

Mapping the probability of wind disturbances in forests – an empirical modelling approach

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Digital Tools for Forestry

Alnarp, 6.2.2019



FINLANDS SKOGSSTIFTELSE

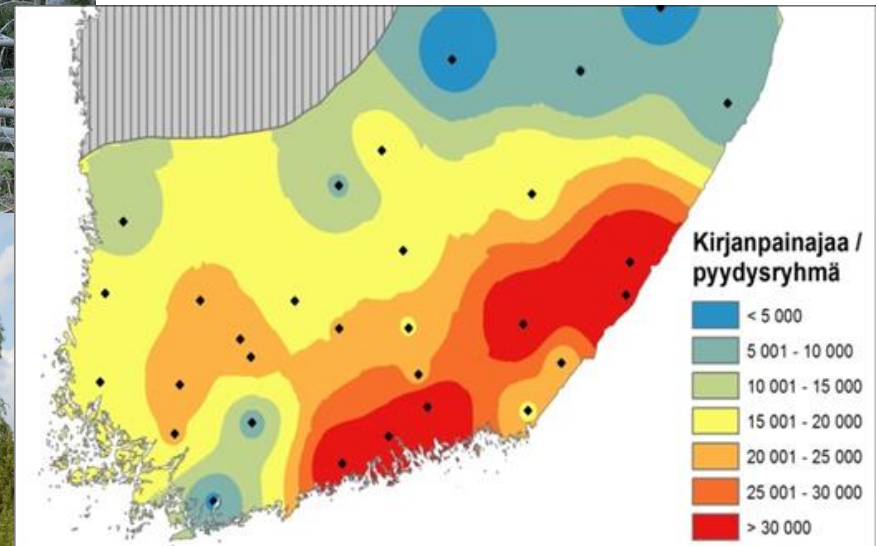


NATURAL RESOURCES
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Thunder storms in 2010 in Eastern and Central Finland – damage: 8.1 million m³



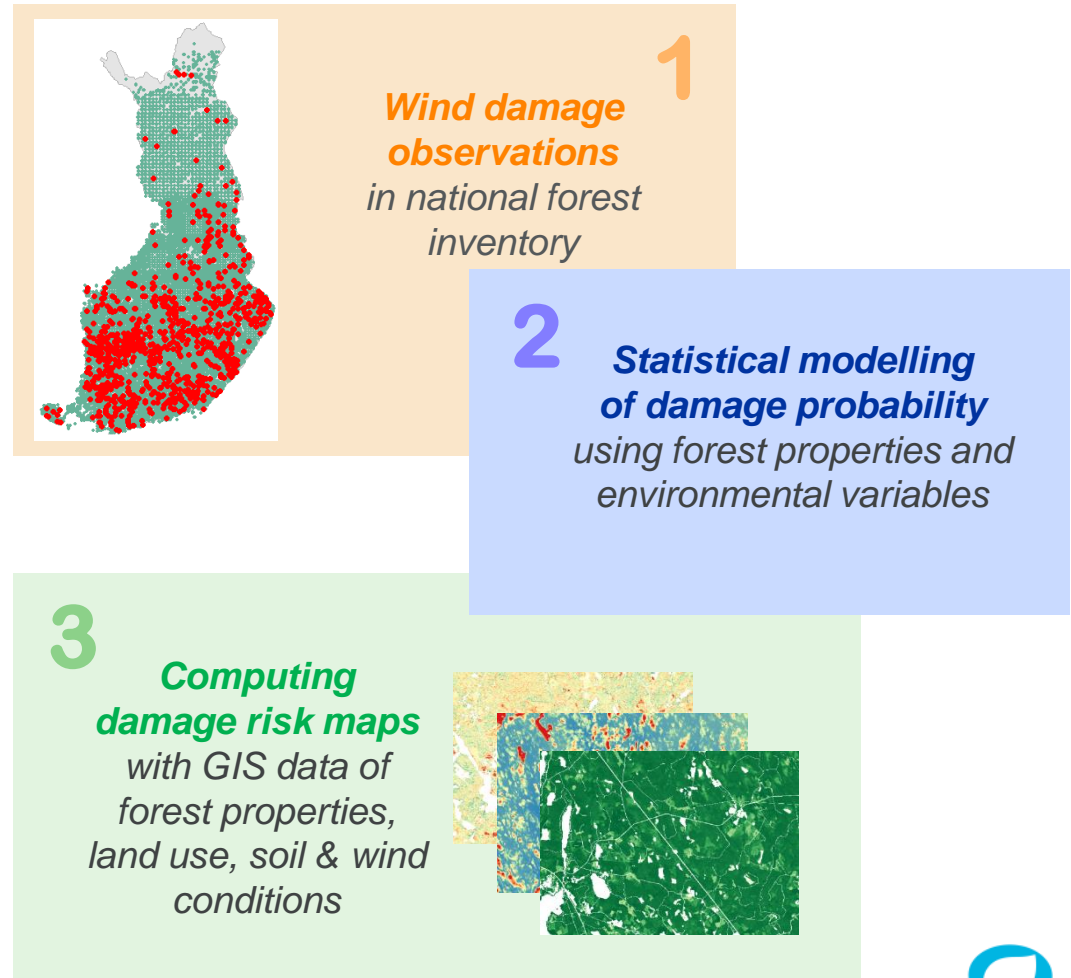
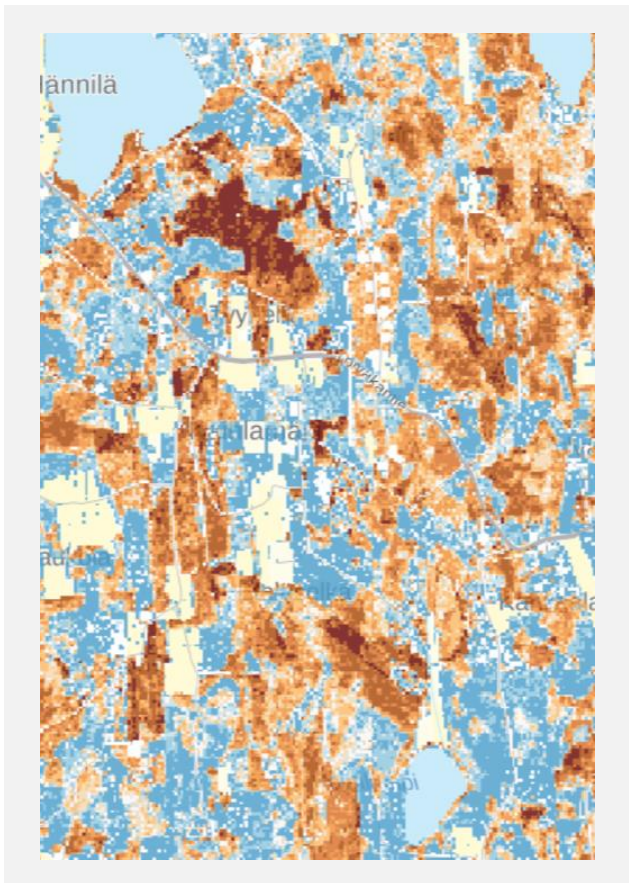
Spruce bark beetle 2013



