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Monitoring long-term forwarder productivity using onboard computer data

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Long-term monitoring of forest harvesting machines is critical to precision forestry and is only feasible using automated technologies. However, most automated technologies lack the required flexibility, simplicity and accuracy. Of these technologies, the most promising use Global Navigation Satellite System (GNSS) receivers. However, previous studies of GNSS receivers have identified two key problems: data analysis requires manual delineation of log landings, etc, and they cannot reliably detect delays.

The study investigated a fully-automated monitoring approach using Multidat data loggers installed in forwarders. GNSS points were recorded every 30 seconds and/or 20m travelled. Locations of log landings were determined using the density of GNSS points. Leaving a log landing marked the end of a work cycle and commencement of the next. Maximum distance travelled from a landing was used to estimate extraction distance. Time elements were identified by the forwarder's location (at a landing or not), its direction of travel (away from or towards a landing) and speed. Delays were identified using the Multidat's vibration sensor which recorded when the forwarder was working/not working.

The study found Multidat-derived work cycle estimates were generally within 2% of manual time and motion study estimates. Results for time elements varied considerably, but the longer the time element, the closer was the Multidat estimate. This was related to the low intensity of GNSS points. Work has commenced to implement the approach using a greater intensity of GNSS points and by near real-time transmission of data to a central server for immediate analysis and reporting.