National Impact of Climate Change on Fire Regimes
" Indonesian Report"

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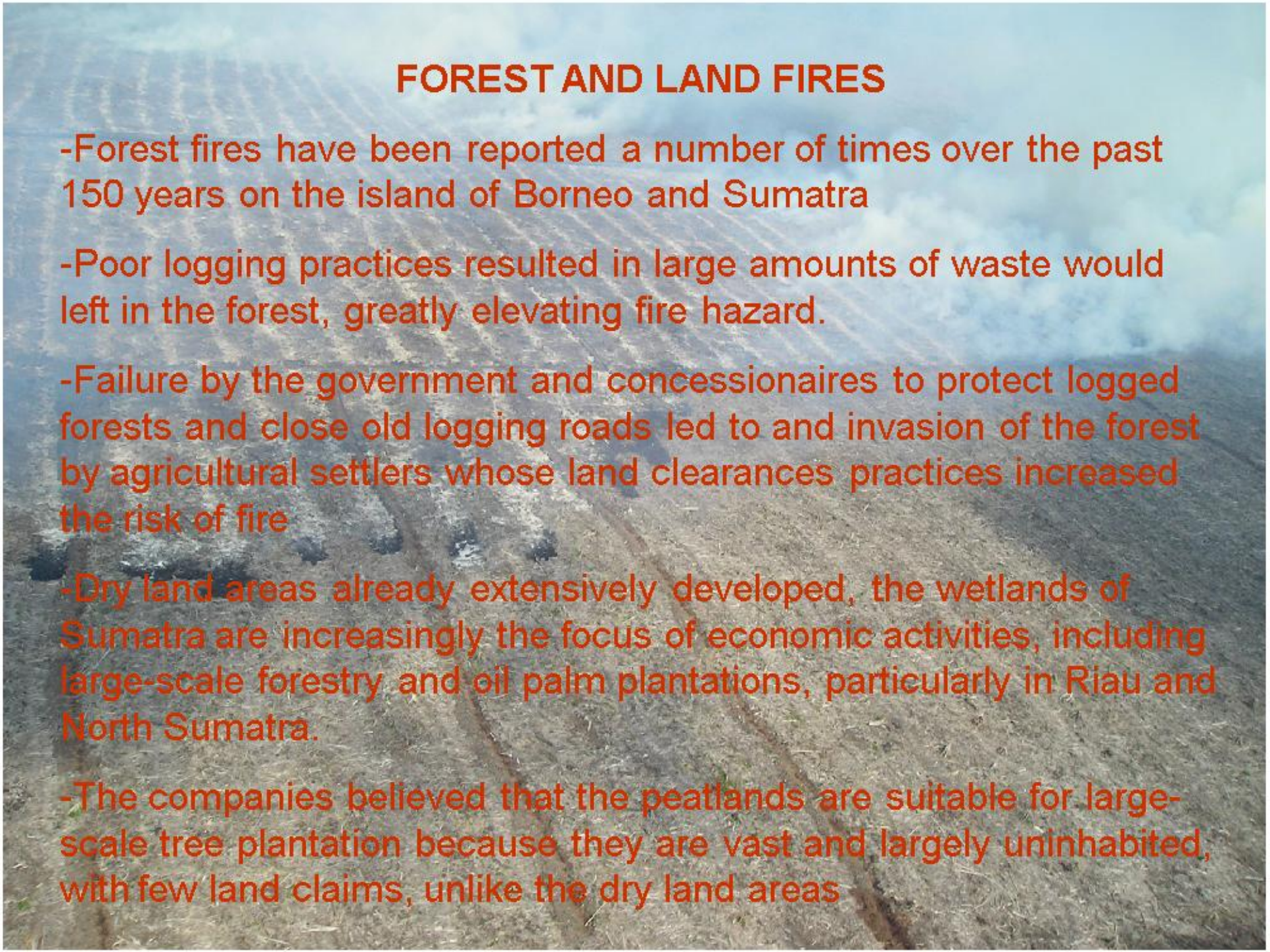


