

# Organic soils within the EU regulatory framework and climate related policies: current status and scientific challenges

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JRC - Unit D.5

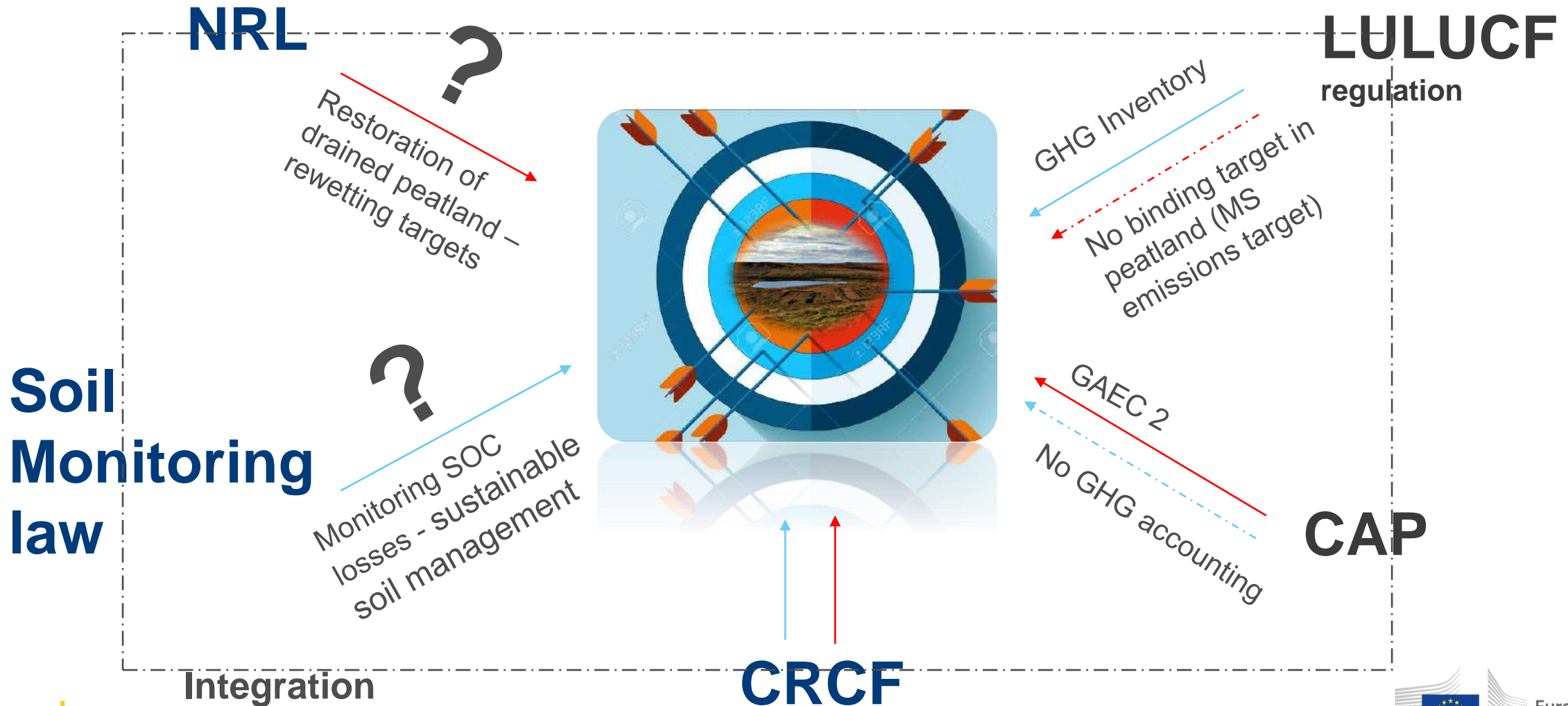
Sustainable Resources Directorate



June 13-14, 2024. Latvia

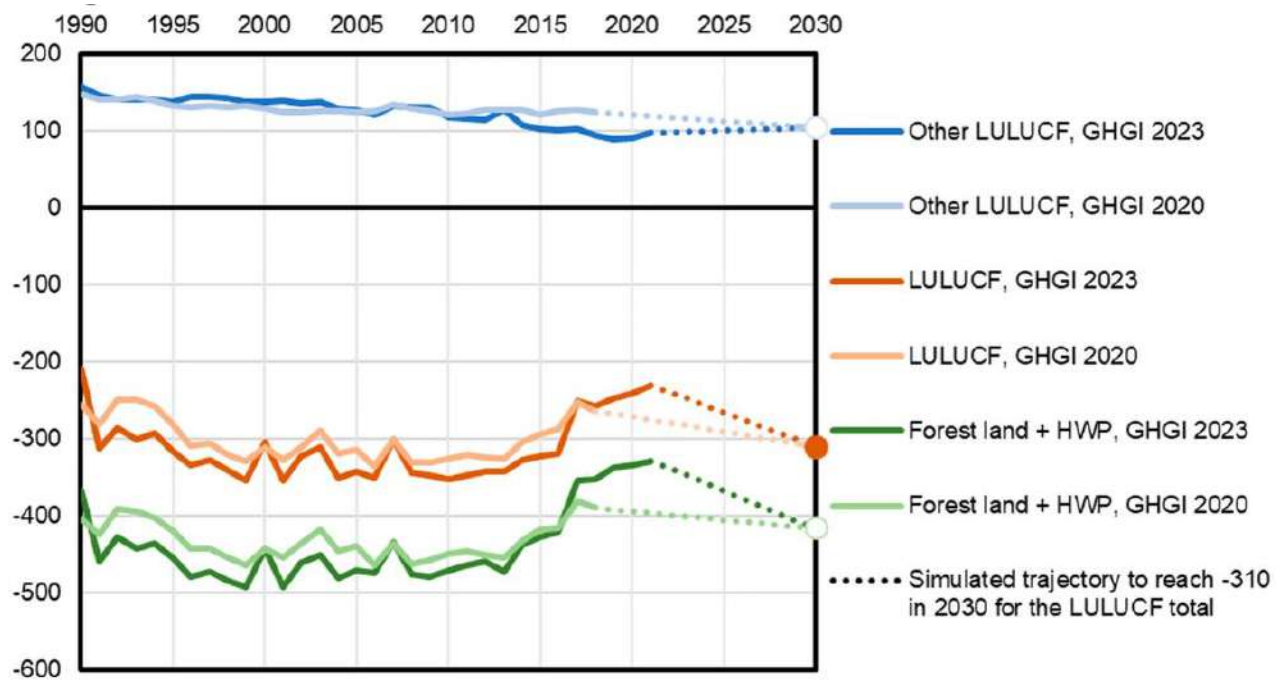


# Peatlands are targets of many EU policies



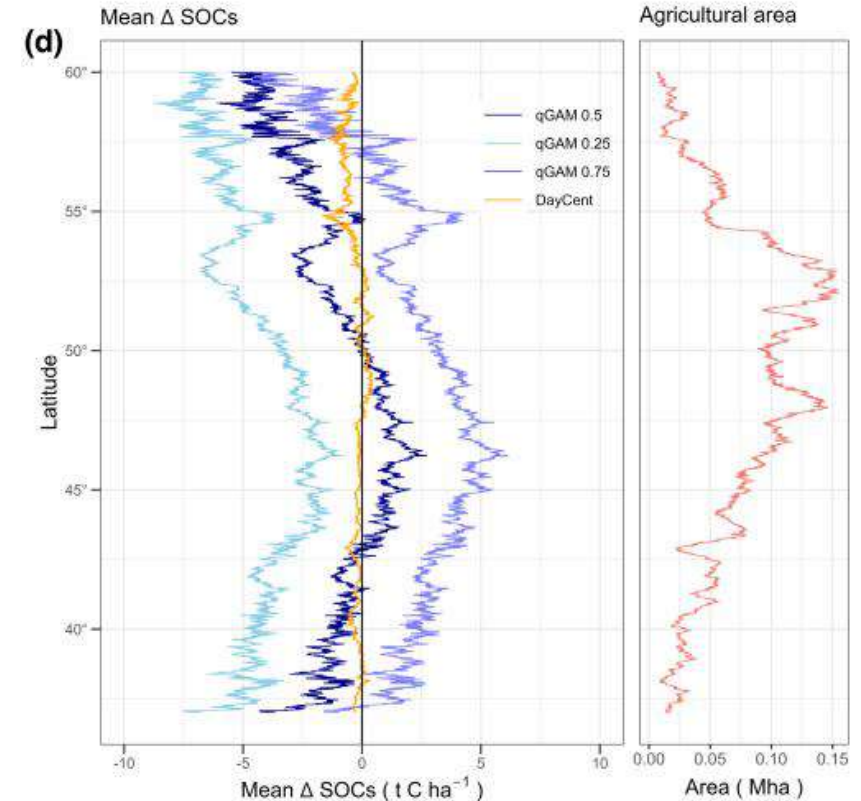
# Pathway to climate neutrality

Trends of EU-27 net emissions and removals for LULUCF



Korosuo, A., Pilli, R., Abad Viñas, R. et al. *The role of forests in the EU climate policy: are we on the right track?* Carbon Balance Manage 18, 15 (2023).

**SOC losses in mineral soils 2018-09**  
= 9 - 28 Mt CO<sub>2</sub>eq per year



De Rosa, D., Ballabio, C., Lugato, E., Fasiolo, M., Jones, A., Panagos, P. (2024). *Soil organic carbon stocks in European croplands and grasslands: How much have we lost in the past decade?* Global Change Biology, 30, e16992.

# Organic soils: a key “special” issue

## EU emissions from organic soils

17 Mha -> 95 Mt CO<sub>2</sub>






>160 Mt CO<sub>2</sub>e

ORGANIC SOILS IN NATIONAL INVENTORY SUBMISSIONS OF EU COUNTRIES

Martin, N. & Couwenberg, J.

60% area correction  
40% EF

Land use subcategory	Area (Kha)	ICECF (tC/ha)	Emissions from Org. Soils. (Kt CO <sub>2</sub> )
 4A1	12 264	[-2.60; 0.65]	13 631
4A2	407		1 494
 4B1	1 242	[-10.01; -1.00]	25 813
4B2	273		5 814
 4C1	4 132	[-6.80; 0.25]	42 150
4C2	354		5 683

