Mapping organic soils in the frame of climate reporting under IPCC

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Background

IPCC definitions for organic soils (simplified)

- Soils with approx. 12% Corg in the upper 20cm

The german soil classification system distinguishes

- Bog soils with peat > 30 cm (> 15% Corg)
- Fen soils with peat > 30 cm (> 15% Corg)
- Soils with peat < 30 cm

- Soils with 9 – 15% Corg in the upper layer

Actual situation in Germany

Up to now, the soil map of Germany at a scale of 1:1.000.000 is the reference for GHG reporting ...

	SM1000
organic soils[ha]	361,373

landuse	SM1000
arable land[%]	29,7
grassland[%]	38,0
forest[%]	19,3
rest[%]	13,0

SM1000
(Soil map of Germany at a scale of 1:1.000.000)

Actual situation in Germany

Up to now, the soil map of Germany at a scale of 1:1.000.000 is the reference for GHG reporting ...

	SM1000	GK200
organic soils[ha]	361,373	288,134

landuse	SM1000	GK200
arable land[%]	29,7	12,9
grassland[%]	38,0	55,9
forest[%]	19,3	18,1
rest[%]	13,0	13,2

SM1000
(Soil map of Germany at a scale of 1:1.000.000)

GK200
(Geological map of Germany at a scale of and 1:200.000)

Actual situation in Germany

Up to now, the soil map of Germany at a scale of 1:1.000.000 is the reference for GHG reporting ...

	SM1000	GK200	MOS
organic soils[ha]	361,373	288,134	328,696
equals MOS	40 %	72 %	-

landuse	SM1000	GK200	MOS
arable land[%]	29,7	12,9	9,9
grassland[%]	38,0	55,9	58,6
forest[%]	19,3	18,1	18,6
rest[%]	13,0	13,2	12,9

SM1000
(Soil map of Germany at a scale of 1:1.000.000)

GK200
(Geological map of Germany at a scale of 1:200.000)

MOS
(newly compiled data on organic soils at a scale of 1:25.000)

Problems to cope with

- No homogeneous large scale data available area wide

- Available legacy data ...

  - are distributed over a multitude of agencies and authorities

  - differ in terms of classification / nomenclature
    - pedological data
    - geological data
    - agricultural data
    - forestal data
    - specific mire inventories

Spatial mapping / compilation

We separate the “spatial” mapping from pedological characterization …

pedological data

geological data

agricultural data

silvicultural data

⋮

mire inventories

→ extract soil classes according to IPCC definitions → assess with respect to soil data quality and actuality →

<u>hierarchical compilation</u>

only best for one site

avoid increase of area

→ organic soils DB

approx. complete, spatially accurate

<u>still needs ground verification</u>

⇒ randomized topsoil samples for Corg analysis

⇒ focus on “shallow” and non-peat sites

⇒ derive soil class specific correction values

Pedological characterization

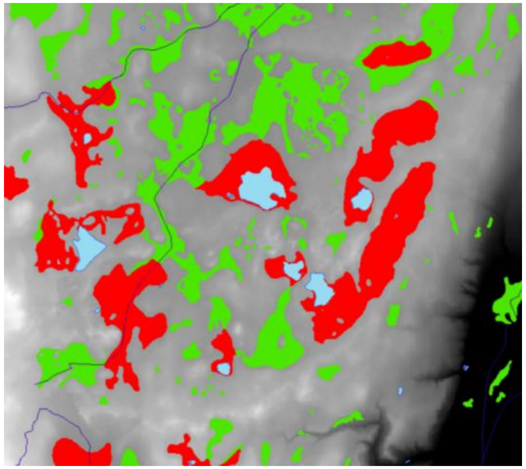
... and do the pedological characterization by estimates on the specific site genesis

