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Netherlands Organisation for Scientific Research

Department of physical geography &
Copernicus Institute of sustainable development

Mapping canopy nitrogen in European forests using remote sensing and environmental variables

Yasmina Loozen

Universiteit Utrecht

Why canopy nitrogen?

- N is an essential nutrient for plant growth
    - Photosynthetic capacity, leaf life span, NPP
    - state variable in vegetation models
- Laboratory measurements of foliar N concentration
    - Time intensive
    - expensive

Remote sensing

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Objective

- What is the spatial pattern of canopy N over European forests?
- Can we predict canopy in European forests using remote sensing variables?
- Can environmental variables improve the prediction?

We developed 2 prediction models:

- remote sensing and environmental variables
- Only remote sensing

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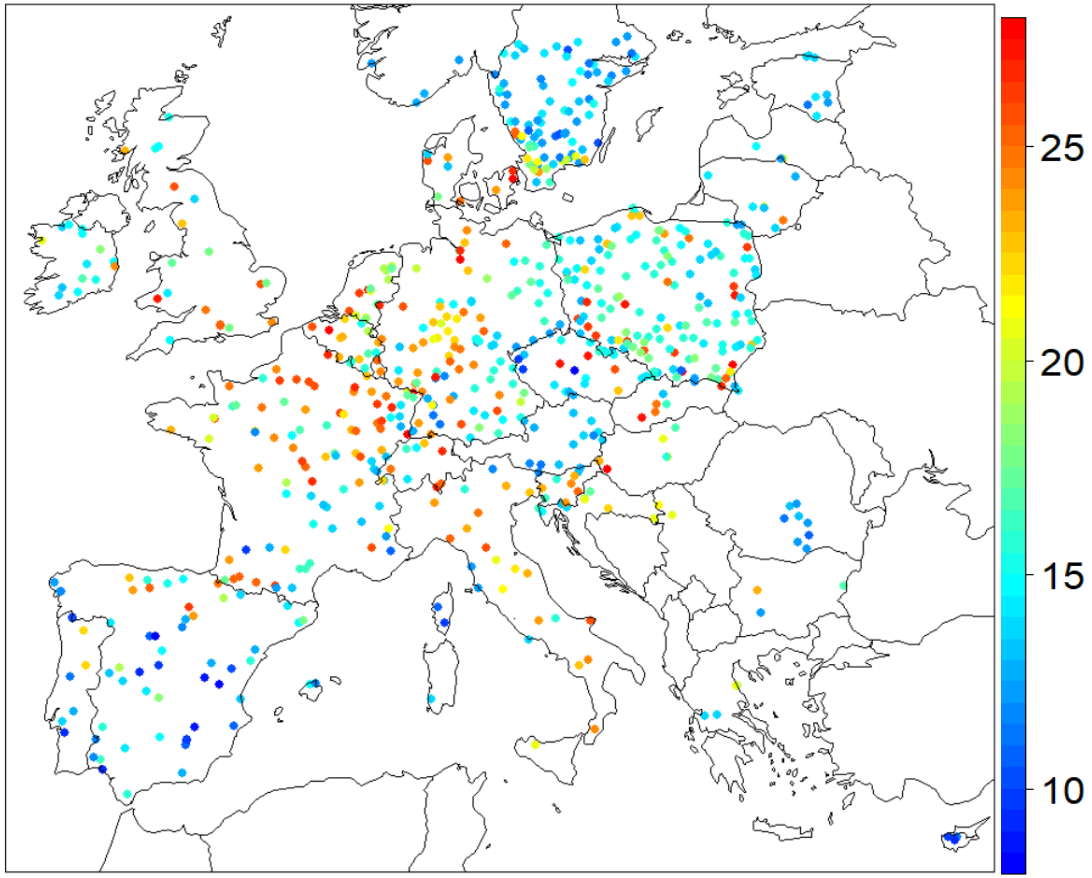
Canopy N plot data (mg/g)



- ICP Forest level II
- n = 834 plots

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Remote sensing variables

- NDVI, EVI and NIR reflectance (MOD13Q1)
- MTCI (MERIS level 3 product)

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Environmental variables

- Bioclimatic variables (Worldclim2)
- soil properties (Soilgrids)
- N deposition (ACCMIP)
- EU-DEM elevation (European Environment Agency)

