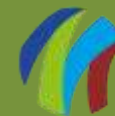


The contribution of drained organic soils to the globally emitted greenhouse gases and emission hotspots



GREIFSWALD
MIRE
CENTRE

Alexandra Barthelmes, John Couwenberg & Hans Joosten

Organic soils and peatlands occur from the tundra ...



Yakutia, RF

... to the tropics and ...



Brunei

...to the uttermost part of the World...



Tierra del Fuego
Argentina

...from the mountains ...



Colombia

... to the sea



Archangelsk, RF

The World's organic soils have meanwhile turned from a carbon-sink to a carbon-source (through drained land use)



although their vast majority is still undrained...

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These emissions need to be quantified to assess their impact on Climate Change.



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- The *'2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands'* (IPCC 2014) offers up-to-date default emission factors.



This enables proper reporting

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But realistic area data is also needed at national scale...

CO₂- emissions from drained organic soils in the Nordic-Baltic countries

1. Analysis of drained organic soil areas & emissions as reported to the UNFCCC in 2014
2. Analysis of peatland, organic soil or proxy GIS datasets delivered from national RAMSAR contact points or peatland researchers
3. Meta-Analysis of available information on organic soil or/and peatland extent from scientific publications
- to assess the reliability of the national area estimates reported to UNFCCC

Data comparison for e.g. ESTONIA

Land use type	drained area per land use type (km ²)		
	NIS Estonia (2014)	after Paal & Leibak (2011)	Vasander et al. (2003)
drained peatland, agriculture		2,400	2,690
drained peatland, forestry		3,617	3,138
drained peatland, peat extraction		543	608
Σ drained peatland		6,560	6,406
drained organic soil, Forest Land	2,218		
drained organic soil, Cropland	226		
drained organic soil, Grassland	215		
drained organic soil, Peat extraction	186		
Σ drained organic soil	2,845		

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drained organic soil, Peat extraction			
Σ drained organic soil			

We used the comprehensive and recent GIS peatland dataset from Paal & Leibak (2011) to derive area data for land use types.

RESULTS: drained organic soils

country	area (National Inventory Submissions 2014; km²)	recent most reliable* area estimates (km²)
Denmark	1,063	1,892
Estonia	2,845	6,560
Finland	64,987	/
Iceland	4,221	3,665
Latvia	5,870	7,978
Lithuania	3,621	4,679
Norway	3,127	4,348
Sweden	15,458	/

*preferably from national peatland researchers

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RESULTS: emissions from drained organic soils

country	Emissions (area data and EF from National Inventory Submissions 2014; Mt CO₂/yr)	Emissions (new elaborated area data; EF after IPCC 2014; Mt CO₂/yr)
Denmark	2.14	3.34
Estonia	0.83	8.04
Finland	16.44	20.72
Iceland	1.47	7.66
Latvia	2.59	13.53
Lithuania	0.69	7.70
Norway	3.33	6.26
Sweden	5.07	10.58

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- areas of drained organic soils seem to be often underestimated in national UNFCCC reporting
- re-estimation of the drained area and the application of the IPCC (2014) default emission factors resulted in 5-10 x higher emissions from drained organic soils for some Nordic-Baltic countries
- no Nordic-Baltic country seems to have overestimated the drainage related organic soil emissions
- collaboration between the national UNFCCC reporting bodies and peatland researchers could enhance reporting in several countries

Assessment of global emissions from organic soils

- area data elaborated during the 2015-Update of the Global Peatland Database
(primary sources: UNFCCC-reporting and peatland / soil research)
- applied emission factors include CH₄, N₂O and DOC and are primarily based on IPCC (2014)

