"ADDRESSING CLIMATE CHANGE IN THE MANAGEMENT OF WETLANDS ".

By
Nyoman N. Suryadiputra
(*Wetlands International Indonesia)*

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"International Symposium on Conservation and Management of Wetlands"
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OUTLINE

- Climate change and ice melts & impact to Indonesia's coastal wetlands (Peatlands & Mangroves)
- Peatlands Characteristics & succession
- Threats faced by coastal wetlands (peatlands: conversion, drainage, subsidence, oxidation, fire. Mangroves: conversion, abrasion/erosion, subsidence)
- Peatlands Hydrologic Restoration & Vegetation Rehabilitation
- Mangrove restoration (semi permeable structure, Natural re-growth and silvofishery)

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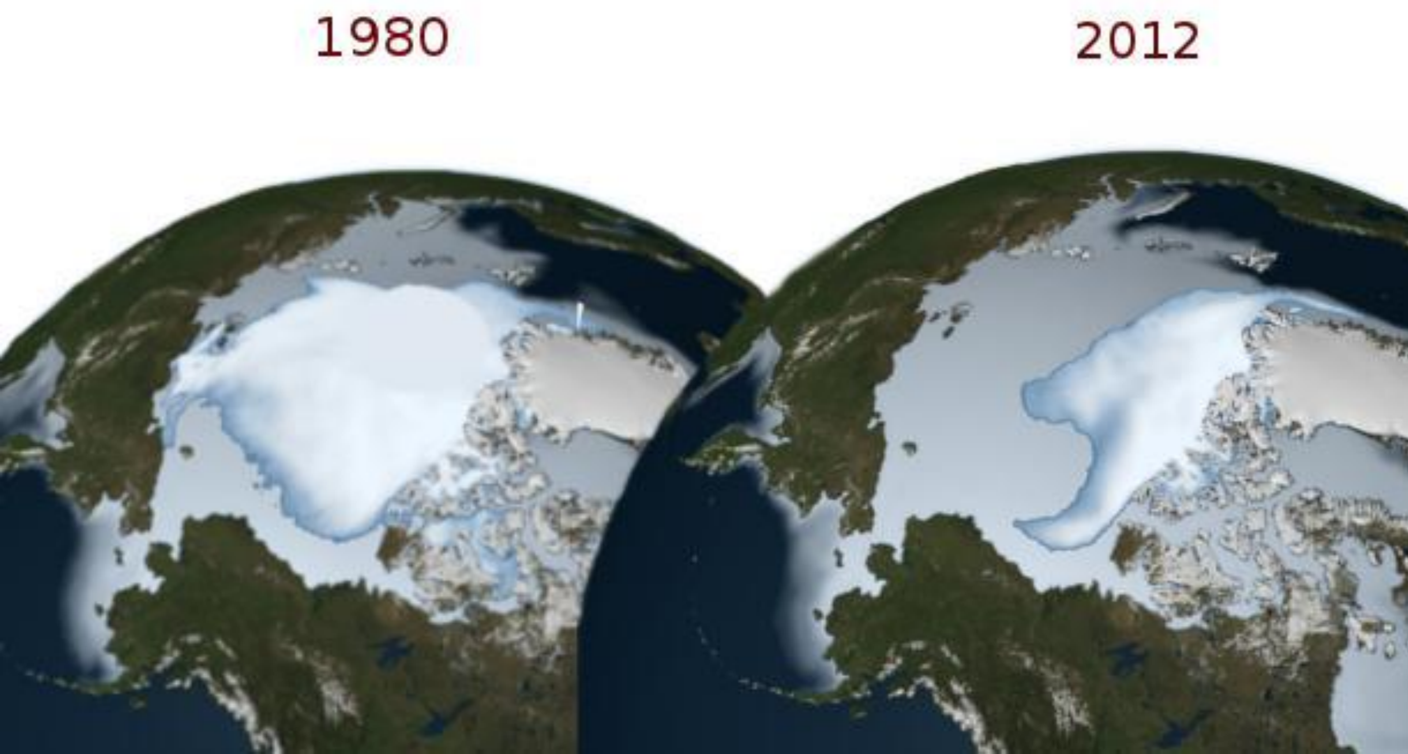
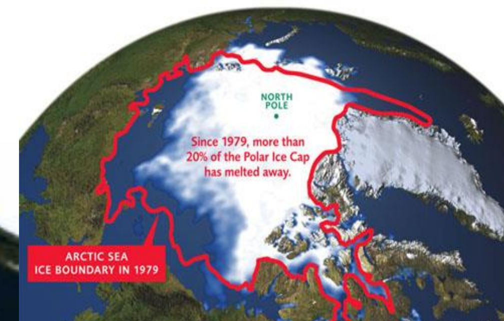


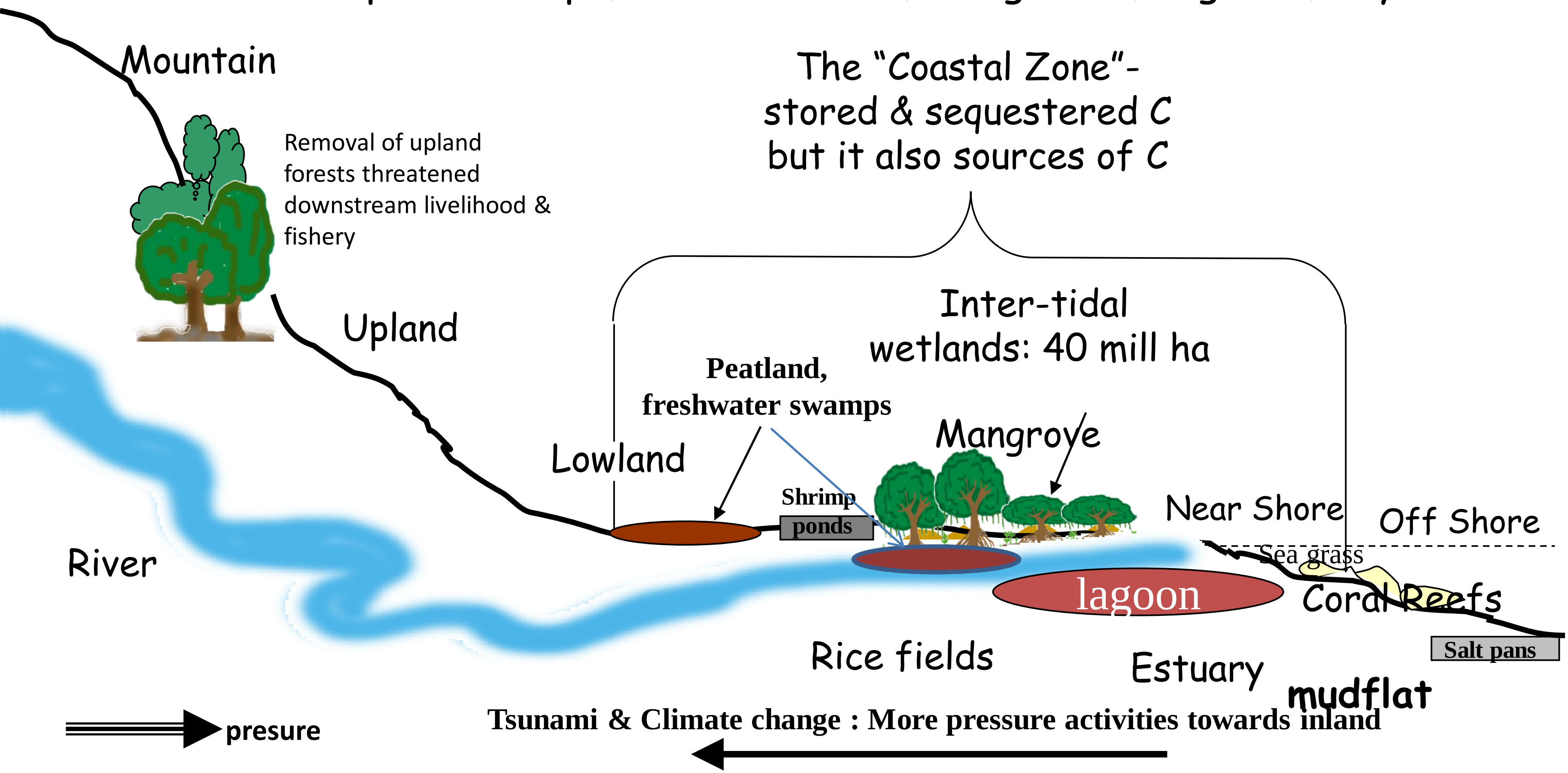


Sea level rises:
3 mm/ annum;
37 cm end of this century ??

Wetlands Distributions in Indonesia

values and benefits, threats and measures to protect and restore them

Components: Estuaries, Coral reefs, Seagrass beds, Ponds, fresh/ brackish water and peat swamps, beach forests, Mangroves, Lagoons, Bays



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Major threats on wetlands

<u>Peatland</u> (conversion mainly to oil palm and acacia, extensive drainage, oxidation, dryness, fires, subsidence, floods, biodiversity loss, land conflicts/land grabs, policy issues etc)

<u>Mangrove</u> (conversion mainly to fish/shrimp ponds, coastal abrasion/erosion, inundated by seawater, etc)

<u>Lake and reservoir/dam</u> (occupied by floating cages, eutrophication, colonized by invasive species, siltation, water quality deterioration/pollution, reduced water volume and discharged affected hydroelectric power, occupation of lake banks for settlements and agriculture)

<u>River (</u>sand mining, river banks occupied by settlements, siltation, pollutions, forests logging along its catchment areas, etc)

ETC

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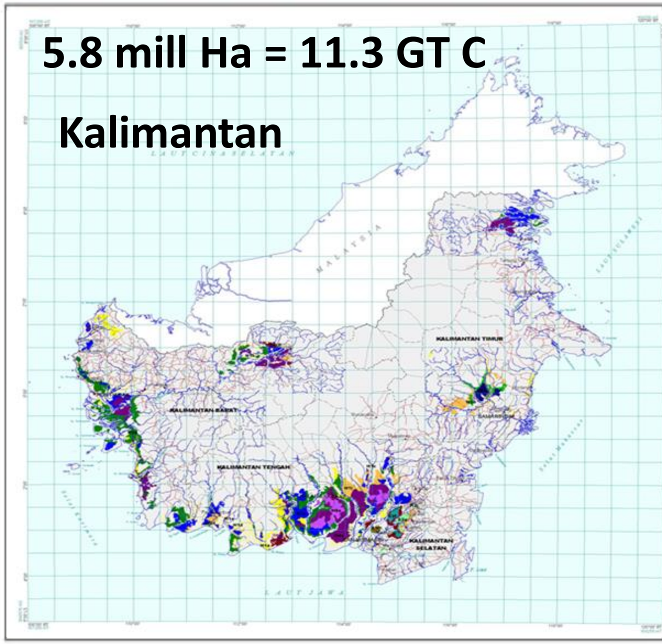
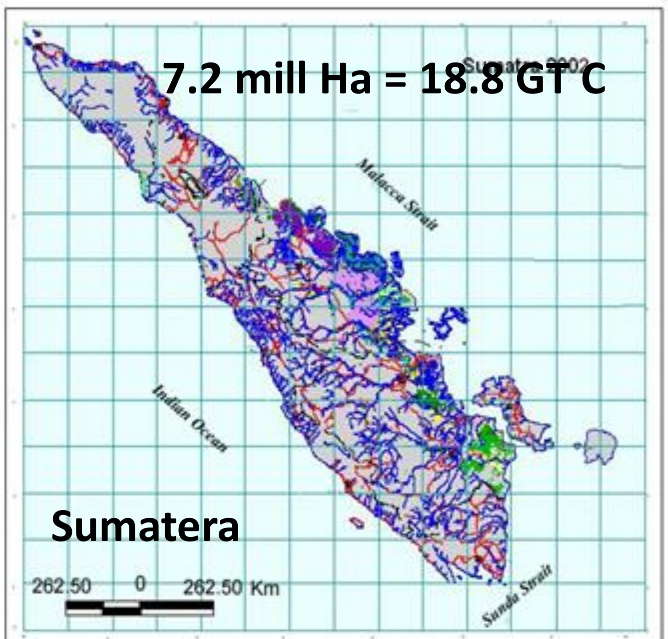
Peat associated with mangroves (Gorontalo Sulawesi) : converted into fish ponds & peat water is drained to remove its acidic water



