The Development of GHG Inventory for LULUCF-Indonesia

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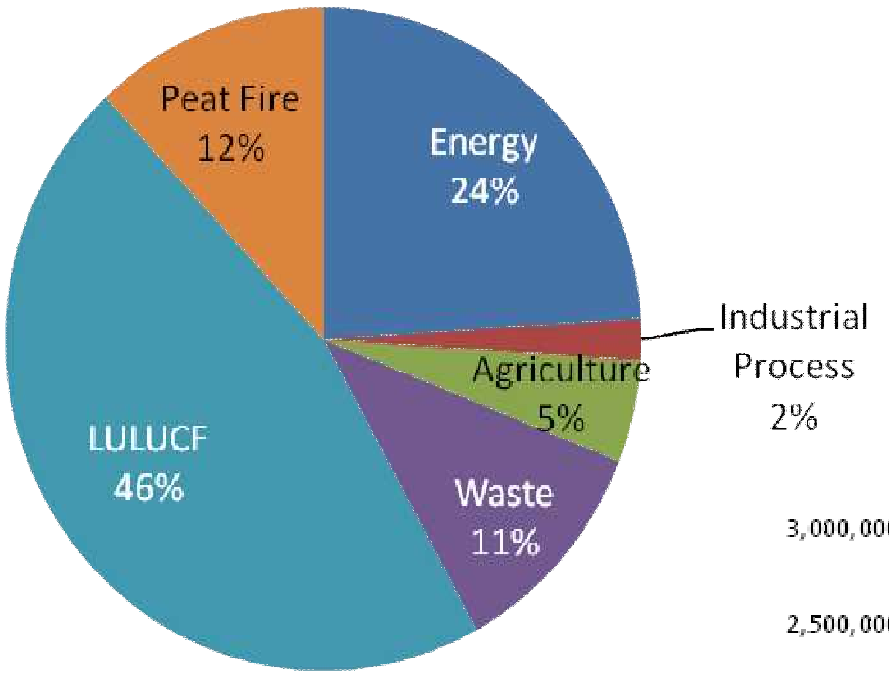
Outline

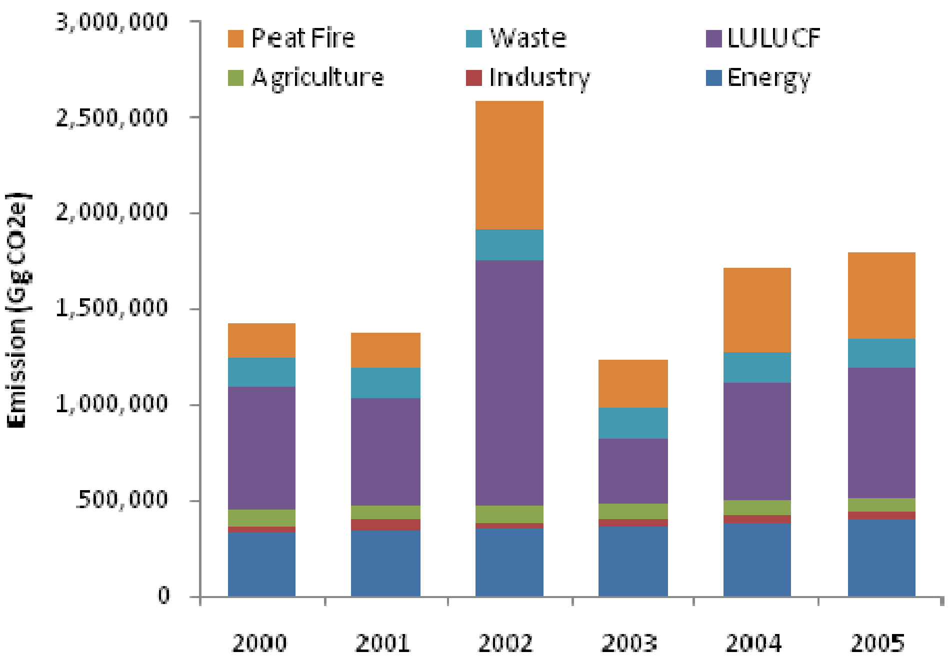
- **Overview of GHG Emission from LULUCF**
- **Generating Activity Data for LULUCF**
- **Methodology for Estimating Emission from Peat Fire**
- **Uncertainty Analysis**
- **Conclusion**

