

How can datasets from ICP Forests contribute to carbon monitoring?

Credible FG 3.4 Meeting, 22nd of November 2024

Nathalie Cools

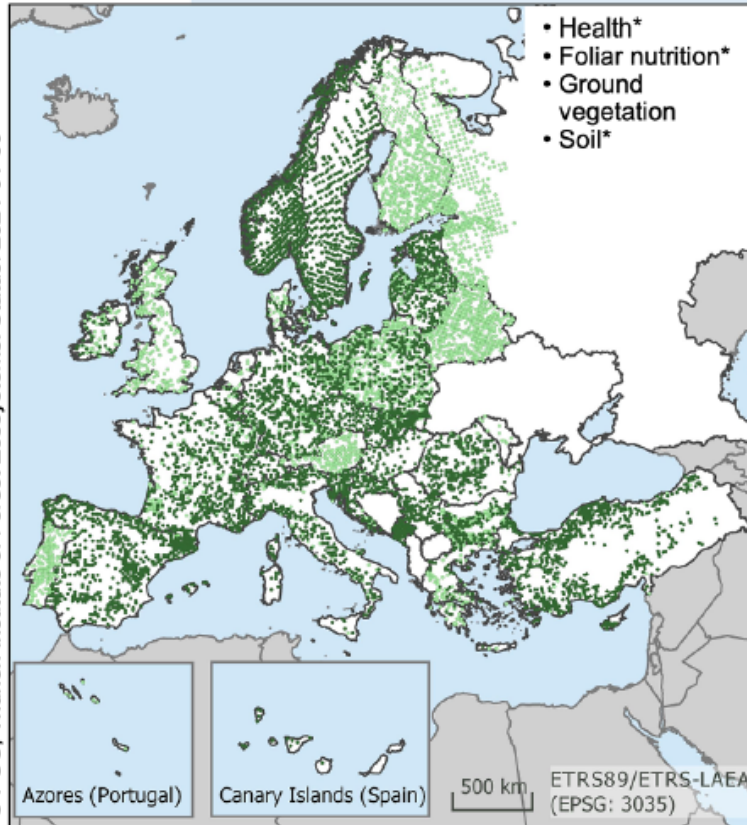
Background

- ▶ 1979: UNECE Convention on Long-range Transboundary Air Pollution
- ▶ 1983: Convention entered into force
 - Working Group on Effects with 6 International Cooperative Programmes (ICPs) on:
 - × [Forests](#)
 - × [Waters](#)
 - × [Materials](#)
 - × [Vegetation](#)
 - × [Integrated Monitoring](#)
 - × [Modelling and Mapping](#)
 - × [Task Force on Health](#)
 - Limited central financial support, support from countries and EC required
- ▶ Commission Regulation 3528/86 on Protection of Forests against Atmospheric Pollution (1986, 1994)
 - 2003 Forest Focus Regulation: forests as carbon sink

