PeatRus project

Restoring Peatlands in Russia - for fire prevention and climate change mitigation

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

Wetlands INTERNATIONAL

KFW

Russian Academy of Sciences
INSTITUTE OF FOREST SCIENCE

Succow Stiftung

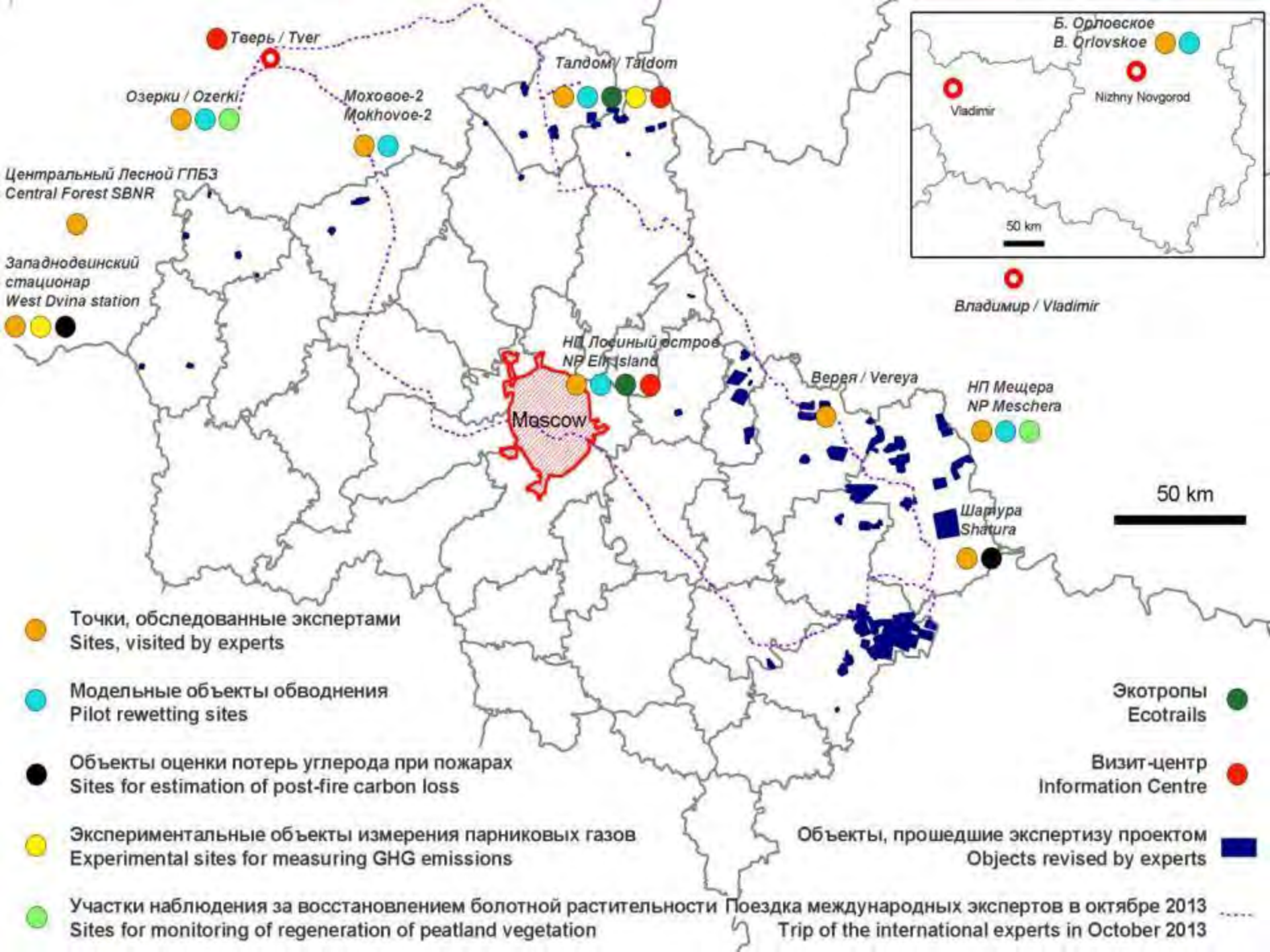
ERNST MORITZ ARNDT
UNIVERSITÄT GREIFSWALD