FOREST AND LAND FIRES

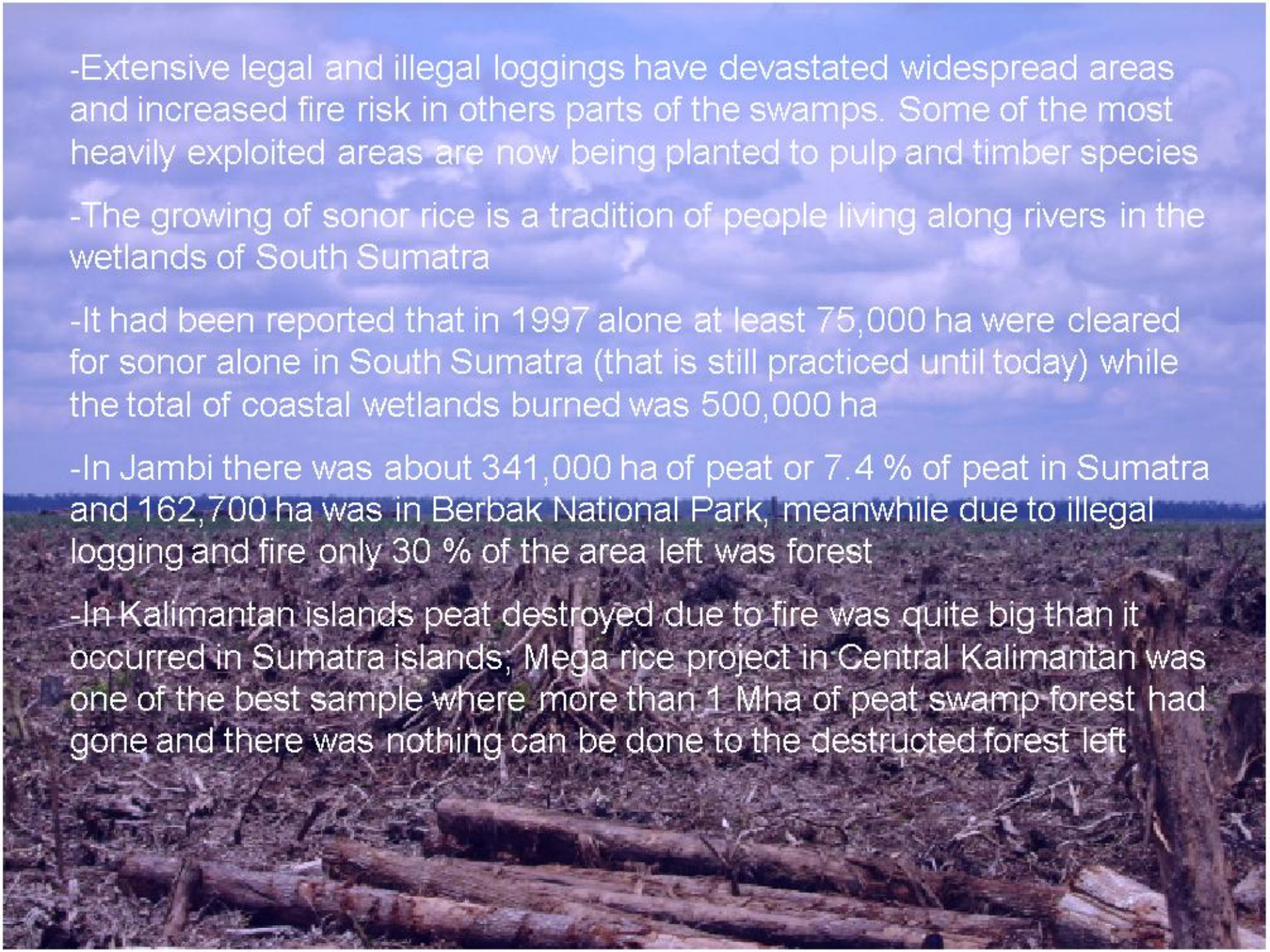
-Forest fires have been reported a number of times over the past 150 years on the island of Borneo and Sumatra

-Poor logging practices resulted in large amounts of waste would left in the forest, greatly elevating fire hazard.

-Failure by the government and concessionaires to protect logged forests and close old logging roads led to and invasion of the forest by agricultural settlers whose land clearances practices increased the risk of fire

-Dry land areas already extensively developed, the wetlands of Sumatra are increasingly the focus of economic activities, including large-scale forestry and oil palm plantations, particularly in Riau and North Sumatra.

-The companies believed that the peatlands are suitable for large-scale tree plantation because they are vast and largely uninhabited, with few land claims, unlike the dry land areas



-Extensive legal and illegal loggings have devastated widespread areas and increased fire risk in others parts of the swamps. Some of the most heavily exploited areas are now being planted to pulp and timber species

-The growing of sonor rice is a tradition of people living along rivers in the wetlands of South Sumatra

-It had been reported that in 1997 alone at least 75,000 ha were cleared for sonor alone in South Sumatra (that is still practiced until today) while the total of coastal wetlands burned was 500,000 ha

-In Jambi there was about 341,000 ha of peat or 7.4 % of peat in Sumatra and 162,700 ha was in Berbak National Park, meanwhile due to illegal logging and fire only 30 % of the area left was forest

