Flooding of lowland peatlands in Southeast Asia

Vast lowland areas of Southeast Asia will be frequently and irreversibly flooded before the end of the century unless action is taken to stop the destruction of peatlands. A radical change in land-use is needed. In particular the palm oil and pulp wood sectors must stop developing new plantations on peat and plan to phase-out existing drainage-based plantations before they are flooded. If no action is taken, productivity will be lost in extensive peatland areas in Indonesia and Malaysia with severe socio-economic consequences.

Our call: Radical change in land-use planning and peatland use

The development and drainage of peatlands in Indonesia and Malaysia for oil palm and pulp wood plantations causes subsidence of extensive lowland landscapes in Sumatra and Borneo. This will lead to increased and prolonged flooding which eventually will result in loss of productivity of these land areas.

To avoid this disaster, development of drainage-based plantations on peat should stop and the current unsustainable land-use on peatlands should be phased out. Drained peatlands need to be rewetted and sustainable alternative land-uses need to be developed and promoted, such as paludiculture (agriculture on wet peat).

Photo by: Deltares

Wetlands INTERNATIONAL

Peat soil emissions and subsidence

Peat consists of 90% water and 10% carbon from dead plant materials that have accumulated for thousands of years. Deforestation and drainage of peatlands results in the decomposition of the organic plant material – turning the peat carbon into CO_2 (a greenhouse gas). The soil thus literally evaporates into thin air. Peatland subsidence is the loss of carbon and physical compaction of the peat resulting in lowering of the soil surface. Under tropical circumstances this can result in a soil subsidence of several centimetres per year. In lowland areas, peat landscapes can subside to a level (i.e. river or sea levels) at which drainage is no longer possible; this will result in frequent and prolonged flooding.

Subsidence and flooding risks

Subsidence and the related flooding risk is a well-known and inevitable phenomenon everywhere 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.

Soil subsidence and flooding in Southeast Asia

In Malaysia and in western Indonesia (i.e. Sumatra and Kalimantan) millions of hectares of peat swamp forests have been drained for oil palm 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 in 100 years.

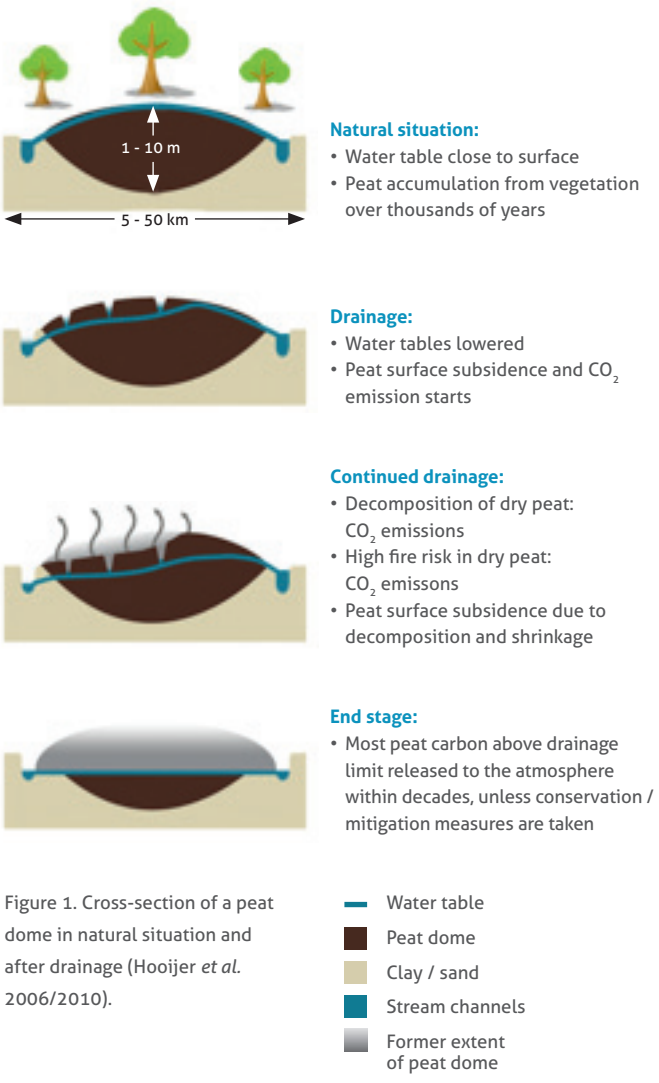

Figure 1. Cross-section of a peat dome in natural situation and after drainage (Hooijer *et al.* 2006/2010).

