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Efficacy of estimating forest wind damage risk from airborne laser scanning data

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Wind is the most prominent abiotic damage element for Finnish forests. Moreover, there is evidence that the amount of wind damage is increasing over much of continental Europe. Hence, effective tools are required to estimate current spatial patterns of wind risk over large forested areas and possible changes in risk patterns for planned silvicultural operations. We present a method for generating maps of forest risk to wind damage by using ALS data along with a modified version of the HWIND model (Heinonen et al 2009). ALS-derived stand height, stand geometry and intra-stand gap data (e.g., caused by clearcuts) was provided to the wind damage model, along with the prevalent wind direction. The output was spatially explicit critical wind speeds needed to uproot trees, for various (gridded) points in the forest stands. Further, a wind multiplier field generated from high resolution digital elevation data and forest stand data was used to better identify points where this critical wind speed could be exceeded (for example, due to local topographic effects). We tested the efficacy of our approach using more than 70 field points from the field where various wind-damaged trees was recorded. We used an appropriate model tailored to the 'presence-only' dataset for this particular analysis. Our work highlights the importance of considering wind damage risk effects for spatial optimization of forest operations planning.