Requirements for and operational aspects of water management in tropical peatlands

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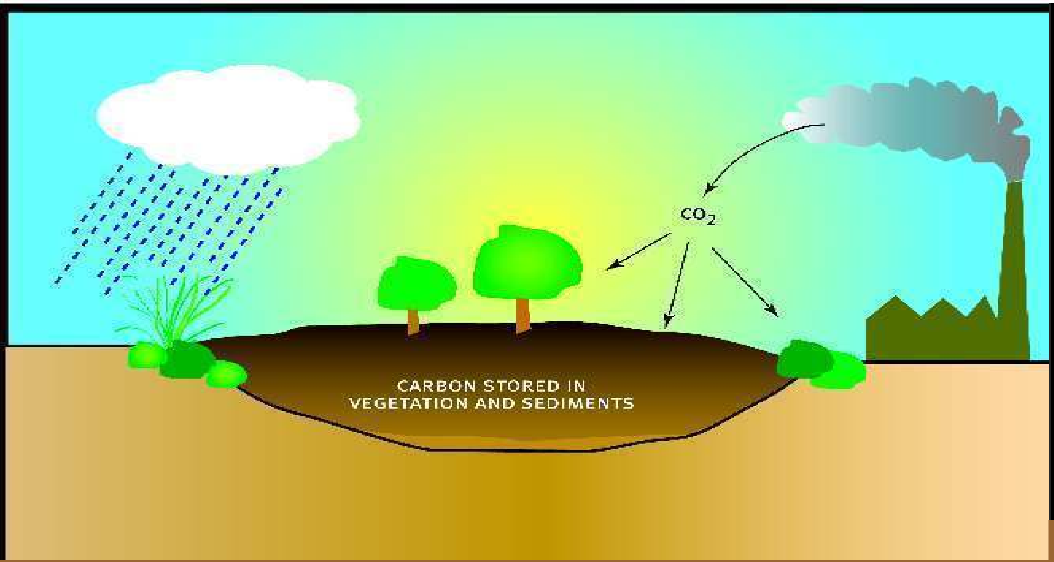
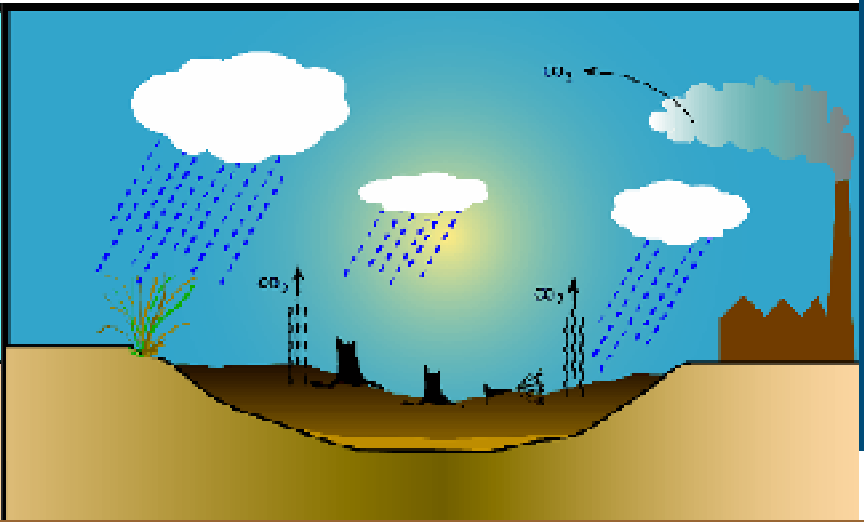
Peatlands and carbon

- Peatlands world wide store 528 Gigatonne (Gt) Carbon,
- Equivalent to:
  - 30% of terrestrial carbon
  - 75% of all carbon (C) in the atmosphere
  - 70 times current annual global emissions from fossil fuel burning
- Carbon storage in peat is very long-term



