Fact book

for UN-FCCC policies on peat carbon emissions

WETLANDS INTERNATIONAL

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1 Introduction

All over the world, precious peatland ecosystems, with a unique nature and beauty are degraded and destroyed. Peatswamp forests in Indonesia are drained and logged; tundra peatlands are affected by global warming and mountain peatlands like in the Himalayas are subject to overgrazing and mining. Contrary to forests, few people recognize or are even aware of these areas. Even less people know that these areas, that cover only 3% of the land surface of the Earth, contain twice as much carbon as all the world's forest biomass. Carbon that under normal conditions would remain stored for infinite times and eventually would turn into coal, is now released at an alarming rate, causing around 10% of all global carbon dioxide emissions. These emissions remain largely unreported. And where reported, they are excluded from the national emission accounts.

Wetlands International is dedicated to spread this message about this disaster and advocates that UNFCCC will provide incentives to address the loss of the world's peatlands. As peatlands are unique ecosystems, addressing the emissions generates unique questions. This publication is meant to provide answers on the emissions from peatlands and formulates some policy approaches to addressing these issues.

The publication is produced jointly by Wetlands International and by the University of Greifswald, Hans Joosten for the technical part. Naomi Pena (Joanneum institute) and Murray Ward Global Climate Change Consultancy (GtripleC) have provided guidance on the last chapters about policy issues.

2 Global overview of peatland areas

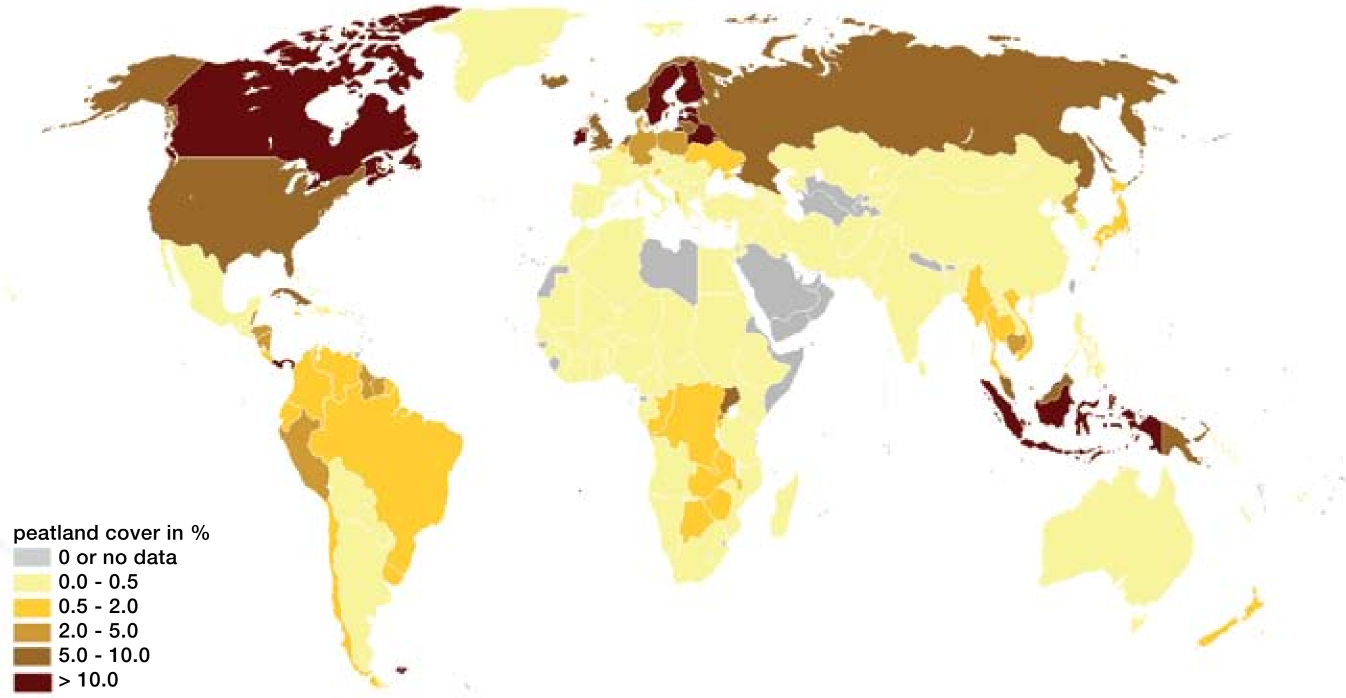

Figure 1: Peatland cover per country (*source: IMCG Global Peatland Database*)

Peatlands are found in almost every country of the world, but are especially abundant in cold (i.e. boreal and sub-arctic) and wet (i.e. oceanic and humid tropical) regions.

Table 1: Distribution of peatlands (more than 30 cm of peat) over the continents (*source: Joosten & Clarke 2002*)

Continents	Total area in 10^6 km²	Continent in % of global land area	Peatlands in km²	Peatland area in % of area of continent	% of global peatland area
Africa	30.37	20.3	58,534	1.9	1.4
Antarctica	13.72	9.2	1	0.0	0.0
Asia	43.81	29.3	1,523,287	3.5	36.7
Australasia (Oceania)	9.01	6.0	8,009	0.1	0.2
Europe	10.40	7.0	514,882	5.0	12.4
North America	24.49	16.4	1,884,493	7.7	45.3
South America	17.84	11.9	166,253	0.9	4.0
Total	**149.64**	**100.0**	**4,155,459**	**2.8**	**100.0**

Table 2: Indicative Top-20 for peatland area *(source: IMCG Global Peatland Database 2008)*.[1)]

	Country/region	Peatland area (km²)
1	Russia	1,390,000
2	Canada	>1,136,000
3	USA	>1,127,000
4	Indonesia	270,000
5	Finland	85,000
6	Sweden	66,680
7	Brazil	55,000
8	Peru	50,000
9	Papua New Guinea	30,000
10	Norway	29,000
11	Malaysia	27,000
12	Belarus	22,350
13	United Kingdom	17,100
14	Dem. Republic of the Congo	14,000
15	Uganda	13,500
16	Germany	13,000
17	Poland	12,500
18	Falkland Islands / Islas Malvinas	11,500
19	Ireland	11,500
20	Chile	10,500

1) The figures are not strictly consistent, as different countries use different definitions of "peatland".

