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THE EUROPEAN PEATLAND MAP

- Technical description and data sources

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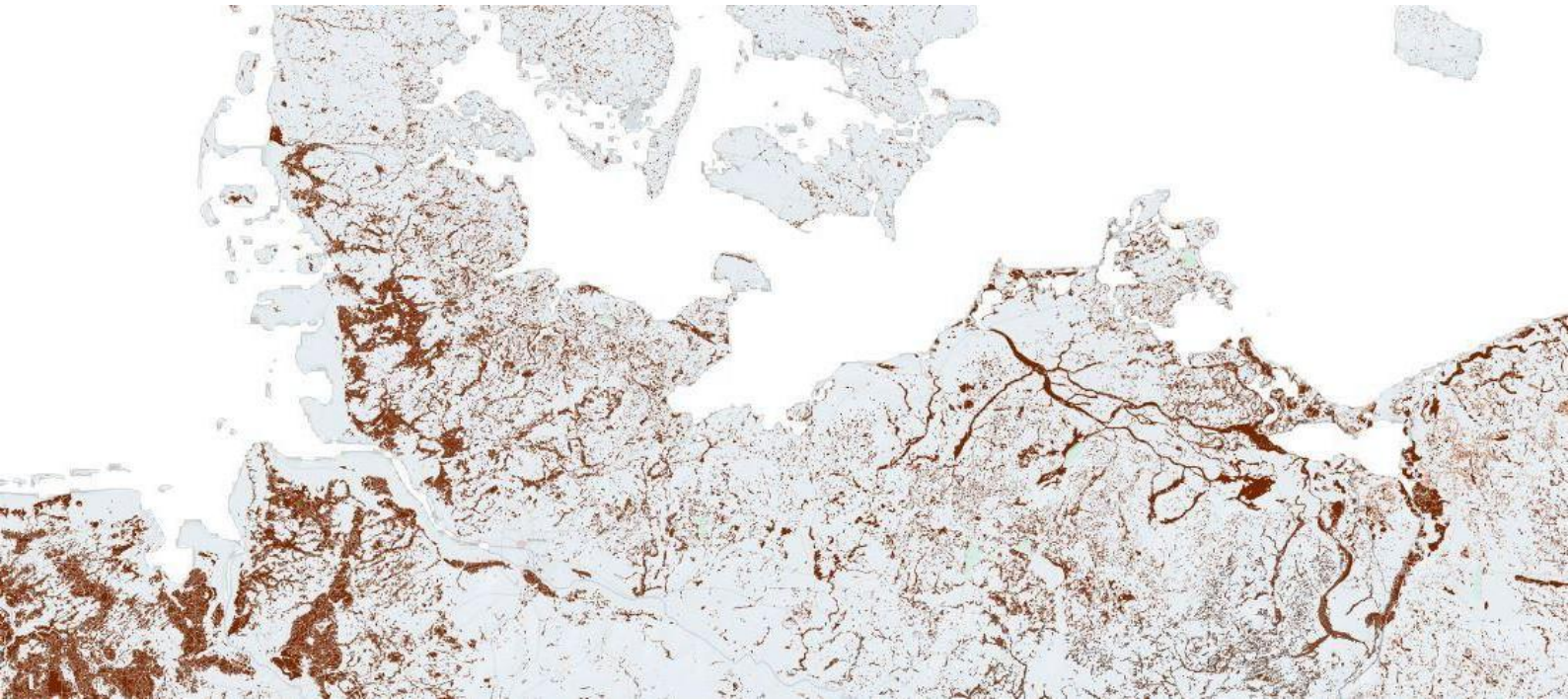

Picture title page: Screenshot of the EPM2025 displayed in QGIS (GPD 2025)

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Content

1. Introduction and Background

The 2017 "Peatland Map of Europe" (Tanneberger et al., 2017) marked a significant milestone in mapping the distribution of peatlands across Europe. It was based on national datasets compiled during the elaboration of the Book “Mires and Peatlands of Europe” (Joosten et al., 2017). Since its publication, knowledge and data on peatland distribution have expanded considerably, driven by improved data collection methods, advanced technologies, and enhanced access to geospatial data. In response to this advance, we have updated the 2017 Peatland Map of Europe and now provide a more comprehensive and accurate picture of peatland distribution across Europe.

