Designing a prototype of a European Forest Monitoring System

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Goals of a European Forest Monitoring System (EFMS)

- Reliable annual estimates of forest attributes, e.g. C-stocks & changes
- Timely information
  - Pan-European level
  - Regions level, e.g. Mediterranean, the Alps, the Nordics, the European Union
- High-resolution maps of forest attributes –
  enhance estimation accuracy, detect hotspots of change quickly
- Primary purpose: inform transnational-level policymaking
- Other uses: support local decision making, research,
  enhance business opportunities

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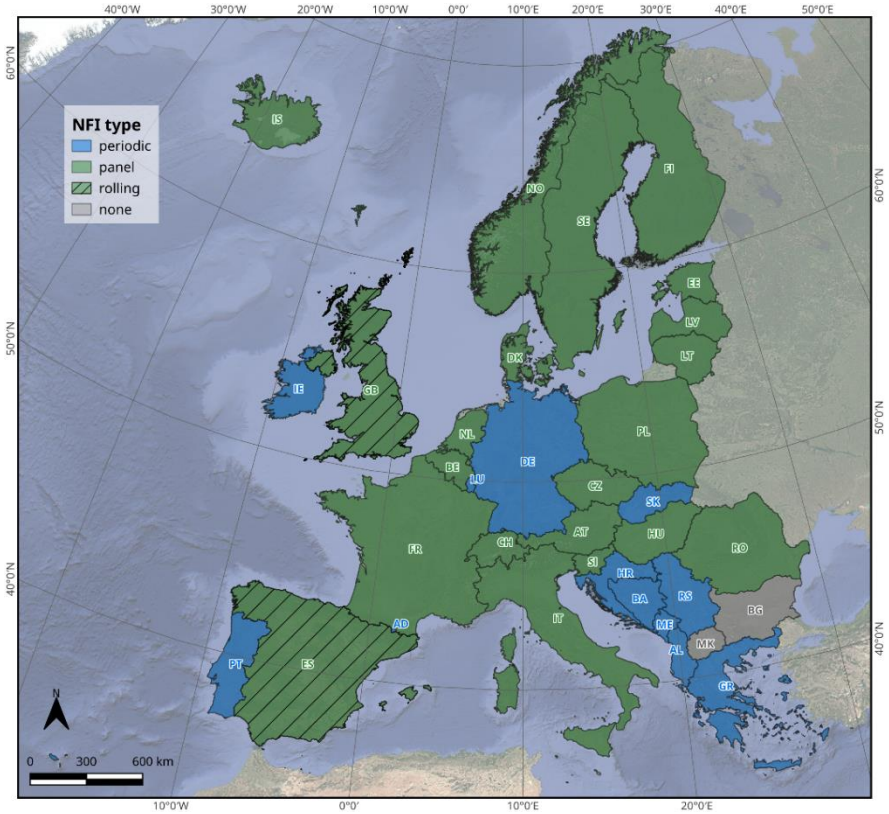
Horizon Europe

Most of Europe is annually covered by NFI data…



… economically efficient to use these data also in a EFMS

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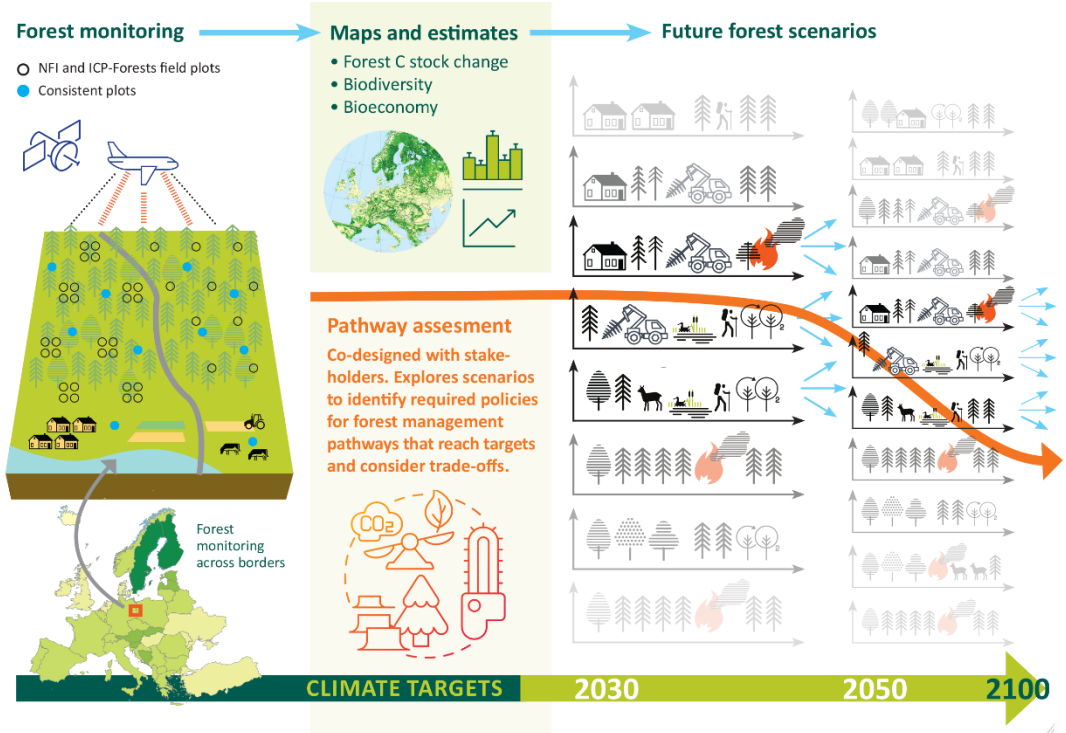
Aim: Prototype of a European Forest Monitoring System (EFMS)

- A bottom-up system integrating NFIs/ICPF and remote sensing
- Harmonized European and national forest information



