



Theme Leader: Keith Raymond



# HARVESTING THEME UPDATE

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## Summary

This update reviews progress in all projects in the “Innovative Harvesting Solutions” programme for the first half of the 2013/14 year. FFR Harvesting Theme work year to date has focussed on technology transfer in the steep slope feller buncher, hauler vision system and improved grapple control projects. Significant progress has also been made in the longer term projects of teleoperation and innovative yarding systems.

## RESEARCH PROGRESS: 2013/14

FFR Harvesting Theme has completed the first half of Year 4 of the six-year PGP Harvesting Programme. Progress in the 2013/14 programme was presented at the Technical Steering Team Meeting on 20<sup>th</sup> February.

### ClimbMAX Steep Slope Harvester

An Open Day demonstrating the ClimbMAX Steep Slope Harvester in operation at John Burt Logging in Mangitaniwha Forest in Hawkes Bay is planned for 20<sup>th</sup> March 2014.

A second study of this machine was undertaken at Hawkes Bay in August 2013. The trial focussed on measuring the productivity of the ClimbMAX felling and bunching trees, measuring the tensions on the winch rope during operation on steep slopes and assessing site disturbance. In 0.6m<sup>3</sup> piece size the harvester felled and bunched 66 trees per hour. Average rope tensions during felling and shovelling were less than two tonnes and tensions during machine travel were about 8 tonnes. In the environmental trial, the ClimbMAX felled area showed rutting in only 3% of plots measured. A Technical Report (H014) has been completed.

The ClimbMAX Steep Slope Harvester developed by Trinder Engineering and Kelly Logging Ltd and partially funded by FFR Members fees and Government funding through the Primary Growth Partnership is now fully commercialised and is available for purchase from ClimbMAX Equipment Ltd in Nelson. The

third ClimbMAX steep slope harvester was completed and delivered to Canada in September 2013.

In a related project, the development and testing of the on-board decision support system called HarvestNav, which provides the operator of any steep slope harvesting machine with information on harvest area terrain has been completed.

Two operational field trials were completed in Tairua and Mamaku Forests, with positive feedback from operators regarding terrain slope and boundary warnings and other harvest area information HarvestNav makes available. The development is now at a stage where contractors can purchase a Windows 8 tablet, source the software from Interpine Forestry Limited, load it up on their tablet, install a digital terrain model (DTM) of the harvest area and have the system up and running in the operator cab in real-time. For more information or to request a demo please click on the following link at <http://www.interpine.co.nz/SitePages/HarvestNav.aspx>.

With the completion of the ClimbMAX Field Day and the release of the HarvestNav software application to the industry next Quarter, Task 1.1 of the PGP Harvesting Programme “Steep Slope Feller Buncher” project will be completed.

### Teleoperated Felling Machine

The development of the teleoperation control system for the lab-based teleoperated hydraulic circuit has been completed to simulation stage



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by UC Mechatronics in Q1 2014. A Technical Note on haptic feedback for a teleoperated felling machine has been published (HTN06-02). The next stage in Task A of this project is the installation of the teleoperation control system into a felling machine. A John Deere 909, owned by Ross Wood of Wood Contracting Nelson Limited, is the candidate machine for this installation. A Development Plan for this installation was approved at the TST Meeting in February.

In Task B of the project, the development of the prototype Biped Felling Machine, dubbed the “stick insect”, was completed in Q1 2014. A Technical Report has been completed on the design of this robotic felling machine (Report H011). Current work is focussed on developing joystick control for the machine and the next steps in this project are to address the scale-up issues for development of a working model “stick insect”.

## Advanced Hauler Vision System

Commercialisation of the CutoverCam camera system has been completed and this system was launched at the Members Meeting in Blenheim in September 2013. It was also presented at the PGP Expo in Wellington on 30th September.

A licensing agreement has been signed between FFR and Cutover Systems Limited to take this unit to market and the first commercial unit has been sold and two more sales are pending.

## Improved Grapple Control

The first two commercial units of the hydraulically-powered Alpine grapple carriage, developed by Alpine Logging of South Africa, have been sold and three more sales are pending.

Another field day demonstration of the Alpine Grapple has been organised for Waimate Forest on Friday 28<sup>th</sup> February, following up on the first

demo at Complete Logging Ltd in Waione Forest, Bay of Plenty in October. A Technical Note of the field trials in the Bay of Plenty is in preparation.