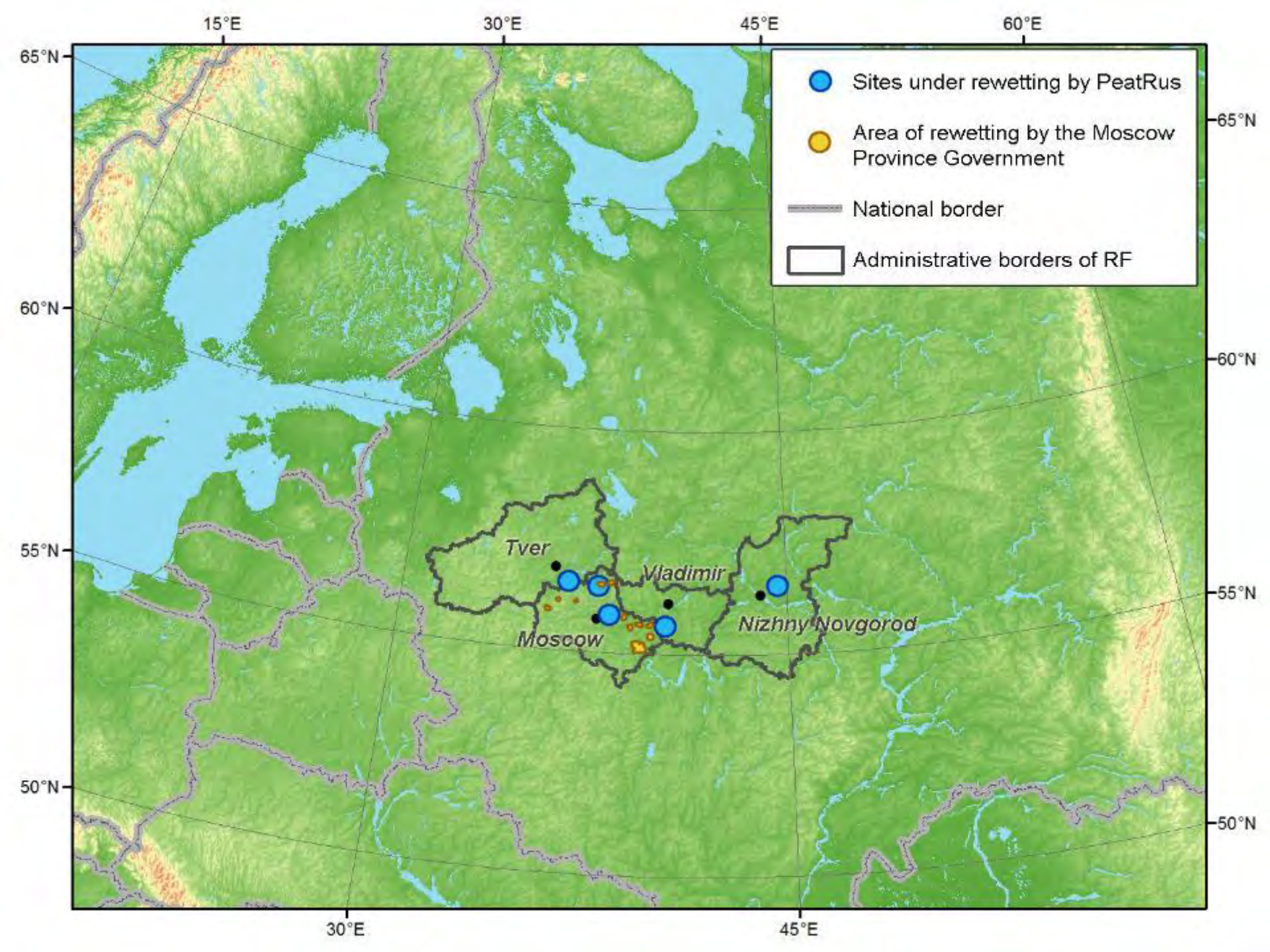
Wissen lockt. Seit 1456

Forest-peat fires 2010

9 August, 2010

MOSCOW

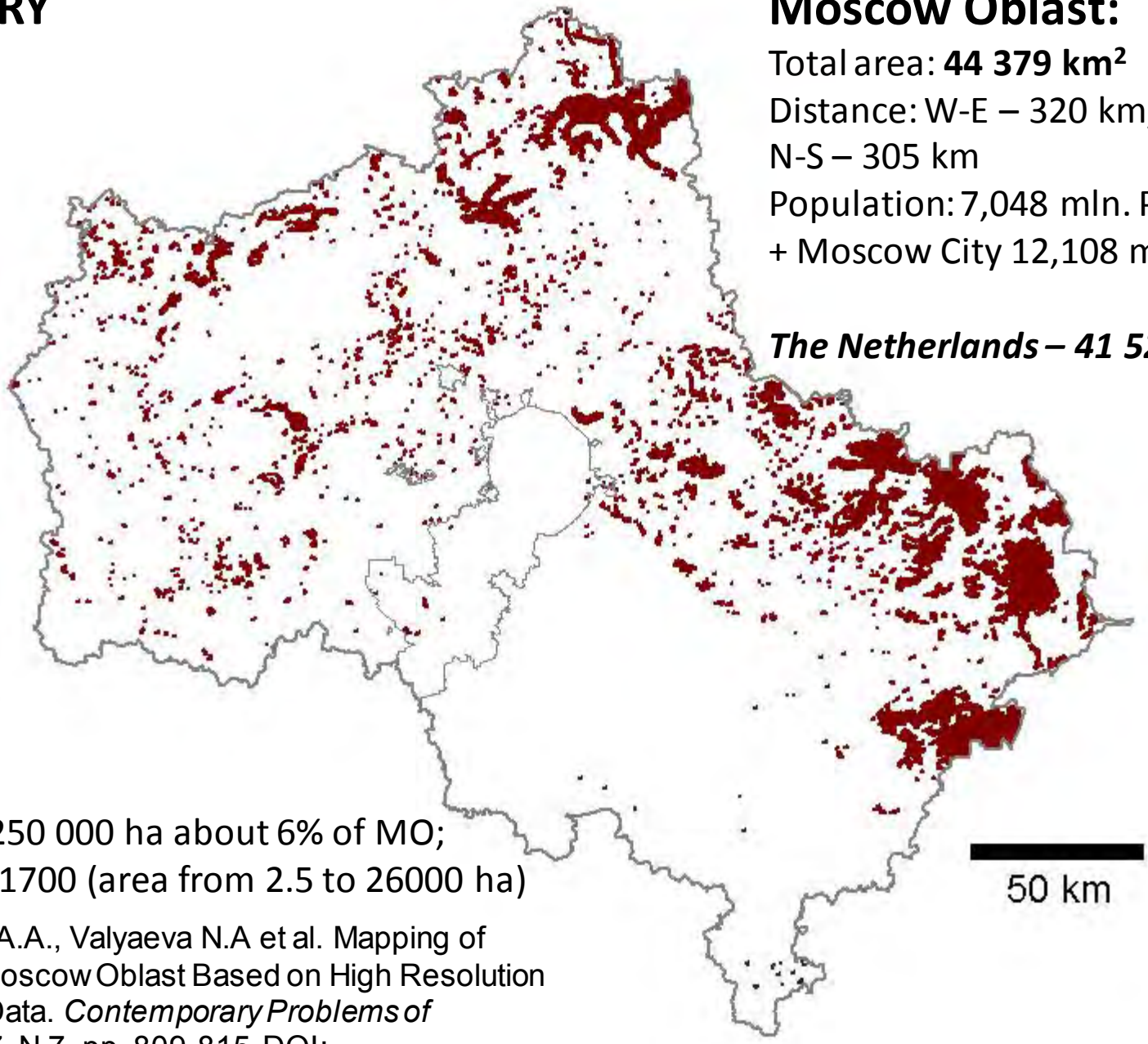

Тверь / Tver
Озерки / Ozerki
Моховое-2
Mokhovoe-2
Талдом / Taldom
Центральный Лесной ГПБЗ
Central Forest SBNR
Западнодвинский
стационар
West Dvina station
НП Лосиный остров
NP Elk Island
Moscow
Верея / Vereya
НП Мещера
NP Meschera
Шатура
Shatura
Б. Орловское
B. Orlovskoe
Vladimir
Nizhny Novgorod
50 km
Владимир / Vladimir
50 km
Точки, обследованные экспертами
Sites, visited by experts
Модельные объекты обводнения
Pilot rewetting sites
Объекты оценки потерь углерода при пожарах
Sites for estimation of post-fire carbon loss
Экспериментальные объекты измерения парниковых газов
Experimental sites for measuring GHG emissions
Участки наблюдения за восстановлением болотной растительности
Sites for monitoring of regeneration of peatland vegetation
Экотропы
Ecotrails
Визит-центр
Information Centre
Объекты, прошедшие экспертизу проектом
Objects revised by experts
Поездка международных экспертов в октябре 2013
Trip of the international experts in October 2013


15°E
30°E
45°E
60°E
65°N
60°N
55°N
50°N
Sites under rewetting by PeatRus
Area of rewetting by the Moscow Province Government
National border
Administrative borders of RF
Tver
Vladimir
Moscow
Nizhny Novgorod

Gaps

- Inventory of peatlands
- Satellite image processing
- GHG emissions – fractal local data
- Mapping fires – calculating carbon losses

INVENTORY



Moscow Oblast:

Total area: **44 379 km²**
Distance: W-E – 320 km,
N-S – 305 km
Population: 7,048 mln. People
+ Moscow City 12,108 mln.