LEGEND

Depth/Thickness	Symbol		Peat Types	1990 Area (Ha)	1990 Carbon Content (million ton C)	2002 Area (Ha)	2002 Carbon Content (million ton C)
Very Shallow/ Very Thin < 50 cm		H0	Peaty Hemic	-	-	7,420	2.21
		H0a	Peaty Hemic/Sapric	-	-	181,336	53.98
	3	H0b-e	Peaty Hemic/Mineral	-	-	349,193	103.95
	4	S0	Peaty Sapric	-	-	56,148	16.71
	5	S0a	Peaty Sapric/Hemic	-	-	65,119	19.38
	6	S0b-d	Peaty Sapric/Mineral	-	-	23,697	7.05
Shallow/Thin 50 - 100 cm	7	F1	Fibrists/Saprists	-	-	68,362	55.57
	8	H1	Hemists	-	-	4,070	2.53
	9	H1a	Hemists/Saprists	49,355	36.91	11,987	7.41
	10	H1b-e	Hemists/mineral	311,071	124.15	626,531	468.55
	11	S1	Saprists	-	-	342,403	162.16
	12	S1a	Saprists/Hemists	-	-	16,373	15.44
	13	S1b-d	Saprists/mineral	16,861	10.46	172,013	142.67
		F2	Fibrists/Saprists	4,070	5.07	-	-
		H2	Hemists	87,357	107.93	67,950	83.95



Peat succsession : Biomass & Fossil

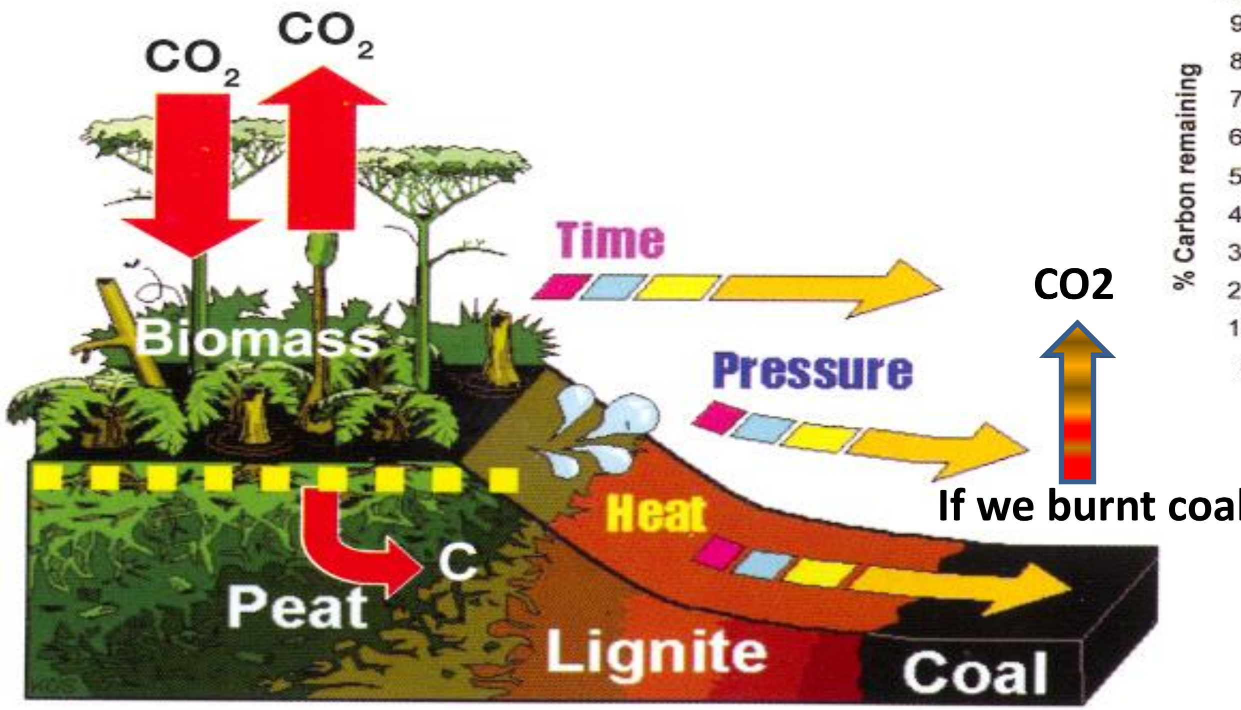


Figure 5: The difference between "biomass" and "fossil": growing plants sequester CO_2 in their bio-mass (left downward arrow). Dead biomass rapidly decomposes and returns as CO_2 into the atmosphere (right upward arrow). In case of peat formation, a part of the biomass is, however, conserved by waterlogging and remains in the peat carbon store infinitely (curved arrow). Over time it may change into lignite and coal.

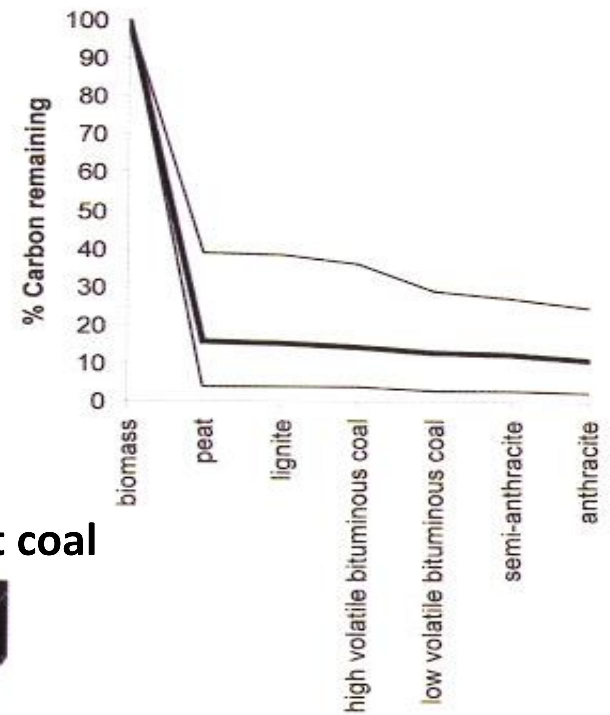


Figure 6: Carbon remaining during the fossilization of biomass (modified after Dukes 2003).

Biomasa – peat-lignite-brown coal-dark coal-anthracite

Global peatland area : 400 mill. ha. Canada (170 mill. ha, ex Uni Soviet (150 mill. ha), USA (40 mill ha). Indonesia 21 mill ha (the largest tropical peatland; 50% from total tropical peatland of 40 mill ha)

Peat ….. Swamp ……forest

Bagan Segitiga Api

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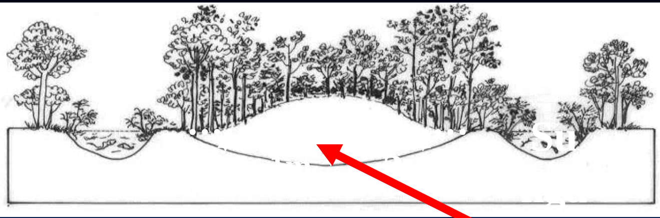
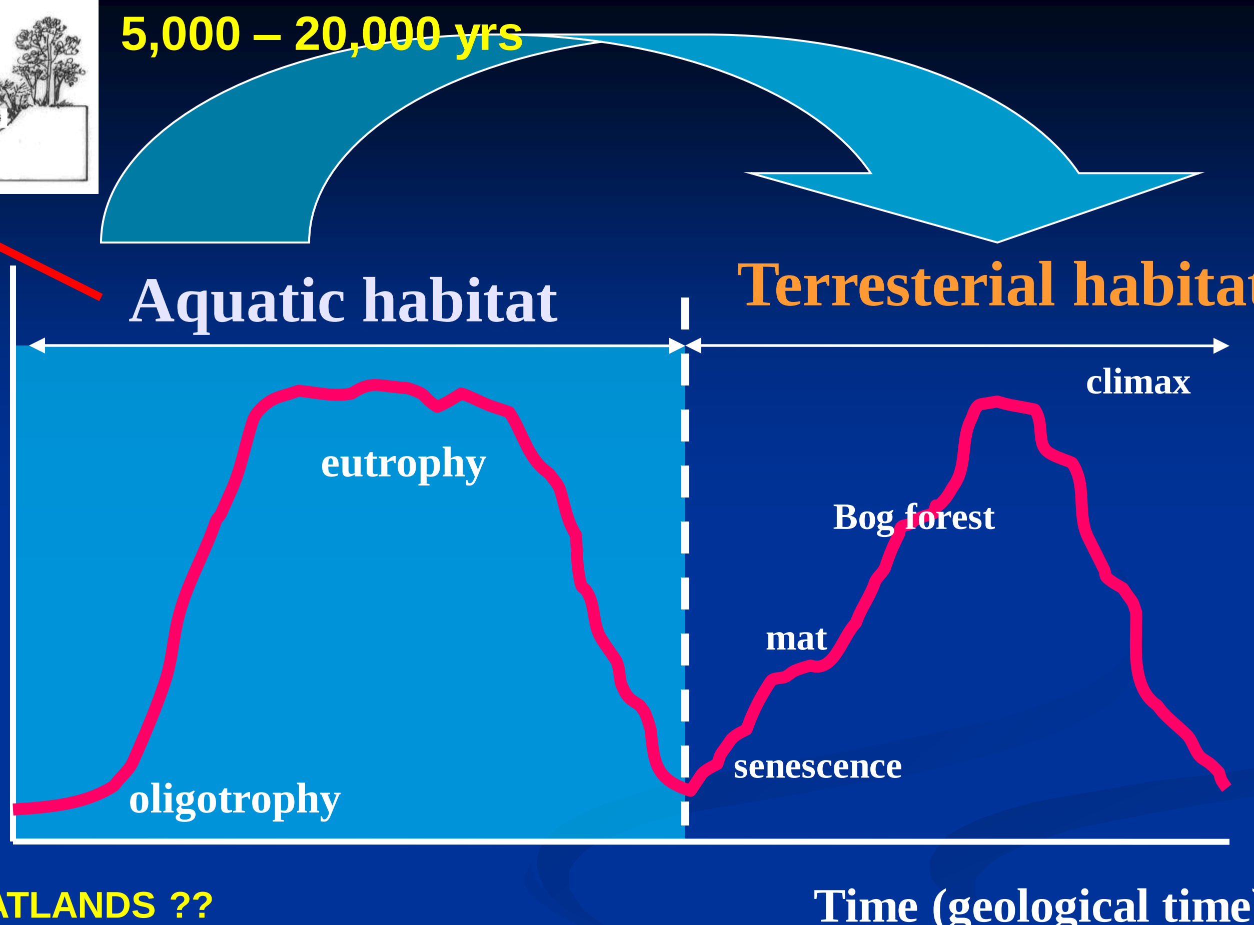


