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COASTAL DEVELOPMENT IN PLEATLANDS: A CHALLENGES OR A CURSE

are experiences from the Netherlands useful in the tropics?

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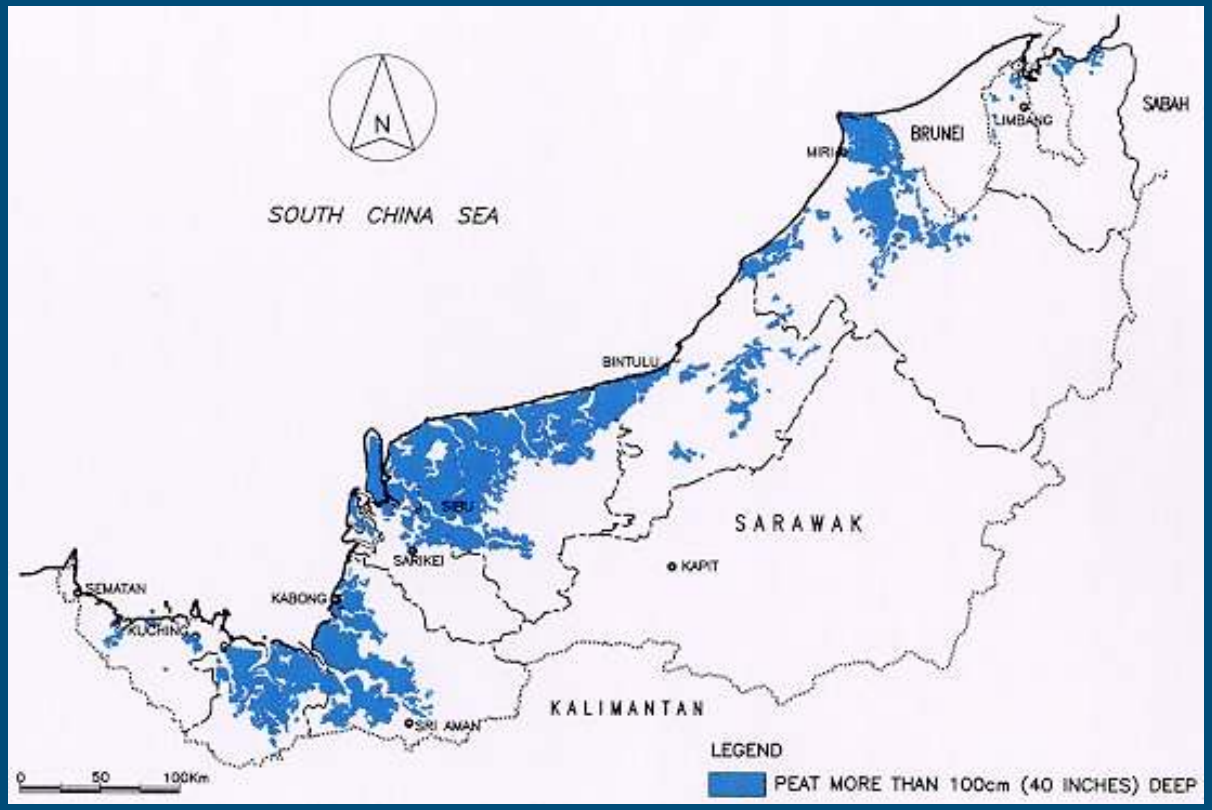
Are experiences from the Netherlands useful?



The Netherlands – 34,000 km²

16.5 million people

? ha peatland

Sarawak - 125,000 km² - 2.3 million people – 1.6 million ha peatland (13% of the land area)

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The Netherlands: an man-made low land

At present:

- 25% of the land below MSL
- 65% of the land protected with dikes & dunes

land periodically flooded by sea and or river waters when there would have been no dikes

1 m + NAP

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Peatlands in the Netherlands

1000 years ago

today

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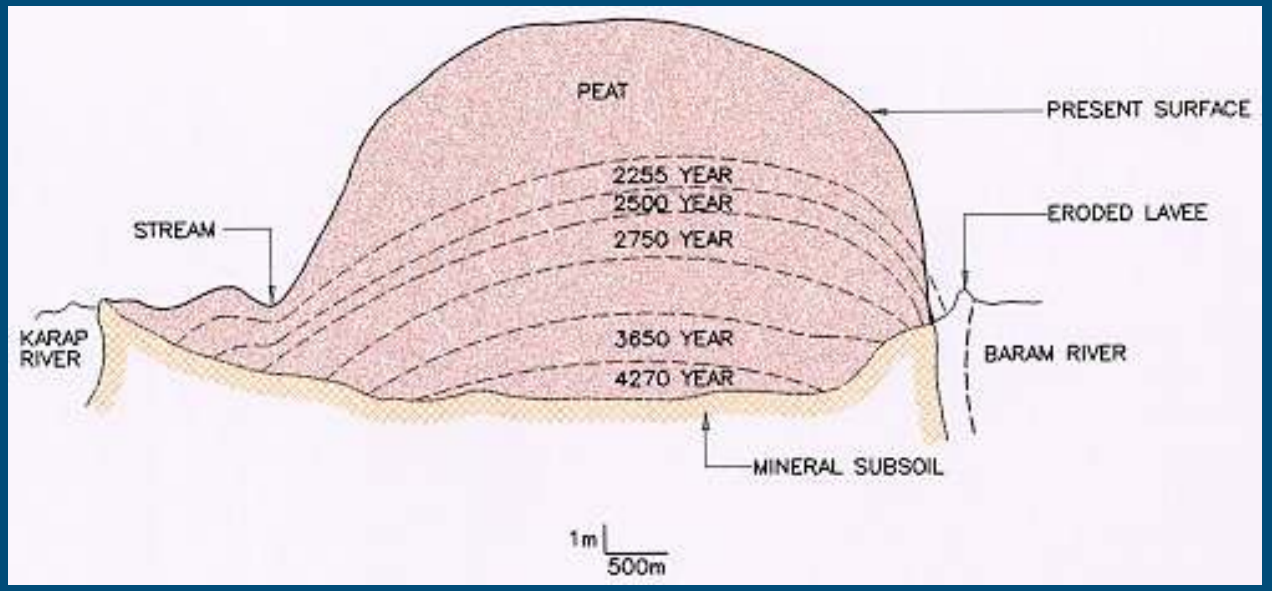
Peat forming

Under natural conditions tropical peatlands consist of waterlogged organic soils with more than 35% organic matter in various stages of decomposition.