The Netherlands – 41 526 km²

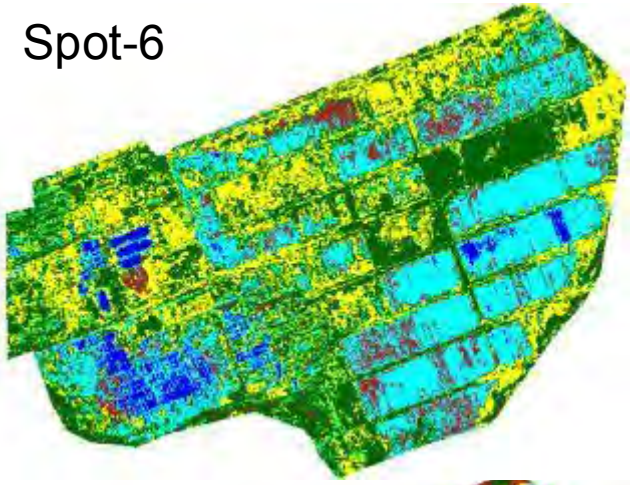
Peatland area: 250 000 ha about 6% of MO;
Total number > 1700 (area from 2.5 to 26000 ha)

Sirin A.A., Maslov A.A., Valyaeva N.A et al. Mapping of Peatlands in the Moscow Oblast Based on High Resolution Remote Sensing Data. *Contemporary Problems of Ecology*. 2014. V.7. N.7. pp. 809-815. DOI: 10.1134/S1995425514070117.

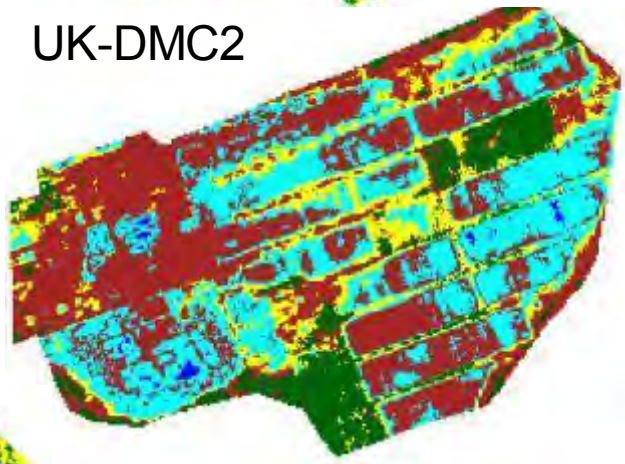
PROCESSING SATELLITE IMAGES

Sensor	Landsat-7	UK-DMC2	Spot-5	Spot-6
Pixel, m	30	22	10	6
Channels	Wave Length, µm			
Blue	0.45–0.52			0.45–0.52
Green	0.53–0.61	0.52–0.60	0.50–0.59	0.53–0.59
Red	0.63–0.69	0.63–0.69	0.61–0.68	0.63–0.70
NIR	0.75–0.90	0.77–0.89	0.78–0.89	0.76–0.89
SWIR	1.55–1.75		1.58–1.75	
SWIR2	2.09–2.35			
Date	11.08.2013	14.08.2013	13.09.2013	13.09.2013