-In Kalimantan islands peat destroyed due to fire was quite big than it occurred in Sumatra islands, Mega rice project in Central Kalimantan was one of the best sample where more than 1 Mha of peat swamp forest had gone and there was nothing can be done to the destructed forest left

No.	Year	Burnt area
1	15.510 BC-1650 AD	First fire in East Kal.
2	1877	First fire recorded
3	1915	80,000
4	1982/1983	3,600,000
5	1987	66,000
6	1991	500,000
7	1994	5,110,000
8	1997/1998	10,000,000-11,000,000
9	2006	6,000,000-8,000,000

- The fires in 1997-1998 resulted in 33% population decline of the Orangutan (*Pongo pygmaeus*) in Borneo

-Fires in 1982-1983 in Kutai National Parks (East Kalimantan) resulted in widespread mortality of reptiles and amphibians and lost of fruit trees that cause the population of fruit-eating birds such hornbills declined dramatically

-Increase of acidity (acid rain), floods and other changes in water chemistry brought about by the ash.

-Those factors triggered the population explosions of *Aeromonas hydrophila*, *Stacphyloccus* sp and Pseudomonas sp that attacked and caused an epidemic of skin infection among the fish population of the Mahakam River.

-The disease also attacked and caused serious health problems to the protected freshwater dolphin (*Oracella brevirostris*) which is unique to the Middle Mahakam River.

-Experience during the 1982/1983 forest fire suggest that fruit-eating mammals and birds are likely to be particularly badly affected, because the trees they feed on take many years to manure and set fruit

-In Kutai National Park (East Kalimantan), it was recognized that Rusa Sambar (*Cervus unicolor*) and Kancil (*Tragulus javanicus*) were found killed and burned because of fire.

-30 female orangutans (*Pongo pygmaeus*) have died as a result of the fires in Kalimantan, while 29 orphaned orangutans have been found in several villages and along side the road after escaping from the forests, providing in search for food and water

-Others unique species that threatened by fires are orangutans in Sumatra (*Pongo pygmaeus abelii*), Javan rhinoceros (*Rhinoceros sondaicus*), Sun bear (*Helarctos malayanus*), Sumatran rhinoceros (*Dicerorhinus sumatrensis*), Sumatran tiger (*Panthera tigris Sumatrae*) and Asian elephant (*Elephas maximus*).

-Animals that live in the leaf litter of the forest floor such as reptiles, amphibians and invertebrates are also especially vulnerable as are species that live in cavities in dead trees, including many bats, because the dead trees are particularly likely to catch fires.

-Insect suffer badly, often being unable to escape the effects of the fires, thus having impacts further up the food chain

DEFORESTATION AND DEGRADATION

-Millions of hectares of forest land where awarded as timber concessions in the late 1960s and early 1970s, leading to a timber boom in Sumatra and Kalimantan that changed the landscape of these two islands over a period of two decades

-The forests of Indonesia are being logged at a rate of approximately 40 million cubic meters per year, a rate that is nearly twice that recommended by the Ministry of Forestry for sustainable yield

-Based on land sat image in the year 2000 about 101.73 million ha of the total forest and land had been degraded where 59.62 million ha of it found in the forest where 10.52 million ha found in the protection forest, 4.69 million ha in the conservation forest and rest totally about 44.42 million ha found in the production forest.

- The rate of deforestation during 1985-1997 estimated at 1.6 million ha/year, in the period of 1997-2000 very much increased to be around 3.8 million ha/year and during 2000-2003 it was hard to estimate because it was very un controlled or at an average of 2.8 million ha/year.

-Almost 20 % of the peat swamp of Indonesia has been developed mostly for agriculture, a sector that will make in roads increasingly into remaining peat swamp forest resource.

-Extensive areas of swamp have been deforested and drained under Indonesian government and foreign aid-funded programs whilst an additional large area has been occupied by spontaneous settlers

-The increase in forest conversion for commercial use in the last few years is a clear example of poor governance in managing the environment. Forests can be easily reoriented to gain short-term economic benefit

-Greenomics Indonesia data show that forest conversion in the country has reached alarming level, with about 10 million ha having been shifted to business purposes, ranging from plantation to office buildings

-Many projects in forestry, mining as well as oil and gas sectors are dominated by foreign companies to meet the demands of Western nations, leaving communities vulnerable to conflicts, poverty and natural disasters

-Based on Citra Land sat ETM7 interpretation made by Ministry for Environment found that forest cover left (2007):

>> Sumatra was 37%,
>>Jawa 8.2%
>> Kalimantan 39%,
>>Bali and Nusa Tenggara 15-18 %,
>> Sulawesi 49%,
>> Maluku 83%
>> Papua 73%

-Total degraded forest and land until 2007 about 77,806,880.78 ha:

>> 51,033,635.73 ha in the forest
>> 26,773,245.05 ha non forest.