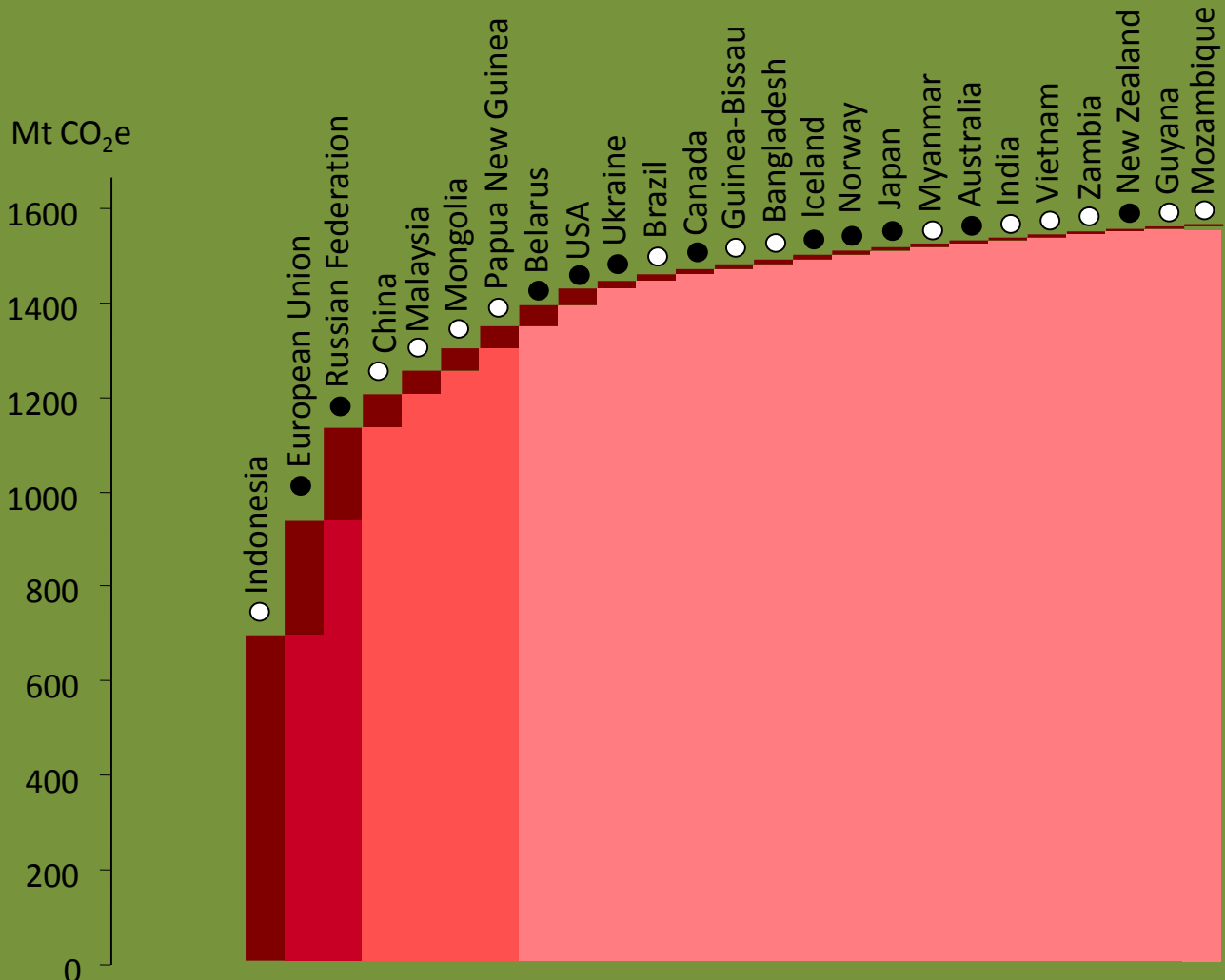
Based on this, the annual emissions from drained organic soils (without peat fires) have been calculated to 1,600 Mt CO_{2e}. This would almost double the amount of CO₂ emissions from aviation.



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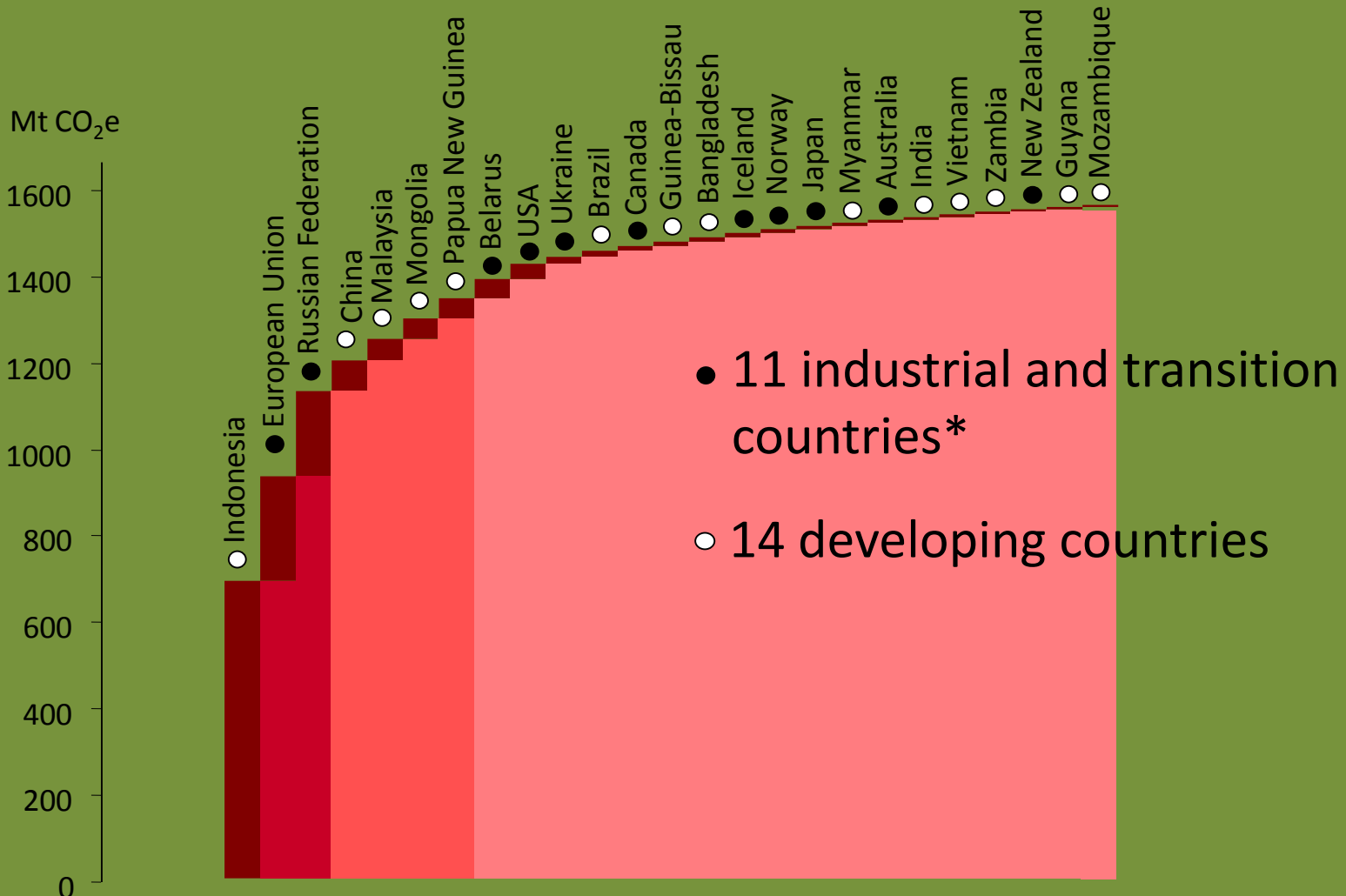


