

Remote Sensing studies in Latvian project sites



Institute for
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Project Scientific Group Meeting

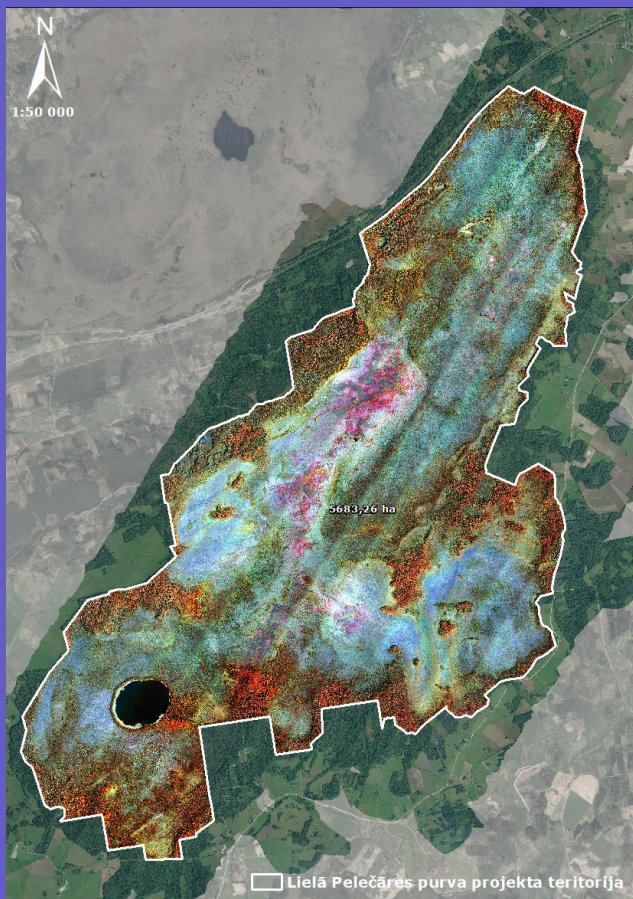
16.04.2025.

University of Latvia, Riga

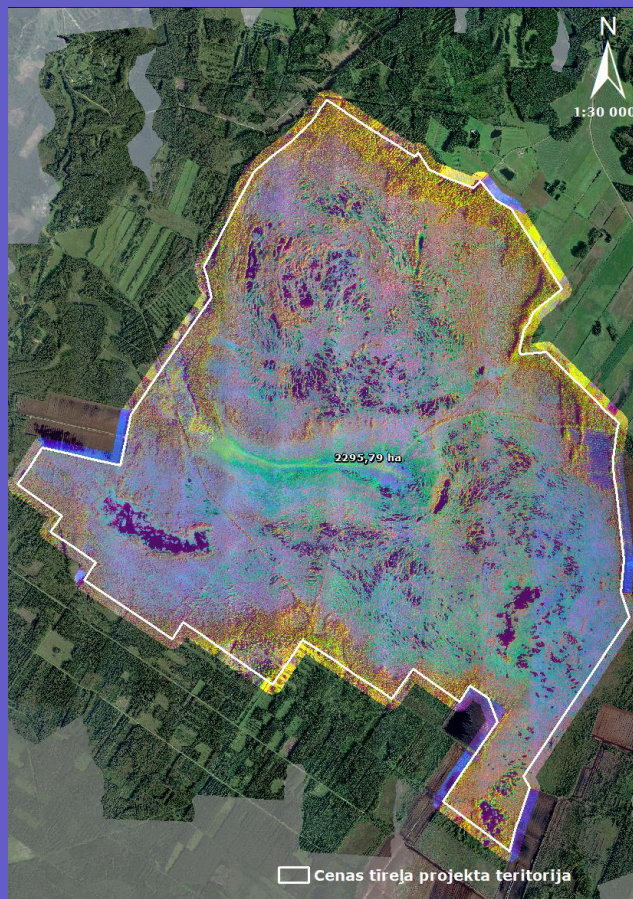
101074396 - LIFE21-CCM-LV-LIFE PeatCarbon

Project sites and remote sensing data

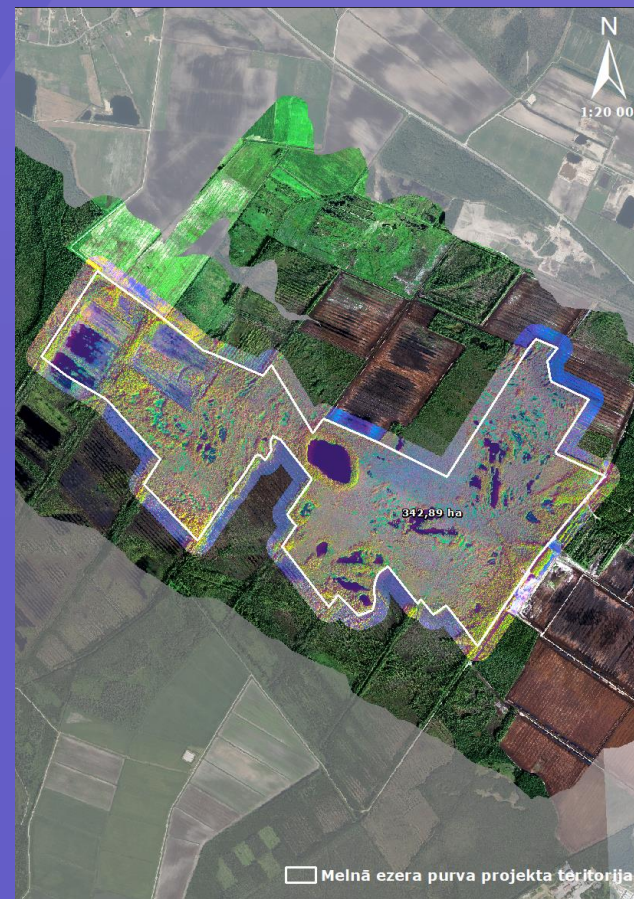
Collected airborne hyperspectral data over 3 project sites in Latvia



Infrared image of Lielais Pelēčāres Mire
RS data collected 16.08.2023.