-The highest degraded forest and land:

>>West Kalimantan province: 10,060,191.34 ha
++ 5,403,443.46 ha in the forest
++ 4,656,747.88 ha non forest ,
>> East Kalimantan province: 9,579,839.18 ha
++ 6,964,546.84 ha in the forest
++ 2,615,292.34 ha non forest

-Until 2007, about 4,741,194 ha of forest had been changed in function to be estate crop and 956,672.81 ha as transmigration site.

-The biggest changing was in Riau province 1,611,859.68 ha and 619,868.37 ha in Central Kalimantan

-Deforestation rate :

>> 1982-1990 : 900,000 ha/year,
>>1990-1997 : 1.8 million ha/year,
>>1997-2000 : 2.83 million ha/year,
>>2000-2005 : 1.09 million ha/year

-It is time for a phase of rehabilitation.

-The government has to stop issuing new permits, including mining and forestry projects, pending an audit of the existing policies that have spurred exploitation of natural resources

GREENHOUSE GAS EMISSION AND GLOBAL WARMING

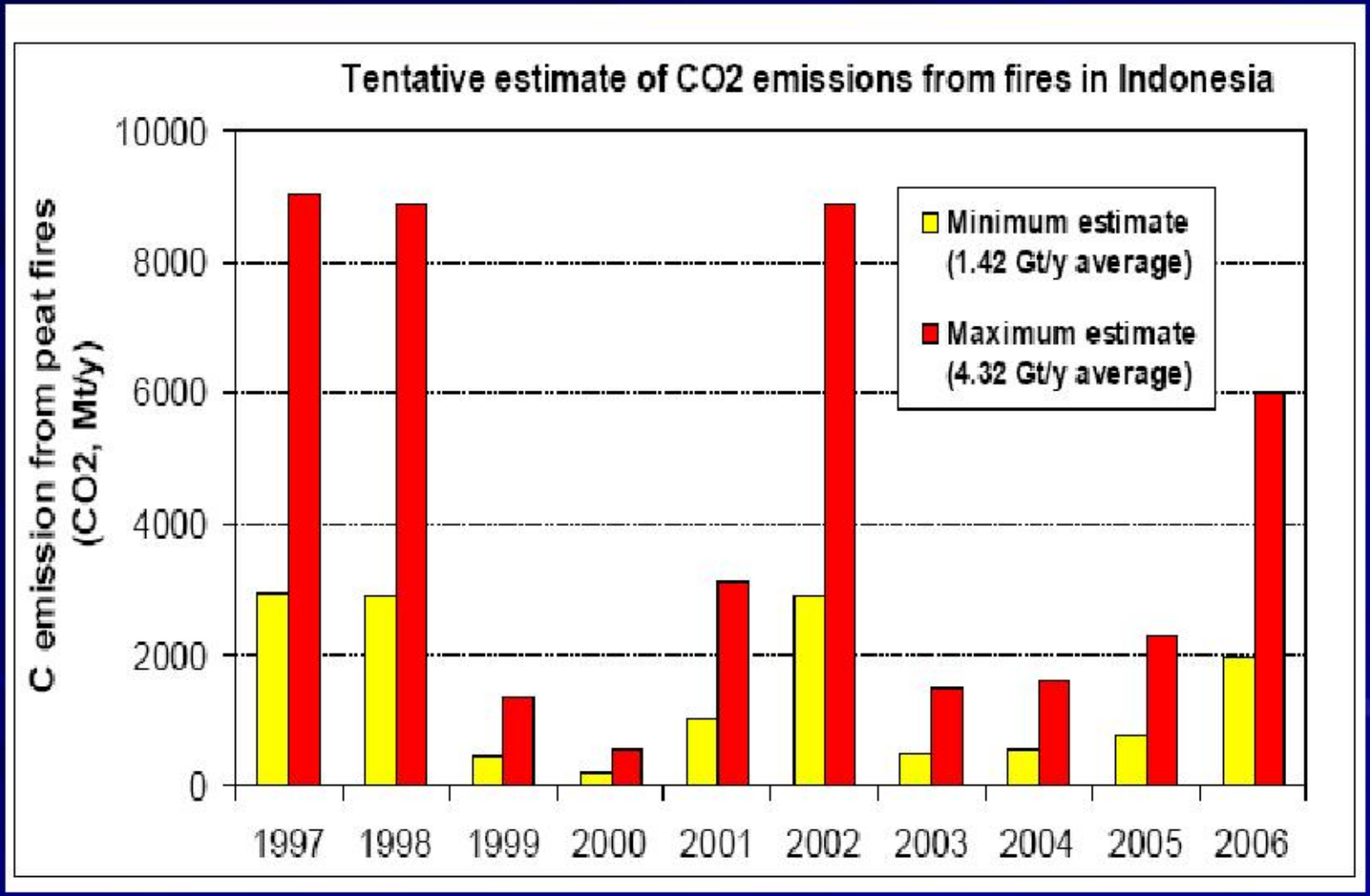
- The total amount of carbon in peat lands in SE Asia is at least 42,000 Megatonnes (depending on assumptions of peat thickness and carbon content), equaling at least 155,000 Megaton's in potential CO2 emissions (Hoojier et al, 2006).