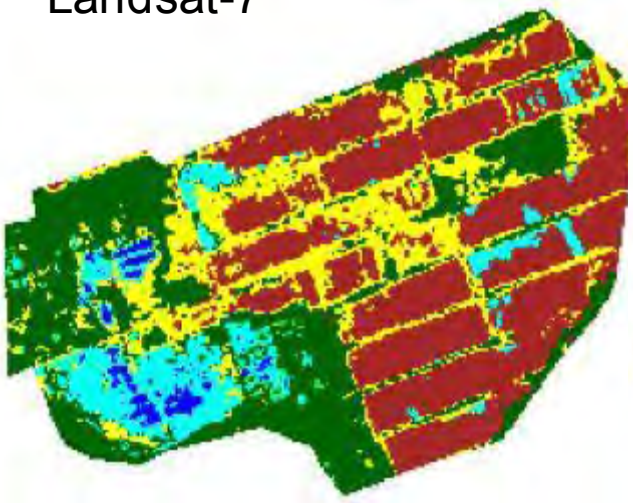
Spot-6



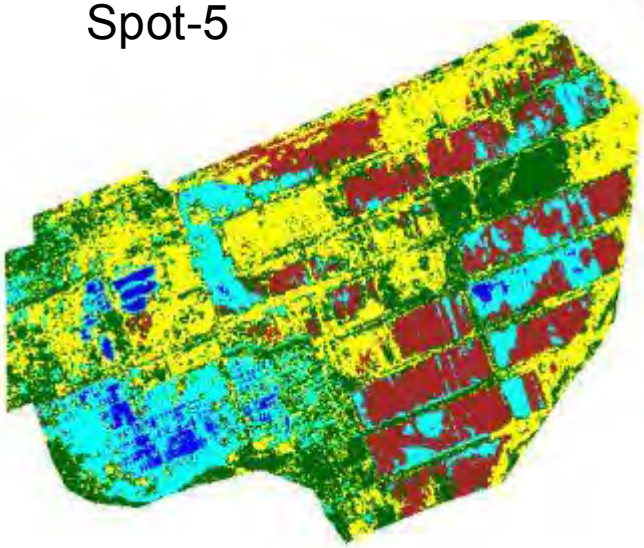
UK-DMC2



Landsat-7



Spot-5



Brown – bare peat; **yellow** – dry grass communities; **light-green** – pine (coniferous) forest vegetation; **green** – deciduous forest vegetation; **blue-green** – hydrophilic vegetation; **blue** – open water.

Methodology

- Classification of land cover classes by **remote sensing**:
  1. Bare peat
  2. Sparse willow-herb, reed and birch-reed communities
  3. Communities dominated by pine
  4. Communities with willow and birch
  5. Hydrophilic communities with cat-tail, tall sedges and reed
  6. Open/sparsely vegetated water surfaces
  7. Recently burned peat

- **Emission factors**: IPCC (2014) default values, literature and field observation data were applied to estimate emissions

Fire-hazardous land/vegetation classes

1. Bare peat

2. Willow herb, small reed and birch-small reed communities

Medium fire-hazardous land/vegetation classes

3. Communities with pine

4. Communities dominated by willow and birch

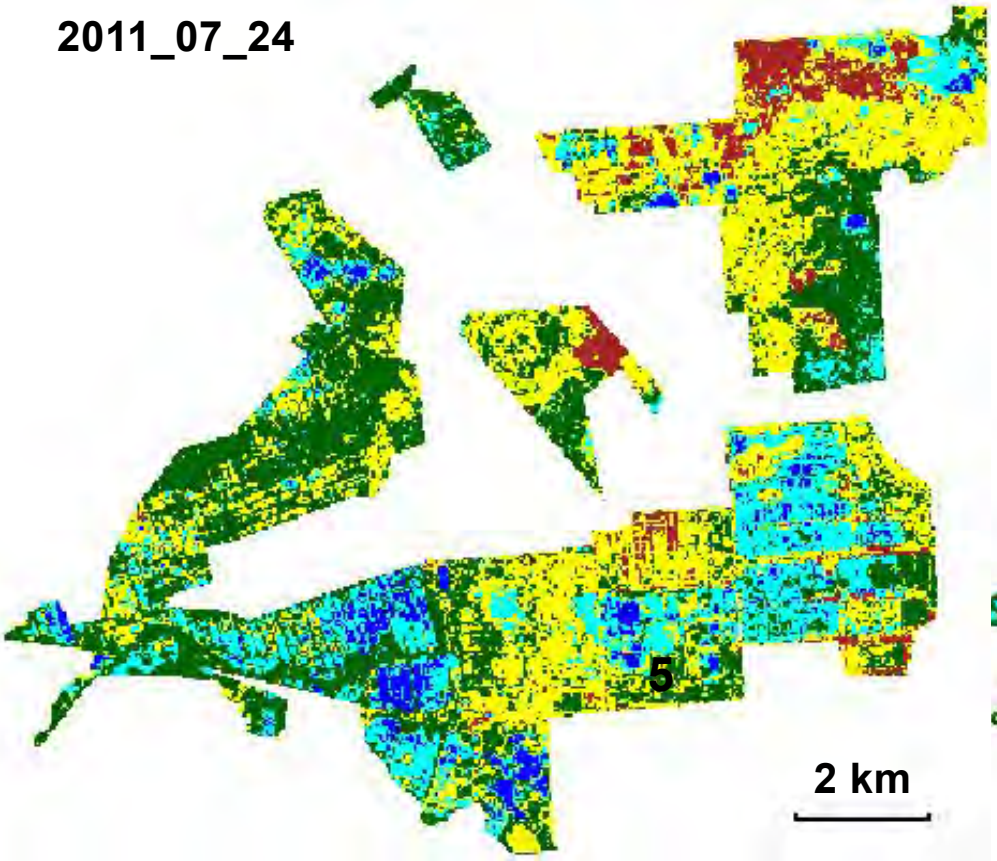
wetland/peatland restoring land/vegetation classes

