

# **Abstract**

## **Estimation of forest stem volume using Airborne Laser Scanning data - models accuracy comparison**

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The following study deals with the area-based methods of forest stem volume estimation using Airborne Laser Scanning data. The aim of the thesis is to compare the accuracy of existing models used to estimate stem volume.

In Poland there are not many research works about the topic. Therefore models evaluated and developed in other parts of Europe were analysed and applied. Seventeen volume predicting models of different tree species were reviewed in the thesis, eight out of which were analysed. The area of investigation was located in Milicz Forest District. In the area of investigation, 216 circular sample plots have been established. The area of the sample plots depended on the age class of the stand. The height of the trees and diameter of the breast height were measured. Next, the volume of each tree located on the plot was estimated using allometric equations. Having estimated the total volume of each sample plot the Airborne Laser Scanning data was calibrated. Airborne Laser Scanning data was clipped to the corresponding area of sample plot and then it was normalized. Volume predicting models were developed based on the point cloud variables, similarly to other studies.

The results of the research showed the reliability of models in stand volume estimation using ALS with calibration of sample plots. The accuracy of the tested models was assessed as satisfactory. The method proved to be useful in practical area-based forest inventory. The most reliable model both for coniferous and Scots pine forest stands was the one developed by Magnussen et al. (2012). Coefficient of determination of field volume correlating to predicted volume was equal to 0.73 in case of coniferous species stands and 0.71 in case of Scots pine. Generally, it is certain that the accuracy of models analysed in the area of interest is smaller than in the research works performed by other authors. For this reason, there is a need for further research work in order to develop models appropriate for Polish sustainable forestry requirements.

**Keywords:** forest inventory, volume estimation, LiDAR, percentiles, accuracy