- Present likely CO2 emissions (fires excluded) from drained peat lands are calculated to be between 355 and 874 Mt/y, with a most likely value of 632 Mt/y.

- If current rates and practices of peat land development and degradation continue, this may increase to 823 Mt/y (most likely value) in 10 to 30 years, followed by a steady decline over centuries when increasingly thicker peat deposits become depleted.

- Current emissions from Indonesia alone are 516 Mt/y. To put this in perspective, this equals (Hoojier et al, 2006):
  > 82% of peat land emissions in SE Asia (fires excluded).
  > 58% of global peat land emissions (fires excluded).
  > Almost 2 times the emissions from fossil fuel burning in Indonesia.

Tentative estimate of annual and average annual carbon emissions due to peat land fires (Hoojier et al, 2006)



- If emissions from peat land fires (which are also caused by deforestation and drainage) are included, the total CO2 emission number is significantly higher.
- Over 1997-2006, CO2 emissions from peat land fires in Indonesia were several times those due to peat decomposition in drained peat land areas: 1400 Mt/y to possibly as much as 4300 Mt/y (Hoojier et al, 2006).
- The lower (and more likely) figure, added to current likely emissions from peat decomposition, yields a total CO2 emission figure for SE Asian peat lands of 2000 Mt/y (over 90% of which are from Indonesia), equivalent to almost 8% of global emissions from fossil fuel burning.
- This is probably the most concentrated (produced on only 0.2% of the global land area) land-use related CO2 emission in the world.
- If emissions from peat land drainage and degradation (including fires) are included, Indonesia takes third place in global CO2 emissions, behind the USA and China (Hoojier et al, 2006).

