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Proof that Canal Blocking at Peatlands in Sungai Ahas Central Kalimantan not Improve Water Quality

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Abstract: Forest fires and haze always occur during the dry season in a peatland area in Kalimantan, which is not only harm the health and community activities in the region, but also disturbing other neighboring regions.The thick smoke coming from peat fires in the Project Pembukaan Lahan Gambut (PLG) million hectares for agriculture in Kapuas.PLG project was implemented in 1996 to 2009 to the start of the destruction of peatlands in Central Kalimantan and become a serious environmental problem, flooding during the wet season and flammable during the dry season. Errors in water management of peatlands in the past cause a peat loses its ability to hold waterduring the wet season. Canal blocking is one of the buildings of water that is expected to maintain ground water table in peatlands to prevent forest fires and improve water quality.Water quality in wetlands is mainly determined by the type of soil, from the water quality test results obtained temperature, TDS and DHL according to the standard for agricultural water, only pH thatvery acidic because the peatlands. The water quality in the channels without canal blocking nearly equal to the water quality in the channel with canal blocking. This proves that the canal blocking does not improve the quality of water in the peat.
Keywords : water quality, canal blocking, peat land, fires.

1. Introduction

Forest fires[1,2] and haze[3] always occur during the dry season in a peatland area in Kalimantan[4],which is not only harm the health[3] and community activities in the region, but also disturbing other neighboring regions. The thick smoke coming from peat fires in the Project Pembukaan Lahan Gambut (PLG) million hectares for agriculture in Kapuas[5]. PLG project was implemented in 1996 to 2009 to the start of the destruction of peatlands in Central Kalimantan[6] and become a serious environmental problem[7,8], flooding during the wet season and flammable during the dry season[9]. Errors in water management of peatlands in the past cause a peat loses its ability to hold waterduring the wet season.

Furthermore the exploitation of peat several years through deforestation[10], drained and dried by making canals for the development of oil palm[11,12] plantations in peatlands, forest plantation and agriculture[5], even illegal logging increased the the destruction of peatlands[13]. As a result of excessive drainage of the decline in groundwater[14] levels, and the thickness of the peat thinning through the process of subsidence. Drainage change anaerobic to aerobic soil conditions, resulting in decomposition of organic materials by a process of oxidation[15]. Decomposition of organic material produces CO2 emissions[3,5,16]. When drainage was continued by deepening the channel, this has resulted in the process of subsidence, drought and fire hazards, as well as carbon emissions will increase. Similarly peatland as water retention will be reduced which will increase the danger of flooding

on the river banks[17]. Within a few decades the whole peat dome will be lost, and all the carbon from peatlands emitted to atmosfer[18]. This issue is an important factor of the water management in the peatlands.

PLG resulted in 400 thousand ha of tropical rainforest into open land, which can not be utilized.Furthermore, the construction of 187 km of primary channels are built cut out the peat dome is very dangerous, because the network of the water system will shed the the peat dome, which should serve as a reservoir field would lose its function resulting decline in the water table.Thus the peat becomes irreversible drying to trigger the occurrence of fire.

Therefore, it needs to handle the management of peatlands which have specific characteristics and vulnerable to the effects from the outside or the inside of the peat itself in the management of land in the peatland. Canal blocking is one of the buildings of water that is expected to maintain ground water table in peatlands to prevent forest fires and improve water quality[19].

The approach of the research is to make an assessment of the quality of water in the channel which has a canal blocking compared with the channels without canal blocking in Peatlands Sungai Ahas.

2. Experimental

The study area is focused on the cultivation of limited buffer area (Adapted Management Zone), where the peat depth of approximately three meters or up to the boundary edge in the peat. The region selected by reason of the peatland areas that are most likely to be developed is limited and most drained. For long-term arrangement of water in this region will determine the condition of deep peat areas bordering.

Protected Forest Management Unit (KPHL) Kapuas in accordance with the Decree of the Minister of Forestry No. 247 / Menhut-II / 2011 dated May 2, 2011 refers among others to the letter of the Minister of Forestry No. S.486 / Menhut-VII / 2010 dated September 20, 2010 on Appropriation Changes in Forest Area Map Not Being Forest Areas, Areal Designation of Forest Areas Not Being Forest Areas and Function Change Interagency Forest Areas in Central Kalimantan Province area. Spatial, KPHL region contained in the letter was the same as the area specified in the ministerial decree No. 292 / Menhut-II / 2011 dated May 31, 2011 and the Minister of Forestry Decree No. 529 / Menhut-II / 2012 dated September 25, 2012.

