-house due to some of the data being private and not wanting other companies to see all data that is collected.

Most of the surveyed companies knew about the FGR Automated Log ID project and responded positively towards the project and believed that the project will provide them with some benefits. There were a few companies that were not on board with the project. They thought that their operations would be too small to gain much benefit from it. FGR should schedule a round of meetings with forest companies since most companies that responded to this survey wanted to have a sit down meeting with the project team to gain a deeper understanding of the Automated Log ID project before they made any major decisions about implementing the marker into their operations.

ACKNOWLEDGMENTS

FGR would like to acknowledge the following companies that participated in the survey and their managers who freely gave their time to the interview process:

- Aratu Forests Limited, Gisborne.
- City Forests Limited, Otago.
- Ernslaw One, Otago, Southland, Marlborough, Gisborne.
- Forest Management NZ (Ltd.), Hawke's Bay.
- Forest360, North Island.
- Juken New Zealand Limited, Gisborne.
- Manulife Investment Management Forest Management (NZ) Ltd., Northland, Central North Island, Bay of Plenty, Hawkes Bay.
- New Zealand Forest Management, Waikato.
- Ngāi Tahu Forestry, West Coast.
- Ngati Porou Forests Ltd, Gisborne.
- OneFortyOne NZ, Nelson / Marlborough.
- Pan Pac, Hawkes Bay.
- Rayonier Matariki Forests, Southland, Canterbury, Otago, Northland, Auckland, Hawkes Bay, Bay of Plenty.
- Timberlands Ltd, BOP, Central North Island.
- Wenita Forest Products Limited, Otago.

REFERENCES

Acuna, M., Murphy, G., Brown, M., & Strandgard, M. (2022). Punch-code supply chain tracking technology and its viability in Australian forestry conditions. In: "One Big Family – Shaping Our Future Together", COFE-FORMEC-IUFRO Proceedings: pages 77-78.
https://www.formec.org/images/proceedings/2022/Proceedings_COFE-FORMEC-IUFRO_2022.pdf

Forest Owners Association. (2021). *Facts & Figures 2020/21*.
https://www.nzfoa.org.nz/images/FGT_3704_Facts_and_Figures_202021_Web_FA1.pdf

Interpine. (2018, November 4). *STICKS – Harvester Woodflow management system*. <https://interpine.nz/sticks/>

Murphy, G. (2018). Technology review of log level chain of custody tag, track, and trace systems: from harvester head through to ship loading. Forest and Wood Products Australia, Project Report. 30 p.

Murphy, G. and Raymond, K. (2019). Project Work Plan: Automated log tagging and log tag reading system. Report No. HDP053, Forest Growers Research Ltd, Rotorua, New Zealand. (unpublished).

Parker-Hay, L. (2022). Benefits of individual log identification to sawmills in New Zealand. Report No. FGR-056, Forest Growers Research, Rotorua. 19 p.

Skogforsk. (2014). *StanForD*.

<https://www.skogforsk.se/english/projects/stanford/#page=1&faarea=Year&fqy=2014>

APPENDIX – FOREST OWNERS SURVEY

Forestry Owners - Survey on Usage of StanForD and Linking it to Individual Log ID

Kia Ora,

My name is Stephen Thompson, and I am from Rotorua New Zealand. I am studying towards a Bachelor of Forestry Science at the University of Canterbury and this summer, I am interning for Forest Growers Research (FGR) helping them with research on an automatic Log ID project. I am working on a research project on finding what the use may be if/when we can link the StanForD data to an automated individual log marker system.

FGR is working with another company to develop and link StanForD data to an automated impact hammer marker that can be installed at the end of processor's heads to mark the log with a distinct marking, which can then later be scanned and used to help identify all of that log's information that was gathered and stored through StanForD.

StanForD is an abbreviation for Standard for Forest machine Data and Communications. It is a de-facto data standard and file-structure standard for communication between computers in forest machines.