Peatlands store large amounts of carbon

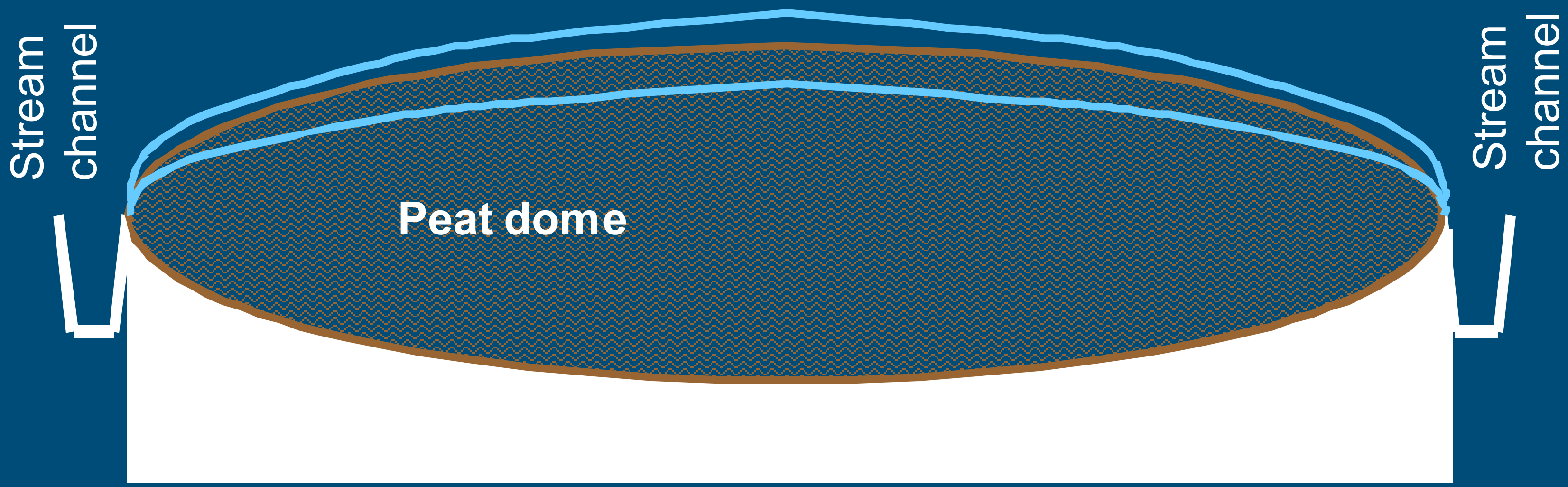


Peatland degradation leads to CO_2 emissions which contribute to global warming

Wet situation leads to CO_2 sequestration

Intact peat:

- water table near surface allows accumulation of organic matter (carbon sink)