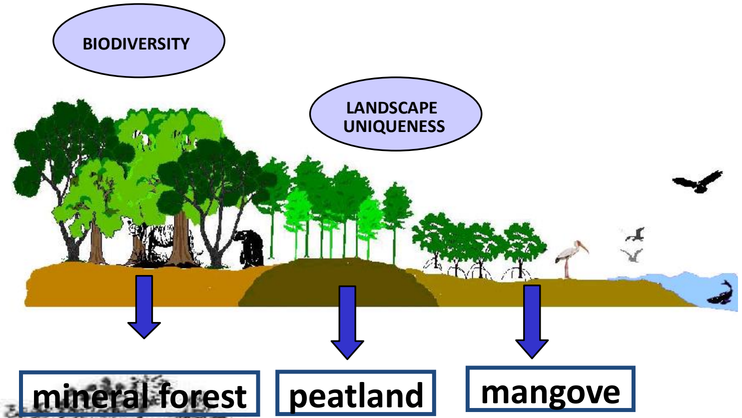


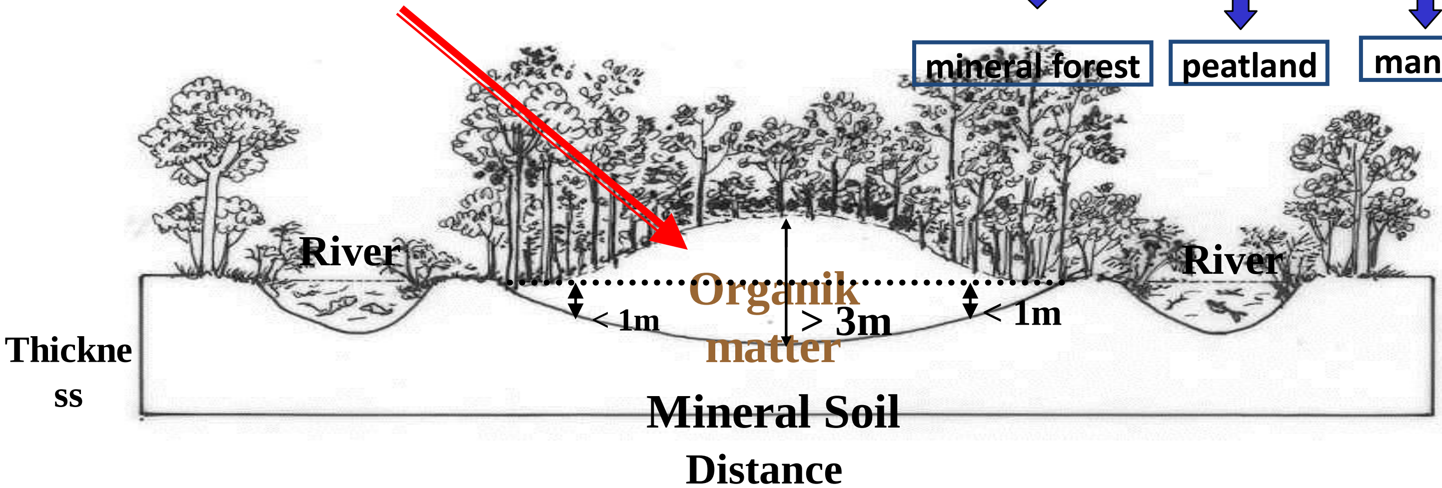
HOW LAKES RELATED TO PEATLANDS ??

Suksesi alami habitat perairan dari sudut pandang daya tampung air

Peatland stored dead organic matters (coastal peatland 5000 – upland peatland 25,000 years old)

Peatland in Indonesia = 21 Mill. Ha (avg. 1,600 ton C/ha) or total 33.7 Gt C; its habitat and support lives for biodiversity



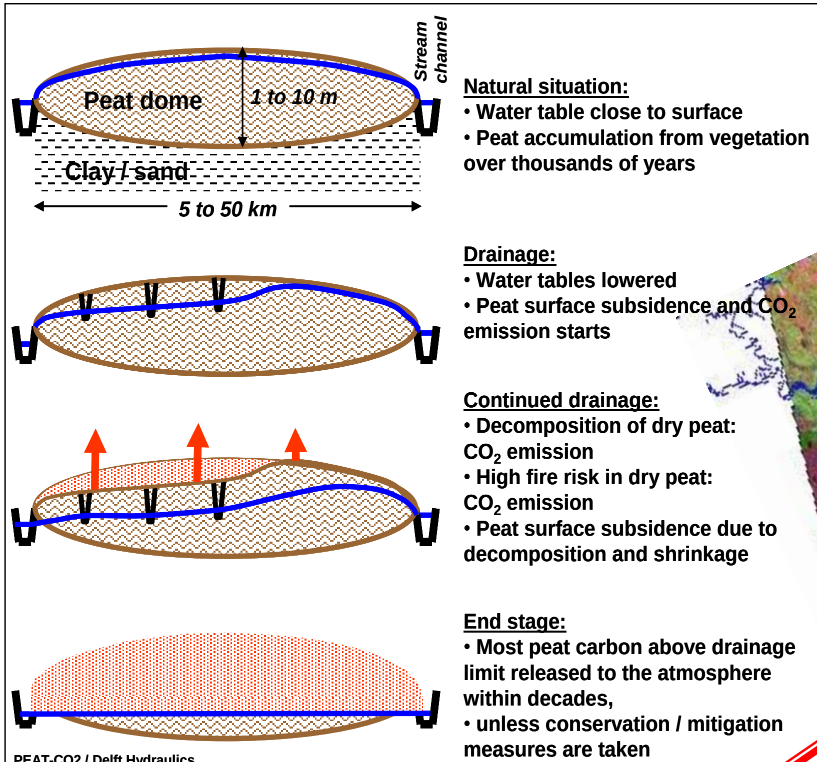


Below/Above Carbon ratio = 50 -88 (Average)… In Mentangai Kalteng > 1200 x

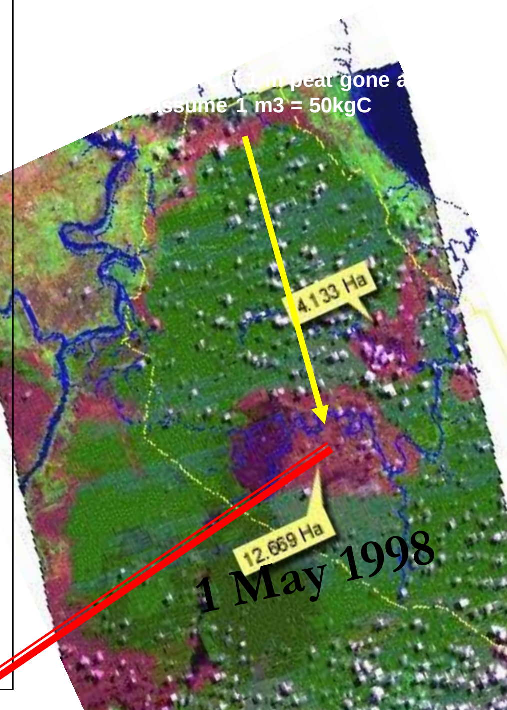
Kepres No 32/1990; UU Tata Ruang No 21/1992: **Peatlands > 3 meter depth is Protected**

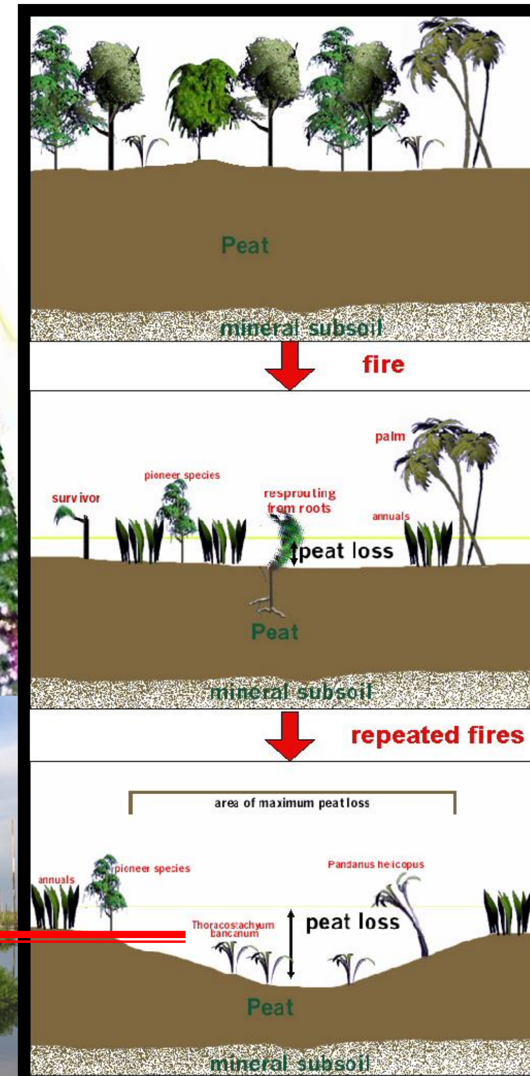
Kebijakan DepTan : **Shallow Peat (0.5-1m) – Medium (1-2 m), Potential for Agriculture (Permentan No 14/2009 related to palm oil).**

Schematic illustration of CO2 emission from drained (left) and burnt peatlands (right)