Overview: 2000 Indonesian GHG Inventory



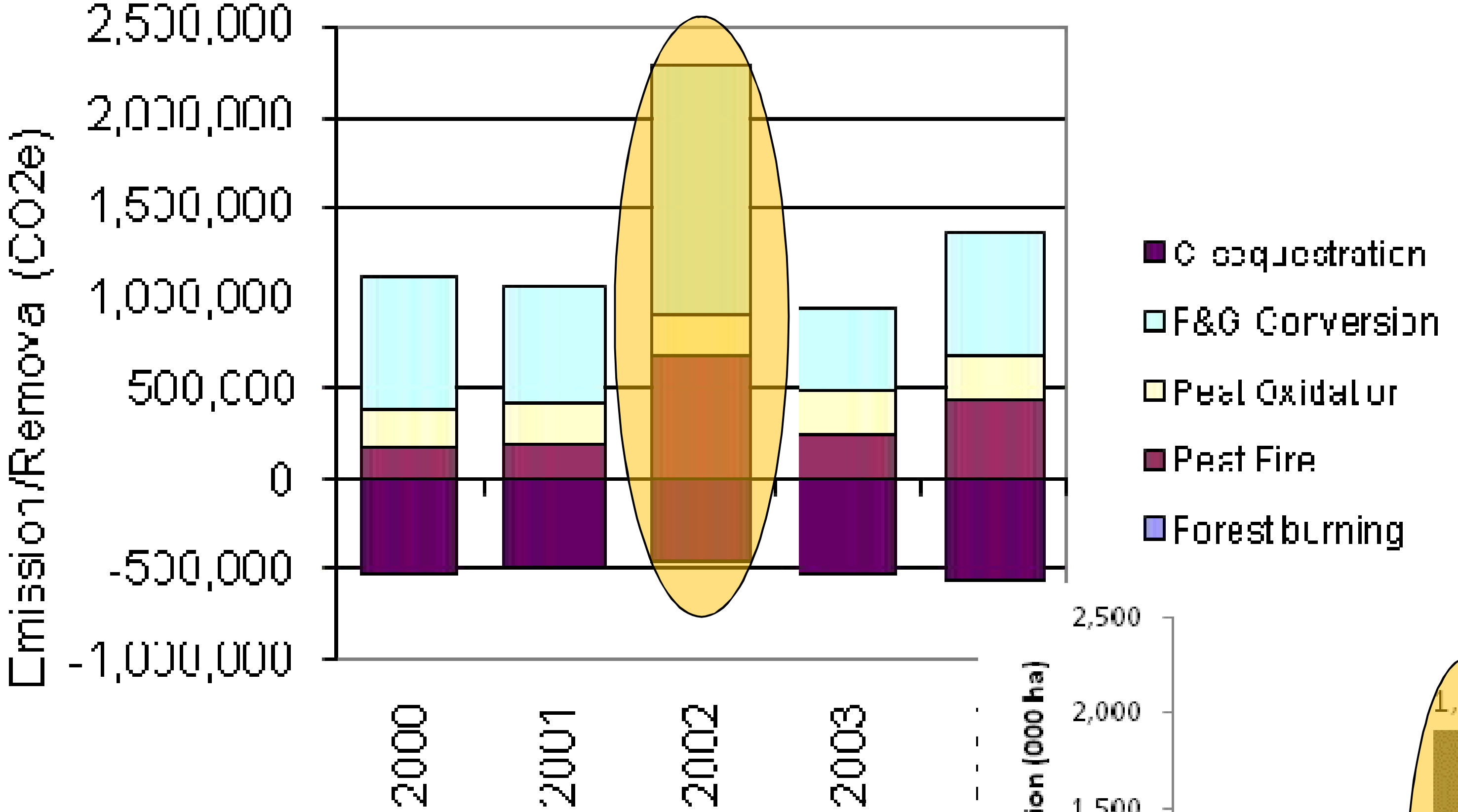
Major source of GHG in 2000 emission was from LULUCF and followed by energy sector. High inter-annual variability of national GHG emission was mainly due to high inter-annual variability in LULUCF emissions