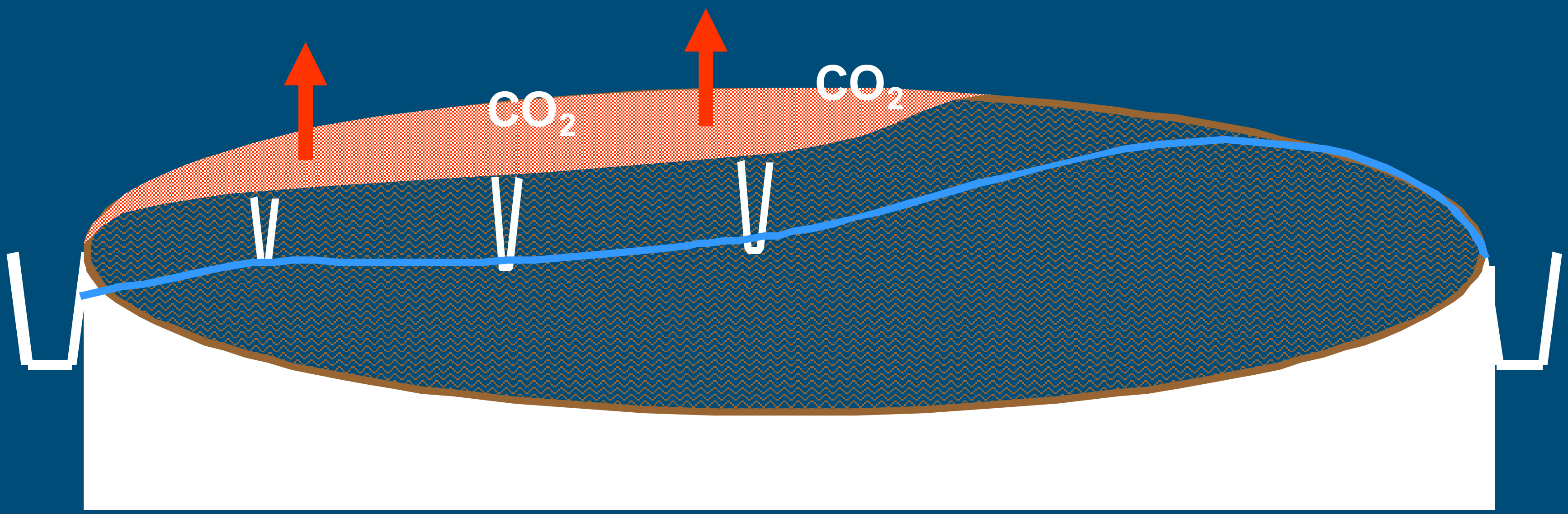


Drainage leads to CO_2 emissions

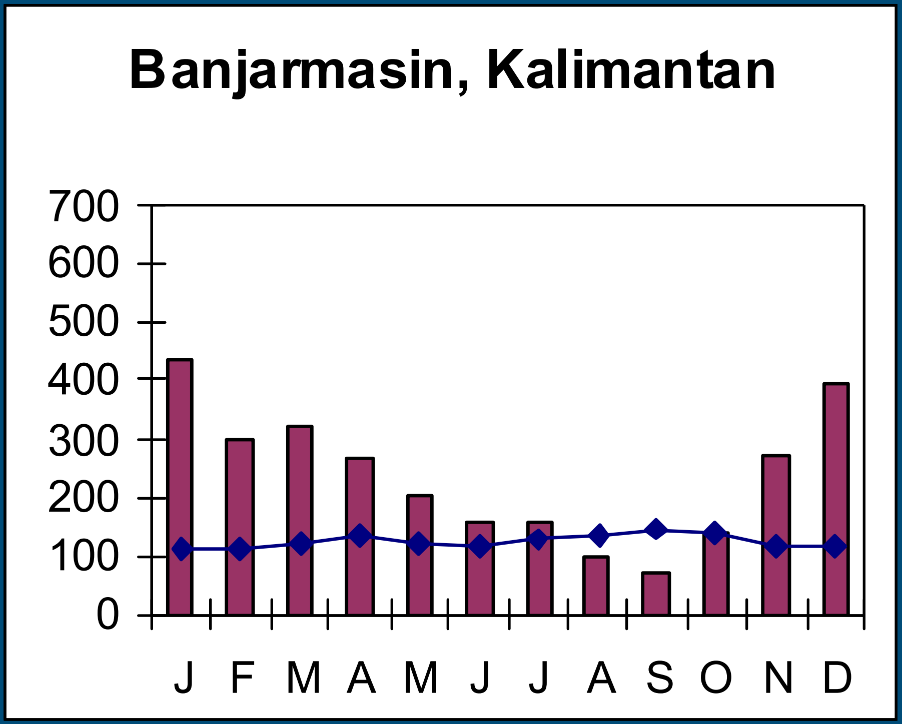
Drained peat:

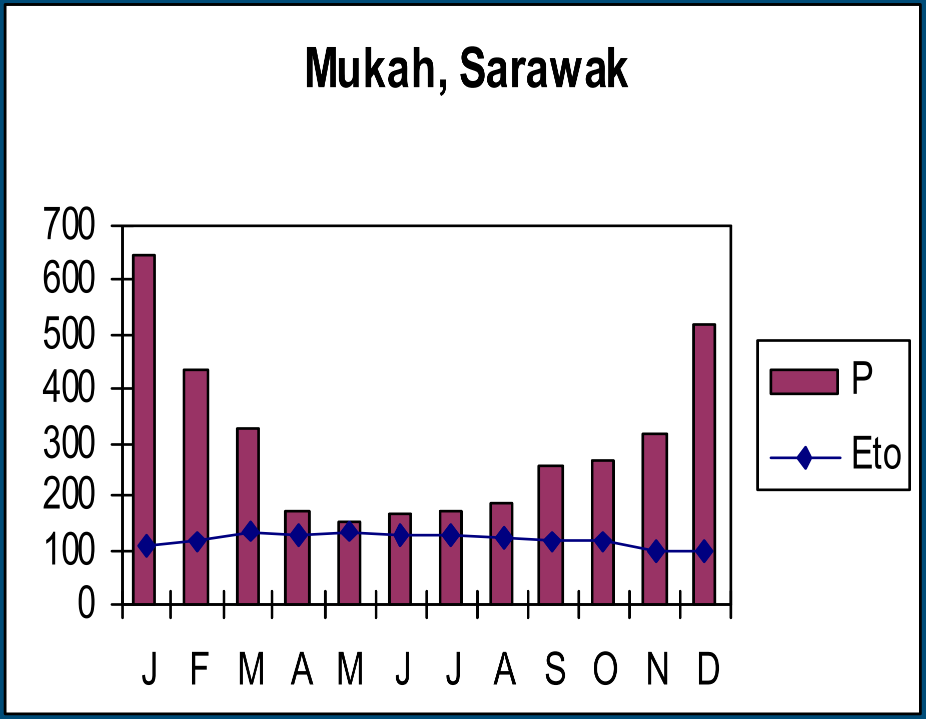
- oxidation
- fires

Carbon source

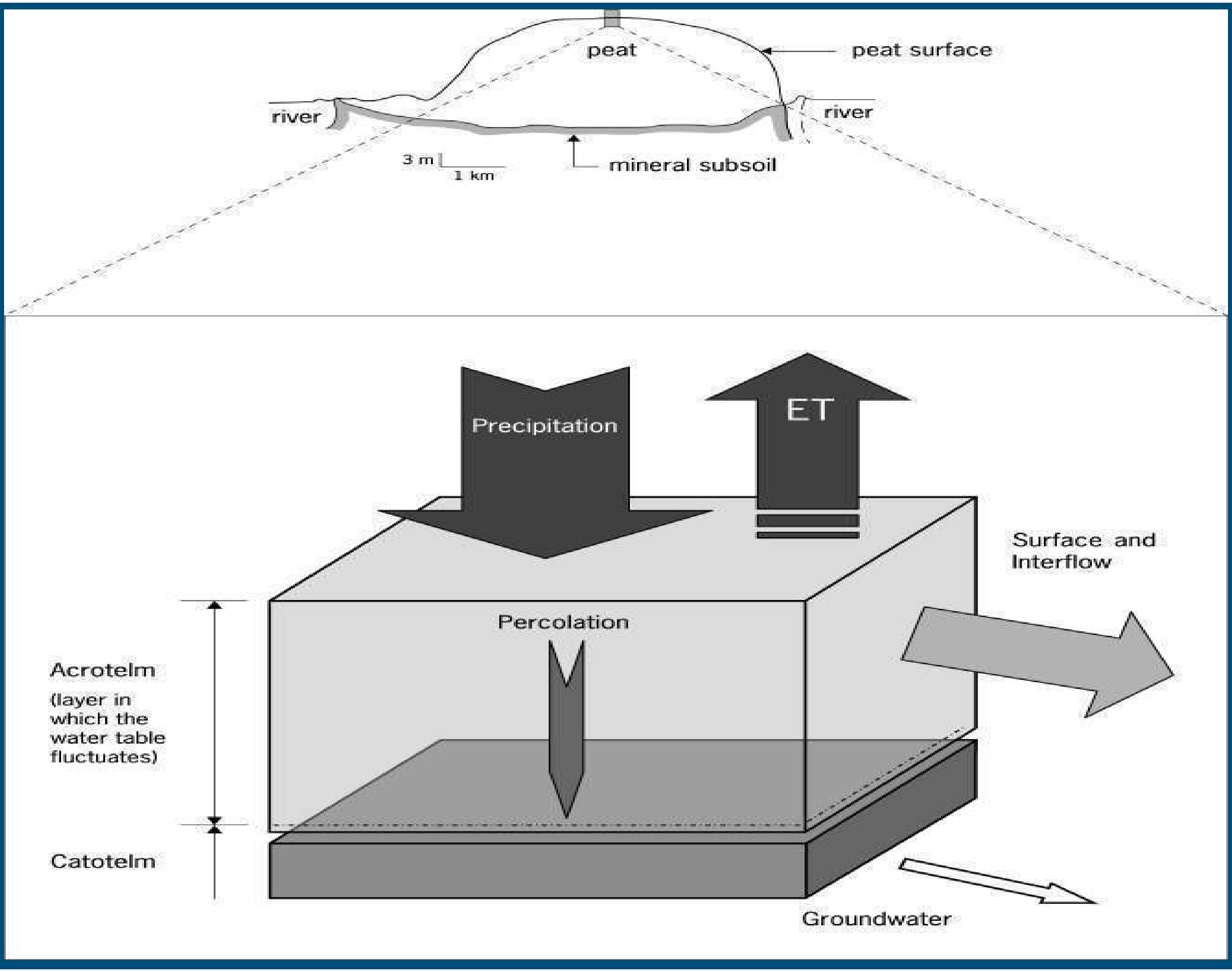


Wet and dry periods vary over the year





Water balance



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Mitigation strategy

Adequate water management is the key issue

In mitigating peat carbon losses due to