Repeated fires in Berbak NP create lake



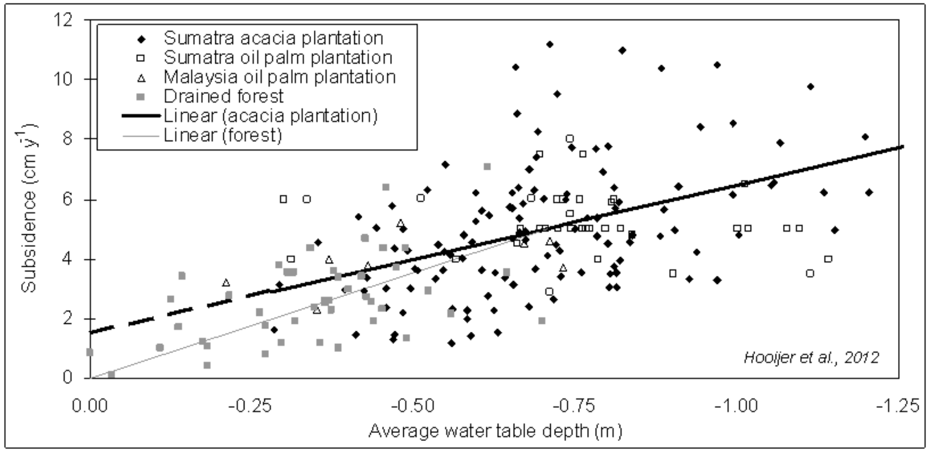


Mangroves conversion & coastal abrasion

PEATLAND WATER MANAGEMENT IN SUMATRA ACACIA PLANTATION

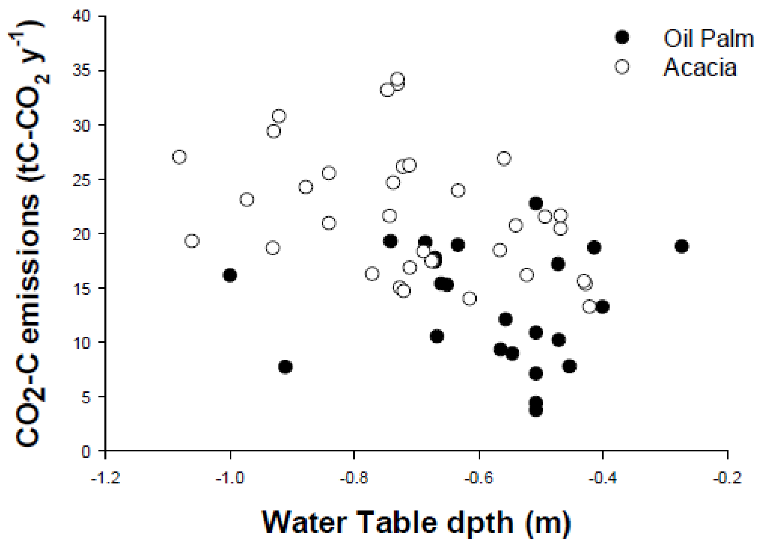
How much will the land subside?

BELOW, Dr. Annette Freibauer, indicates for drainage depths between 60 and 80 cm (for Oil Palm on peatland), the EF of over 17 t C/ha/yr



average 5.2 cm/y at 0.7 m drainage depth.

Hooijer A, Page S, Jauhiainen J, Lee WA, Lu XiXi, Idris A, Anshari G, 2012. Subsidence and carbon loss in drained tropical peatlands. Biogeosciences, 9, 1053-1071.



subsidence rate
(1 cm / year per 10 cm drainage)

Impact of peat Subsidence in oil palm plantation, mineral soil exposed

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Can wetlands contributes to climate change mitigation ?

Healthy natural wetlands (peatland, freshwater swamp forest, mangroves, lakes) sequestered and stored carbon.

- Intact peatlands, the deeper the peat the higher the amount of carbon stored. In Indonesia C stored in peatland is about 1600 ton C/ha (avg peat depth 4 m). C stores in pristine/ intact forest is only 200-400 ton C/Ha
- Pristine /Intact Mangrove forests stored 1023 ton C/ha (CIFOR April 2011, Nature Geoscience, but mostly (70%) as carbon soil). If peat deposits found under the mangroves, carbon stores should be higher.
- Lake/dam/reservoir, stored C mostly (as the results of photosynthesis) of algae and aquatic plants. The dead algae and aquatic plants, if preserved at lake bottom, would stored large amount of C (but lake water volume can be reduced and aquatic ecosystem will change into terrestrial)

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Can we improved wetlands capacity/role in storing carbon (mitigate climate change) and How ??

Peatlands.

Rewetting of peatlands by blocking of canals/ditches, and then followed with vegetation rehabilitation (if necessary).

Paludiculture can be applied for inundated peatland

But need to consider:

- Land tenurial issues
- Policy issues
- Cost benefits, etc

Mangroves.

Vegetation rehabilitation in degraded mangrove areas,

Application of semi-permeable hybrid engineering structures (combined with mangrove replanting) along the eroded coastal areas

Application of Silvo-fishery in ponds areas (planting mangrove trees along pond dikes

Lakes/dams

Unlikely to be agreed by people to improve lakes capacity to store carbon , as it main function is to store water for domestic consumption, irrigation, recreation, hydroelectric power generation etc.

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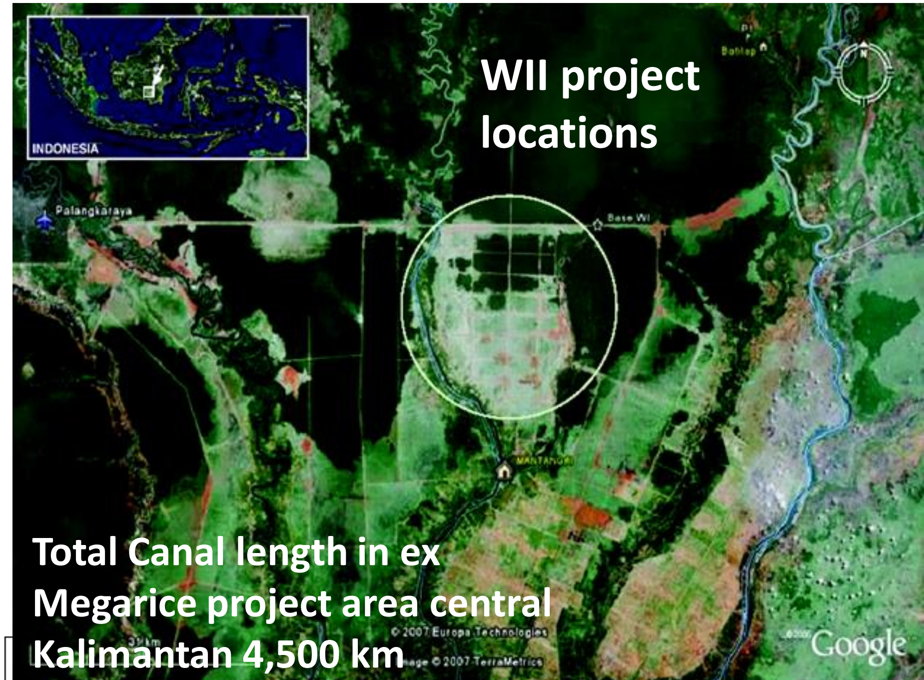
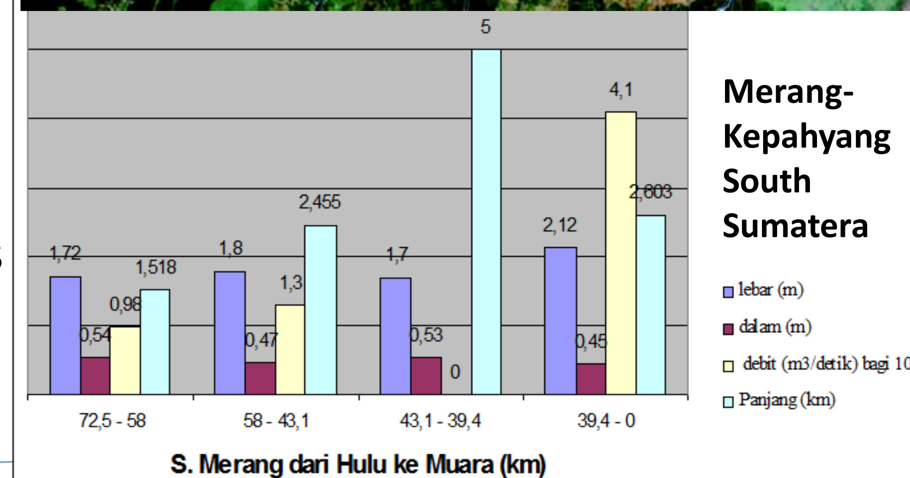
Peatland Restoration / Rewetting

STEPS :

- Identify canals/ditches distribution (area to be rewetted)
- Canal/ditch dimensions (wide, deep, length)
- Ownership & canal utilization status
- Legal (ownership) status
- Policy related issues
- Preparation of Rewetting (public consultations, permits, rewetting/technical designs, raw materials and labors availability and their staying, etc)
- Rewetting activity (transporting materials and construction considering climatic seasonal changes etc)
- Maintenance of physical structures (eg dams)
- Monitoring & evaluation