Altitude differences soil / peat affect the flow of water (upstream and downstream), and impact on people's reliance on natural resources. Surface soil / peat is the highest located in Desa Petak Puti (Ex PLG Block E), approximately 20.5 meters from thethe meansea water level. While in the downstream from the Primary Channel Master (SPI) or Ex PLG Block A has height under 11 meters from thethe meansea water level.

Land cover conditions from the the Main Primary Channel (SPI) in the village of Katunjung upstream relatively better than the land cover from the SPI in the downstream direction.

Sei. Ahas, Block A ex PLG million hectares, District Mentangai, east of the river Kapuas the Kapuas district, Central Kalimantan Province, which has a deep peat dome that needs to be addressed to prevent environmental damage. At these locations mineral soils, shallow peat and peat can be found in a relatively short distance, where peat had burned, degraded quite heavy, unproductive and each have channels that can drained water from the peat in the river Kapuas[15].

The surface condition from theupstream peat in Desa Petak White to Main Primary Channel (SPI) in the village of Katunjung relatively intact, while the SPI downstream mini peat dome formed as a result of the canals. Peat depth in the work area KFCP varies between less than 0.5 meters to more than 8 meters. Land cover map of 2010 shows the forest cover in Block E is much larger than Block A. The forest land cover are in Tumbang Muroi, reaching almost 30,000 ha.

Based on Landsat satellite images in 1990, 1997, 2001, 2002, 2004, 2005, 2006, and 2009, many fires occurred in Block A ex PLG, especially those around canal. In Block E, fires occur around the trans street (the street plan from the Mentangai Hulu to Tanjung Kalanis).

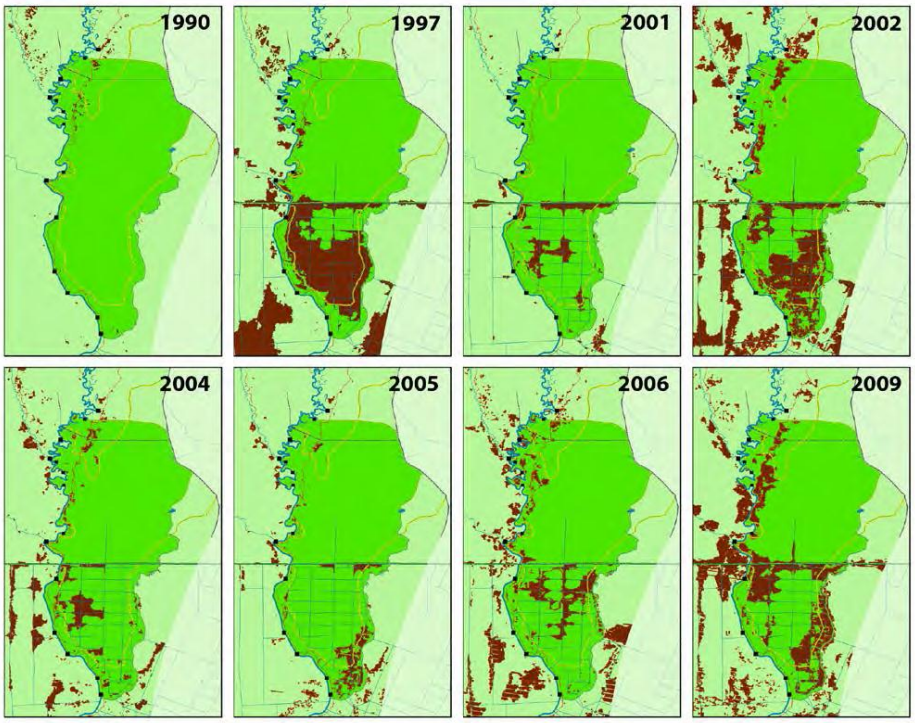

Figure 1. Map of Forest Fires[20]

Water quality in wetlands is mainly determined by the type of soil, if the pH of the water is low and DHL too low then the water comes from the peat soil, but when the pH is low but DHL is high then the water comes from acid sulphate soils, this is due to the iron and aluminum liberated from the pyrite. If the pH is high and DHL are also high that the water comes from the salty sea water intrusion[21].