(Heli Viiri / Luke)

Photos: Erkki Oksanen / Luke
Susanne Suvanto

Project StromTree: Creating national high-resolution forest wind damage risk maps





Metsainfo.luke.fi

Aluevalinta

Valitse ▾

Tasot

Riskitasot

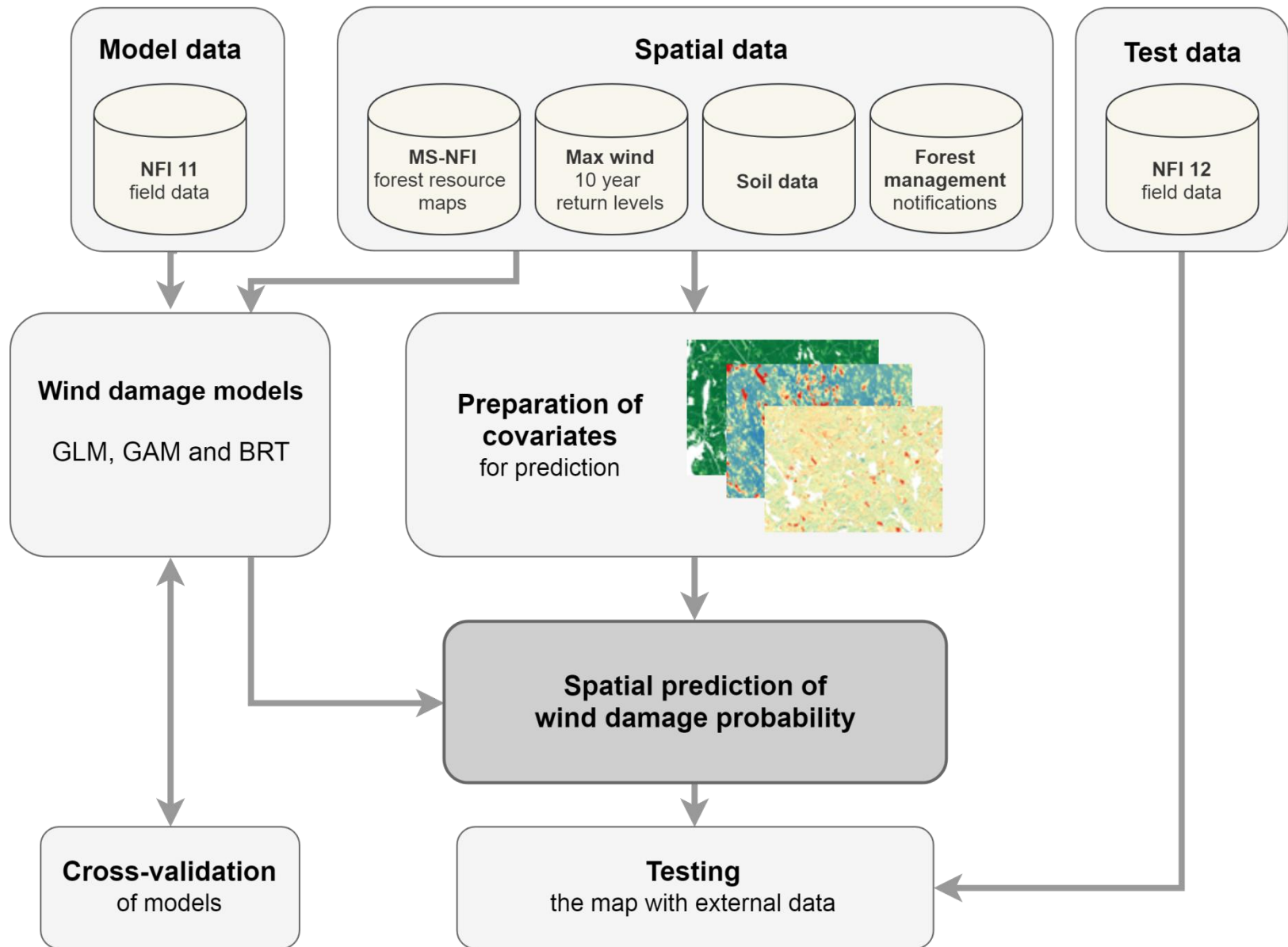
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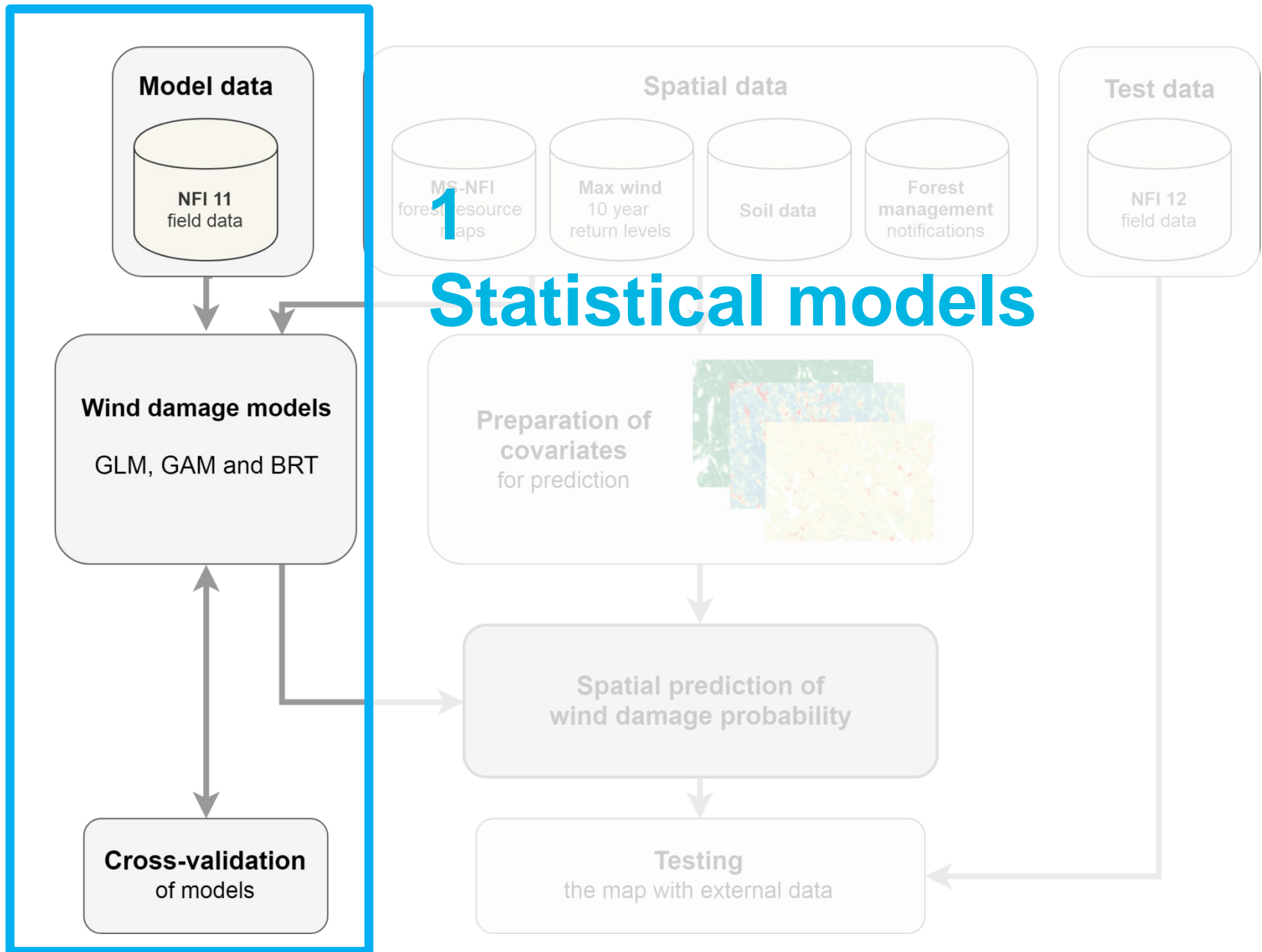
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Taustakartat © MML



