Introduction to data sources used to produce PEATMAP

In this appendix, we provide details of the data sources used to produce PEATMAP. These sources were selected based on methods described in the main paper. The inventory of data sources used to produce PEATMAP is shown in Table A.1.

1. Northern Peatlands (>30°N latitude)

The UK peatland maps in this study have involved combining DiGMapGB-625 with the 'Bog' and 'Fen, Marsh and Swamp' layers of UK Land Cover Map (LCM) 2007 (Morton et al., 2011).

The DiGMapGB-625 Surficial Deposits dataset is a freely available superficial theme of the Digital Geological Map of Great Britain at 1: 625,000 by the British Geological Survey. The DiGMapGB-625 Surficial Deposits dataset was compiled from the latest available 1: 50000 data of England and Wales, Scotland and the Isle of Man and the 1: 250000 published Quaternary map of Northern Ireland. The most recent source data for DiGMapGB-50 was resurveyed in 2003 and published in 2010. The survey of superficial geological deposits in the UK recognised the occurrence of peat deposits extending to at least 1 m below the ground surface (McMillan and Powell, 1999).

The surficial peat deposits that occur entirely within 1 m of the ground surface are not included in DiGMapGB-625 as superficial geology mapping was intended to show material underlying the modern soil profile (Joint Nature Conservation Committee, 2011; Smith et al., 2013). Thus, for shallower peatlands, LCM 2007 was used. It is a parcel-based classification of 23 types of British land cover as part of the UK Biodiversity Action Plan (BAP) Broad Habitats. The spatial resolution of LCM 2007 is 25 m and source data were collected around 2007. The UK LCM 2007 provides the spatial distribution of 'Bog' and 'Fen, Marsh and Swamp' based on the habitat and vegetation information and provides good information on

surficial peatland extent (e.g. blanket bog or raised bog plant communities associated with peats).

The Irish National Soils Map (Teagasc, 2014) is one part of the Irish Soil Information System project which provides a national association soil map for Ireland at a scale of 1: 250,000 by adopting a combined methodology of utilising novel geo-statistical predicted mapping techniques in tandem with traditional soil survey applications during the period 2002-2009.

Superficial deposits of Finland 1: 200,000 (sediment polygon) was produced by Geological Survey of Finland (2010) which contains data produced from the whole of Finland during the period 2002-2009 at a scale of 1: 200,000.

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Table A. 1 Inventory of data sources used to produce PEATMAP

Region	Reference	Map scale/ nominal resolution (spatial resolution)	Period (date) of most recent revision	Notes
Northern Peatlands (>30°N latitude)				
United Kingdom	British Geological Survey (2013)	1:625,000	2003-2010	Peat feature from Surficial Deposits of DiGMapGB-625.
	Morton et al. (2011)	25 m	2007	'Bog' and 'Fen, Marsh and Swamp' layers of UK Land Cover Map (LCM) 2007.
Ireland	Teagasc (2014)	1:250,000	2002-2009	Using peatland features.
Finland	Geological Survey of Finland (2010)	1: 200,000	2002-2009	Using peatland features.
Sweden	Geological Survey of Sweden (2009)	1:1,000,000	Around 1994	Using peatland features extracted from quaternary deposits map.
Other European regions	Hiederer (2013)	1 km	2000-2006	'Peat' attribute maps from 'European Soil Database (ESDB) Derived data'.
Western Siberia	Sheng (2009)	1:1,000,000	1999-2001	West Siberia peatland features.
Asian Russia (Except Western Siberia)	Stolbovoi and McCallum (2002)	1:2,500,000	1990s	Using (1) Bogs with deep peat (>50 cm) and (2) Swamps with shallow peat (30-50 cm) features from Russia Wetland Database.
Canada	Tarnocai et al. (2011)	1:6,500,000	2011	Using Bog, Fen and Swamp features with percentage.
United States	Soil Survey Staff (2012)	1:1,000,000 in Alaska and 1: 250,000 in other regions	1999-2005	Using histosols order and gelisol-histel sub-order layers of STATSGO2.
China	Ma et al. (2015)	1 km	2000	Using bogs, fens, swamps and marshes that are non-saline and which excludes lakes or river wetlands.
Tropical Peatlands				
Indonesia	Ritung et al. (2011)	1:250,000	2005-2010	Peat feature from 'Indonesia Peat Lands' dataset.
Malaysia	Wetlands International (2010)	1: 50,000	2002-2009	Peat feature from 'Malaysia Peat Lands' dataset.
Central Congo Basin	Dargie et al. (2017)	50 m	2009-2010	Peat swamp forest feature.
Other regions in 38° N to 56° S; 161° E to 117° W	Gumbricht (2015)	236 m	2011	'Peat' attribute layers derived from 'Tropical Wetland Distribution (38° N to 56° S; 161° E to 117° W)'.
Southern Peatlands (>30 °S latitude)				
Australia (Except Tasmania)	Environment Australia (2015)	1:500,000	2001-2010	Peatland features from Directory of Important Wetlands in Australia.
Tasmania	Department of Primary Industries and Water (2013)	1:25,000	2013	MBU, MBW, MSW, MSP, MRR features from 'Moorland, Sedge land, Rush land and Peatland' class.
New Zealand	MFE (2013)	1:50,000	2008	Current extent feature of peatlands from wetland typology.
Other regions (i.e. Hokkaido, Mongolia, and North Korea**)**	FAO/IIASA/ISRIC/ISSCAS/JRC (2012)	30 arc-second (c. 1 km at the equator)	1997	Using histosol features from HWSD v1.2 with a percentage.