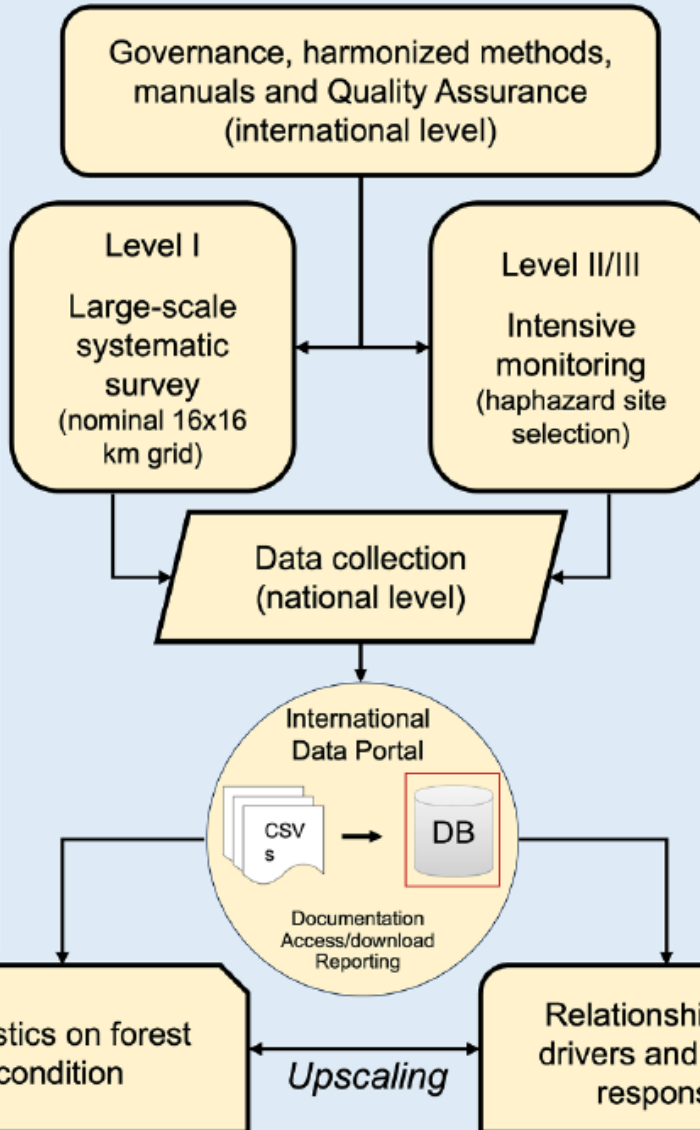
The ICP Forests terrestrial monitoring system