Accumulation rate: **2 – 5 mm/year** (Charman 2002)



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What happened during the last 1000 years?

Under natural conditions: peatlands are waterlogged

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drainage is needed to make these waterlogged lands suitable for agriculture or other land use

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drainage = changing the water balance

Negative consequences:?

- irreversible drying
- excessive subsidence
- water stress during dry periods

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Why is hydrology of peatlands important - subsidence

Under natural conditions peat accumulation: **2 – 5 mm/yr**

Reclaimed: lower water table ➔ subsidence

Subsidence (cm/yr) = 0.1 x watertable (cm)

⬇

2 – 5 cm/yr

subsidence ≈ 10 x accumulation

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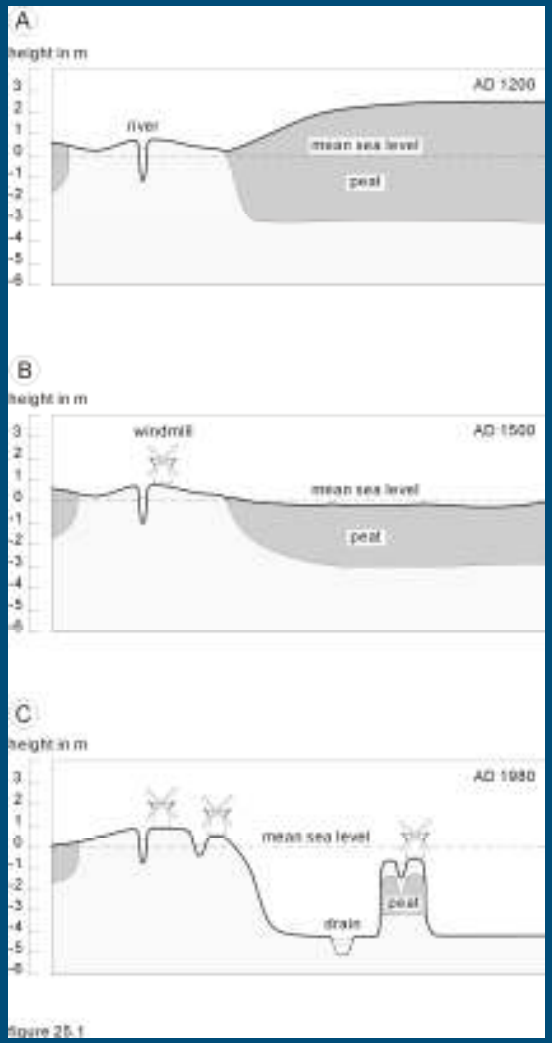
Peatland management in the Netherlands



1200: gravity drainage

1500: pumped drainage

2000: 25% below MSL
pumping 24 hrs/day

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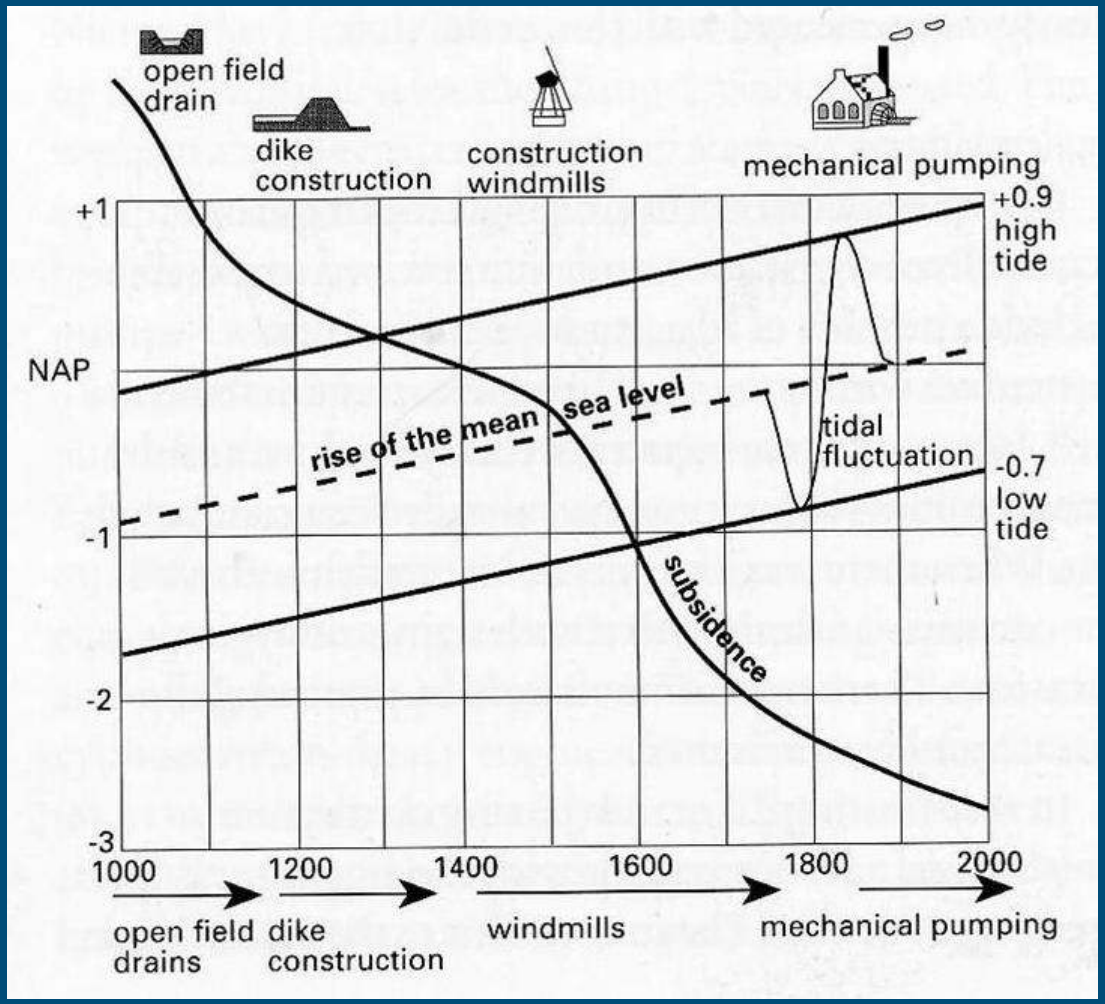
Never-ending subsidence in The Netherlands



