Reed Qualification Based on Airborne Laser Scanning

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1. Introduction

Reeds are very precious habitat areas, which can be found extensively in and around the Lake Fertő / Neusiedler. This area is the second largest continuous reed area in Europe. All the extensive reed area should be qualified in every 5 years, according to the Government Decree (No. 22/1998. (II.13.)). This decree also determines the applicable classes, and the necessity of a detailed map. Generally colour infrared orthophotos have been used with visual interpretation and detailed field surveys for this map. Visual interpretation is rather a subjective method, so supporting this qualification with some objective reed parameters are needed. Airborne Laser Scanning can play an important raw here.

2. Materials

2.1 Study Area

The Lake Fertő / Neusiedler is the most western situated saline lake in Europe. Its area is 310 km^2, which is shared amongst Austria and Hungary with the rate of 3:1, but the average water depth is half meter approximately, but never extends to two metres. The lake, and especially its Hungarian part has a very extensive reed area (50% and 85%). The Hungarian part of the lake (75.2 km^2) and its very extensive reed area (62.9 km^2) was in the focus of the current research.

2.2 Airborne Laser Scanning

The Airborne Laser Scanning (ALS) of the area was planned and executed in the frame of a Cross-border Cooperation Programme Austria - Hungary 2007-2013 called GENESEE. The approximately 92.6 km^2 large area over the lake was planned with minimum 4 pulses/m^2, and relative high, 70% overlaps between the stripes (see Figure 1).

The survey finally was executed on the 6th of December, 2011, applying a Riegl 560i full waveform sensor.

2.3 Reference data

The reed was qualified last time (according to the previously mentioned Decree) in 2007, based on a digital metric (UltraCamD) aerial survey with 30 cm GSD (Király and Márkus 2011).

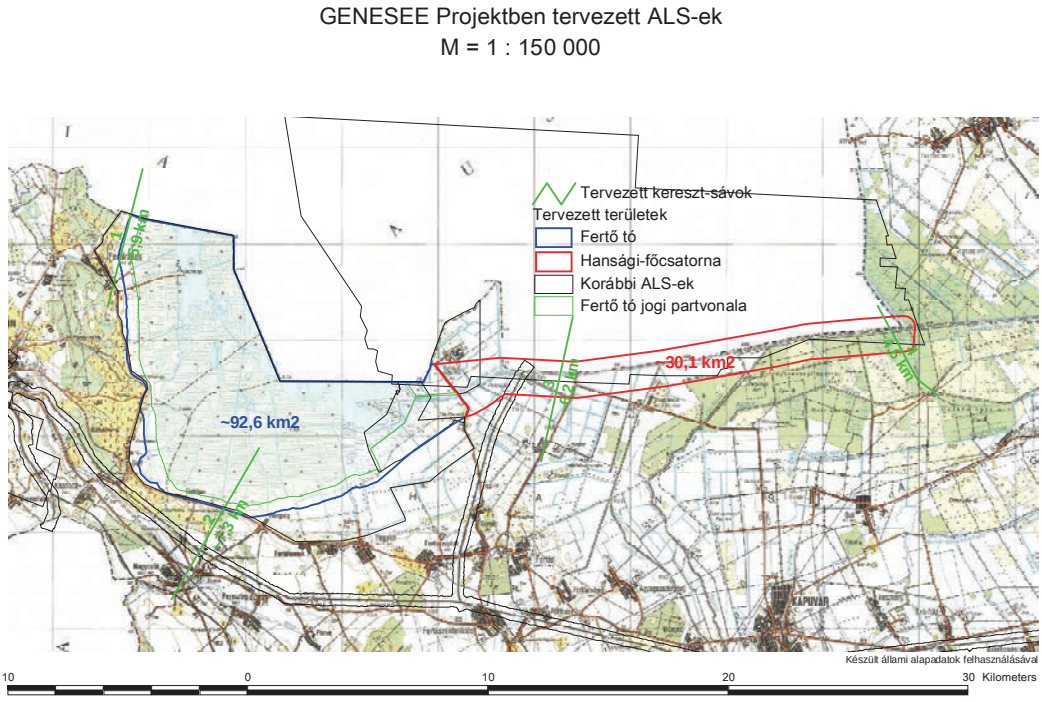

Figure 1: The planned area for the ALS surveys

3. Methods

3.1 Pre-processing

The provided dataset was pre-processed first, calculating the trajectories and point densities, filtering the outliers. The relative and absolute orientations of the strips were also checked using the advance technique in OPALS package (Mandlburger et al 2009).

3.2 Creating the models

The Digital Surface Model (DSM) was created first using a moving plane and also a moving parabola interpolations (Király et. al., 2012).

The creation of the Digital Terrain Model (DTM) was a real challenge in this very flat areas dominated by reed and water. An adaptive filtering technique has been applied finally to have a sufficiently detailed but also reliable subset of points from which the hierarchic robust filtering were applied (Kraus and Pfeifer, 2001).

The normalised Digital Surface Model (nDSM) has been created by subtracting the above two models (DSM-DTM), which is suitable for direct reed-height calculations.

3.3 Deriving reed parameters

The delineation of the reed and water-covered areas was a very crucial point during the data-processing. The vertical distributions of the points as well as the echo-ratio (Höfle et al, 2009) have been calculated for this separation. Additional reed parameters, such as density and stem diameters have been calculated directly from the raw point cloud.

4. Results

The delineation of the reed areas from water-covered areas was most accurate using the echo-ratio layer, with (at least theoretically) exact. The reed density showed a good correlation with the reed-classes, with a R^2=0.73. The stem diameter – which is not directly correlated with a certain reed-class – gave medium correlation with R^2=0.57. However both parameters showed much more spatial variablilities than the reference map.

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