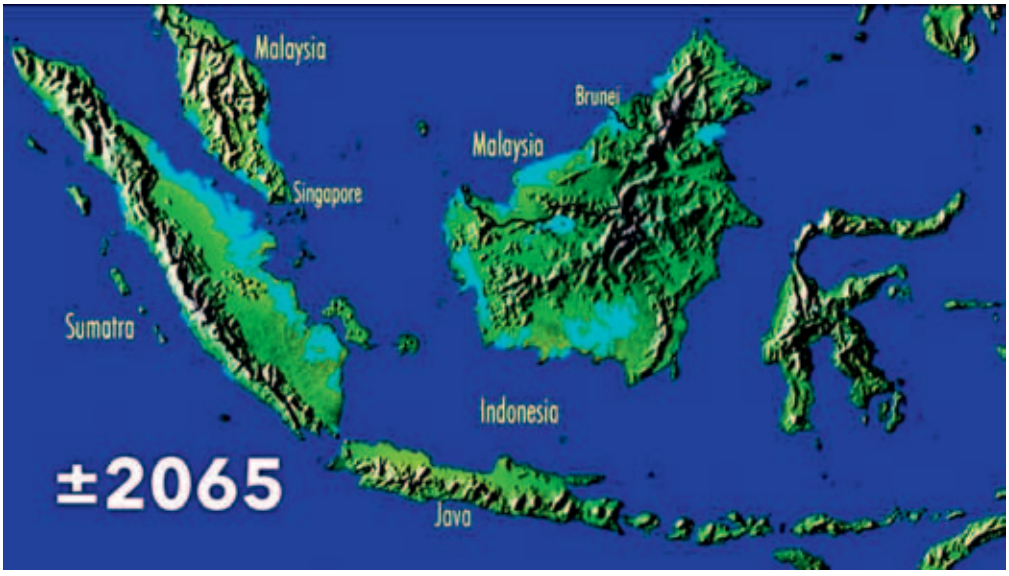

Figure 2. In Southeast Asia, extensive low-lying areas (light-blue) are degrading and experiencing soil subsidence as a result of deforestation and drainage. Many of these are expected to become unproductive as a result of frequent and prolonged flooding, affecting the lives and livelihoods of local communities and resulting in large economic losses.

Subsidence is happening in Sarawak right now

A study conducted in an area of 850,000 hectares located on the Rajang river delta, on the coast of Sarawak (Malaysia), suggests that peatland subsidence will lead to the flooding of most of the region and in these areas oil palm cultivation (and any other form of drained land use) will become impossible.

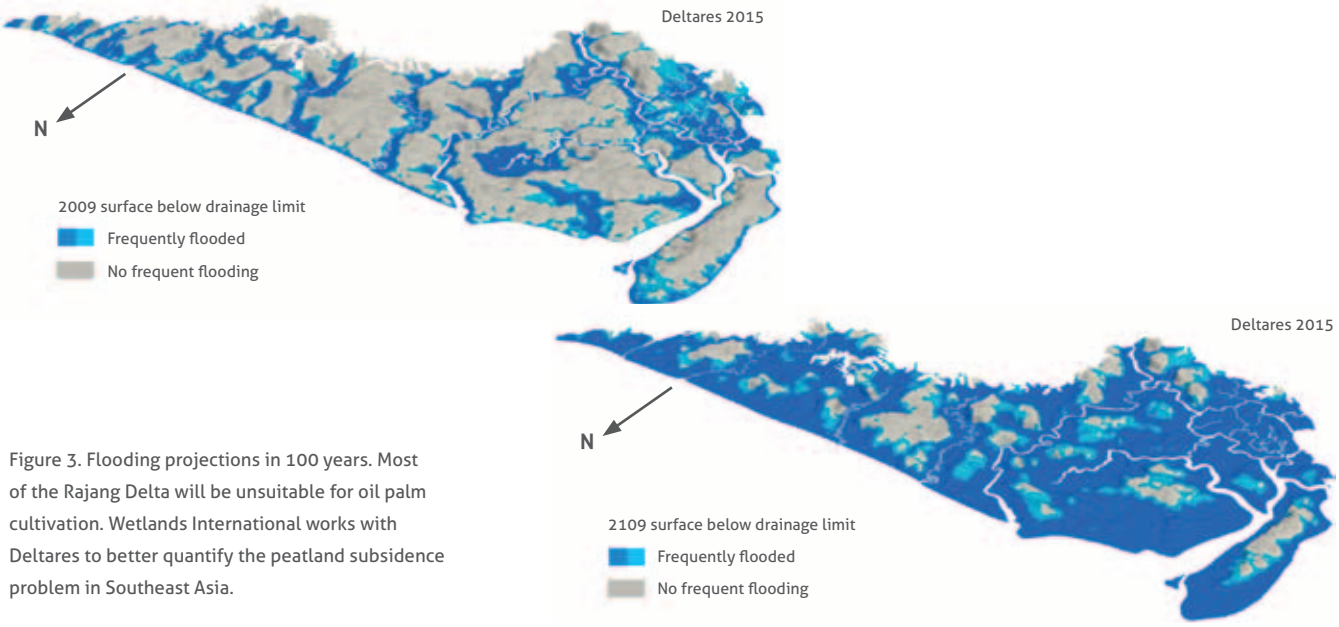

Figure 3. Flooding projections in 100 years. Most of the Rajang Delta will be unsuitable for oil palm cultivation. Wetlands International works with Deltares to better quantify the peatland subsidence problem in Southeast Asia.