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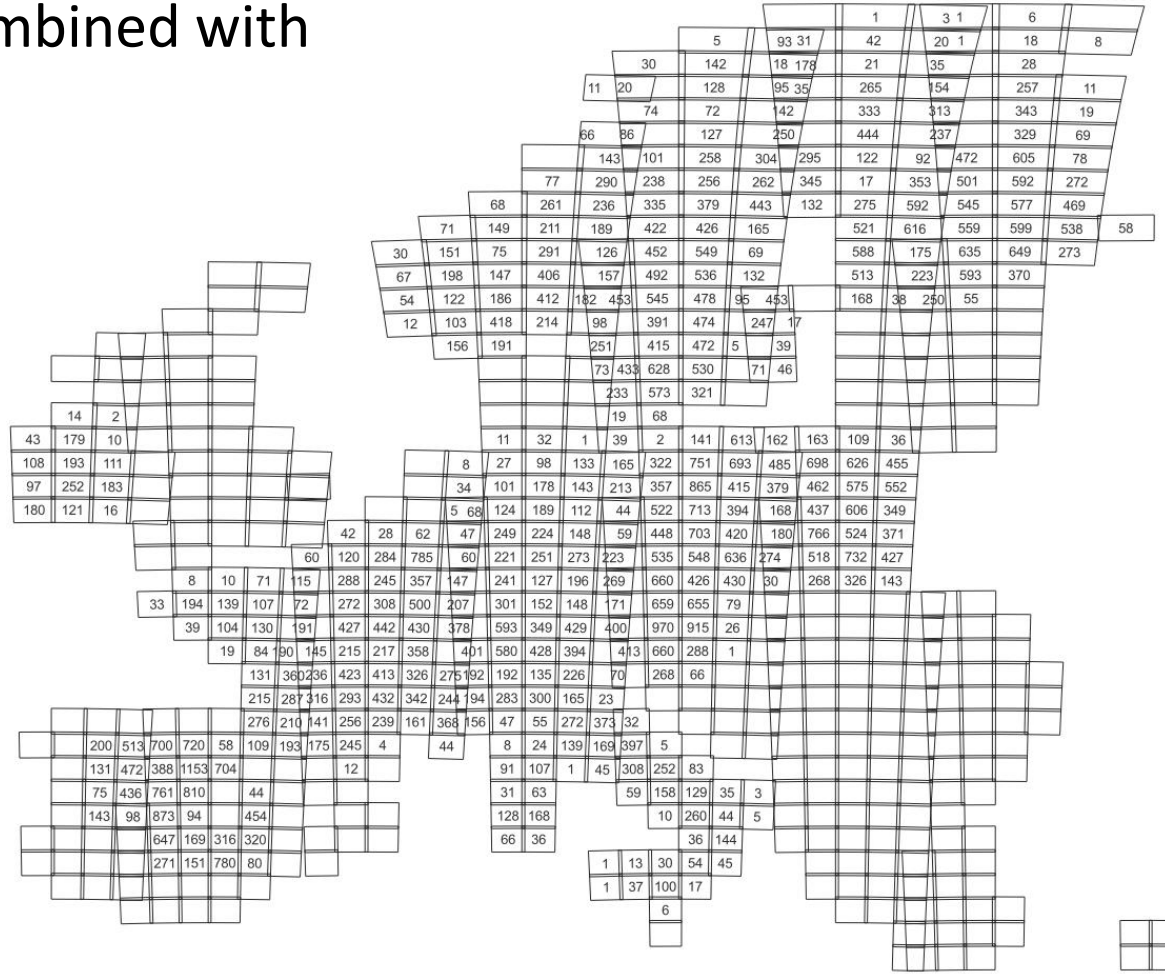
Horizon Europe

Harmonized NFI data combined with Sentinel2 data

Country	FB1	FB2 (DBH, SC)	FB3 (BA)	FB4 (H)	FB5 (gai/nai)
AT	5749	1482	1482	1482	1317
BE	1061	1061			499
CH	2624	2624	2624		2170
CZ	5022	5021	5021		2206
DE	6186	6186	6186	6186	5799
ES	14454	14259	13875	13875	8377
FI	16545	16545	16545		
FR	15845	15845	15845	15845	
IE	1509	1509	1509	1509	1489
IT	6688	6656			6536
NO	7024	6575	6575	6575	6705
PL	18802				
SE	17299	17299			9973
SI	736				
Σ	**113514**	**95062**	**69662**	**45473**	**45071**



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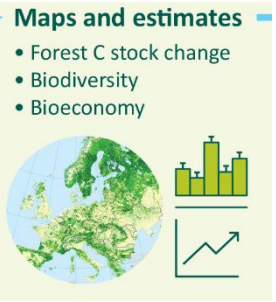
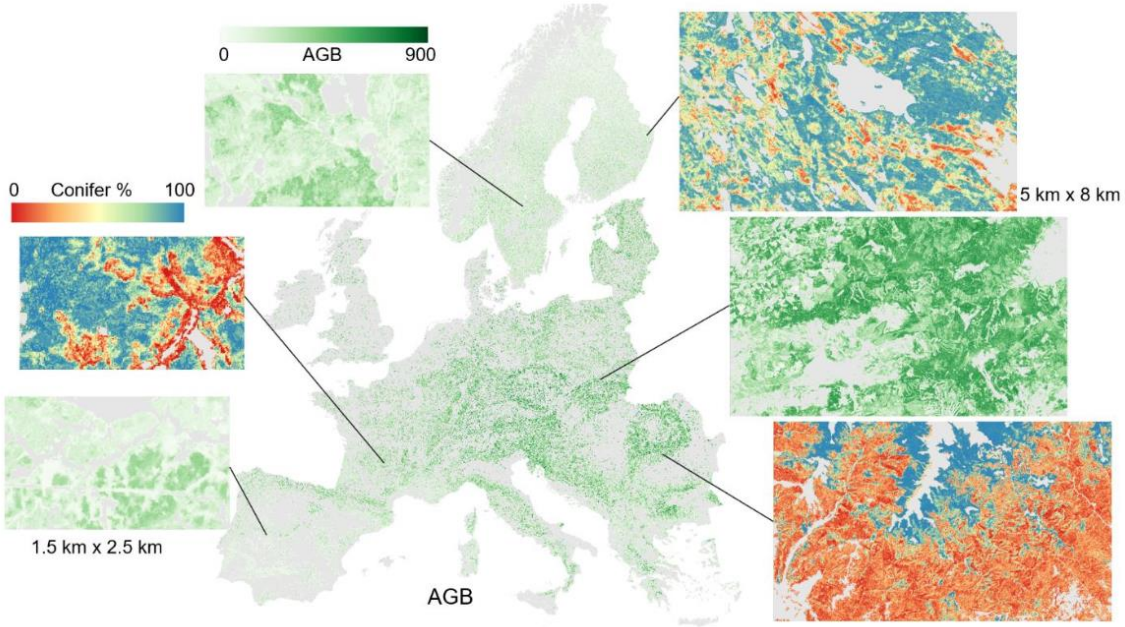
Mapping and estimation