The update of the Peatland Map of Europe (Tanneberger et al. 2017) was conducted as part of the development of the European Wetland Map (Tegetmeyer et al. 2024) under the EU projects “ALFAwetlands”, “WET HORIZONS” and the EUKI project “Building the European Peatlands Initiative: a strong alliance for peatland climate protection in Europe" financed by the German Federal Ministry for Economic Affairs and Climate Action (BMWK). For most of the peatland-rich countries of North and West Europe already integrated datasets have been updated or have been replaced by more comprehensive and up-to-date other peatland data. The majority of these datasets is not older than 2020.

Moreover, particular attention was paid to the Balkans and Mediterranean countries, where peatland distribution data could be improved significantly, by replacing prevailing point distribution data by polygon data. This allows a better understanding of peatland extent and distribution. The increasing availability of freely accessible geodata has played a critical role in the updating process, supporting both the mapping effort and the broader dissemination of knowledge on peatlands.

The present European Peatland Map 2025 (EPM2025) is a composite map consisting of 36 separate country datasets depicting the distribution of peatlands and partly giving further information on peatland types. This updated map is a valuable tool, e.g., for sustainable (peat)land management and nature conservation, peatland monitoring as well as for the development of climate change mitigation strategies across Europe.

As improving the accuracy and comprehensiveness of the EPM2025 is an ongoing process, we will continue our efforts to map peatlands in Europe. In addition to spatial distribution data, there is an urgent need for more detailed information on the type of peatlands, biodiversity, especially vegetation cover. In addition, data on land use and land-use change, drainage and actual site condition will be an essential part of improving the EPM2025 with regard to greenhouse gas emissions, conservation measures and the implementation of rewetting projects in future.

2. The European Peatland Map (2025)

The EPM2025 (Figure 1) is a composite of individual datasets for each of the countries. Both, a vector and a raster dataset on the geographical distribution of the peatlands were created for each country and are available as an ArcGIS geodatabase (projection: Lambert Azimuthal Equal Area, EPSG 3035) and as a country-specific Geo-TIFF collection (grid size: 1 arcsecond, projection WGS84, EPSG 4326) under CC BY 4.0 licence.

Figure 1. The European Peatland Map 2025 ('EPM2025').

2.1 Vector Data

All country-wise, individual vector datasets (polygon) of the EPM2025 are stored in one ArcGIS geodatabase named **EPM2025.gdb**. The projection is ETRS 1989 LAEA, EPSG 3035. The minimum mapping unit is 1m². The attributes of the datasets are described in the following.

Table 1. Data description of the EPM2025 vector data (attributes).

attribute name	data type	description
OBJECTID*	ObjectID	automatically generated object ID
Shape*	Geometry	describes the geometry of the vector data
Id	Long	ID from source layer
source	Text	specification of the data source
map_cat	Long	specification of the GMC classification approach for the visualization of peatland geodata
peatl_type	Text	peatland classification according to the original data source
Shape_Length*	Double	feature length (according to projection, here decimal degree)
Shape_Area*	Double	feature area (according to projection, here decimal degree)

* read only

Table 2. Description of attribute value 'source'

source	
value	**description**
GPD 2023/2024	data of the Global Peatland Database 2023/2024, details in table A1 of this report
OSM	data extracted from OpenStreetMap (OSM; www.openstreetmap.org)
european	Extended wetland ecosystem layer 2018 (raster 100m) version 1, Jul. 2021 (EEA geospatial data catalogue, 2022)
Alfa	unpublished product developed in the EU funded HORIZON project 'AlfaWetlands', details in table A1 of this report
national	Other national dataset, details in table A1 of this report

Table 3. Description of attribute value 'map_cat'

map_cat	
value	**description**
0	no peatland
1	peat dominated, comprises areas with a rather complete spatial coverage of peatland in the underlying GIS dataset
2	peat in soil mosaic, comprises areas where peat coverage is rather patchy, aims at highlighting areas where peatlands intimately interlace with mineral soils and the factual extent of peatland is readily overestimated

