FACTSHEET

SUBSIDENCE OF PEAT SOILS – FLOODING RISK IN SOUTH-EAST ASIA

There is an increase in awareness of the carbon emissions resulting from peatland drainage and peat fires. There is in general however a lack of recognition link between *carbon loss and peatland subsidence, i.e. lowering of the soil surface.*

In the tropics the process of subsidence after drainage is very fast due to high temperatures. Flood risks are also more severe because of high precipitation. Continuous peatland subsidence may eventually result in increasing flooding and possibly in production loss in agriculture and silviculture as has been shown in studies both in South-east Asia and beyond (Hooijer et al. 2012).

What is soil subsidence?

Subsidence is the lowering of the soil surface as the result of physical compression of the peat and loss of carbon due to oxidation and erosion. Peat soils comprise of 10% accumulated organic materials and 90% of water. When drained, the peat oxidizes and all peat above the drainage level will eventually be lost (see Figure 1).

Flooding risks

Subsidence and the related flood risk is a well-known and inevitable phenomenon in all places in the world where lowland peatlands have been converted to drainage-dependent land-uses. Examples include the UK (Somerset), USA (Sacramento Delta, Everglades), northern Germany, Denmark and the Netherlands where a large part of the highly populated west is situated below sea-level as a result of soil subsidence.

Research results peat soil subsidence SE Asia

In western Indonesia (namely Sumatra and Kalimantan) and Malaysia many of the peat swamp forests have been drained for palm oil or pulp wood plantations. In the first five years after drainage, peatland subsidence is typically 1 to 2 metres. In subsequent years, this stabilizes to a constant 3 to 5 cm per year, resulting in a subsidence of 2-3 metres in 25 years and 4-5 meters within 100 years.

Wetlands International works with Deltares in better quantifying the peatland subsidence problem in SE Asia. These insights in peatland drainage impacts and subsidence rates are largely taken from Hooijer et al. (2010) and Hooijer et al. (2012).

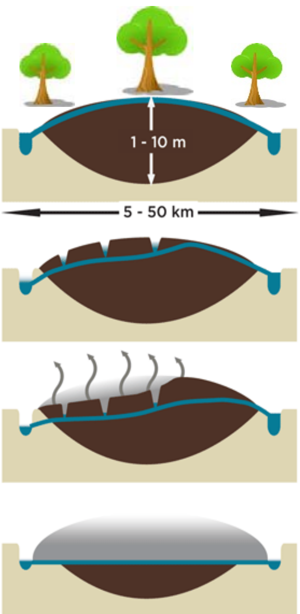

Figure 1: Cross-section of a peat dome in natural situation and after drainage *(Hooijer et al 2006/2010).*

Natural situation:
- Water table close to surface
- Peat accumulation from vegetation over thousands of years

Drainage:
- Water tables lowered
- Peat surface subsidence and CO_2 emission starts

Continued drainage:
- Decomposition of dry peat: CO_2 emission
- High fire risk in dry peat: CO_2 emission
- Peat surface subsidence due to decomposition and shrinkage

End stage:
- Most peat carbon above drainage limit released to the atmosphere within decades,
- unless conservation / mitigation measures are taken

Water table
Peat dome
Clay / sand
Stream channels
former extent of peat dome

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Flooded oil palm plantation in Aceh, by BPKEL and Deltares, 2011

What can be done to mitigate further subsidence and resulting flooding in the tropics and instead create sustainable peat landscapes?

Radical land use change needed

In South-east Asia the land conversion of peat swamp forests started relatively recent, mostly for palm oil and pulp plantations and other drainage dependent agricultural land-uses.

In 2010, 20% of the peatlands in South-east Asia were occupied by palm oil and pulp plantations and only 34% was covered by (mostly degraded) forest. Extrapolating past trends, plantation cover could double or even triple by 2020 (Miettinen et al. 2012).

If land use on peatlands is not changed radically, large-scale subsidence and flooding of lowland peatlands will become inevitable with tremendous socio-economic consequences.

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Illustration by Joost Fluitsma, JAM Visueel Denken

Recommendations for sustainable peat landscapes:

- No (new) drainage based plantations on peat. There is a need for a stronger Moratorium on conversion of peatlands and other forests in Indonesia and a similar moratorium should be considered for Malaysia;
- Issuance of a Government Regulation limiting drainage use in forest and plantation concessions in peatlands;
- Conservation of all remaining tropical peat swamp forests in view of their valuable ecosystem services (including carbon storage, water regulation, biodiversity);
- As an interim measure towards permanent solutions, existing agriculture and plantations should minimise drainage, bringing the water level up, curb the application of fertilizers and maintain a permanent soil cover to reduce the rate of peat soil degradation and enhance peat soil protection;
- In the mid and long term degraded peatlands should be rewetted and rehabilitated, either to natural habitat or to alternative land-uses like paludiculture (cultivation of commercially interesting crops on rewetted peatlands). Indigenous peatland species like Tengkawan (Ilipe Nut), Jelutung (Asian latex) and Sago (starch) can yield an income for local people and provide opportunities for global marketing;
- Plantation companies will eventually have to abandon their peat-based plantations or change their production systems: they can either move to suitable mineral soils areas, or must switch to production systems that require no drainage;
- Implementation of environmental and social safeguards in peatland development, restoration and conservation.

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