A. The ICP Forests terrestrial forest monitoring system

B. Level I: ca 6,000 active plots*

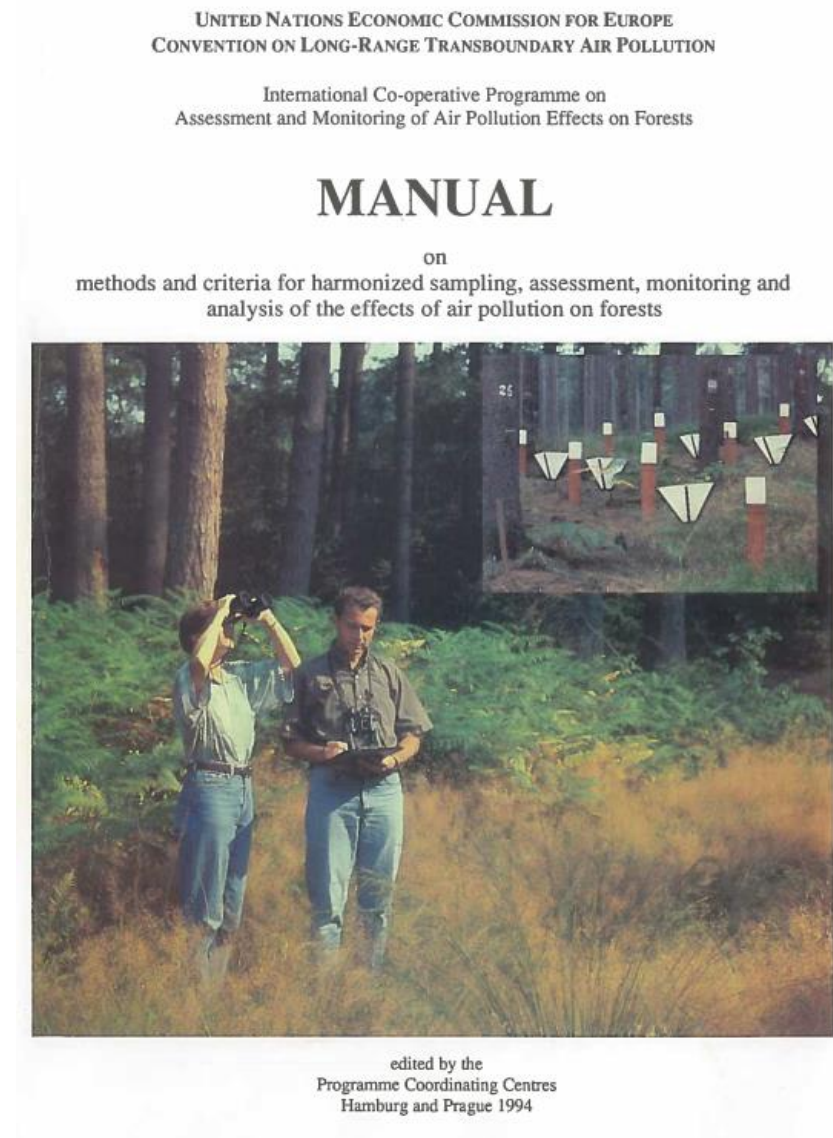


C. Level II: ca 700 active plots*



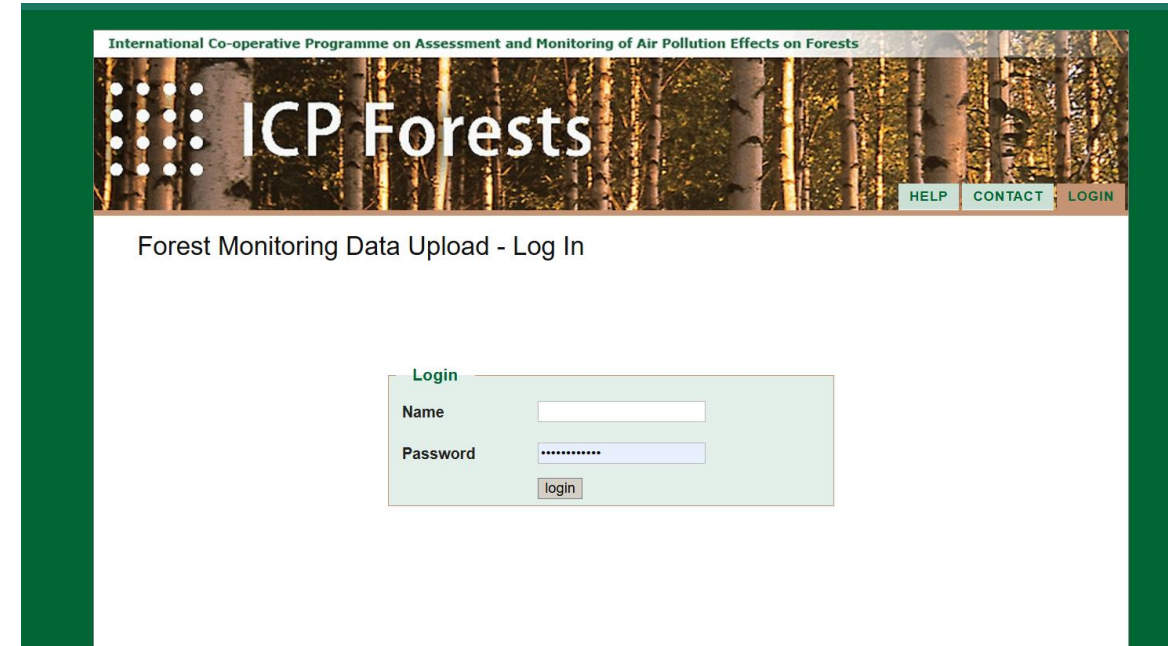
Data collection and management

- ▶ <http://icp-forests.net/page/icp-forests-manual>
 - Manual first edition 1994
 - Revision: every 5 years (next in 2025)
- ▶ **Central ICP Forests database** managed by Programme Coordinating Centre (PCC) in Eberswalde, DE (lead country)
- ▶ **Data formats:** description in online documentation <https://icp-forests.org/documentation/Introduction/index.html>



Data requests

- See <http://icp-forests.net/page/data-requests>
 - Access to the 'layer 0 data'
 - [ICP Forests Intellectual property rights](#)
 - Through research projects publications of data product:
 - 'Layer 1 data' quality checked or
 - 'Layer 2 data' gap filled data
- e.g. Fleck et al. (2016) Level II Aggregated Forest Soil Condition Database
- 2025: data products on forest soil carbon stocks of the 2 – 3 soil surveys



