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Creating high-resolution forest wind damage risk maps to support disturbance-aware forest management decisions

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Wind damage in Northern European forests is increasing with the changing climate. As the period of winter soil frost shortens, trees are left exposed to strong winds without the anchorage provided by frozen soils. Changes in wind climate are also expected. Forest wind damage causes substantial economic losses and affects the ecosystem services provided by forests. Wind-thrown trees also harm infrastructure by damaging power lines and blocking roads. Consideration of wind damage in forest management may help to reduce the negative consequences of wind disturbances. However, an effective mitigation of the damage risk requires detailed and accurate information about the susceptibility of forests to wind damage.

Our aim is to create a high-resolution map describing the spatial variation in the probability of wind damage in forests. To achieve this, stand-level wind damage information from the Finnish National Forest Inventory was used to build a statistical model of wind damage probability. The probability of damage was modeled using generalized linear mixed models (GLMM) with stand characteristics, the properties of neighboring stands, soil type, local wind conditions and the soil frost period length as predictors. After this, spatial data sets to be used as inputs in the wind damage model were compiled from different sources, containing data about forest resources, soil properties, wind exposure and soil frost. The final results provides an estimation of wind damage probability for forested areas in Finland in a 16 m x 16 m resolution grid, and it will be validated using external forest wind damage data. The resulting map product will be provided openly for forest owners and other stakeholders, thus supporting the consideration of wind damage risk in decision making.