Wetlands
INTERNATIONAL



25 key parties with their emissions from organic soils = 95% of global emissions

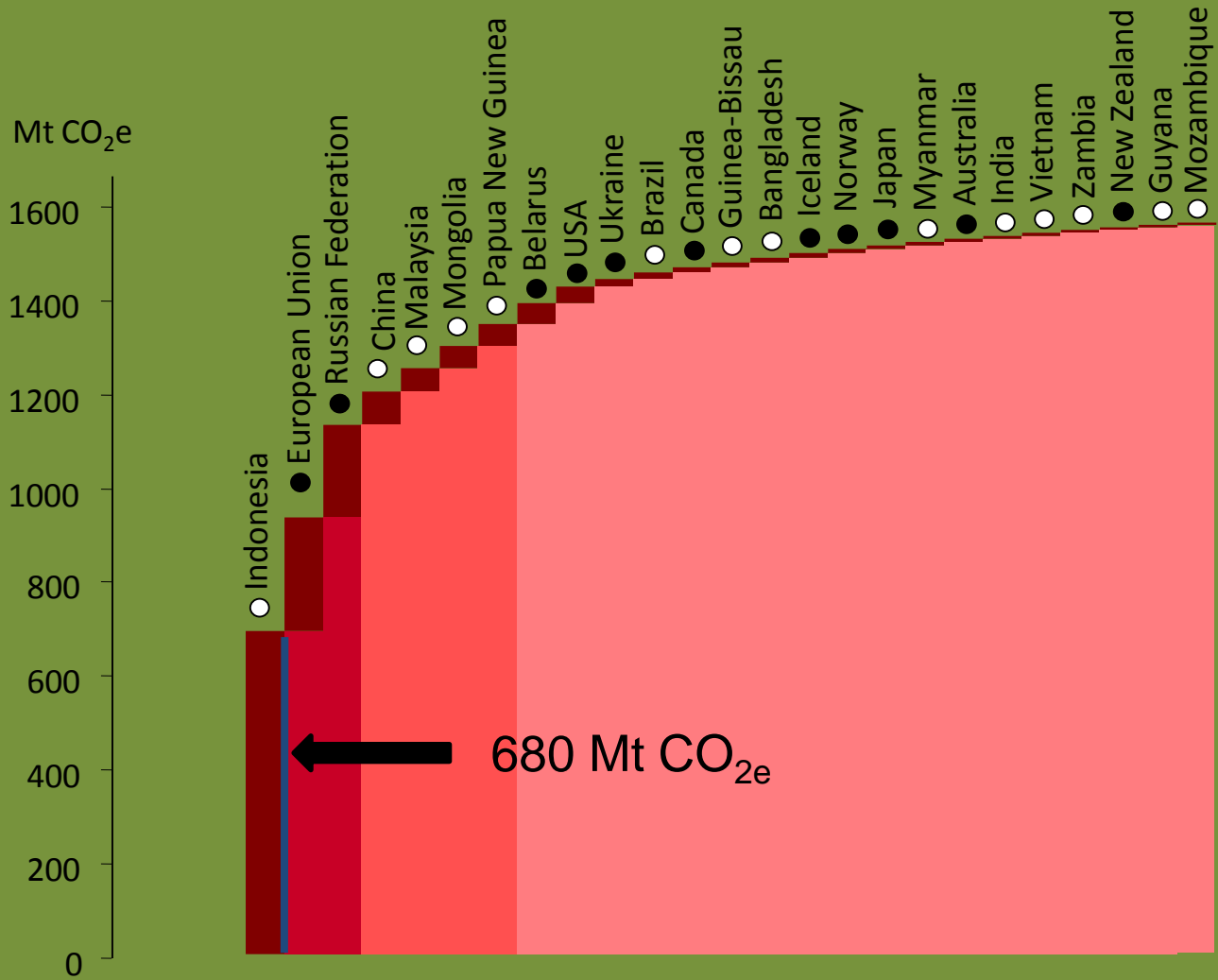
(figure shows amount of greenhouse gas emissions in a cumulative way)