The screenshot shows the ICP Forests website interface. At the top, there is a header with the text "International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests" and the "ICP Forests" logo. Below the header, there are navigation links for "HELP", "CONTACT", and "LOGIN". The main content area is titled "Forest Monitoring Data Upload - Log In" and contains a login form with the following fields:

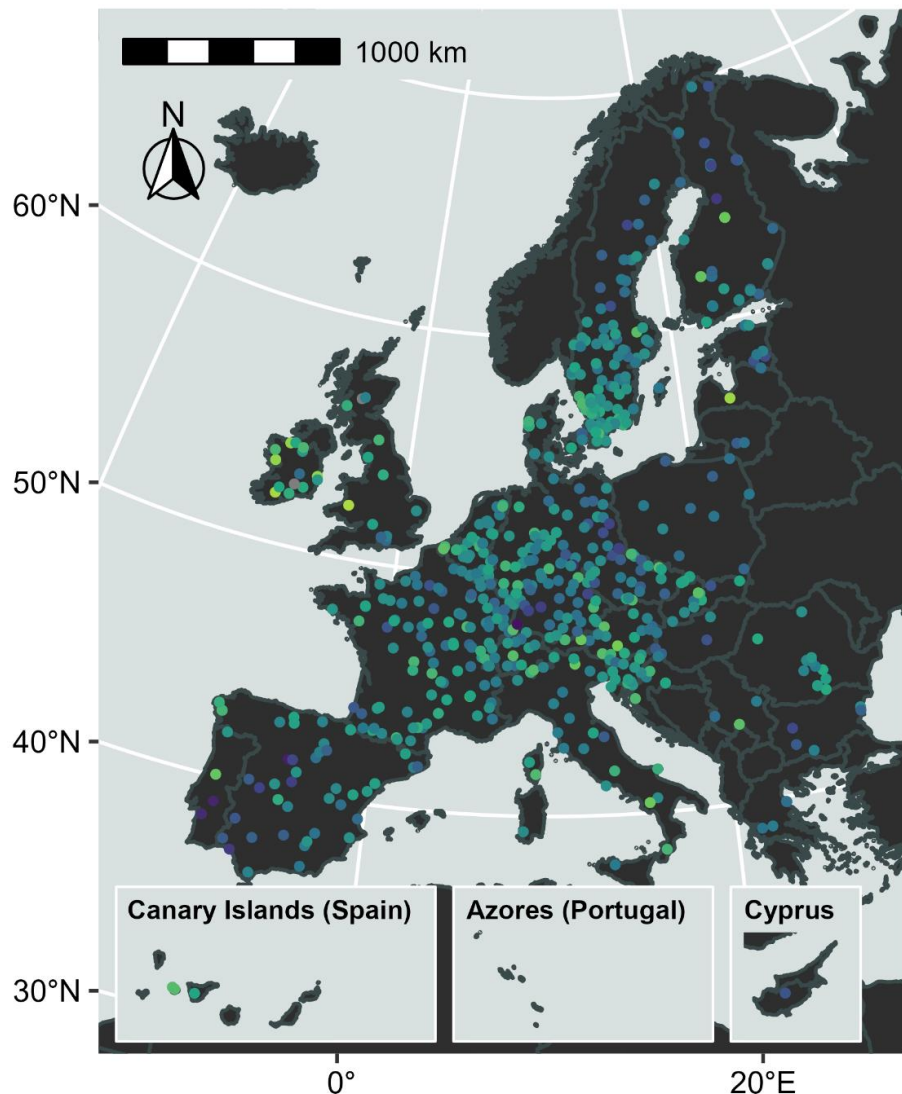
- Login** (Section Header)
- Name**: A text input field.
- Password**: A password input field with a masked password (represented by dots).
- login**: A button to submit the login information.