Temperatures related to the solar radiation, availability of energy in the earth's surface also determines the kinds of plants that can be grown. Each type of plant to know the cardinal points, to the tropics of the cardinal points[22] are:

1. The minimum temperature (5-15^{0}C): the plant will be stunted and even can cause death if the temperature lasts longer
2. The optimum temperature (about 30^{0}C): The best temperature for plant growth.
3. The maximum temperature (about 40^{0}C): plant growth will also be affected can even cause death.

Water quality requirements of class D according to Government Regulation No. 20 of 1990 are:

Table 1. List of Water Quality Criteria Group D (Water can be used for agriculture as well as urban, industrial, and hydroelectric power plants)

No.	Parameter	Unit	Maximum Level	Information
A	Physics			
1	Temperature	°C	The water temperature normal	According to local conditions.
2	Dissolved Solid (TDS)	mg/liter	2000	Depending on the type of plant. The maximum levels for crops that are not susceptible.
3	Electrical Conductivity (EC)	mmhos/cm	2250	Depending on the type of plant. The maximum levels for crops that are not susceptible.
B	Chemistry			
	Inorganic Chemistry			
1	Mercury	mg/liter	0,005	
2	arsenic	mg/liter	1	
3	boron	mg/liter	1	

Water quality requirements for tidal areas[23] are:

Table 2. Requirements the tidal water quality

Elements	Good	Average	Poor
Fe (mg/l)	≤ 2	2 – 5	> 5
Al (mg/l)	≤ 1	1-3	> 3
SO_4(mg/l)	≤ 100	100 – 150	> 150
pH	> 5	4 – 5	< 4
DO_{water}(mg/l)	≥ 4	2,5 – 4	< 2,5
Cl (mg/l)	≤ 500	500 – 750	> 750

Salinity is closely related to poor drainage due to the circumstances from the poor water management (Dent, 1986 in[24]). High salt solubility can inhibit the absorption of water and nutrients by plants in line with the increase in osmotic pressure. In particular, the high salinity plant poisoning, mainly by Na + and Cl[24].

Influence intrusion of salt water (saline) is limiting for agricultural cultivation in tidal areas, especially in the dry season. Salinity critical value to the rice crop is 5 mS / cm. This limits the rainy season is relatively higher, given the presence of neutralizing the effect from the rain.

Effect of salinity intrusion is classified into two categories[25], namely:

1. Salinity (DHL ≥ 5 mS / cm) in the main channel lasting> 1 month.
2. Not salinity (DHL ≤ 5 mS / cm) in the channel ≤ 1 month.

High TDS is not toxic, but if excessive may increase turbidity values, which in turn will inhibit the penetration of sunlight into the water column and eventually affect the process of photosynthesis in water[26].

Plants grow normal (healthy) generally at a pH of 5.5 for peat and mineral soil pH to 6.5. Induce high acidity to increase the solubility of Al 3+, Fe 2+, organic acids and accompanied by a nutrient deficiency P, Cu and Zn micronutrients. Availability of P in the soil is very low sulphate, other than that P (from the fertilizer) will be tied up by Al-active form compound P is not available at a low pH[26].

Water quality measurements carried out on the channel with blocking canal and canal channels without blocking, the test includes the analysis of temperature, DO (dissolved oxygen), EC (electrical conductivity), TDS (total dissolved solids) and pH (acidity).

Table 3.Water Quality Analysis Experiment List

No.	Experiment	Tool (samples were tested directly in the field)	Tool (samples tested in the laboratory)
1.	Temperature	Thermometer digital	U-50 HORIBA (*multi water quality checker*)
2.	Total Dissolved Solids	TDS-EC meter	
3.	Electrical Conductivity	TDS-EC meter	
4.	Ph	pH-meter	
5.	Turbidity	-	
6.	Dissolved Oxygen	-	

3. Results and Discussion

Water sampling in the Wetlands of SungaiAhas, District Mentangai, Central Kalimantan conducted on Friday 13 November 2015 at the hour 8:00 a.m to 1:00 p.m. (end of dry season).

