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Quantification of a continuous-cover forest in Sweden using remote sensing techniques

Mapping and quantifying forest information about e.g. land cover, tree height and biomass has traditionally been a both time-consuming and labour-intensive part of forestry and forest research as field measurements typically are collected manually using handheld equipment. Remote sensing has proved to be a valuable complement to field based measurements as it enables for fast and relatively cheap collection of data from areas that would be hard to access from the ground. The aim of this thesis was to map and quantify the Romperöd forest outside Glimåkra in southern Sweden where selective thinning forestry has been practised since the 1960's. The study was carried out using high resolution multispectral aerial images and small-footprint discrete-return LiDAR data included in the Swedish national elevation model in conjunction with field measurements. The results revealed a mixed forest where Norway spruce was the most dominating tree species, accounting for 40.2 % of the total coverage of the study area, followed by Scots pine (13.8 %), broadleaved trees (8.7 %), succession (6.7 %) and bare-ground (4.1 %). The elevation of the terrain varies between 76.2 and 107.3 meters above sea level, with a ridge extending from south to north. The canopy height of the forest varies greatly throughout the study area and ranged between 1.0 and 34.6 m with an average height of 15.1 m and a standard deviation of 8 m. Above-ground biomass (AGB) was estimated by fitting a multiple regression model to LiDAR-derived vegetation metrics (independent variables) and AGB estimates based on field measurements (dependent variable). The model managed to explain 70 % of the variability in the field measured AGB estimates and was applied to the entire study area yielding an average AGB of 122 900 kg/ha and a standard deviation of 50 497 kg/ha. The inclusion of remote sensing data improved the AGB estimates compared to those based solely on field measurements. The results were compared to the AGB data included in the SLU Forest Map which showed low correlation with AGB estimates based on field measurements (adjusted R^2: 0.14), proving it unsuitable for the part of the Romperöd forest characterized by selective thinning.

Keywords: Physical Geography and Ecosystem analysis, remote sensing, selective thinning, land cover classification, digital elevation model (DEM), above-ground biomass (AGB).

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