3D HABITAT MODELING IN CASE OF NATURA 2000 SITE

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Abstract

The examination was carried out with Leica ScanStation C10 terrestrial laser scanner in "Debrecen-hajdúböszörményi tölgyesek" (site code: HUHN20033) NATURA 2000 site. In case of the monitoring of Natura 2000 sites different field measure technique are used in Europe. The terrestrial laser scanning technique is a new innovation among remote sensing methods. The structure of trees and branches, the canopy extension, which can help to recognize some biophysical parameters, can be determined on the basis of 3D model. In this study the measuring principle, the parameters and the terrestrial laser scanner method are presented.

Key words: laser scanning, LIDAR, Natura 2000, 3D modeling, habitat

INTRODUCTION

Remote sensing (RS) is rapidly developing discipline. Remote sensing, also called earth observation, refers to obtaining information about objects or areas at the Earth's surface without being in direct physical contact with the object or area (Belényesi et al. 2008). According to Lóki (1996) the remote sensing means not only a special data collection, but processing and evaluation of these data also. Remote sensing provides to get information from large areas beside/instead of traditional sampling data (Burai, 2007).

The reflected radar signals are sensed by the detector. By measuring the amount of time it takes for the signals to return. Another type of remote sensing technique is laser scanning (LIDAR – LIght Detection And Ranging). The LIDAR are similar to RADAR systems, but in this case a laser light sweeps the object or the earth's surface (Belényesi et al. 2008). The laser scanner analyzes a real-world or object environment to collect data on its shape and possibly its appearance (e.g. color).

To the 3D modeling of a certain surface is necessary more scan stations sweep the object, so it could be get a point cloud, which is contain more million points. The instrument is put the scan stations in a common coordinate system, so it is create the spatial location of the target.

Airborne laser scanning has already been adopted and accepted as a very valuable tool in forestry applications shortly after its advent as a commercially available measurement technique in the 1990s. The using of terrestrial laser scanner (and mainly airborne laser scanning technology) has been even less spread in horticulture applications (*Vosselman and Hans-Gerd 2010*). Both in two areas (forestry and horticultural applications) with laser scanner technology it could be recognized the structure of trees, the canopy extension and else structural aspects, so it could be long term shadowing many biophysical processes and monitored the changes (*Rosell et al. 2009*). So it could be recognized photosynthesis, growth, CO_2-sequestration and evapotranspiration (*Li et al. 2002*; *Rosell et al. 2009*).

MATERIAL AND METHOD

The field measurements were carried out in "Debrecen-hajdúböszörményi tölgyesek" (site code: HUHN20033) NATURA 2000 site. "Debrecen-hajdúböszörményi tölgyesek" is covered by 5634.62 ha. Main habitat classes are Broad-leaved deciduous woodland and Artificial forest monoculture (e.g. Plantations of poplar or other trees). Main impacts in Debrecen-hajdúböszörményi tölgyesek are replanting, forestry clearance and hunting, which are high influenced.

On this site laser-scanning was carried out during the summer of 2011 to detect human influenced disturbances and impacts in oak woods. This new technology is used at first time, which is an advanced monitoring technology development. The ScanStation C10 by Leica Geosystems uses the time-of-flight (TOF) principle for ranging. A short laser pulse is emitted towards the object and is reflected on its surface; a part of the reflected radiation comes back to the scanner where it is detected by a sensor. The fast determination of objects is provided by a high scan rate of up to 50,000 points/sec. The emitted laser beam is 532 nm wavelength, so the color is green. The green laser light sweeps the objects; the deflection of laser beam is occurred by a Smart X-Mirror™ automatically spins polygon mirror system. Thus the scanner creates with high speed a point cloud. The maximum range of laser scanner is 300 m; it is depend on the albedo. The coherence of laser beam is high, but if increase the range – increase the beam divergence too – so the scanning error is more and more bigger. Because of the larger beam diameter is more probability that the laser beam hits an edge on the object, so the beam is split in two parts. The result of this mixed edge problem is inaccuracy of distance. This error is bigger in case of vegetation scanning, because the plants have less plain parts, like e.g. buildings. The beam divergence is 0.1 mrad; it means that the diameter of laser point is 10 mm on 100 m. This value is – in case of maximal measurement distance (on 300 m) – only 3 cm. The Field-of-View (horizontal 360° and vertical 270°) is arisen from the construction of instrument, since the laser scanner doesn't survey under itself in 90°. Near the laser emitter it could be found an auto-adjusting, high-resolution digital camera with zoom video. The integrated 4 megapixel (1920x1920 pixel) camera takes photos to color the point cloud. The Field-of-View of the camera is 17°, so the automatically spatially rectified (panoramic) dome was made form 260 images on each scan position.

The processing of raw point cloud was carried out by Leica Cyclone 7.1 and 3DReshaper software. The two softwares are appropriate for cleaning the point cloud form noises, and ideal for several engineering calculations.

RESULTS AND DISSCUSIONS

We were measures at 2 different sample site (reading point). The measure accuracy was 5 mm in 10 m, so the damages on the surface of the oak trees can be detected.

The colors of point cloud indicated different intensity values. After cleaning the point cloud, a tree was chosen for the examination. The software could be fitted an object depending on the topology of the scanned point clouds. We have modeled the stem of investigated tree, and Cyclone fitted the best shape which was a cylinder. Then we were able to determine some characteristics of this cylinder, such as (stem) diameter, height, surface and volume calculation too.

We have built the oak trees and undergrowth in 3DReshaper (*Figure 1.*).

Fig. 1 The building of the oak trees trunk from the point cloud

The point cloud from the trees and branches weren't full, but the 3DReshaper fitted a sphere, based on the curvature of point cloud (*Figure 2.*).

Fig. 2 The built oak trees

On the Figure 2, it can be seen the density of the tree crown and the undergrowth, so the nature conservation scientists could evaluate the necessity of the cutting out or planting.

In the future we would like to identify the different habitat type with the help of the full 3D structure and the growing mechanisms of trees. The parameters of habitat (e.g. stock density, conditions of trees, undergrowth) could help to work out forestry and nature conservation tasks.

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