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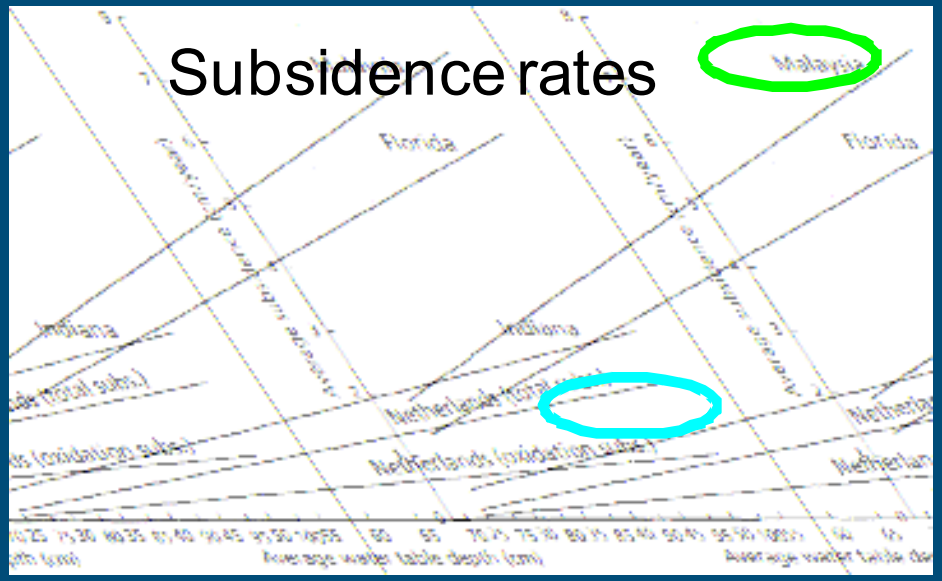
Is this wise use?

"*Wise use*" is defined as use for which reasonable people, now and in the future, will not attribute blame (Joosten and Clark,

Differences between the Netherlands and Malaysia?



1978 ➔

Sarawak

2007 ➔

UK

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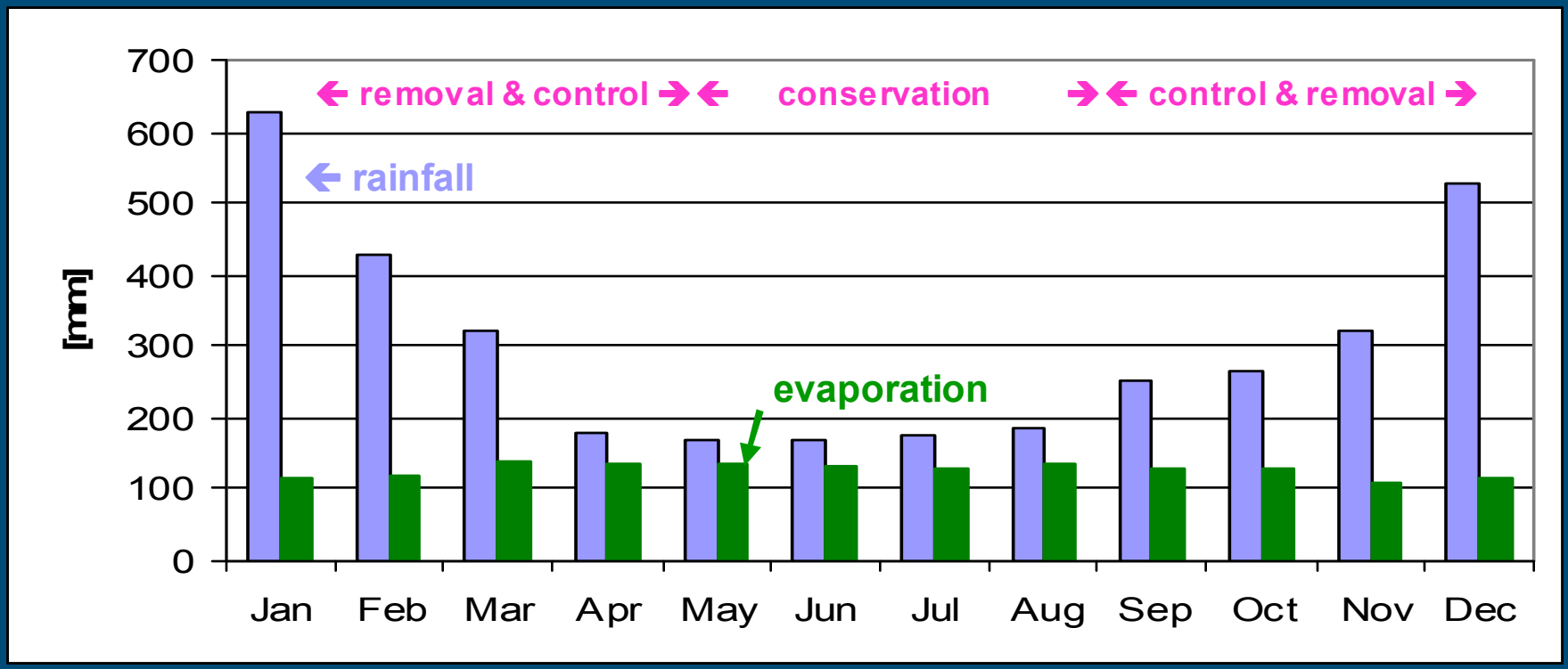
Why is water management needed?