Principal component analysis image of Cena
Mire. RS data collected 16.09.2023.



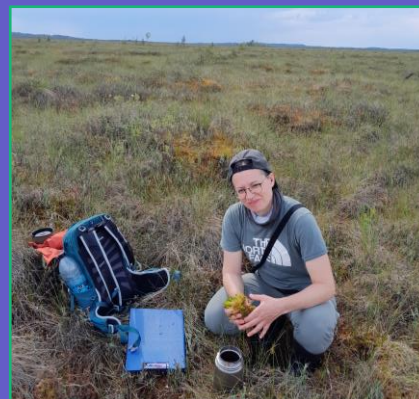
Principal component analysis image of Melnais
ezers Mire. RS data collected 16.09.2023.

Reference data gathering



Lielais Pelēčare Mire

Project sites	Dates of data gathering
Cena Mire	17., 19.10.2023
Melnais Lake Mire	02.11.2023
Lielais Pelečāre Mire	21.-22., 30.-31.05.2024
Sudas-Zviedru Mire	Planned in 2025



Team of reference data gatherers – Līga Strazdiņa (UL), Rūta Abaja-Felce (IES)

Reference data gathering



GEST type: Moist bog heath



GEST type: Wet meadows and forbs



GEST type: Wet peat moss lawn



GEST type: Moderately moist forsts and shrubberies



GEST type: Bare peat wet



GEST type: Moist forsts and shrubberies (OL)

GEST types and GHG emission factors



	GEST klase	Project sites in Latvia				Data without considering wood biomass				Data including wood biomass			
		Cenas Mire	Melnais Lake Mire	Lielais Pelēčāre Mire	Sudas-Zviedru Mire	Water level	CO ₂	CH ₄	GWP	Water level	CO ₂	CH ₄	GWP
1	Moist forests and shrubberies (OL)	X	X		X	3+	9.4	0	9.4	3+	-2.2	-1.8	-4
2	Moderately moist/dry bog heath	X				2+/2-	nd	nd	nd	2+/2-	nd	nd	nd
3	Moist bog heath	X				3+	9.4	0	9.4	3+	9.4	0	9.4
4	Dry forest and shrubberies (OL)	X	X			2-/3-	26	0	26	2-/3-	nd	nd	nd
5	Wet meadows and forbs	X	X			5+	0	5.8	5.8	5+	0	5.8	5.8
6	Moderately moist forest and shrubberies (OL)	X	X		X	2+	20	0	20	2+	-3.1	-0.11	-3.22
7	Open water/ditches	X			X	6+	nd	2.8	nd	6+	nd	2.8	nd
8	Wet peat moss hollows resp. flooded peat moss lawn	X	X		X	5+	-3.1	12	8.9	5+	-3.1	12	8.9
9	Wet peat moss lawn	X	X		X	5+	-0.5	0.3	-0.3	5+	-0.5	0.3	-0.3
10	Bare peat wet	X	X			4+	1.5	0.1	1.6	4+	1.5	0.1	1.6
11	Peat moss lawn on former peat-cut off areas	X	X			5+	1.5	0.4	1.9	5+	1.5	0.4	1.9
12	Very moist peat moss lawn	X	X			4+	-1.1	3.4	2.3	4+	-1.1	3.4	2.3
13	Wet peat moss lawn with pine trees	X	X			4+	3.9	0.2	4.1	4+	nd	nd	nd
14	Moderately moist (forb) meadows		X			2+	20	0	20	2+	20	0	20
15	Bare peat moist (OL)		X			3+	6.2	0	6.2	3+	6.2	0	6.2
16	Dry forests and shrubberies (ME/EU)		X			2-/3-	43.4	0	43.4	2-/3-	nd	nd	nd
17	Very moist bog heath		X			4+	1.7	3	4.6	4+	1.7	3	4.6
18	Bare peat dry (OL)		X			2-/3-	7	0.4	7.5	2-/3-	7	0.4	7.5
19	Wet tall reeds		X			5+	-2.3	6.3	4	5+	-2.3	6.3	4
20	Very moist meadows, forbs and small sedges reeds				X	4+	-0.5	2.3	1.9	4+	-0.5	2.3	1.9

GHG values (t CO₂ eq./ha/year) taken from literature: Jarašius L. et al. 2022. Handbook for assessment of greenhouse gas emissions from peatlands. Application of direct and indirect methods by LIFE Peat Restore. Lithuanian Fund for Nature, Vilnius, 201 p.