The regions with the largest peatland areas and peat carbon stocks include northern countries like Russia, Canada, USA (Alaska!), Finland, Sweden, Norway, and their southern antipodes (Falklands/Malvinas, Chile), next to tropical countries (Indonesia, Brazil, Peru Papua New Guinea, Malaysia, Dem. Re. of Congo, Uganda). Other notable occurrences are in countries in the temperate zone, incl. Belarus, United Kingdom, Germany, Poland, and Ireland.

3 Global overview of peat-carbon stocks

Peatlands are wetlands with a peat layer (soil). Their huge carbon stock is attributable to the thick layers of peat that are conserved by the wetness of the substrate. This peat largely consists of organic material with a carbon content of over 50%. Peatlands have carbon stocks that greatly exceed those of other terrestrial ecosystems. Even the Giant Conifer Forest in the Pacific West of North America – with the highest trees in the World – reaches per ha only half of the carbon stock that peatlands hold in average.

Peatlands constitute the largest and most concentrated reservoir of carbon (C) of all terrestrial ecosystems, storing worldwide an estimated 550 Gt (1 Gt = 1 Gigatonne or 10^9 metric tonnes) of C in their peat. This is equivalent to 75% of all atmospheric C, equal to all terrestrial biomass, and twice the carbon stock in the forest biomass of the world (Parish et al. 2008).
Of this 550 Gt carbon, almost halve is stored in Canada (155 Gt) and Russia (113 Gt).

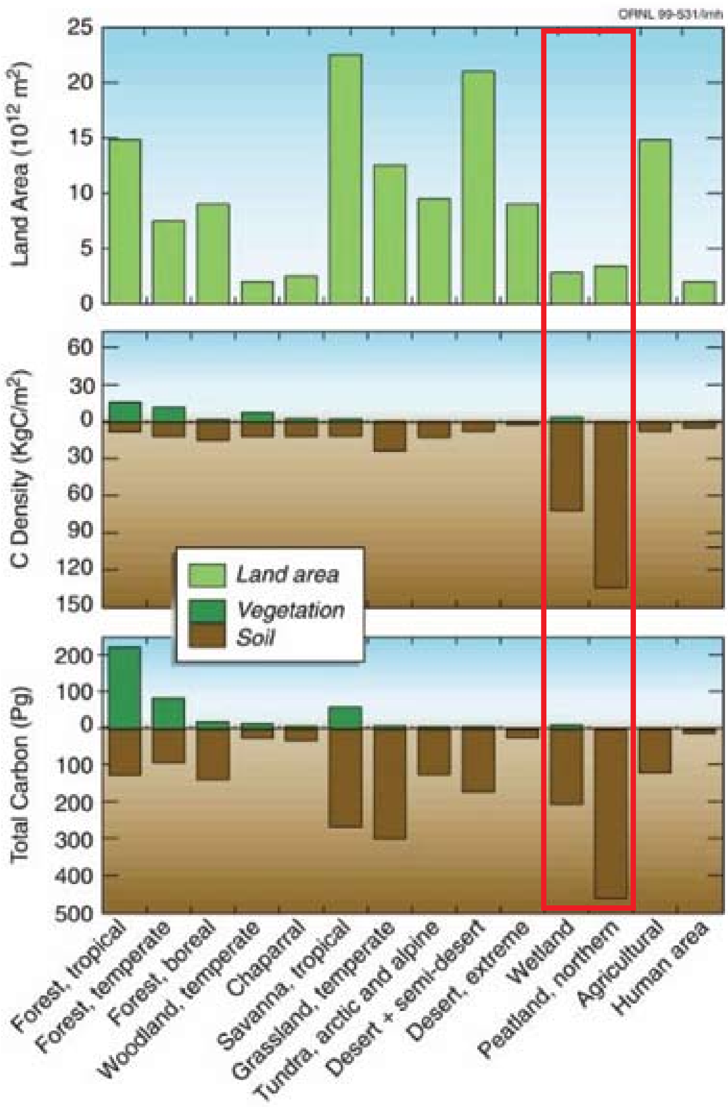

Figure 2: The areas, carbon densities and total carbon stocks (in Pg = Gt) of the major formations of the world. The category "wetland" also includes some peatlands. (*source: http://csite.esd.ornl.gov/faqs.html*).

Table 3: Indicative Top-20 for peat-carbon stock (*source: IMCG Global peatland Database 2008*).[1)]

	Country	Peat carbon stock (Mton C) 1990
1	Canada	155,000
2	Russia	113,500
3	United States of America	>65,000
4	Indonesia	55,000
5	Falkland Islands / Islas Malvinas	8,500
6	Brazil	5,500
7	Malaysia	5,500
8	Finland	5,300
9	Sweden	5,000
10	Papua New Guinea	3,000
11	Norway	2,200
12	Germany	2,100
13	United Kingdom	1,800
14	Dem. Republic of the Congo	1,400
15	Belarus	1,300
16	Uganda	1,300
17	Ireland	1,150
18	Chile	1,100
19	Poland	1,000
20	Peru	1,000

1) The figures are not strictly consistent, as different countries use different definitions of "peatland".

Although for most countries indicative data on peatlands are available, exact figures on peatland stocks are still hard to give. The available information is certainly much less than that for forest carbon stocks. This is a direct result of the lack of attention for these carbon stocks so far. It is also a result of the fact that remote sensing techniques to determine peat depth over large areas are not well developed and laborious field work is still necessary.

4 Global overview of peat-carbon emissions

When peatlands are drained, the peat is no longer conserved. It decomposes, which leads to vigorous releases of carbon dioxide. It is estimated that the total carbon emissions from degraded peatlands currently amount to almost half of the worldwide emissions from Land Use, Land Use Changes and Forestry (LULUCF) and to 9 – 15% of the total global anthropogenic carbon emissions.

In recent times large changes have taken place with respect to peatland use and degradation. As a result of geo-political and economic changes, peatland drainage has largely stopped since 1990 in the Annex 1 countries. Emissions from already drained peatlands, however, continue to be large. Also the peat extraction activities of the World's largest peat extractor (Russia and other Former Soviet states) have almost vanished (but currently show again an upward trend). In the tropics in contrast, peatland drainage has since 1990 massively increased.