- **Wise use – reduce subsidence:** Control the water table
- **Nature & restoration:** Conserve the water
- **Other land use:** Remove excess surface and subsurface water



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Water management in peatlands: leading principle

Control of the water level

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In peat soils hydraulic conductivity is high

↓

Control of the water level is difficult

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Peat has a large water-holding capacity

Storage capacity

=

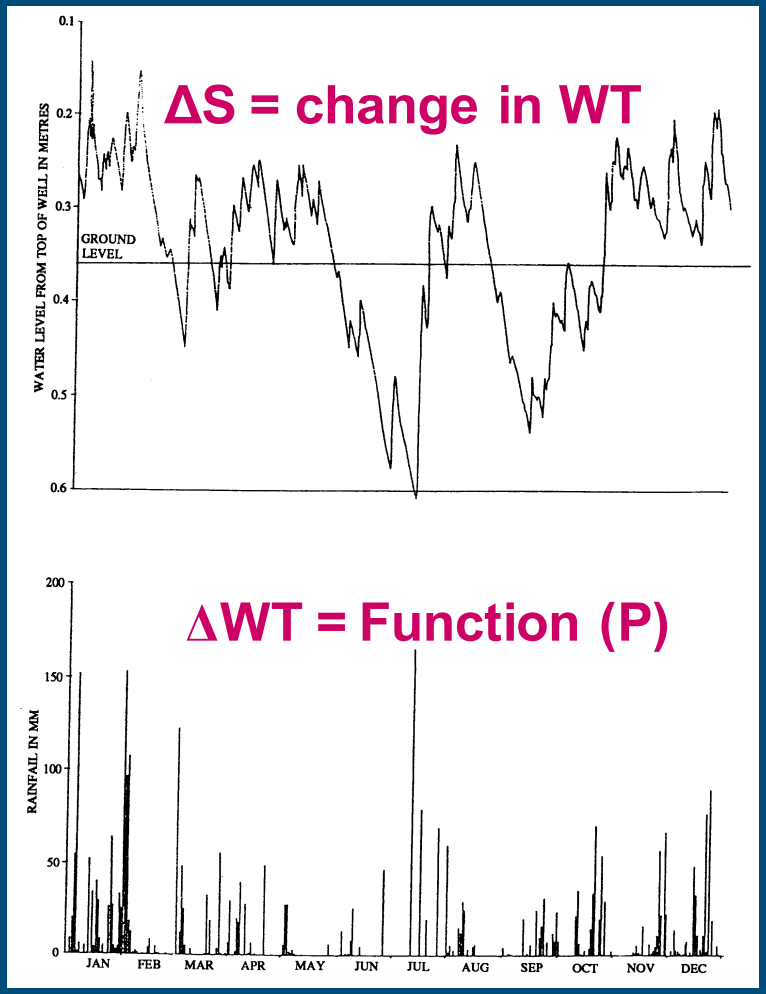
change in watertable

↓

runoff is rather small compared to mineral soil areas

e.g. in Western Johore for 1 x 5 yrs rainfall:

- peatland 7 mm/d (0.8 l/s)
- mineral soil: 52 mm/d (6.0 l/s)



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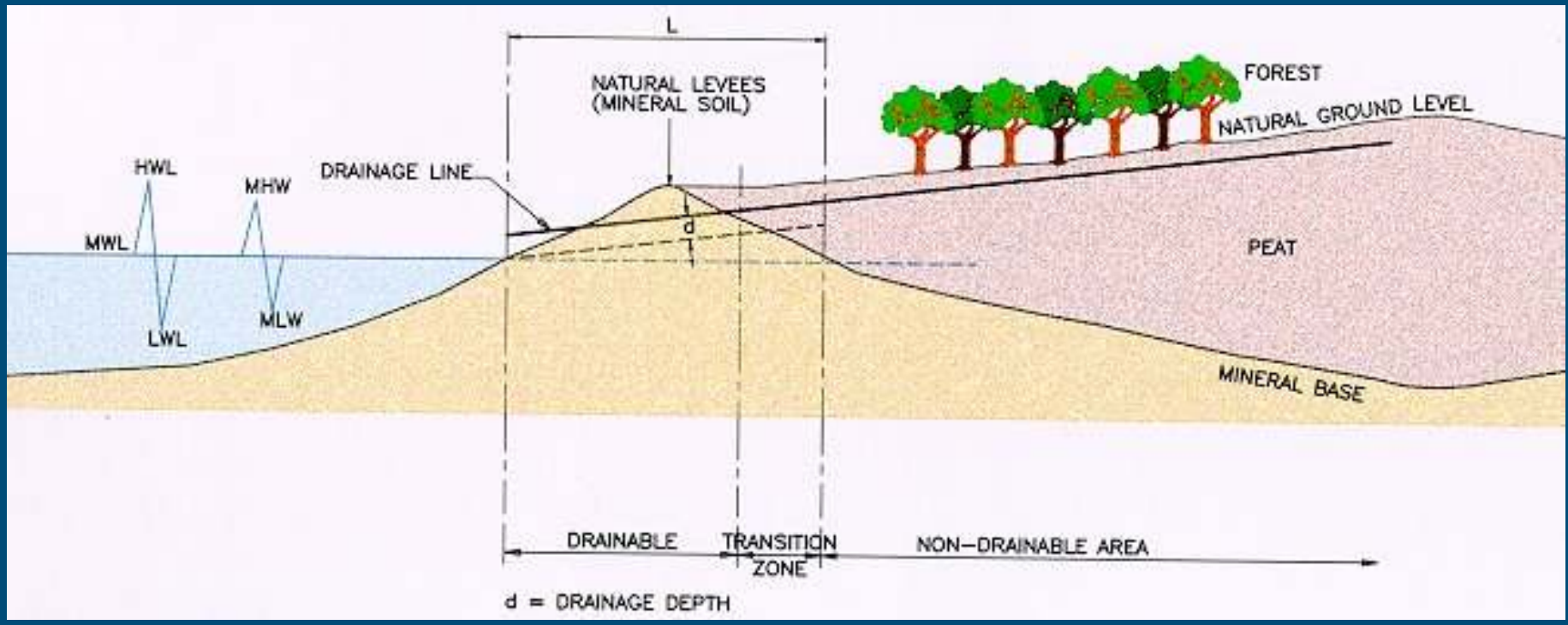
Challenges: drainability