85%

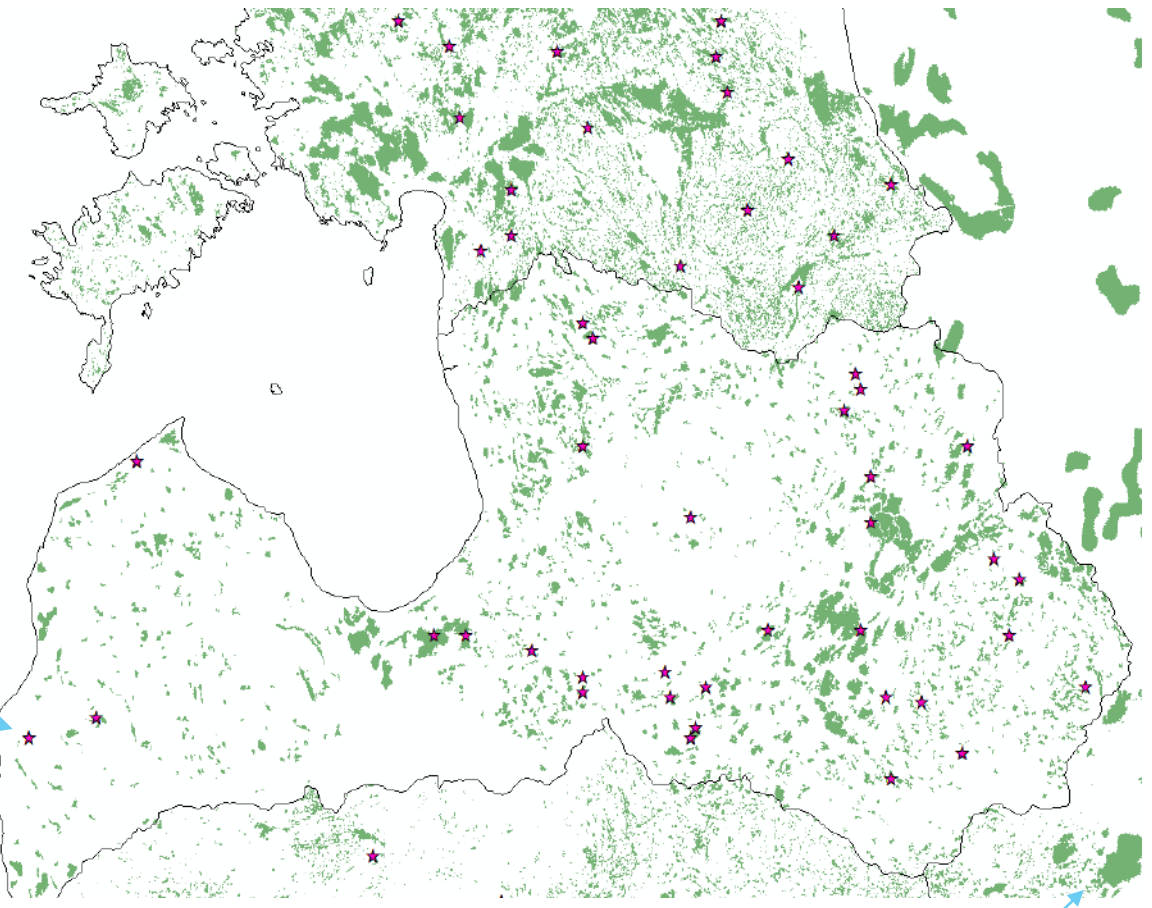
Large uncertainty EF

Annual European Union greenhouse gas inventory 1990–2018 and inventory report 2020

# Moving from pan EU to local data



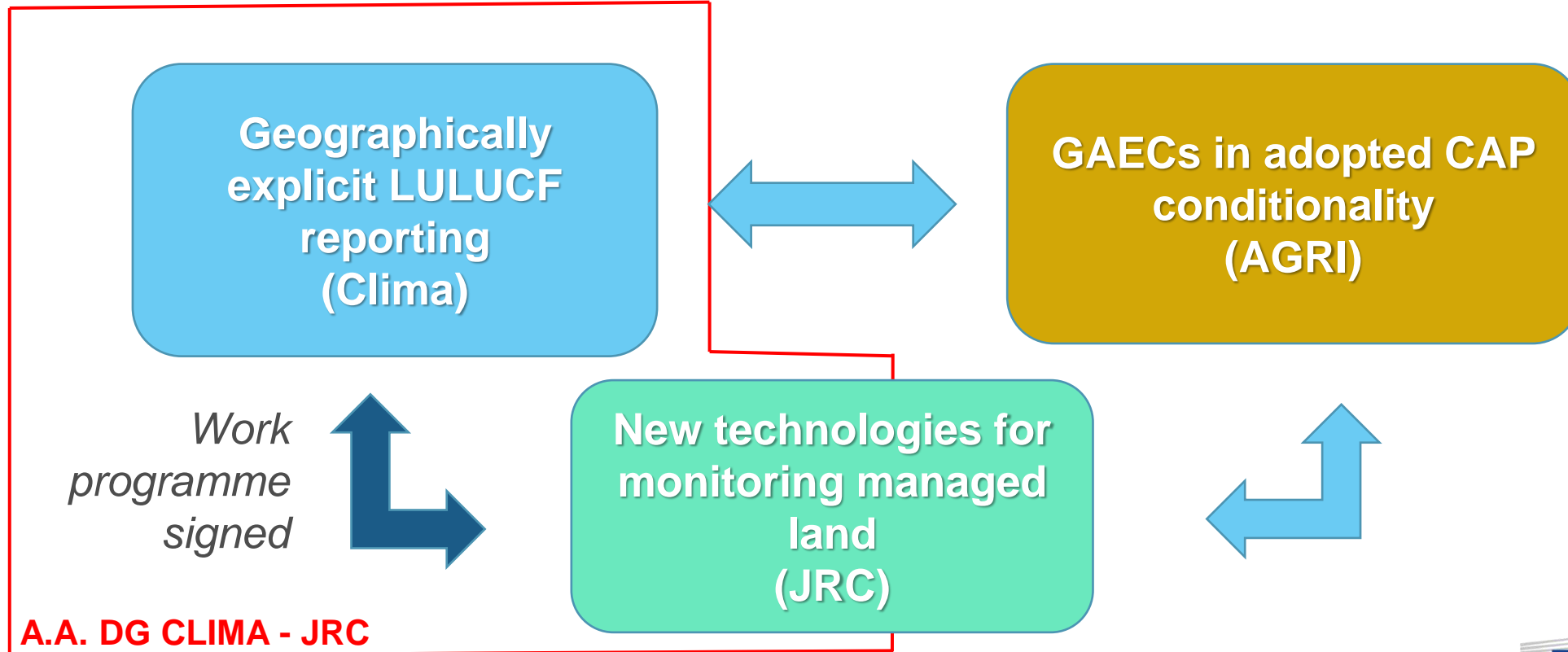
- Surveys in 2009, 2015, 2018, 2022
- 42,000 observation