Subsidence rates and future flooding projections

Since the early 1990s, large areas of the delta have been converted, mainly to oil palm plantations, which in June 2014 already covered at least 47% of the area.

Using conservative estimates of a subsidence rate of 3.5 cm per year, researchers from Deltares modelled the following flooding projections:

- 60% of the area will be affected by some form of flooding or drainability loss after 25 years, and 70% after 50 years. This corresponds to an area 7 to 8 times the size of Singapore. In 2009, 48% of the area already experienced regular flooding.
- After 100 years, only 13 % of the area will still be drainable by gravity; an area 10 times the size of Singapore will be lost for oil palm cultivation.

The researchers expect a gradual decline in crop production, but not an immediate stop. Drainage will become increasingly problematic, especially during the wet season. As a result, plantations on peatlands will be abandoned due to the loss of productivity. Other areas will require major investments in water management to rectify the situation. With continued subsidence, within 50 years much or even most of the area is expected to become unsuitable for oil palm cultivation.

Building dykes and pump-operated drainage systems in these large peatland dominated landscapes is unlikely to be feasible. The huge investments required for such protective measures will probably be uneconomic given the extent of the areas, the length of rivers and coastline and the high amount of rainfall in Sarawak. The study's predictions are conservative and other processes such as peat fires may speed up subsidence rates which, together with sea level rise and peak flood conditions, will increase the water level and result in the flooding of more land.

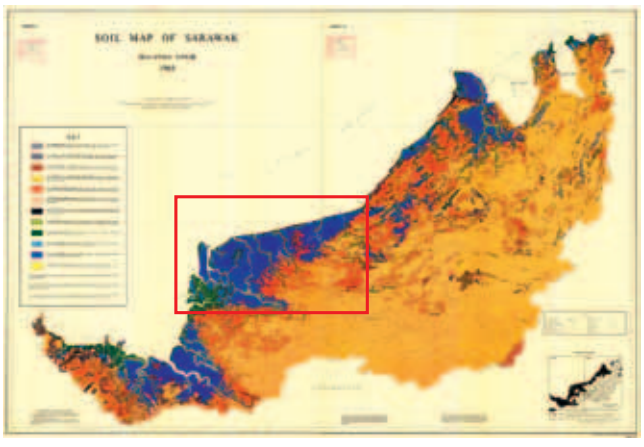

Figure 4. The Sarawak coastal area is known since the 1960s to be exceptionally flood prone, especially around the Rajang Delta. This soil map of Sarawak, published by the Department of Agriculture of Sarawak in 1968, depicts areas of "deep peat (commonly more than 3 m)" in dark blue. The red box indicates the study area. The suitability of these lands for drainage-based agriculture has always been contested, including by the Department of Agriculture of Sarawak in the same year.

Join our efforts

Wetlands International works with local and international partners, from government, industry, scientists and NGOs, to raise awareness on the issues of unsustainable peatland development and management. We advocate the conservation of the remaining peat swamp forests in view of their tremendous value in terms of carbon storage, water regulation, biodiversity and natural productivity.

Our recommendations to mitigate subsidence and create sustainable peat landscapes in Southeast Asia:

- No (new) drainage-based plantations on peat. The Moratorium on conversion of peatlands and other forests in Indonesia should be strengthened and a similar moratorium should be introduced in Malaysia;
- Governments in the region should issue and enforce regulations limiting and eventually stopping drainage in forest and plantation concessions on peatlands;
- All remaining tropical peat swamp forests should be conserved and, where needed, restored in view of their valuable ecosystem services (including carbon storage, water regulation and biodiversity);
- As an interim measure towards permanent solutions, existing agriculture and plantations should minimise drainage, elevate the water table, 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 medium and long term degraded peatlands should be rewetted and rehabilitated, either to natural habitat or to alternative land-uses like paludiculture (cultivation of crops on rewetted peatlands). Indigenous peatland species like Tengkawan (Ilipe Nut), Jelutung (Asian latex), Rattan (for furniture) and Sago (for starch) have global marketing potential and can provide opportunities for the local economy, including community-based development;
- 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 switch to crops that require no drainage;
- Environmental and social safeguards must be implemented in peatland development, restoration and conservation.

Stay in touch

www.wetlands.org

Global: Marcel Silvius, marcel.silvius@wetlands.org
Indonesia: Nyoman Suryadiputra, nyoman@wetlands.or.id
Malaysia: Lee Shin Shin: shin@wetlands.org.my

www.facebook.com/wetlandsint
@WetlandsInt
Wetlands International

Supported by Norad

Wetlands INTERNATIONAL