Further work in the project on measuring the efficiency of different rigging configurations has been undertaken by Hunter Harrill of the University of Canterbury, School of Forestry. A literature review of cable logging research relevant to New Zealand is in preparation (H013). So far field trials measuring the skyline tensions of 3 different Falcon Forestry Claw grapple operations, 3 North Bend operations and one Acme motorised carriage operation has been undertaken.

A new project to develop a dual-arm grapple, called the Scorpion Grapple, has commenced. The first or alpha prototype of this innovative grapple arm has been built, a grapple tong fitted and initial field trials done. The carriage is now under construction and Scion will provide documentation of the initial development of this grapple carriage. Once the alpha prototype is complete further field trials will be undertaken in 2014/15.

A new improved felling wedge, developed by loggers in Northland, has had initial trials. Improving directional felling of manually-felled trees was identified as a major barrier to the uptake of grapples. This development is aimed at improving the efficiency of directional felling and reducing the impact of stem breakage during felling and breaking out. One type of felling wedge, the Hydrawedge, was initially trialled and a Technical Report (H010) was published in October. An improved felling wedge is now under development.

## Innovative Yarding Systems

This project aims to design an alternative new extraction system that has the potential to provide a 30% productivity improvement over current systems. The first part of this project involved the design of a new mobility platform for cable yarding – The Hill Country Harvester.



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The expert panel guiding direction in this project did not support further development of the Hill Country Harvester in its present design due to its complexity and high cost. A new design for a hydraulically-powered yarder will provide a low cost alternative to existing cable yarders capable of synchronised control of three innovative cable yarding carriages (a mobile tail hold carriage, a lateral yarding carriage and a new grapple carriage).

A revised Development Plan for this Innovative Yarding System has been approved by the Technical Steering Team. This plan involves development of the three new carriages and a control system as part of the yarder design.

The Research Plan budget for the Innovative Yarding System in 2013/14 has been revised to \$388,341 down from \$462,753 due to proposed changes in the Development Plan. The first stage is the construction of scale working models of the low cost yarder and the carriages.

## Delimiting and Cut-to-Length Systems on Slopes

Initial work examining opportunities for extending harvesting functions on steep terrain was undertaken in 2013. This project aimed to investigate the potential for tree length mechanised delimiting on steep slopes as an extension of the functions of the ClimbMAX steep slope harvester.

Delimiting on the slope offers the potential benefit of increasing effective payload by not hauling limbs, tops and bark, while enabling efficient extraction through bunching delimited stems. Rather than being concentrated at cable landings residues would also be dispersed across the cutover, creating a vegetative mat to reduce the footprint of machine travel across the cutover. Initial feasibility work was undertaken and a Technical Report (H012) was completed. Further work in this project was rescheduled to 2014/15.

## New Hauler Technology and International Monitoring

Completion of a number of 2012/13 projects in the Harvesting Technology Watch area resulted in a number of reports published during the Quarter.

A short field study of the Valentini V1500 cable yarder in Italy in June was published in a Technical Note (HTN06-01) and a Technical Note on alternative power sources for cable yarders (HTN06-04) was also published.

A Technical Note on a survey of cable yarders used in New Zealand, undertaken in 2012 by Dr Rien Visser at the School of Forestry, University of Canterbury was published in January (HTN06-03).

A Technical Note on steep country harvesting in British Columbia, arising from a field visit to FPInnovations in Vancouver and associated field visits in B.C. in November 2012 was also published (HTN06-05).

In the Benchmarking of Forest Industry Harvesting Cost and Productivity project a Technical Note on the results of the analysis of the 2012 benchmarking database was published in October (HTN05-13). Collection of 2013 benchmarking data has been completed and over 200 data entries have been received. Data analysis is now underway and a report will be published.

At the University of Canterbury two student projects are underway: the first in Precision Forestry looking at the application of GPS and geospatial information to mechanised harvesting. The second project is evaluating the Cable Hauler Planning System (CHPS) outputs in comparison to other cable analysis software.

A regional Technical Meeting is also planned for Dunedin in the first week of April.

Dr Rien Visser from School of Forestry, University of Canterbury is also organising a



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forest engineering field trip to Austria from 19<sup>th</sup> – 24<sup>th</sup> October, 2014. This will provide New Zealand logging professionals with the opportunity to investigate modern European steep terrain harvesting operations, visit cable yarding manufacturers, and undertake a full day of professional training at the Ossiach Forest Education and Training Center in Austria.

For more information or to register your interest, please contact Dr Rien Visser at (03) 364 2127 or email [rien.visser@canterbury.ac.nz](mailto:rien.visser@canterbury.ac.nz).

