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The scenario of carbon management by water management, fire fighting and forest recovery in tropical peatland



Micro → Small → Meso → Large → Global — Scales
1 cm 10 m 10 km 1000 km

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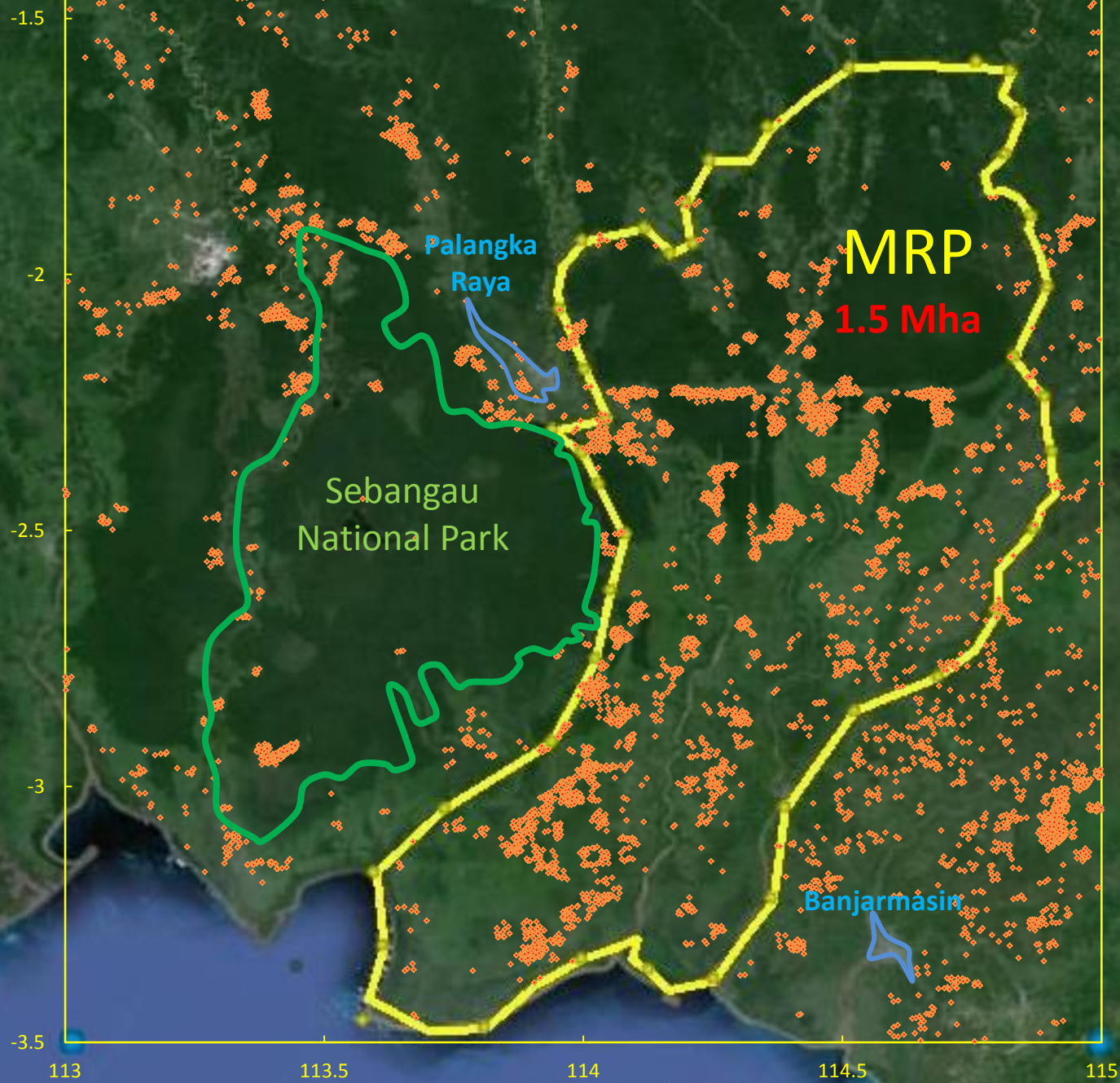
2.Univ. Palangka Raya, Indonesia