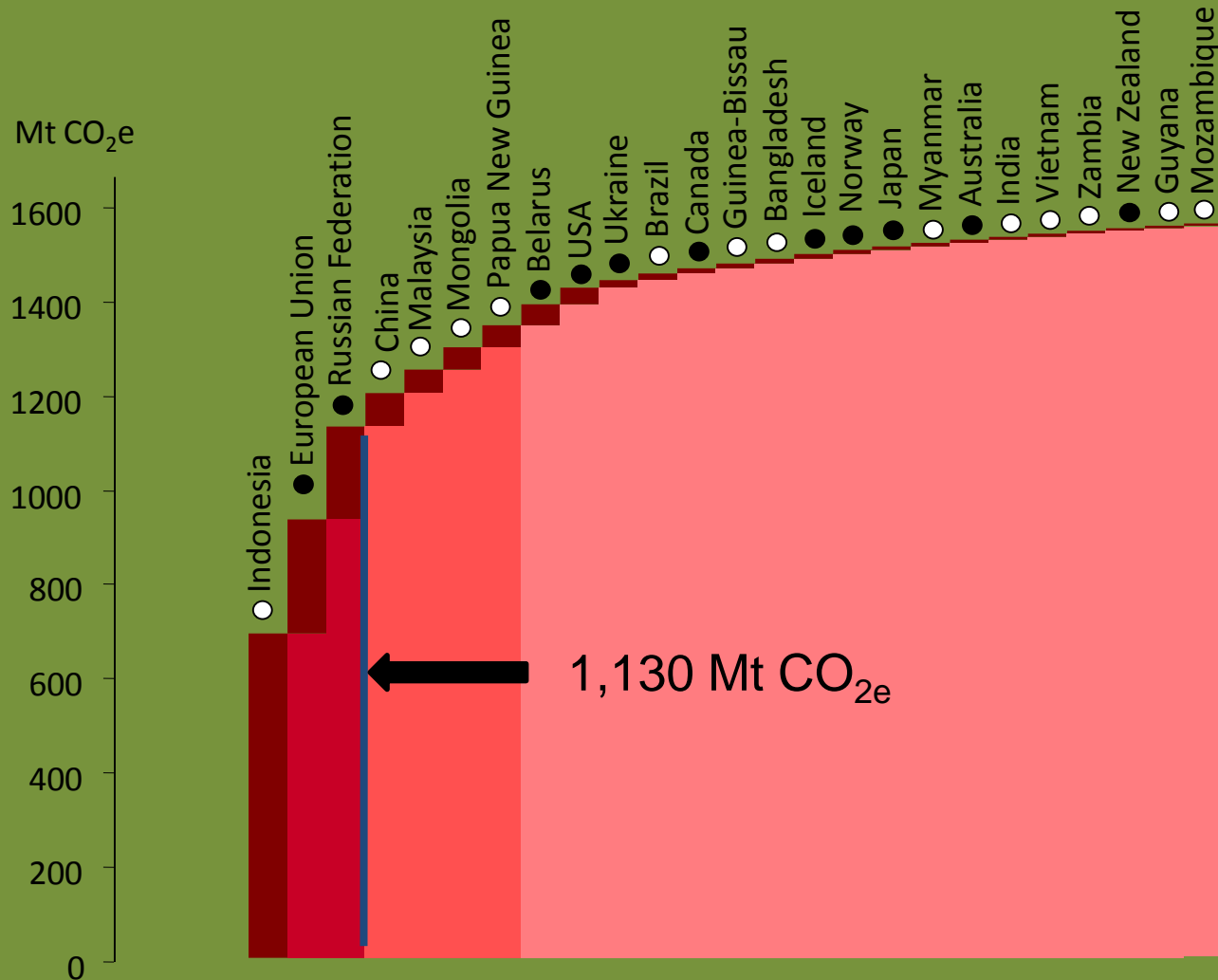
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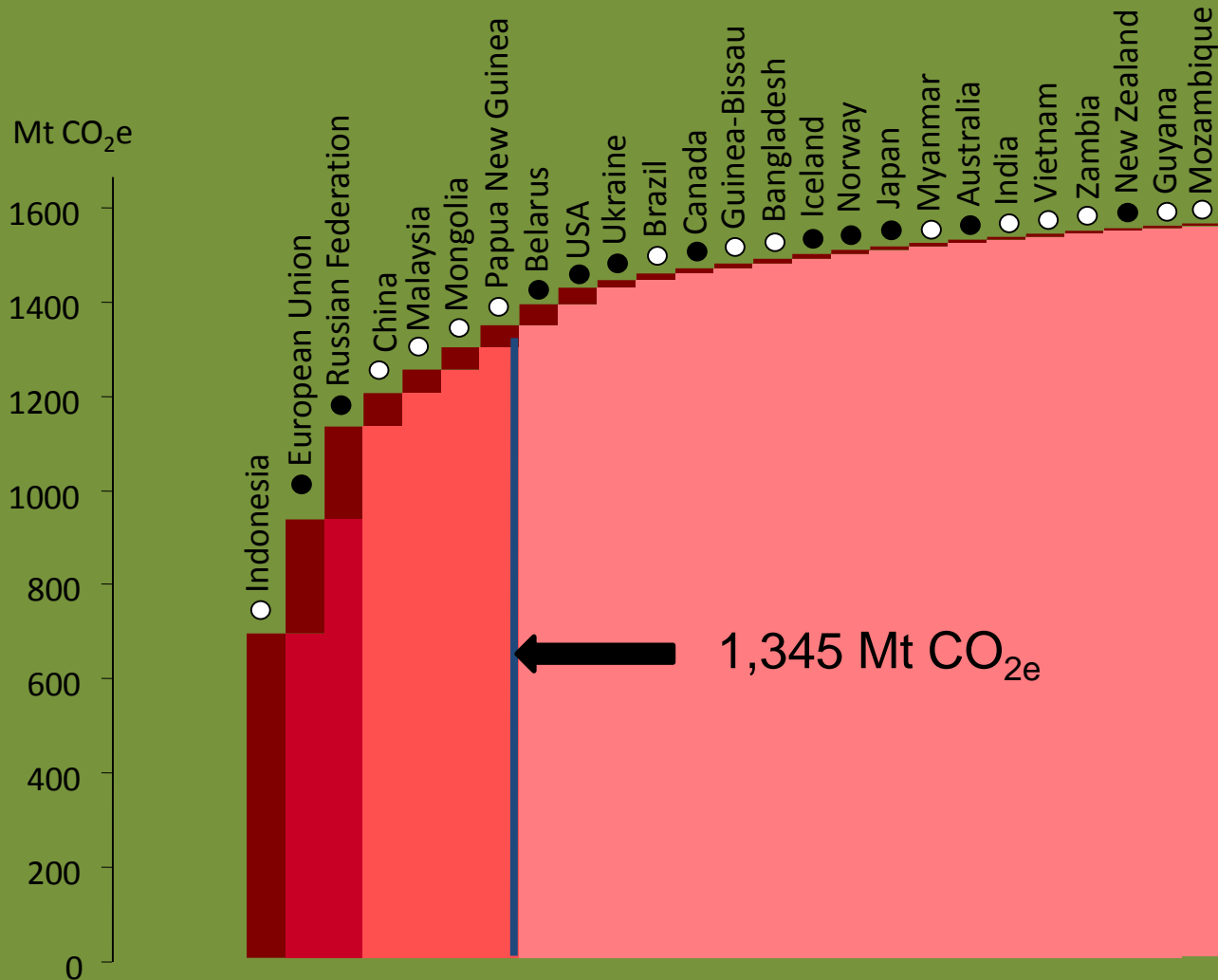
* countries of the European Union are aggregated