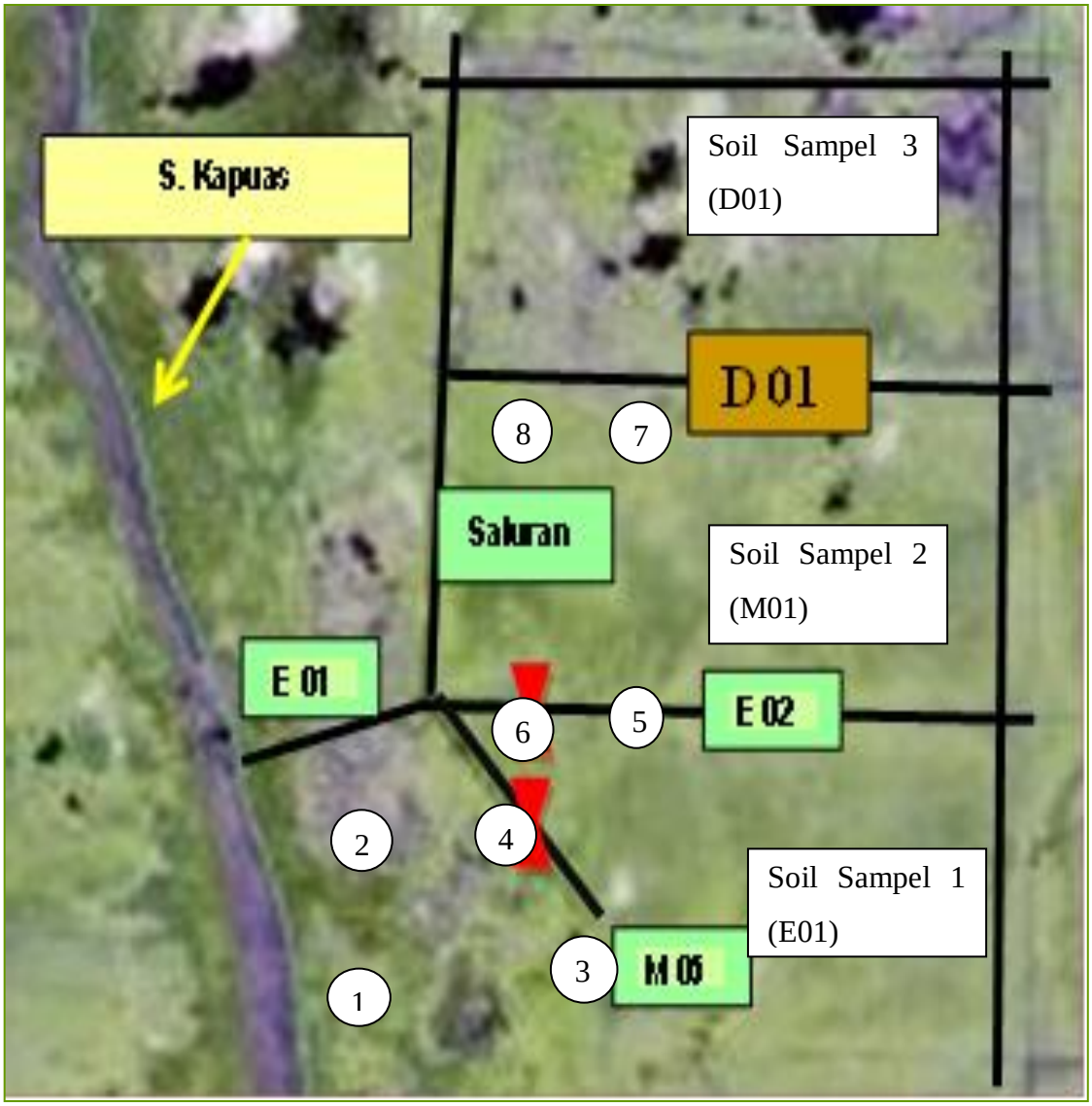

Figure 2. Location Sampling Water Quality Wetlands of Sungai Ahas Central Kalimantan

