Overview - Peatlands and carbon

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In living peatlands:

- Production is larger than decay
- Dead plants accumulate as peat

Kolkheti, Georgia
Peat accumulates through water saturation: Natural peatlands are wetlands!

Scotland
Peat accumulates during thousands of years and stores concentrated carbon in thick layers.

Peat of 2 m deep
Peatlands are found in almost every country. Worldwide: 4 million km$^2$
... from the tundra ...
... to the tropics and ...
...to the uttermost part of the World...

Tierra del Fuego
Argentina
...from the mountains ...
... to the sea ...
the Cinderella Syndrome: very important but not appreciated...

Ruoergai, China
Mires have - on the short run - little effect on the climate.
Mire C-sink compensates globally for only 1% of the C-emissions from burning fossil fuels.
Global mire CO$_2$ sink: 150-250 Mio t CO$_2$ a$^{-1}$
Global mire CH$_4$ source: 200 Mio t CO$_2$-eq a$^{-1}$
As CH$_4$ rapidly oxidizes, CH$_4$ concentration in atmosphere from mire emissions soon reaches a steady state.
In contrast, mires continuously absorb CO$_2$. Therefore they cool the climate already since 11,000 years.
More important than their role as carbon sink is their role as carbon store. Peatland = peat land!
Compared to other formations, peatlands contain disproportionately much carbon, largely in their soil.
Peatlands are the most effective carbon stores of all terrestrial ecosystems
While covering only 3% of the World’s land area, peatlands contain 500 Gt of carbon in their peat.
i.e. twice the carbon stock in the world’s total forest biomass
They hold *in average* even twice the Carbon stock of the giant redwoods of California.
Through a *redwood* you can walk....
...through a peat deposit not...
When drained, peatlands become strong sources of carbon dioxide (and nitrous oxide)

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Much recent research into GHG-fluxes from peatlands (CO$_2$, CH$_4$ and N$_2$O)
Clear relation between mean annual water level and emissions ($\text{CO}_2$, $\text{CH}_4$ and $\text{N}_2\text{O}$)
Mobilisation of the carbon stock by peatland agriculture and forestry leads to huge emissions
A potato field on peat in Germany emits 29 T CO$_2$ ha$^{-1}$ a$^{-1}$

$= 145.000$ km with middle class car
Agricultural peatlands in Germany emit almost twice as much CO$_2$ as Jähnswalde, the World’s 7$^{\text{th}}$ most dirty power station.
The World’s peatlands have meanwhile turned from a carbon-sink to a carbon-source (although 80% is still “pristine”...)
Globally, degraded peatlands emit 2 Gigatonnes CO$_2$ a$^{-1}$
Drained peatlands on 0.3% of the land emit 5% of all anthropogenic CO$_2$. 
Indonesia leads the global list, but the EU is a good second...
In many European countries peatland CO$_2$ emissions constitute the fast majority of those from *all* agricultural land.
In many European countries peatland GHG emissions even constitute the fast majority of those from all agricultural land
Globally, emissions from drained peatland have increased with +25% since 1990, especially in the tropics.
Main driver of peatland degradation: drained agriculture...
'Our' arable farming started in a 'semi-desert'...
...creating the idea that productive land must be dry...
...and soils must be continuously moved...
...illusions we also apply to organic soils...
Second driver: drained forestry
Forests on drained peat loose more peat carbon than the trees sequester... → „fossil“ wood
Third driver: peat extraction...

Germany
...for energy generation (increasing!)....

Belarus
...and horticultural substrates...
Peatland drainage causes problems

Ruanda
Drained peatland subsides, becomes wetter and requires ever deeper drainage, leading to further subsidence.
... the “devil’s cycle” of mainstream peatland utilisation...
Bavaria: 3 m loss since 1836

UK: 4 m loss since 1870
...Nether-lands: bogged down: 1000 yr of peatland drainage, now half the country deep under sea level...
...Nether-lands: bogged down: 1000 yr of peatland drainage, now half the country deep under sea level...

In tropics subsidence 5 times faster!
Many tropical peatlands are coastal and will - with continuous drainage and >2000 mm of rainfall - become undrainable ...
In Sarawak, 30 years of oil palm plantation on coastal peatland will lead to the loss of >10% of the entire land area.
In Germany, ten thousands of hectares of agricultural peatland have already been given up as they could no longer be drained.
In continental areas peat soils degrade irreversibly. In Belarus, Ukraine and Russia millions of hectares have been abandoned.
Desertification after peatland overgrazing
...and drained peatlands burn, even under snow...
We can’t continue like this!