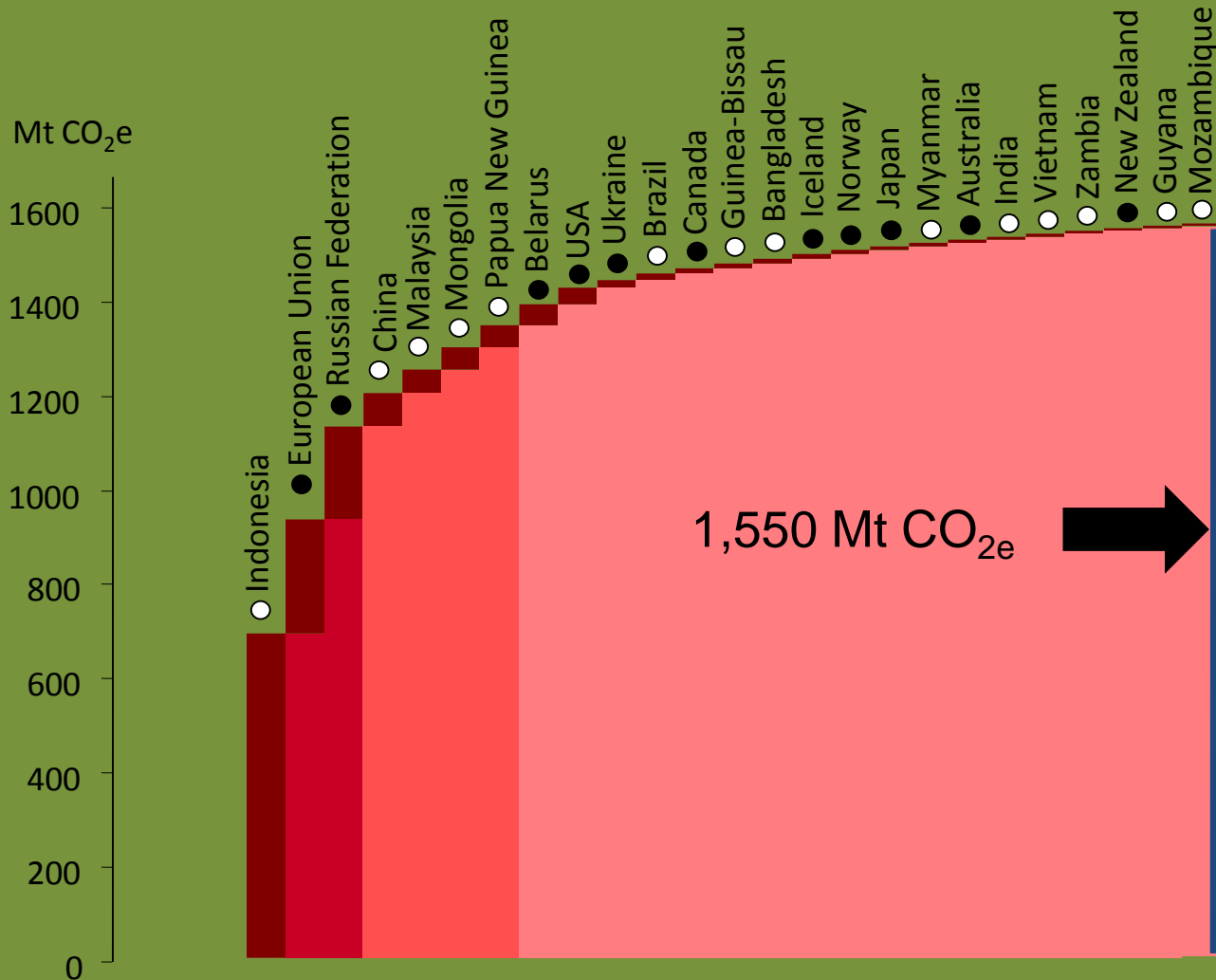
Emissions from Indonesia are the largest single source.



Emissions from Indonesia, EU and Russian Federation account for 70% of globale organic soil emissions.