Table 4. Description of attribute value 'peatl_type'

peatl_type	
value	**description**
various values like *bog, fen, transition mire* etc.	peatland type description or proxy data classification taken from the original data source, not every feature has mandatory content

2.2 Raster Data

The EPM2025 raster dataset is made up of individual Geotiff-files with the respective extent of all countries considered. The Geotiff-files have a resolution of 1 arc second and are projected in WGS 84. EPSG 4326. Each country Geotiff contains information about the GMC - classification approach for the visualization of the data (compare: 'value' in Table 5).

Table 5. Raster data values in country Geotiff-files.

value	description
0	no peatland
1	peat dominated, comprises areas with a rather complete spatial coverage of peatland in the underlying GIS dataset
2	peat in soil mosaic, comprises areas where peat coverage is rather patchy, aims at highlighting areas where peatlands intimately interlace with mineral soils and the factual extent of peatland is readily overestimated

2.3 Coverage

The EPM2025 covers most countries on the European continent. The following countries were included in the updating process, largely similar to the Peatland Map of Europe (2017): Albania, Andorra, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark (excl. Greenland), Estonia, Finland (incl. Aland), France (excl. overseas territories), Germany, Greece, Hungary, Ireland, Iceland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Montenegro, Netherlands, North Macedonia, Norway (excl. Svalbard), Poland, Portugal (excl. Azores), Romania, Serbia (incl. Kosovo), Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom (excl. overseas territories). Armenia, Azerbaijan, Belarus, Cyprus, Faroe Islands, Georgia, Isle of Man, Malta, Moldova, Monaco, San Marino, the Russian Federation, Ukraine, Turkey and Vatican City are not included (Figure 2).

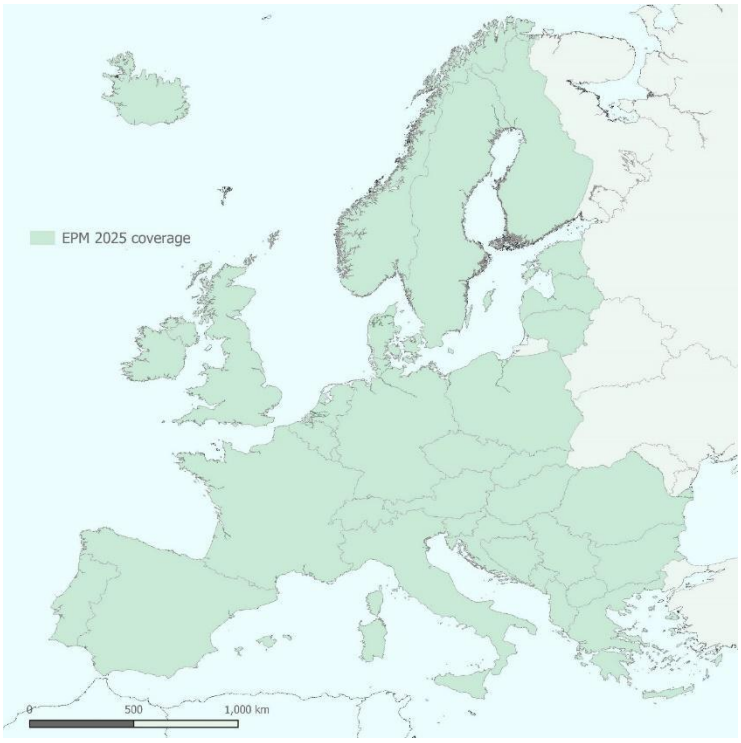

Figure 2. Coverage of the European Peatland Map 2025

3. Peatlands and Definitions

A **'peatland'** is land with a naturally accumulated layer of peat near the surface. Peatlands can either actively accumulate peat or no longer accumulate but lose their peat layer (degraded peatlands). To address conceptual and definitional variety across countries and languages, we took an integrative approach and refrained from defining peatlands based on specific thresholds for soil organic carbon (SOC) concentration or the depth of the organic-soil layer (peat, or O horizon). In case such information was provided for specific geospatial datasets, we included those that surpassed the threshold of >12% SOC (rarely >6%, if data available). Our integrative approach incorporates all data that fulfill at least one of the following criteria and definitions (cf. Convention on Wetlands 2021):

Organic matter: Carbon-hydrogen based material of botanical, faunal or microbiological origin.