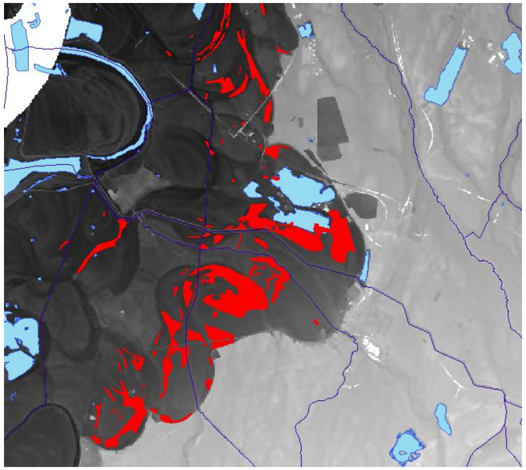
- Soil profiles differ with respect to site genesis
- Site genesis is related to geomorphic setting
- Estimates on genesis are possible based on hydrology, geomorphology, ...
- These data are available area-wide for Germany

Pedological characterization II

We collect parameters describing the geomorphic setting manually ...

- coastal situation (y/n)
- contact to lakeshore (y/n)
- valley situation (y/n)
- along slope toe and higher than receiving stream (y/n)
- lies within floodplain (y/n)
- regional setting (e.g. quaternary glacial formed, ...)
- …





... others are calculated in GIS ...

- mean height (GIS / DTM25)
- mean slope (GIS / DTM25)

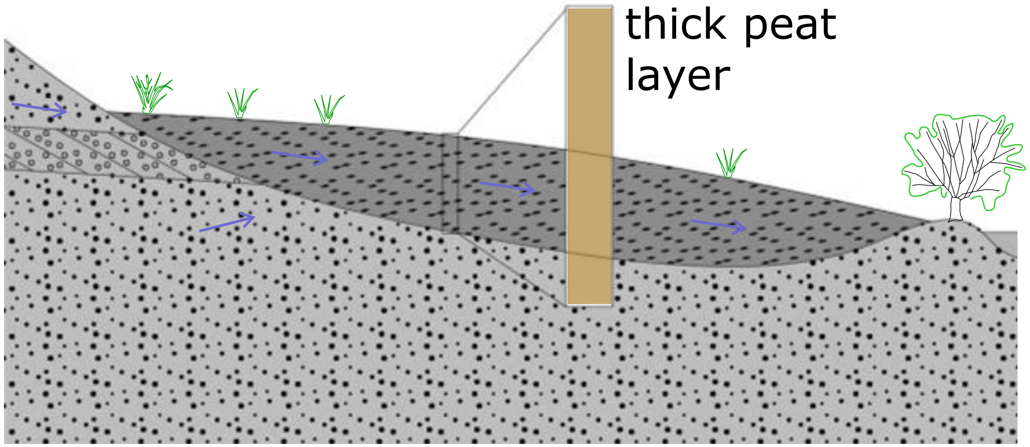
... existing soil data is maintained ...

- peat thickness
- soil type

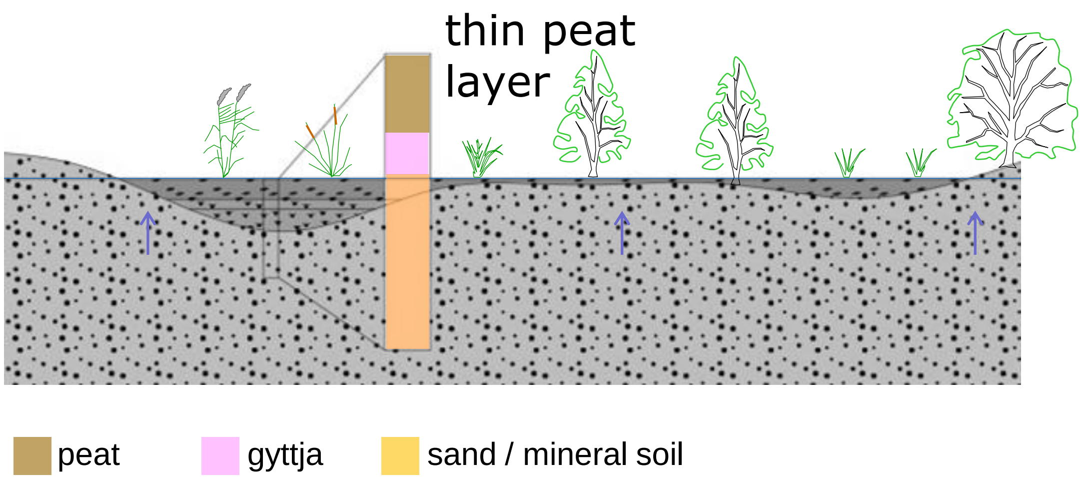
Pedological characterization III

... and we combine them in an index based approach to make estimates on site genesis.