International Workshop on
Peatland Management

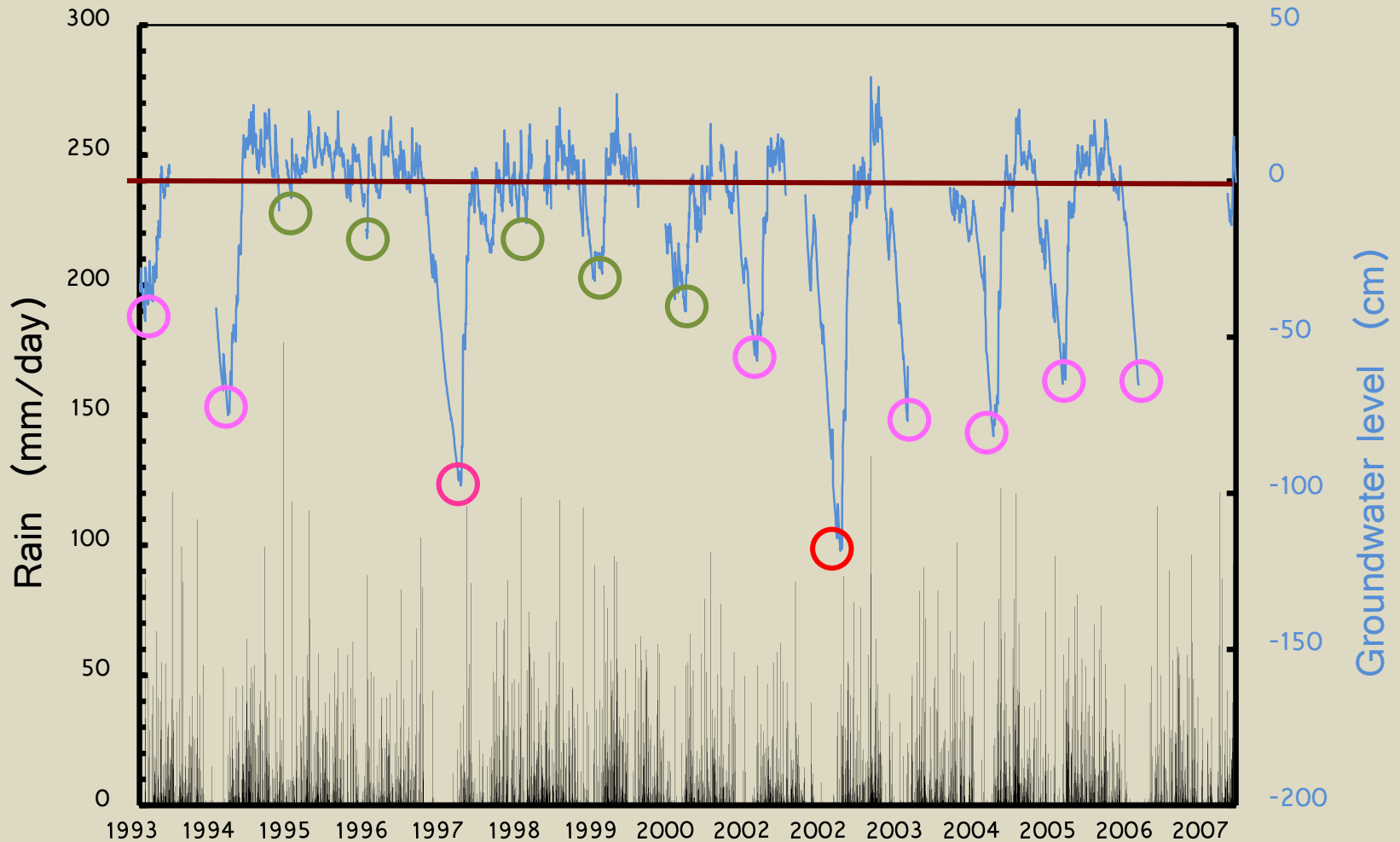
10th October, 2013

Sapporo, Japan

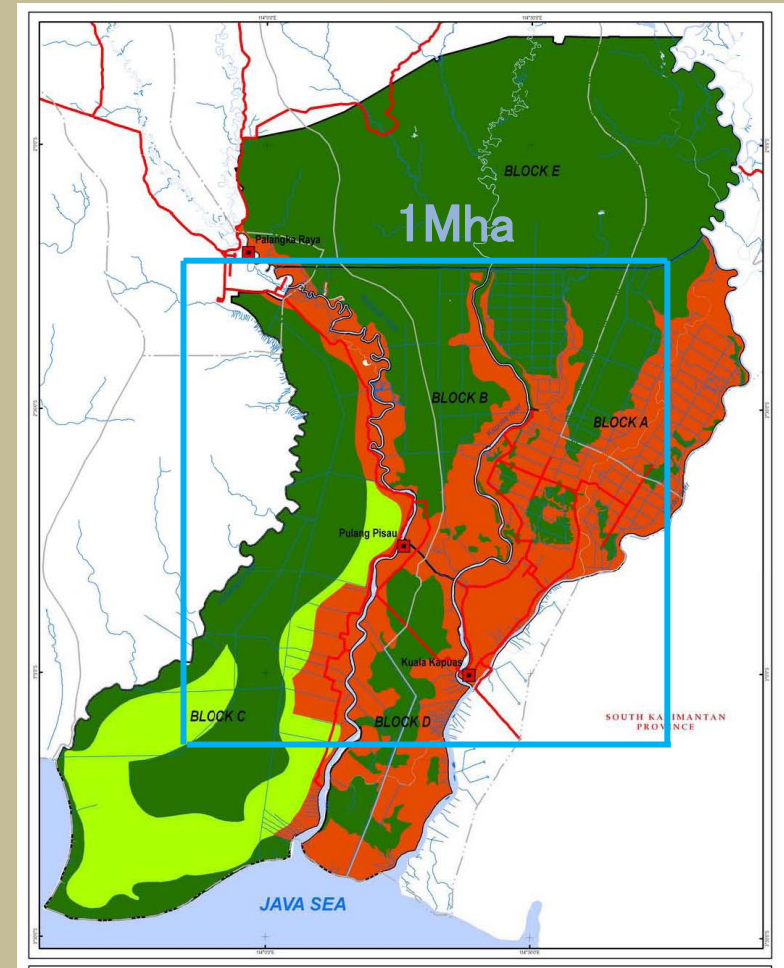
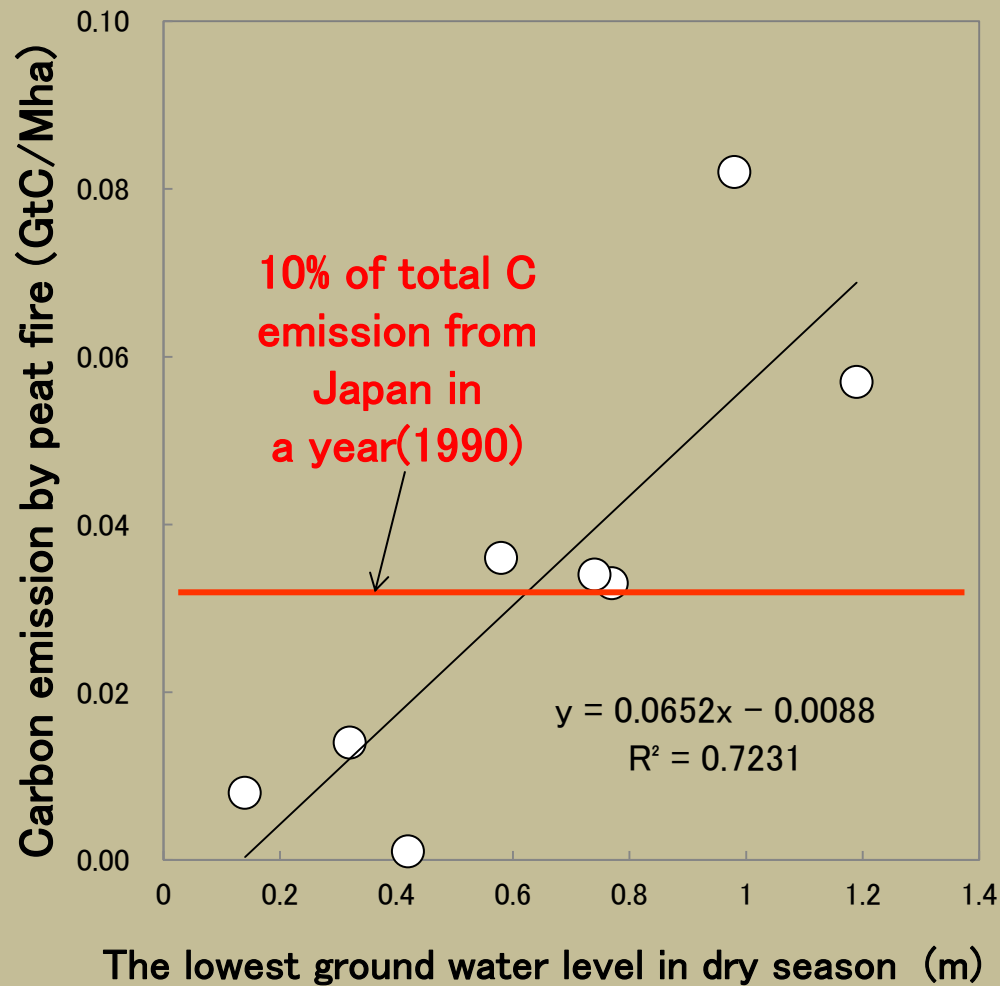
