

Evaluation of multirotor drone system for thinning operations

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Abstract

Thinning operations in forestry are typically done by two-machine systems with a harvester and a forwarder, and their productivity is well documented. Drones are being used for data collection and surveillance but not as an alternative to two-machine systems. Recently, there are multirotor drone systems being developed and tested for thinning operations for smaller trees, but there is little known of their productivity and how they should be configured. Important considerations for a system are the number of drones, charging effect, charging locations, drone battery capacity, and overall automation level. We propose an evaluation approach that describes such drone systems in detail and enables a direct comparison with standard two-machine systems. This approach is then tested on a case study with 1171 harvest areas with diverse characteristics with regards to, for example, flying and forwarding distance, wetness, and hilliness. The results show that some drone system configurations are competitive against the two-machine system on a proportion of the harvest areas and that this increases with higher CO₂ tax and soil damage fees.

Keywords: Transportation, Routing, Forestry, Drones, Optimization