GEST type reference – Melnais Lake Mire

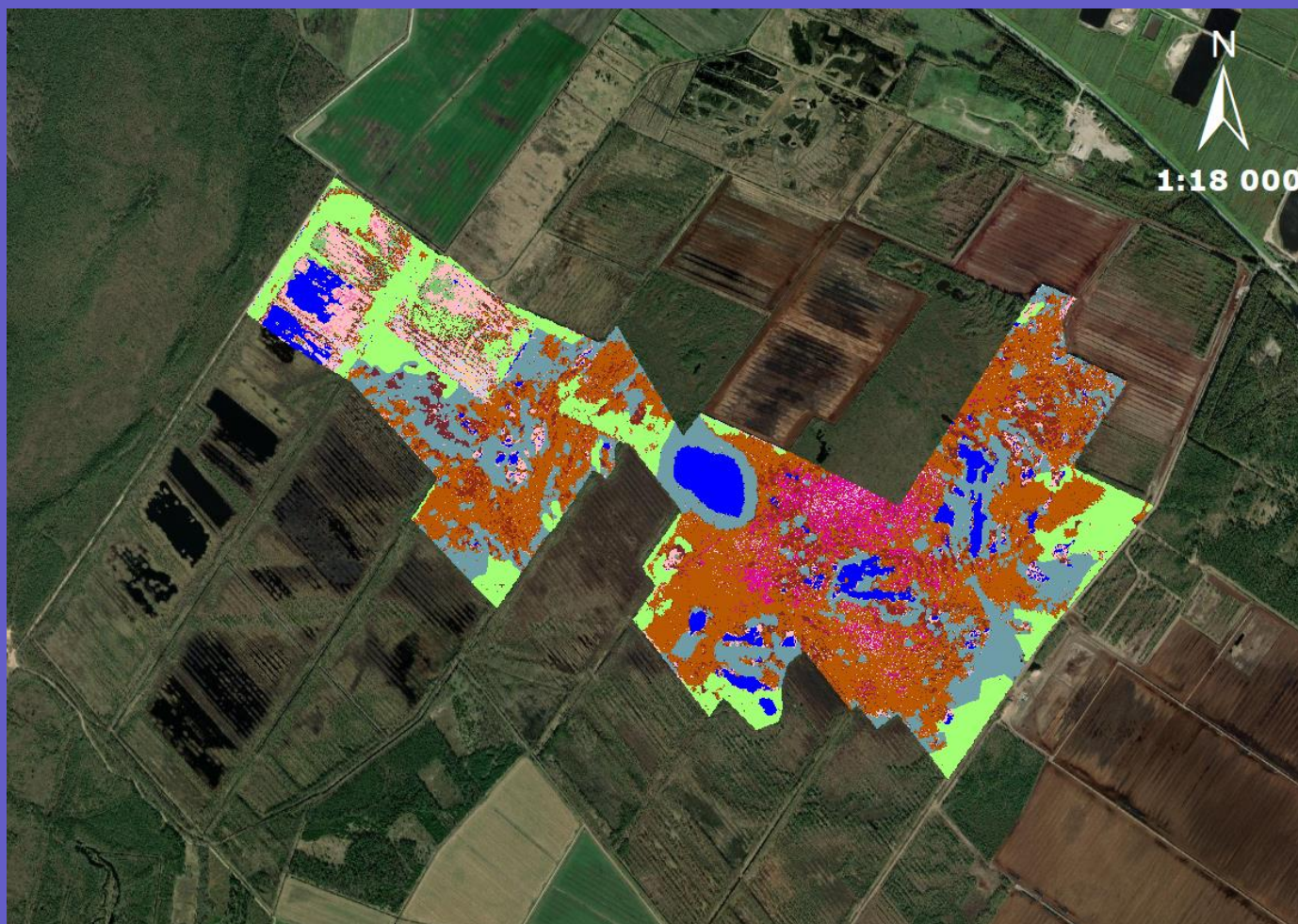
Collected reference data for supervised classification
















- 1, Very moist bog heath
- 2, Wet peat moss lawn with pine trees
- 3, Bare peat wet
- 4, Bare peat
- 5, Bare peat moist (OL)
- 6, Wet tall reeds
- 7, Very moist peat moss lawn_1
- 8, Very moist peat moss lawn_2
- 9, Very moist peat moss lawn_3
- 10, Wet peat moss lawn_1
- 11, Wet peat moss lawn_2
- 12, Wet meadows and forbs_1
- 13, Wet meadows and forbs_2
- 14, Wet meadows and forbs_3
- 15, Wet meadows and forbs_4
- 16, Wet meadows and forbs_5
- 17, Wet meadows and forbs_6
- 18, Wet meadows and forbs_7
- 19, Moderately moist (forb) meadows
- 20, Trees
- 21, Trees_2

GEST type mapping – Melnais Lake Mire

Supervised classification (SVM)