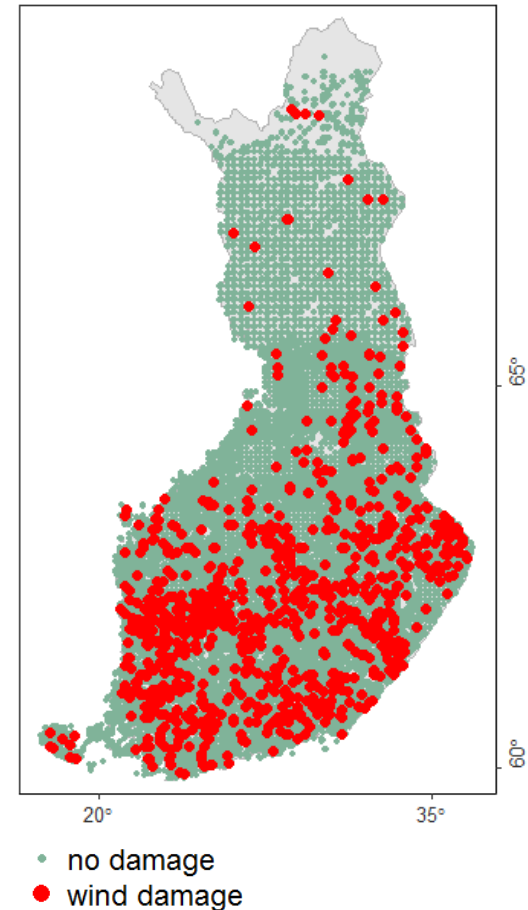


Wind damage observations in the Finnish National Forest Inventory (NFI)

Field data for the 11th National Forest Inventory (NFI) was collected from 2009 to 2013

In this study we use

- 41 397** NFI plots on forest areas, where
 - **1 070** plots had wind damage in the forest stand (within previous 5 years)
 - ~ **2.6%** of plots with wind damage



Statistical modelling & machine learning approaches

Generalized linear mixed models (GLM)

- Fully parametric models (logistic regression model)

Generalized linear additive models (GAM)

