HARVESTING TECHNOLOGY WATCH

Number HTW-004
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Summary

TECHNOLOGY WATCH is a biannual report outlining research and technology developments that are occurring outside the FFR Harvesting Theme. The report is divided into the following sections:

- New Logging Technology - Showcasing new logging equipment and technology being developed around the world
- Technology Outside Forestry - Technology being utilised in other industries that could be applied in logging
- Ex-FFR Files - A review of interesting research projects carried out in other FFR research themes
- Global View – What's new in logging from around the world

In this issue, a couple of relatively new technologies are reviewed: a GPS navigation / GIS data management system and a new design for a tree harvester. In Technology Outside Forestry we present a specialist ready-meal for extreme outdoor athletes, of interest to loggers. Using remote sensing for spatially explicit forest assessment is the focus of one of the projects in the FFR Radiata Management theme. Global View provides a brief overview of Forestry SA – one of the main players in the forest industry in South Australia.

Dzhamal Amishev, Scion

NEW LOGGING TECHNOLOGY

Harvesting operations spend considerable machine and operator time navigating harvest blocks, determining location of wood, and estimating optimum yarding distance and location. Genesis Industries' Timber Guide™ Harvest Management System is a GPS navigation / GIS data management system that provides real-time harvest data which can be used to improve operational efficiency, manage costs, and improve the overall quality of harvesting operations. Guess-work is removed by accurately identifying machine location relative to natural or man-made land features, boundaries, and obstacles, allowing operators to focus on harvesting and yarding, with resulting improvements in operational efficiency. In the U.S., independent logging contractors working on purchased stumpage, and contractors working with Plum Creek Timber Co. in multiple southern U.S. states and American Forest Management Inc. in Maine are using this system to improve efficiency and productivity.

Figure 1. Timber Guide™ unit in harvester cab

Each equipped unit (Fig. 1) has a ruggedised, high-accuracy GPS antenna, receiver, and touch-screen computer in the cab. Operators can see harvest area boundaries, aerial photography, and elevation data. Operators can also add additional operational or environmental information, determine area and distances, and

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share information between machines. The components and features can be customised depending on the needs of the operator or region.

Collected data can be exported from field harvesting equipment and uploaded to the Timber Guide™ server for production reporting and analysis. These data provide valuable and accurate information for use in subsequent silvicultural management practices, such as fertilisation, vegetation management, tillage, and planting, as well as harvest performance verification for certification systems.

A GPS-based Load Management System is also available, which is designed to reduce clerical errors and enhance load security and chain-of-custody verification of load out dockets. At the same time it decreases the overall administrative work load associated with load dockets.

Harvest area information from the forest owner is loaded onto the unit using a simple memory stick. Harvester operators can quickly plan their operation, identifying harvest corridor width, direction, and spacing and optimum yarding locations. Each cut tree and bunch location is recorded and transferred “on-the-go” to the skidder/forwarder operator, eliminating the need to search for wood and improving yarding efficiency.

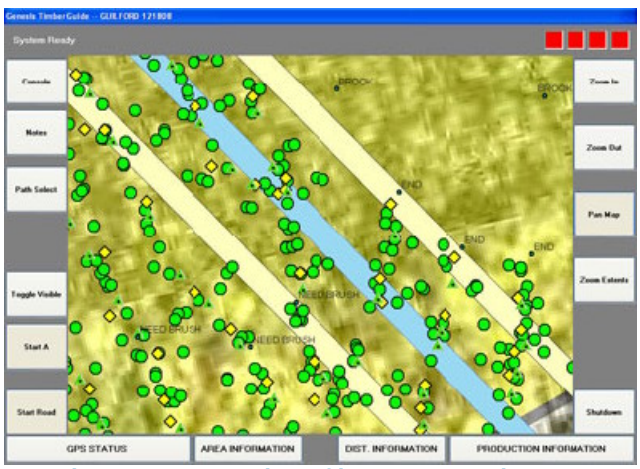

Figure 2. Screen-shot of harvest area - harvest corridor, trees cut, wood bunches and notes.

The operator also has the ability to mark riparian management zone crossings, and other sensitive areas, for future reference.