- Pan-European maps combining NFI and sattellite data for 2020
- 10 m resolution



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Horizon Europe

For each 10 m pixel:
Predicted value and uncertainty

-Increment

Basal Area

Mean DBH

0 BA (m2/ha) 70

0 DBH (cm) 80

0 H (dm) 500

Height

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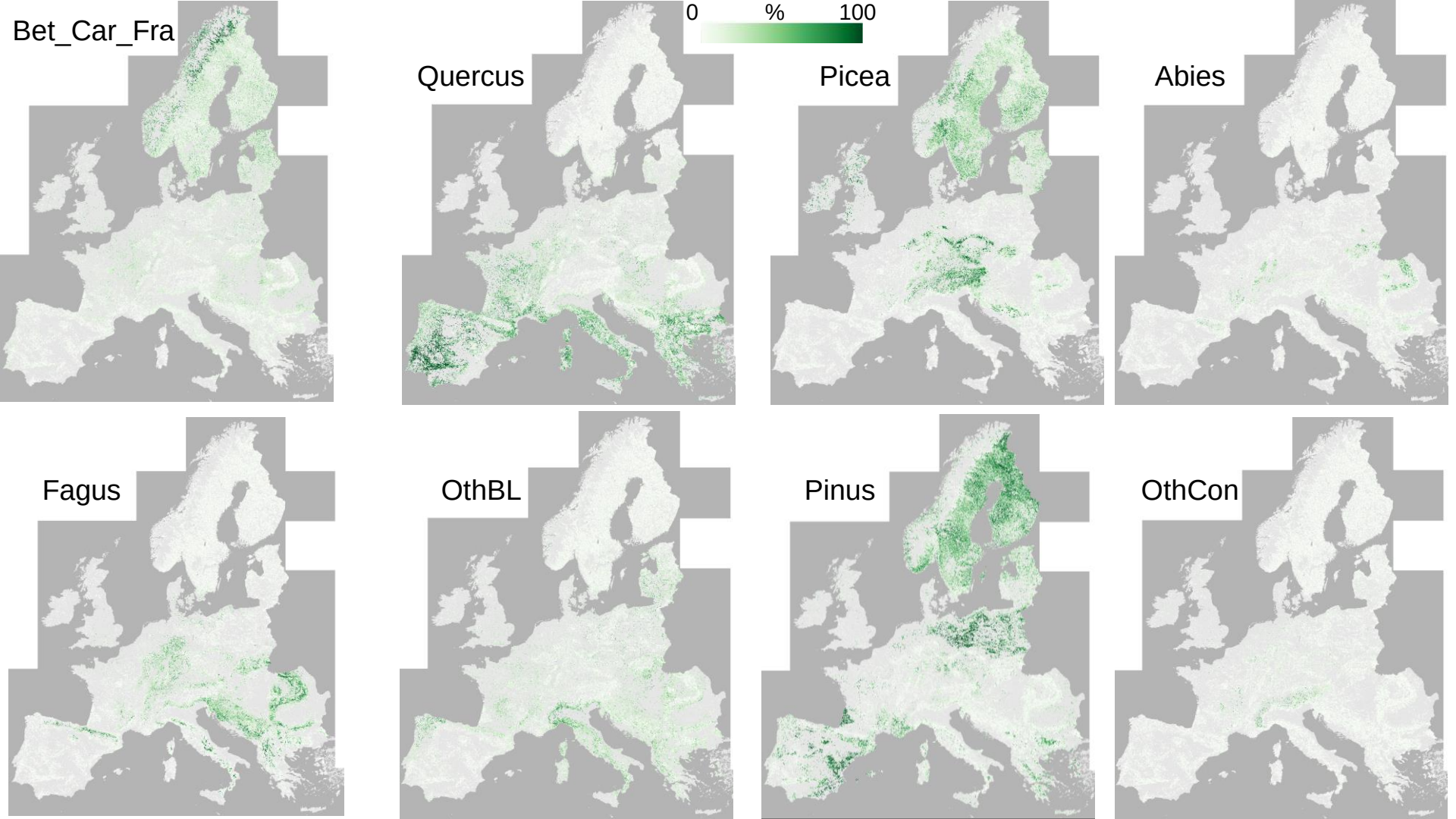
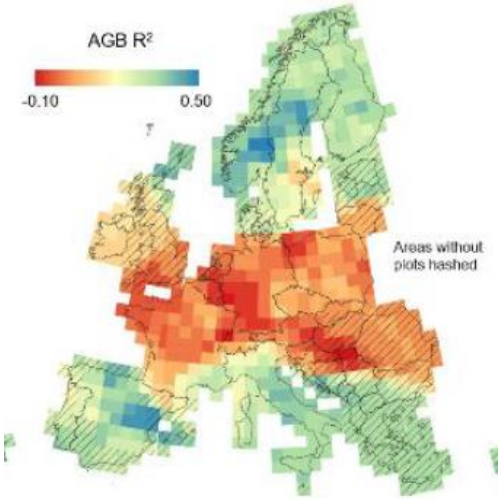
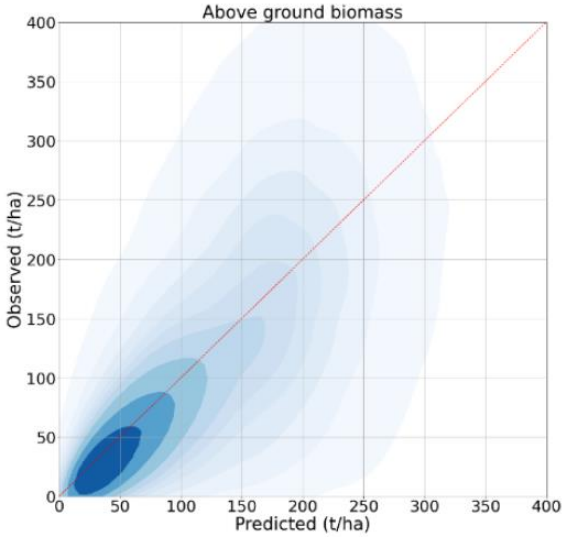

Bet_Car_Fra
0
%
100
Quercus
Picea
Abies
Fagus
OthBL
Pinus
OthCon

General trends in mapping uncertainty

- kNN method – preserves covariation among MV responses
- Lower map accuracy in central Europe than in north and south
- Bias in extreme values