- Accounting for non-linearity with non-parametric smoothing splines

Boosted regression trees (BRT)

- Ensembles of regression trees

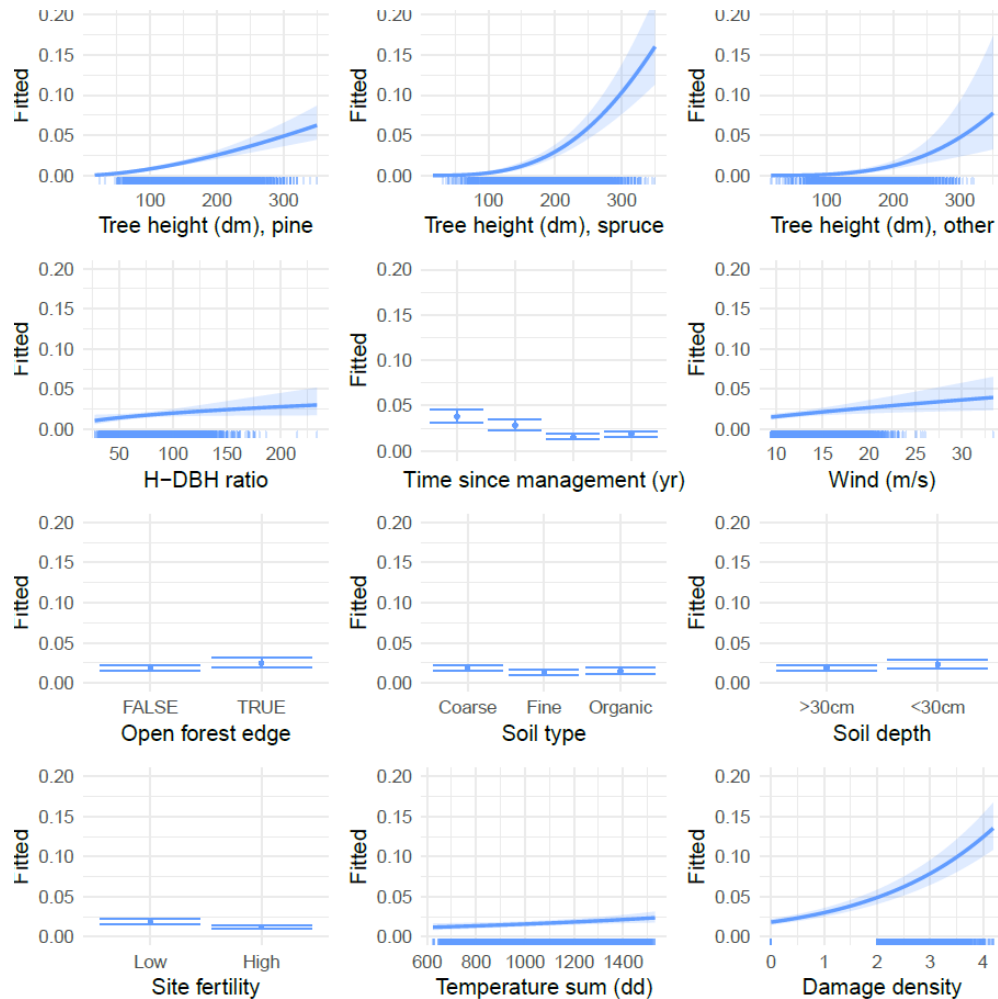


Increasing

- flexibility
- ability to account for non-linearity
- risk of overfitting

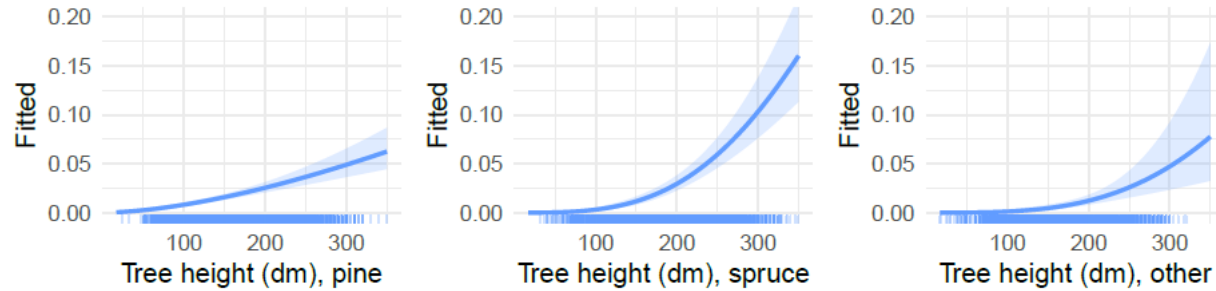
Responses of damage probability to model predictors