Location of fire spots during dry season in 2009



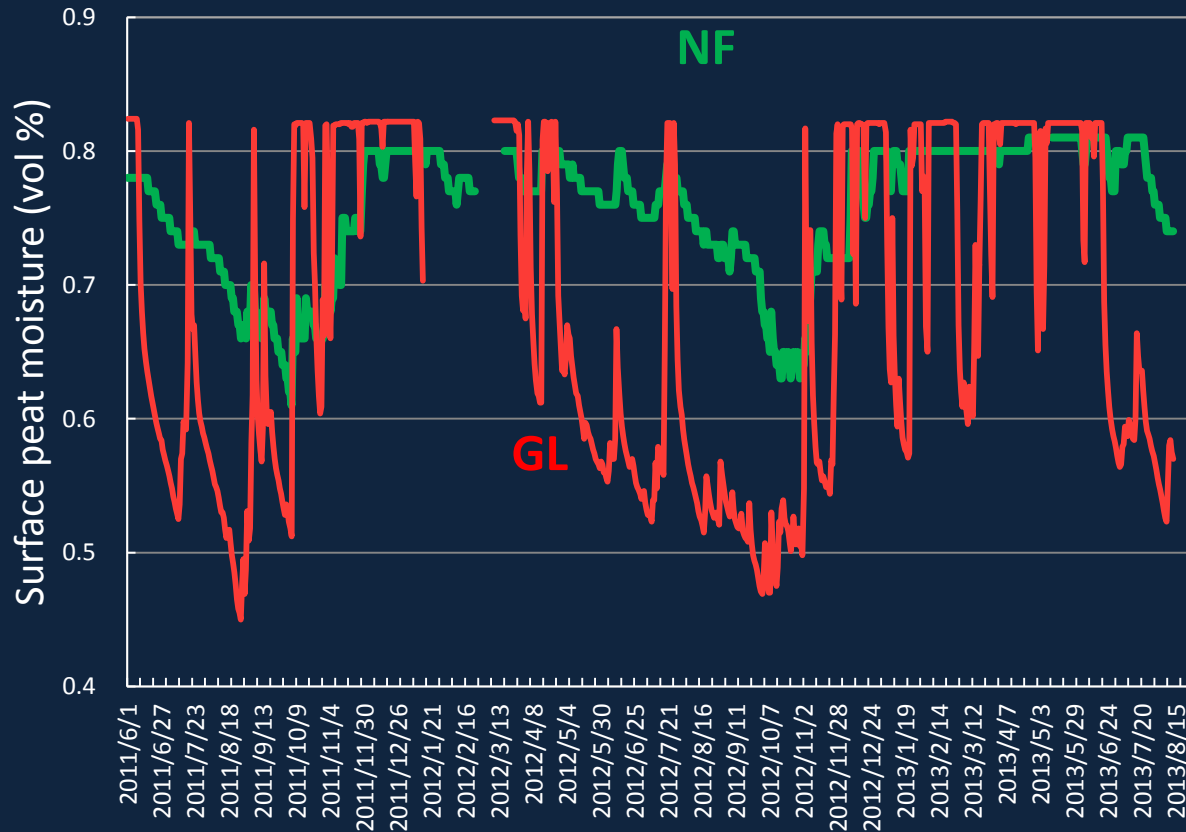
Groundwater level in a peat swamp forest and rainfall in Central Kalimantan, Indonesia