Tanneberger et ., *The peatland map of Europe*

# The context of SEPLA project

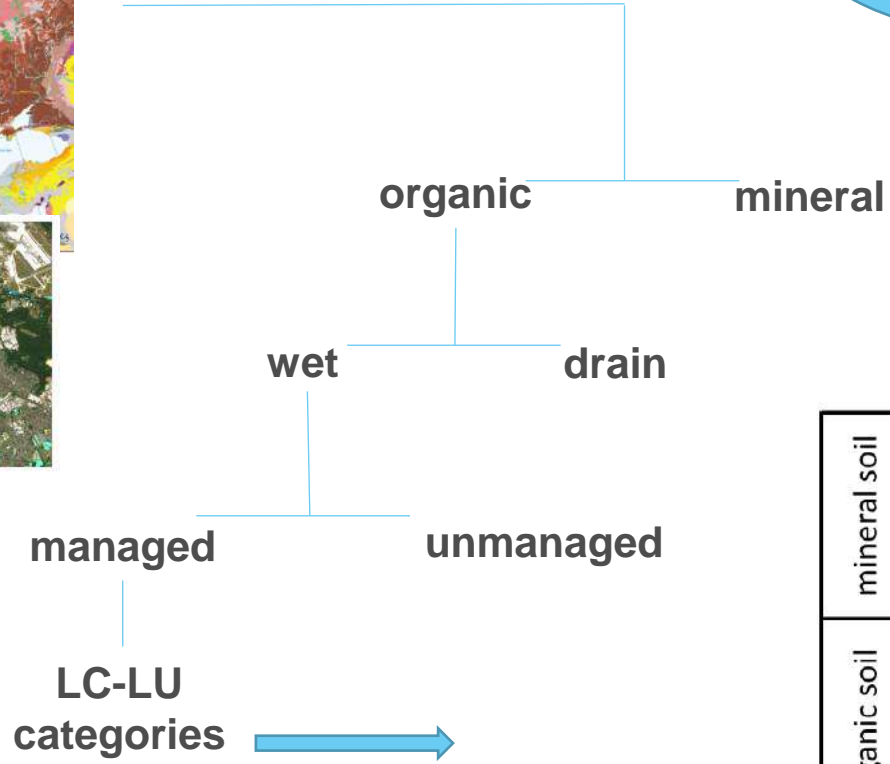
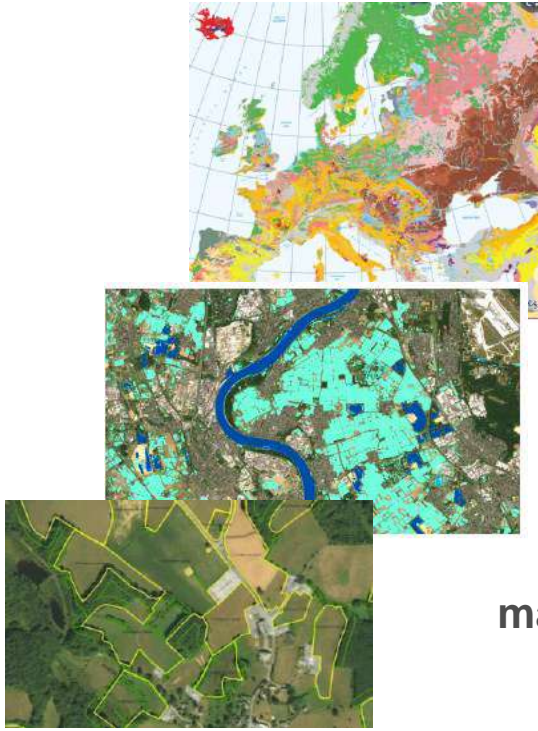
*“Ensure comprehensive inventory of wetlands and peatlands and address the monitoring of their preservation and restoration through the use of remote sensing and regularly updated geographically explicit datasets.”*



# Best use of data available within MS

*Participatory approach  
with 4 MS in a development phase  
DK, LV, BG, IE*

Do we have the right data?  
Is it complete?  
Does it allow historic analysis?  
Is it enough spatially disaggregated?  
Where data enters the workflow?