percolation

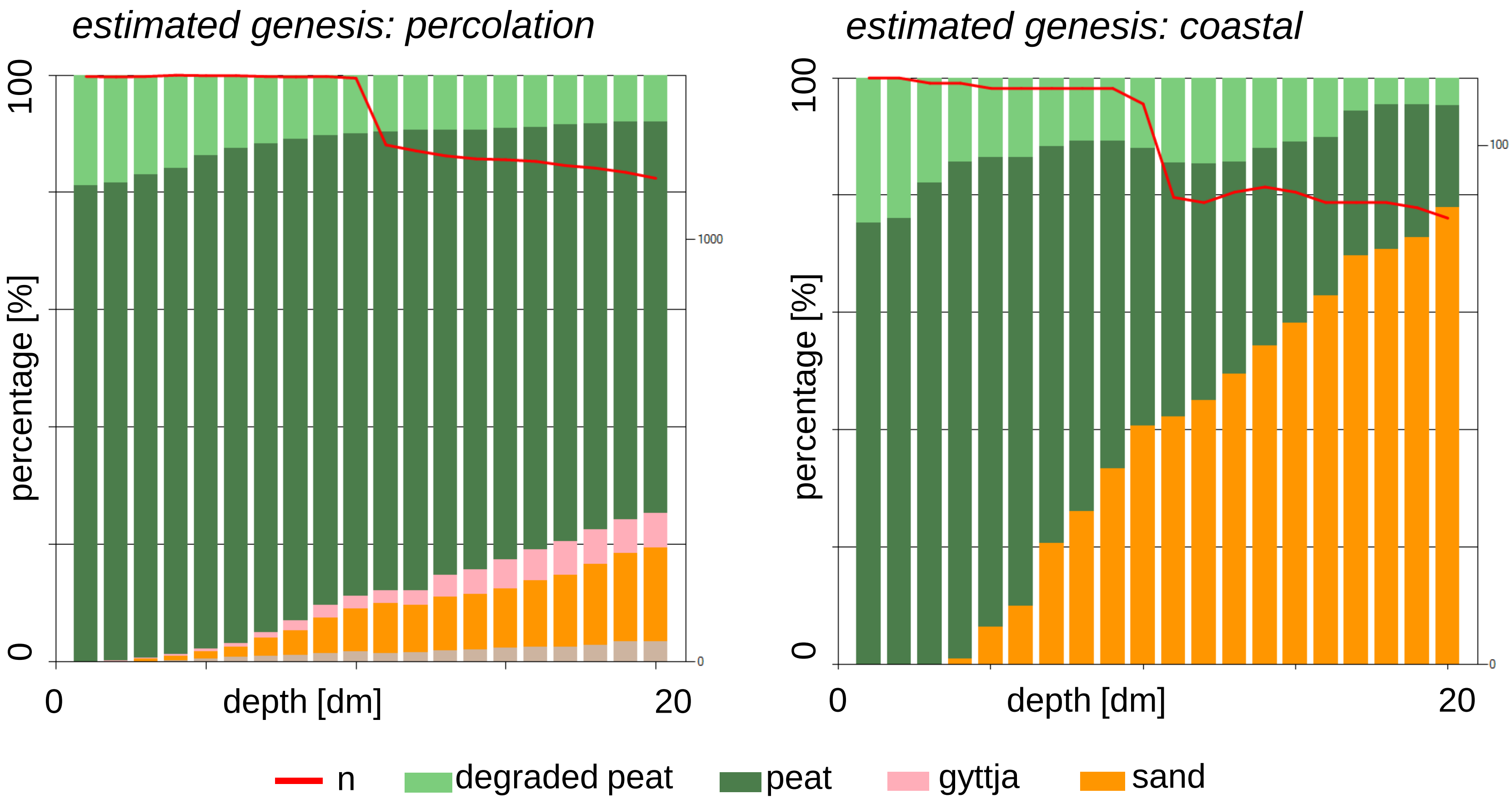


paludification



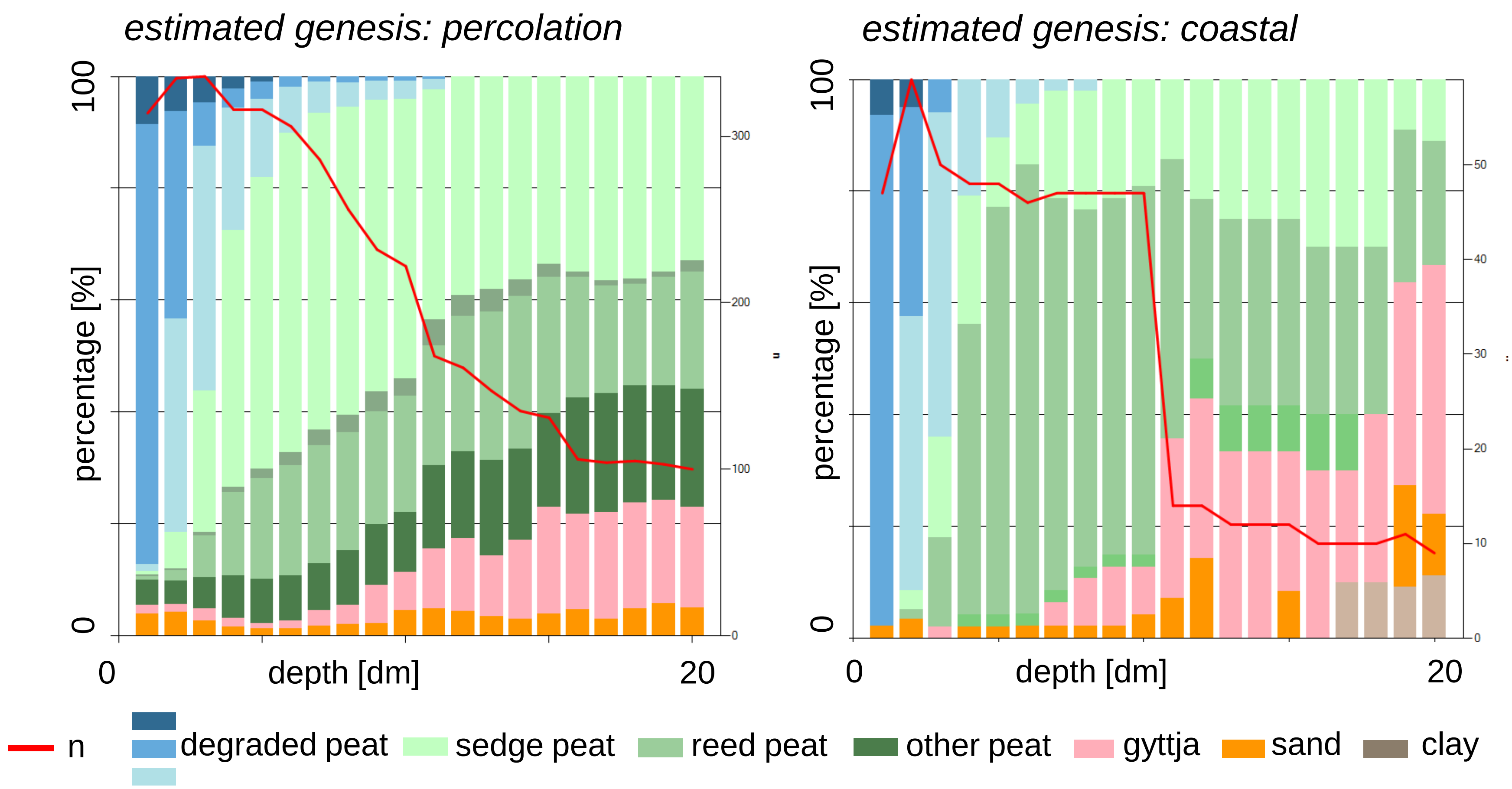
Results I (Verification of estimated genesis)

- Soil profiles from the early 20th century
- Analysis on depth dependent substrate distribution