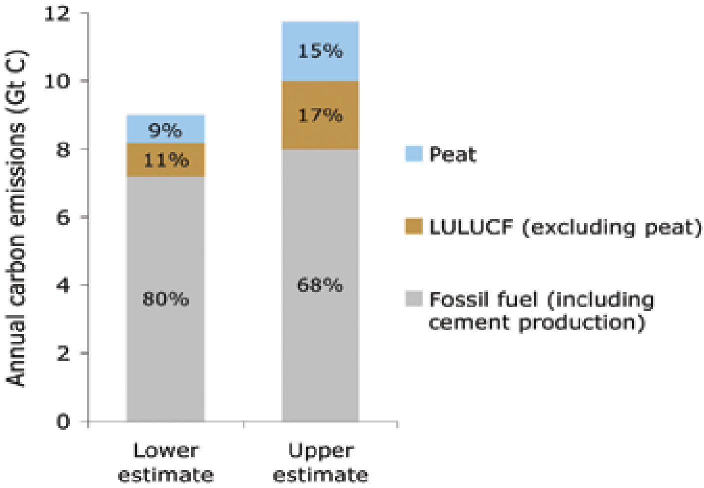

Figure 3: Lower and upper estimates of carbon emissions from peatland degradation. Mean values for the period 1997-2006 for peatlands emissions and 2000-2006 for other land use changes and fossil fuel use. Percentages show the contribution to the total. (*source: Trivedi et al. 2008*)

Figure 4: Global hotspots of peat carbon emissions (*source: Hooijer, A. et al.*)

Table 4: Indicative Top-10 for carbon dioxide emissions from peat degradation (fires excluded!) (*source: IMCG Global peatland Database 2008*) [1)]

	Country	Carbon dioxide emissions (Mton CO_2/a)
1	Indonesia	>500
2	Russia	100
3	United States of America	70
4	Malaysia	60
5	Belarus	45
6	Germany	30
7	Poland	27
8	Papua New Guinea	25
9	Ireland	22
10	Uganda	20

1) The figures are not strictly consistent, as different countries use different definitions of "peatland".

The largest hotspot of peatland carbon emissions is with some 2000 Mt carbon dioxide emissions per year Southeast Asia. Other hotspots, with in total around 1000 Mton carbon dioxide emissions per year together, are Central Europe, Northeast China, Florida and the US Midwest with adjacent Canada.

5 Causes behind peatland emissions

The current global peatland carbon stock is around 550 Gtons. Peatlands cover an area of 400 million ha. Of this area about 65 million ha is drained, leading to a total annual CO_2 emission of 3 Gton CO_2. Pristine peatlands generally sequester net CO_2.

Peat carbon sequestration is a matter of a delicate imbalance of production and decay and only a small proportion of the peatland biomass enters the permanently waterlogged zone and becomes peat. The delicate balance causes peatlands to easily become carbon emission sources following human interventions, especially drainage. Lowering of the water table in peatlands stimulates decomposition. The oxygen allows aerobic decomposition to take place, which is fifty times faster than anaerobic decomposition. CO_2 emissions from drained peatlands generally increase with increasing drainage depth and warmer climates.

Table 5: Global emissions from drained peatlands (*source: Joosten & Couwenberg, 2008*)

Cause	Drained area	CO_2 emission	Total CO_2 emission
Unit	Mio Ha	Ton CO_2 ha^{-1} a^{-1}	Mton a^{-1}
Drained peatlands in SE Asia[1]	12	50	600
Peatland fires in SE Asia[1]			1,400
Peatland agriculture outside SE Asia	30	25	750
Urbanisation, infrastructure on peatland	5	30	150
Peat extraction			60
Boreal peatland forestry	12	1	12
Temperate/tropical peatland forestry	3.5	30	105
Total	**63**		**3,077**

1 Southeast Asia: Malaysia, Indonesia, Brunei, PNG

6 Measurability of peat-carbon stocks and emissions

Assessment of stocks

For most countries indicative data on peatland area and peat carbon stocks are available (see table at the end of this brochure). To reach a consistent, unified worldwide inventory the following steps are required:

- Standard definitions of peat (i.c. the minimum content of organic material it should hold) and peatland (i.e. the minimum depth of peat necessary to call something a peatland). At present these standards vary between countries, with time, and even between peatland types and drainage level. In Canada, for example, the thickness criterion of organic soils is 24 inches (60 cm) for fibric Sphagnum peats and 16 inches (40 cm) for other types of peats. In Germany, in former times "peatlands" only had to have 20 cm of peat, whereas currently a minimum thickness of 30 cm is required.
- Global standards for spatial resolution of peatland mapping. Current inventories consider only peatlands of a certain minimum extent, e.g. larger than 3, 10, or 100 ha. The FAO/ UNESCO Soil Map of the World (SMW; 1: 5,000,000, 1974 - 1981) from which many peatland distribution data in tropical countries are derived, has legend units that consist of associations of soil types, from which the peatland occurrences are not sharply deducible.
- The regional use of remote sensing techniques to assess the presence of peatlands and of field mapping to assess the thickness and type of peat.
- The recognition that the variety of peatlands is very large. Often overlooked peatlands include mangroves, salt marshes, paludified forests, cloud forests and elfin woodlands, paramos, dambos (and their equivalents in other languages like "bas-fonds", "marigots", "inland valleys", "bolis", "fadama", "vleis", "bani", "mapani", mbugas", …), and cryosols.

Assessment of emissions

Whereas adequate techniques exist to measure greenhouse gas fluxes in detail (chamber method, eddy-covariance), these methods are labour intensive and expensive and not applicable for assessing and monitoring emissions over many and large areas. The development of proxies for easy assessing peatland emissions over large areas is, however, rapidly progressing. As emissions are largely determined by water levels and prevailing vegetation, the use of vegetation and water level (also via remote sensing) as indicators of area-wide peatland emissions is very promising. Sufficient information is already present for the boreal zone and temperate Europe, similar approaches for SE Asia are being developed. These will enable contracting parties to provide reliable and verifiable figures on their national peatland emissions.

