Forest Engineering




Timber Harvesting and Logistics

Fuel Consumption and the carbon balance in South African pine felling CTL operations: A case study

The case study's objectives is to determine the carbon balance of South African plantations by assessing emissions associated with mechanised CTL harvesting and comparing these to the carbon stored in the logs harvested. The secondary objective was to determined baseline estimates for mechanised CTL diesel and oil consumption as well as rates when stand and terrain factors are considered.

South African pine cut-to-length harvesting: an analysis of fibre loss and productivity

This study done in the Southern Cape and Mpumulanga forestry regions assessed the accuracy of a harvester's ability to cross-cut *Pinus spp.* stems. In addition, it evaluated the factors that could potentially affect the useful wood yield lost through inaccurate cross-cutting. The study suggests tree species have a significant influence in precision with cross-cutting of *Pinus spp.* The findings of this study suggest that harvesting *P. patula* stands in a CTL system may require more caution as *P.patula* is associated with potentially more fibre loss, lower productivities and greater economic losses. This study hopes to aid and improve the efficacy of mechanized CTL harvesting.

A South African pine sawtimber mechanise cut-to-length study

As mechanized harvesting data is currently limited, this study targets to present a preliminary investigation of productivity of a harvester and forwarder in a saw timber cut-to-length system. Objectives include determining productivity and time distribution of work elements; determining factors (i.e. slope, operator, log assortment, etc.) that have significant effects on the productivity; develop separate and applicable models to predict productivity; ascertain cross-cutting accuracy of a harvester; record initial estimate of fuel consumption and emissions of machines under specific operating, terrain and work object conditions; and evaluate cost of each machine and the system as a whole using the South African Harvesting and Transport Systems and Costing Model.

The effects of road network interventions on forested landscapes: A case study of KwaZulu-Natal, South Africa

Potential economic improvements with excessive and low forest road network intervention were investigated near Greytown in KwaZulu-Natal. This study compared the impact of deactivating in-compartment roads on road network related costs, its capacity to increase

productive area and upgrading's potential to decrease transport costs. The study found that all intervention levels produced economic gains in compared to *status quo*, but the best economic scenario included both deactivation and mergers. Regardless of associated costs with deactivation and mergers, the additional income derived from mills (due to increases in volumes produced) was more than sufficient to offset the increased cost. As a result, road network interventions may enhance long-term economic value of forested landscapes.

An Eastern Cape Softwood Sawtimber Supply Chain Case Study

The objective of this study was to quantify and model potential monetary gains and improved resource utilisation of a forest to mill softwood sawlog supply chain. The results were constructed by observing stages of wood procurement process that included: fibre losses during the timber harvesting phase; establishing a primary transport wander ratio, travel speeds and operations efficiencies; predicting secondary transport travel speeds along with a study of current and potential efficiencies in transport; and a supply chain management study. The study formed part of a completed PhD study at Stellenbosch University.

Analysis of a mechanised cut-to-length harvesting operation working in a poor growth *Eucalyptus smithii* stand through use of discrete-event simulation in R

In South Africa, mechanised timber harvest systems have increased in forestry operations. This study aims to analyse the current inefficiencies in implementation and gather evidence of unnecessary operational variability in mechanised timber harvesting operations. The study observed and recorded data from a typical cut-to-length operation (excavator-based harvesters and purpose-built forwarder). This data was then modelled and statistical analysed using R to determine efficiency.

Cost and productivity comparison of two single grip harvesting machines, a Timberpro TL-725-B (Purpose-built) and a Volvo EC-210-BF (Excavator based), across a range of slopes in the Kwazulu-Natal region of South Africa.

This study utilises time study techniques to acquire productivity estimates for machines working on a variety of different slopes. The slope extent will be determined from LiDAR data with a 2 metre resolution. The main differences between the machines are that the Timberpro is a purpose built forestry specific machine and has cabin levelling capabilities that make it better suited for sloped terrain; however this also makes it significantly more costly. This study aims to identify and quantify the effects of ground slope on the productivity of both single-grip harvesters, whilst also comparing the costs associated with running either machine type to determine the optimal usage scenario for both machines.