➔ Pixel counting not advised – therefore plot-based (model assisted) estimates





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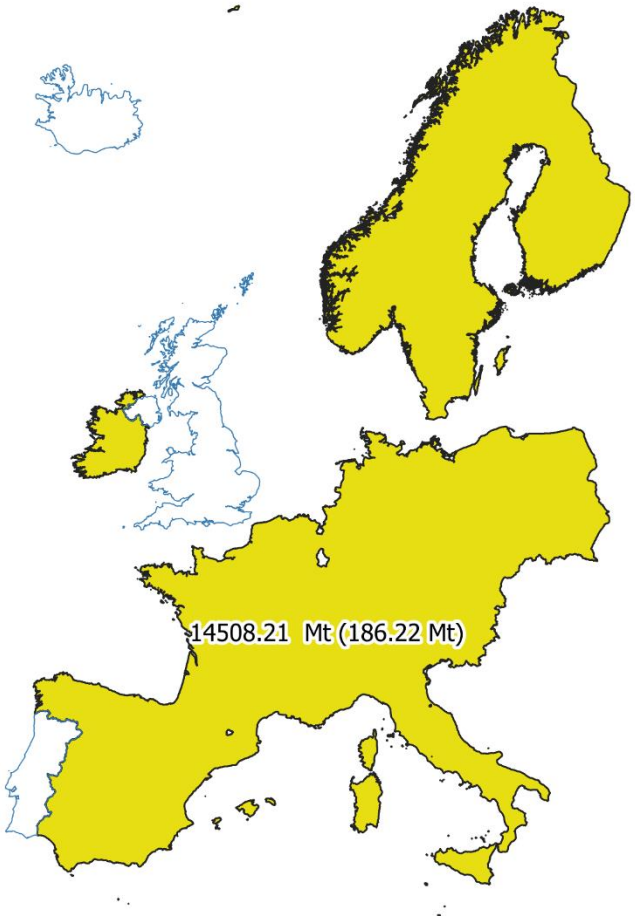
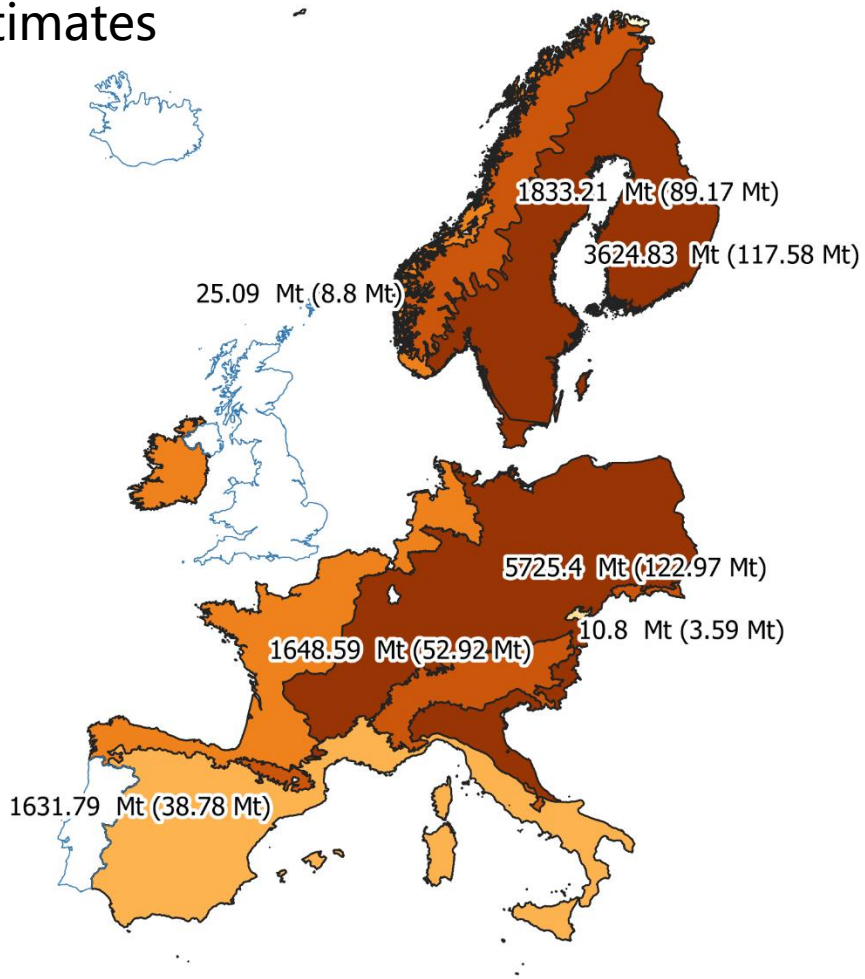
Horizon Europe

Reliable estimates
AGB





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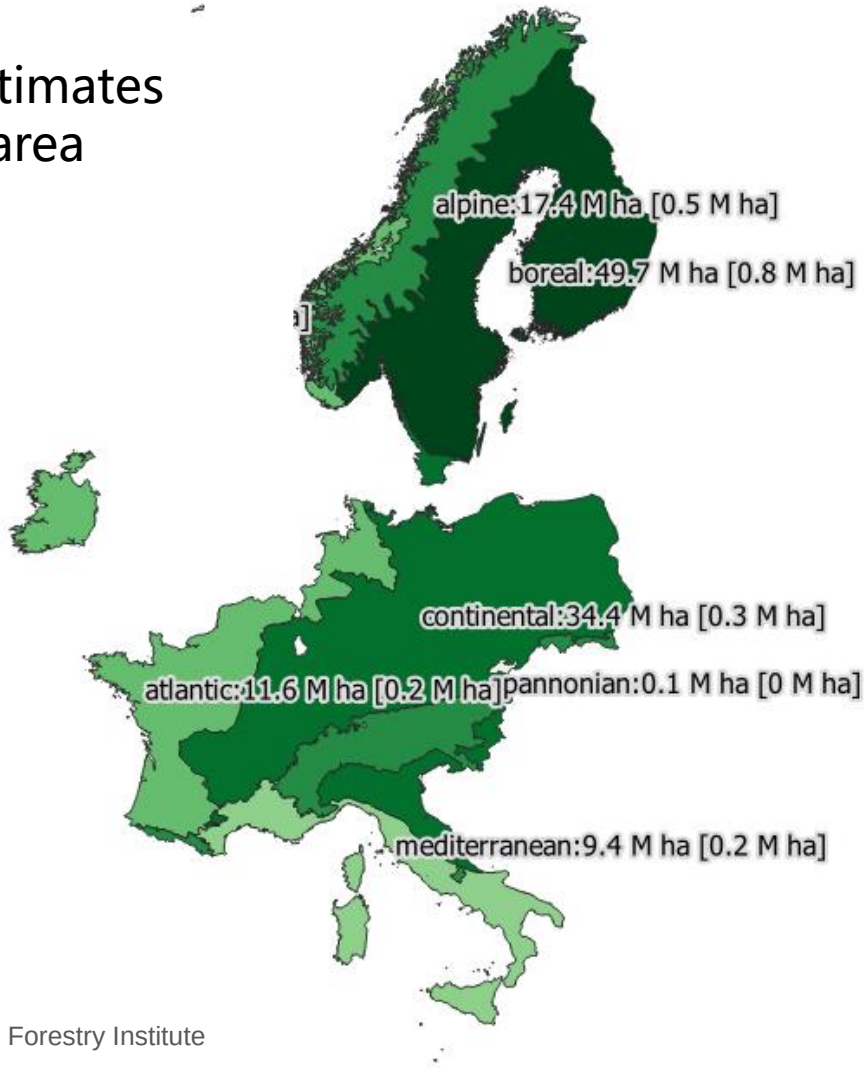
Reliable estimates
Forest area