Drainability is based on the level of the mineral subsoil related to the water level in the adjacent river or stream

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Subsidence never-ending

Peat depth (cm)	Elapsed time span (years) for peat disappearance	
	Oil palm cultivation (watertable 0.50 m)	Sago cultivation (watertable 0.25m)
Shallow peat (< 150)	< 10	< 20
250 – 500	30 – 80	60 – 160
500 – 1000	80– 180	160 – 360

If peat layers has disappeared:

- Gravity drainage ➔ pumped drainage
- Runoff will increase 5 to 10-fold,

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Experiences from the Netherlands:

- Increased risk of flooding
- Unevenly distributed subsidence causes misalignment of roads, power cables, water and gas mains

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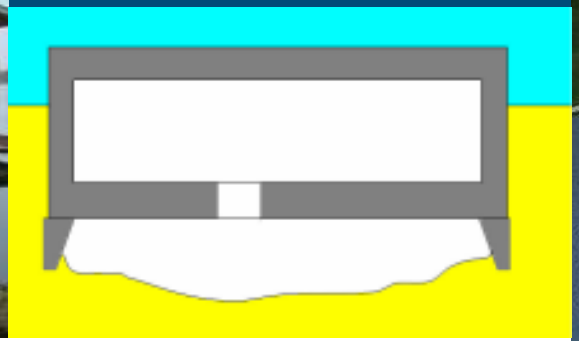
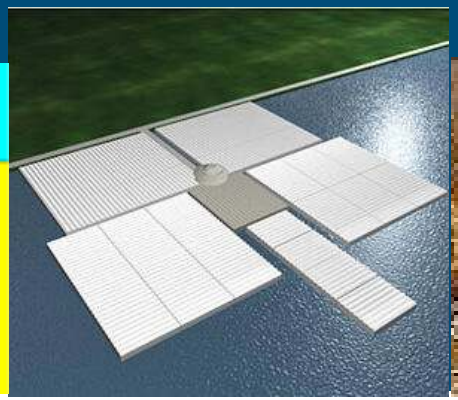
Infrastructural options:

- Land fill
- Low pressure vehicle
- Floating roads
- Floating buildings
- Flexible connections between houses and sewerage & water mains, between roads and bridges, etc





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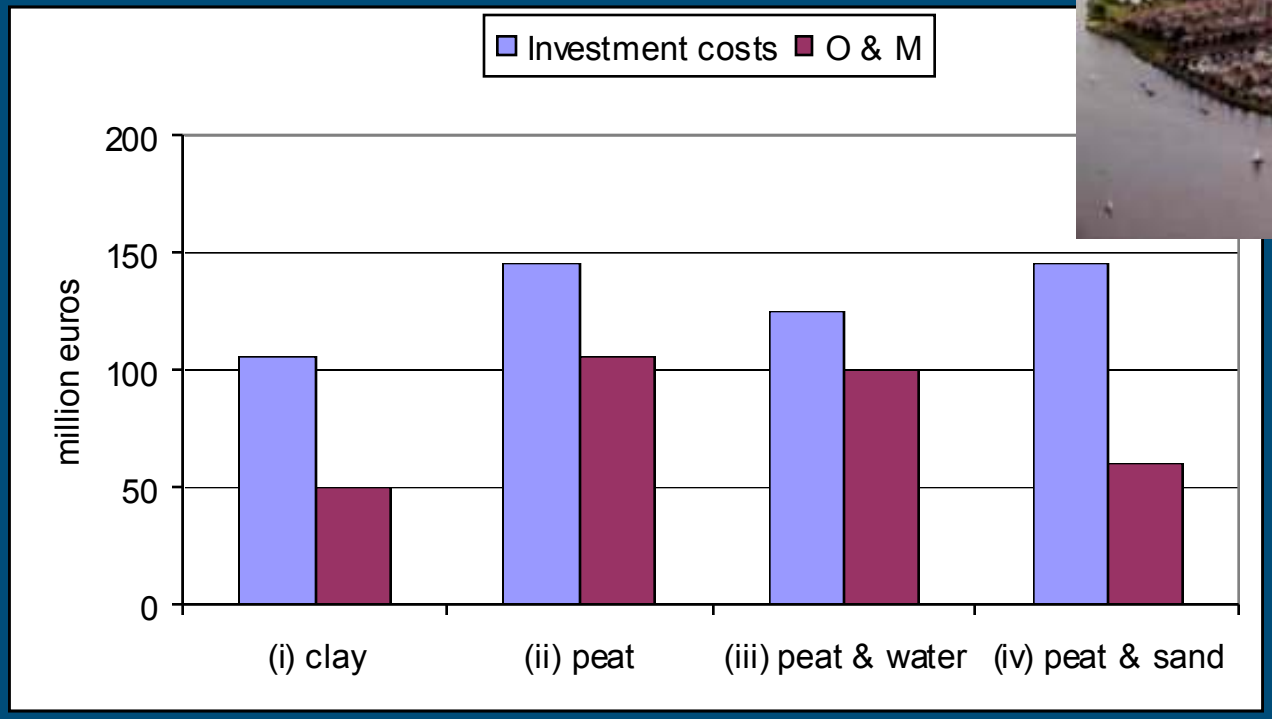
Urban development on peat: higher costs