7 Carbon sequestration in peatlands

In all terrestrial ecosystems, plants convert atmospheric CO_2 into plant biomass that after death rapidly decays under the influence of oxygen. In peatlands, part of the dead plant material soon arrives in a permanently water logged, oxygen poor environment, where the rate of decay is extremely low. Approximately 5–15% of the produced peatland biomass is sequestered in this way and (under natural conditions) for ever conserved. Peat accumulation rates are dependent on climatic, hydrologic, and hydrochemical conditions. In general, accumulation increases from nutrient rich to nutrient poor, from polar to equatorial, and from continental to oceanic conditions.

The rate of Carbon accumulation (LORCA) is generally in the order of magnitude of 0,1–0,4 ton C ha^{-2} yr^{-1} in the subarctic, boreal and temperate zone, and may reach 1–2 ton C ha^{-2} yr^{-1} in temperate and tropical swamp forest peatlands. The total present-day rate of C sequestration in the pristine peatlands of the World is less than 100 Mtons C y^{-1}. If all the world's peatlands would be restored by ending drainage, this amount would increase with 10 – 20 %. The most important effect of rewetting degraded peatlands is, however, not the re-installment of Carbon sequestration, but the avoidance of Carbon emissions from peat oxidation.

8 Permanence of carbon storage in peat

Without exploitation the peat carbon would remain in the peatland store virtually forever. Part is on the long run remobilized by tectonic processes and sever climate change (Ice Ages!), another part changes into lignite and later coal. The latter is illustrated by the oldest peat being 10 million years old, whereas the youngest lignite and coal is only 100,000 years and 20 million years old, respectively.

Here lies also the fundamental difference between 'biomass' fuels and 'fossil' fuels (like peat and coal). By burning biomass fuels (like wood and straw), organic material is oxidized that anyhow would have been oxidized by decay after the plant's death. In case of biomass combustion, humans consume the energy, whereas in case of natural decay microbes consume the energy provided by oxidation. In both cases the same amount of CO_2 ends up in the atmosphere, only the pathways are different.

Fossil fuels, on the contrary, would – without exploitation – remain in the long-term store and nót end up in the atmosphere as CO_2. By peat combustion and oxidation, carbon is oxidized that otherwise would have remained stored for thousands and thousands of years. This applies whether the peat is 10 or 1,000 or 100,000 years old. Not the age determines whether something is 'fossil' or 'biomass', but the natural destiny of the material. Similar to coal, lignite (browncoal) or oil, the *natural destiny* of peat carbon is to remain stored.

The permanence of the peat carbon store is clearly illustrated in natural coalification (see figure 6). Whereas in the initial process of peat formation 85-90% of the original biomass carbon stock is lost, most of the residual carbon remains during the further coalification process that changes peat – over millions of years – into lignite, coal and eventually anthracite.

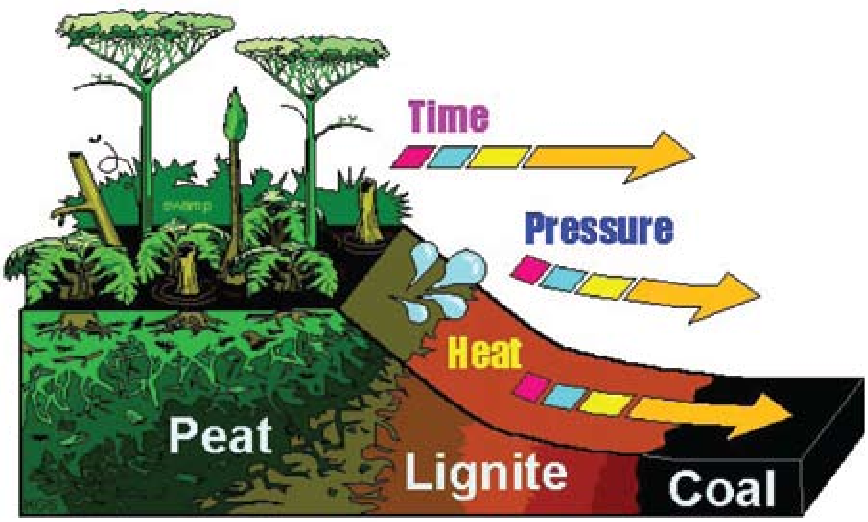

Figure 5: The difference between "biomass" and "fossil": growing plants sequester CO2 in their bio-mass (left downward arrow). Dead biomass rapidly decomposes and returns as CO2 into the atmosphere (right upward arrow). In case of peat formation, a part of the biomass is, however, conserved by waterlogging and remains in the peat carbon store infinitely (curved arrow). Over time it may change into lignite and coal.

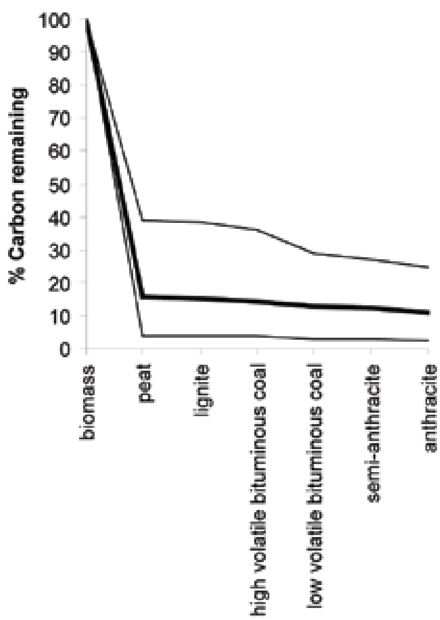

Figure 6: Carbon remaining during the fossilization of biomass (modified after Dukes 2003).

9 Methane (CH_4) and Nitrous Oxide (N_2O) emissions

Next to sequestering net CO_2, peatlands may also emit methane (CH_4) and N_2O. The overall balance is that peatland restoration reduces the emissions of greenhouse gasses into the atmosphere.

The emission of CH_4 strongly depends on the water level, is virtually zero at water levels lower than 20 cm below surface, but rises rapidly with higher water levels. CH_4 emissions from pristine tropical peatlands seem to be 3 times lower than those from temperate peatlands.

N_2O emissions in the temperate zone are restricted to mean water levels below -20cm, with emissions negligible in case of pristine peatlands. In the tropics trends seem similarly erratic but without clear correlations with site parameters. An important factor for N_2O emissions is land use: fertilized peatlands emit part (in the temperate zone 2 – 9 %) of the applied fertilizer N as N_2O.