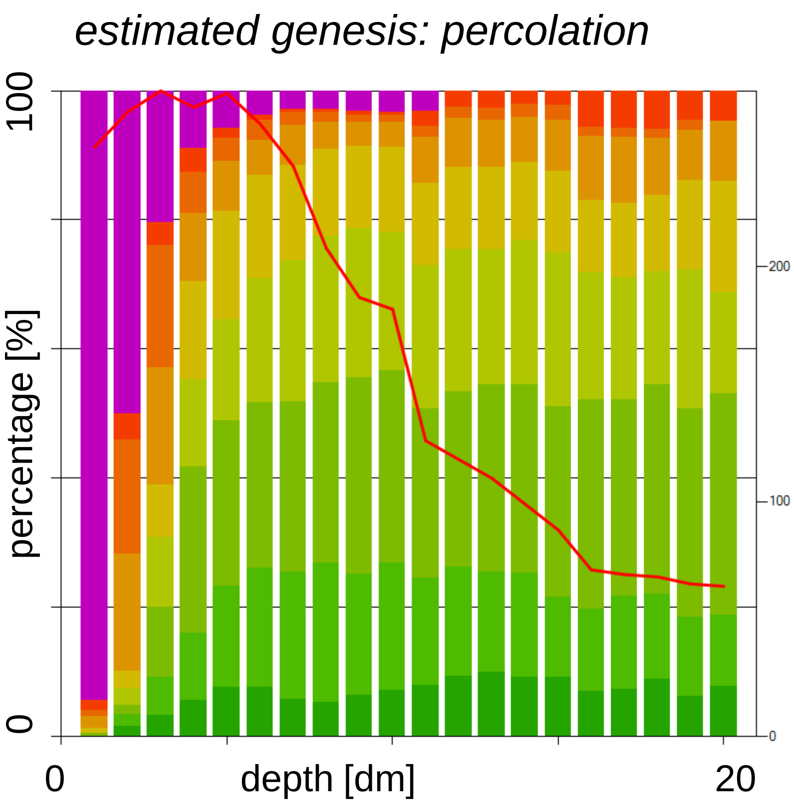
Results II (Verification of estimated genesis)

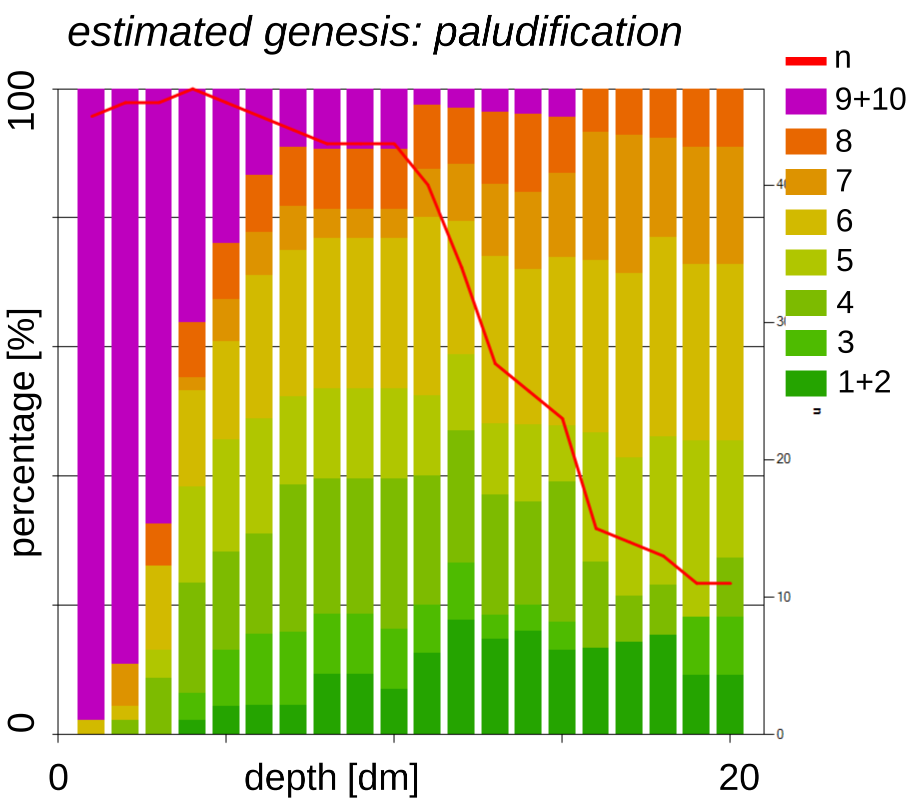
- Soil profiles from the late 90s of the 20th century
- Analysis on depth dependent substrate distribution