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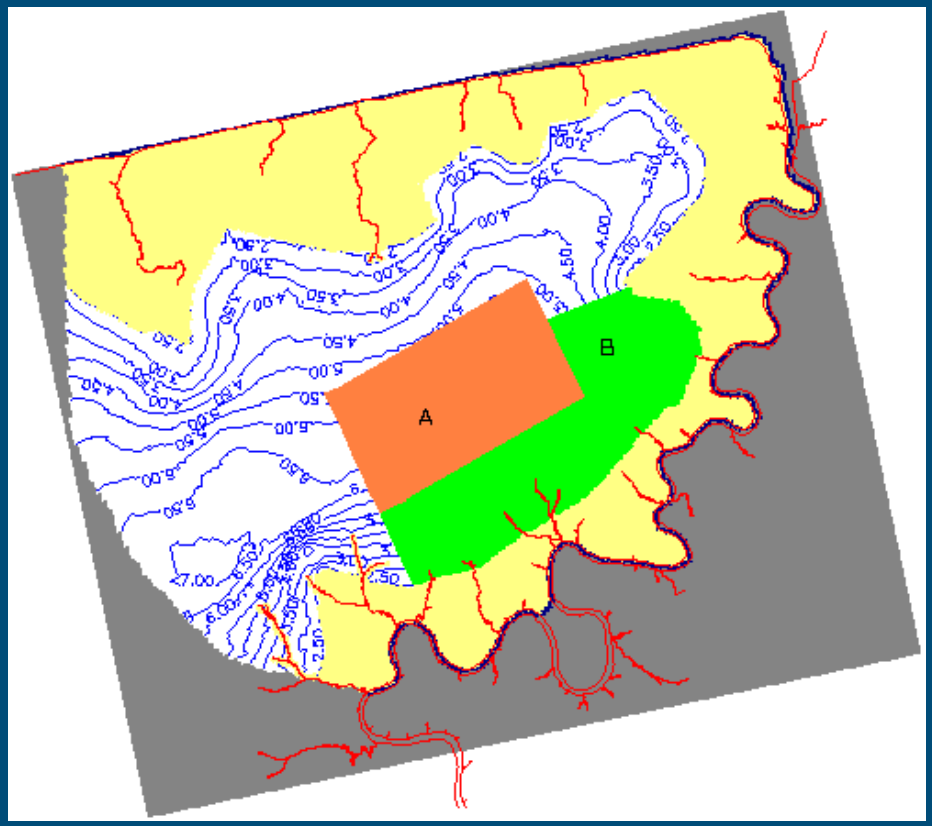
Spatial planning on peat: dynamic process

- Groundwater model (PMWIN or SIMGRO
- GIS based (ArcView)
- Expert Knowledge on:
  - Agriculture
  - Water Management
  - Subsidence
  - etc.



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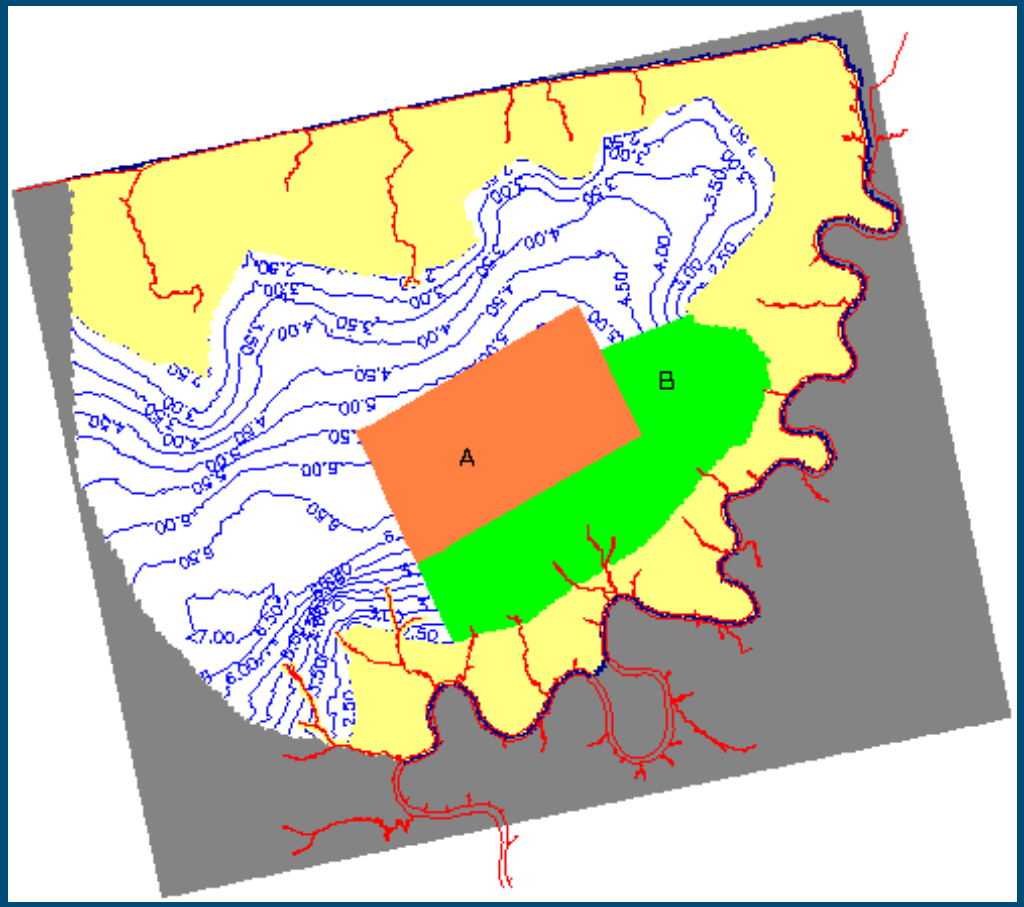
Model approach to predict consequences of land use

Two types of land use in one catchment: is that possible?