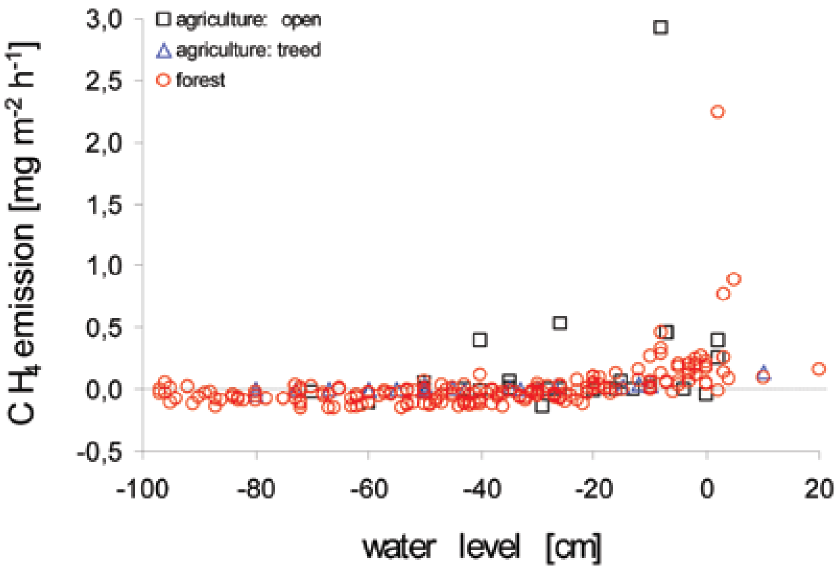

Figure 7: Water levels and methane emissions (per hour) in tropical peatlands

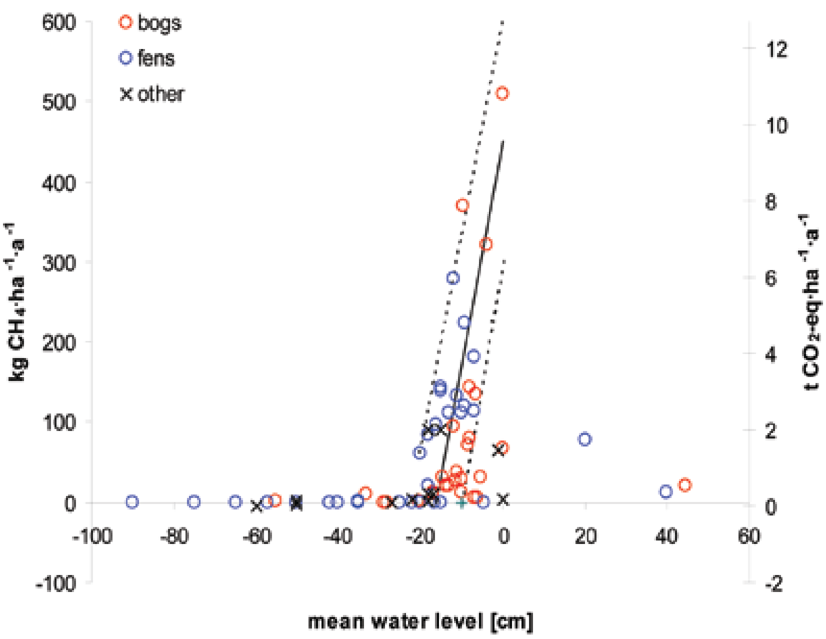

Figure 8: Mean water levels and (annual) methane emissions in temperate peatlands

In case of peatland drainage, CH_4 emissions decrease and CO_2 and N_2O emissions from the peat increase. As the latter dominate, the combined effect leads to (often much) larger climate relevant emissions.

In case of peatland rewetting, the opposite occurs: CO_2 and N_2O emissions strongly decrease. CH_4 emissions increase, but are generally of much less importance. Only in exceptional cases (flooding of crops), CH_4 emissions after rewetting may increase to such an extent, that the effect of CO_2 and N_2O emission reduction is annihilated. This effect is, however, only of short duration, and on the mid- and long-term, rewetting of peatlands always leads to a net reduction of climate relevant emissions.

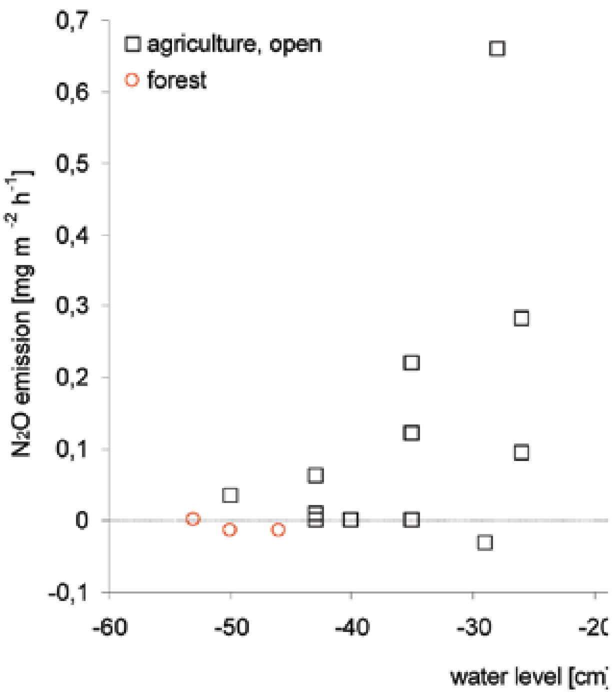

Figure 9: Water levels and nitrous oxide emissions (per hour) in tropical peatlands