GLM

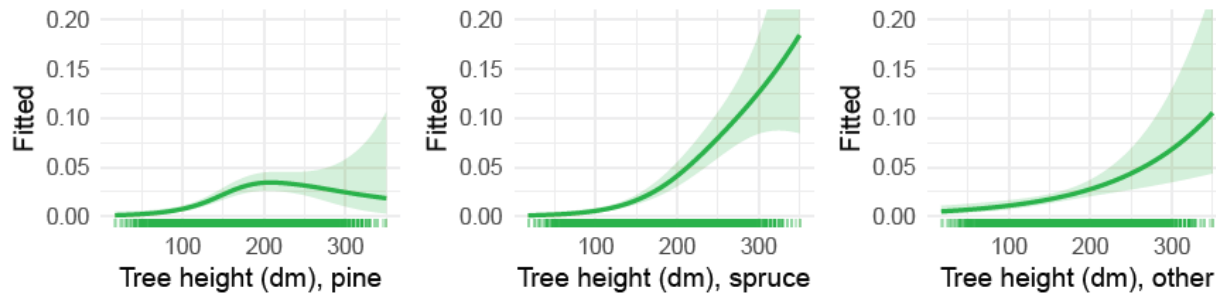


Responses – comparison of methods

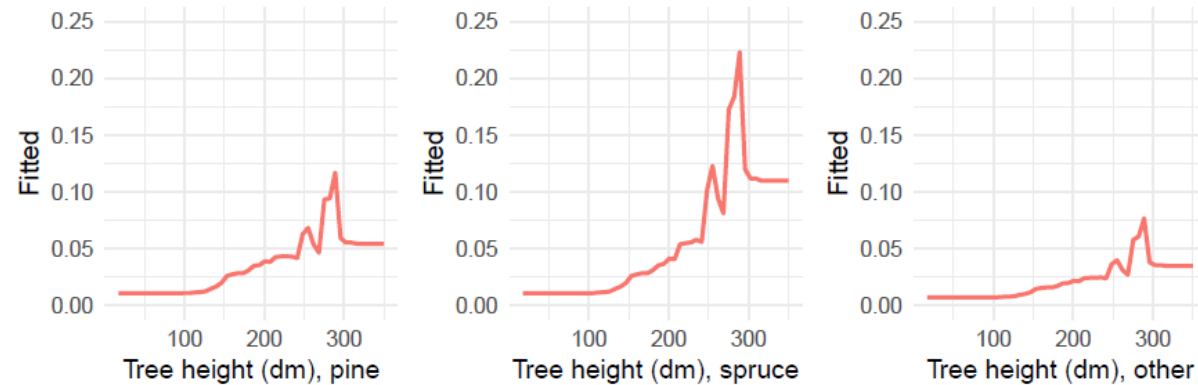
GLM



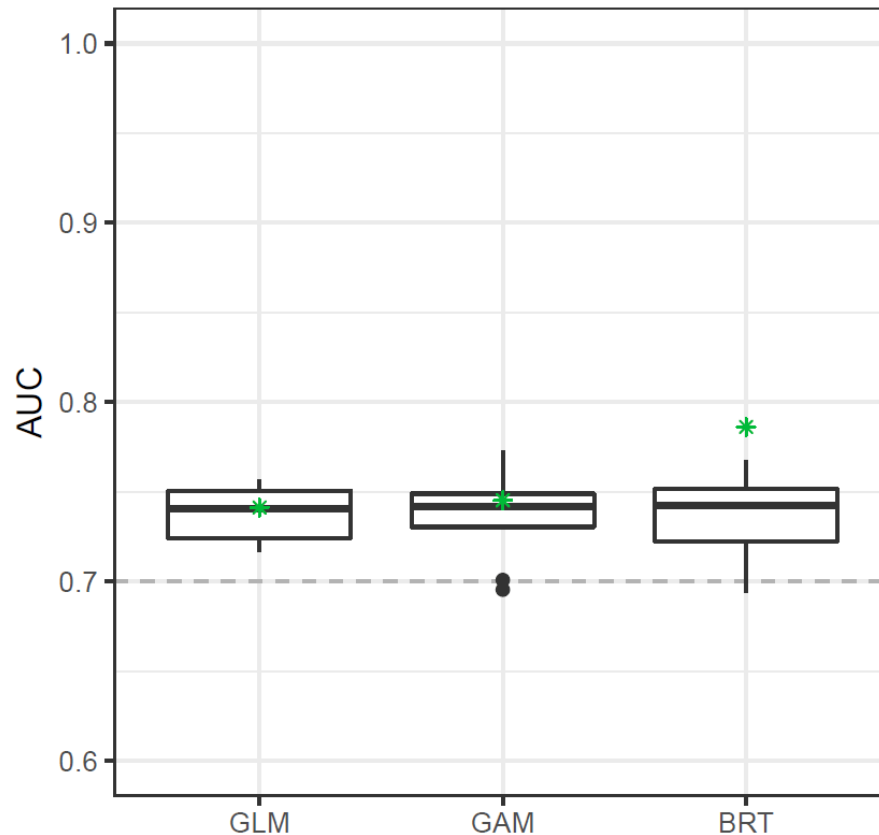
GAM



BRT