## IPCC wetland sub-categories

	Forest Land	Crop-land	Grass-land	Wet-lands	Settle-ments	Other Land
	inland	coastal	inland	coastal	inland	coastal
mineral soil	mineral drained	mineral drained	mineral drained	mineral drained	mineral drained	mineral drained
	mineral wet	mineral wet	mineral wet	mineral wet	mineral wet	mineral wet
organic soil	organic drained	organic drained	organic drained	organic drained	organic drained	organic drained
	organic wet	organic wet	organic wet	organic wet	organic wet	organic wet

# What is a wetland?

Ecosystem that is flooded by water, either permanently or seasonally (Fresh, brackish, salt water)

Wetland



Accumulation of organic material (generally 30% OM in dw) different stage of decomposition (from fibric to sapric)



bog

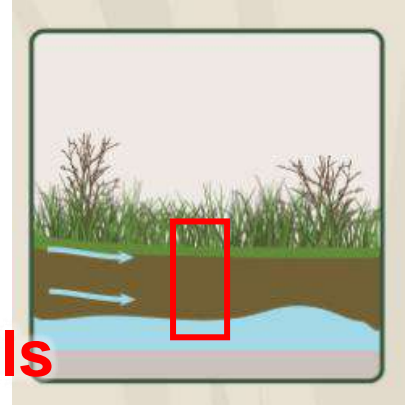
fen

- Ombrotrophic
- Acidic
- Mosses (sphagnum)

- Minerotrophic
- Less acidic
- Mosses, sedge



PEAT  
ORGANIC-RICH

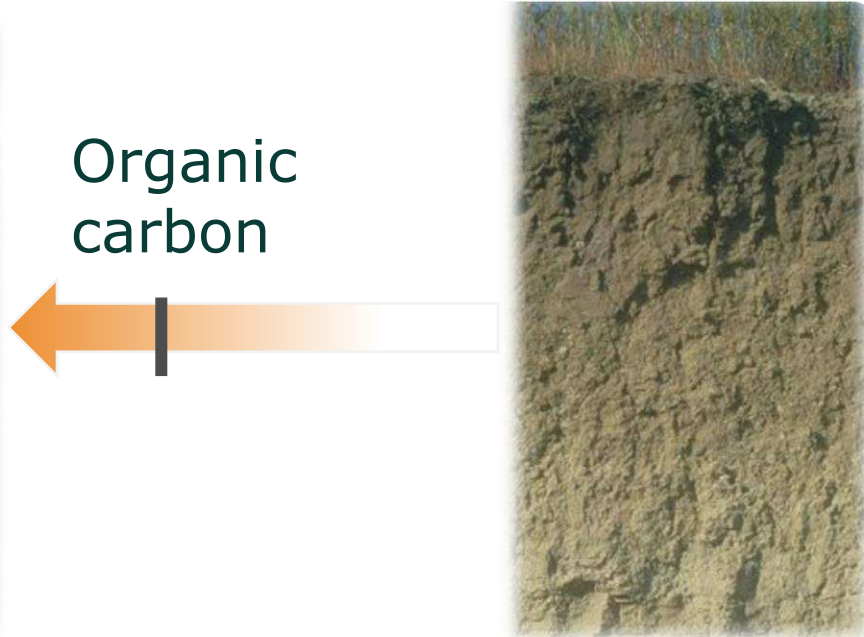
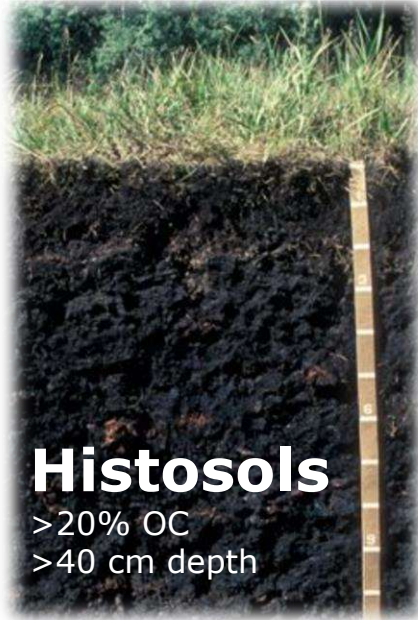