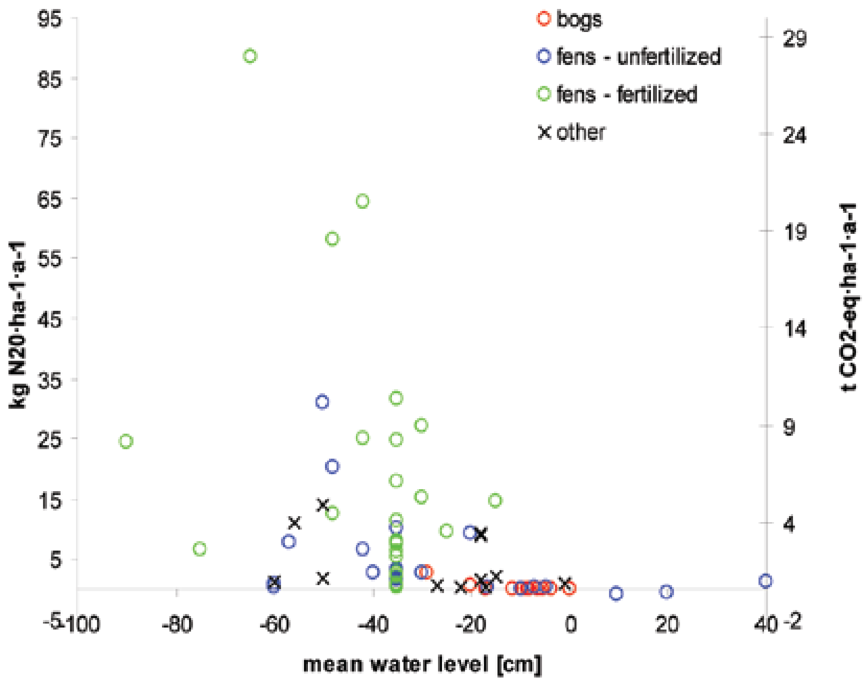

Figure 10: Mean water levels and annual nitrous oxide emissions in tropical peatlands

10 Expected development of peat-CO_2 emissions

In recent times large changes have taken place with respect to peatland use and degradation. As a result of geo-political and economic changes, expansion of peatland drainage has largely stopped since 1990 in the Annex 1 countries, whereas also the activities of the World's largest peat extractor (Russia and other Former Soviet states) have largely collapsed. In the tropics, however, peatland drainage has in the same time massively increased. Very recently, a renewed attention to using peat for energy and peatlands for crop production can be observed in all parts of the world as a result of the demand for energy, land and food. Predicting future land use developments by projecting past trends is under these circumstances a crude simplification of actual developments.

The increase in emissions in Southeast Asia (fig. 11) is caused by progressive deforestation and drainage of peatlands. The projected decrease after 2020 ('likely' scenario) is caused by shallower peat deposits being depleted. The stepwise pattern of this decrease is an artefact caused by using discrete peat thickness classes (0.25m, 0.75m, 1.5m, 3m, 6m, 10m). This trend is, however, only dealing with Southeast Asian peatlands. For the vast boreal peatlands in Russia, Scandinavia and Canada, the expectations are different. The current, direct threat is less, but the maintenance of these huge carbon stocks is by no means secured.

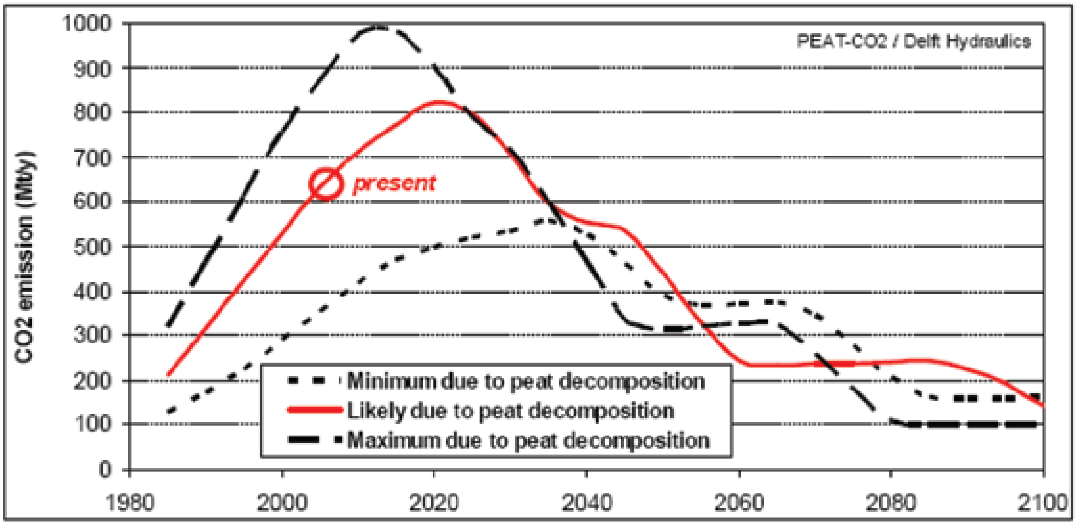

Figure 11: Historical, current and projected CO_2 emissions from peatlands in Southeast Asia, as a result of drainage (fires excluded) (*source: Hooijer et al. 2006*)

The technical potential exists to drain and exploit up to 90% of the World's peatland area and peat stock, which would lead to an emission of 1,800 Gtonnes of CO_2: an amount equal to 60 times the global annual CO_2 emissions! The *annual* emission will strongly depend on how the peatlands will be used. As a rule of thumb one can assume that utilisation as a fuel leads to a 10 times faster consumption of peat and thus to a 10 times larger annual emission per ha than peatland used for arable agriculture. Arable agriculture again consumes the peat 10 times faster than peatland used for forestry (largely in the boreal zone).

Concrete ("economical") use will strongly depend on:

- Local fuel availability, with countries with less other local resources faster changing to peat as a fuel.
- The general scarcity of fuels and "clean" fuels in particular. The development of the modern peat fuel industry in Sweden and Finland, for example, is directly attributable to the "oil crisis" of the 1970s. Currently renewed expansion of peat fuel can be observed in Finland and Sweden, Indonesia (local fuels), Russia (local fuels to save oil and gas for export), whereas new plans for extracting peat fuel arise as an alternative for more dirty (sulphur!) local coal or nuclear power (e.g. Ontario).
- Inclusion of peat carbon stocks in GHG accounting and the associated "attractiveness" of peat soils for biofuel crop (incl. wood) cultivation. Currently the use of drained peatland soils for biofuel production is observed all over the world, even though in most cases those biofuels lead to 3 – 9 times more CO_2 emissions per energy unit produced than burning coal…
- Climate change, leading to other land use options for peatlands. Currently arable peatland agriculture is largely restricted to the temperate to tropical zone and largely absent from the boreal to arctic zones. With (substantial) climate change the vast boreal zone will become more suitable for arable agriculture and more profitable for forestry. In the North, the melting of permafrost may lead to both a increase in carbon sequestration rate through higher plant productivity and to an increased emission of methane (through more humid conditions). Human activities (oil/gas exploration and exploitation) may lead to an acceleration of permafrost degradation.

