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The effect of implementing innovative harvesting and handling technologies for young dense thinning on the cost and energy efficiency of supply systems

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The objective of this work was to study the effect of implementing innovative harvesting and handling technologies for the thinning of young forests under Nordic conditions on the cost efficiency and energy efficiency of biomass supply chains. Costs and energy requirements for delivering biomass from the forest to industry were modeled with data from the literature, using type of stands, products delivered and transport distances as variables. The effects of increasing the payloads of off-road and road transportation by 10-30% were also analyzed.

If boom-corridor thinning technologies, optimized bundle-harvesters and load-compression devices are implemented, on average, costs are reduced by 12 – 27% and 11 – 30% less energy is required when compared with handling tree sections using conventional systems. For example, if one considers stands giving an average tree size for removal of 22 dm³, then the harvesting of tree parts using innovative technologies would, for road transportation distances of 75 km, reduce the cost by up to 15% and the energy requirements by 21% . These effects increase with reduced tree sizes (denser stands) and increased forwarding and transportation distances.

The effects of implementing innovative technologies is especially significant for stands with stem sizes below ca. 30 dm³, representing a significant part of the potential forested area that could be harvested annually in Sweden and Finland. Thus, there should be increased research and development of harvesting and handling technologies, such as boom-corridor felling technology, bundle-harvesters and load-compression devices for implementation in biomass supply chains from the young dense thinning forests.