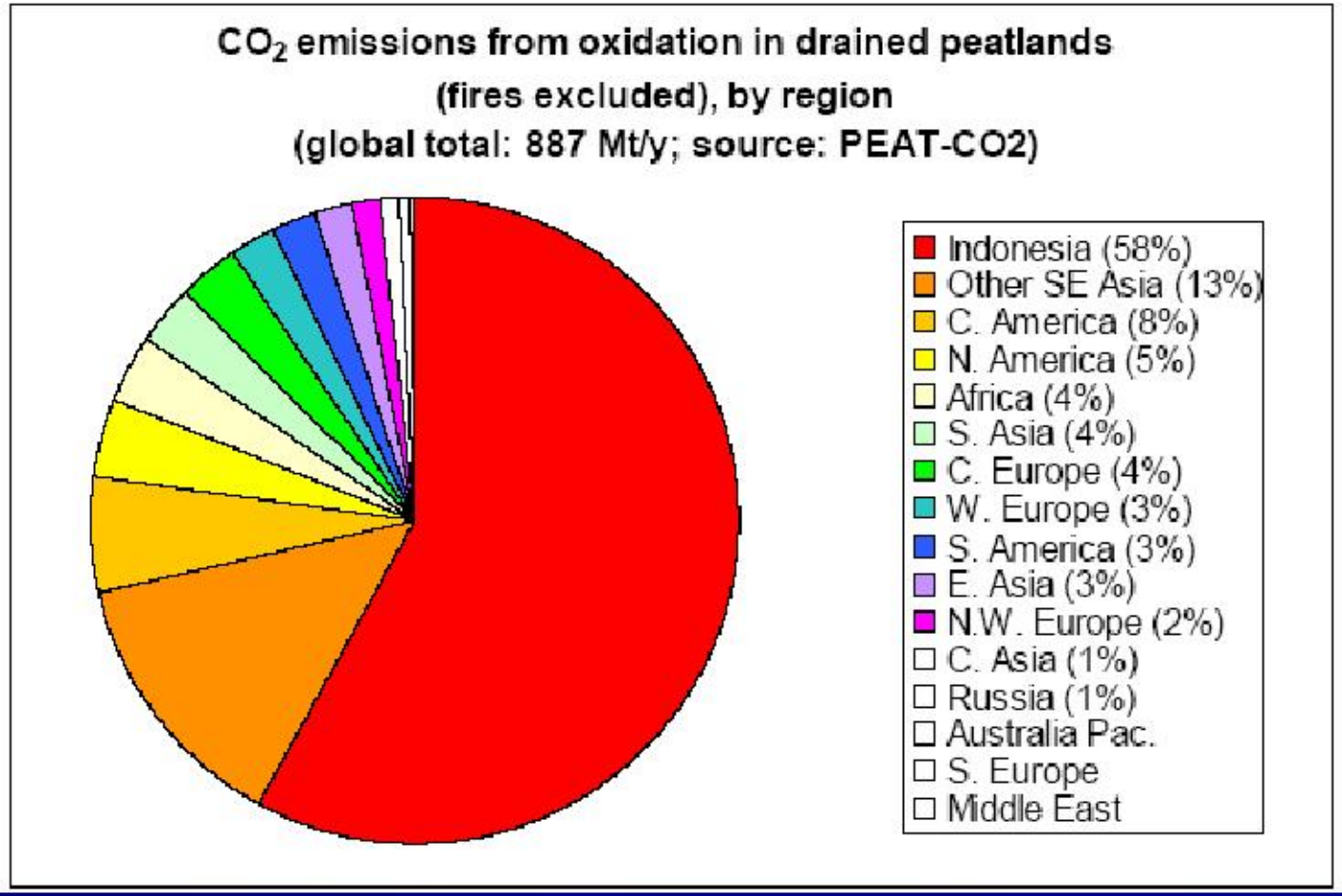
- Without peat land emissions, Indonesia takes 21st place.
- Interestingly, the annual CO2 emission of 2000 Mt/y found for 2005 is supported by an independent study: Wetlands International has estimated an average annual emission of 1480 Mt/y between 1990 and 2002, based on mapping of lost peat areas and measurement of reductions in peat thickness in remaining peat lands.

It should be noted that, while peat fire emissions currently exceed those from slower peat decomposition, this does not mean that the problem can be solved by fire fighting (Hoojier et al, 2006):

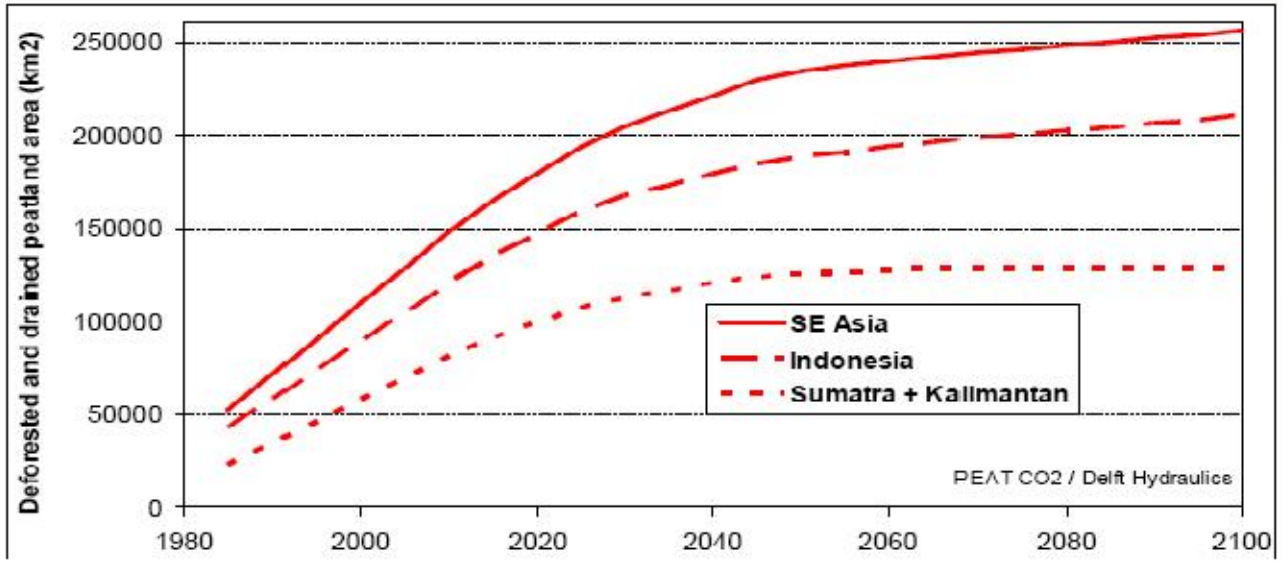
- First of all, peatland fires are promoted by deforestation and by forest degradation and peat drying linked to peatland drainage, and can be stopped in the longer term only if these root causes are dealt with.