Description point water sampling :

1. Kapuas River (S. Kapuas)
2. Estuary Channel
3. Canal Blocking Upstream Channel 1 (E01)
4. Canal Blocking Downstream Channel 1 (E02)
5. Canal Blocking Upstream Channel 2 (M01)
6. Canal Blocking Downstream Channel 2 (M02)
7. Upstream Channel Without Canal Blocking (D01)
8. Downstream Channels Without Canal Blocking (D02)

Description of soil conditions:

1. E01 represents the soil sampling on the condition of the land is blocked (canal blocking) between the years 2003 - 2007. This effort is an attempt to restore the condition of peatlands already degraded and experiencing subsidence with a canal system, which began around 1995 with the project PLG 1 million hectares to restore to its original state
2. M01 represents a soil sample in field conditions with the right side of the channel blocked and the left side of the channel without the canal blocking with the assumption that in this region occur semi restoration.
3. D01 represents degraded peat lands and subsidence occur as a result of the process of canalization.

The following recapitulation test results of water quality field from the eight sample points.

Table 4. Summary of Test Results Water Quality Fields SungaiAhas Central Kalimantan

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Unit
Temperatur	29,9	29,8	30,4	31,2	31	31,2	32,6	31,4	^{o}C
TDS	11	26	89	83	104	126	106	95	ppm
EC	22	52	179	166	210	253	212	188	μS/cm
pH	3,42	2,12	1.35	1.51	1,9	1,89	1,45	1,62	pH

Table 5. Summary of Test Results Water Quality Laboratory SungaiAhas Central Kalimantan

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Unit
Temperatur	27,702	27,54	27,448	27,514	27,93	27,5	27,526	27,46	^{o}C
TDS	18	42	118,8	131	170	145,6	139,4	132,8	ppm
EC	28	64,4	182,6	201	261,6	224	214,4	204	μS/cm
pH	4,074	3,254	2,886	2,732	3,012	2,936	2,596	2,706	pH
Turbidity	112,8	94,88	0,04	16,08	2,14	0,74	0,9	0,88	NTU
DO	6,286	6,332	6,24	6,158	7,344	6,022	6,108	6,29	mg/L

From the results can be concluded that the temperature ranges between 27 - 33°C, the temperature is best for plant growth[22]. Total Dissolved Solids (TDS) ranging between 10-170 ppm, TDS < 2000 mg/L is still below the threshold, the lowest TDS in the estuary and the highest in the downstream canal blocking number two. TDS not toxic, but if excessive may increase turbidity values, which in turn will inhibit the penetration of sunlight into the water column and eventually affect the photosynthesis process in water[4,9,27,]. Electrical conductivity (EC) ranged between 20-270 μS / cm, DHL < 5000 μS/cm still is under the threshold, the lowest DHL was the highest in the estuary and in the downstream canal blocking number two. DHL closely associated with the state of poor drainage due to poor water management. DHL high can inhibit the absorption of water and nutrients by plants in line with the increase in osmotic pressure[23]. In particular, high DHL plants cause poisoning, especially by ion Na + and Cl[28]. Acidity (pH) ranging from 1.3 to 3.5, the pH of highly acidic water canals for water even in the Kapuas River. Plants grow normal (healthy) generally at a pH of 5.5 to peat. High acidity caused to increase the solubility of Al 3+, Fe 2+, organic acids and accompanied by a nutrient deficiency P, Cu and Zn micronutrients. Availability of P in the soil is very low sulphate, other than that P (from fertilizer) will be tied up by Al-active form compound P is not available at a low pH[25].

Water quality in wetlands is mainly determined by the type of soil, if the pH of the water is low and DHL too low then the water comes from the peat soil[21]. From the results of water quality testing obtained temperature, TDS and EC according to the standards for agricultural water, only pH thatvery acidic because the peatlands.

The water quality in the channels without canal blocking nearly equal to the water quality in the channel with canal blocking. This proves that the canal blocking does not improve the quality of water in the peat.

4. Conclusion

Temperature, TDS and DHL according to the standard for agricultural water, only pH thatvery acidic because the peatlands. Canal blocking does not improve the quality of water in the peat.

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