The lowest groundwater level in a year and carbon emission by peat fire in tropical peatland



Seasonal change of moisture contents of surface peat layer in different types of vegetation



Data was contributed by Dr. Adi Jaya

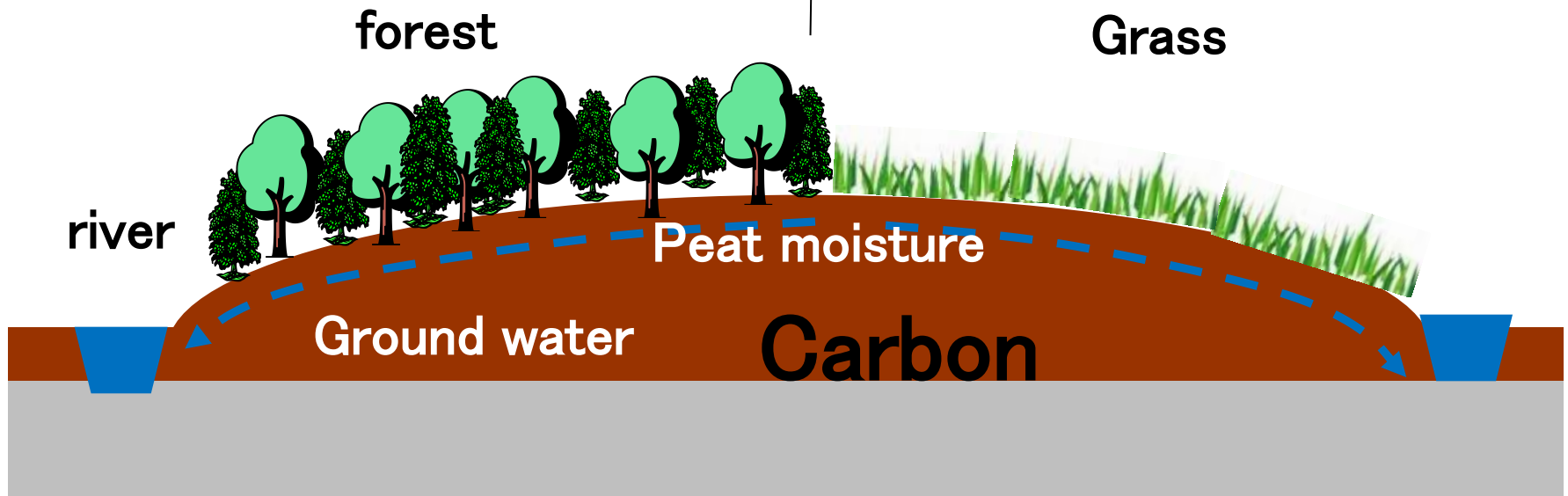
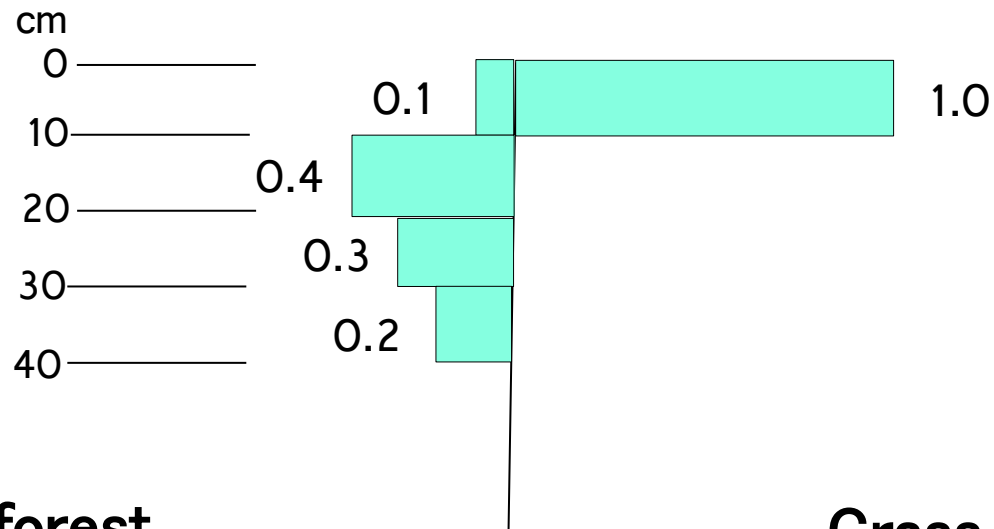