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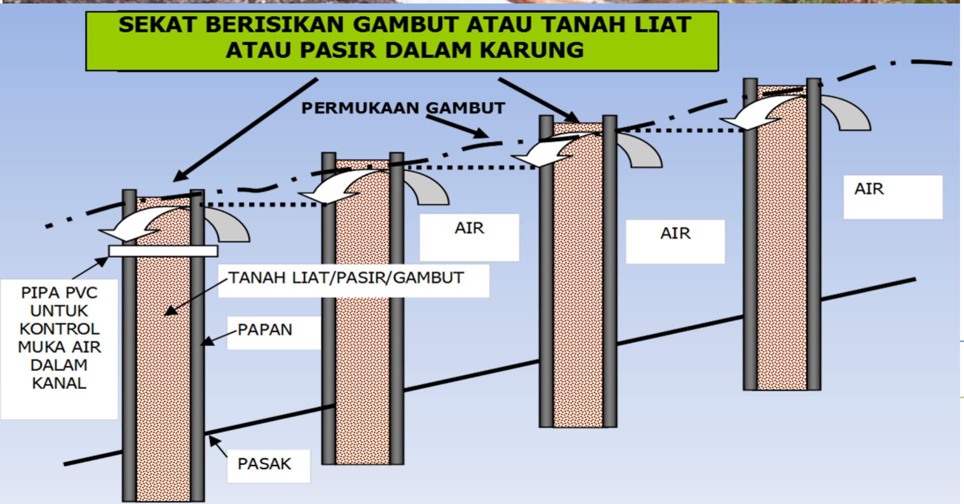
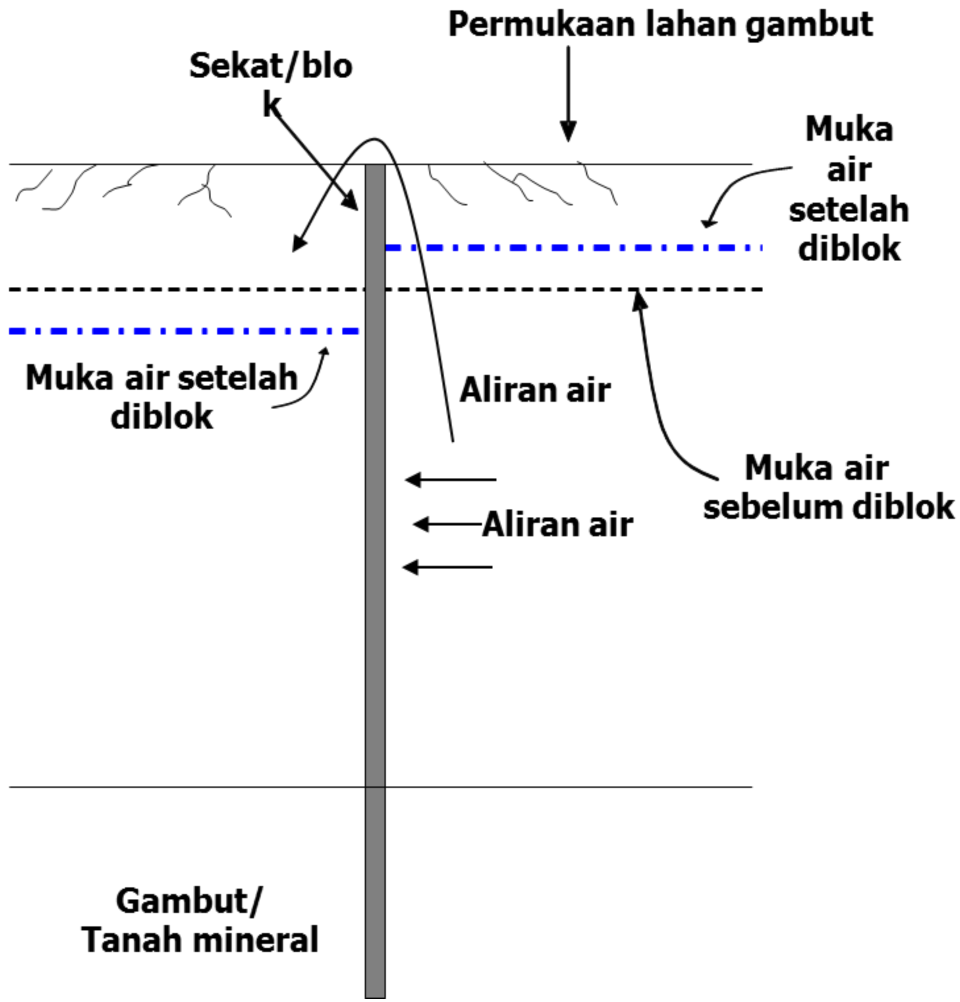
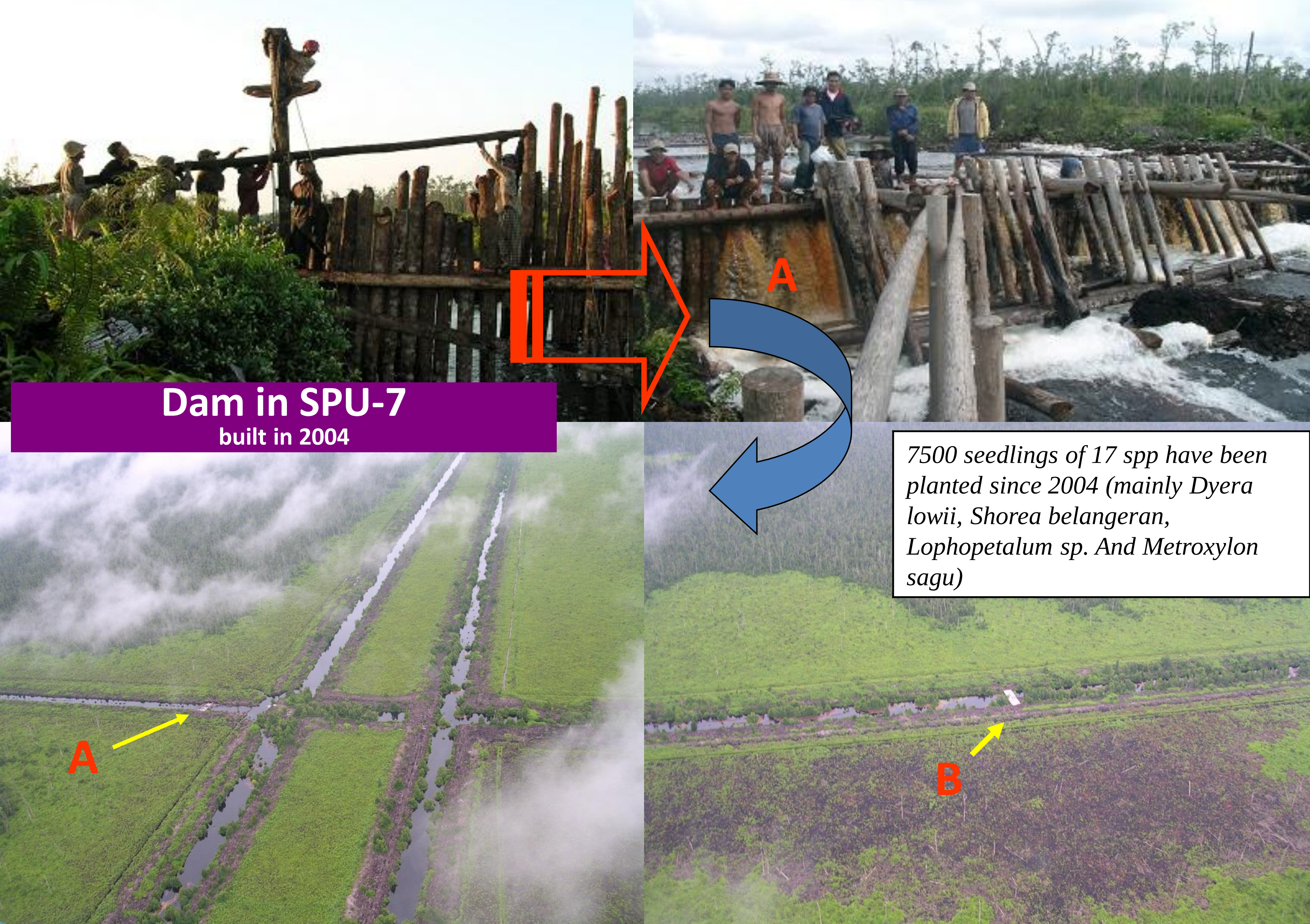
Main principle in peatland hydrology restoration / rewetting : increase ground water table





Penabatan Kanal di SPU Eks PLG – Kalteng



Dam in SPU-7
built in 2004

7500 seedlings of 17 spp have been planted since 2004 (mainly Dyera lowii, Shorea belangeran, Lophopetalum sp. And Metroxylon sagu)

Impact of blocking of canals in ex-megarice project areas SPI-1 (flooding in 2005)

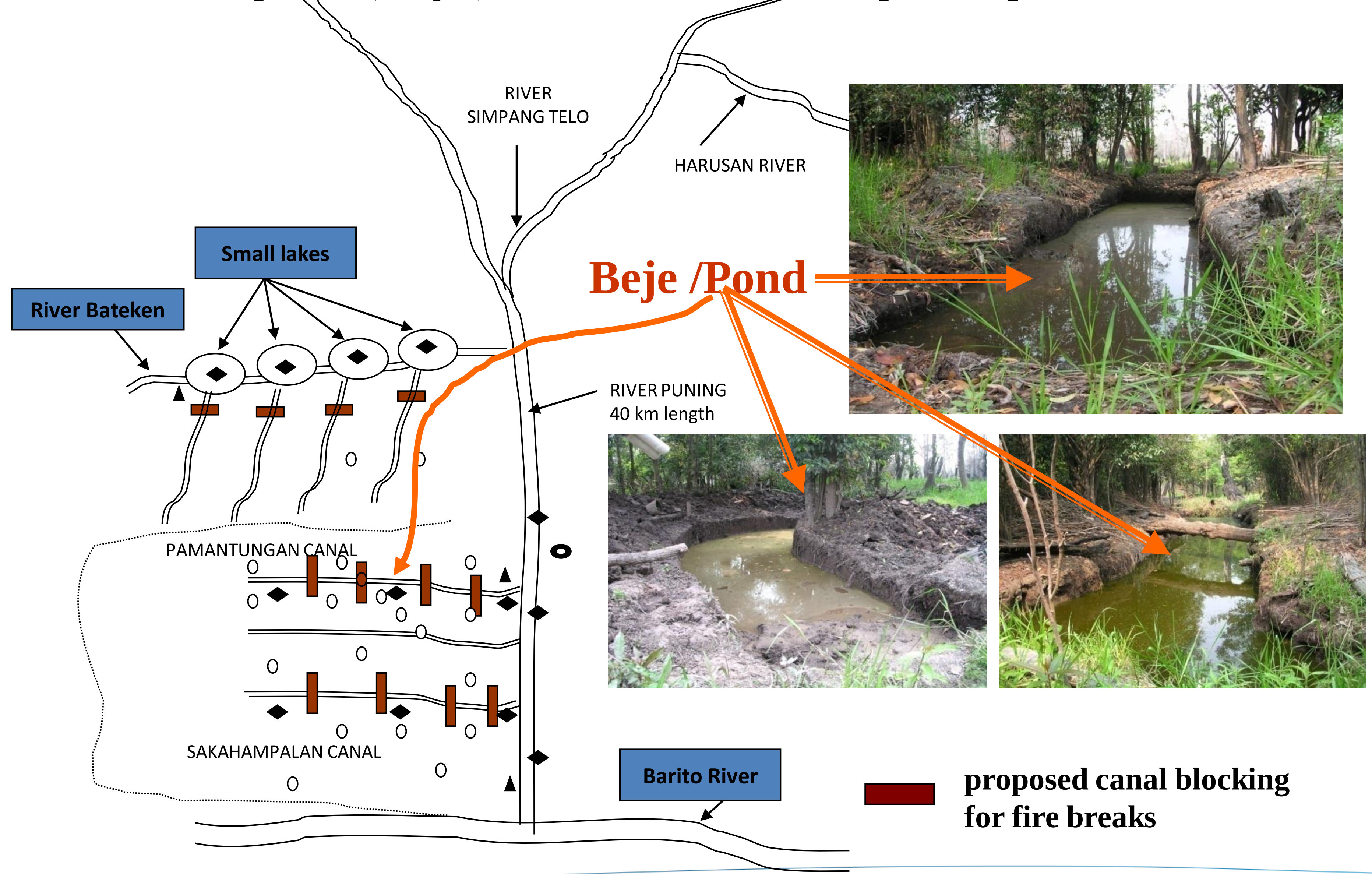
Hydrology Restoration (in Eks Mega Rice Project site Central Kalimantan)