## 2013/14 RESEARCH OUTPUTS TO DATE

### Technical Reports:

- Report H010: Development of an Improved Felling Wedge for Directional Felling – Initial Trials – B. Vincent.
- Report H011 Design of the Robotic Tree Felling Machine – R.Parker and P.Milliken
- Report H012: Feasibility, Costs and Benefits of Mechanised Delimiting on Slopes – T. Evanson and R. Parker.
- Report H013: An Evaluation of a ClimbMAX Steep Slope Harvester in Mangataniwha Forest – T. Evanson, D. Amishev, R. Parker and H. Harrill.

### Harvesting Technical Notes:

- Technical Note HTN05-13: 2012 Update to the Benchmarking Database – R. Visser.
- Technical Note HTN06-01: Valentini V1500 Cable Yarder – S. Hill and K. Raymond.
- Technical Note HTN06-02: Haptic Feedback for a Teleoperated Felling Machine – R. Parker and P. Milliken

- Technical Note HTN06-03: Survey of Yarders Used in New Zealand – R. Visser
- Technical Note HTN06-04: Alternative Power Sources for Cable Yarders – P. Milliken and D. Amishev
- Technical Note HTN06-05: Steep Country Harvesting in British Columbia – K. Raymond.

All these reports will soon be available to harvesting theme members on the FFR website: <http://www.ffr.co.nz/>. If you do not have a login, please contact Veronica Bennett at [veronica.bennett@ffr.co.nz](mailto:veronica.bennett@ffr.co.nz).

## FUTURE FUNDING OF PGP HARVESTING RESEARCH PROGRAMME

In October, FFR was informed by the interim implementation committee of the Forest Growers Levy Trust Board that the PGP Harvesting programme would not be co-funded from the levy.

As of February 2014, the FFR Harvesting Theme has 33 industry members comprising 16 forestry companies, 11 associate members and six forestry consultant firms contributing a total of over \$473,000 of research cash funding in 2013/14. All Harvesting Theme members have confirmed their on-going financial support for the continuation of the research programme, in addition to the new Forest Growing Levy, subject to satisfactory governance arrangements.

A Harvesting Research entity managed by NZ Forest Owners Association (NZFOA) is the most likely contracting entity for the on-going PGP Harvesting Programme. Options being evaluated are: retaining the existing FFR company structure or creating a new legal entity.

Russell Dale, CEO of FFR, has been appointed as R&D Manager for NZFOA which will assist



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with the smooth transition to the new structure. Project management by Keith Raymond will also continue.

For the final three years of the programme the required industry funding is \$1,676,415 split into three intermediate outcomes (including FFR overhead):

- Mechanisation on Steep Terrain: \$545,948 (33%)
- Increased Productivity of Cable Extraction: \$831,273 (50%)
- Development of Operational Efficiencies: \$299,195 (17%)

This industry cash funding plus in-kind contribution will be matched by PGP funding from the Ministry for Primary Industries.

The Research Plan to completion of the “Innovative Harvesting Solutions” programme by 30 June 2016 covers seven projects:

- Task 1.1 Steep Slope Feller Buncher: Completion of field trials and demonstration of the ClimbMAX Steep Slope Harvester and commercialisation of the HarvestNav on-board navigation system (completion March 2014).
- Task 1.2 Teleoperated Felling Machine: Installation of the teleoperation control system to a harvesting machine (Task A) and development of the robotic felling machine to prototype stage (Task B).
- Task 2.1 Advanced Hauler Vision System: commercialisation of the CutoverCam camera system and field demonstrations (completion March 2014).
- Task 2.2 Improved Grapple Control System: Commercialisation of the Alpine grapple carriage; development of the Scorpion grapple and Improved Felling Wedge; and completion of the Cable Rigging Efficiency project (completion June 2014).

- Task 2.3 Innovative Yarding System: Construction of the prototype innovative carriages and Hill Country Harvester (low cost yarder) and co-investment to take to commercialisation stage.
- Task 3.1 Delimiting and Cut-to-Length Systems on Slopes. Investigating the feasibility, and demonstrating the benefits of mechanised delimiting on the slope and cutting to log length using log optimisation processes on the slope (rescheduled to commence 2014/15).
- Task 3.2 New Hauler Technology and International Monitoring: Continuation of the Harvesting Technology Watch programme and on-going development of the Benchmarking Harvesting Cost and Productivity database.

Budgeting for the 2014/15 Annual Research Plan will commence in March, 2014. If FFR members have any new research project ideas you would like to see included in the 2014/15 Research Plan please contact Keith Raymond at [keith.raymond@ffr.co.nz](mailto:keith.raymond@ffr.co.nz) or call 027 438 5233.