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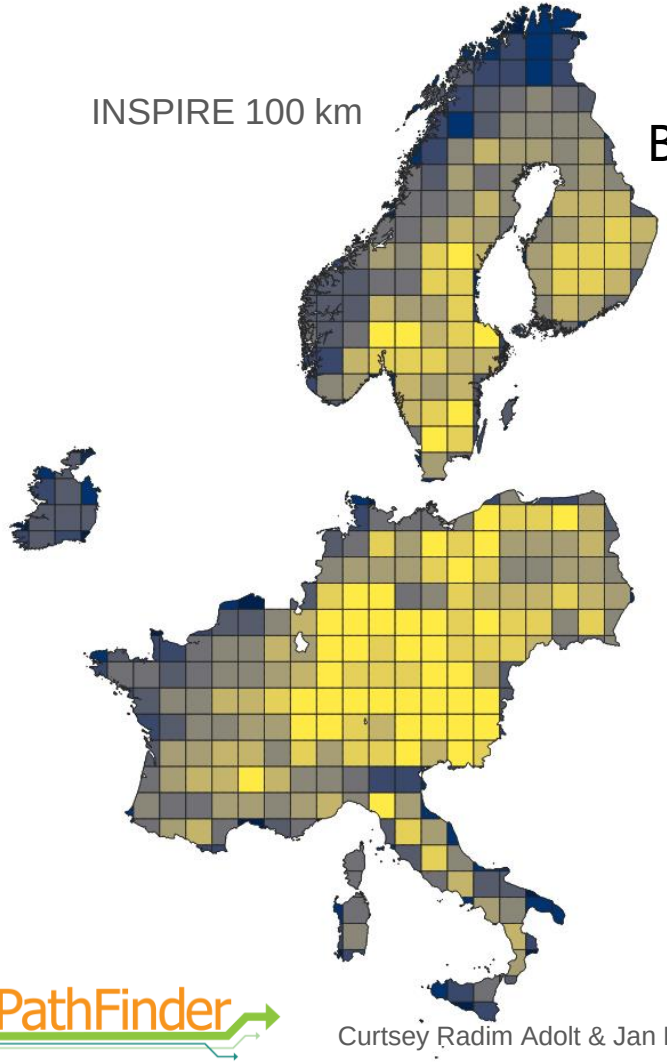
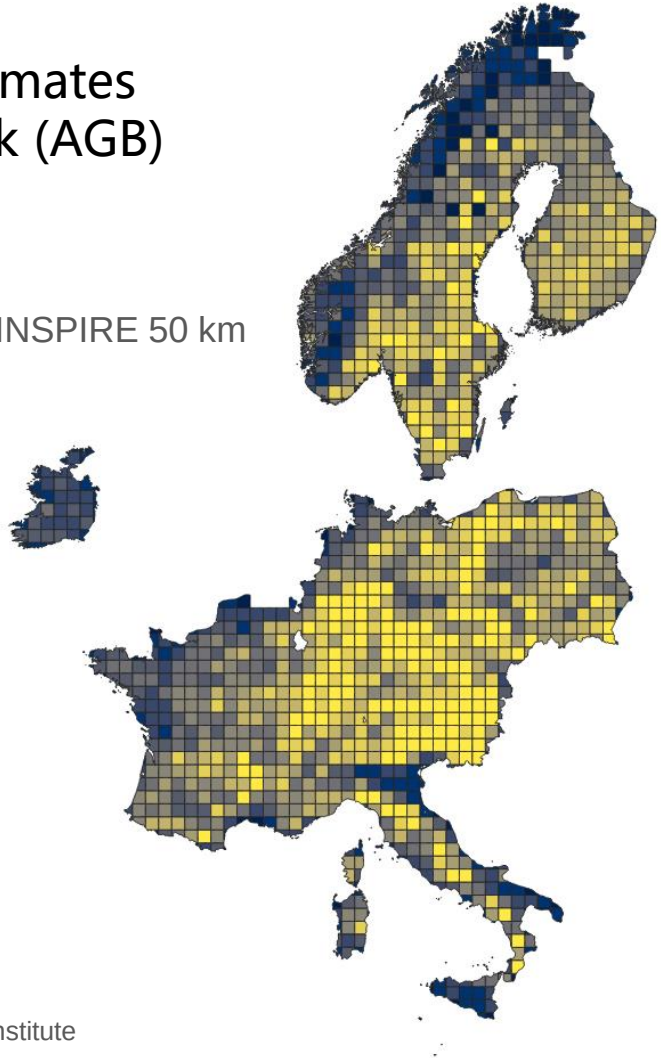
Reliable estimates
Biomass stock (AGB)