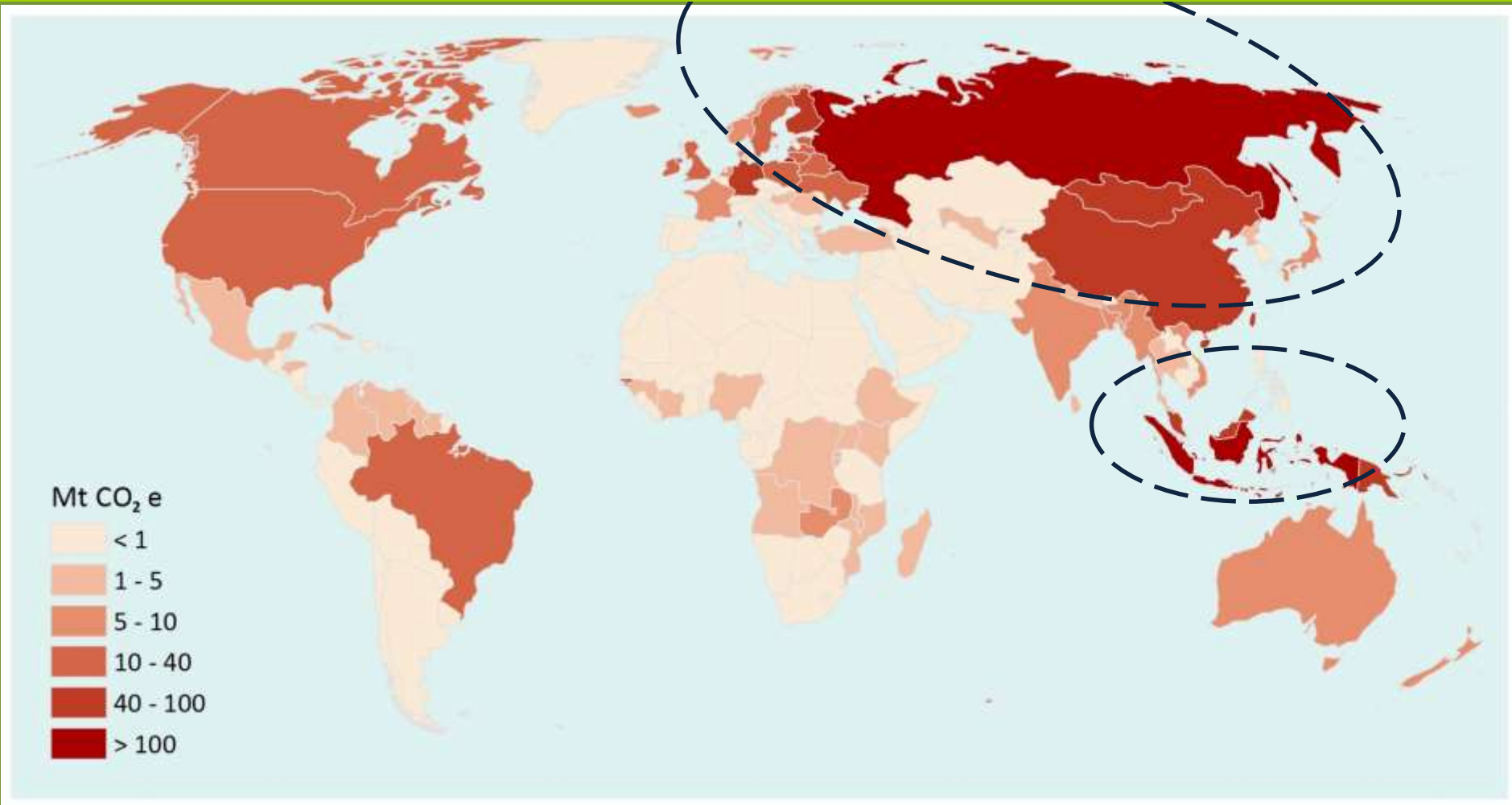


Including 4 further countries, 80% of the global emissions from drained organic soils are reached.



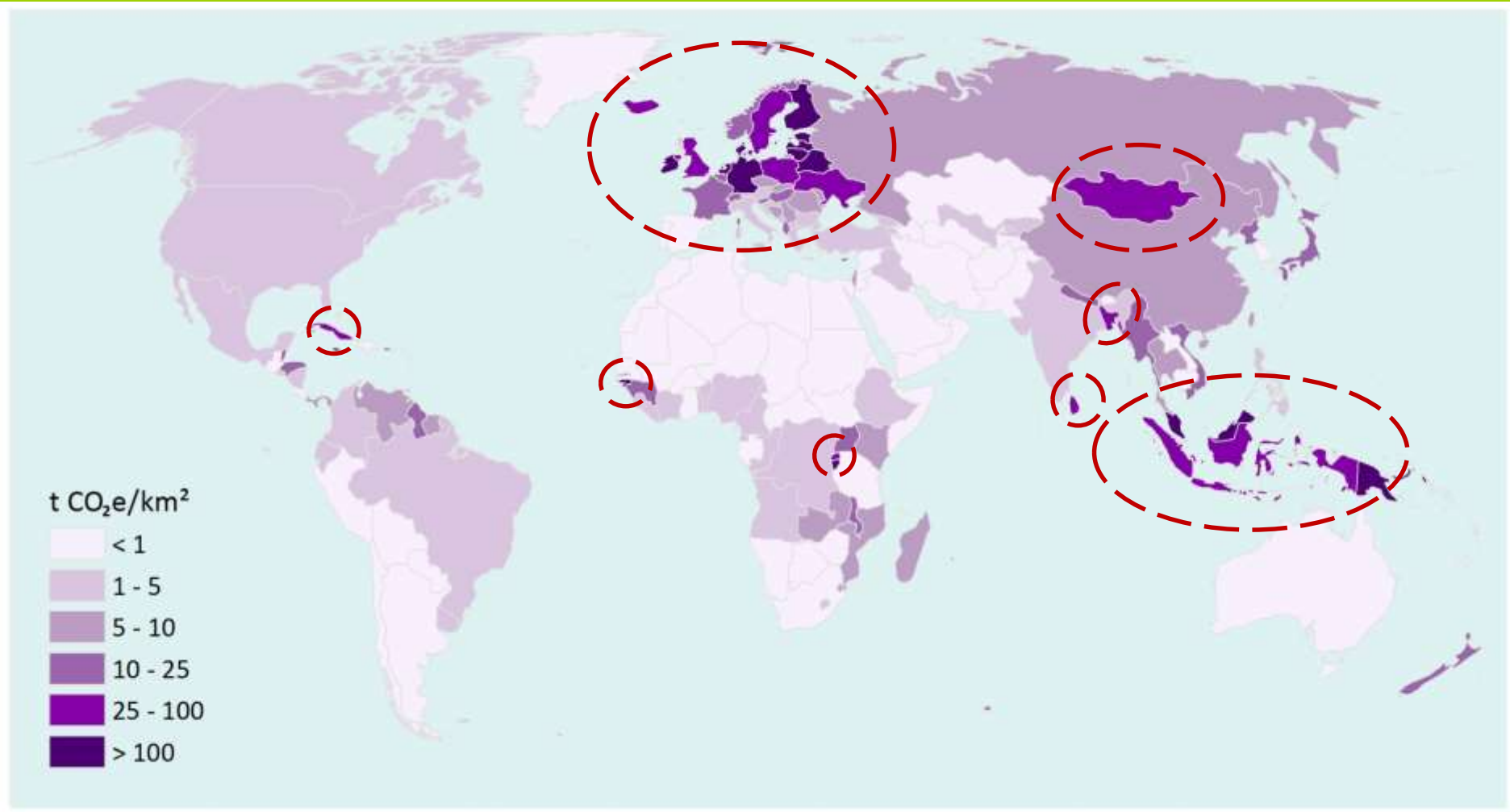
25 countries are together responsible for 95% of global emissions from organic soil drainage (excluding fires).