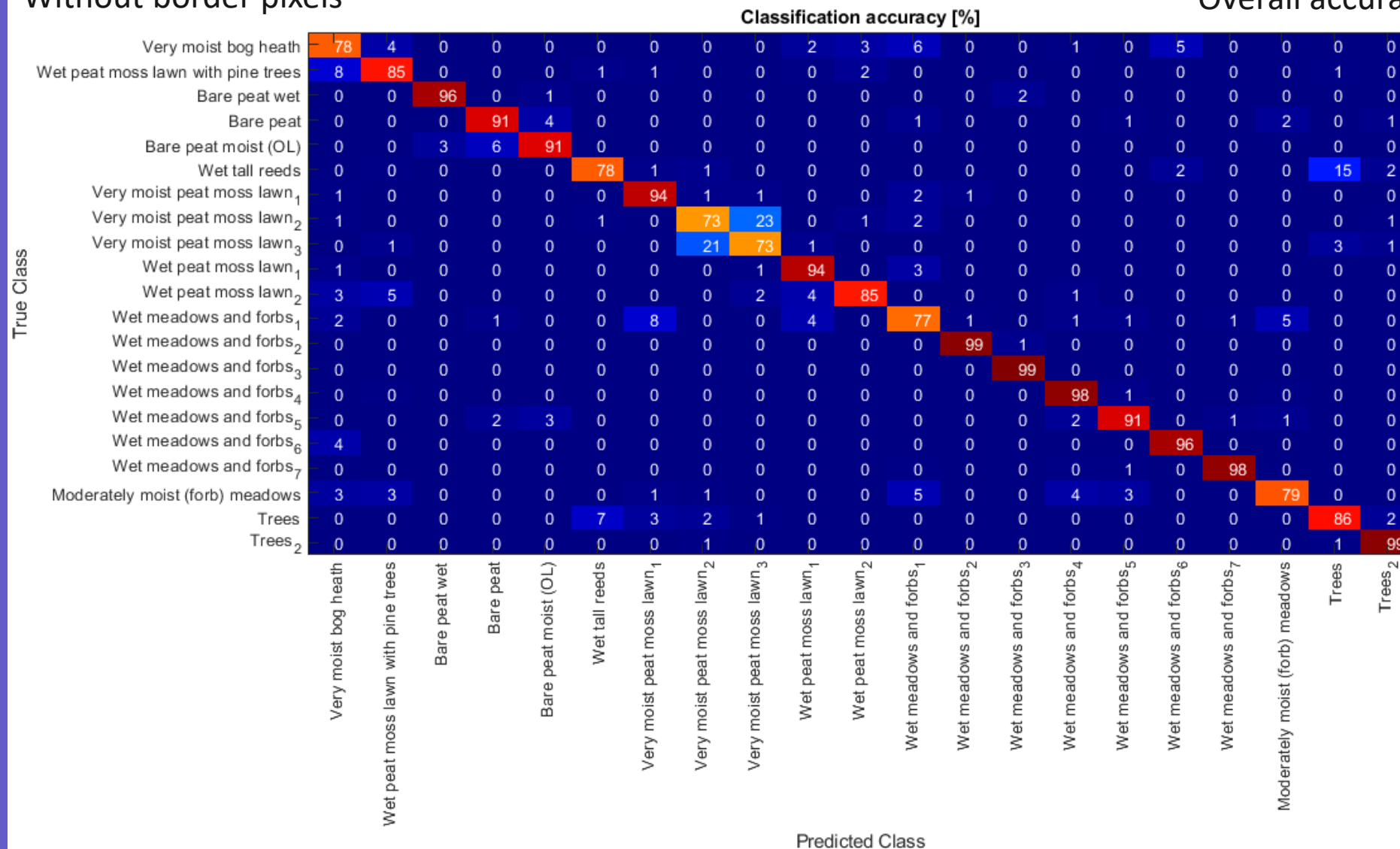


-  Very moist bog heath
-  Wet peat moss lawn with pine trees
-  Bare peat wet
-  Bare peat
-  Bare peat moist (OL)
-  Wet tall reeds
-  Very moist peat moss lawn
-  Wet peat moss lawn
-  Wet meadows and forbs
-  Moderately moist (forb) meadows
-  Moist forests and shrubberies (OL)
-  Moderately moist forests and shrubberies (OL)
-  Open water

GEST type mapping accuracy – Melnais Lake Mire

Without border pixels

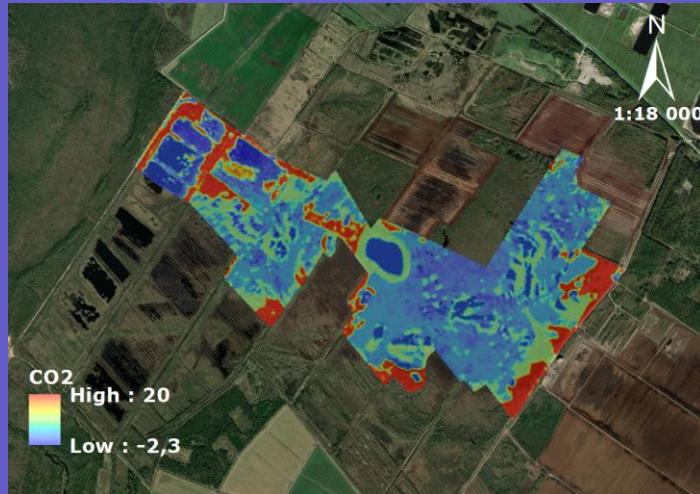
Overall accuracy = 88%



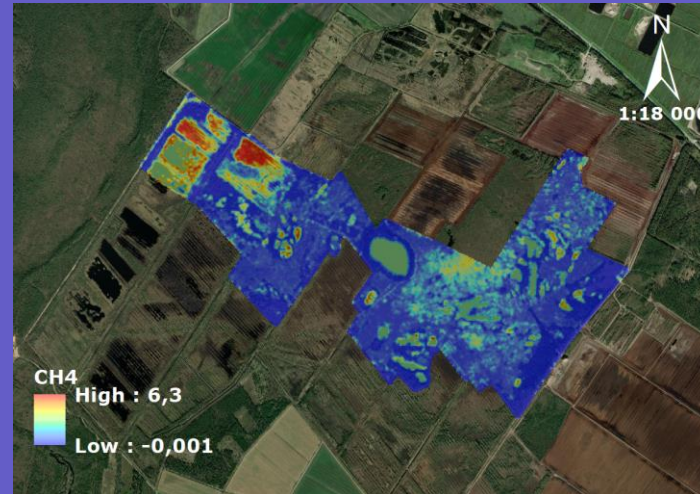
GHG emission mapping – Melnais Lake Mire

GHG emission maps based on GEST methodology

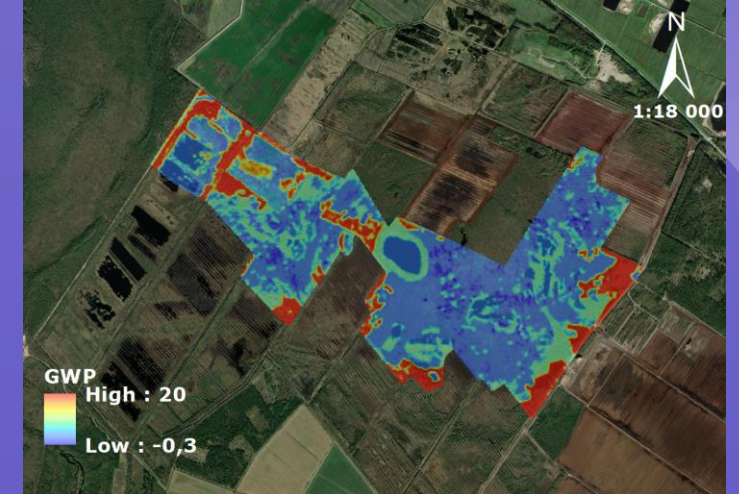
Without wood biomass



CO2 emission image (t CO₂ eq./ha/year)