drainage and fire

- Natural peat swamp forest

- Agricultural land use

- Plantation crops

Water management Requirements and Operational Aspects

Natural peat swamp forest

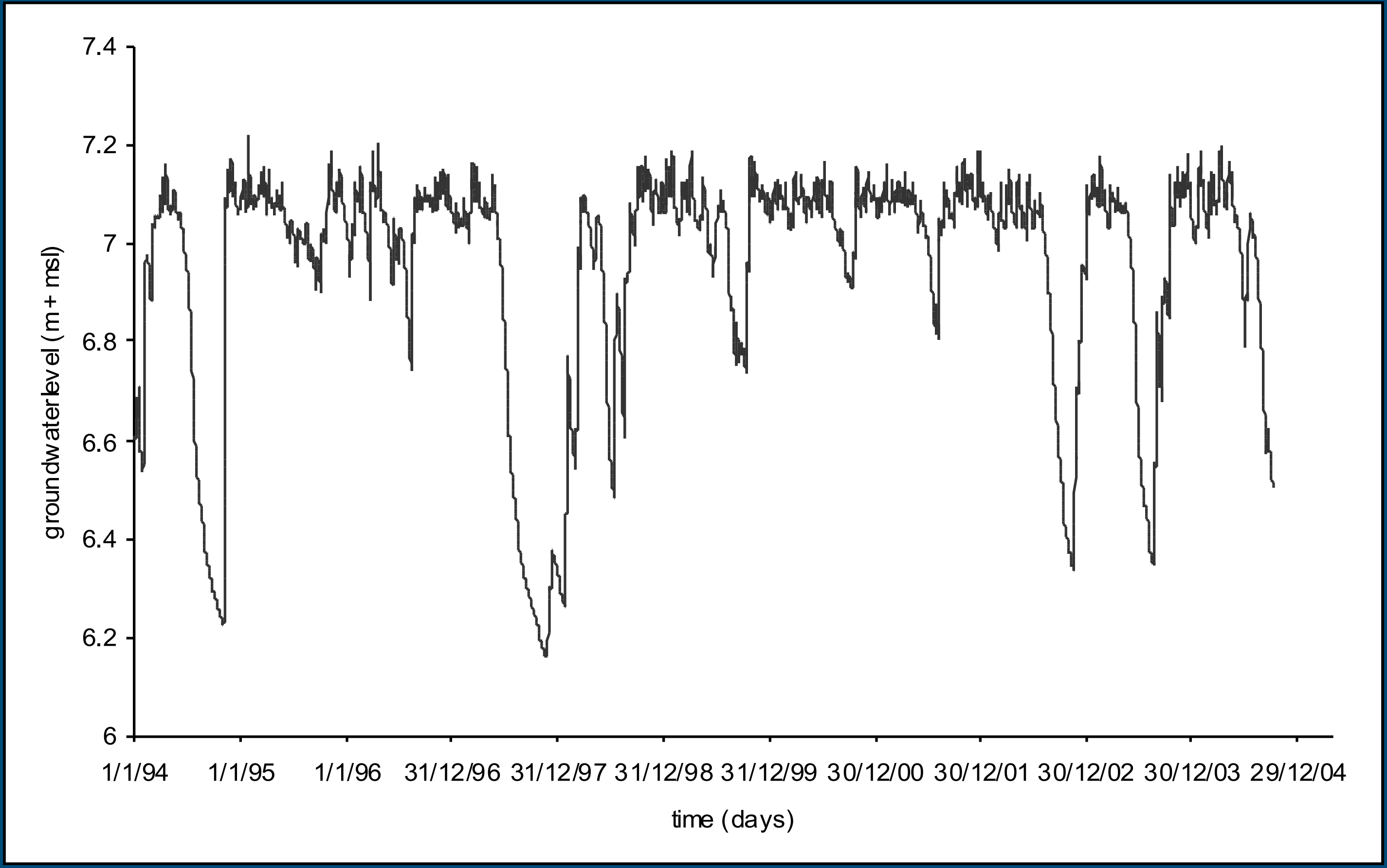
Natural peat swamp forest

Natural peat swamp forest

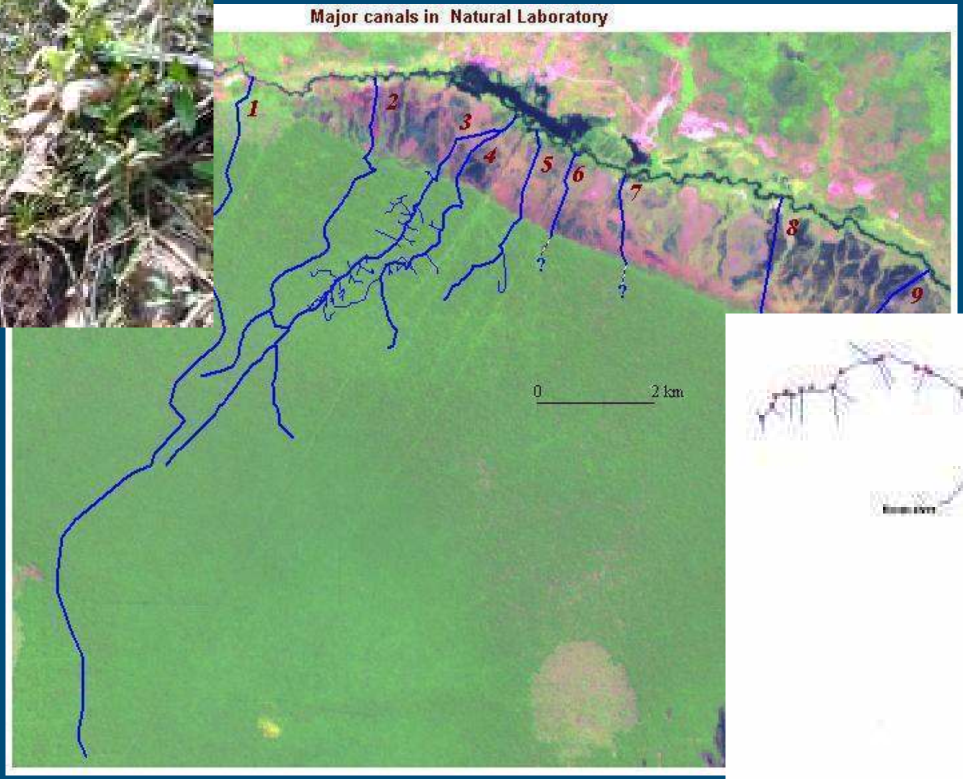
Reservoirs of:

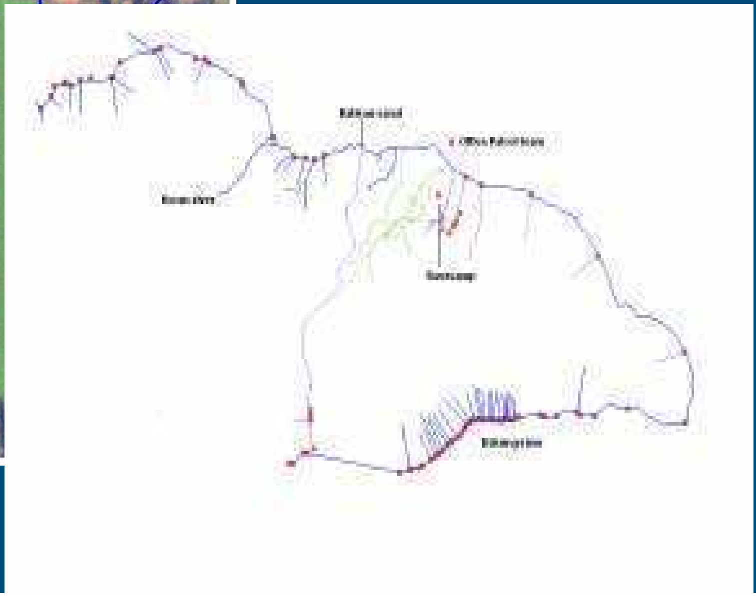
- water
- biodiversity
- carbon

Water level fluctuations



Natural peat swamp forest





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Simple dams using local available material

