TERRESTRAL LASER SCANNING VERSUS TRADITIONAL FOREST INVENTORY
FIRST RESULTS FROM THE POLISH FORESTS

Weyzk P., Koziol K., Glista M., Pierczechalski M.

Laboratory of GIS & Remote Sensing, Faculty of Forestry, Agricultural University of Krakow (AUC), Poland

THE FOREST STANDS IN THE DISTRICT OF Milicz (RDLP Wroclaw, central-west Poland; WGS84: 51°27' N; 17°12' E) were selected for the pilot study. In November 2006 - TLS was carried out on 30 circular plots (5 – plots located in deciduous forest stands: beech, oak and 24 plots in coniferous stands: Scots pine) by the AUC. The results are presented for the 4 inventory plot which are part of the RTD project: “Elaborating the method of forest inventory, based on the integration of selected geomatic techniques” financed by the General Directorate of Polish State Forest and managed by Warsaw Agricultural University (SGGW).

RESEARCH AREA

The forest inventory campaign was carried out in August 2006 by company Taxus S1 (reference data = Ref. Inv.). Like: azimuth, distance, DBH, height, diameter at 5 m height, length of crown, crown shape, tree species at 500 sq m plot). The additional measurements were done in April 2007 by scientific staff of the Agricultural University of Krakow (AUC) concentrate on defining for each tree the DBH, DBH, height, diameter at 5 m. In this poster only the results for 4 plots (2 deciduous and 2 coniferous stands are presented) for all the scanner positions (141 visible pines, 36 oaks and 22 beech trees) showed that the mean scan error of joining 4 point clouds from respective 4 positions of scanners, varied for the analyzed within the range: 2.8-4.9 mm - long mismatch and 2.1-6.3mm - orthogonal mismatch. Different filters was used to improve the point cloud computing (cleaning from ghost points, dark points, distance etc).

WORK FLOW

The tasks for the algorithm focused on:
- the definition of the neighbourhood of points;
- assignment of points to a concrete tree trunk;
- definition of the angle range for the trunks visible from subsequent scanner positions;
- recognition of tree trunks and definition of their sizes;
- definition of the visibility of trunks (overshadowing by other trees);
- drawing a probable outline of the trunk in the places without measurement points.

The first step for the Algorithm 1 was to define the number of points in the surroundings of the point for plane XY and XYZ. Points with only three or less neighbours were treated as auxiliary points. The algorithm of automatic definition of the assignment of points to the given trunk is realized by triangulation (TIN) between points and then by the elimination of triangles not fulfilling the initial prerequisites. As testing parameters the values of triangle’s angles and lengths of its sides were accepted. The border value for angles was defined on the level of 10°, while the border value for the length ranged from 0.04 m to 0.08 m.

RESULTS

The number of trees

Depending on the scanner position (S_1-S_4), the number of tree trunks on the reference plot, possible to be interpreted as full slices or their fragments, can be different. The percentage of trees visible for manual measurement in plot 19 ranges from 63.3% to maximal 90.0% from individual scanner positions.

Polar measurement

Compared to traditional forest inventory, a constant angular shifting was observed (about 4°) resulting from the Azimuth of the scanner detentials to measure azimuth from the centre of the plot to the tree, as well as the situation of a survey pole northwards at the moment of scanning. The error in marking the north and inaccurate reading can cause the change of the position of the tree trunk to about 0.80 -1.0 m, on the border of the reference plot (radius = 12.82 m).

Tree DBH

The carried out statistical analysis of the measurements for all the scanner positions (141 visible pines, 36 oaks and 22 beech trees) showed that manual pixel and pipe methods provide quite precise results. A very clear relationship (R² = 0.946) between DBH defined with the pixel method and Ref. AUC (calliper) is presented on diagram.