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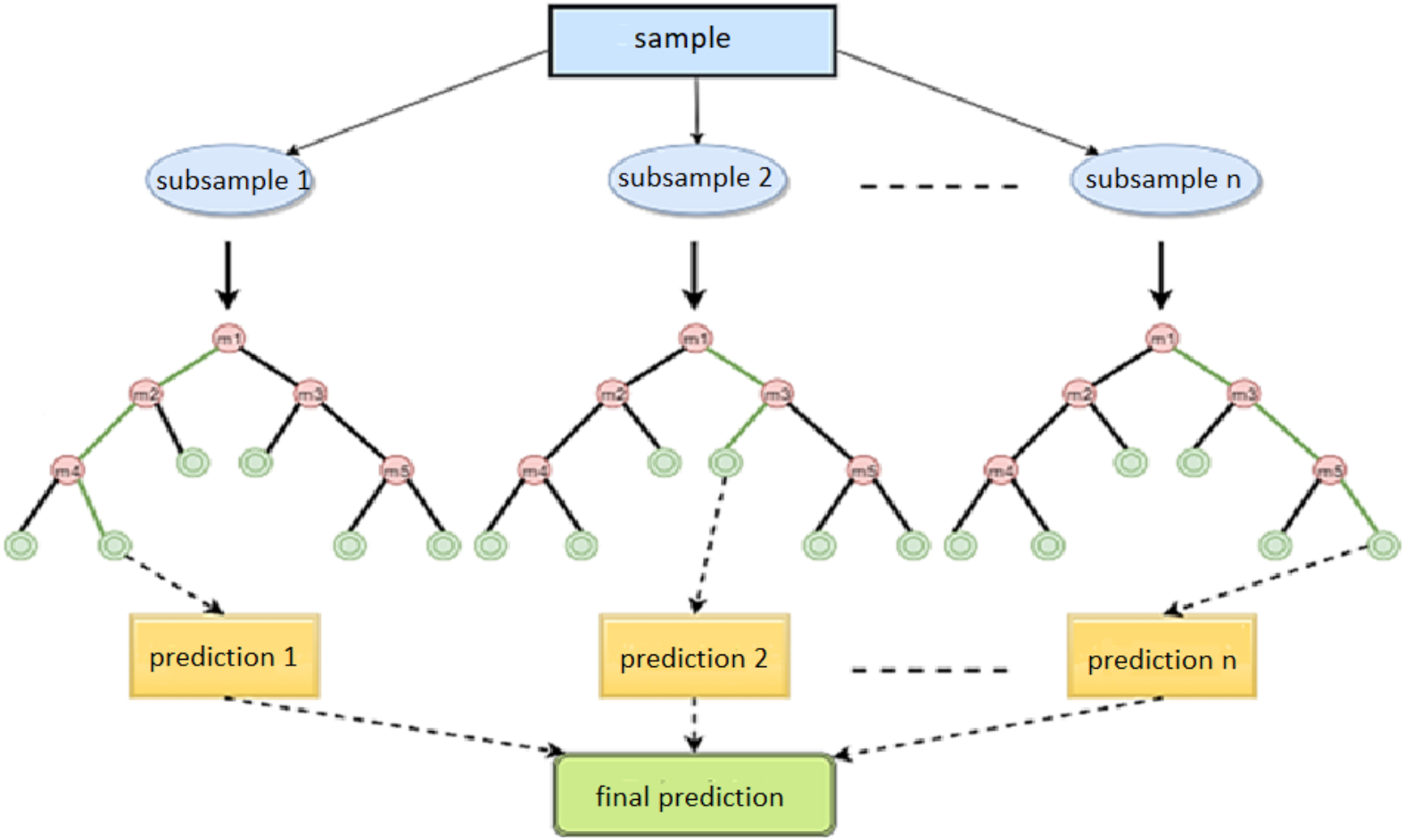
Random forest analysis



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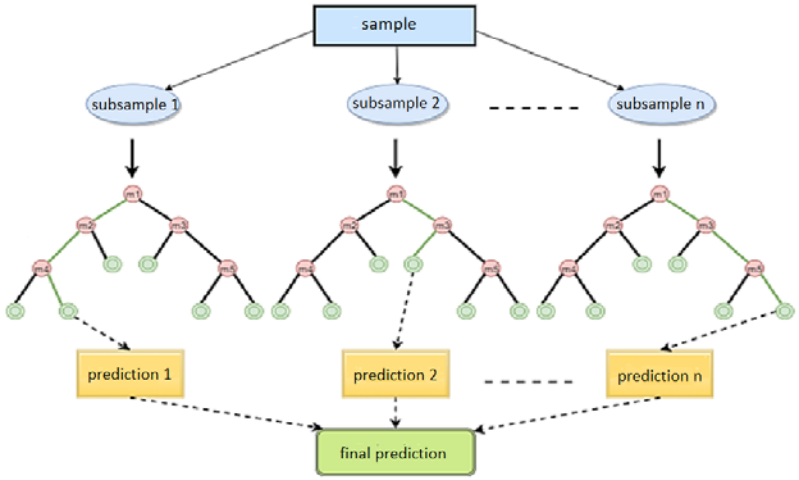
Random forest analysis

1) Covariates selection using recursive backward selection

2) 10-fold cross validation



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Results

Model	Nb of plots	Nb of covariates selected	Rsquare OOB	Rsquare CV	RMSE CV
All covariates	834	11	0.61	0.55	3.54
Remote sensing only	834	11	0.57	0.51	3.69