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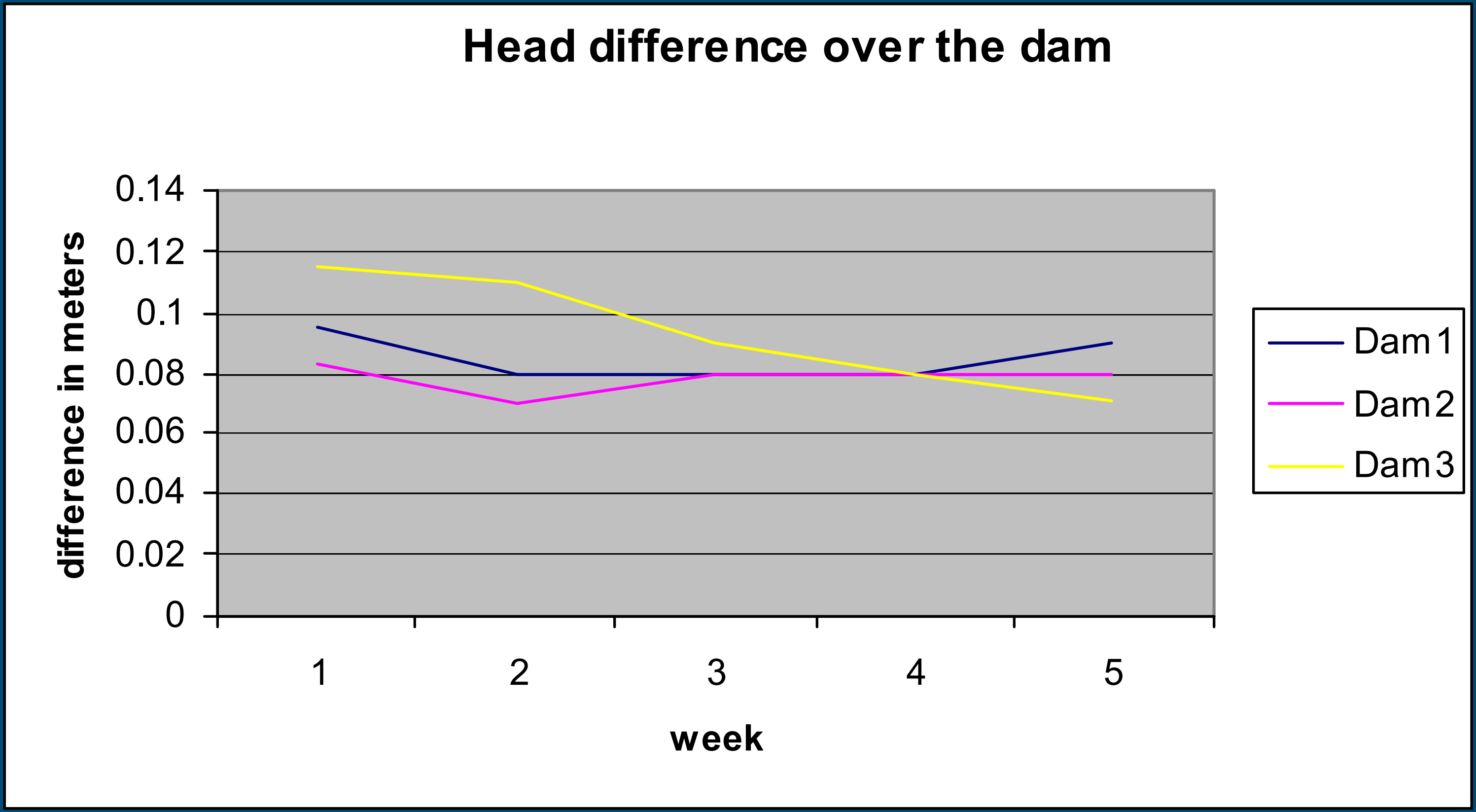
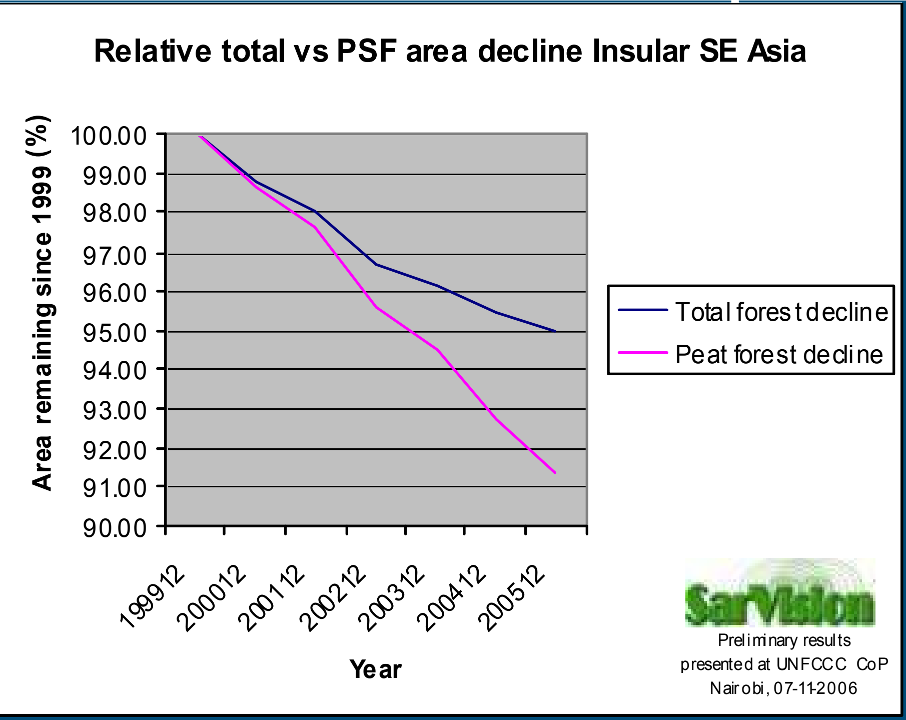
Effectiveness of simple dams



Agricultural land use

Peat swamp forest deforestation



Peatland deforestation:

- since 2000: 1.5%/yr which is double the rate for non-peatlands
- currently 45% deforested

Peat forest conservation

- < 5% of total peatland area

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Expansion of agricultural areas

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Forest degradation

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Crop water requirements

Crop	Water Management Requirements			Main constraints to yields or productivity
	Optimum range of the water table (m)		Maximum period of flooding (days)	
	Min	Max		
Oil palm	0.6	0.75	3	low fertility, susceptible to termites , poor anchorage, drought stress
Cassava/Tapioca	0.3	0.6	nil	Mechanisation
Sago	0.2	0.4		
Horticultural crops	0.3	0.6	nil	Mechanisation
Aquaculture				water quality, construction of ponds, water control in ponds
Paddy	-0.1	0.0		water control in individual plots, plant nutritional problems, mechanisation
Pineapple	0.75	0.9	1	Mechanisation
Rubber	0.75	1.0		poor anchorage
Acacia crassicarpa	0.70	0.8		poor anchorage