histosols





# What is an organic soil?



**What is an organic soil?**



**Is there a minimum depth?**



**Is an organic soil a peat?**

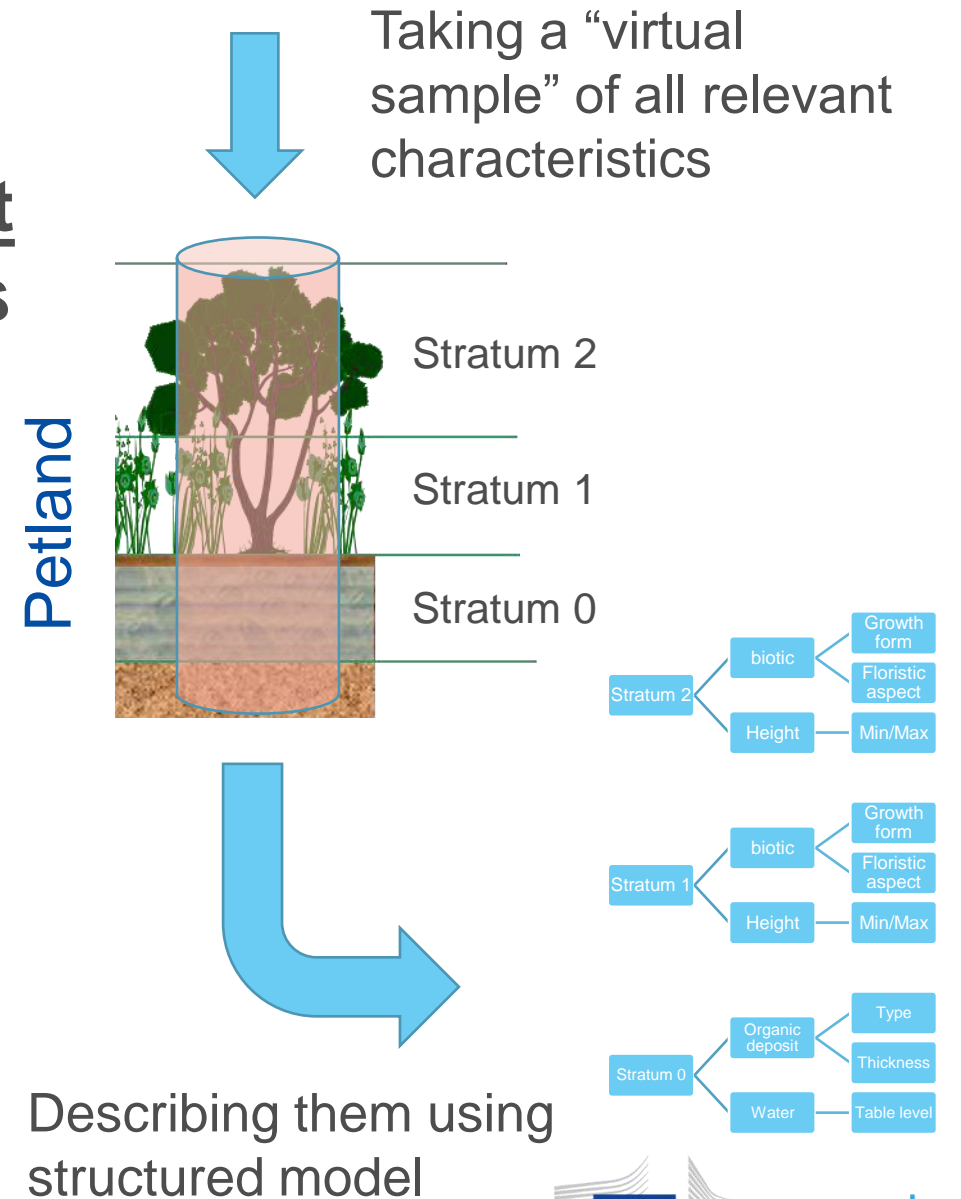


**Is a peat soil a wetland?**

# Semantic Meta-Model

No common definition, but a common set of classifiers to describe local definitions

- Based on broadly accepted bio-physical characteristics
- Hierarchically structured by semantic logic
- From LCML, EAGLE
- Allowing the link between land cover and soil
- Retaining the relationship with land use



# Semantic passport



Article  
**Enabling Spatial Data Interoperability through the Use of a Semantic Meta-Model—The Peatland Example from the JRC SEPLA Project**

Pavel Milenov <sup>1,\*</sup>, Aleksandra Sima <sup>2,+</sup>, Emanuele Lugato <sup>3</sup>, Wim Devos <sup>3</sup> and Philippe Loudjani <sup>3,\*</sup>

Map the local definition and create a semantic passport

N2K class 7.1.2 Peat bog semantic passport

Stratum 1	Vegetation	Growth form	Woody	Tree	
				Shrub	
				Leaf Type	Broadleaf
					Needleleaf
					Aphyllous
				Leaf Phenology	Deciduous
					Evergreen
					Reed
				Graminoid	
				Non-graminoid	
		Herbaceous	Annual	One life cycle	
			Biennial	Several life cycles	
			Perennial		
		Lichen and Mosses	Lichen		
			Mosses		
	Floristic aspect	Group of Plants			
		Single Plant			
		Species name			
	Height				
	Cover	Sparse			
		Open			
		Close			
	Presence	Fixed			
		Occasional			
Stratum 0	Organic Deposit	Type	Litter (O horizon - Folie)	Decomposition	Undecomposed L - Layer
					Partially decomposed F - Layer
				Fully decomposed H - Layer	
			Peat (H horizon - Histic)	Decomposition	Undecomposed
					Partially decomposed
					Fully decomposed
			Environment	Minerotrophic	
				Ombrotrophic	
			Position	On surface	
				Buried	
		Thickness			
		Swelling/Shrink	Yes		
			No		
		Acidity	Less acidic		
			Acidic		
		Organic carbon content			
		Texture	Sand		
			Silt		
			Clay		
		CN ratio			
		Colour			
		Salinity	Fresh		
			Brackish		
			Saline		
			Brine		
	Water	Water Table level	Max		
			Mean	0 meters	
			Min		
	Persistent Period	Number of months	6 months		
			Start month		
			End month		
	Hydrological connectivity	Impact on water level			
		No impact on water level			

**Copernicus N2K class 7.1.2 Peat bog definition**

7.1. Inland wetlands are predominantly **water-logged** specific **plant** and animal communities supporting water regulation and peat-related processes.