Results III (Verification of estimated genesis)

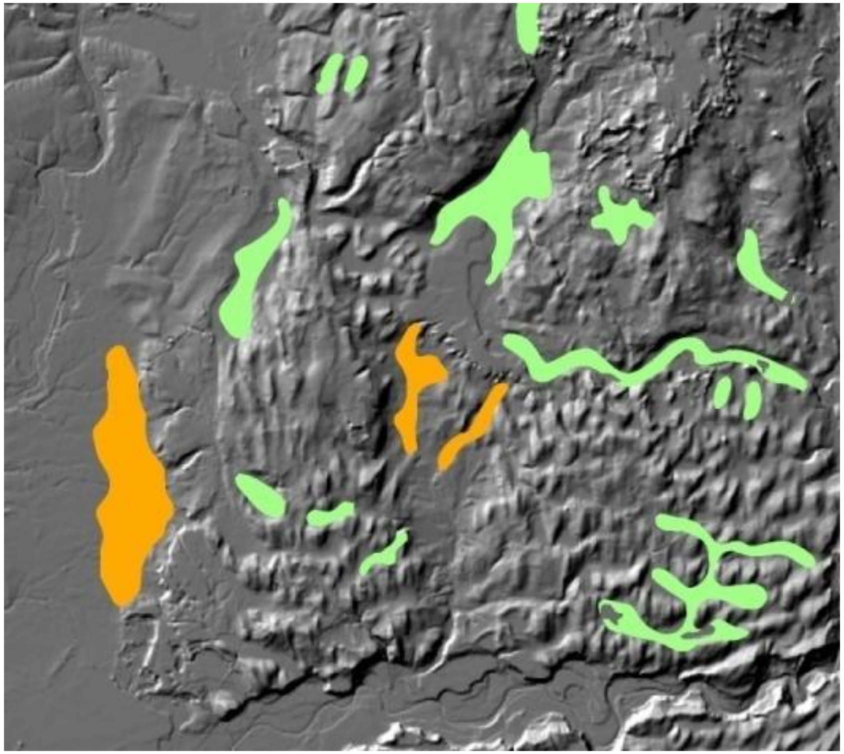
- Soil profiles from the late 90s of the 20th century
- Analysis with respect to landuse (grassland) and the degree of decomposition (1-*3: fibric; 4-7 hemic; 8-10 sapric)*