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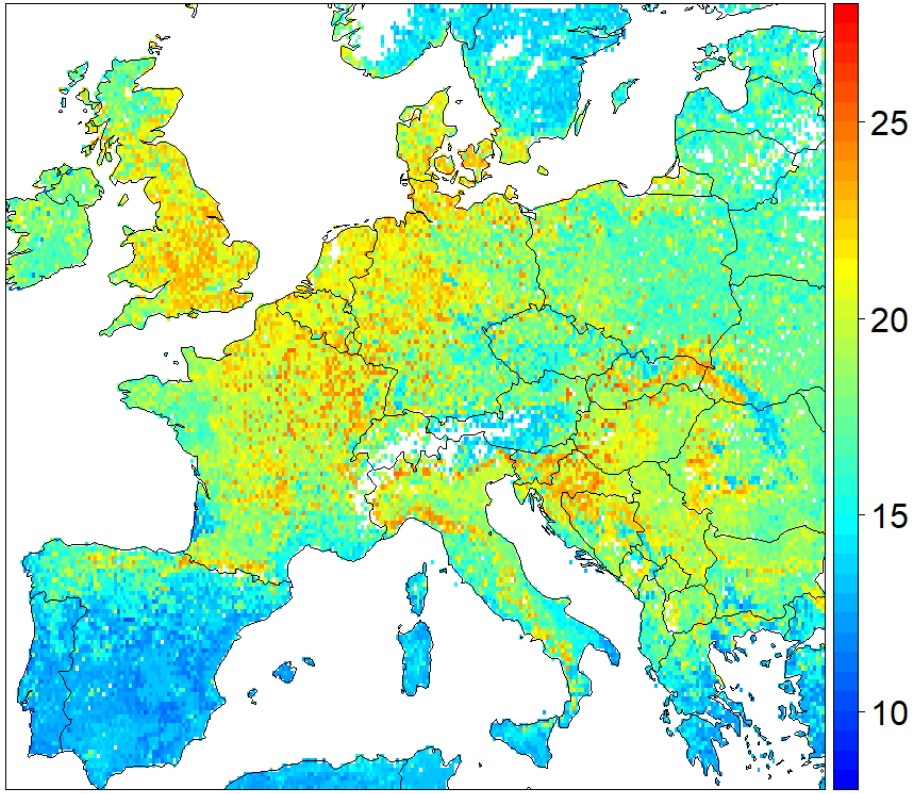
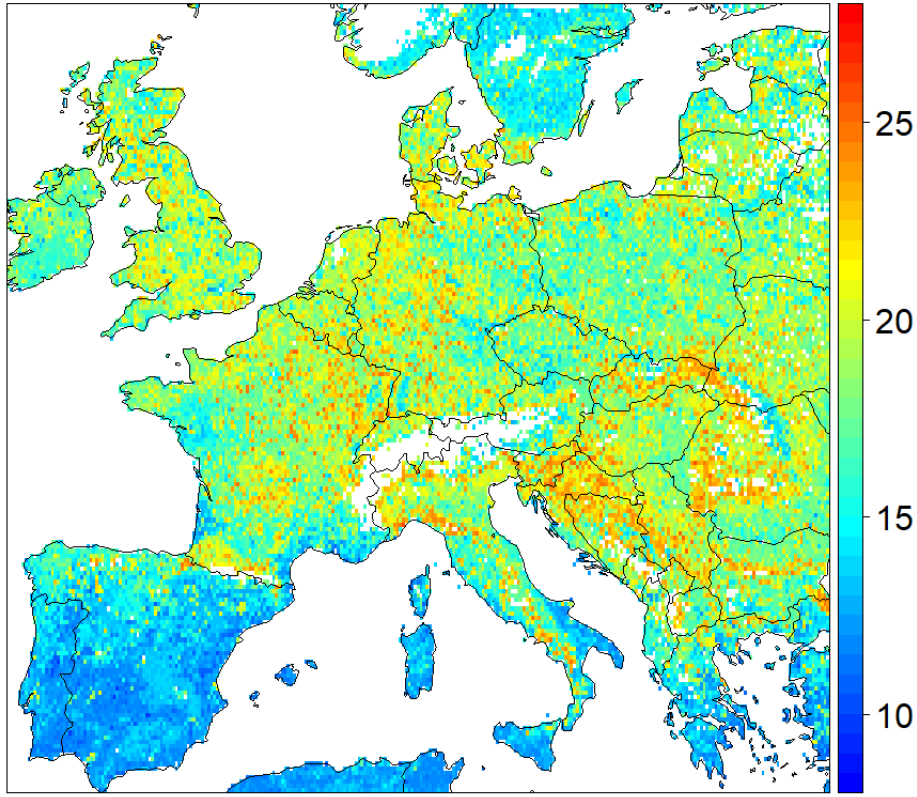
European canopy N map (mg/g)

all covariates model



remote sensing covariates only model



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Conclusions & implications

- Canopy N map predicted using both environmental and RS covariates

→ small gain in accuracy

- Canopy N map can be used in modelling studies

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Thank you for listening!

Feel free to ask any questions!

Yasmina Loozen

https://orcid.org/0000-0002-9896-2704