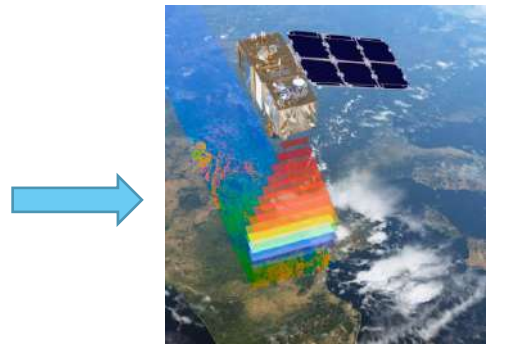
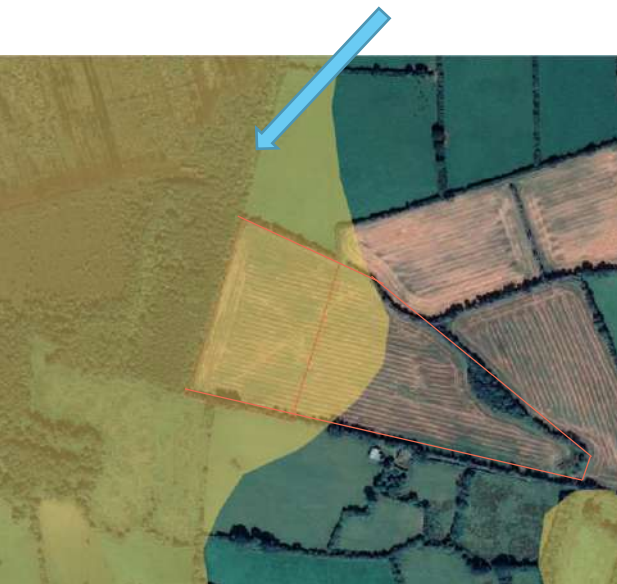
This class includes natural or modified **mires, bogs and fens**, as well as peat extraction sites. Surfaces of **temporary water** are included in wetlands. According EUNIS guidelines (see table below), water-logged means **the presence of the water table at or above ground level for at least half of the year.**

7.1.2 Peat bog

**Mosses, dwarf shrub vegetation** and herbaceous vegetation typical for hummock mires, lawn and carpet mires, mud-bottom mires

# Development of EO-AI based monitoring

A reference (sub)parcel is partially overlaid by organic (wet/dry) dataset



Earth Observation



Response of the vegetation (S1, S2, VPPI, LST, DEM)

Response of the soil (Ground Motion Service)



Visible properties of surface/soil (Segmentation)

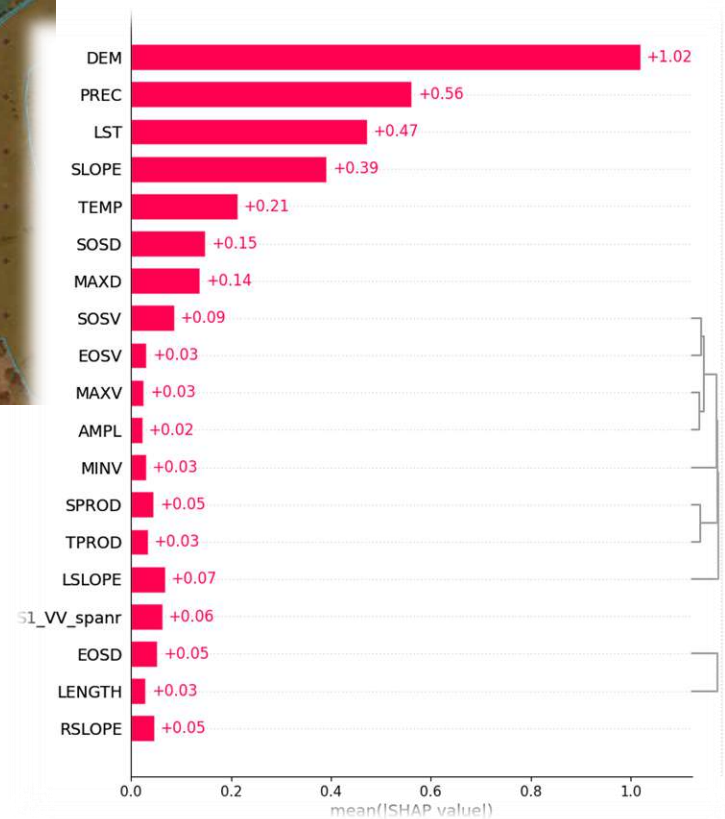
Training and testing different ML model in some test areas of Ireland

# Augmented mapping by AI



Virtual sampling (60 x 60 m grid)

Grassland GSA parcel (organic, mineral)



## Data extraction

- VPPI index (Copernicus Sentinel2)
- Terrain (DEM, SLOPE)
- MAT, MAP, LST
- Sentinel S1

