The contribution of paludiculture to climate change mitigation and adaptation

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2015 Paris Agreement: „Limit global average temperature increase to 2º C, with 1.5º as more aspirational.”
Consequences: back to 0 emissions in 2050 and starting the decrease within the coming few years

[Graph showing CO₂ emissions from 1990 to 2050 with different emission scenarios.]
Paris agreement: “…in the context of sustainable development and efforts to eradicate poverty”…
breaking radically with wrong developments from the past, also with respect to peatlands
In living peatlands (‘mires’):
- Production is larger than decay
- Dead plants accumulate as ‘peat’
Peat accumulates through water saturation: Natural peatlands are always wetlands!
Peatlands are found in almost every country.
Worldwide: 4 million km²
Peatlands are ‘everywhere’ and very diverse

Sichuan, China
... this is a peatland in the tundra ...
... this is a peatland in the tropics ...
...this is a peatland 1000 km from Antarctica...
...this is a peatland in the high mountains ...
... this is a peatland in the sea ...
Not recognized - not appreciated: the Cinderella Syndrom

Ruoergai, China
UNFCCC 2006 (Nairobi): In Kenya there is no peat...
UNFCCC 2011 (Panama): We didn’t know we had peat swamps
Living peatlands are climatically ~neutral. Globally: CO$_2$ sink is counterbalanced by CH$_4$ source.
More important: carbon stock! Peatlands are the most space-effective carbon stores of all terrestrial ecosystems.
While covering only 3% of the World’s land area, peatlands contain >500 Gigaton of carbon.
i.e. twice the carbon stock of the world’s total forest biomass
Through a forest you can walk...
...through a peat body not...
By drainage the peat dries out and becomes prone to (catastrophic) fires (with resulting haze)
Indonesia 2015 peat fires:
100,000 people killed; >US $16 billion damage
By drainage, peat is oxidized and large amounts of greenhouse gases (GHG) are released.
Peat is like atjar tjampoer or Spreewaldgurken: when you remove the acid/sweet water, the organic material rots away.
Deeper water table $\rightarrow$ more greenhouse gas emissions
Deeply drained grassland on peat emits 29 T CO$_2$e /ha/yr = 145,000 Km with middle class car
A potato field on peat in Europe emits 37 T CO$_2$e /ha/yr = 185,000 km with middle class car...

... peat potatoes are fossil resources...

Bavaria
Agricultural peatland in Germany emits almost 2 x more than the 7th dirtiest energy plant in the world.
In Mecklenburg-Vorpommern drained peatlands emit 1/3 of all anthropogenic greenhouse gas emissions.

<table>
<thead>
<tr>
<th>Emissionsquellen</th>
<th>Mt CO₂-eq yr⁻¹</th>
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<tbody>
<tr>
<td>öffentl. Strom- und Fernwärmeversorgung</td>
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<tr>
<td>Industrie</td>
<td>0.3</td>
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<tr>
<td>Verkehr</td>
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<td>Kleinverbraucher</td>
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<td>Emissionen aus den Moore</td>
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</tbody>
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Emissionen aus den Moore:
- naturnahe/ ungenutzte Moore
- landwirtschaftlich genutzte Moore
- forstwirtschaftlich genutzte Moore

Drained peatlands emit 1/3 of all anthropogenic greenhouse gas emissions.
Oil palm on peat in the tropics emits 60 T CO₂e /ha/yr = 300,000 km by car: every hectare, every year
Globally, drained peatlands emit >2 Gigatonnes CO$_2$e /yr, i.e. 0.4 % of the land produces 5% of all global emissions.

And in some years much more...
Indonesia leads the list of global top emitters, also without the enormous peatland fires...
But the European Union is a good second...
24 UNFCCC parties, incl. 12 European and 9 EU countries are responsible for 95% of all global peatland emissions.
Peatland emissions per country (in Mt CO$_2$e/yr): highest global urgency for peatland rewetting
In 25 countries, peatlands emit > 50%, in 50 countries >10 % compared to their emissions from fossil fuels & cement
Peatlands emit in PNG 13x, Burundi 10x, Iceland 5x, Mongolia 4x, Zambia 3x and Finland 2x more than fossil fuels & cement.
Peatland emissions as % of national fossil fuel & cement emissions: highest urgency for national
Peatlands emissions per unit national land area (tCO$_2$e/km$^2$): highest urgency for national land use policies
Peatlands produce 30% of all emissions from agriculture.

- Indonesia
Agriculture in Germany: 7% of land causes 37% of emissions
In Germany peatland agriculture causes annually a climate damage of € 3.6 billion, and gets 300 million EU-grants (CC)
“Biogas” from mays on causes 8x more climate damage than burning lignite...but receives green energy subventions
The ‘polluter pays’ principle is put on the head:

We pay peatland agriculture for causing massive climate damage

... and frustrate in this way sensible solutions
Climate damage is merely one of the societal damages

Van de Riet et al. 2014
In continental regions peatland drainage creates deserts...
...and soils like made of stone...

Ukraine
Insufficiently recognized: drainage also causes subsidence!
Drainage → subsidence (loss of height): 1 - 2 cm annually

Bavaria: 3 m loss since 1836

UK: 4 m loss since 1870
In Germany 10,000s ha of agricultural peatland have been flooded because they could no longer be economically drained.
...Nether-lands: bogged down by 1000 yr of peatland drainage and subsidence

8 m subsidence
...Nether-lands: now half the country deep under sea level...
...and subsidence continues...
...and subsidence continues...