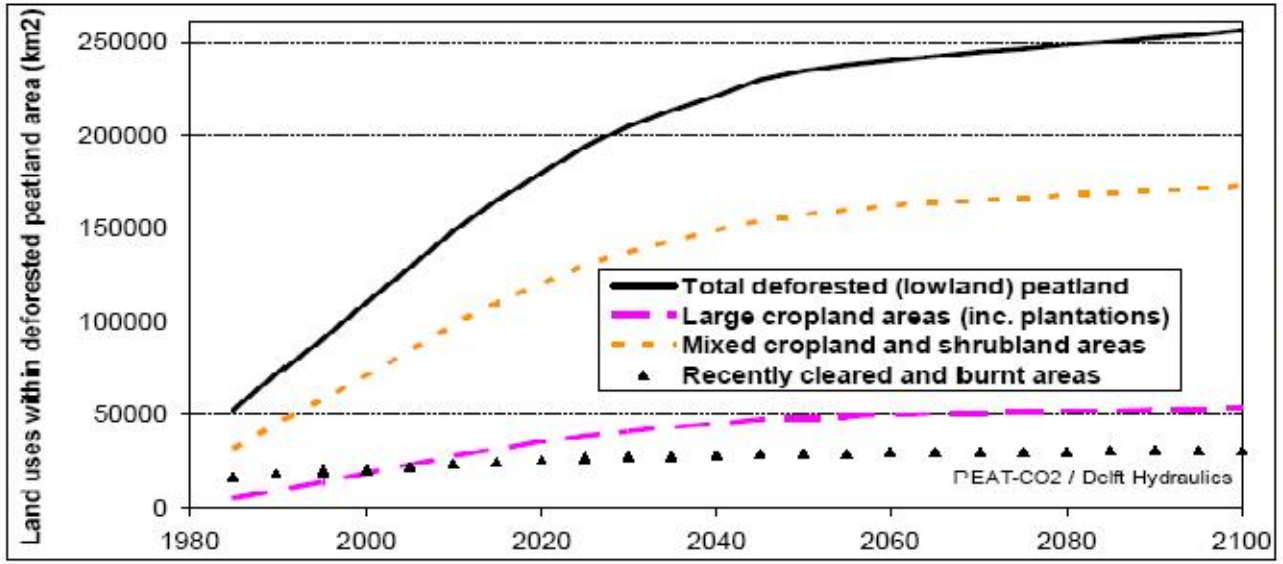
> Secondly, only stopping the fires but not the drainage merely means it will take a longer time for the carbon resources to be released to the atmosphere.

CO2 emission from peatlands in Indonesia and the rest of SEA as compared to emission for other peatland region in the world (Hoojier et al, 2006)



Current trends and future projections of deforestation in lowlands peatlands in SEA (Hoojier et al, 2006)





- The highest CO_2 emission in Indonesia (PEACE, 2007) supported by forestry activities.
- Deforestation and land conversion cover about 75 % followed by energy used in forestry sectors about 23 % and 2 % from forest industry.
- Forest fire was the main contributor for deforestation and land conversion which cover about 57 %.
- During 1997 forest fires alone released 3,000 to 9,000 $MtCO_2e$ to atmosphere (Page et al, 2002).
- Fire alone annually released about 1,400 Mt carbon supported by dry peat land decomposition about 600 Mt.

NATIONAL IMPACT OF CLIMATE CHANGE

> The sign impact of climate change occurs in Indonesia included several things below (KNLH, 2008):

<< The sign of season changing which indicated by flood and storms during

<< rainy seasons that gradually increase.

<< Drying period at the same time at dry season

<< Daily temperature increase

<<Disappearing of small islands

DISASTER

- **Data from the Indonesian Forum for the Environment (WALHI) show Indonesia spends more time than ever mitigating disaster impacts.**
- **The green group recorded 840 ecological disasters from 2006 to 2007, leaving 7,300 people dead and 750,000 houses destroyed.**
- **Environmental activist agree that ecological disasters have intensified.**
- **They blame these calamities on environmental mismanagement, mainly in the last 30 years.**

- The country report presented by the Department of Public Works of Indonesia during the COP Conference of 13 Parties in Bali in November 2007, shows that all of disasters that hit Indonesia between 2003-2006, 75 to 80% were induced by climatic change.
- Climate change is caused by global warming, which is as consequences of human activities, including the burning of fossil fuels since the beginning of the industrial revolution and other exploitative activities especially relating to Land Use, Land Use Change and Forestry, all of which are outpacing efforts to mitigate them.
- According to Global Review 2007, a hazard is an event, phenomenon, or human activity with the potential to inflict casualties, damage property, disturb social and economic activities, or degrade the environment.
- Climate change-induced disasters are classified under climatic hazards (cyclones, floods and droughts) and highly localized climate hazards (flash floods, landslides, mudslides and wild forest fires).