Peat: Substance largely consisting of dead organic matter with macroscopic plant remains, that has not been relocated by water, ice or wind (in contrast to 'sediment') after its production.

Organic soil: Soil with a substantial layer of dead organic matter at or near the surface (which includes also peatlands and histosols).

4. Input Data

The EPM2025 has been compiled from over 100 different national and regional datasets (see Table A1 in Appendix). It includes various geospatial data (raster, polygon and point data) mainly from peatland and soil research publications, **national or regional soil databases, OpenStreetMap (OSM)** (wetland features defined as natural=wetland+bog/fen/swamp/marsh/ etc. [proxy data][1]). For some countries access to national or regional data from research institutes, ministries or agencies was granted. Datasets were included in the EPM2025 regardless of peatland type, ecological or degradation statuses.

Peatland types: Information on peatland types is also included in the vector data (Geodatabase) of the EPM2025. However, peatland type information can use different classification frameworks, e.g., deriving ecological peatland types (trophy, pH), information on nutrient content ('nutrient-rich' vs. 'nutrient poor'), peat thickness ('shallow' vs. 'deep') or hydrological peatland types such as 'raised bog', 'river valley fen', 'blanket bog'. Generally, such additional data seem to be limited in quality and availability. As a consequence, such specification was not available for all countries, regions or single features and needs further improvement.

Names and descriptions contained in the original data have been largely maintained in the Geodatabase/vector data of the EPM2025 and have not been harmonized. In some cases, however, categories were generalized in order to facilitate the management and processing of polygon vector layer (i.e., peatland distribution of Finland).

We further applied the classification according to the Global Peatland Map GPM 2.0[2] (GMC classification approach: 1= peat dominated, 2= peat in soil mosaic) for the presentation of peatland distribution data (see also Table 3). The European Peatland Map of Tanneberger et al. (2017) does not make this differentiation.

[1] OpenStreetMap. https://wiki.openstreetmap.org/wiki/Map_features#Natural
[2] https://maps.work/gpd/

5. Peatland Extent

The total peatland area in the covered countries is according to the ArcGIS geodatabase (EPM2025.gdb) **38,422,008 ha** (384,220 km², Table 6). Despite the improvements of the EPM2025, we are aware that several input datasets are biased compared to the ground. Thus, the total area can be both an overestimation or underestimation, depending on several factors. Since some input datasets required the inclusion of two categories—one of which is “peat in the soil mosaic” (category 2)—the total calculated peatland area also includes mineral soils that are closely interwoven with peat soils in the landscape. As a result, this may lead to a slight overestimation of the overall peatland extent. Oppositely, peatland distribution data can be generally incomplete for countries (e.g., France) or for specific environments as coasts. Moreover, wide-spread but small peatlands of mountainous regions in southern Europe (e.g., the Balkans, Alps, Pyrenees) are not recorded in available soil and peatland data. In drained peatland areas, peat layers may already be substantially altered or overprinted due to anthropogenic disturbance and prolonged hydrological modification – which all lead to an underestimation of the total area. Despite all uncertainties, the area estimates from the EPM2025 present the up-to-date knowledge on a European level which invite to verify and refine the data at national and regional level in future.

Table 6. Area of peatlands in the countries analyzed derived from the EPM2025 vector data (EPSG 3035).