Planting trees on top of dam

4 tahun setelah itu.. Foto 2008

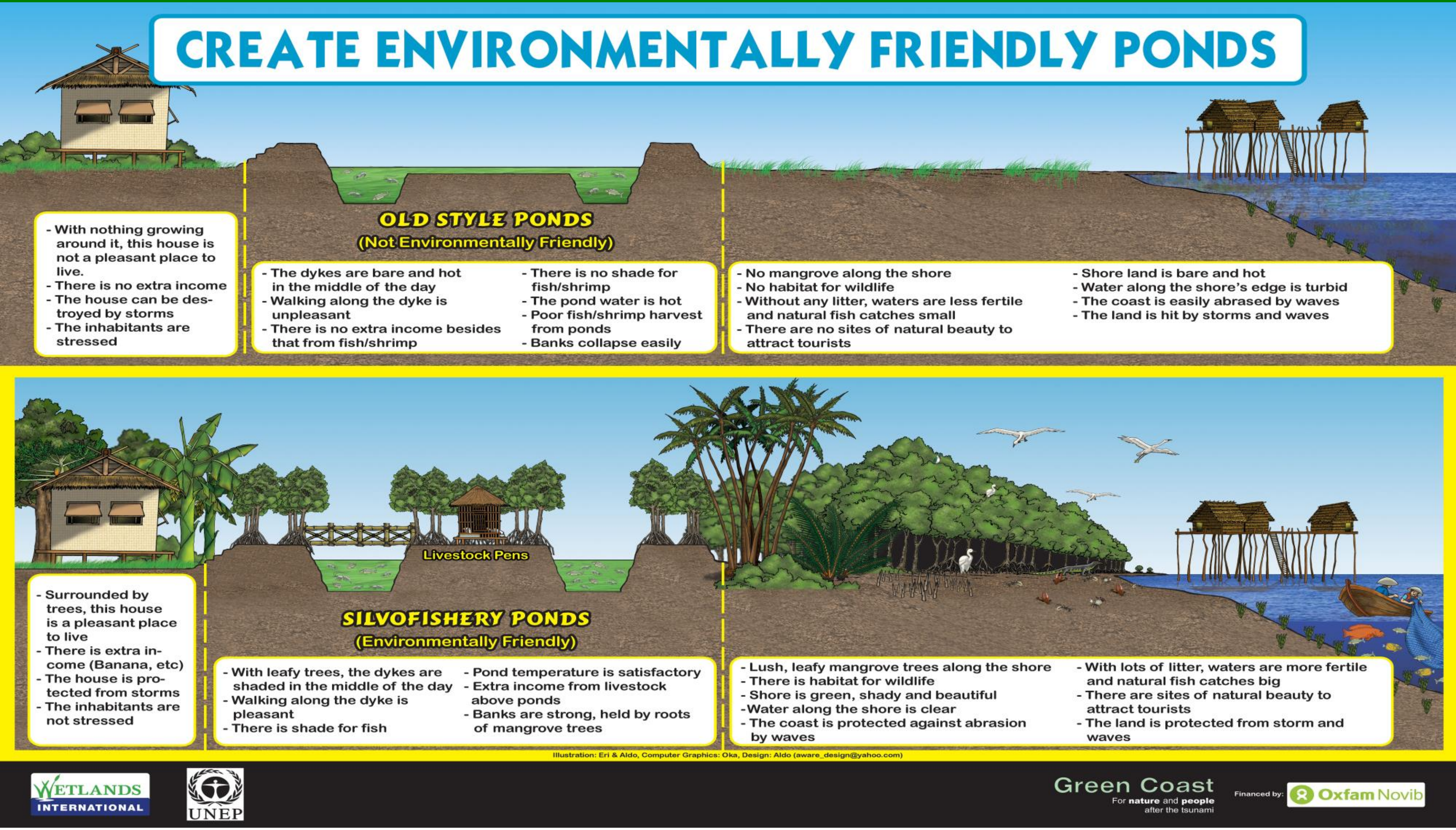
8 tahun setelah itu.. Foto June 2012

Fish ponds ('Beje') act like fire break and protect peatland from fire



Blocking of canals : rewetting peatlands and producing fishes

Silvo-fishery may contributes to climate change mitigation

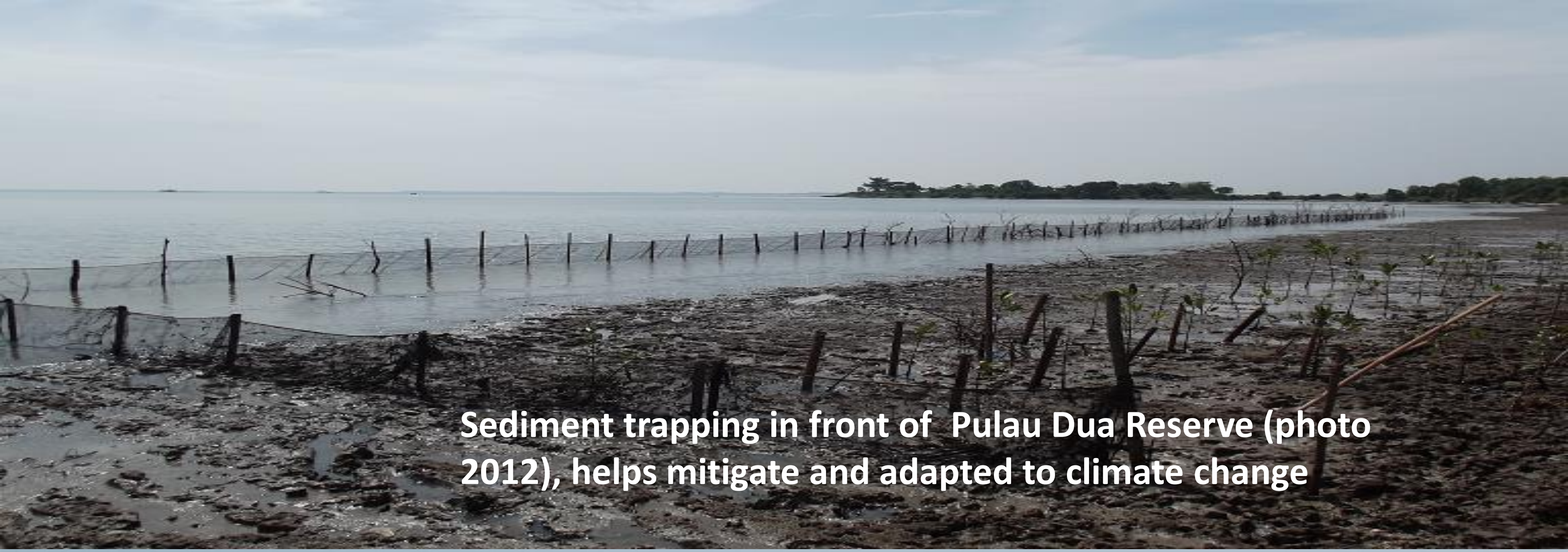


Roles of mangrove trees in pond area

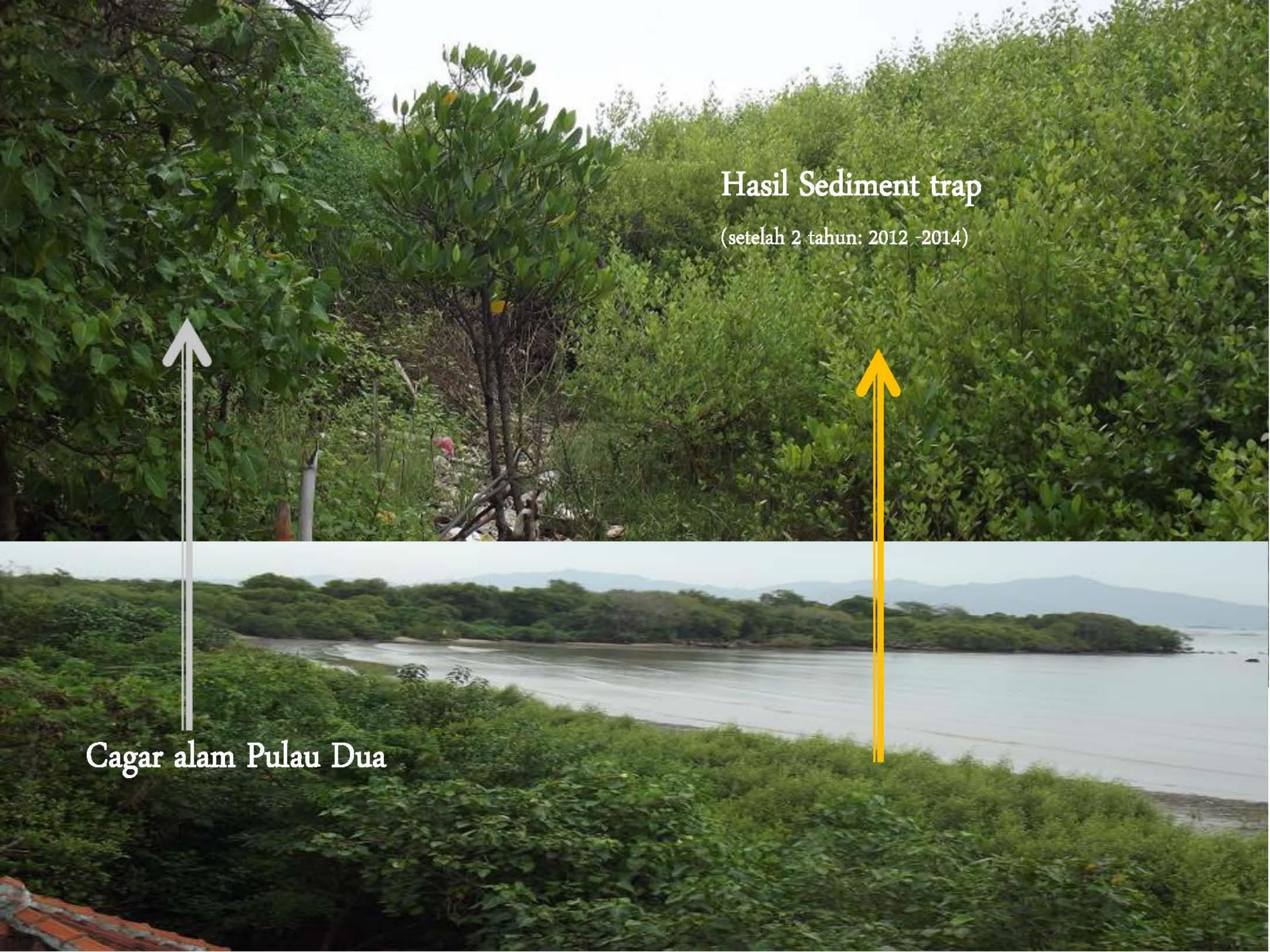
Silvo-fishery pond - Pemalang, Central Java

Bio Rights in Banten Bay : to protect water bird reserve & restored degraded ponds

Mangrove Rehabilitation behind Pulau Dua Nature Reserve by WIIP 2009 – 2023 (Photo taken in March 2013)


Sediment trapping in front of Pulau Dua Reserve (photo
2012), helps mitigate and adapted to climate change


Accretion Land (sediment trapped using sand bags)
colonized by Avicennia spp. in Banten Bay in 2014
Mangrove role in CCA & DRR & CC Mitigation


Hasil Sediment trap
(setelah 2 tahun: 2012 -2014)
Cagar alam Pulau Dua

Ponds and huts as Tourisms objects at Pulau Dua

Semi Permeable structure in Demak Central Java (above)