NF: Natural forest

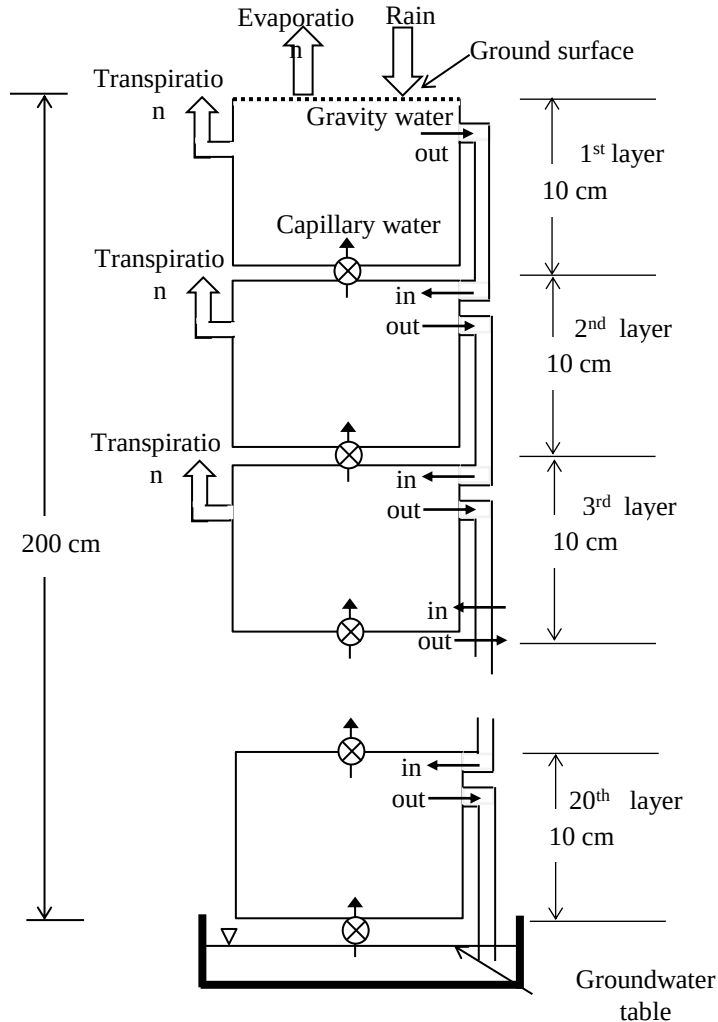


GL: Grass land

Water use patterns by root system



Tank model for estimation of peat moisture



The water budget in the first layer in the unit time

$$\Delta W_1 = P + E + T_1 + F_{o1} + C_{i1} \quad \text{Eq. 1}$$

where, ΔW_1 : the change of water in the layer and subscript means number of layer, P : Rain, E : evaporation from the ground surface, T_1 : transpiration through plant, F_{o1} : flow out to lower layer by infiltration, C_{i1} : flow in from lower layer by capillary.

The evaporation E in Equation 1 is replaced with the water flow into the first layer by capillary C_{i1} from the second layer. The rain P is replaced with the water F_{o1} flow out from the first layer. Transpiration T_2 becomes active when the second layer is unsaturated by water.

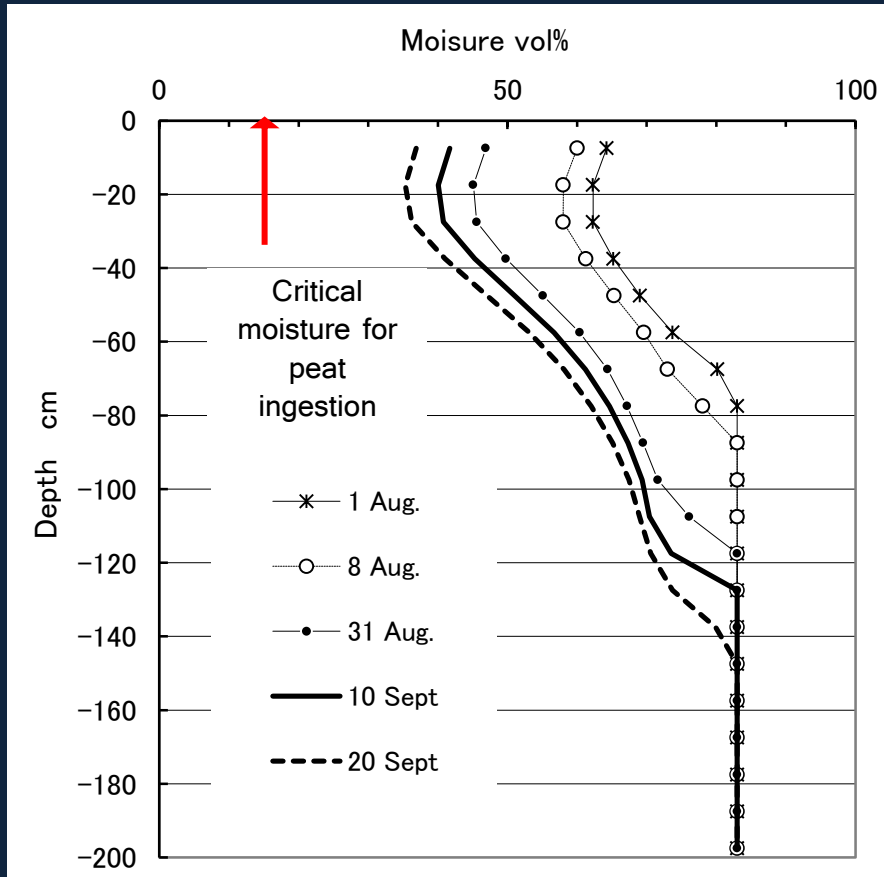
$$\Delta W_2 = F_{o1} + F_{o2} + C_{i1} + C_{i2} + T_2 \quad \text{Eq. 2}$$

Water budgets in the layers without effect of transpiration are follows to next equation.