A : Oil palm

B: Vegetables

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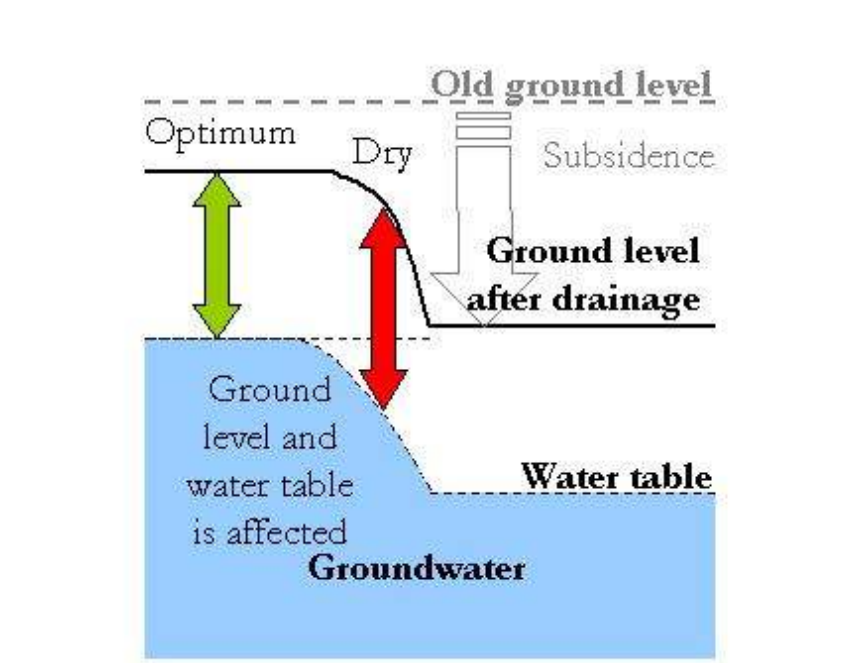
Effect of land use on subsidence

Different depths of the watertable ➔ different rates of subsidence

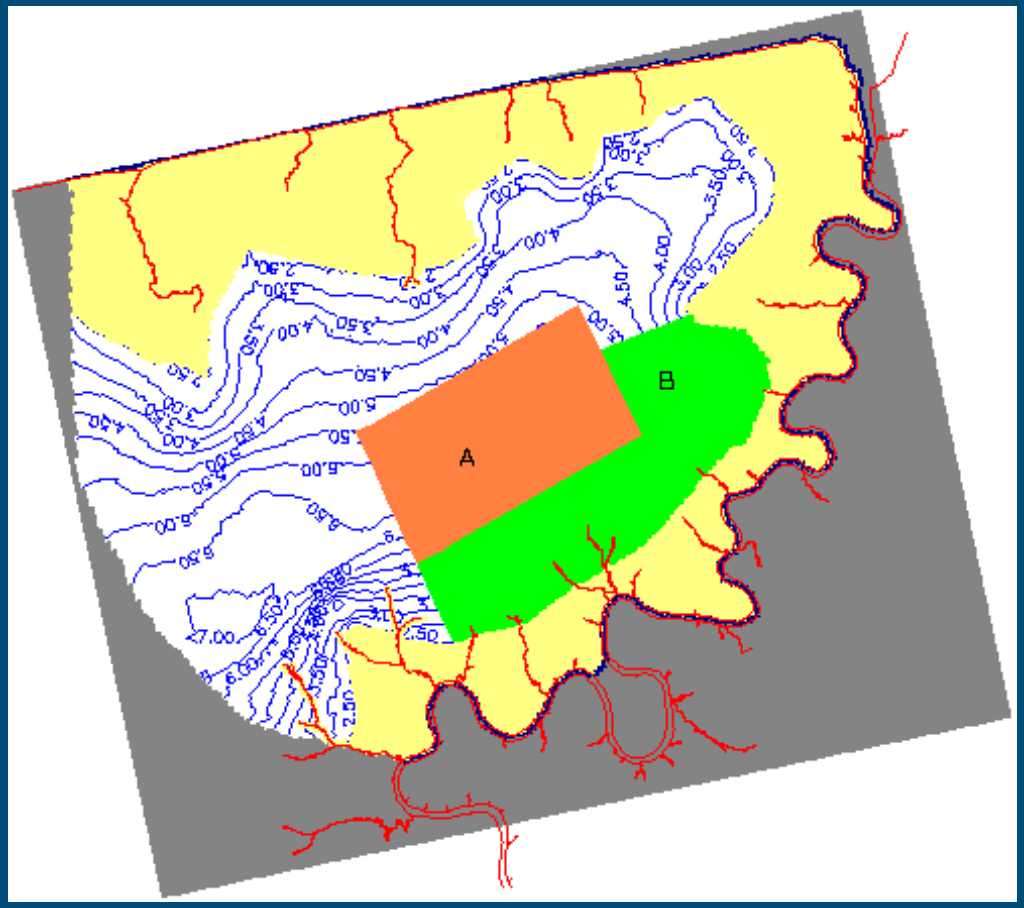


Vegetables: WT = 0.30 m ➔ S = 3 cm/yr

Oil palm: WT = 0.75m ➔ S = 7.5 cm/yr

Conclusion: Eco-hydrological approach

Two types of land use in one catchment: is that possible?



A : Oil palm

B: Vegetables

X

Conclusion:

↓

Do not mix different types of land use in a peat catchment

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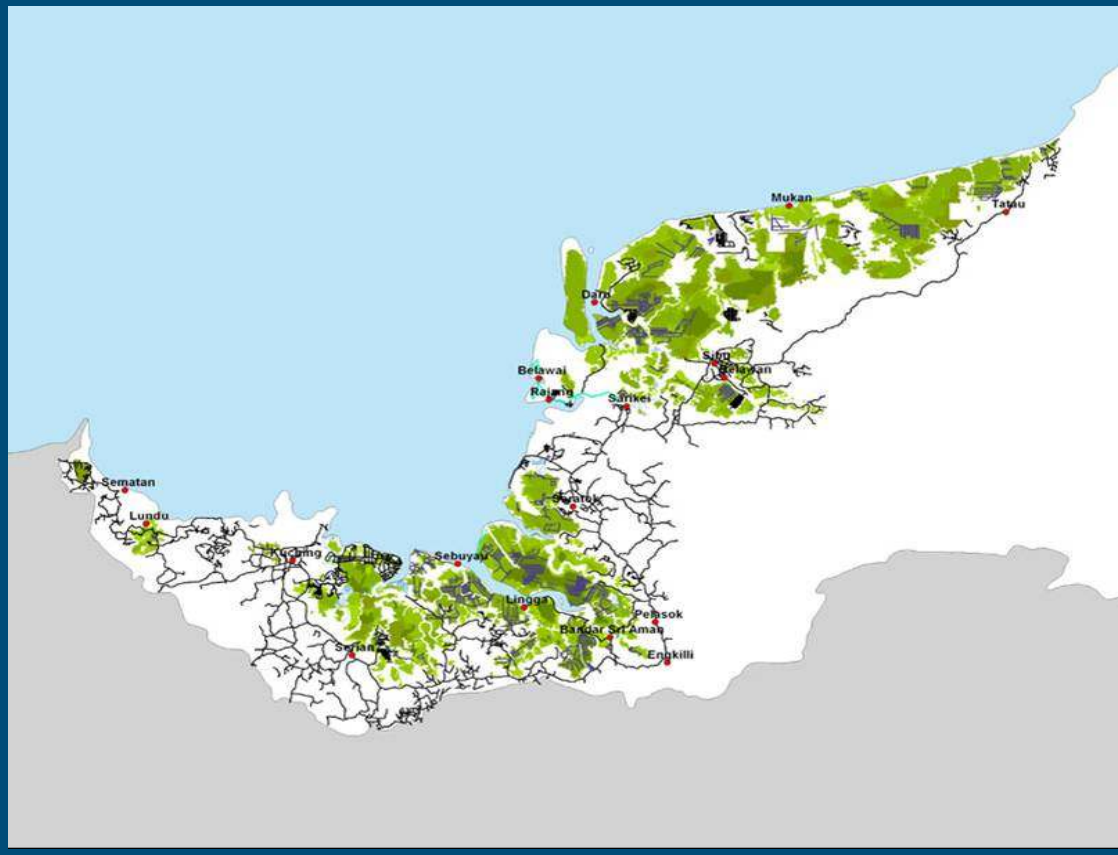
Developments ?

- Regional planning
  - effects (subsidence, water quality, etc)
  - stakeholder communication
- Management:
  - monitoring land use
  - water management
  - yield prediction (agriculture, forestry, etc)



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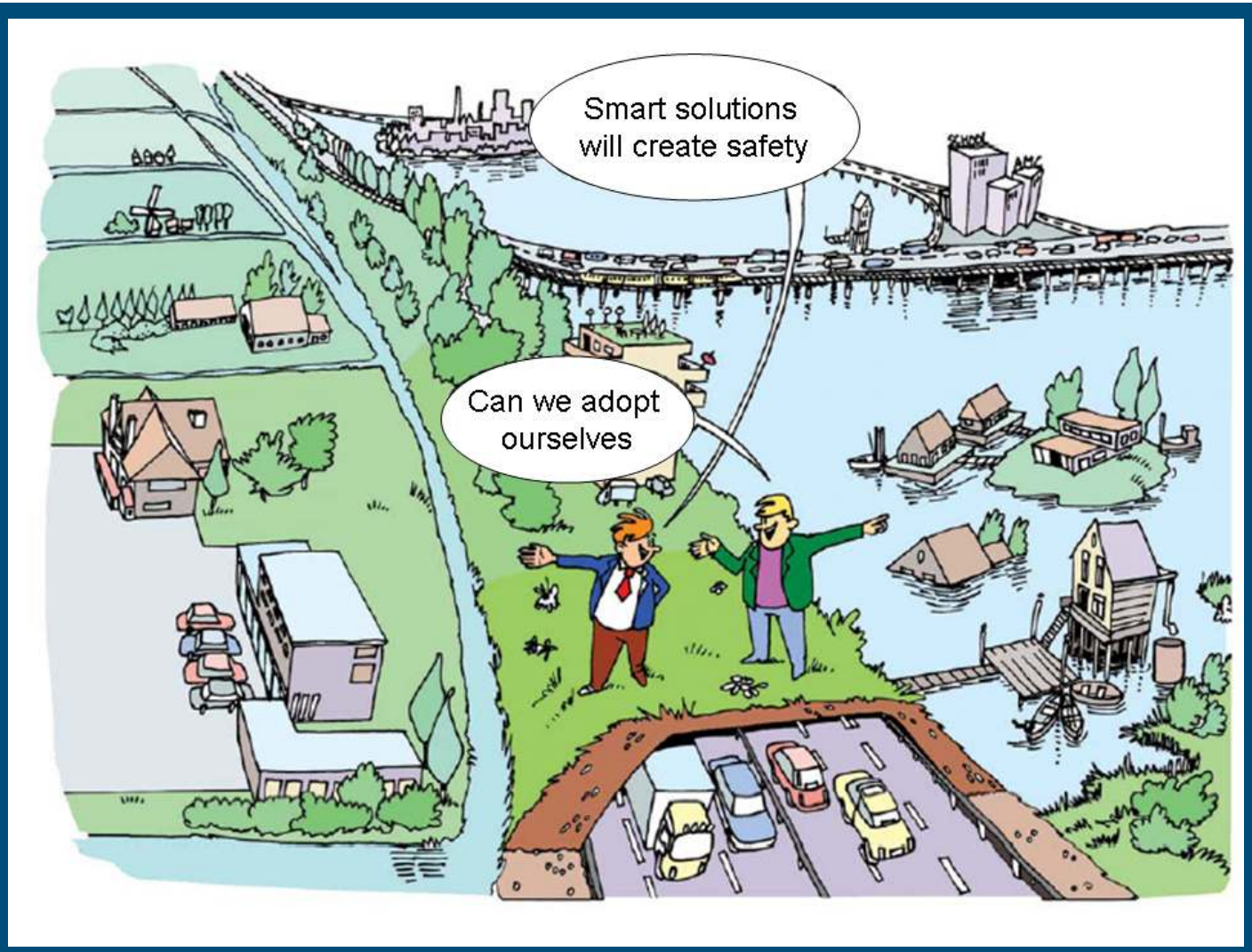
Peatlands will always change over time



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Terima kasih

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Thank you




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