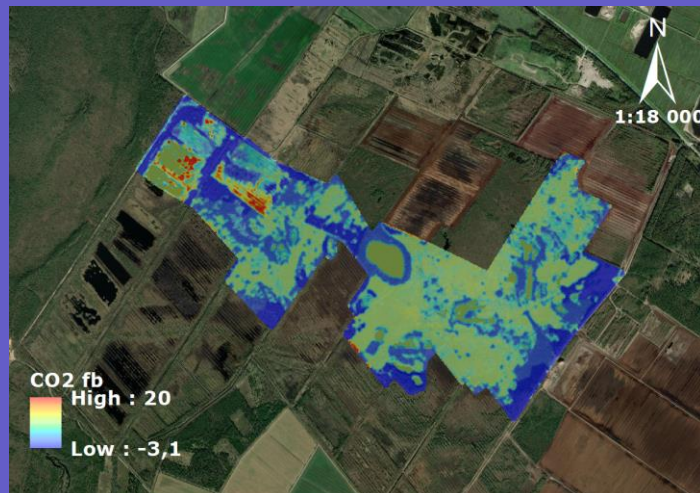


CH4 emission image (t CO₂ eq./ha/year)

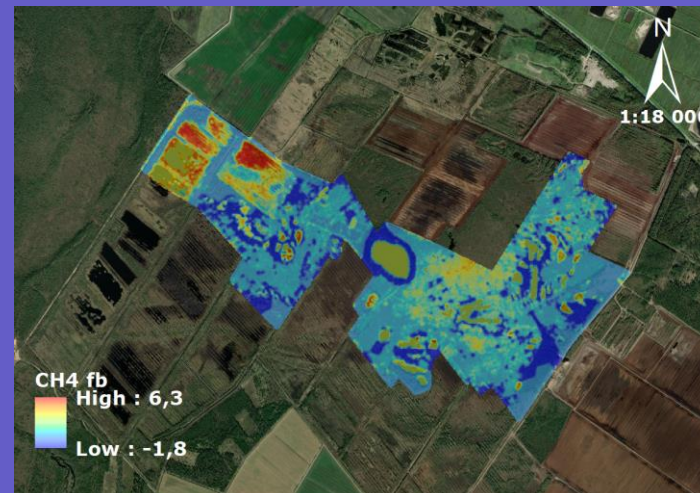


GWP emission image (t CO₂ eq./ha/year)

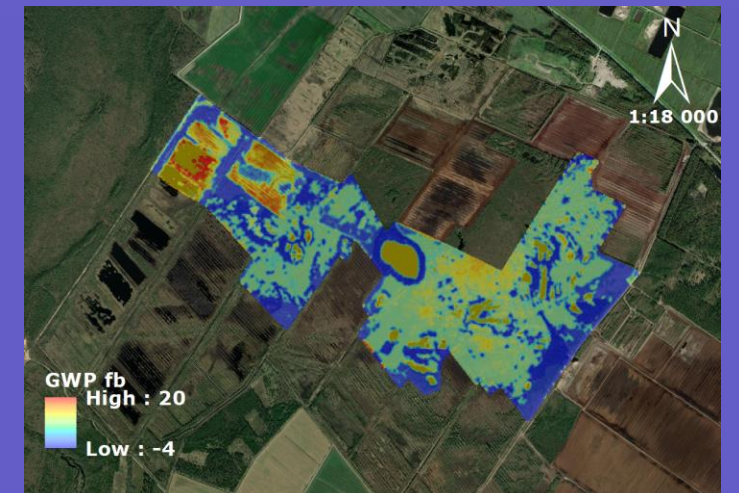
With wood biomass



CO2 emission image (t CO₂ eq./ha/year)