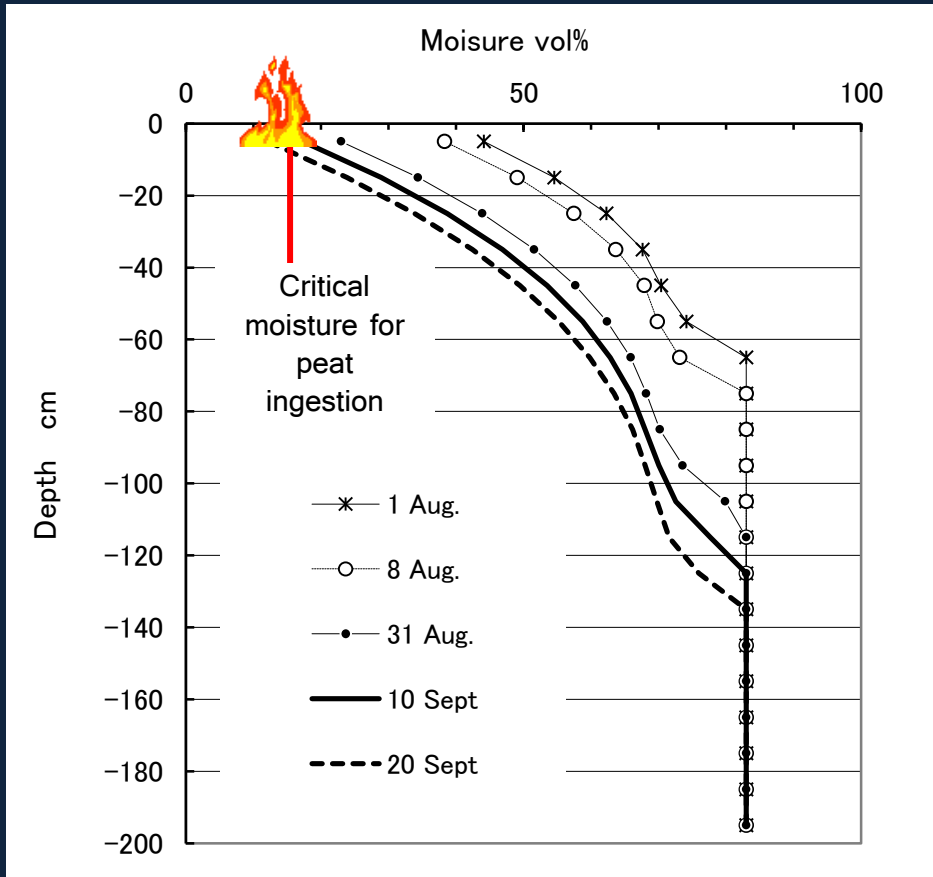
$$\Delta W_n = F_{on-1} + F_{on} + C_{in-1} + C_{in} \quad \text{Eq. 3}$$

Peat moisture profiles

Evapotranspiration: 4 mm/day Bulk density: 0.17 g/cm^3 Field capacity: 35 vol%



with dense canopy



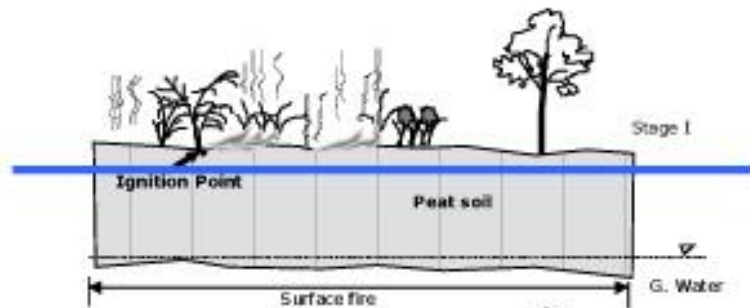
without canopy

Combustion process of peat fire

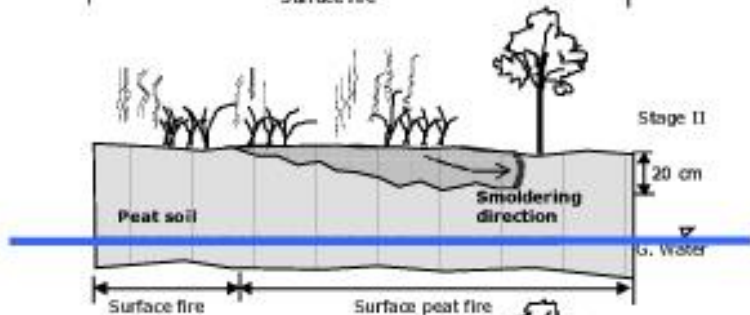
(A. Dj. Usup et al., 2003)