INSPIRE 100 km



INSPIRE 50 km



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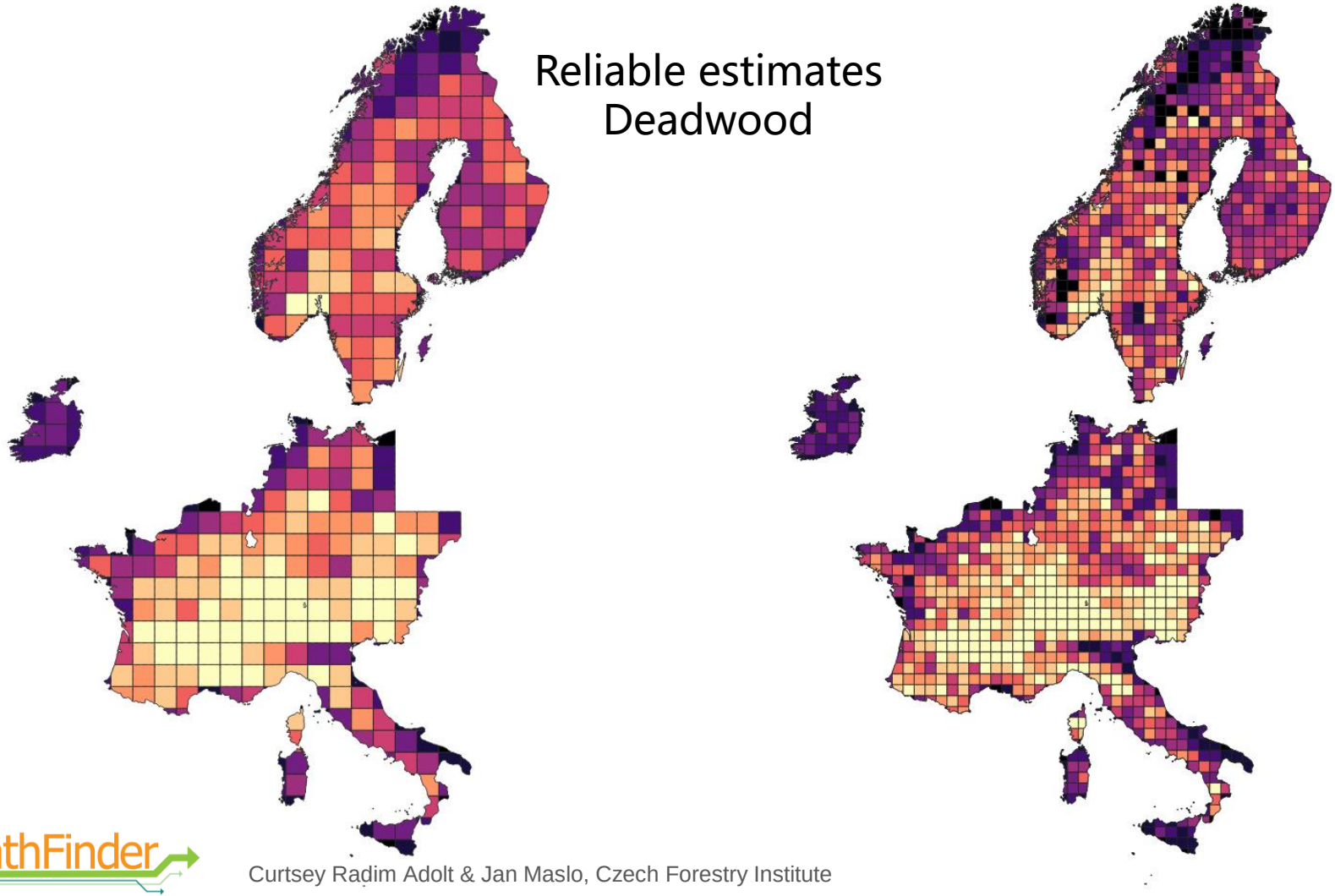
Reliable estimates
Deadwood



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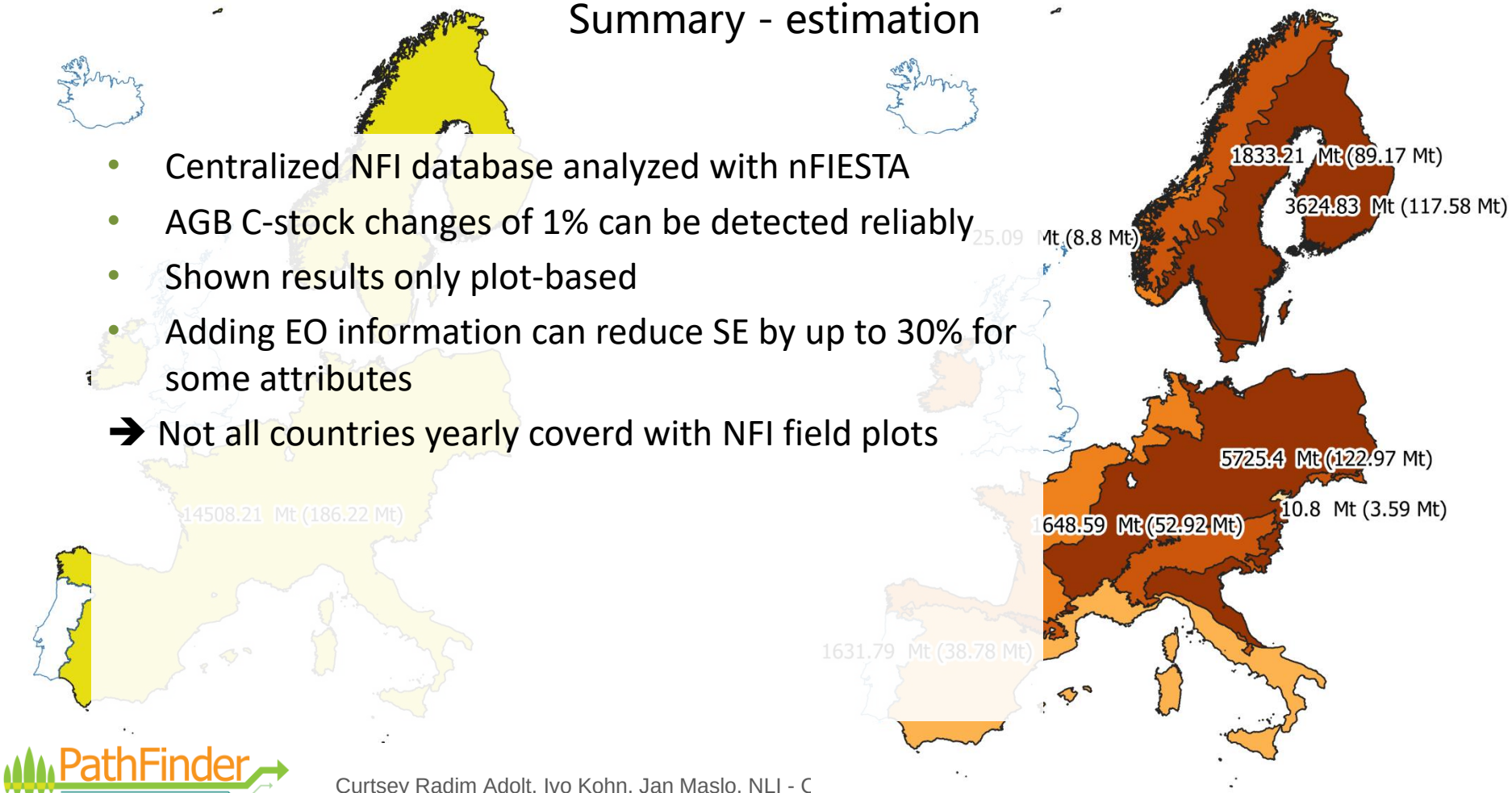
Summary - estimation

