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Mapping the probability of wind and snow disturbances in forests

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The uncertainty about future changes in forest disturbance regimes has highlighted the need to consider disturbances in forest management. In order to effectively reduce the vulnerability of forests to disturbances, detailed information about the risks is needed to support management decisions.

Here, our aim is to provide such information by creating high-resolution maps of forest wind and snow damage probability for Finland. First, damage probability models separately for wind and snow were developed based on damage observations in the Finnish national forest inventory (NFI). Three different statistical and machine learning methods were used and compared for the damage probability models – generalized linear models (GLM), generalized additive models (GAM) and boosted regression trees (BRT). Then, the damage probability maps were created in 16 m x 16 m grid resolution by combining the damage models with national coverage spatial data about the model predictors (forest properties, management history, soil properties and climatic conditions) compiled from different sources. Finally, we test the predictive performance of the maps with a large test data from new NFI damage observations not included in model fitting, demonstrating the ability of the maps to identify forests vulnerable to wind and snow disturbances.

The maps provide a tool for identifying the vulnerable forest areas and communicating disturbance risks to forest owners and managers. Therefore, they have potential to steer forest management practices to a more disturbance-aware direction by providing easily available high-resolution information about damage probabilities to support management decisions.