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The Swedish Quaternary Deposits map is produced by Geological Survey of Sweden (2009) and provides peat coverage for Sweden at 1: 1,000,000, and reflects the soil information from around 1994.

For other parts of Europe, the 'peat' layer from the European Soil Database Derived data with a raster resolution of 1 km was used, which was last updated in the period 2000 - 2006 (Hiederer, 2013). The classification of peat was performed on the basis of the soil clay and organic carbon content as found in the Soil Geographical Database of Eurasia (SGDBE) v 4.0. Therefore, only for regions where an updated peatland map was unavailable, the PEATMAP data were derived from European Soil Database Derived data.

The Asian Russia peatland map was compiled from two datasets - Western Siberia peatland GIS Data Collection (Sheng, 2009) and Russia Wetland Database (Stolbovoi and McCallum, 2002). Detailed physical characteristics of 9,691 individual peatlands (patches) in the 1: 1,000,000 Western Siberia peatland GIS Data Collection were obtained from previously unpublished Russian field and ancillary map data, previously published depth measurements, and field depth and core measurements were taken throughout the region during field campaigns in 1999 - 2001 and published in 2009. The Russian Wetland Classification Shapefile was generalised from the standard 1: 2,500,000 soil map of Russia and reflected the soil situation in the 1990s.

The Peatlands of Canada in Geological Survey of Canada Open File 6561 (Tarnocai et al., 2011) was developed in 2011 by updating the 2005 version of the database using new spatial and site data, together with updated information from the peatland component of the Soil Organic Carbon Database. Peatlands are classified as land surfaces containing more than 40 cm of peat accumulation on which poorly-drained organic soils develop. The map scale of Peatlands of Canada is 1: 6,500,000 and reference year of source data last revision is 2011. The Bog, Fen and Bog/Fen features in this dataset were used to produce PEATMAP.

STATSGO2 is a broad-based inventory of soils at 1: 250,000 for continental U.S., Hawaii, Puerto Rico and the Virgin Islands and at 1: 1,000,000 in Alaska. It uses the U.S. soil classification system - Soil Taxonomy. In the U.S. soil classification system - Soil Taxonomy (Soil Survey Staff, 2012), soils where the surface organic layer is more than 40 cm thick have been classified as histosols, while permafrost-affected organic soils (i.e. permafrost peats) are classified as the histels suborder in the gelisols order. Therefore, the peatlands in the United States were derived from the histosols and gelisol-histel layers of the Digital General Soil Map of the United States. The source materials of STATSGO2 include multiple soil survey publications from the U.S., the USGS, and the 2005 National Soil Information System (NASIS) data base from NRCS.

