MAPPING THE RISK OF FOREST WIND DAMAGE USING AIRBORNE SCANNING LiDAR

Authors:
Ninni Saarinen
Mikko Vastaranta
Markus Holopainen
Department of Forest Sciences,
first.last@helsinki.fi
Eija Honkavaara
Paula Litkey
Juha Hyypä
Department of Remote Sensing and
Photogrammetry, Finnish Geospatial
Research Institute, (eija.honkavaara,
paula.litkey)nls.fi,
juha.coelars@gmail.com
Michael A. Wulder
Joanne C. White
Canadian Forest Service, Pacific Forestry
Centre, first.last@nrcan-rncan.gc.ca

BACKGROUND

- Wind was the most significant abiotic factor causing losses in forest yield in Finland in 2012
- Accurate and detailed information is needed from susceptible areas
 - Forest owners and managers, electricity companies

OBJECTIVE

- To **understand** and quantify drivers of wind damage
- To **test** the feasibility of open-access LiDAR data from the National Land Survey of Finland (NLS) in mapping the probability of wind damage

STUDY AREA

- Covered approximately 173 km² of mainly managed boreal forests
 - Dominated by Norway spruce and Scots pine
- Relatively flat terrain (50-111 m above sea level)
- Was subjected to heavy **winter storm** on 26th of December 2011

Figure 1. Study area.

MATERIALS AND METHODS

- **LiDAR data** were used as before-storm information
- High resolution **aerial imagery** acquired after the damage were used for providing the reference data

Figure 2. Work flow of the study.

- Possible predictor variables for risk model were extracted from the LiDAR-derived **surface models**
 - Digital Terrain Model (DTM)
 - Canopy Height Model (CHM)
 - Variables describing forest structure
- Multivariate **logistic regression model** was used to examine potential drivers associated with probability of wind-induced forest damage
- Accuracy was evaluated by comparing the predicted damage probability to the visual interpretation of aerial images

RESULTS AND DISCUSSION

- **Selected predictor variables** were
 - Mean elevation
 - Mean height of a sample cell when a buffer area of eight grid cells was included
 - Gave better results than mean height of a sample cell alone
- Prediction accuracy of 73 % (with Kappa value of 0,47) was obtained
- The selected logistic regression model was used to estimate the wind damage probability for the entire study area

Figure 3. Risk map.

ACKNOWLEDGEMENTS

The authors are grateful to Blom Kartta Oy for their support in providing the image materials and to the National Land Survey of Finland for the laser scanning data. This study was made possible by financial aid from Finnish Academy in the form of the Centre of Excellence in Laser Scanning Research (272195) and Ministry of Agriculture and Forestry (LuhaGoeIT, 350/311/2012).