Assessment of global emissions from organic soils



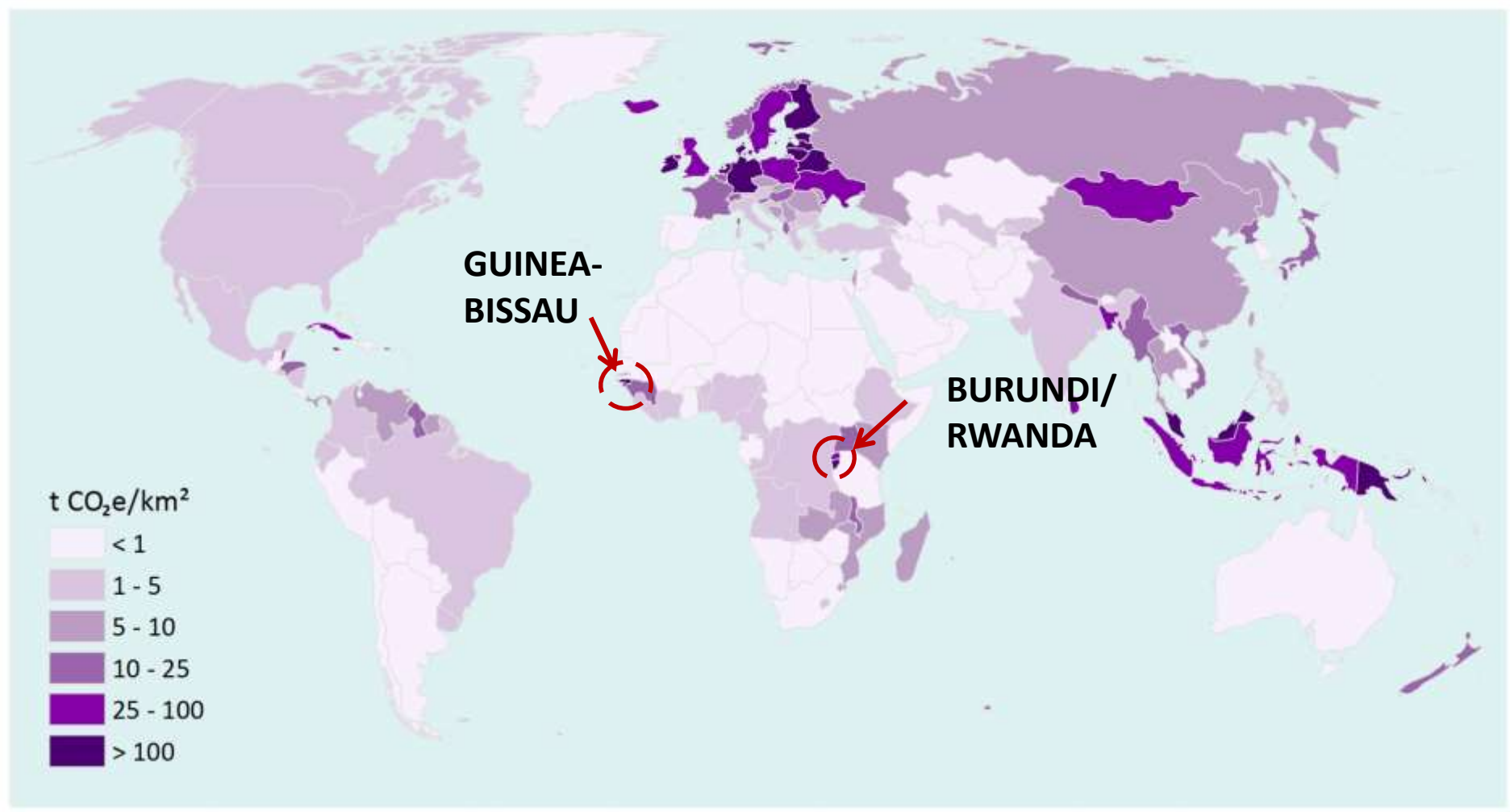
Emissions from organic soils per country (in Mt CO_{2e})
- indicating countries that contribute most to global emissions.