- Centralized NFI database analyzed with nFIESTA
- AGB C-stock changes of 1% can be detected reliably
- Shown results only plot-based
- Adding EO information can reduce SE by up to 30% for some attributes

➔ Not all countries yearly coverd with NFI field plots



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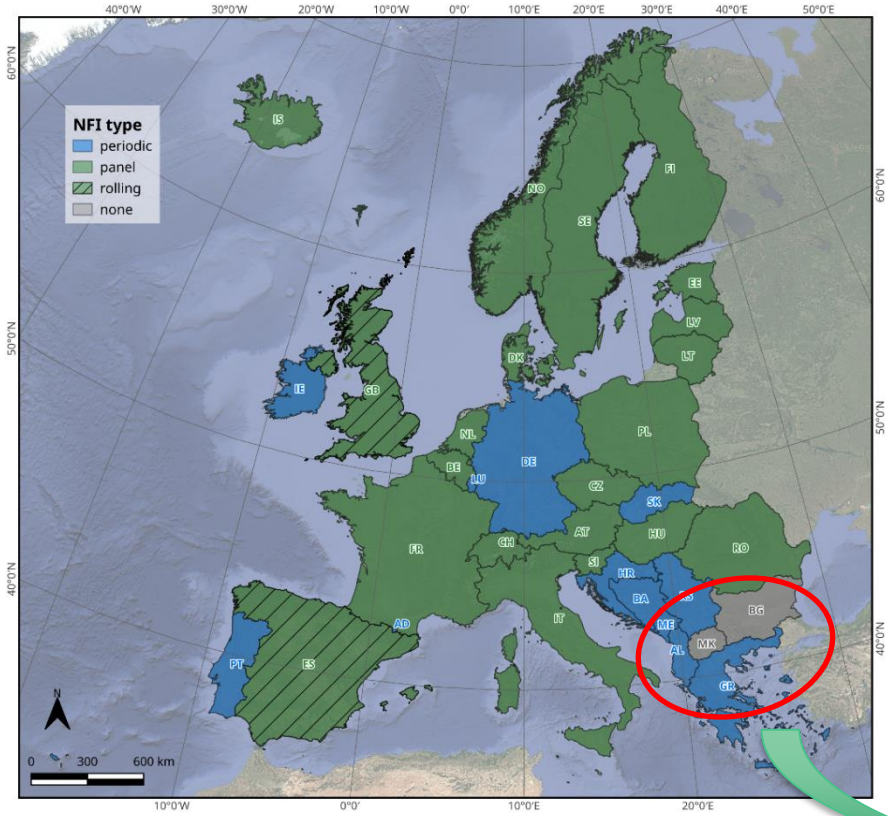
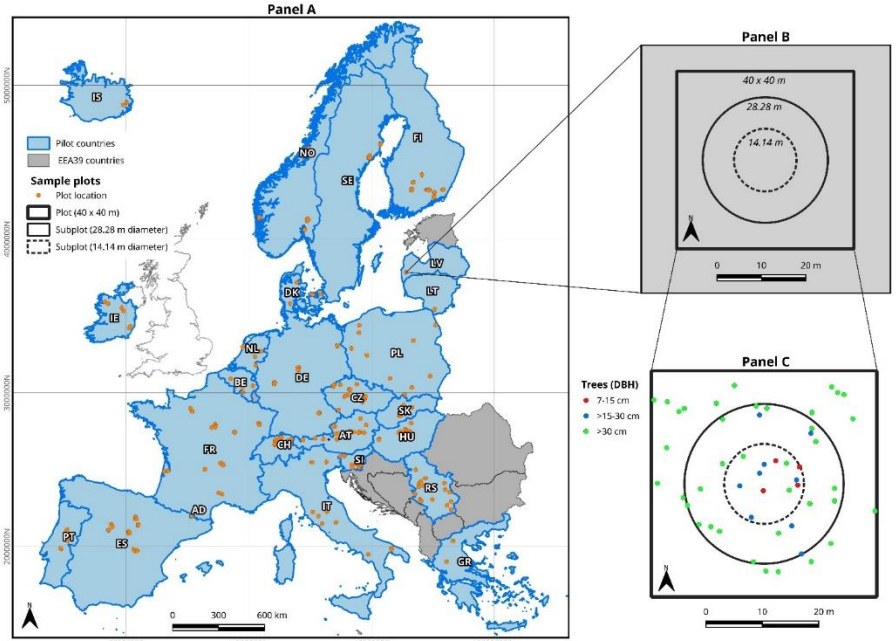
Standardized EO-friendly plots if yearly data are not available





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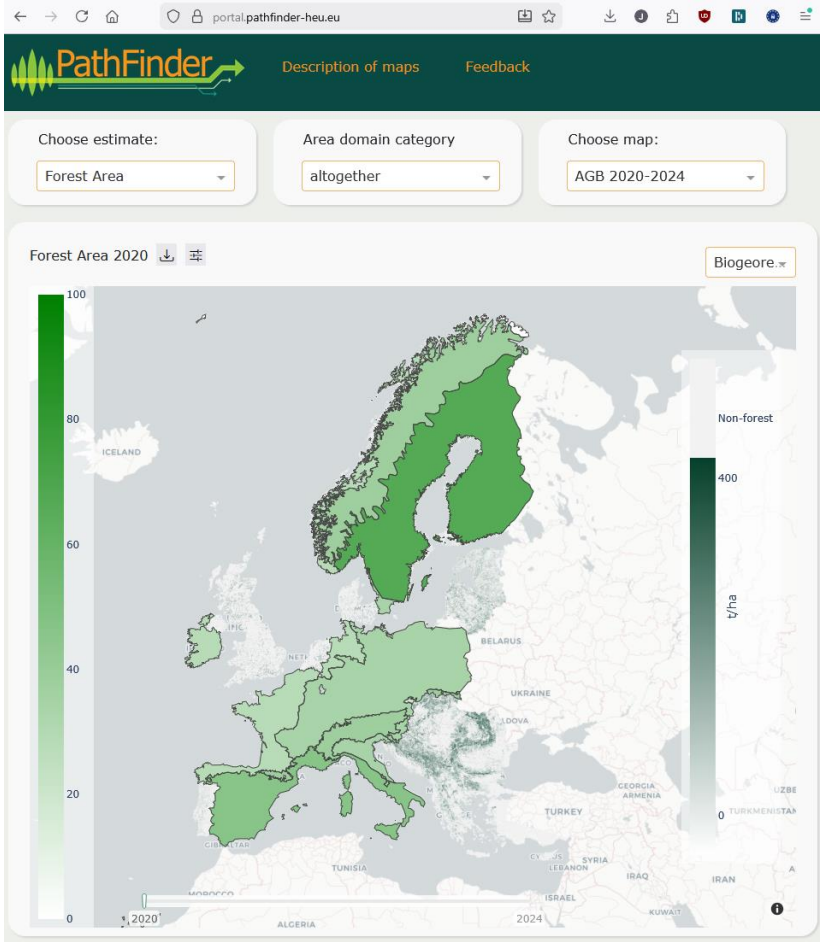
View and download data from the PathFinder portal