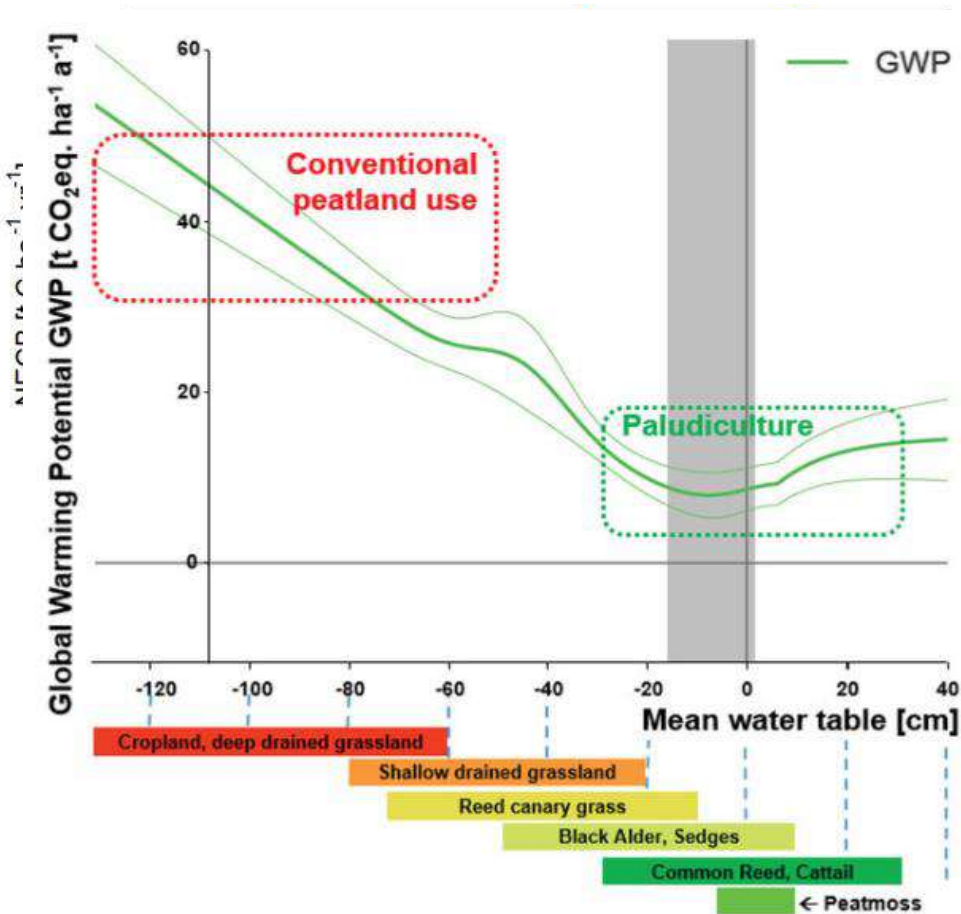


ML model

# Peatland rewetting

## The Power of Nature-Based Solutions: How Peatlands Can Help Us to Achieve Key EU Sustainability Objectives

Franziska Tanneberger ✉, Lea Appulo, Stefan Ewert, Sebastian Lakner, Niall Ó Brolcháin, Jan Peters, Wendelin Wichtmann



### Article

## Overriding water table control on managed peatland greenhouse gas emissions

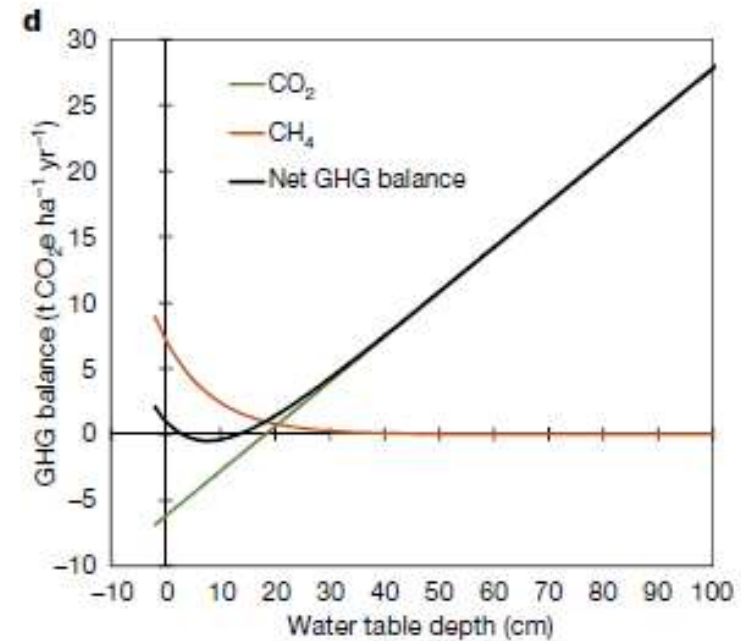
<https://doi.org/10.1038/s41586-021-03523-1>

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C. D. Evans<sup>1,2,3</sup>, M. Peacock<sup>2</sup>, A. J. Baird<sup>2</sup>, R. R. E. Artz<sup>4</sup>, A. Burden<sup>1</sup>, N. Callaghan<sup>1</sup>, P. J. Chapman<sup>2</sup>, H. M. Cooper<sup>2</sup>, M. Coyle<sup>4,5</sup>, E. Craig<sup>1,2</sup>, A. Cumming<sup>2</sup>, S. Dixon<sup>2</sup>, V. Gauci<sup>2</sup>, R. P. Grayson<sup>2</sup>, C. Helfter<sup>1</sup>, C. M. Heppell<sup>10</sup>, J. Holden<sup>3</sup>, D. L. Jones<sup>2,12</sup>, J. Kaduk<sup>13</sup>, P. Levy<sup>4</sup>, R. Matthews<sup>4</sup>, N. P. McNamara<sup>2</sup>, T. Misselbrook<sup>14</sup>, S. Oakley<sup>15</sup>, S. E. Page<sup>13</sup>, M. Rayment<sup>1</sup>, L. M. Ridley<sup>1</sup>, K. M. Stanley<sup>16</sup>, J. L. Williamson<sup>1</sup>, F. Worrall<sup>1</sup> & R. Morrison<sup>2</sup>



# Conclusion and way forward

- More integration of policies to protect/restore peatlands
- Improved mapping and monitoring (ecosystems degraded)
- Importance of local knowledge
- Promising approach of AI
- Incentives (Carbon Farming) to promote effective actions (rewetting)

# Thank you



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