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Systems comparison of 10 supply chains for whole tree chips.

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Whole trees from energy thinnings or vegetation management on road verges, constitute one of many sources, yet it was possible to define ten widely applied supply chains for this feedstock alone. These ten represent only a subset of the real possibilities, as felling method is held constant and only a single market (combustion of whole tree chips) is considered. Stages included in-field, roadside landing, terminal, and conversion plant, and biomass states at each of these included loose whole trees, bundled whole trees or chipped material. Assumptions on prices and performance were made based on own studies and published literature in similar boreal forest conditions of Sweden and Finland. The economic outcome was calculated on the basis of production, handling, treatment and storage costs and losses. Outcomes were tested for robustness on a range of object volumes (50-350 m³ solid), extraction distances (50-550 m) and transport distances (10-70 km) using simulation across a set of discrete values. Transport was calculated for both a standard 19.5 m and an extended 22 m timber truck.

Results showed a 20% difference between the cheapest (roadside chipping and direct transport to conversion plant with container truck, 19 € m⁻³lv chip (s.d. = 2) and most expensive (in-field bundling, roadside storage, terminal storage and delivery to plant using a 19.5m timber truck), 23 € m⁻³lv chip (s.d. = 1.5) supply chains overall – ie. across the range of stand sizes and distances. Outcomes vary at specific object volumes and transport distances, highlighting the need to verify assumptions.

This paper highlights the relative performance of the methods used for extraction, bundling, chipping, primary and secondary road transport, losses through handling and respiration, and storage costs, allowing for each module to be compared. It also makes all the assumptions and calculations on performance explicit, and as such contributes to the growing body of work on supply chain modeling.