Igniting and expansion of peat fire

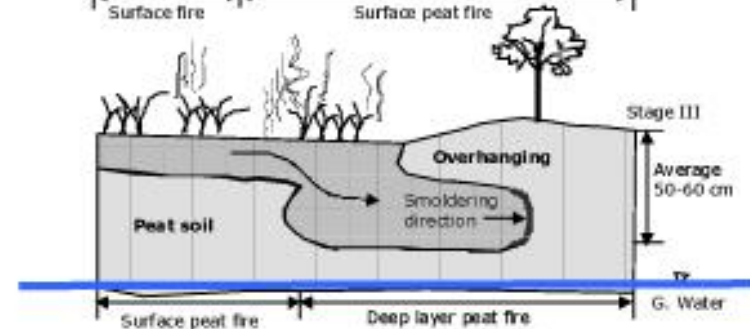
Lowering of groundwater level and drying of surface peat



Surface fire



Surface peat fire



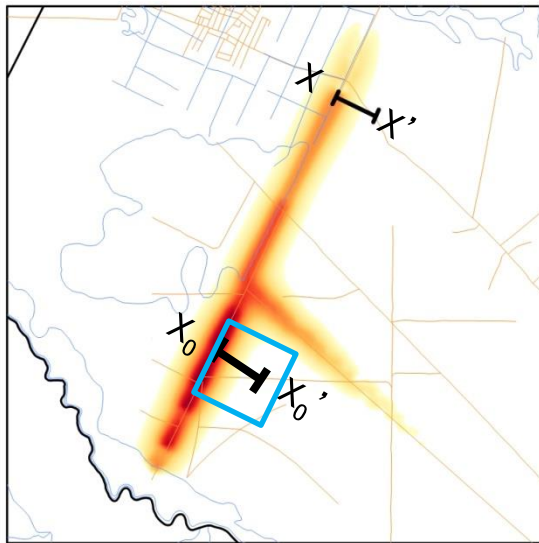
Deep peat fire



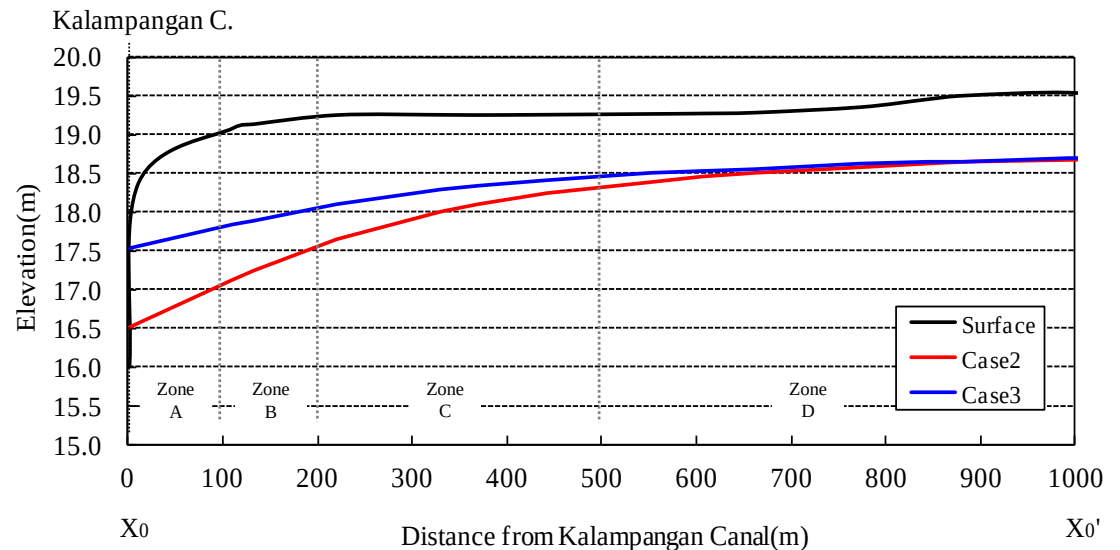
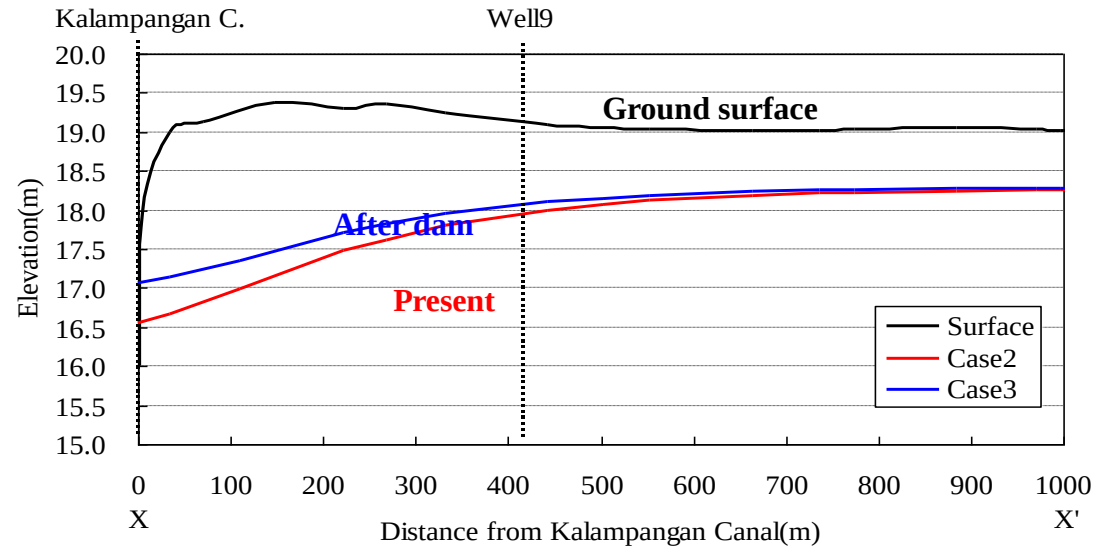
What is rewetting of tropical peatlands