In tropics subsidence 5 times faster!
Whereas the sea level rises, we bog the peatlands down....
Many peatlands are coastal and will - with continuing drainage - be flooded...
Drained land use on coastal peatland will – in the near future - lead to the loss of substantial tracts of land.
We are loosing land, now that we need it most: for more people, for less poverty, and for replacing fossil resources.
Problem: Our land culture had a semi desert as a cradle...
...and has since the idea that productive land must be dry...
...and soils continuously be moved...
...illusions that we worldwide apply to wet, organic soils...
with desert plants on drained peat in Indonesia: *Aloe vera*
... or semi-arid Maize on drained peat in Germany...
Living peatlands: they still exist worldwide (>80%)....
even in Germany but that is not where it is all about...
When we talk about peatlands and climate, we talk about cows on drained peatland...
...hay from drained peatland...

Netherlands
... potatoes on drained peatland...
... forests on drained peatland....

Scotland
Palm oil can grow and produce well on peatland…

Malaysia

... oil palm on drained peatland...
... pulpwood on drained peatland....
Rewetting solves most of the problems
Rewetting to reduce haze and emissions
Rewetting to reduce emissions and drainage costs
Rewetting for carbon credits and for restoring biodiversity
But we cannot flood all drained peatland worldwide and take it out of production.
We have to solve the drainage problem while maintaining the production function: i.e. with *paludiculture*.
If you need to use them, use them wet!
Rewetting with paludiculture reduces emissions and produces renewable biomass resources.
Paludicultures under study in Greifswald (cf. excursions)
Reed cultivation: Biomass and peat accumulation
Reed: demand in Europa larger than supply
Construction and insulation material from reed
China uses 450,000 ton of reed annually for paper
Alder cultivation on rewetted fens
Alder cultivation: biomass and peat accumulation
Alder wood: good for furniture and furneer
Typha cultivation on rewetted peatland

Bavaria
2017 our first mechanical harvest of *Typha*
Typha: very strong and ideal for insulation
Since 2014, first city heating plant in Germany using only biomass from rewetted peatlands. More are underway
Peatmoss cultivation on rewetted bog grassland to replace fossil peat in horticulture
2016 first large scale harvest of cultivated peatmoss
Water buffalo in rewetted coastal transgression mire

Karrendorf
Cultivation of Typha in the Netherlands
Briquetage of reed in Belarus to replace peat as fuel
Indonesia orientates on paludiculture for its huge peatland rewetting program (2.8 million ha!), e.g. Jelutung

Juni 2017: "Paludiculture is the new environmental buzzword"

Marcel Silvius
Rewetting provides additional local and regional benefits for climate change adaptation.
Wet peatlands are ‘cool’: they cool hot landscapes:
More energy for evaporation → less for heat
Rewetting **Polder Kieve** cools more (3.0 W m\(^{-2}\)) than anthropogenic greenhouse effect since 1750 (2.4 W m\(^{-2}\)) has heated

![Adaptation!](image-url)
Polder Kieve could absorb 92% of all high water events (1983-2011) and strongly reduce peak flow

Adaptation!
Peatland rewetting retains groundwater in the catchment: good for dry periods

Adaptation!
Paludiculture may support species conservation: Red List species as “weeds”
Paludiculture strengthens nature conservation by wet land use around wet conservation sites

Adaptation!

Van de Riet et al. 2014
Paludiculture allows migration corridors

Adaptation!

Van de Riet et al. 2014
And coastal flood mires grow up with the rising sea level!
And coastal flood mires grow up with the rising sea level!

Adaptation!

Karrendorf
Wet peatlands connect landscapes and political targets: Green network with many synergies
Paludiculture: many advantages and synergies of mitigation and adaptation

- Cheap, effective way to reduce GHG emissions
- Land exploitation with minimal soil degradation
- Rehabilitation of degraded land
- Employment in rural area
- Raw materials for energy and industry
- Resource-political autarchy
- Better landscape hydrology and mesoclimate
- Decreased nutrient emissions to the seas
- Habitats for rare wetland species
- Improved perspectives for (eco)tourism
- Prevention of peatland fires
Knowledge summarized (2016), but large-scale implementation is still lacking...
Paludiculture: like Father X-mas: Everybody believes in it, but it does not (yet really) exist...
Paludiculture: more than a change from carrots to potatoes!
We have desert land in our genes, but need wetness in our heads and in our landscapes!

Ancient European genomes reveal jumbled ancestry

Mysterious peoples from the north and Middle Easterners joined prehistoric locals.

Ewen Callaway

02 January 2014

Newly released genome sequences from almost a dozen early human inhabitants of Europe suggest that the continent was once a melting pot in which brown-eyed farmers encountered blue-eyed hunter-gatherers.

Present-day Europeans, the latest work shows, trace their genetic inheritance to both groups.
Paludiculture is ‘unknown land’

Development of the entire production chain: Crops, infrastructure/logistics, products, machinery, ....

Skipping of perverse agricultural subventions and adaptation of old-fashioned laws and regulations

Awareness raising, pilot and demonstration sites

Research!
Research: 10,000 years behind...
Awareness raising worldwide

The Global Peatlands Initiative is a targeted effort by leading experts and institutions to protect peatlands, the world’s largest terrestrial organic carbon stock.

www.globalpeatlands.org
GPI: south-south and triangular exchange
Aims simple and clear: no land loss, 0-emissions by 2050. And getting the curve soon!
How are we doing? UNEP-EGR: Global emissions from drained peatlands will be 300 Mt CO$_2$e lower in 2030 than in 2015.
>200 Mt CO$_2$e from SE Asia, 10 Mt from Europe (sic!)...
So we are getting the curve. But no paludiculture yet....
After 2030 we have to massively implement paludiculture to approach the 0-emission goal by 2050.
Paris + Peatland = Paludiculture
MOORMUSST NASS!
Peatlands must be wet: for the climate, for the land, for the people, for ever...