Towards a global high resolution peatland map in 2020

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Peatlands occur all over the World and large areas are drained.
Drainage has severe environmental effect:

- Flooding due to land subsidence
- Soil degradation and erosion
- Peat fire
- Huge GHG emissions
Global CO$_2$ emissions from drained peatlands: ~ 2 Gt/yr

= 5% of all anthropogenic CO$_2$, but drained peatlands cover only 0.3% of the global land area

Land use emission Hot Spot!

Recently recognized in international policy (e.g. UNFCCC, EU, FAO, RAMSAR, ...)

GHG emissions:
Mitigation of peatland GHG emission requires data...

- ... on the extent of peatlands (including abandoned areas)
- ... differentiated for drainage depth/intensity
- ... differentiated for land use types (forestry, agriculture, peat cutting, ...)

But this kind of peatland data is very scarce!
Peatland mapping faces several problems:

- Terms, concepts, definitions and resolution of data (very) far from being uniform across the Globe
- Available maps often lack detailed information on survey methods
- Peatlands are fragmented by land use: high resolution mapping needed
- Peatlands are diverse - extrapolation of approaches often difficult
- Properly analysed & geo-referenced soil profiles from peatlands are rare
- ...
Peatland mapping faces several problems:

**Floated lowlands of Africa**

- Hydromorphic soils often not separated into mineral and organic in soil mapping
- Especially in remote areas with difficult access, or the exposure to diseases or predators

- Still fragmentary ecological knowledge for vast areas
FAO (2014): summarized the future of peatland mapping

‘Future global peatland mapping systems should be based on aggregated data from local and national peat information (...).’

‘The first step (...) would be a complete inventory of the available national and global peatland information.’

L. Montanarella
Such an inventory started several years ago: in the IMCG Global Peatland Database.
The IMCG Global Peatland Database...

... coordinated by the Greifswald Mire Centre (Greifswald, NE-Germany)

... largest database of distribution and status of peatlands for all countries of the World.

... is a continuously developing & improving database of digital peatland, organic soil and peatland proxy data per country or region.

... has a broad variety of data collected, incl. regional GIS data.

(AFRICA: currently ~8,000 digital files in ~ 600 folders ~ 20 GB)
Global Peatland Database - mapping related activities

A. Collection of available geospatial peatland or proxy datasets
   (e.g. organic and hydromorphic soils, wetlands, vegetation, geology, ...)

   • evaluation of completeness and accuracy

   • evaluation of underlying terms, definitions and concepts

   • identification of restrictions and conflicts within and between datasets

B. Peatland mapping for countries without geospatial peatland data
Countries of East Africa with considerable amount of peatlands

- Ethiopia
- Uganda
- Burundi
- Rwanda
- Kenya
- Tanzania
- Zambia
- Malawi
- Mozambique
Global Peatland Database - peatland mapping

- **Vector GIS** (1:25,000) and **Raster GIS** (1 x 1 km grid cells)

- mapping of *confirmed*, *probable*, and *possible* peatland areas (depending on the reliability of the integrated data)

- **assessment of drainage/degradation status based on satellite images** (no, low, heavy drainage/degradation)

- attached database with additional information (e.g. peat depth, peat carbon content, vegetation, peatland type, ...)

1. Diverse ‘ground truthing’ points from scientific literature 
   *(palaeo-ecology, pedology, geology, ...)* and from 
   governments, NGO’s, companies, ...

2. Existing models of landscape constraints 
   *(Digital Elevation Models, Topogr. Wetness Index, Climate Phenology, ...)*

3. Lower resolution peatland, soil or proxy maps 
   *(e.g. wetlands, vegetation, geology, geomorphology, ...)*

4. Data integration = manually drawn PEATLAND map 
   *(using QGIS, Google Maps and Bing Aerial; balancing conflicting information, quality control)*

5. Status assessment for each PEATLAND polygon

- not drained
- drained/degrading
Global Peatland Database - mapping peatlands of Uganda

Example for data integration: valleys southeast of Lake Kyoga
Global Peatland Database - mapping peatlands of Uganda

Africa Soil Information Service - Map Tool

AfSIS homepage: downloadable Topographic Wetness Index
Global Peatland Database - mapping peatlands of UGANDA