Cross-validation results

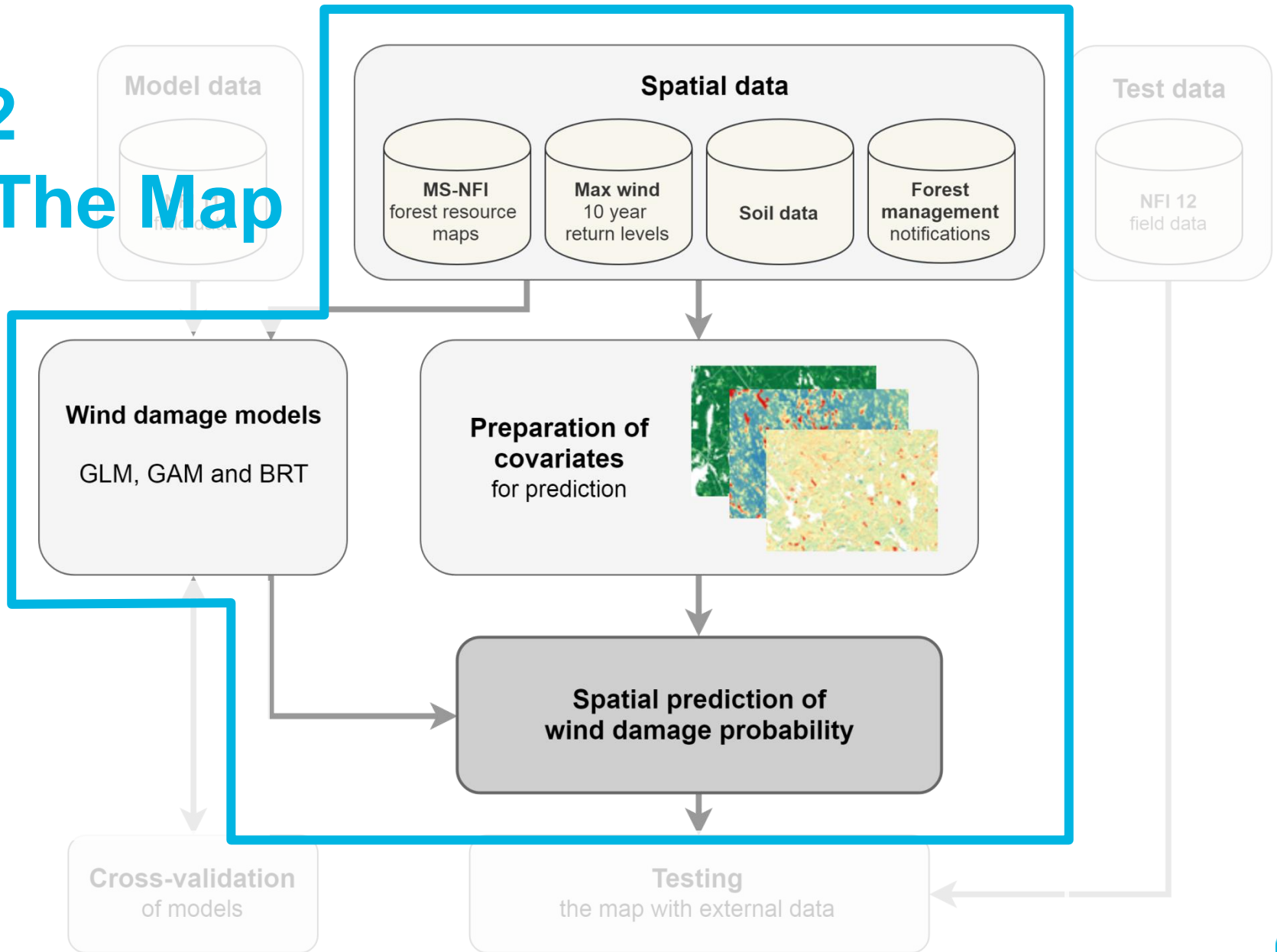


10-fold cross-validation

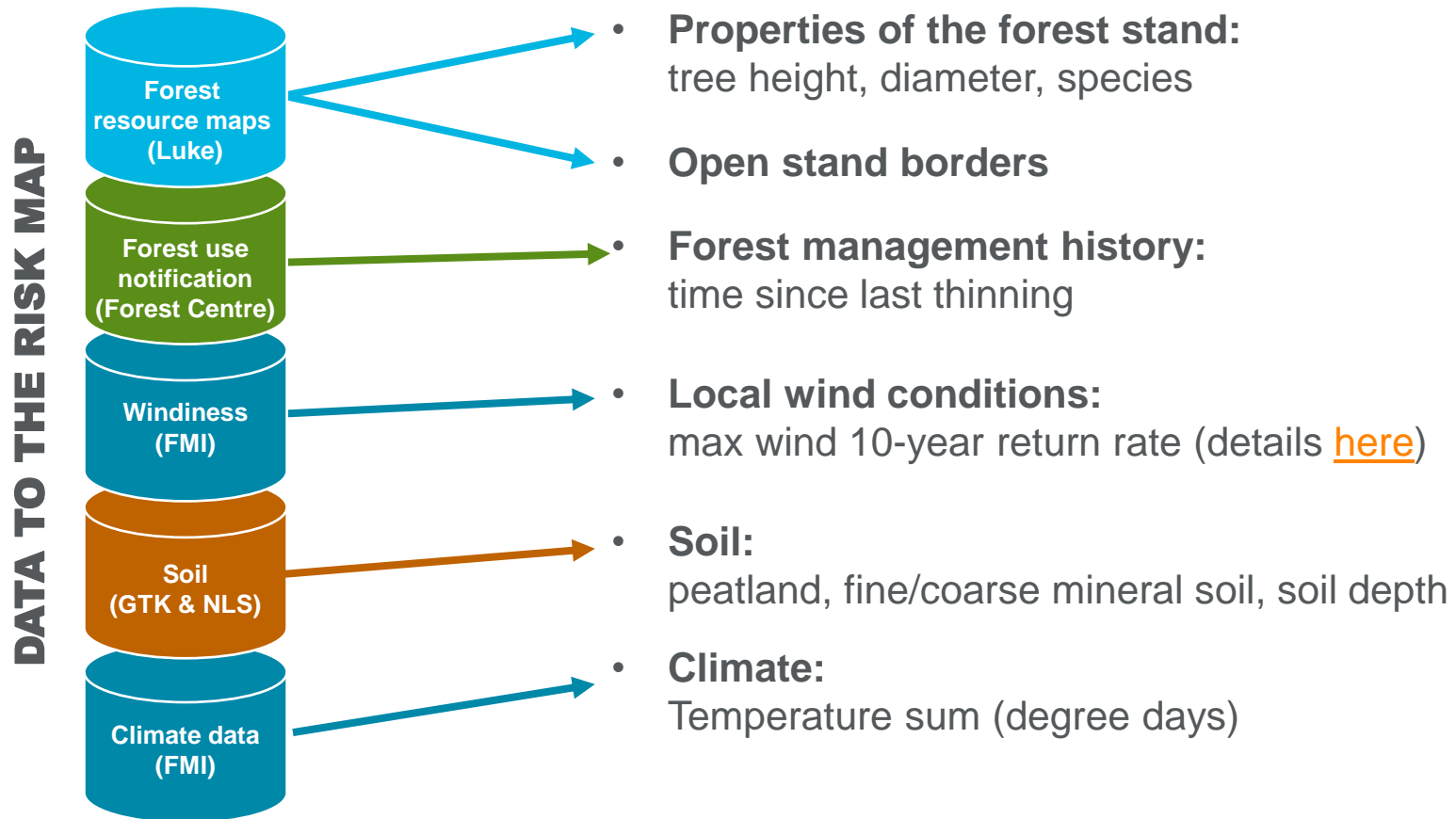
** AUC when full data used for both training and testing*