Contractors in the South-eastern U.S. states and Maine have reported immediate increases in production, decreased fuel consumption, and improved harvest quality and precision from using this system. Benefits include:

- Operators spend more time harvesting and skidding, less time navigating or travelling. Skidding distance is optimised.
- Less time spent on operation layout and planning.
- Exact location of harvest activities confirmed in relation to boundaries.
- Confirmed skidding of all wood without separate verification.
- Improved performance to harvest area specifications.

References:

FRA Technical Release 09-R-9 (2009). http://genesisindustries.net/PressReleases/FRA_TG_Technical_Release.pdf

The Striding Harvester - New tree harvester design that is forest-friendly

A German mechanical engineer and industrial designer, Christian Knobloch, has designed a concept tree harvester that weighs only one-sixth of a conventional tree harvester and causes less damage to the forest soil. In comparison to most harvesters weighing 45 tonnes, the “Striding Harvester” weighs only 7.5 tonnes and creates a small footprint (Fig. 3), selectively pushing down on the soil as it moves. It can take 8-metre steps and function on boggy ground and on slopes of up to 36%. It can also step over rocks and debris up to 4.5 metres in width.

Knobloch looked at a radical change in the way tree harvesters moved rather than trying to improve on the existing techniques of conventional harvesters. He used "constructional-geometrical optimisation

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methods" to come up with the large stepping movement motion of the harvester. He argued that his harvester could reach trees up to 10 metres away and create a working area of 480 square metres. Even though the machine is relatively light, the large base created by the widely spread cantilevered feet enables the boom and arm to lift weights far heavier than itself.

Figure 3. The Striding Harvester

The telescopic crane arm and cabin of the harvester sit on a bridge with three cantilevered feet on each end that allows the harvester to adapt to the ground surface, says Knobloch. Once a step is taken, a new direction can be chosen and the bridge moves accordingly. As the weight bears down on one of the two legs or bases, the unloaded base can pivot and move.

Knobloch, in collaboration with Professor Jörn Erler, of the Institute of Forest Management and Forestry Technology at Dresden University of Technology has also developed a simple, inexpensive way to transport felled trees, without damaging the soil. Christian Knobloch was presented with the Rudi Högner Advancement Award for Industrial Design for his diploma thesis at the 3rd Industrial Design Symposium in April 2009.

Reference: Gizmag (2009). http://www.gizmag.com/tree-harvesting-design-that-is-forest-friendly/11550/

TECHNOLOGY OUTSIDE FORESTRY

The canned cheeseburger – fast food for the forest

A topic often overlooked by forestry workers, in terms of their general health and well-being, is that of nutrition and hydration. Kirk *et al*. (1996) described the role of each food group (carbohydrates, fats, and proteins) in the overall performance of the human body. An innovative solution has been developed in Europe to this important issue.

Swiss-based company Katadyn has diversified into a range of products servicing the special requirements of outdoor enthusiasts and adventure seekers, campers and sailors.

Given that its products will be found in the kit of any international relief organisation, military Special Ops unit or extreme adventure athlete, it is somewhat of an irony that this company should produce the world's first cheeseburger in a can (Fig. 4).

Figure 4. Trekking-Mahlzeiten's canned Cheeseburger

The canned cheeseburger is sold under one of Katadyn's best known brands, Trekking-Mahlzeiten, a subsidiary company that develops

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specialist ready-meals for the outdoor, expedition and extreme athlete markets.

The high tech hamburger has been developed for trekkers, and the non-traditional metal wrapping reflects the Trekking-Mahlzeiten company ethos that its speciality meals should be easy to prepare and require only water to do so - simply throw the can into hot water, wait a few minutes, open the lid, and eat. With a shelf life of 12 months without requiring refrigeration, the lightweight snack is the ideal fast food for the forest.

Trekking-Mahlzeiten also offers an array of freeze-dried nourishment, designed so it can be prepared quickly and easily by trampers and outdoors people, using only water and fire. The product range consists of complete meals, vegetarian meals, soups, and snacks, and other diverse nutritional items suitable for everything from breakfast to a high tech chocolate mousse, to Peronin, a complete liquid food to which vitamins and minerals have been added. It is especially suitable for meeting high performance requirements and is marketed as "fuel for the bloodstream."