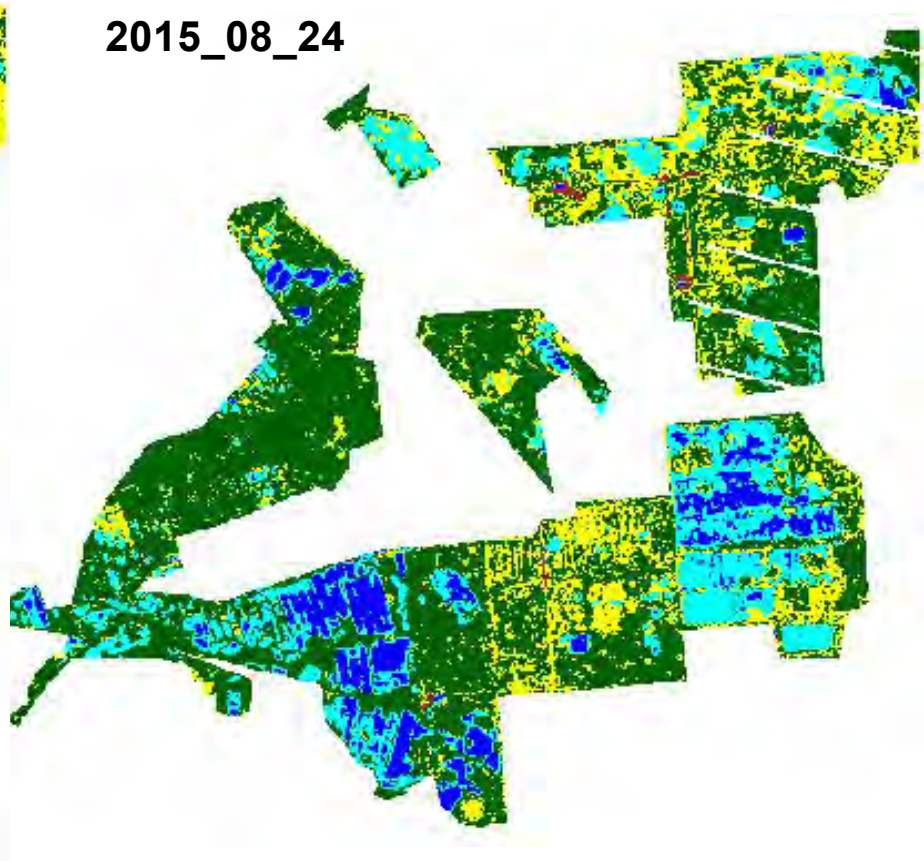
5. Hydrophilic communities with cat-tail and reed

6. Shallow-water

Examples of land/vegetation changes after rewetting applied by Moscow Oblast during 2010-2015 years

(2011 image already include effect of 2010 rewetting)





Fire-hazardous land/vegetation classes: brown – bare peat, yellow – dry grass communities;
Not fire-hazardous land/vegetation classes: blue – open water, blue-green – hydrophilic vegetation;
Medium fire-hazardous land/vegetation classes: different green – forested and sparsely treed.