The source data of China's peatland distribution was derived from the Hybrid Palustrine Wetland Map of China (HPWMC) by Ma et al. (2015). The HPWMC is a hybrid map of 1 km spatial resolution reflecting bogs, fens, swamps and marshes that are non-saline and which are not lakes or rivers. HPWMC was mapped based on seven existing datasets including the wetland database of the Chinese Academy of Sciences (Wetland-CAS); the wetland database of Beijing Forestry University (Wetland-BFU); the wetland database of Chinese Land Use (Wetland-LU); the Global Lake and Wetlands Database (GLWD-3); the Chinese wetland census dataset; historical temperature and precipitation datasets; and 1 km resolution Digital Elevation Model (DEM). The reference year of the last revision is 2000. These datasets were processed by i) ranking available datasets; ii) ranking pixels, and iii) allocating the statistics of palustrine wetland area for each province reported in the Chinese wetland census database to pixels. The HPWMC has been validated showing that it can reproduce high fidelity distributions of peatland in China according to the national statistics database, although there still could be some undiscovered peatlands have been omitted and some peatlands may have been incorrectly classed (i.e. small error of omission, but unknown error of commission). It

should be noted that palustrine wetland refers to non-tidal marshes, peat swamps, bogs, and fens (Ramsar Convention Secretariat, 2013), which means some non-peatlands may be incorporated in the palustrine map (i.e. non-tidal marshes). However, there are approximately 11,343 km^2 of marshes in China (Zhang et al., 2014), only accounting for 8.28 % of total Chinese palustrine wetland area. The area of non-tidal marshes should be much less than the total area of marsh, therefore, HPWMC could be used to determine the peatland distribution in China.

2. Tropical Peatlands

The Indonesia peatlands map at a scale of 1: 250,000 published by Indonesia Ministry of Agriculture (Ritung et al., 2011) is the official government map of peatlands in Indonesia. It is based on several preceding peatland and soil maps of Indonesia, including the Land Resource Evaluation and Planning Project (LREP) data (LREP, 1999), Land Form Classification Maps produced by Regional Planning Program for Transmigration (RePPProT, 1989), Wetlands International peatland map (Wahyunto et al., 2006; Wahyunto and Subagjo, 2003; Wahyunto and Suparto, 2004) and data from several more recent updated regional land and soil surveys in 2005 - 2010 (Haryono and Ritung, 2011).

The Malaysia Peat Lands map was released by Wetlands International (2010) to assess the current status, extent, distribution, and conservation needs for peatlands in Malaysia by overlaying 2009 satellite imagery (Landsat Thematic Mapper, scale 1: 50,000) on a 2002 map of land use provided by Department of Agriculture. Ground data were collected in sample sites throughout the peninsular to assess the local extent and condition of peat soils.

Peatland extents in the Central Congo Basin were derived from Dargie et al. (2017). This GIS file was produced by combining radar backscatter, optical data and ground data. The spatial resolution of these data is 50 m and the latest date of acquisition data of remote-sensing products used in mapping peatland extent is 2010.

The Tropical and Sub-Tropical Wetland Distribution dataset by Gumbricht (2015) is one part of The Global Wetlands Map which was produced by the Sustainable Wetlands Adaptation and Mitigation Program (SWAMP). This dataset shows a distribution of wetland that covers the tropics and subtropics (38° N to 56° S; 161° E to 117° W), excluding small islands. It is by far the highest spatial resolution and most recent tropical and sub-tropical wetland dataset. It was mapped at 236 m spatial resolution by combining a hydrological model and annual time series of satellite-derived estimates of soil moisture to represent water flow and surface wetness that are then combined with geomorphological data, and the source data collection period was around 2011.