Talibura- Flores Island

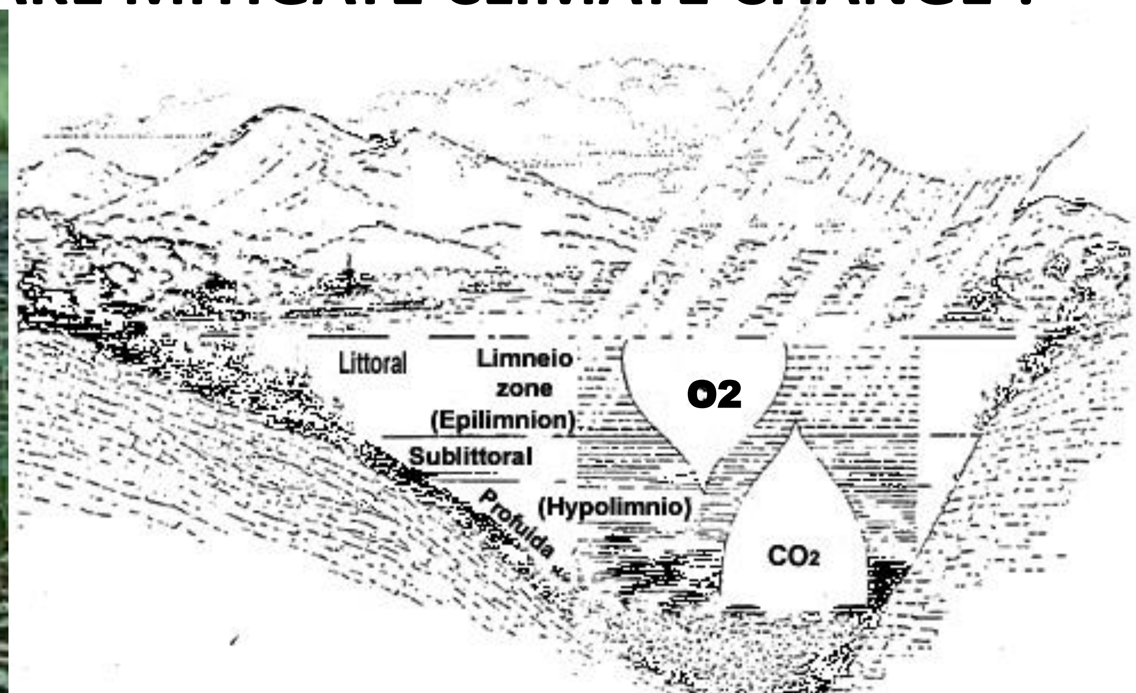
Cassuarina , 3 years old : 18.7 ton C/Ha in 3 years).
Mangrove, 3 years old: 1.26 ton C/ Ha in 3 years

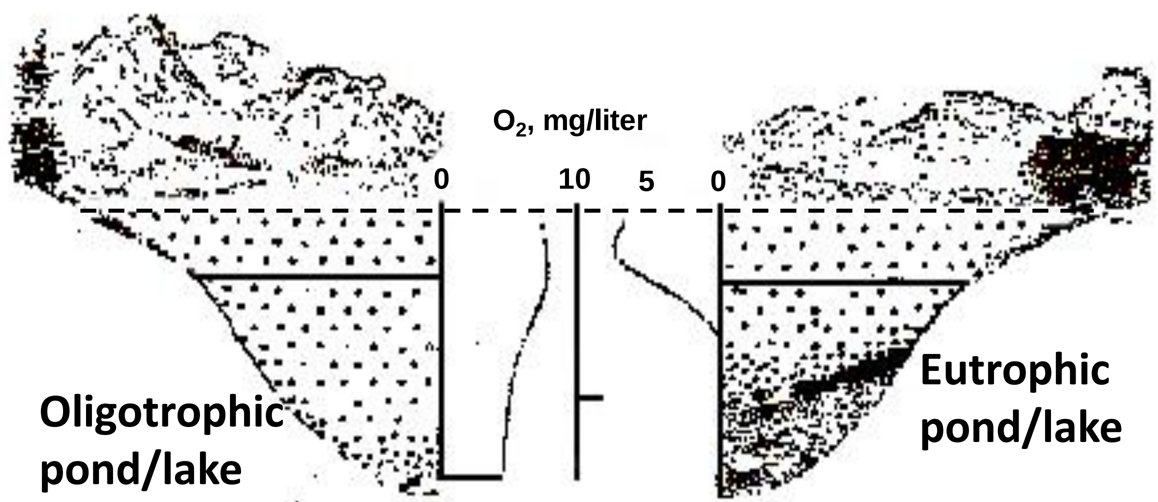
Rehabilitation results in ex tsunami area in Aceh

C-Sequestration: What plant species need to plant ??

Bottom Zonation, O2 & CO2 distribution

CAN POND / LAKE MITIGATE CLIMATE CHANGE ?





Terima Kasih

Thank You

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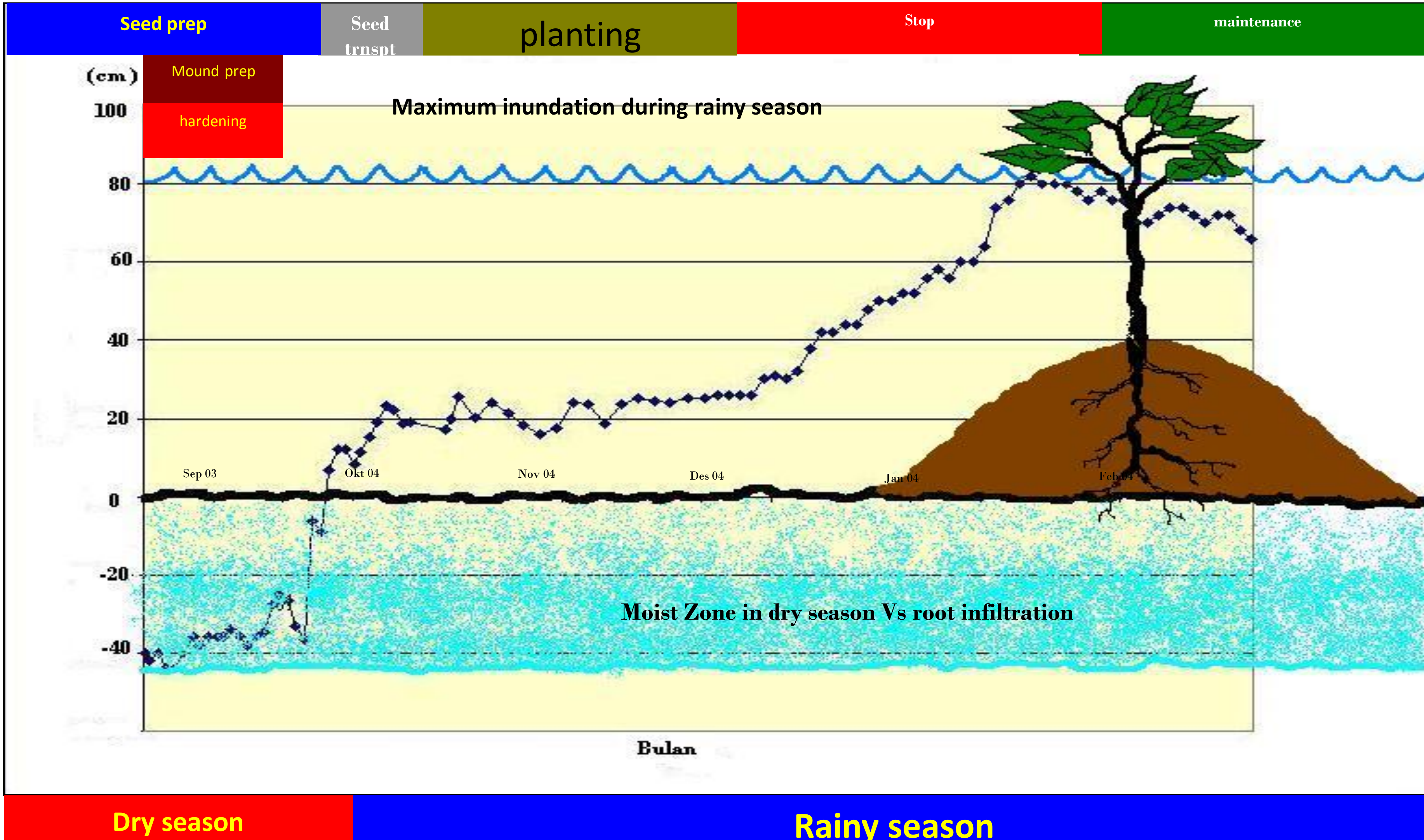
Rehabilitation in degraded peatland areas should consider:
climate, ground water table, floods , height of mounds, and plant species



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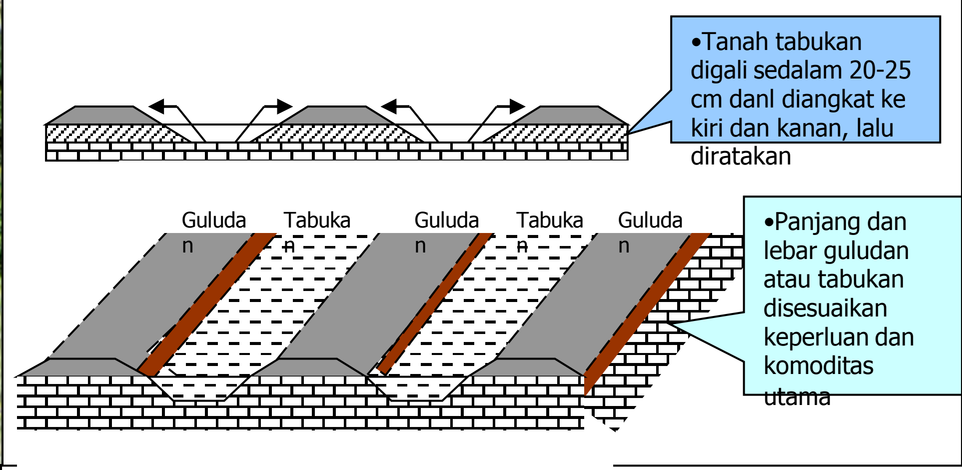
Vegetation Rehabilitation in Berbak NP-Jambi using mound technique

Survival 70%: Ramin (H=1.8 m; D=2 cm) ***Gonystylus bancanus*****, Perepat** ***Combretocarpus rotundatus*** **and Rengas manuk** ***Mellanoorhoea walichii***

Surjan Dengan Komoditas Padi dan Ubijalar



Suksesi surjan dari padi dan palawija menjadi tanaman perkebunan karet dan nenas pada bagian guludannya serta tanaman rumput purun pada bagian tabukannya.