country	total [ha]	peat dominated [ha]	peat in soil mosaic [ha]
Albania	**24,179**	2,849	21,330
Andorra	**535**	535	0
Austria	**169,616**	26,517	143,099
Belgium	**107,217**	90,399	16,818
Bosnia and Herzegovina	**16,255**	16,255	0
Bulgaria	**11,467**	2,222	9,245
Croatia	**22,485**	531	21,953
Czech Republic	**29,600**	28,559	1,041
Denmark	**219,938**	219,938	0
Estonia	**1,075,539**	1,075,539	0
Finland	**8,952,267**	8,952,267	0
France	**241,151**	153,909	87,242
Germany	**2,069,197**	2,069,197	0
Greece	**23,534**	23,534	0
Hungary	**622,320**	488,133	134,187
Iceland	**1,055,837**	1,055,837	0
Ireland	**1,659,248**	1,659,248	0
Italy	**17,134**	1,518	15,616
Latvia	**954,935**	954,935	0
Liechtenstein	**669**	0	669
Lithuania	**873,961**	655,635	218,325
Luxembourg	**1,511**	1,511	0
Montenegro	**6,695**	6,695	0
North Macedonia	**2,999**	1,688	1,311
Norway	**2,523,706**	1,993,366	530,339
Poland	**2,270,826**	1,407,858	862,968
Portugal	**8,588**	608	7,980
Romania	**355,913**	3,175	352,738
Serbia (incl. Kosovo)	**16,085**	16,085	0
Slovakia	**4,822**	509	4,313
Slovenia	**7,837**	7,837	0
Spain	**99.028**	303	98.725
Sweden	**7.281.872**	7.281.872	0
Switzerland	**99.222**	24.761	74.462
The Netherlands	**526.258**	526.258	0
United Kingdom	**7.069.564**	3.762.630	3.306.934
total SUM	**38,422,008**	**32,512,712**	**5,909,295**

6. Acknowledgments

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Data were produced with funding by the European Union.

7. Author’s contribution statement

Cosima Tegetmeyer: data curation, methodology, data collection (OSM data), data processing, formal analysis, final processing and provision of data, visualization (map layout), writing: original draft

Moritz Kaiser: data curation, data collection, writing: review & editing

Marija Chobanova: conception and development of the peatland distribution geodataset of North Mazedonia

Franziska Tanneberger: data collection for the European Peatland Map 2017, validation, funding acquisition, writing: review & editing

Alexandra Barthelmes: methodology, plausibility check of geodata, validation, supervision, funding acquisition, writing: review & editing

8. References

Convention on Wetlands (2021) Global Guidelines for Peatland Rewetting and Restoration, Ramsar Technical Report No, 11, Gland, Switzerland: Secretariat of the Convention on Wetlands.

EEA geospatial data catalogue (2022) Extended wetland ecosystem layer 2018 (raster 100m) version 1, Jul, 2021, https://www.eea.europa.eu/en/datahub/datahubitem-view/b9399908-557a-47a8-954a-958dabeaf1b6?activeAccordion=1083788

European Union's Copernicus Land Monitoring Service information https://doi.org/10.2909/205e2db2-4e35-4b1b-bf84-271c4a82248c

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Tanneberger, F., Tegetmeyer, C., Busse, S., Barthelmes, A., et al, (2017): The peatland map of Europe, Mires and Peat, Volume 19, Article 22, 1–17, DOI: 10,19189/MaP, 2016, OMB, 264,

Tegetmeyer, C., Kaiser, M., Barthelmes, A. (2025). The European Wetland Map ('EWM') [Dataset]. Zenodo. https://doi.org/10.5281/zenodo.14745285

Appendix 1

Table A1. Sources of peatland data of the EPM25.