Many countries are huge potential peatland CO$_2$-emittors
“Wetland drainage and rewetting” is a system of practices for draining and rewetting on land with organic soil that covers a minimum area of 1 hectare. The activity applies to all lands that have been drained since 1990 and to all lands that have been rewetted since 1990 and that are not accounted for under any other activity as defined in this annex, where drainage is the direct human-induced lowering of the soil water table and rewetting is the direct human-induced partial or total reversal of drainage.
Recent carbon market developments

Since March 2011, a global standard for Peatland conservation & rewetting in development Experiences summarized

MRV Methodologies in development
Recent new policy attention

Decision No 529/2013
FAO: Causes → peatland drainage → consequences
Climate change mitigation ↔ food security
Drained peatland use destroys its own subsistence base

That thing with the Three gears cannot work. Can it, daddy?

No girl, It can’t...

fodder
fuel
food security
productivity
fiber

salt intrusion
land loss
subsidence
acid sulphate soils
flooding

haze
ghg emissions
drainage
biodiversity loss
fire
FAO: Decision support tree

Start
- Do you have organic soils?
  - YES → Choose the relevant type(s)
  - NO → Are you sure?
    - YES → This report is not relevant for you
    - NO → Use chapter 4.1

6. Wet organic soils
- Is productive use necessary?
  - YES → Paludiculture chapter 2.2
  - NO → Is the ecosystem pristine?
    - YES → Conservation chapter 2.1
    - NO → Can a near-nature state be restored?
      - YES → Restoration chapter 2.3
      - NO → Check paludiculture options

7. Drained organic soils
- Is productive use necessary?
  - YES → Check paludiculture options
  - NO → Can a near-nature state be restored?
    - YES → Rewetting chapter 2.3
    - NO → Check restoration options

8. Is rewetting possible?
- YES → Best practice chapter 2.4
- NO → Hazard control chapter 2.5
UNFCCC 2006 (Nairobi): In Kenya there is no peat...
White peatland spots on the map: e.g. Amazon basin

Peru
White peatland spots on the map: e.g. Congo Basin
Peatlands partly under rapid conversion: Kisoro, Uganda
Necessity of detailed Global Peatland Map!

**Histosols** *(HWSD)*

**Peatlands** *(IMCG_GPD)*
Is the ecosystem pristine?

- Yes: Paludiculture chapter 2.2
- No: Is productive use necessary?

- Yes: Conservation chapter 2.1
- No: Can a near-nature state be restored?
Non-used peatlands are not use-less: they provide vital ecosystem services and biodiversity...
Is the ecosystem pristine? NO

Is productive use necessary? YES

Paludiculture chapter 2.2

Can a near-nature state be restored? NO

Yes

Conservation chapter 2.1

NO

NO

YES

Restoration chapter 2.3
If you need to use them, use them wet: paludicultures!
Drained organic soils

Check paludiculture options

Rewetting chapter 2.3

Check restoration options

Is productive use necessary?

YES

Is rewetting possible?

YES

Best practice chapter 2.4

NO

Hazard control chapter 2.5

FAO: Decision support tree
Rewetting to reduce haze and emissions

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Rewetting to reduce emissions and to reduce drainage costs
Rewetting for carbon credits and for restoring biodiversity
Rewetting with paludiculture to reduces emissions and to produce renewable biomass resources.
Cultivation of Sphagnum to replace peat in horticulture
Drained organic soils

Check paludiculture options

Rewetting chapter 2.3

Check restoration options

Is productive use necessary?

YES

Is rewetting possible?

NO

NO

Best practice chapter 2.4

Hazard control chapter 2.5

NO
i.e.: no desert plants on drained peatland: *Aloe vera*...
i.e.: no mays for „bio“- gas on drained peatland
i.e.: no oil palm for „biofuel“ on drained peatland
Drained organic soils

Check paludiculture options

Rewetting chapter 2.3

Check restoration options

Is productive use necessary?

YES

Is rewetting possible?

YES

Best practice chapter 2.4

NO

Hazard control chapter 2.5

NO

FAO: Decision support tree
Peatlands burn if drained, abandoned and easily accessible. Better prevent this!
• Secure undrained peatlands
• Rewet/restore drained/degraded peatlands
• Adapt management of peatlands that cannot be rewetted
Peatlands must be wet: for climate, for people, for ever...