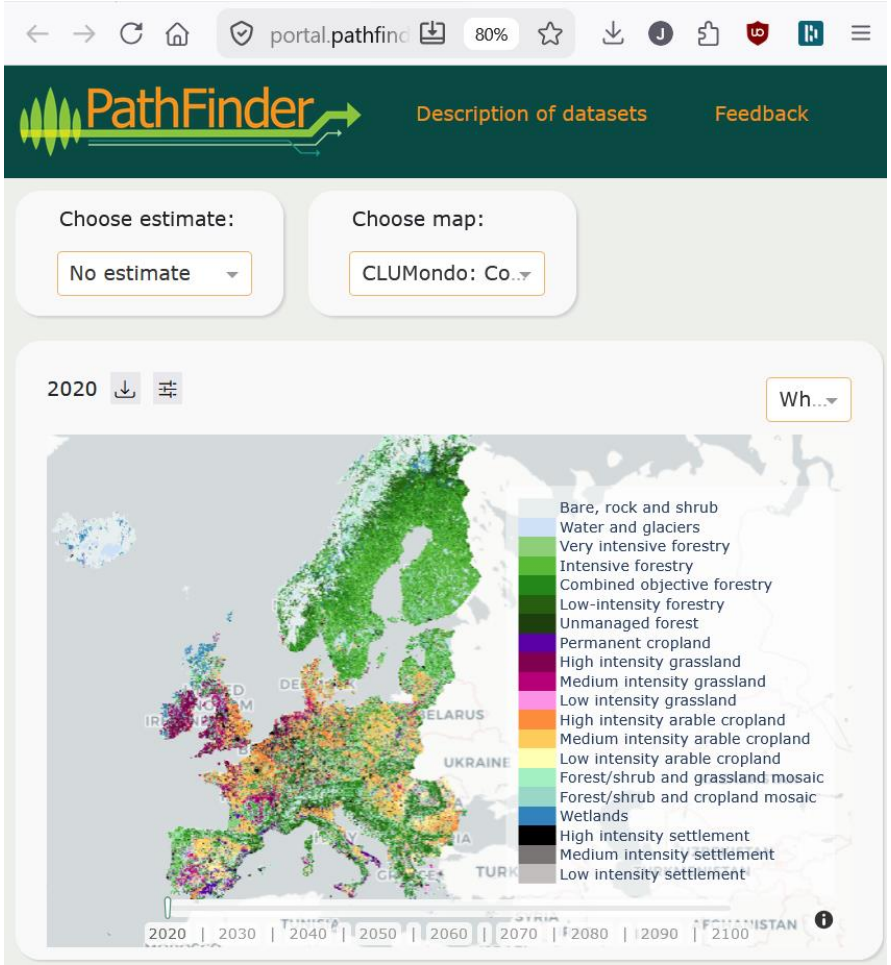
Answers questions like:

-How much pine biomass with diameters > 50 cm per biogeographic region?

-How much forest in the Mediterranean?

(Stay tuned!)

PathFinder portal: a time machine



Scenarios for

- Land-use change (CLUmondo)
- Forest productivity (GPPx)
- Forest structure (PixSimEU)
- Disturbance risk (ForestGales)
- Biodiversity indicators

(Stay tuned!)

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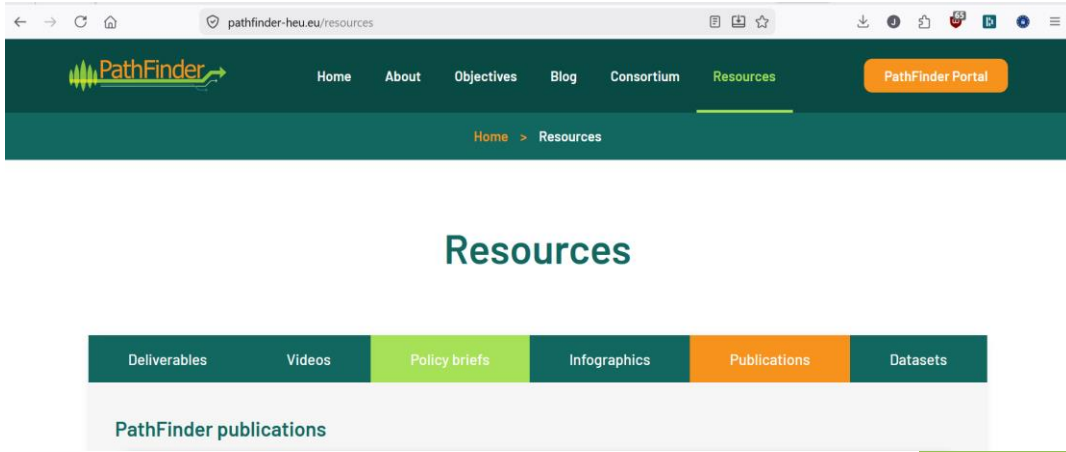
Many more outcomes…

- Development and comparison of AI models
- A forest-sensitive climate emulator
- New statistical estimators
- Models for soil C development
- Consistent LULUCF reporting

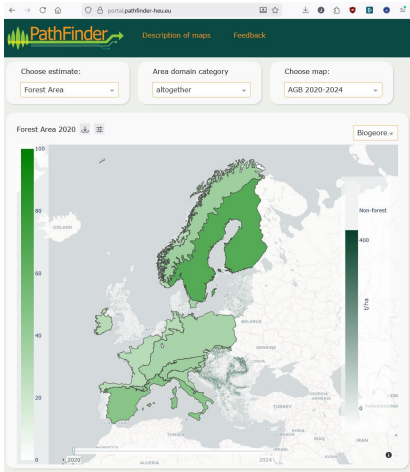


Horizon Europe GA number 101056907

Conclusions

- A European Forest Monitoring System based on National Forest Inventories and ICPF is feasable
- EUFEMIA – European Forest Monitoring and Analysis system
- Combining field and remote sensing data improves maps and estimates
- RS-based maps can give a timely first impression and are useful for mapping disturbances
- Important decisions should not be based on pixel counts of maps – combine with in situ!

➔ We need institutional arrangements to proceed



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How to proceed…

PathFinder prototype

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