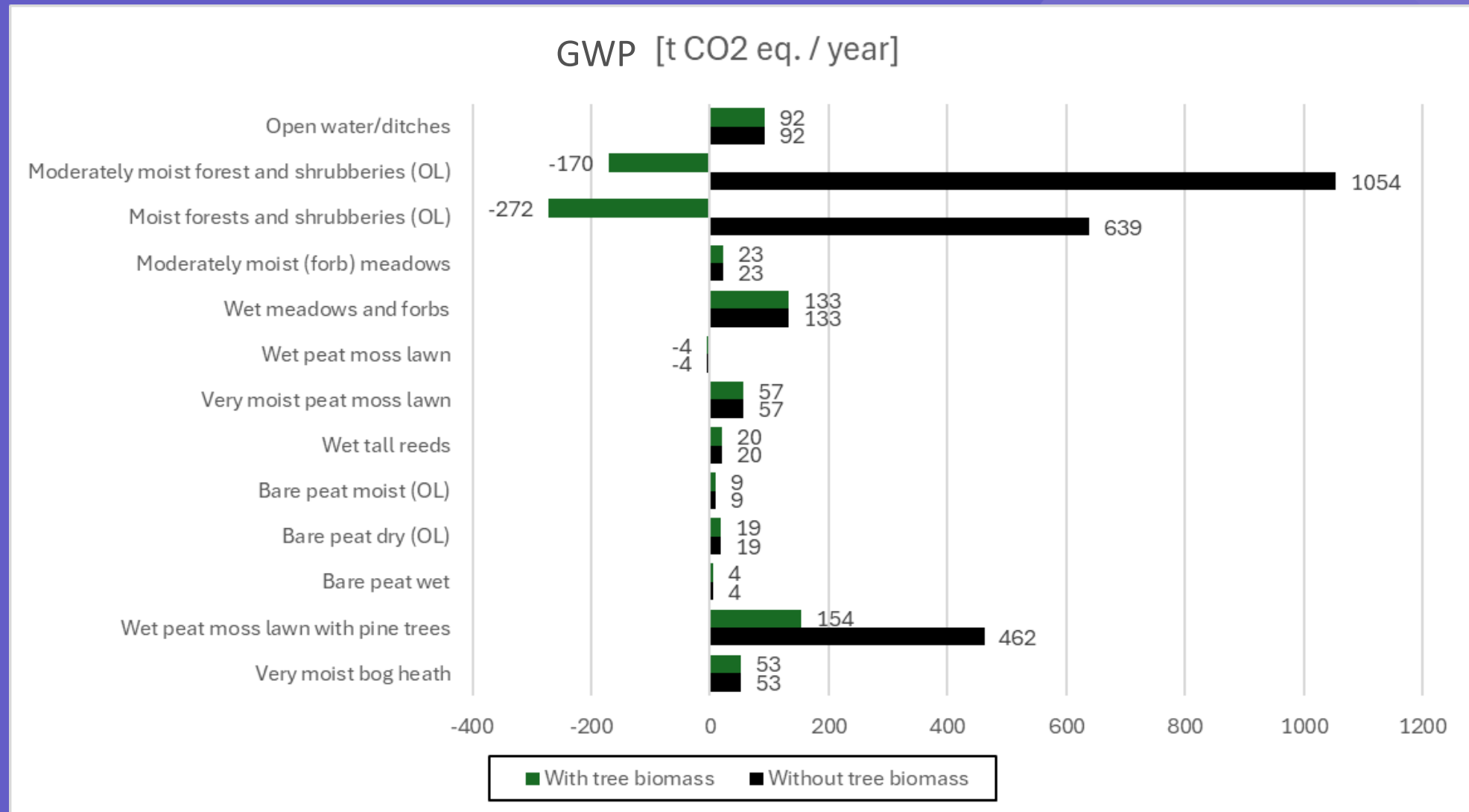


CH4 emission image (t CO₂ eq./ha/year)



GWP emission image (t CO₂ eq./ha/year)

GHG emission budget assessment – Melnais Lake Mire



Total GWP: with tree biomass 119 t CO₂ eq. / year | without tree biomass 2562 t CO₂ eq. / year

RS data for ecosystem modelling - PFT

- **PFT** = plant functional types - data format how information of plant species cover linked with GHG values in ecosystem modelling according the species impact on GHG flux
- **GEST** = method of vegetation association classification linked with particular GHG values, used for indirect GHG flux assesment of peatland ecosystems
- The task required GEST data conversion into PFT data of LV project sites for the data usage into ecosystem modelling
- Collected reference data (only from field studies organised in the project) for GEST classification were grouped per each GEST type, normalised and expressed their average PFT values per each GEST type

