

# Abstract

## Two-phased inventory of standing volume in mountain forests with the use of aerial photographs and ground sample plots

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Aerial photography is an integral part in forest inventory applications and a very significant data source. This study aimed to elaborate and develop the existing methods used in inventorying lowland forest and adapt them for mountainous forests. Colour infrared (CIR) digital aerial photographs of a scale 1:10 000 and spatial resolution 13 cm were used.

The inventory of mountain forests (in Stolowe Mountains National Park) with the use of CIR aerial photographs in this study relied on the implementation of the 3D (dimensional) methods and it was characterised by two phases (two-phased sampling with regression estimators). In the 1<sup>st</sup> phase the auxiliary variables (e.g. crown cover, height of dominant trees, density) were measured on the aerial photographs (355 circular plots). Variable of interest (standing volume) was recorded during the terrestrial survey on the corresponding ground sample plots. A statistical relationship was established between the variable of interest and the auxiliary variables by means of multiple regressions. In the 2<sup>nd</sup> phase selected auxiliary variables were measured on the enlarged set of 2772 plots on the aerial photographs only. The variable of interest (standing volume) was computed by using the regression model developed in the 1<sup>st</sup> phase (between it and the auxiliary variables) for the whole forest area. The main focusing points in this study were the collection of data through aerial 3D interpretations and measurements, analyzing of the extracted data, estimating the standing volume and assessment of the accuracy.

Achieved results indicated that tree height and green volume are the most significant variables for estimating the standing volume in two-phased forest inventory. The coefficient of multiple correlation  $R = 0.85$  indicated a very strong relationship between ground volume and these two variables. The estimated mean volume for the whole forest of the Stolowe Mountains National Park was  $403 \pm 11 \text{ m}^3/\text{ha}$  (i.e.  $\pm 2.8 \%$ ). The accuracy of inventory was similar to the result of inventory for the management planning (carried on ground plots only – approx. 800 plots).

**Keywords:** Mountainous forests, forest inventory, CIR aerial photographs, standing volume