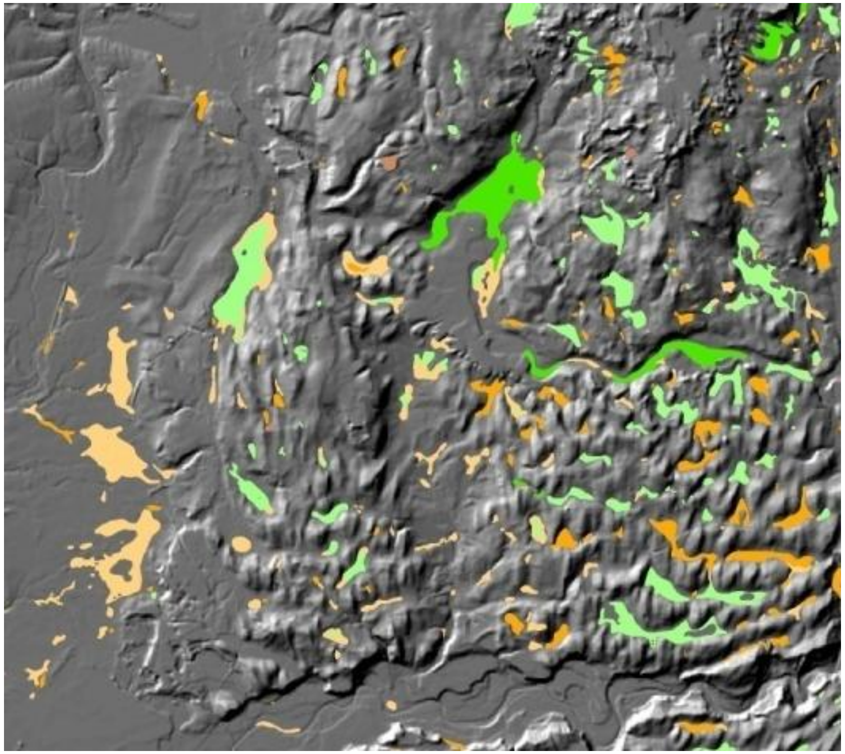


Mapping results (SW-Germany)

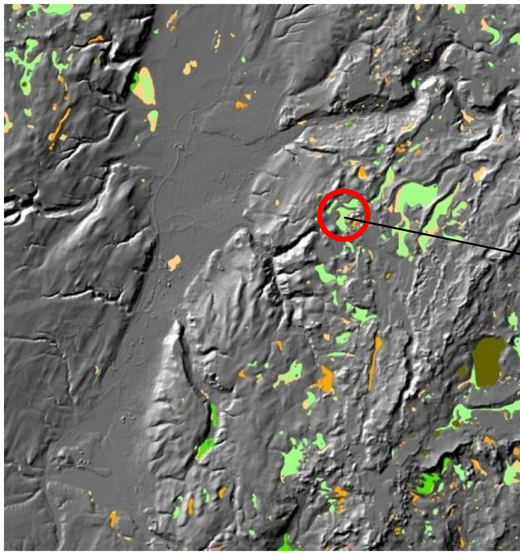
Geological map
(1:200,000)

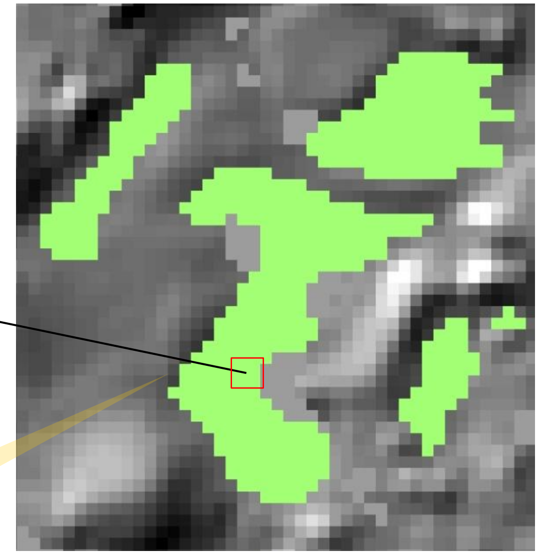


Newly compiled map of
organic soils
(1:25,000 – 1:50,000)



Regionalization and modelling





+ estimated genesis

Idealized soil profile for sites with est. percolation regime

samples: 417

depth [dm]	substrate	deg. decomp.
1	sapric amorphous peat	10
2	sapric amorphous peat	8-10
3	sapric amorphous peat	8-10
4	hemic sedge peat	6-7
5	hemic sedge peat	6-7
6	hemic sedge peat	6-7

Characteristic soil properties

		X	ku 1,8	ku 2,0	ku 2,2	ku 2,6	kf
	n	8	7	7	7	7	4
	median	36,400	0,492	0,155	0,022	0,004	2,295
	average	32,775	0,762	0,477	0,215	0,013	2,384
	standard deviation	8,949	0,779	0,666	0,400	0,017	0,795
	n	21	8	8	8	8	19
	median	37,000	0,786	0,372	0,151	0,016	0,721
	average	35,299	0,966	0,446	0,151	0,018	1,518
	standard deviation	9,510	0,751	0,424	0,136	0,013	1,369
	n	15	11	10	10	10	12
	median	21.700	0.617	0.274	0.090	0.015	1.074

Conclusions

What is possible ...

- Higher spatial accuracy and completeness
- Homogeneous pedological characterization
- Regionalization or modelling with linked soil properties now possible
- Data will be available for entire Germany in late summer

What is not possible ...

- No replacement for site specific investigation
- Typical soil profiles only for common site genesis
- No new delineation of boundaries

Thank you very much for your attention!!

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