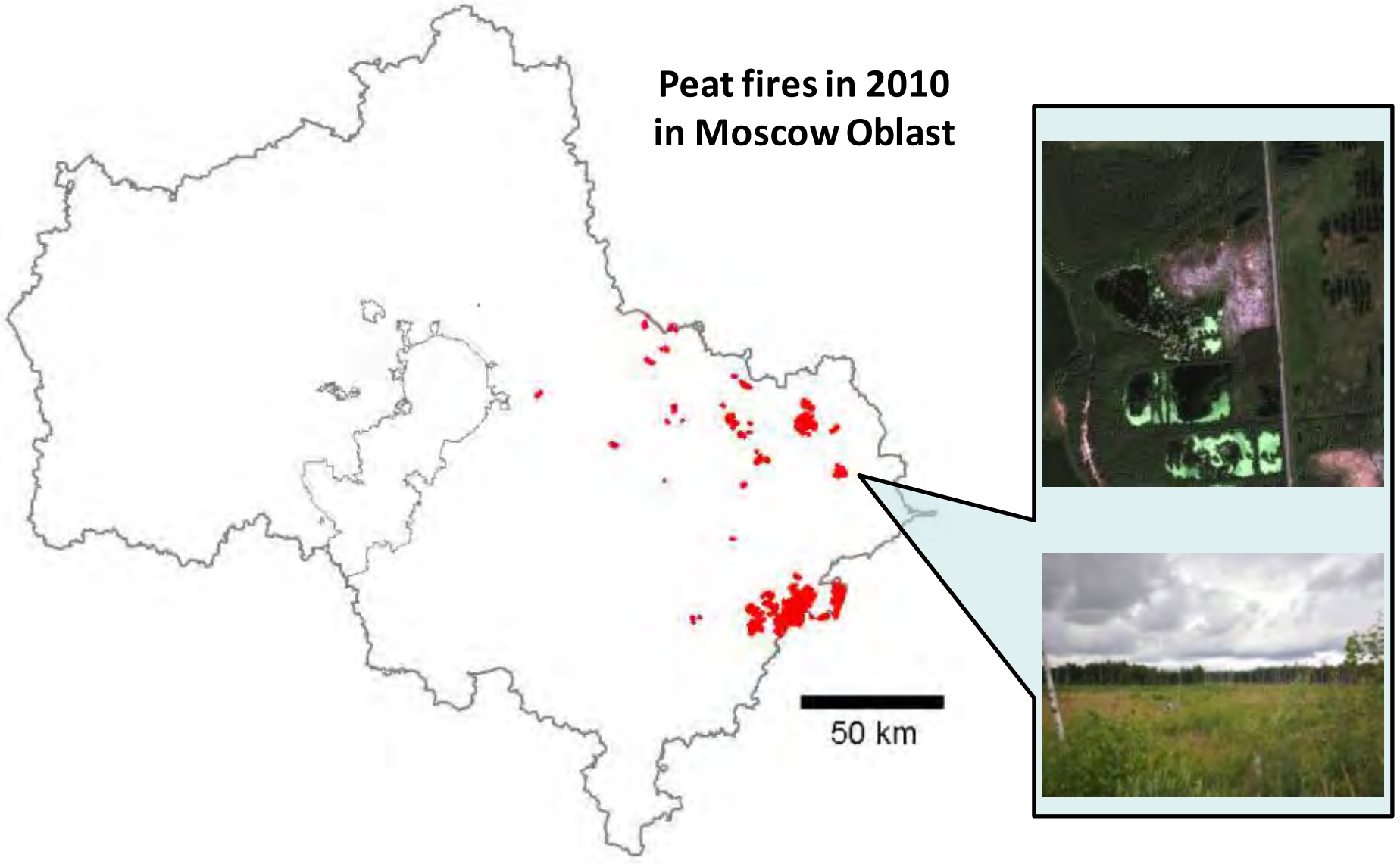
Emission factors used for calculating emissions for the land/vegetation cover classes

Land cover class	IPCC land use class	IPCC EF t CO_2eq. ha^{-1} yr^{-1}	Tier 2 EF t CO_2eq. ha^{-1} yr^{-1}
1) Bare peat (sparse vegetation)	Average boreal and temperate peatland managed for extraction	**11.5**	**9**
2) Forb communities	Average boreal, temperate nutrient poor and shallow drained grassland	**21.5**	**13.5**
3) Communities with pine trees (3)	Forest land, drained, nutrient poor (boreal)	**1.5**	**6**
4) Communities with willow and birch	Average boreal nutrient rich and temperate forest land	**8.5**	**7**
5) Hydrophilic communities	Average temperat poor and rich rewetted organic soils	**7**	**7**
6) Open water	Assumed the same as land cover class 5	**7**	**7**

IPCC 2014, 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands, Hiraishi, T., Krug, T., Tanabe, K., Srivastava, N., Baasansuren, J., Fukuda, M. and Troxler, T.G. (eds). Published: IPCC, Switzerland.

Wilson D., Blain D., Couwenberg J., Evans C.D., Murdiyarso D., Page S.E., Renou-Wilson F., Rieley J.O., Sirin A., Strack M., Tuittila E.-S. Greenhouse gas emission factors associated with rewetting of organic soils . *Mires and Peat*. V. 17 (2016). Article 04. 1–28. DOI: 10.19189/MaP.2016.OMB.222