Forest soil carbon stock · Level II

625 plots (forest floor + topsoil)

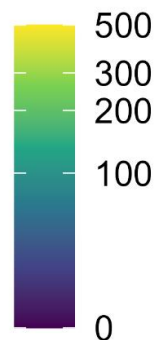
Mean over survey period (1990 - 2023)

Forest soil carbon stocks at Level II



Carbon stock

t C ha⁻¹



t C ha⁻¹

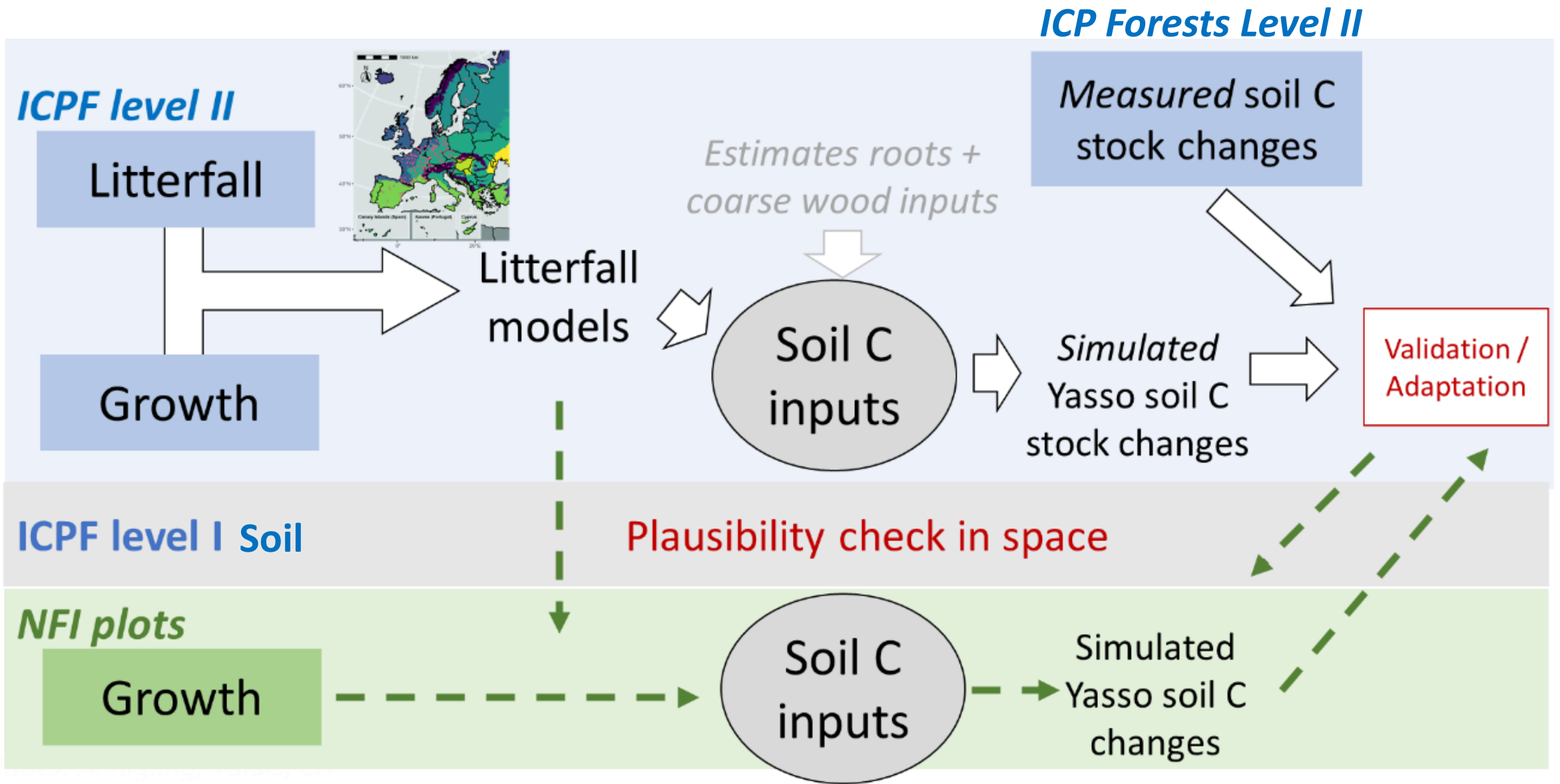
Compartment	n	Mean	95 % CI mean	Median	95 % CI median
Forest floor SOC stock	625	20	[18.0; 24.2]	12	[10.4; 12.8]
Below-ground SOC stock (mineral soil)	766	117	[112.5; 122.7]	101	[96.2; 106.3]
Below-ground SOC stock (peat soil)	17	335	[226.6; 466.1]	226	[106.1; 524.9]
Total SOC stock (forest floor + soil)	612	153	[145.5; 161.2]	131	[125.1; 136.2]