The world's first Canned Cheeseburger ensures enjoyable meals in the mountains and other extreme situations. While this may not be readily available to forestry workers, there are a number of similar food options available in New Zealand to offer portable complete nutrients.

References: Kirk, P., Gilbert, T., Darry, K., 1996. Increased safety and performance through "smart food". NZ LIRO Report, Vol. 21(26), 7 pp.
http://www.trekneat.com/en/trekn-eat-products/

EX-FFR FILES

Spatially explicit forest assessment utilising remote sensing

A project in the Radiata Management theme, is estimating inventory parameters (stocking, area, height, standing volume, biomass) and wood quality parameters utilising information from Optical, Radar and LiDAR remote sensing systems. A combination of model-based inventory and multi-phase sampling systems will be developed which would be suitable for end-users including small forest growers.

Work was completed in previous years that generated several large datasets. The work programme for this year is the analysis of primarily LiDAR data in predicting aspects of forest structure, and determining LiDAR's usefulness for planning and inventory purposes. Work will also evaluate Radar, C-band and P-band data, to determine the heterogeneity of a stand.

Active sensors such as LiDAR and radar are capable of providing estimates of forest parameters such as volume and height. Optical sensors, when fused with plot data, can be used to interpolate parameters of interest across the forested landscape. This research aims at developing proof-of-concept of the role of LiDAR, Radar and optical sensors in inventory. It will look at methods and algorithms for parameter estimation and methods and algorithms for mapping spatial variability within supposedly homogenous 'stands'.

Detailed further research is planned for improvements in prediction precision and accuracy as well as new algorithms. The specific technological platforms to be utilised are planned but flexible, and will react to any new satellites and aerial sensor developments if they are deemed positive. An advantage of focusing on Radar and LiDAR is the current availability of radar satellites and an in-country LiDAR unit. Further work is required to achieve improvements in sampling systems, parameter determination, costs and operating procedures.

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FUTURE FORESTS RESEARCH

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GLOBAL VIEW

ForestrySA

Forestry in South Australia

The South Australian Forestry Corporation trading as ForestrySA manages the state-owned forestry resource in South Australia. This consists primarily of 86,000 hectares of *Pinus radiata* in the Green Triangle, Mount Lofty Ranges and Mid North regions of South Australia. The Head Office for ForestrySA is in Mount Gambier.

South Australia was the first state in Australia to develop and commercialise radiata pine plantations, and was the earliest commercial manufacturer of radiata pine-based paper and particleboard. The total volume of wood sold from all plantations in 2008/09 was around 1.7 million cubic metres. The annual planting programme is maintained at about 2,500 hectares per annum, principally in the Green Triangle. Opportunities for forest expansion are also being realised through an annual programme of land purchase for new plantations. It also manages two joint venture hardwood plantation programmes in the Green Triangle region, both growing blue gums to produce export woodchips for paper production.

ForestrySA is committed to the economic, environmental and social aspects of sustainable forest management practice. ForestrySA maintains an integrated Forest Management System certified to the Australian Forestry Standard (AS 4708) as well as the international standards for quality and environmental management (ISO 9001 and ISO 14001).

It manages and protects some 25,000 hectares of native forest for conservation in South Australia. A number of these areas, including the Mount Gawler Native Forest in the Mount Lofty Ranges and Honans Native Forest in the Green Triangle, represent areas of high conservation and biodiversity value. Each year more than 200,000 day visits are undertaken in the Mount Lofty Ranges and Mid North Forest Reserves. These forests provide a wide range of opportunities including outdoor recreation, conservation of native forests, water catchments, habitat for native flora and fauna, and plantation grown timbers.

A forest research programme is maintained by ForestrySA to improve wood growth and timber characteristics, lower costs and better manage risk through adaption. The programme also seeks to support industry activities with a range of trials and activities jointly funded by ForestrySA and the State Government.

Several research projects, especially in the forest operations area, have been carried out. Examples of some of the Forestry SA research and innovation projects include:

- Operational implementation of optimisation and harvesting technology
- Investigating harvester head measurement accuracy.
- Log sorting based on acoustic measurement of wood stiffness.
- Extracting resource information from harvester data.
- Linking LiDAR and harvester data.

Reference: www.forestrysa.sa.gov.au

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