

German Tier-3 approach allows to assess impact of climate change on emissions from drained organic soils

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The general approach

Approach was developed by large research project (2009 – 2012) funded by Ministry of Agriculture.



A new methodology for organic soils in national greenhouse gas inventories: Data synthesis, derivation and application



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The general approach



Project derived relationships between water-table depth and CO₂/CH₄ emissions

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Map of organic soils (until submission 2024)

Catena 133 (2015) 157-170



Organic soils in Germany, their distribution and carbon stocks

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ARTICLE INFO

ABSTRACT

Article history: Received 16 June 2014 Received in revised form 29 April 2015 Accepted 6 May 2015 Available online 20 May 2015

Keywords: Organic soils Peat Mapping Climate reporting Carbon stocks The knowledge on spatial distribution and status of organic soils are essential for climate reporting and carbon stock calculations. In Germany so far, the official soil map at a scale of 1:1,000,000 is used. With respect to e.g. land use dependent calculations of greenhouse gas emissions, a significantly higher level of detail is required. The aim of this study was to establish a homogenous and nationwide dataset on the distribution of organic soils and their relevant soil properties for Germany at a sufficient spatial resolution.

For the first time, a detailed and almost complete dataset on organic soils for Germany could be derived based on map legacy data, soil borehole databases and detailed data on topography, hydrology and geology accompanied by additional ground verification.

Based on the new dataset, organic soils are estimated to cover $15,682 \text{ km}^2$ of Germany (4.4% of the total area) and account for an organic carbon pool up to a depth of 2 m of nearly 1.3 Gt.

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The map combined all available data at the time.

The license was restricted to use for GHG inventory purposes.



The map was derived with machine-learning (boosted regression trees).

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Large-scale regionalization of water table depth in peatlands optimized for greenhouse gas emission upscaling

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Received: 18 March 2014 – Published in Hydrol. Earth Syst. Sci. Discuss.: 7 April 2014 Revised: 2 July 2014 – Accepted: 20 July 2014 – Published: 1 September 2014

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Figure 2. Illustration of the predictor variables determined for each dip well based on available national maps (see Table 1).

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New map of organic soils

- Map of organic soils was not open access
- More and better data had become available
- \rightarrow New map of organic soils
- ~ 7 % larger area
- Includes organic soils covered by mineral layer





Recalibration was necessary for <u>consistency with new</u> <u>map</u> of organic soils.

- → Now 1671 observation wells and 10761 annual mean water levels from 1988 to 2024
- \rightarrow Now annual water balances as predictor
- \rightarrow Emissions depend on weather!



Effect of weather



The model takes into account the spatial and seasonal distribution of precipitation and evapotranspiration (climatic water balances).



German projections are based on RCP4.5 climate scenario (5th IPCC Assessment Report).

The German Weather Service (DWD) has provided corresponding spatial data for climatic water balances.





Effect of weather (on organic soils) in projections



Uncertainty due to weather was assessed by calculating projections for each member of the RCP4.5 model ensemble separately.



Conclusions

- The German Tier 3 method for emissions from organic soils takes weather into account.
- → It automatically reflects the effect of climate change on peatland hydrology.
- Loss of organic soils and long-term vegetation changes are not reflected in results.
- Work on approach to model rewetting is ongoing. In projections, rewetting was implemented by modifying water-table depths in rewetting areas.