Example for data integration: valleys southeast of Lake Kyoga

Blue: *peat point data* (National Survey for Energy Peat, 2004)

Blue: available legacy soil maps indicate *Fluvisols or Gleysols*
Global Peatland Database - mapping peatlands of UGANDA

Example for data integration: valleys southeast of Lake Kyoga

Blue: *peat point data* (National Survey for Energy Peat, 2004)

Topographical Wetness Index (AfSIS): high TWI in red & darker blue

Orange: drawn peatland polygons
Global Peatland Database - mapping peatlands of UGANDA

- peat point data (blue dots) = confirmed

- main valley polygons with peat point data = probable peatland areas

- smaller valleys without peat point data in this region, but with:
  • the same geomorphological setting
  • the same indication from landscape constraints
  • the same appearance on satellite images = possible peatland areas

Orange: drawn peatland polygons
Reliability of peatland occurrence assessed with decision tree: *(confirmed, probable, possible)*

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>Presence of mineral soil directly and spatially explicitly designated</td>
</tr>
<tr>
<td>1*</td>
<td>Not so</td>
</tr>
<tr>
<td>2.</td>
<td>Presence of organic soil (peat, Histosol, muck soil, bog soil, organic soil) directly and spatially explicitly designated</td>
</tr>
<tr>
<td>2*</td>
<td>Not so</td>
</tr>
<tr>
<td>3.</td>
<td>Area represented by a separate ‘peatland’ mapping unit on a high quality i and (preferentially) high resolution (≤ 1: 125.000) map</td>
</tr>
<tr>
<td>3*</td>
<td>Not so</td>
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<tr>
<td>4.</td>
<td>Presence of peat near the surface spatially explicitly specified for a (few) single core(s) but not for an area</td>
</tr>
<tr>
<td>4*</td>
<td>Not so</td>
</tr>
<tr>
<td>5.</td>
<td>Maps (vegetation, land use, geomorphology, other) indicate that land around the peat core(s) is or has been a wetland iii</td>
</tr>
<tr>
<td>5*</td>
<td>Not so</td>
</tr>
<tr>
<td>6.</td>
<td>Homogenous area surrounding and including the core locality(s) can clearly be delineated with Google Maps iv</td>
</tr>
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</table>
Global Peatland Database - mapping peatlands of UGANDA

Mountains of SW Uganda
Global Peatland Database - mapping peatlands of UGANDA

Valleys/bottomlands in SW Uganda
Global Peatland Database - mapping peatlands of UGANDA

Red/darker blue: areas with high Topographic Wetness Index
Global Peatland Database - mapping peatlands of UGANDA

Blue: areas with ‘Papyrus peat’ (legacy soil map)
Orange: Peatland areas deduced due to integration of diverse information.
ITEM: 537  
Reliability of peatland occurrence: confirmed  

Drainage status: no  


Reliability information: 'Papyrus peat‘ according to reference  

Each polygon of the peatland map gets at least the entries as shown.
Peatland status: „no drainage/degradation“

- drainage: no
- agriculture: no
Peatland status: „low drainage/degradation“

- **drainage**: small scale drainage without connection to main outlet or only few drainage channels with connection to main outlet

- **agriculture**: predominantly subsistence fields (often irregular structures)
IMCG Global Peatland Data Base

Peatland status: heavy drainage/degradation

- drainage: intensive and well maintained drainage system connected to main outlet, with a dense net of drainage channels (often regular)

- agriculture: industrial and high output agriculture

© Google Satellite 2013
~ 60% ‘confirmed’ and ‘probable’ peatland polygons
Global Peatland Database - mapping peatlands of RWANDA

Another output: raster maps of peatland drainage/degradation ( % of grid cells 1 x 1 km²)
We offer our expertise,

- to develop regional and peatland type adapted models to indicate them, based on Digital Elevation Models, Topographic Soil Wetness, Climate Phenology, Landforms, Hydrology, ...

- for interpreting legacy soil maps regarding peatland occurrence

We invite you,

- to share your soil science expertise...
... to get peatland emissions integrated in the Post-Kyoto Climate Agreement (UNFCCC)!