11 Peatland restoration and leakage

About leakage
"Leakage" occurs when restoring an area to prevent emissions leads to increased pressure on other areas by which the positive results on the one site (for which possibly credits could be earned) are outdone by the negative effects elsewhere.

This problem is clear for forests. Globally deforestation is fuelled by the demands for precious timber. Ending deforestation in one area will automatically increase the pressure on other forests in or outside the country of the conservation project.To prevent such intra-national leakage, "wall to wall" accounting approaches are proposed.

Less leakage for peatland restoration
Compared to forest, leakage is less of a risk in peatland areas. In most cases, the loss of carbon-rich peat is an unintended side effect and the subsidence of peatsoils even a problem for sustainable agriculture or other activities. Many degraded peatlands have never been permanently used or have been abandoned after degradation. Only in limited areas, the peat itself is a commodity, for fuel or as a raw material for horticultural growing media.

Leakage may occur in case of peatlands drained and reclaimed for agriculture or urban uses. In the region with by far the largest peatland emissions, Southeast Asia, this is still a relatively small issue. Whereas almost all peatswamps are drained or to some extent affected by drainage, only some 5% of the peatland area is cultivated and managed for instance for palm oil plantations. The other 95% is only sparsely used or not used at all. Large parts consist of drained and degraded forest leftovers and shrublands that remained after logging Restoring these areas will have little impact on land pressure and will cause far less leakage than in case of forests. Furthermore large areas have a status as conservation or special management area.

A wall to wall approach for peatlands?
For forest REDD projects, a so called "wall to wall" approach is envisaged to prevent leakage .This means that the forest carbon stock at a national (or regional) level is determined and used as a baseline. For forests, this is not without difficulties. In case of peatlands, the annual carbon losses in case of drainage are relatively small compared to the huge peat carbon stocks. Therefore changes in stocks are difficult to monitor directly and can much easier be assessed via the annual emissions from the peat.

12 Including peatlands under land-based or activity-based approaches

Currently the land sector is included in climate agreements through a human-activity based approach. Article 3.3 of the Kyoto Protocol specifies that emissions due to human-induced afforestation, reforestation, and deforestation (ARD) must be accounted for. Article 3.4 allows Parties to include, on a voluntary basis, net emission reductions or stock increases resulting from management of crop and grazing lands and forest management.

This approach was adopted to allow countries to reduce emissions from LULUCF and to build carbon stocks, without unduly compromising the commitments set based for “gross” (non-LULUCF) emissions. Over time, the complications of such an activity-based approach have become clear. The approach requires a detailed defining of what constitutes a forest, managed forest, and grassland. It furthermore requires complex site-specific monitoring and reporting, e.g. of lands that have undergone deforestation.

Advocates for a land-based approach argue that it would simplify all this by accounting all anthropogenic emissions from the land base (biomass, soil carbon), as are already required to be reported under the UNFCCC.

Inclusion of peatlands: Activity-based approach

Since adoption of activities mentioned under Article 3.4 is voluntary, the only peatland emissions that Annex I countries currently have to account are emissions due to deforestation under Article 3.3. Making activities under Article 3.4 mandatory would be the first step to effectively address greenhouse gas emissions from conversion of peatlands in Annex 1 countries. However, the current land use categories have their limitations for peatlands (which may not qualify as croplands, grazing lands or managed pre-1990 forests) and should be completed with new activities, e.g. the restoration of abandoned peatlands.

Inclusion of peatlands: Land-Based approach

Option 4 outlined in the Summary of the Chair from Accra eliminates Articles 3.3 and 3.4. All managed (and possibly all) peatlands would be included unless an exception were made (which is unlikely under this approach). The land base would become a sector/source for Annex I countries and the activity-based approach would be abandoned. It is expected that elaborations (and perhaps) variations of this land-based approach will be presented by its proponents.

13 Net-net or gross-net accounting

About gross-net and net-net
For accounting peatland carbon emissions, two systems could be applied. Under "net-net" accounting, emissions or changes in carbon stocks in the commitment period would be compared to what they were during a base year or period, times a factor representing desired emission reductions. The differences (positive or negative) are then used to assess whether commitments have been met. Under the Kyoto Protocol, this is the mandatory accounting practice for fossil fuel emissions.

"Gross-net" accounting implies calculating the emissions or changes in carbon stocks over the commitment period and assigning credits or debits without reference to a base year or period. The current calculation of carbon emissions and removals under Article 3.3 of the Kyoto Protocol is an example of gross-net: the carbon stock of lands subject to afforestation, reforestation, and deforestation (AR&D) since 1990 is compared at the end of the first commitment period in 2012 with the stock on 1 January 2008, and credits or debits accounted accordingly.

Annex 1 Parties that ratified the Protocol must include biosphere-based carbon stock increase or decrease due to human-induced AR&D. They may also voluntarily include emission reductions or stock increases due to management of crop and grazing lands and pre-1990 forests. However, only about half have elected to do this.

As a result of these LULUCF rules for the first Kyoto period, peat carbon losses are most often not accounted in the national emissions, but just reported (and even that only fragmentarily).

Winners and losers of both options for peatlands
Countries with large peat emissions in the base year (currently 1990) and declining emissions after this time will have an easier task to meet their national target if a net-net approach is taken in future LULUCF rules. Russia is an example: a country where peat mining and forestry in peatlands collapsed since 1990. The opposite is true for countries with increasing emissions.

However, for such countries a net-net approach will always be beneficial to a gross-net approach that provides no base year emissions allowance. And despite declining emissions, a country like Estonia might still have emissions and declining peat carbon stocks. They might lose in a gross-net approach.

Technical complexity
For net-net accounting, emissions in a base year or period and during the commitment period need to be accounted. This is feasible: the development of methods for assessing emissions with default values and remote sensing is proceeding well. This will also enable determining emissions in the past, based on default values and land use.

To determine carbon stocks, hence changes in carbon stocks, is more complex. The depth of peatlands needs to be assessed in the field. Providing reliable data about stocks is therefore labour- and cost- intensive. Assessing changes in carbon stocks over time is difficult because of the large stocks and the relatively small changes. This technical difficulty will frustrate a gross – net accounting for peat emissions.