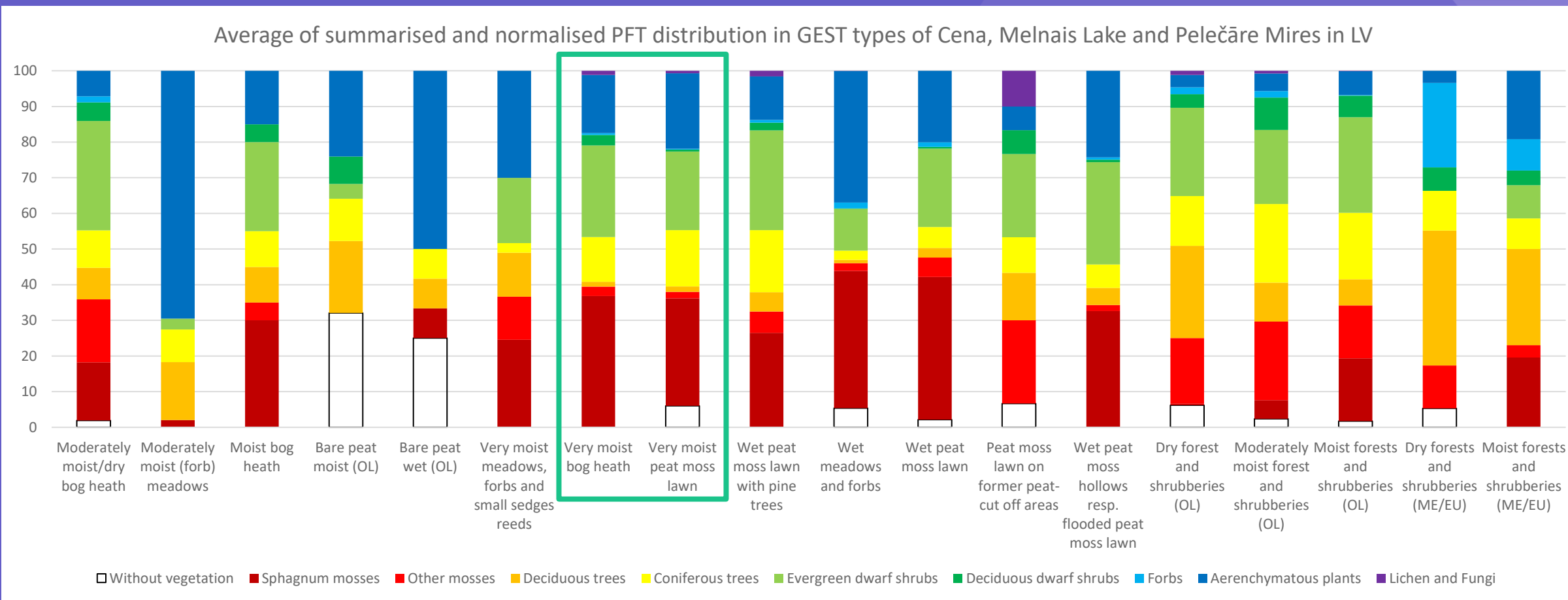
RS data for ecosystem modelling - PFT



GEST type	Mire	Number of reference data samples	Without vegetation	Sphagnum mosses	Other mosses	Deciduous trees	Coniferous trees	Evergreen dwarf shrubs	Deciduous dwarf shrubs	Forbs	Aerenchymatous plants	Lichen and Fungi
Moderately moist/dry bog heath	Cena	2	2	16	18	9	11	31	5	2	7	0
Moderately moist (forb) meadows	Melnais Lake	3	0	2	0	16	9	3	0	0	70	0
Moist bog heath	Cena	1	0	30	5	10	10	25	5	0	15	0
Bare peat moist (OL)	Melnais Lake	2	32	0	0	20	12	4	8	0	24	0
Bare peat wet (OL)	Melnais Lake	1	25	8	0	8	8	0	0	0	50	0
Very moist meadows, forbs and small sedges reeds	Pelečāre	5	0	25	12	12	3	18	0	0	30	0
Very moist bog heath	Melnais Lake	2	0	40	0	0	14	26	3	0	17	0
	Pelečāre	15	0	33	5	3	11	26	3	1	15	2
Very moist peat moss lawn	Cena	1	6	28	0	0	28	22	0	0	17	0
	Melnais Lake	2	13	30	0	3	10	18	0	0	28	0
	Pelečāre	10	0	33	5	2	10	26	1	1	19	2
Wet peat moss lawn with pine trees	Cena	2	0	28	4	6	19	29	1	1	11	0
	Melnais Lake	2	0	26	6	4	18	28	0	1	14	4
	Pelečāre	19	0	26	8	6	15	27	5	0	12	1
Wet meadows and forbs	Cena	4	10	35	2	1	1	16	0	0	34	0
	Melnais Lake	1	6	47	0	0	0	0	0	0	47	0
	Pelečāre	13	0	33	4	2	6	20	0	5	29	0
Wet peat moss lawn	Cena	2	6	34	9	6	6	19	0	0	19	0
	Melnais Lake	3	0	53	2	0	6	21	0	0	18	0
	Pelečāre	12	0	33	6	2	5	25	1	4	23	0
Peat moss lawn on former peat-cut off areas	Melnais Lake	1	7	0	23	13	10	23	7	0	7	10
Wet peat moss hollows resp. flooded peat moss lawn	Cena	2	0	31	3	8	5	40	0	0	13	0
	Pelečāre	7	0	34	1	2	8	17	1	1	35	0
Dry forest and shrubberies (OL)	Cena	1	0	0	15	38	0	46	0	0	0	0
	Melnais Lake	1	19	0	16	23	19	7	5	0	9	2
	Pelečāre	2	0	1	24	16	23	21	7	6	1	1
Moderately moist forest and shrubberies (OL)	Cena	2	0	9	26	5	24	19	8	2	7	0
	Melnais Lake	3	7	0	16	17	19	27	4	4	5	1
	Pelečāre	8	0	7	24	11	23	16	15	0	3	1
Moist forests and shrubberies (OL)	Cena	5	0	25	11	7	17	32	0	0	8	0
	Melnais Lake	4	5	8	21	7	20	28	6	0	4	0
	Pelečāre	10	0	20	12	8	19	20	12	1	7	0
Dry forests and shrubberies (ME/EU)	Melnais Lake	2	11	0	17	35	12	0	10	15	0	0
	Pelečāre	2	0	0	7	40	10	0	4	32	7	0
Moist forests and shrubberies (ME/EU)	Pelečāre	4	0	20	3	27	9	9	4	9	19	0

Sudas-Zviedru Mire do not have the reference data yet. The same work for the mire will be done in autumn this year.

RS data for ecosystem modelling - PFT



The data later will be supplemented with data of Sudas-Zviedru Mire

Satellite data products for improvement of national GHG inventories

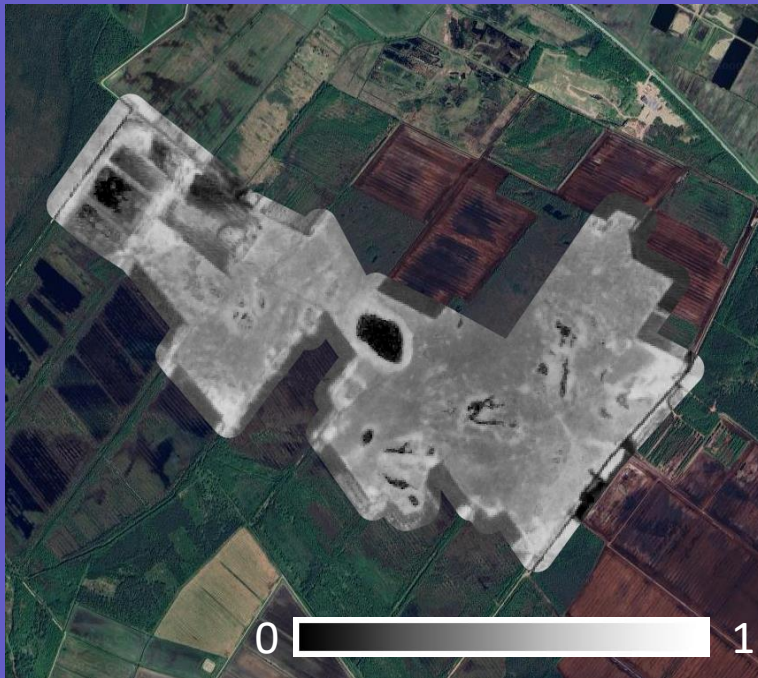


1. product: Map of vegetation intensity
2. product: Map of vegetation functional types
3. product: Mapping the extent of burned areas
4. product: soil temperature maps (feasibility study)
5. product: Soil moisture/underground water level maps (feasibility study)