country	Reference
Andorra	Details in Tanneberger et al. 2017 (http://mires-and-peat,net/media/map19/map_19_22.pdf)
Albania	Details in Tanneberger et al. 2017 (http://mires-and-peat.net/media/map19/map_19_22.pdf)
Albania	OpenStreetMap, Natural:Wetland, https://wiki.openstreetmap.org/wiki/DE:Map_Features (accessed on 01 July 2024)
Austria	Details in Tanneberger et al. 2017 (http://mires-and-peat.net/media/map19/map_19_22.pdf)
Belgium	Decleer, K., Wouters J., Jacobs S., Staes J., Spanhove T., Meire P., van Diggelen, R. (2016) Mapping wetland loss and restoration potential in Flanders (Belgium): an ecosystem service perspective. Ecology and Society 21(4). 46.
Belgium	Databank Ondergrond Vlaanderen - Vlaamse overheid. Departement Omgeving. Vlaams Planbureau voor Omgeving (VPO) – (accessed on 25.11.2022) (https://www.dov.vlaanderen.be/)
Belgium	Carte des Principaux Types de Sols de Wallonie au 1/250000 constituée de polygones représentant les PTS. Géoportal de la Wallonie. https://geoportail.wallonie.be/home.html
Belgium	EIONET (2013) Member State reports on Art 17 reporting period 2007-2012. https://www.eionet.europa.eu/etcs/etc-be/activities/reporting/article-17/outcomes-2007-2012
Bosnia and Herzegovina	Details in Tanneberger et al. 2017 (http://mires-and-peat.net/media/map19/map_19_22.pdf) (Appendix 1; http://mires-and-peat.net/media/map19/map_19_22.pdf).
Bulgaria	OpenStreetMap. Natural:Wetland. https://wiki.openstreetmap.org/wiki/DE:Map_Features (accessed on 24 June 2024).
Bulgaria	European Union's Copernicus Land Monitoring Service information https://doi.org/10.2909/205e2db2-4e35-4b1b-bf84-271c4a82248c

country	Reference
Bulgaria	Koinov, V., Trashliev, H., Yolevski, M., Andonov, T., Ninov, N., Hadzhiyanakiev, A., Angelov, E., Boyadzhiev, T., Fotakieva, E., Krastanov, S., Staykov, Y. (1968) Soil map of Bulgaria at a scale of 1:400,000. GUGK. Sofia. Bulgaria.
Bulgaria	Details in Tanneberger et al. 2017 (http://mires-and-peat.net/media/map19/map_19_22.pdf)
Bulgaria	Michev, T. (ed.) (1995) National action plan for the conservation of the most important wetlands in Bulgaria, Ministry of Environment. Sofia. Bulgaria. 55 p.
Croatia	Details in Tanneberger et al, 2017 (http://mires-and-peat,net/media/map19/map_19_22.pdf)
Croatia	OpenStreetMap, Natural:Wetland, https://wiki,openstreetmap,org/wiki/DE:Map_Features (accessed on 24 June 2024)
Czech Republic	Details in Tanneberger et al, 2017 (http://mires-and-peat,net/media/map19/map_19_22.pdf)
Czech Republic	OpenStreetMap, Natural:Wetland, https://wiki,openstreetmap.org/wiki/DE:Map_Features (accessed on 24 June 2024)
Denmark	Skov- og Naturstyrelsen (2009) *Naturbeskyttelsesloven. Lovbekendtgørelse nr. 933 af 24.09.2009 om naturbeskyttelse.* [Nature Protection Act. Act no. 933 of 24.09.2009 on nature protection] (in Danish)
Denmark	Adhikari, K., Kheir, R.B., Greve, M.B., Bøcher, P.K., Malone, B.P., Minasny, B., McBratney, A.B., Greve, M.H. (2013) High-resolution 3-D mapping of soil texture in Denmark, Soil Science Society of America Journal, Wiley Online Library
Estonia	Kmoch, A, 2017, Soil map of Estonia – Mullastikukaart. National Soilmap of Estonia. 1:10.000. dataset deposit (https://datadoi.ee/handle/33/103?show=full)
Estonia	Estonian Topographic Database. Map data: Estonian Land Board 06.03.2023. https://geoportaal.maaamet.ee/eng/spatial-data/estonian-topographic-database-p305.html
Finland	Middleton, M., Laatikainen, M., Kivilompolo, J., Harju, A., Lerssi, J., Valkama, M., Pitkänen, T., Pohjankukka, J., Balazs, A., Tuominen, S., Zelioli, L., Farahnakian, F., Nevalainen, P., Heikkonen, J. (2023) Geological Survey of Finland Information Solutions/Environmental Solutions (2023). Technical description for the peatland site type data of Finland. Report 73.
France	Adrià Descals Ferrando (2024). CREAF. https://www.creaf.cat/en, unpublished product of the AlfaWetlands project
France	Gilbert, D., Muller, F., Bernard, G., Pilloix, M. (2021) Digitized inventory of the French peatlands of 1949. Laboratoire Chrono-environnement (UMR 6249). doi:10.25666/DATAOSU-2021-03-01