→ **GLM model chosen for the map**

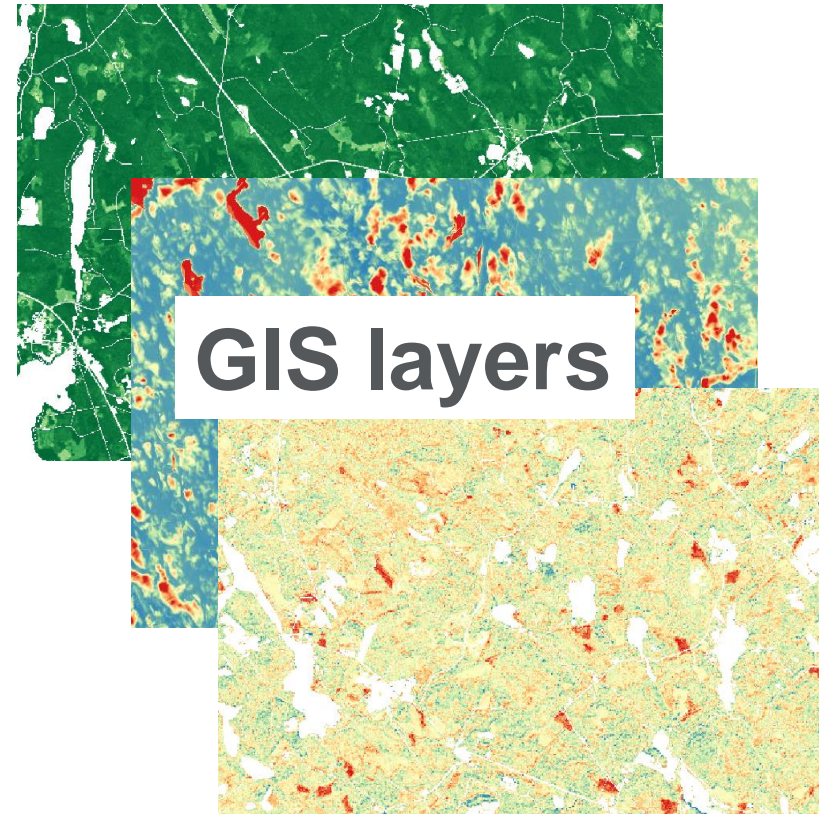
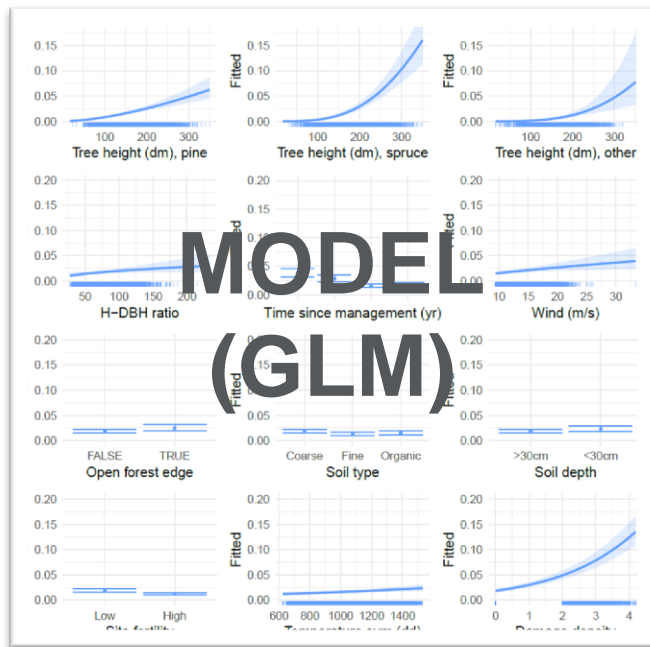
2 The Map