1. Increasing of groundwater level
2. Recover the dense forest

Made clear the effects of canal and dam constructions on groundwater regime in peat dome (2)



Increased groundwater level



Effect estimation of carbon management activities

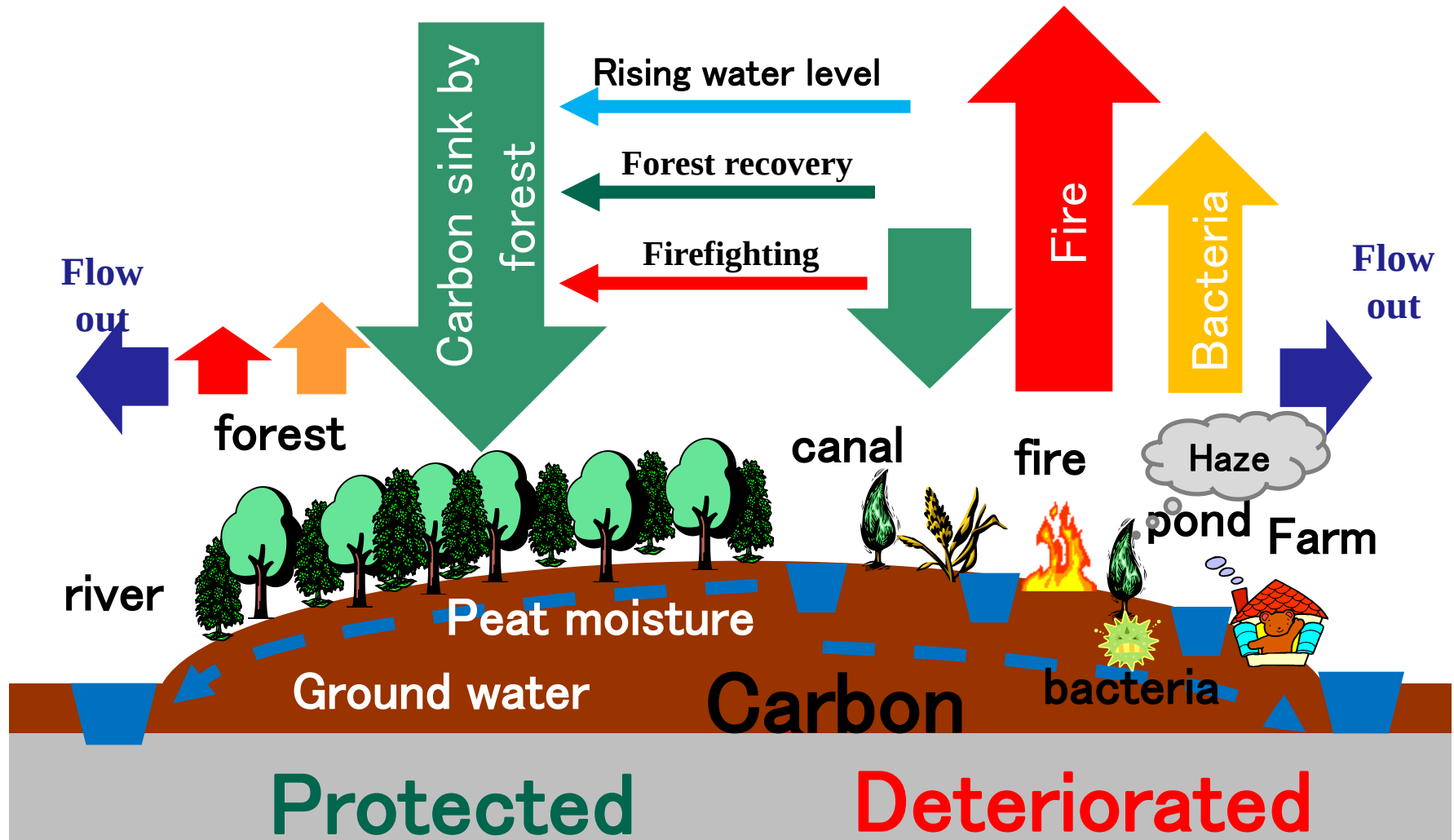
	Dam construction				Fire fighting	Re-forest	Peat Moist
Zone (m)	Dam	GWL (m)	C- loss (Gt/ Mha)	C -loss (%)	Extinction rate (%)	C emit/sink	Ignite rate
A (100)	before	2.0	0.122	100	40		
	after	1.0	0.056	46.4	27.8	sink	down
B (100)	before	1.9	0.115	100	30		
	after	1.3	0.076	66.0	46.2	sink	down
C (300)	before	1.2	0.069	100	20		
	after	0.9	0.050	72.8	58.2	sink	down
D (500)	before	1.2	0.069	100	10		
	after	1.1	0.063	90.6	81.5	sink	down
Total (1000)	before		0.792	100			
	after		0.597	75.3	61.8	sink	down

Carbon sink



Carbon emission

Scenario





Conclusion

Reforestation and reformation of dense forest canopy is keys for prevention of peat fire



*Terima
kasih*