Agro-forestry in peatland area can participate in climate change mitigation (no drainage)

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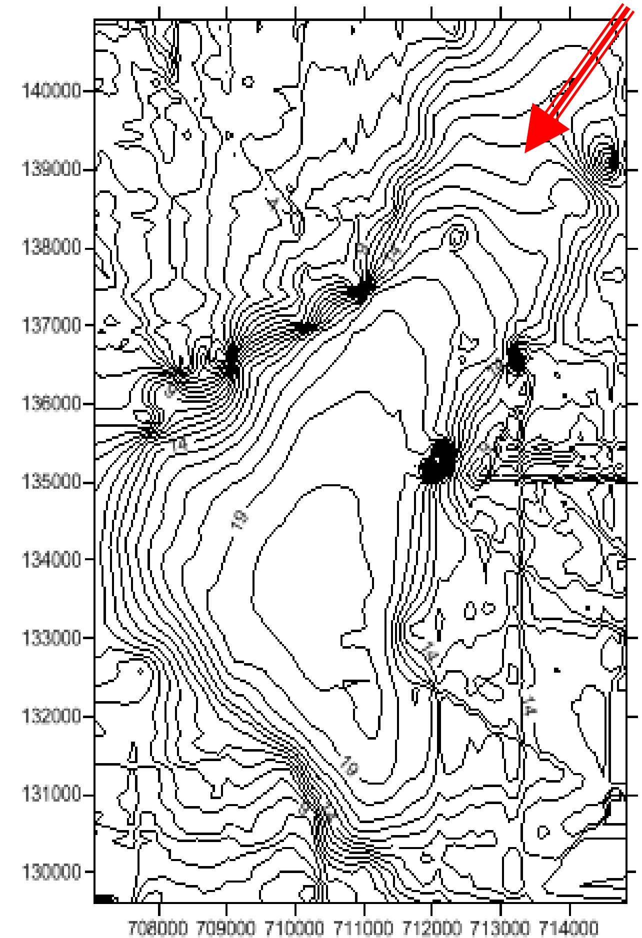
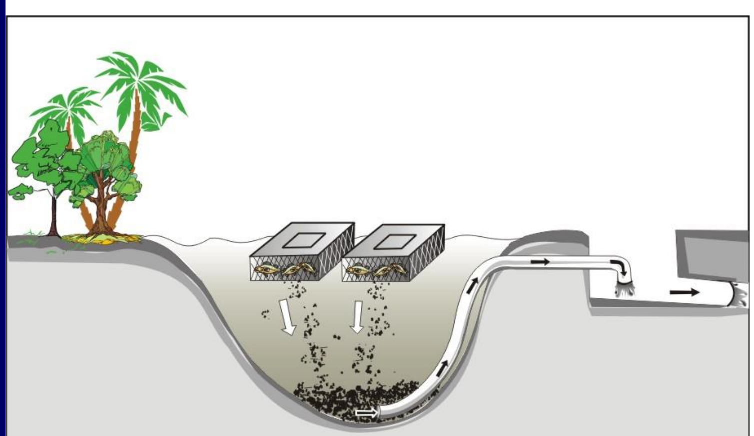
Eceng Gondok & Pendangkalan

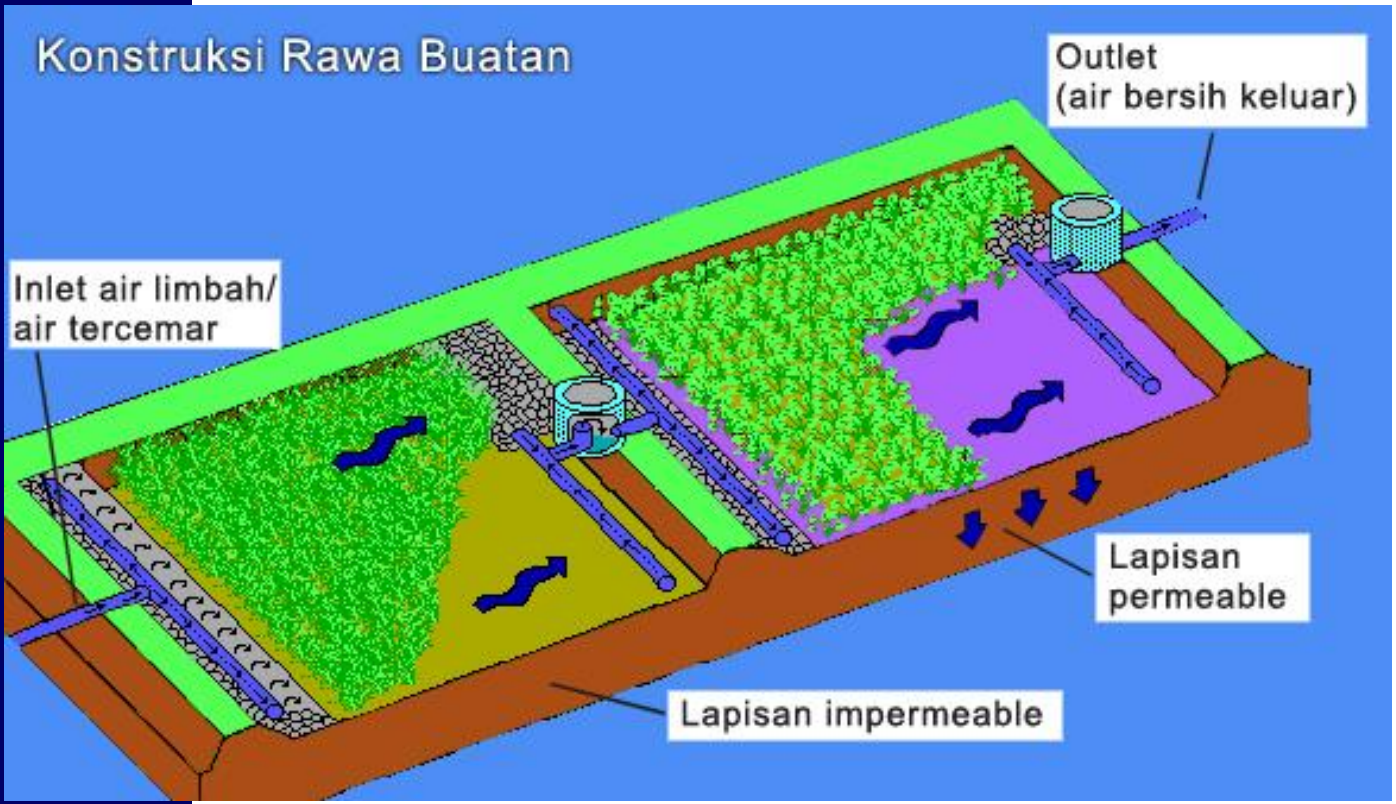
LOKASI	KECEPATAN PERTUMBUHAN ENCENG di DANAU TONDANO (dalam luas area kajian 48 m2)					
	Berat Tanaman /minggu		*Jumlah Daun /minggu*		*Jumlah Stolon /minggu*	
	(gr)	(%)	Lbr	(%)	Tangkai	(%)
1. Inlet	52.08	41.59	9.75	58.75	1.92	110.56
1. Peternakan Itik/ Persawahan	251.04	79.52	31.33	98.39	7.42	157.14
1. Peternakan Babi	41.25	20.15	3.08	22.76	0.75	55.37
1. Outlet	43.75	25.81	2.75	23.73	0.08	11.11
1. Restoran	33.25	19.62	4.00	30.59	0.75	90.74
1. Jaring apung	638.54	157.22	99.67	173.28	27.50	271.84





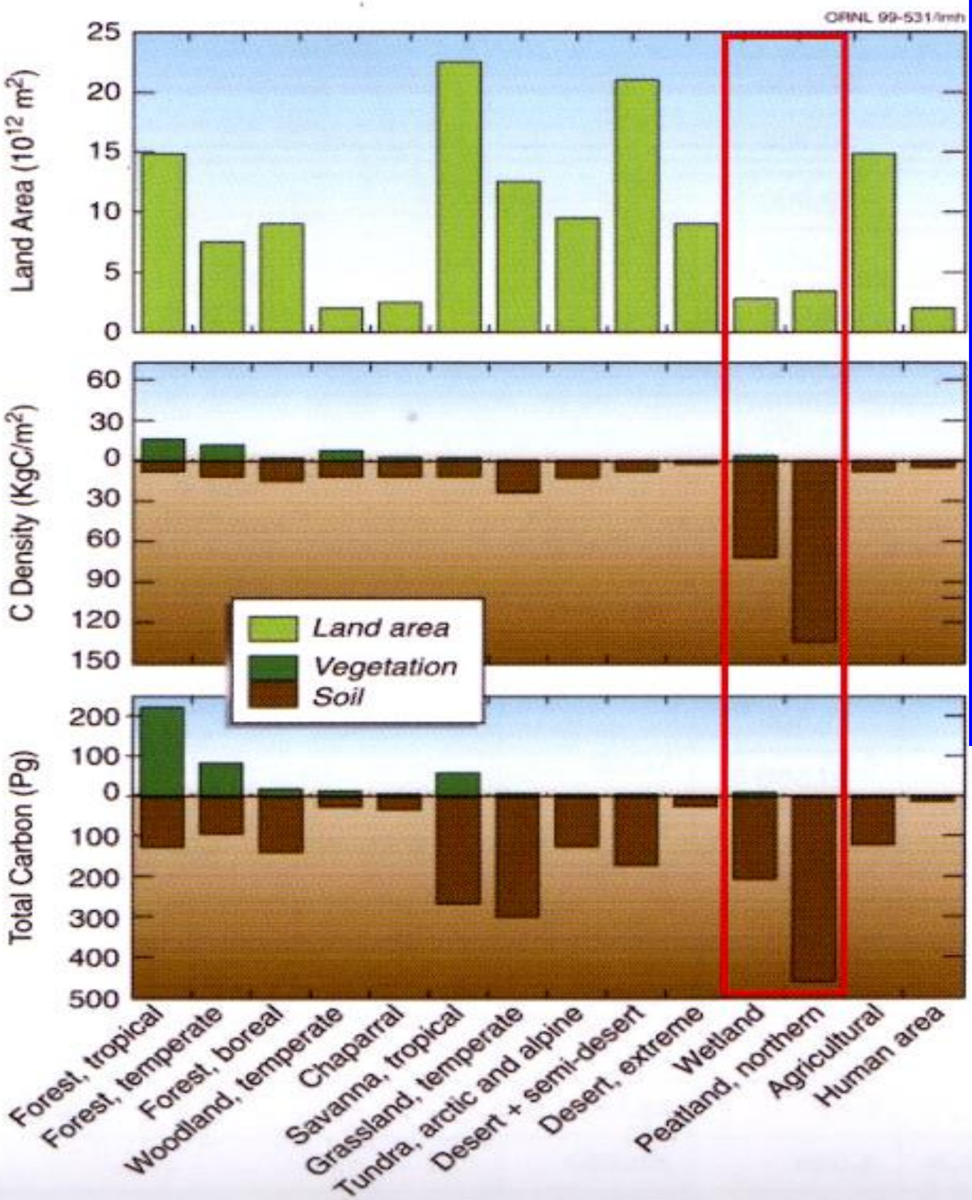
Tehnik Siphon : memperbaiki kualitas air danau

Ponds and huts as Tourisms objects at Pulau Dua



Rawa buatan di Desa Selacau, Kabupaten Bandung (Foto: Puslit Limnologi – LIPI)

Can constructed wetlands stored carbon ?



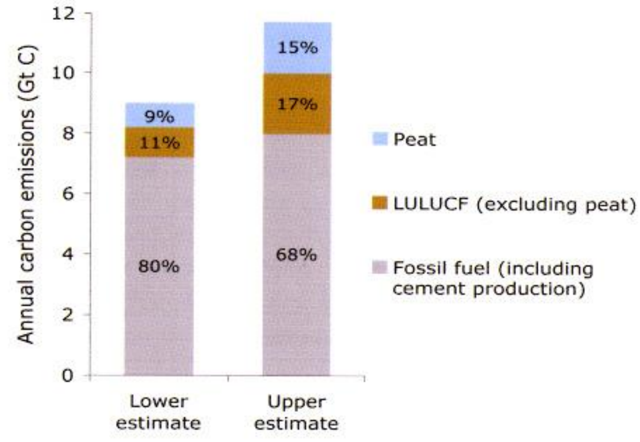


Figure 3: Lower and upper estimates of carbon emissions from peatland degradation. Mean values for the period 1997-2006 for peatlands emissions and 2000-2006 for other land use changes and fossil fuel use. Percentages show the contribution to the total. *(source: Trivedi pers. Comm. 2008)*

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)*.

ppika

3 Maret 2014

Why wetland is important to mitigate climate change?
Its carbon stock extremely high

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Biodiversity in peatland : pitcher plants indicator of peat domes