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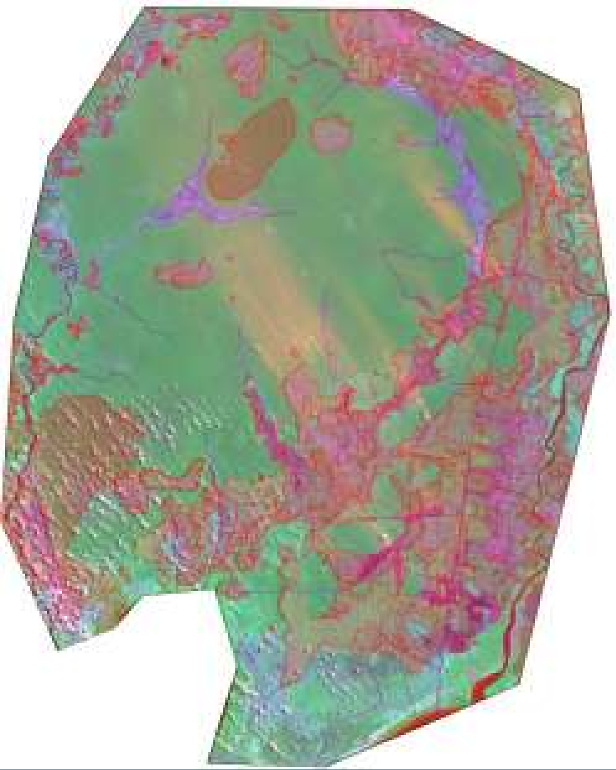
Simple relationship

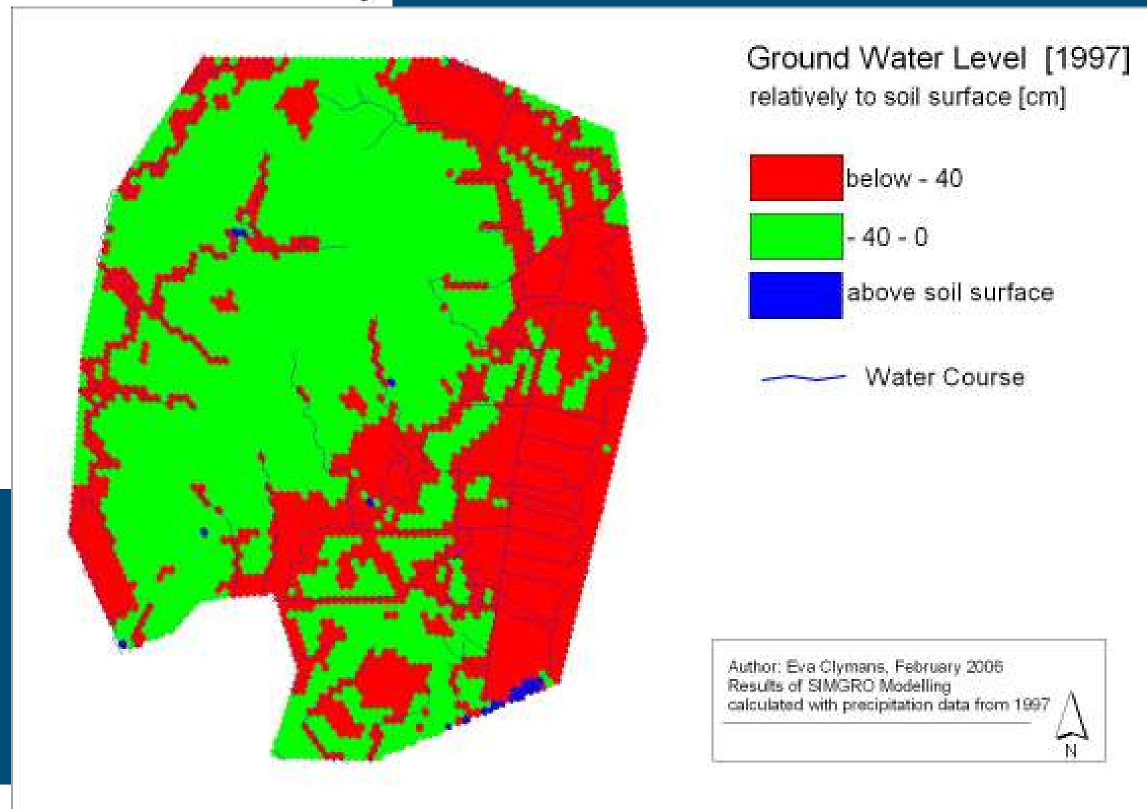
subsidence rate (cm / year) = X * groundwater level (cm)

X co-efficient varies: 0.1 Sarawak

0.04 Western Johore

Fire risk: comparison





Groundwater level < -40 cm

⇨ very high chance on fire

Sophisticated dams

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Plantation crops

Livelihood → Plantation

Drainage is needed to make peatlands suitable for agriculture

Oil palm

Aloe Vera

Sago palm in rice plot

Vegetables

Construction of drainage canals

Oil palm cultivation

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Complicated dams

Road maintenance

Conclusions

- Subsidence readings show that agricultural use of peat – thus also plantations – causes disappearance of peat.
  Whereas in a natural peat swamp forest peat is accumulated

- The deeper the drainage the more peat is lost

Conclusions (continued)

- Adequate water management has a high carbon mitigation potential as it helps to minimise subsidence under a given land use type and associated groundwater level

- More severe and longer dry spells as predicted from climate change is likely to increase carbon emissions due to drainage and fire

Thank you for your attention

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