GIS data for model predictors



Spatial predictions of damage probability

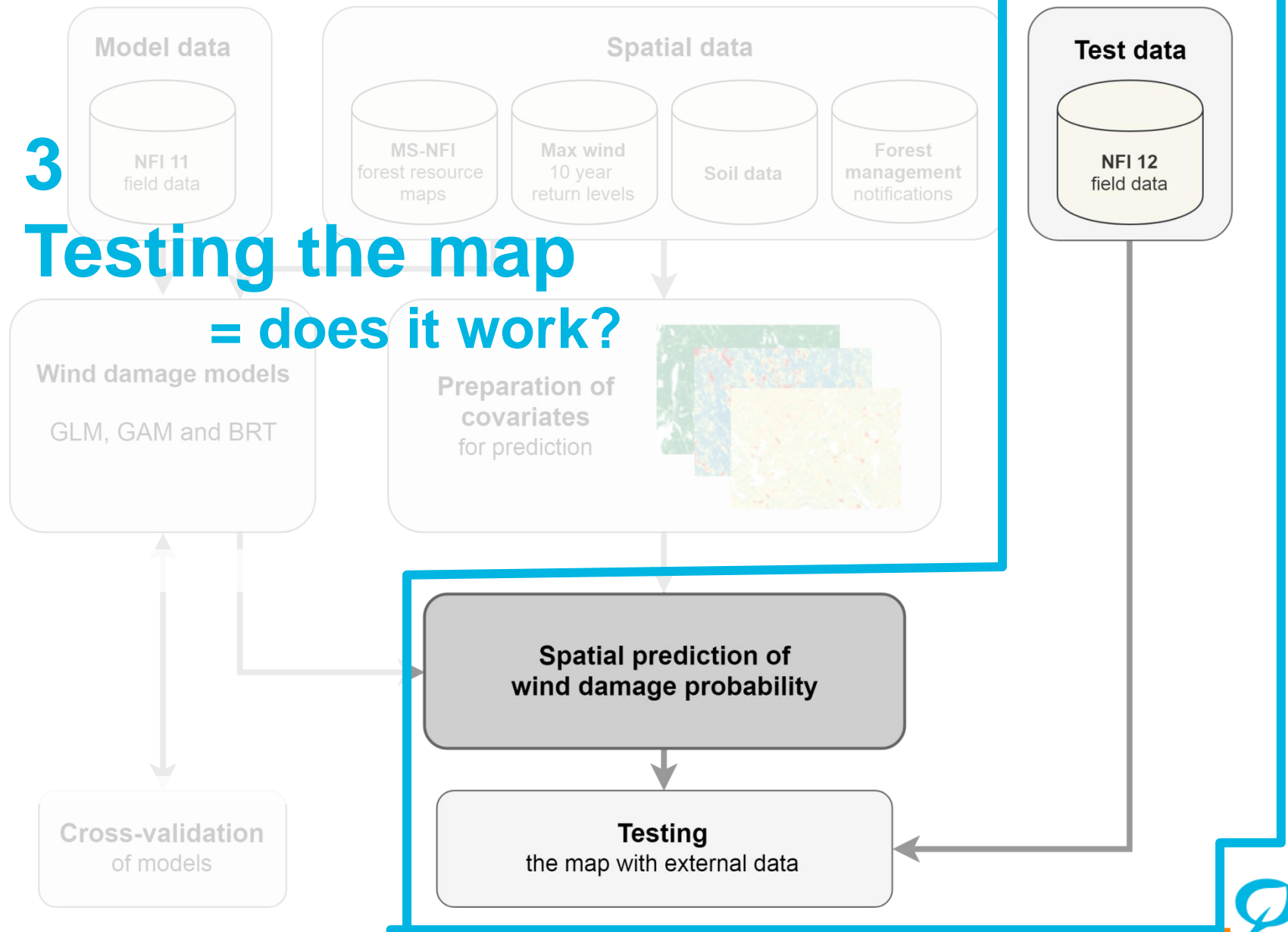


WIND DAMAGE PROBABILITY MAP

3

Testing the map

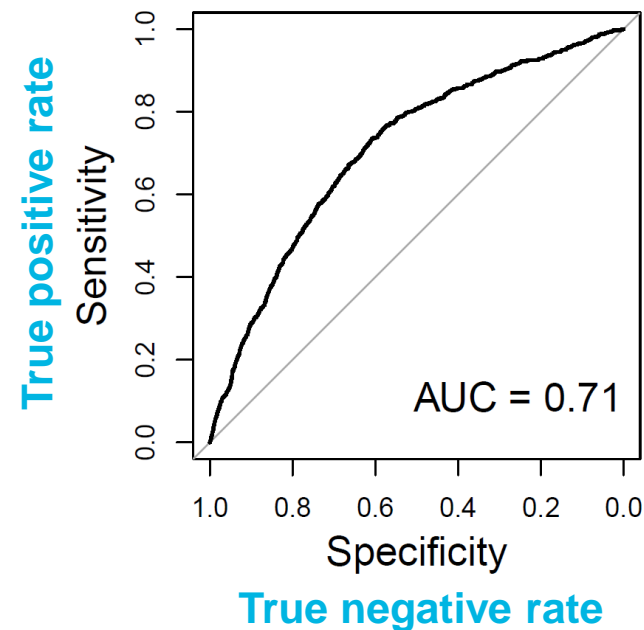
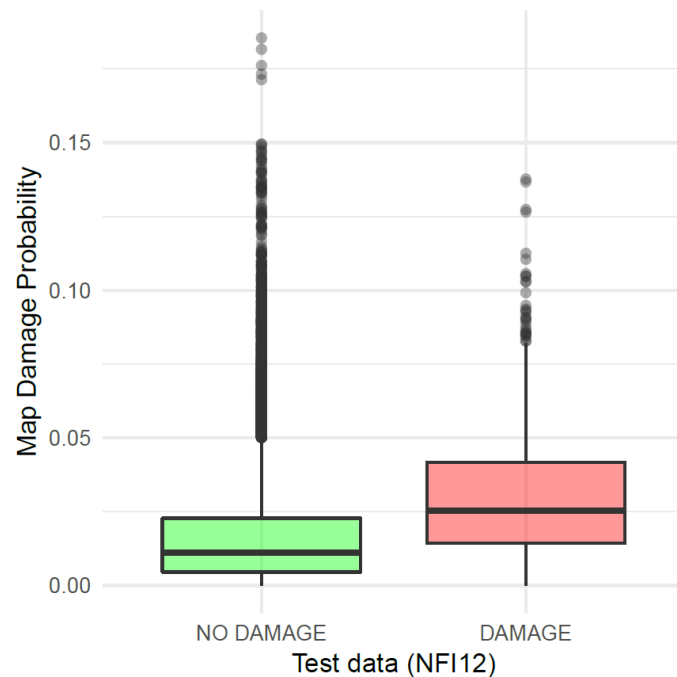
= does it work?



Testing with new NFI data

Comparing the map predictions to NFI12 damage observations

- with wind damage
- without wind damage



Wind damage probability map for Finland

- Shows the wind sensitivity of forests in fine spatial resolution
- Release as:
 1. Easy to use web-map application
(out now & developing)
<https://metsainfo.luke.fi/en/tuulituhoriskikartta>
 2. GIS data set *(out later)*
- Methods & results will also be published in a scientific paper

Thank you!



#MyrskyPuu
#StormTree



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