3. Southern Peatlands (>30 °S latitude)

Directory of Important Wetlands in Australia (DIWA) Spatial Database is a polygon coverage dataset produced by Environment Australia (2015) that presents the different types of wetland (e.g. marsh, swamp, peatland) boundaries and locations in Australia on a scale of 1: 500,000 from 2001 to 2010. We also used the Tasmanian Vegetation dataset produced by Tasmanian Resource Management and Conservation Division (Department of Primary Industries and Water, 2013) which depicts the extent of more than 150 vegetation communities, including those representing peatlands at 1: 25,000 spatial coverage. TASVEG (Tasmania's vegetation) is continually revised and updated via photographic and satellite image interpretation and is verified in the field where possible. The reference year of source data last revision is 2013.

The Current Wetland Extent 2013 from The Ministry for the Environment and Statistics New Zealand (Ministry for the Environment and Statistics New Zealand, 2013) provides the current extent of seven classes of wetlands of New Zealand at 1: 50,000 by using 26 Landsat ETM+ satellite imagery in 2008 and wetland point and polygon data collated from surveys, field work or photo–interpretation held by local and central government.

4. Harmonized World Soil Database (HWSD) v1.2

For Mongolia, North Korea and the north island of Japan (Hokkaido) (south island peatlands were derived from Tropical and Sub-Tropical Wetland Distribution dataset which cover 38° N to 56° S and 161° E to 117° W), where a high-quality peatland spatial dataset is unavailable, the peatland extents were determined from the histosol maps derived from HWSD v1.2. The HWSD v1.2 (FAO/IIASA/ISRIC/ISSCAS/JRC, 2012) has a nominal resolution of 30 arc-seconds on the ground (corresponding approximately to 1 × 1 km at the equator). The raster database contains more than 40 years of soil information. A map of histosols was derived from HWSD according to the FAO-74 and/or the FAO-90 soil classification. Five source databases (Table A. 2) were used to compile version 1.2 of HWSD. The period of most recent revision according to our source dating protocol is the 1980s which is when the second national soil survey of China was launched. We used the date consistent with the authors' definition for histosols as the date of most recent revision.

Table A. 2 Source databases of HWSD v1.2

Soil Map of the World	The Digitized Soil Map of the World Including Derived Soil Properties (version 3.5) (FAO, 1995, 2003). The FAO-UNESCO Soil Map of the World. Legend and 9 volumes. UNESCO, Paris (FAO, 1971-1981).
SOTER regional studies	Soil and terrain database for north-eastern Africa and Crop production zones (FAO, IGADD/ Italian Cooperation, 1998). Soil and Terrain database for north and central Eurasia at 1: 5 million scale (FAO/IIASA/Dokuchaiev Institute/Academia Sinica, 1999). Soil and terrain digital database for Latin America and the Caribbean at 1: 5 Million scale (FAO/UNEP/ISRIC/CIP, 1998). Soil and Terrain Database, Land Degradation Status and Soil Vulnerability Assessment for Central and Eastern Europe (1: 2,500,000) (FAO/ISRIC 2000). Soil and Terrain Database for Southern Africa (FAO/ISRIC, 2003). SOTER-based soil parameter estimates for Central Africa – DR of Congo, Burundi and Rwanda (SOTWIScaf, version 1.0) (Batjes, 2007). SOTER parameter estimates for Senegal and The Gambia derived from SOTER and WISE (SOTWIS-Senegal, version 1.0) (Batjes, 2008). Soil property estimates for Tunisia derived from SOTER and WISE. (SOTWIS-Tunisia, version 1.0) (Batjes, 2010).
The European Soil Database	European Soil Bureau European Soil Database (v. 2.0) (Panagos et al., 2012)
Northern Circumpolar Soil Map and database	Datasets with dominant soil characteristics at a scale of 1: 10,000,000 (Tarnocai et al., 2002).
The Soil Map of China 1:1 Million scale	The Soil Map of China based on data from the office for the Second National Soil Survey of China and Institute of Soil Science in Nanjing (Shi et al., 2004).

Soil parameter estimates based on World Inventory of Soil Emission Potential (WISE) database	Version 2.0 of the WISE database (Batjes et al, 1997; Batjes, 2002). SOTWIS (Batjes, 2007; Van Engelen et al., 2005).

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