SOC sequestration rates (t C.ha⁻¹.yr⁻¹)

Compartment	N° plots	Mean	95 % CI mean	Median	95 % CI median
Forest floor	162	-0.11	[-0.27; 0.01]	-0.10*	[-0.15; -0.01]
Mineral soil	161	0.42*	[0; 0.76]	0.48*	[0.23; 0.66]
Peat soil	4	-3.20*	[-4.74; -2.26]	-2.91*	[-5.14; -2.06]
Full profile	151	0.32*	[0.03; 0.60]	0.39*	[0.09; 0.56]

Time span between 2 surveys between 9 and 29 years (1991-2023)

Country	Sequestration rate (t C ha ⁻¹ yr ⁻¹)	Reference
DE	FF Broadleaved: -0.62 FF Conifers: 0.23	Wellbrock & Bolte 2019
DE	Min soil: 0.41	Grüneberg (2014)
FR	Min soil: 0.35	Jonard et al.(2017)
BE	Min soil: 0.13 - 0.34	De Vos (2009)
EU	Min soil: 0.1 - 1	Luyssaert et al. (2010)

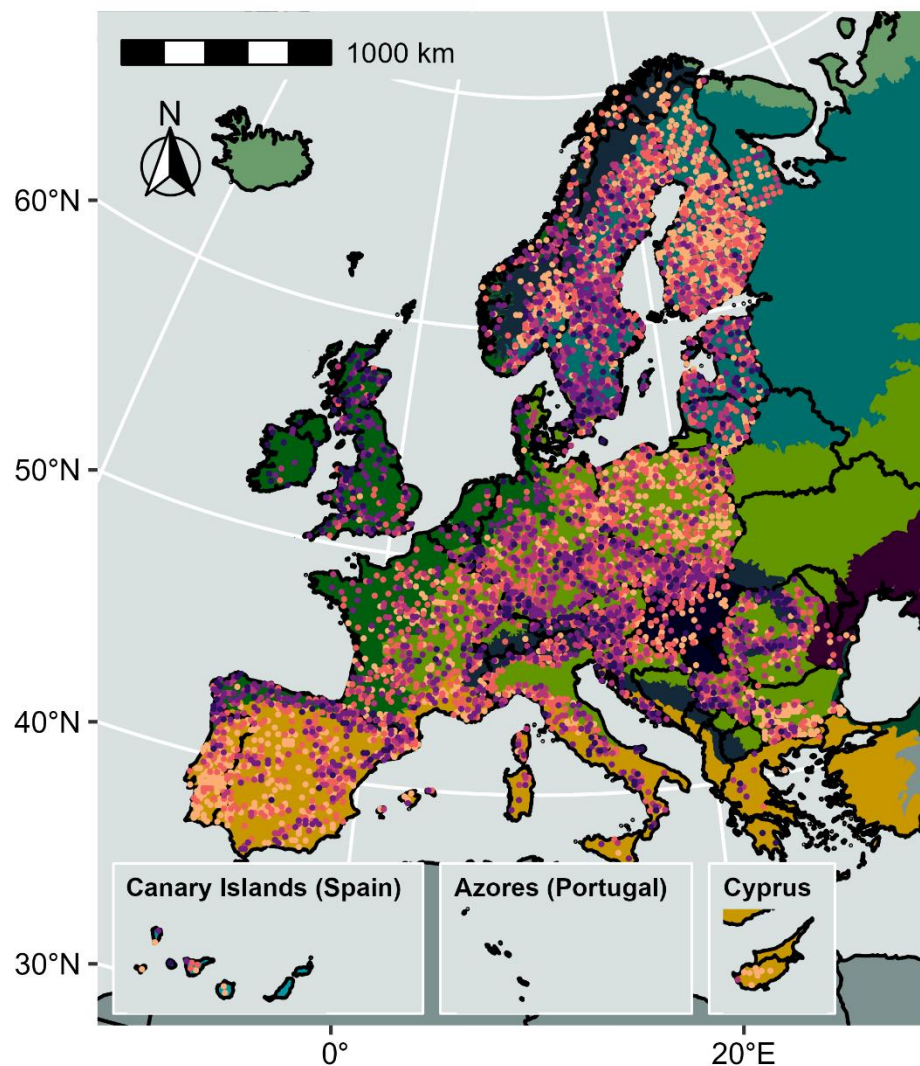


Level I: Plausibility checks in space

Forest soil carbon stock · ICP Forests (Level I)

5678 plots (forest floor + topsoil)

Mean over survey period (1985 - 2022)