Assessment of global emissions from organic soils



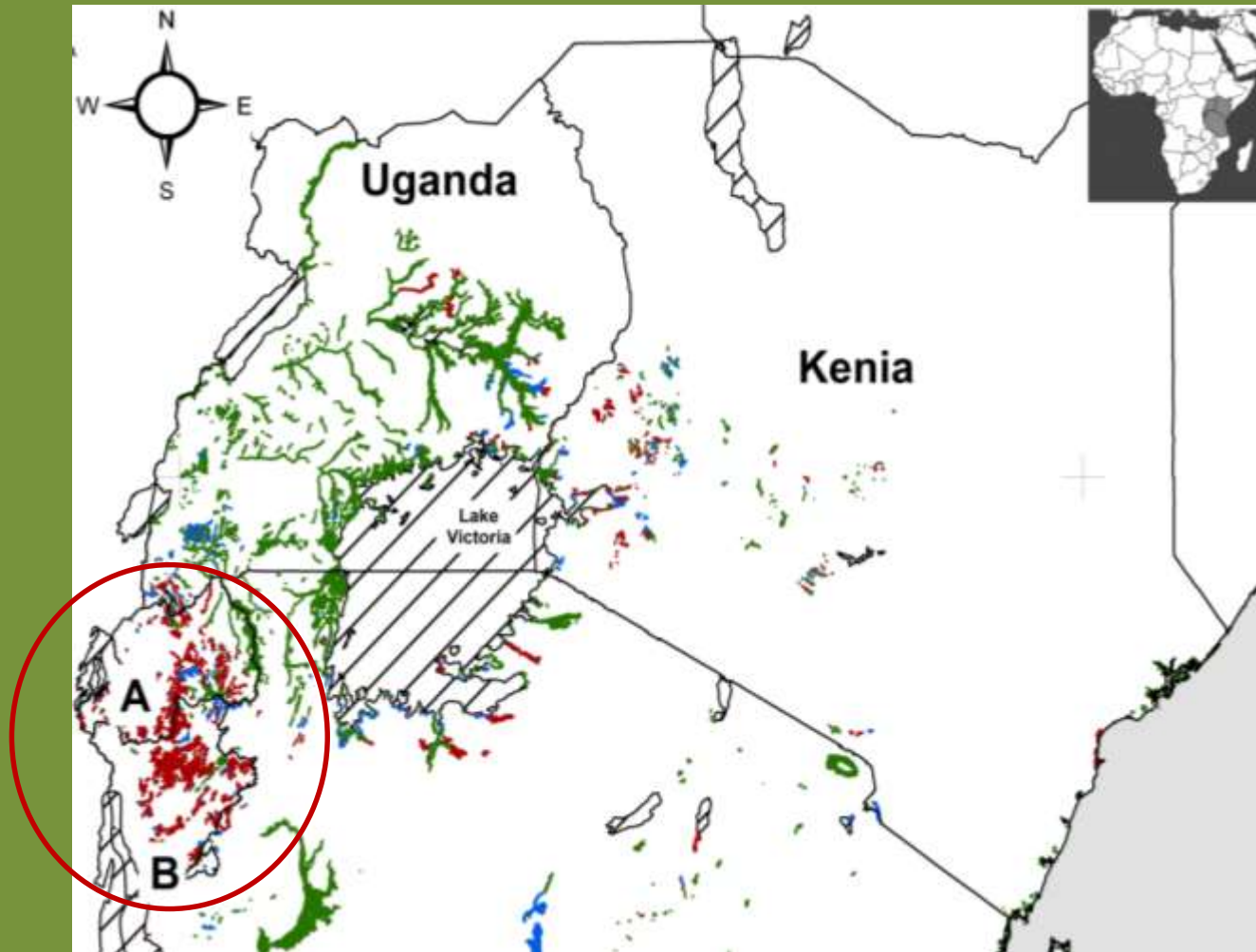
Mean emissions from organic soils per unit national land area (in tCO_2e/km^2) - indicating countries with high emissions related to their size.

Assessment of global emissions from organic soils



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Assessment of global emissions from organic soils



Area data from own mapping of the Lake Victoria catchment, incl. the estimation of drainage impact. RED: heavily drained and degrading organic soils (A=Rwanda; B=Burundi)

Assessment of global emissions from organic soils

“... In this study was found that all agriculture practiced in **Guinea-Bissau** is in organic soils (...).

According to data from DEA in 2006, there are (...) totally 206,737 ha that is used for agriculture...”

Guinea-Bissau is an exception among the developing countries while reporting on drained organic soils in its National Communication to the UNFCCC.



Assessment of global emissions from organic soils



Mangroves, back swamps, lagoonal marshes of lowlands comparable to Guinea-Bissau occur extensively along the coasts of Tropical Africa...
...and are hardly covered by GHG research and UNFCCC reporting

- Although very probably underestimating the real extent of globally drained organic soils, their global emissions almost double CO₂ emissions from aviation (~1,600 Mt CO_{2e}).
- The area assessment of drained organic soils is 'work in progress' - especially in Tropical regions of Africa and America.
- Several industrial countries might improved their emission reporting the UNFCCC to achieve realistic area estimates and to be in line with the IPCC (2014) Guidance on Wetlands.
- Closer collaboration between the national UNFCCC reporting bodies and peatland researchers might enhance emission reporting.

ACKNOWLEDGEMENTS

Collaboration



To ~ 130 European peatland researchers that have contributed to the *European Mires Book*, and many national authorities that provided data



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