SEASON CHANGING

- Farmers in East Nusa Tenggara have lost 25-40% of their income due to irregular rainfall, while fishermen in the Maluku islands have complained of poor catches in recent years as they lose their ability to predict sea climate and fish movement

- Climate change has arrived in Indonesia and it is hitting the countries poorest first and hardest according

- It said that unpredictability of the rainy and dry seasons has resulted in farmers in many areas of the province failing to harvest what they planted, creating a drastic drop in income and widespread hunger and malnutrition especially among children

- The real impact of global climate change to the species as biodiversity component is distribution range, scarcity increase, reproductive period change and the changing in periodicity of the planting season
- The negative impact of global climate change threatens Indonesian biodiversity:

<< 515 species of mammalians (12% of world species);

<< 781 species of reptilians (16% of world species);

<< 1,529 species of birds (17 % of world species);

<< 270 species of amphibians;

<< 38,000 flora (55 % endemic)

<< 27,000 species of flowers (10% of world species);

<< 477 species of palms and 350 species of Dipterocarpace (155 species endemic).

- It had been found that due to global climate change disappearing of flora and fauna increased year by year.
- Until 2007, disappearing species:

  -140 species of birds,

  -63 species of mammalians,

  -21 species of reptilians disappeared
- Until 2007, left Sumatran Rhinos about 300 while Java Rhinos about 60.
- Sumatran elephants predicted around 2400-2800, while in Kalimantan about 60-100 elephants.
- In the next 15 years if the efforts fail to protect those elephants hence 35 % of it will disappeared and if in the next 30 years again if the efforts fail hence those elephants disappeared.
- The rate of disappearing Orang utan predicted about 1-1.5 % per annum in Sumatra while in Kalimantan about 1.5-2.0 %.
- In Sumatra totally about 6,667 Orang utan left while in Kalimantan about 54,567. In Central Kalimantan alone in the year 2006 about 1,500 orang utan dead in oil palm area.

No.	Species/Family	Number of protected species
A	**Flora**	
1	Palmae	14
2	Orchidaceae	29
3	Dipterocarpacea	13
4	Nephenthes	1
5	Rafflesia	1
B	**Fauna**	
1	Mammalians	70
2	Aves	193
3	Reptilians	31
4	Insect	20
5	Pisces	7
6	Anthozoa	1
7	Bivalva	14

DAILY TEMPERATURE

> IPCC (2007) put Indonesia as the country which daily average daily temperature increase between 0.2° C – 1°C during 1970-2004 period

The increasing of sea water level at monitoring station

No.	Monitoring station	Increasing of sea water level (mm/year)	Source data
1	Cilacap (Central Java)	1.30	1993
2	Belawan (North Sumatra)	7.83	1990
3	Jakarta	4.38	1990
		7.00	1984-2006
4	Semarang (Central Java)	9.37	1990
		5.00	1984-2006
5	Surabaya (East Java)	1.00	1984-2006
6	Sumatra	5.47	1990
7	Lampung	4.15	1991

Number of islands (small) disappeared

No.	Province	Disappeared islands
1	Nanggroe Aceh Darussalam	3
2	North Sumatra	3
3	Riau Island	5
4	West Sumatra	2
5	South Sulawesi	1
6	Jakarta	7
7	Papua	3
	Total	24

CONCLUSION

- Forest and land fires finally found known as the main contributor for deforestation and land conversion which reach 57 % to the forestry sector, which responsible for 75% of greenhouse gas produce that elevated Indonesia as third rank of greenhouse gas producer in the world.

- The impact of climate change direct or indirectly believed occurred in Indonesia as it can be seen through the sign on thousands disaster occurred, the increasing of sea water level which eliminated 24 small islands, increasing daily temperature, and others that is being occur.

- Fire and land conversion become the most destructive actors in worsening the situation due to global warming which finally cause global climate change.

- Reduction of forest and land fire occurs and land conversion hopefully will minimize the national impact of climate change and prevention is the best solution through community based fire management.