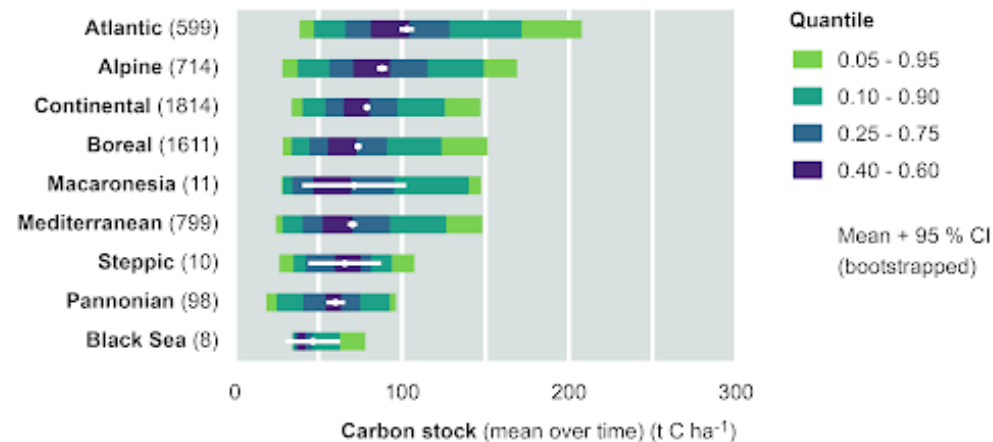
Carbon stock t C ha⁻¹

- 0 - 50
- 50 - 75
- 75 - 100
- 100 - 150
- 150 - 400

Biogeographical region

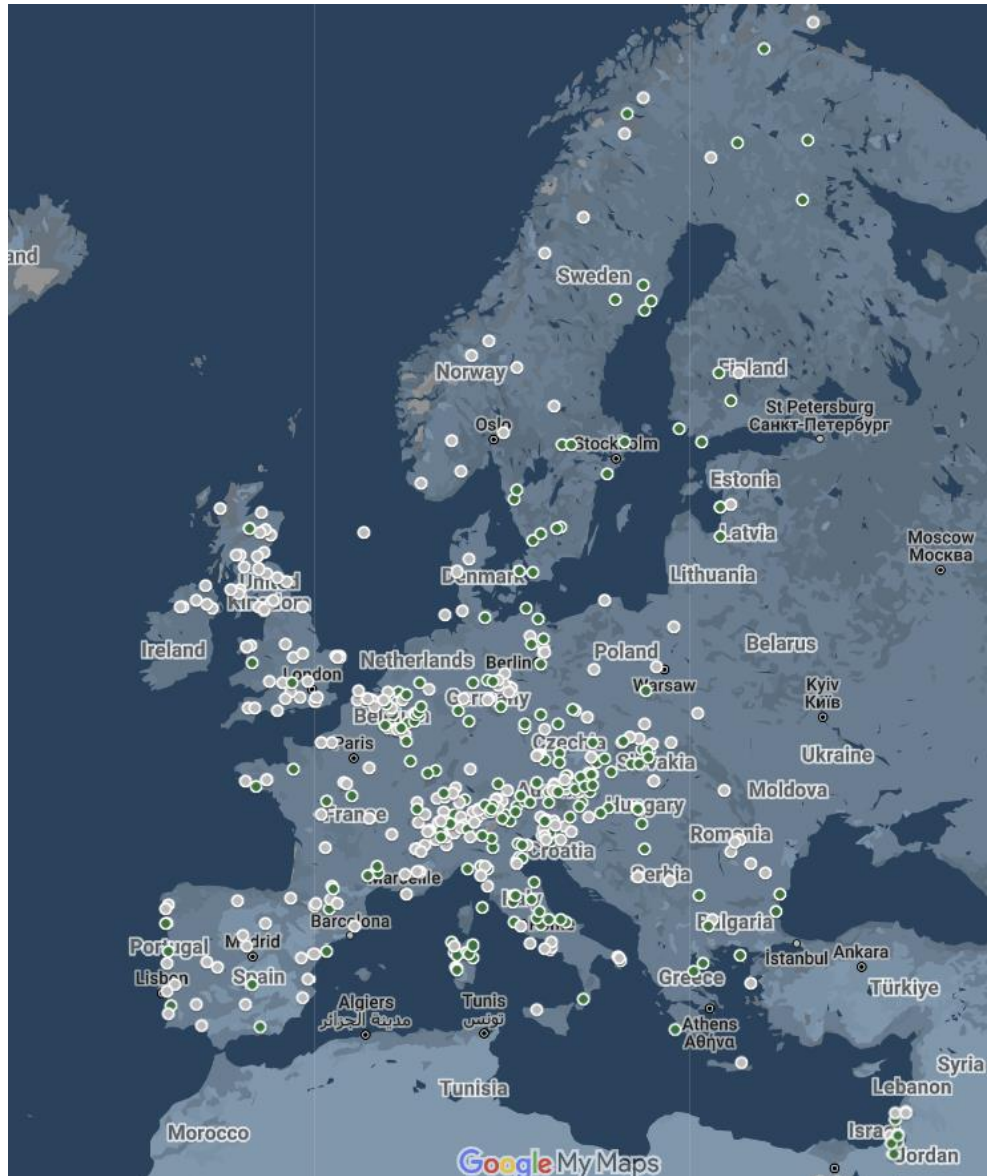
- Alpine
- Arctic
- Atlantic
- Black Sea
- Boreal
- Continental
- Macaronesia
- Mediterranean
- Pannonian
- Steppic

Carbon stock (forest floor + topsoil)
as a function of biogeographical region
(ICP Forests Level I)



	biogeographical_region	n	Mean	Conf. level	Trad. lower	Trad. upper
1	Atlantic	599	102.810	0.95	98.450	107.160
2	Alpine	714	88.016	0.95	84.838	91.194
3	Continental	1814	79.004	0.95	77.350	80.658
4	Boreal	1611	73.683	0.95	71.582	75.783
5	Macaronesia	11	71.305	0.95	40.259	102.350
6	Mediterranean	799	70.286	0.95	67.519	73.052
7	Steppic	10	65.738	0.95	43.968	87.508
8	Pannonian	98	60.257	0.95	54.779	65.735
9	Black Sea	8	46.568	0.95	30.137	62.998

LTER-Europe and the eLTER RI



LTER: all land uses

- 484 sites in Europe
- 213 in forests
- 86 part of UNECE programme:
 - 33 ICP Forests Level I
 - >57 ICP Forests Level II
 - 9 ICP Integrated monitoring
- 6 sites part of ICOS and ICP Forests Level II

eLTER Standard Observations (SO)

- Soil characterisation
- Soil chemical and physical properties (o.a. SOC), 5 or 10 year interval monitoring
- Protocols are in development, though largely follow the ICP Forests protocols

● Suggested to be included in eLTER ERIC