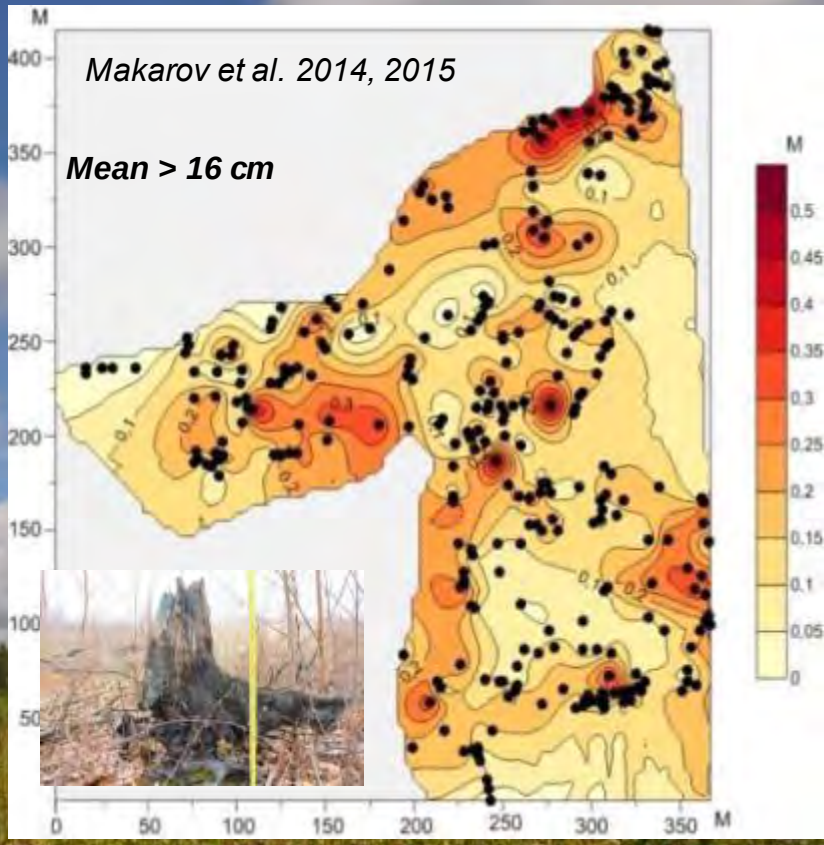
MAPPING PEAT FIRES AND CALCULATING CARBON LOSSES



ScanEx technological center. Based on satellite images of July-August of 2010
http://www.scanex.ru/ru/news/News_Preview.asp?id=n2205174

Only 10 cm of peat loss after burning (biomass is not considered) → CO_2 emission over 350 t per ha;

Makarov D.A., Gummert I., Suvorov G.G., Uspenskaya O.N., Sirin A.A. Soil carbon loss after forest fire on peat – example from Moscow Province. *Fundamental and applied aspects of forest soil science.* Proc. 6th All-Russian scientific conf. (Syktyvkar, 14-19th Sept. 2015). pp. 212-214.



Assumptions and calculations of the fire prevention effect for reduction of GHG fluxes

Total peat fire area in 2010 (ha)	**20828**
Peat fire area later rewetted (ha)	**13656**
Total rewetted area 2010-2013 (ha)	**73109**
Assumptions:	
Peat loss (m)	0.1
Biomass loss	not considered
Bulk density (kg m^{-3})	100
Carbon content (fraction)	0.5
Carbon loss (0.1 m × 100 kg m^{-3} × 0.5 × 10; t ha^{-1})	50
CO_2 emissions (50 × 44/12; t CO_2 ha^{-1} of burnt land)	**183**
CO_2 emissions 2010 (13656 ha × 183; t CO_2)	**2,499,050**
Frequency of peat fires as in 2010 once in 10 years (yr^{-1})	0.1
Effect of rewetting by avoiding fires (0.1 × 2,499,050; t CO_2 yr^{-1})	**249,905**
Effect of rewetting by avoiding fires (249,905 / 73,109 ha; t CO_2 ha^{-1} yr^{-1})	**3,42**

Results

- **Reduction from reducing of peat decomposition:**

  0.7 – 1.0 t CO_2eq. per ha and year

  Total: **50 000 – 70 000 tCO_2eq. per year** (for 73 000 ha)

- **Reduction from avoiding peat fires:**

  3.5 t CO_2eq. per ha per year

  Total: **~ 250 000 t CO_2e per year**

- **Combined emission reduction:**

  4.5 t CO_2eq. per ha and year

  Total: **~ 300,000 t CO_2e per year**

Under consideration and discussion

- Methane release with bubbles from ditches
- N_2O emission removal after rewetting
- DOC, DIC and POC output changes after rewetting
- Biomass loss after peat fires
- Long term effect of peat fires (e.g. GHG emissions, wind and air erosion, etc.)
- "Black carbon" release during peat fires

Thank you