The StanForD standard handles hundreds of variables on the attributes of harvesting (and forwarding) machines (e.g., machine ID, machine brand, machine ownership, time utilization, location, bucking system, calibration), harvesting operators, harvested stems (e.g., length, species, diameters, locations), and logs (e.g., lengths, diameters, volumes, grades, prices, species, bark thickness functions).

This survey is being undertaken to gain an understanding of how different actors in the tree-to-customer supply chain in different countries make use of StanForD data and if linking the StanForD data to the Log ID would be found beneficial to forest companies.

Section 1: Company Background Information

- 1) Name of your Company:
 -
- 2) Country in which you operate:
 -
- 3) Region in which you operate:
 -
- 4) How many contractor crews do you use:
 -
- 5) How many mechanized processing heads do you use/have:
 -
- 6) Total annual Harvest Production (Tonnes):
 -

Section 2: Information About Load Delivery Dockets

- 1) What do you currently use your delivery docket for:
- 2) Where Does the information on the delivery docket go?
- 3) Who uses the delivery docket within your company and why?

Section 3: Use / Usage of StanForD (Processor Data)

StanForD is used for communication between computers in forest machines.

1) Do you use StanForD data? (Circle one)

- If NO go to Question 2 / If YES go to Question 4

Yes / No

2) Do you know you can use StanForD data collected for the following (Circle as many as are appropriate)

- Operational monitoring of productivity.
- Monitoring of change in area harvested.
- Basis for paying harvesting contractors.
- Operational planning. (e.g., for truck scheduling)
- Monitoring grade out-turn and value recovery.
- Measure of machine utilisation. (e.g., hours worked, delays, repairs, maintenance, etc.)
- Yield reconciliation. (cubic meters produced vs planned)
- Monitoring of tree diameter distribution.
- Tactical planning for the next crop. (volume and grade recovery)
- Monitoring machine calibration frequency/issues.
- Other (Please Specify)

3) Why don't you use StanForD data? (Once answered go to Next Section)

4) Do you use a third-Party service company (e.g., ForestPHD) to extract the StanForD data from the harvesting machine and summarise it for you?

Yes / No

5) What software is used to summarise the data?

- Silvia
- Timber Office
- Sticks
- Don't Know
- Other (Please Specify)

6) What do you do with this data? (Circle all that apply)

- Operational Monitoring of Productivity by Crew.
- Operational Monitoring of Productivity by Operator.
- Operational Monitoring of Productivity By Stand.
- Time Utilization. (e.g., hours worked, repairs and maintenance, etc.)
- Monitoring of change in area harvested.
- Basis for paying harvesting contractors.
- Operational logistics planning. (e.g., for truck scheduling)
- Monitoring grade out-turn and value recovery.
- Tactical planning for the next crop.
- Monitoring machine calibration.
- Other (Please Specify)

7) How frequently do you use StanForD Data?

- Daily
- Weekly
- Monthly
- Quarterly
- Other:

8) Do you have any comments on the usefulness or benefits of StanForD data?

9) Do you have any other comments you would like to make about how it could be improved?

Section 4: Linking StanForD to an Individual Log Identification System

Forest Growers Research (FGR) is working on a project to link StanForD data to Individual logs using an impact marker. I would like to know if you would have any interest in implementing this within your company.

1) Would you find linking the StanForD data collected to the individual logs to be useful?

Yes / No

2) Reasons, why you think tagging logs to link StanForD data to individual logs, will be beneficial or not to your company. (What you would use it for)

3) Are you aware of the FGR Log ID project?

Yes / No

4) If / when we can link StanForD data to the Log ID would you implement/use the log marker?

Yes / No

5) (If YES) How many processors would you install the Individual Log ID Marker on?

6) What implications do you think you may encounter with individual log IDs?

7) Do you have any comments you would like to make surrounding the FGR Log ID project?