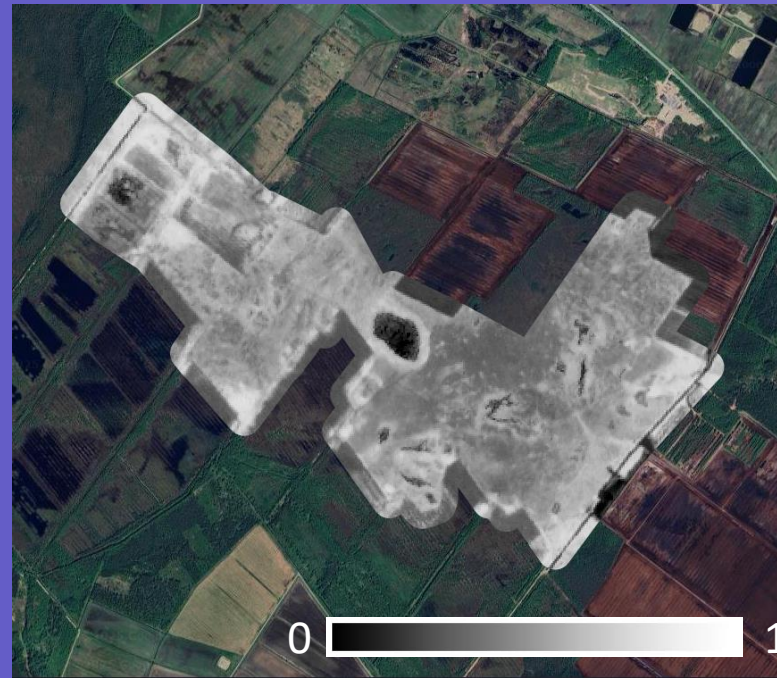
Satellite data products for improvement of national GHG inventories

1. product: Map of vegetation intensity

NDVI dynamics over different seasons in 2023



NDVI for Spring



NDVI for Summer



NDVI for Autumn

Testing results of Sentinel-2 data capabilities for **Melnais Lake Mire**

Satellite data products for improvement of national GHG inventories

1. product: Map of vegetation intensity

NDVI dynamic over different seasons

An RGB representation of seasonal NDVI observations

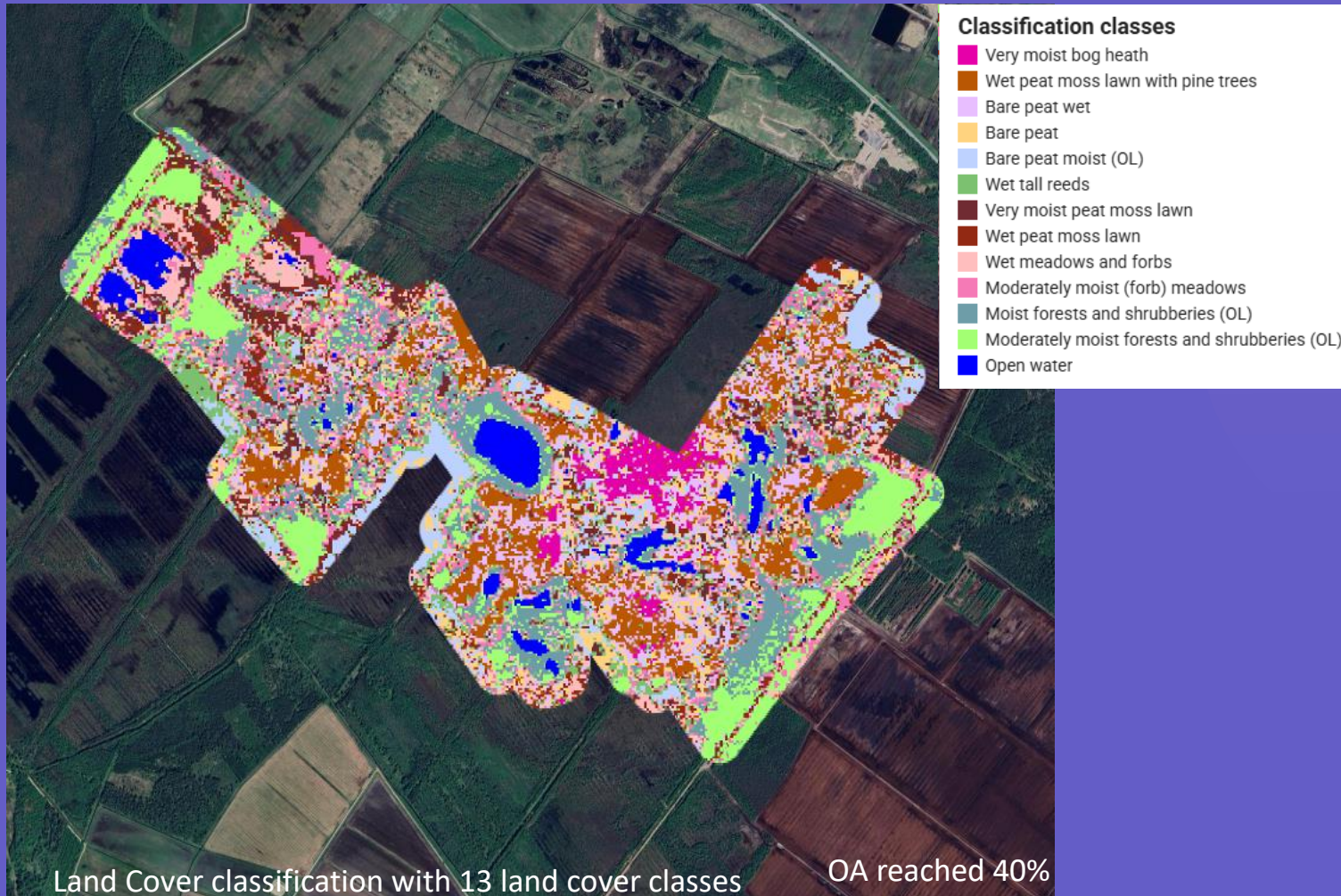
Red – Summer
Green – Spring
Blue - Autumn



Testing results of Sentinel-2 data capabilities for **Melnais Lake Mire**

Satellite data products for improvement of national GHG inventories

2. product: Map of vegetation functional types



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