country	Reference
France	Details in Tanneberger et al. 2017 (http://mires-and-peat.net/media/map19/map_19_22.pdf)
France	OpenStreetMap. Natural:Wetland. https://wiki.openstreetmap.org/wiki/DE:Map_Features (accessed on 24 June 2024).
Germany	Tegetmeyer, C., Barthelmes, K.-D., Busse, S., Barthelmes, A. (2020) Aggregierte Karte der organischen Böden Deutschlands (pdf) Greifswald Moor Centrum-Schriftenreihe 01/2020 (Selbstverlag, ISSN 2627-910X), 10 p.
Germany	Wittnebel, M., Frank, S., Tiemeyer, B. (2023) Aktualisierte Kulisse organischer Böden in Deutschland. [Datensatz]. OpenAgrar-Repository, Göttingen, Germany, (https://atlas.thuenen.de/layers/geonode_data:geonode:ti_kulisse_kat_final_v10)
Greece	Details in Tanneberger et al. 2017 (http://mires-and-peat.net/media/map19/map_19_22.pdf)
Greece	Wetlands of the Balkan Mediterranean territory. Fitoka E., Petrov P., Ivanova S., Hatziirdonou L., Terziyska I. (eds) (2020) The Regional Balkan - Mediterranean Wetland Mapping & Connectivity Assessment:methodological approach, findings, future considerations. WetMainAreas INTERREG Balkan - Mediterranean project Technical Publication. 53 p.
Hungary	Pásztor, L., Laborczia, A., Bakacsi, Z., Szabó, J., Illés, G. (2018) Compilation of a national soil-type map for Hungary by sequential classification methods. *Geoderma* 311. 93-108
Hungary	Várallyay, Y, Szucs, L., Rajkai, K., Zilahy, P., Murányi, A. (1980) Soil water management categories of Hungarian soils and the map of soil water properties (1:100 000) Agrokémia és Talajtan 29(1):77-112
Hungary	Ministry of Agriculture (2019) Development of an ecosystem basemap and data model. https://www.interregeurope.eu/good-practices/national-ecosystem-map-of-hungary
Iceland	Guðmundsson, J., Brink, S.H. (2014) IGLUD - Icelandic Geographical Land Use Database (ed. by J.), Agricultural University of Iceland, Reykjavík. Iceland.
Ireland	Gilet, L., Morley, T, R., Flynn, R., Connolly, J. (2024) An adaptive mapping framework for the management of peat soils: A new Irish peat soils map. Geoderma 447. 116933.
Italy	Details in Tanneberger et al. 2017 (http://mires-and-peat.net/media/map19/map_19_22.pdf)
Italy	Gardin L., Chiesi M., Fibbi L., Maselli F. (2021) Mapping soil organic carbon in Tuscany through the statistical combination of ground observations with ancillary and remote sensing data, *Geoderma* 404, 115386.
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Lithuania	Lithuania fund for Nature and Lithuanian Geological Survey (2005) Lietuvos durpynų ir pelkių žemėlapis. [Map of peatlands and mires in Lithuania]. scale 1:200.000. GIS dataset. (https://www.geoportal.lt/geoportal/subscribe/-/asset_publisher/I0YH9ZsWns4x/content/nauji-duomenys-geoportal-lt-lietuvos-pelkiu-ir-durpynu-duomenu-perziuros-paslauga)
Lithuania	Lietuvos pelkių ir durpynų GIS duomenų bazės atnaujinimas. VšĮ Gamtos paveldo fondas (2018)
Luxembourg	Details in Tanneberger et al. 2017 (Appendix 1; http://mires-and-peat.net/media/map19/map_19_22.pdf)
Montenegro	Details in Tanneberger et al. 2017 (Appendix 1; http://mires-and-peat.net/media/map19/map_19_22.pdf)
North Macedonia	Marija Chobanova unpublished
Norway	Details in Tanneberger et al. 2017 (Appendix 1; http://mires-and-peat.net/media/map19/map_19_22.pdf)
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