14 Peatlands in CDM

To date the Clean Development Mechanism (CDM) has not been successful in bringing many types of projects to the market, and the failure in land-based projects has been particularly noticeable.

There are two options for including peatlands management under the CDM.

The first is to allow carbon sequestration projects, in addition to the forest carbon sequestration projects that are currently already allowed under CDM. The impact will be limited as carbon sequestration in peatlands is rather slow.

The other option is to reduce predictable emissions from degraded peatlands. As peatland emissions after drainage are very predictable, it is much easier than for forest to set a business as usual scenario; backward or forward looking. With low costs to reduce large emissions, this is the promising scenario.

15 Peatlands in REDD policies

Following the Bali Action Plan, discussions are underway to include reduced emissions from deforestation (RED) and possibly also reduced emissions from forest degradation (REDD) as eligible activities in a new mechanism that receives financial incentives from direct funds and/or carbon finance.

Differences with a forest approach
There are several opportunities to include peatlands in a REDD or RED approach. The forest definition of UNFCCC does not allow to include many peatland areas, including those that cause the biggest carbon emissions due to drainage: the drained and deforested peatlands in Southeast Asia.

Compared to reducing deforestation sensu stricto (i.e. removal of forest biomass and litter), peatland restoration and conservation can be extraordinarily efficient:

1) Tropical peatswamps contain much more carbon (largely in their peats) than forests on mineral soil: in average ~3,000 tC ha-1 against ~250 tC ha-1; therefore peatswamp degradation leads to much larger cumulative emissions per area, meaning that restoration leads to much larger avoided emissions;
2) Opportunity costs of avoided emissions from peatswamp degradation can thus be much lower than those from deforestation;
3) Net emissions from peatswamp degradation continue on the same spot for many decades, whereas those from deforestation only continue when progressively more areas are affected;
4) Peatland emission baselines resulting from drainage can be assessed on site without the need to derive (hypothetical) baselines from long time trends over larger areas;
5) Similarly peatland emission reductions from hydrological restoration can be monitored directly on the spot without the need of longterm observation;
6) In volume, worldwide emissions from degraded peatlands are equivalent to those from deforestation but originate from a much smaller area ('hotspots').

Options to include peatlands
REDD could be expanded to explicitly include conservation and restoration of peatlands.
This would, however, within the current UNFCCC definition of forests be limited to "forested" peatlands, and would exclude the enormous importance of peatland emissions from deforested peatlands and non forested peatlands. If these are excluded from REDD, an option is to establish a similar, peatlands specific instrument: i.e., peatland restoration and conservation: PREC.

Emissions from non forested peatlands
The division between forested and non forested peatlands in developing countries is very important. Forested peatlands, including their soils, could apply for conservation and restoration activities under a REDD scheme. As the forest definition of UNFCCC is settled; there is little hope that permanently deforested peatlands could fall under such scheme.

UNFCCC definition of forests:
"Forest" is a minimum area of land of 0.05 to 1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10 to 30 percent with trees with the potential to reach a minimum height of 2 to 5 metres at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10 to 30 percent or tree height of 2 to 5 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest.

Southeast Asia is the hotspot for peat carbon emissions (2000 Mton per year). The table below shows the land use in this region (Table 6).

40 - 50% of all peatlands in Southeast Asia are currently not forests anymore and partly inside and partly outside the UNFCCC /IPCC forest definition. These drained areas cause according to the 'Peat-CO_2' study (Hooijer et al. 2006) over 600 Mton CO2 emissions per year through drainage and 1400 Mton CO_2 emissions through fires.

The remaining forests are currently partly drained directly by logging ditches and indirectly by drainage of neighboring plantations.

Conclusion
REDD provides some but limited options for including peatlands. The forest definition of UN-FCCC is too strict and will exclude the most degraded and emitting peatlands. The immense current emissions of 2000 Mt will likely not be addressed by any REDD scheme as much of these are not forests anymore according to the UNFCCC definition, unless it is decided to not strictly limit REDD to forests only.

A separate mechanism to address the low cost options to reduce the huge peatlands emissions is desired. Such a 'peatland restoration and conservation' (PREC) mechanism could be developed. The Bali Action Plan (under the mitigation chapter, part b ii) provides options for this.

Table 6: Peatland use in Southeast Asia 2000 (*after Hooijer et al. 2006*).

	Forests	Shrublands + burnt areas	Mosaic of small scale cropland, shifting cult. and shrubs	Cropland (large scale)
	% peat area	% peat area	% peat area	% peat area
Total Indonesia	**61**	**7**	**27**	**5**
Kalimantan	58	20	19	3
Sumatra	52	1	37	10
Papua	72	2	25	1
Malaysia	**53**	**1**	**38**	**7**
Peninsular	37	1	50	13
Sabah	43	10	31	17
Sarawak	59	2	35	4
Brunei	**84**	**4**	**10**	**2**
Papua N. Guinea	**61**	**1**	**35**	**3**
Total SE Asia	**61**	**5**	**29**	**5**

References

Dukes, J.S. 2003. Burning buried sunshine: human consumption of ancient solar energy. Climatic Change 61: 31–44.

IMCD Global Peatland Database: www.IMCD.net/gpd/gpd.htm

Hooijer A., Silvius M. Wosten, H. and Page, S. 2006. Peat-CO2

Parish, F. et al. 2008. Global Peatland Assessment

Pena, N., Joanneum Institute. 2008. Inclusion of Peatlands in Post 2012 Climate Agreements

Trivedi, M., et al. 2008 (in prep).

Mission:

To sustain and restore wetlands, their resources and biodiversity for future generations.

Peatland degradation fuels climate change

3% of the world surface is covered with peatswamps.

550Gt of carbon is stored in peatlands, this is as much carbon as all accessible fossil coal reserves (585 Gt), twice as much as all global forest biomass, and 75% of allatmospheric carbon.

3Gt CO_2 is emitted every year due to rapid peatland loss. This is equivalent to 10% of all fossil fuel emissions.

Nothing is done under current climate policies to stop these emissions.

Wetlands International calls for UN-FCCC policies that provide incentives to reduce carbon emissions from peatland loss.

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