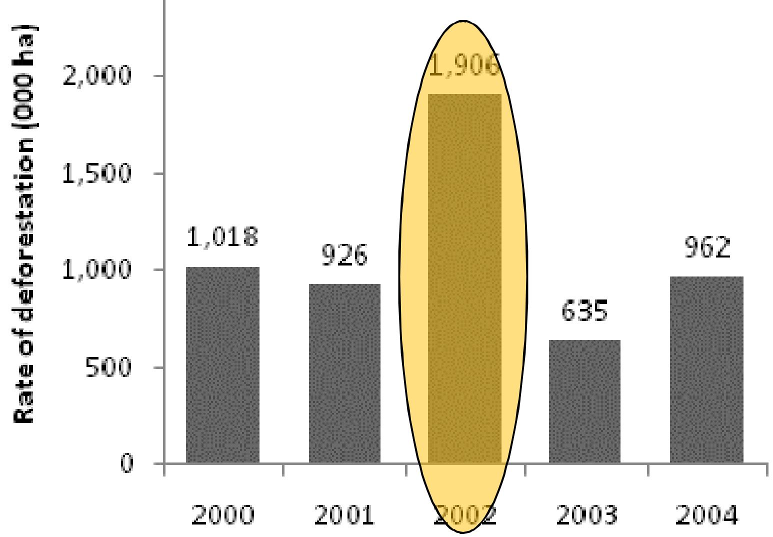
Energy	333,541
Industry	34,279
Agriculture	75,420
LULUCF+Peat Fire	821,254
Waste	151,580
TOTAL	1,416,074



Source: SNC (2010)

Inter-annual Variation of LULUCF emission





Sudden increase in 2002 emission was due to the increase of deforestation and peat fire in that year.

Source: SNC (2010)

Generating Activity Data

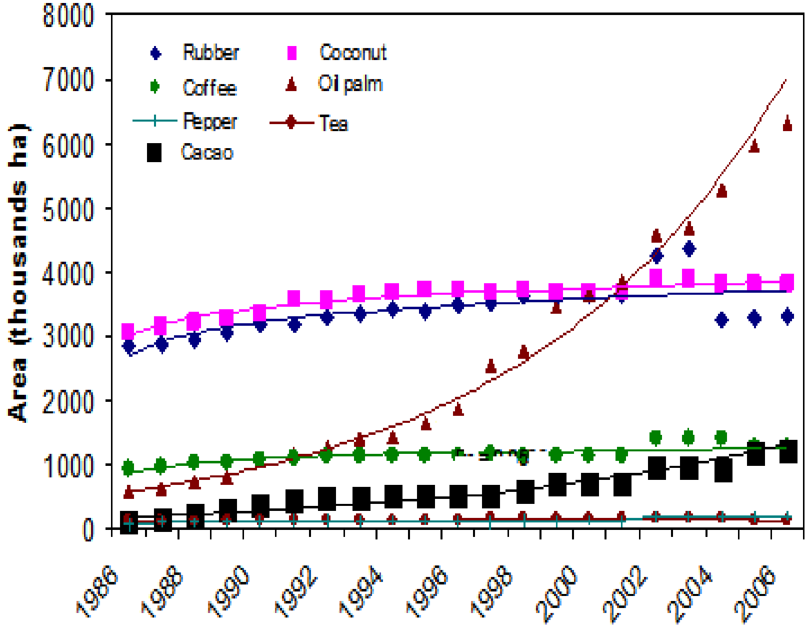
- Activity data for land use and forest cover change were taken from official forestry statistic reports (MoFor, 2001-2007) which was derived from satellite images processing (LANDSAT7 ETM+) by Directorate General of Forestry Plan, Ministry of Forestry (BAPLAN). However, data on land use transition matrix was not documented and available.
- Activity data on area change from forest lands to crop lands (estate crops) was based on statistical data series

1	Primary Dryland Forest	Forest Land
2	Plantation Forest	Forest Land
3	Primary Swamp Forest	Forest Land
4	Primary Mangrove Forest	Forest Land
5	Secondary Dryland Forest	Forest Land
6	Secondary Mangrove Forest	Forest Land
7	Secondary Swamp Forest	Forest Land
8	Estate crops	Cropland
9	Mix agriculture shrubs	Cropland
10	Rice field	Cropland
11	Transmigration	Cropland
12	Agriculture	Cropland
13	Grassland	Grassland
14	Shrubs	Grassland
15	Swamp	Wetland
16	Water	Wetland
17	Swamp shrubs	Wetland
18	Settlement	Settlement
19	Airport	Other Land
20	Dyke	Other Land
21	Open lands	Other Land
22	Cloud Cover	NA

Source: SNC (2010)

The use Satellite and Statistical Data in generating land use transition

- The decrease in forest area derived from satellite data is assumed as a result of conversion to crop lands (perennial and annual crops): dF
- Activity data on forest lands change to crop lands were estimated from the time series data of perennial and annual crops taken from Bureau of Statistics (BPS)



	2000	2001	2002	2003	2004	2005
Palm oil (PO)	3,769	3,974	4,116	5,239	5,390	5,630
PO-PO		3769	3,974	4,116	5,239	5,390
FL-PO	205	142	1,123	151	240	

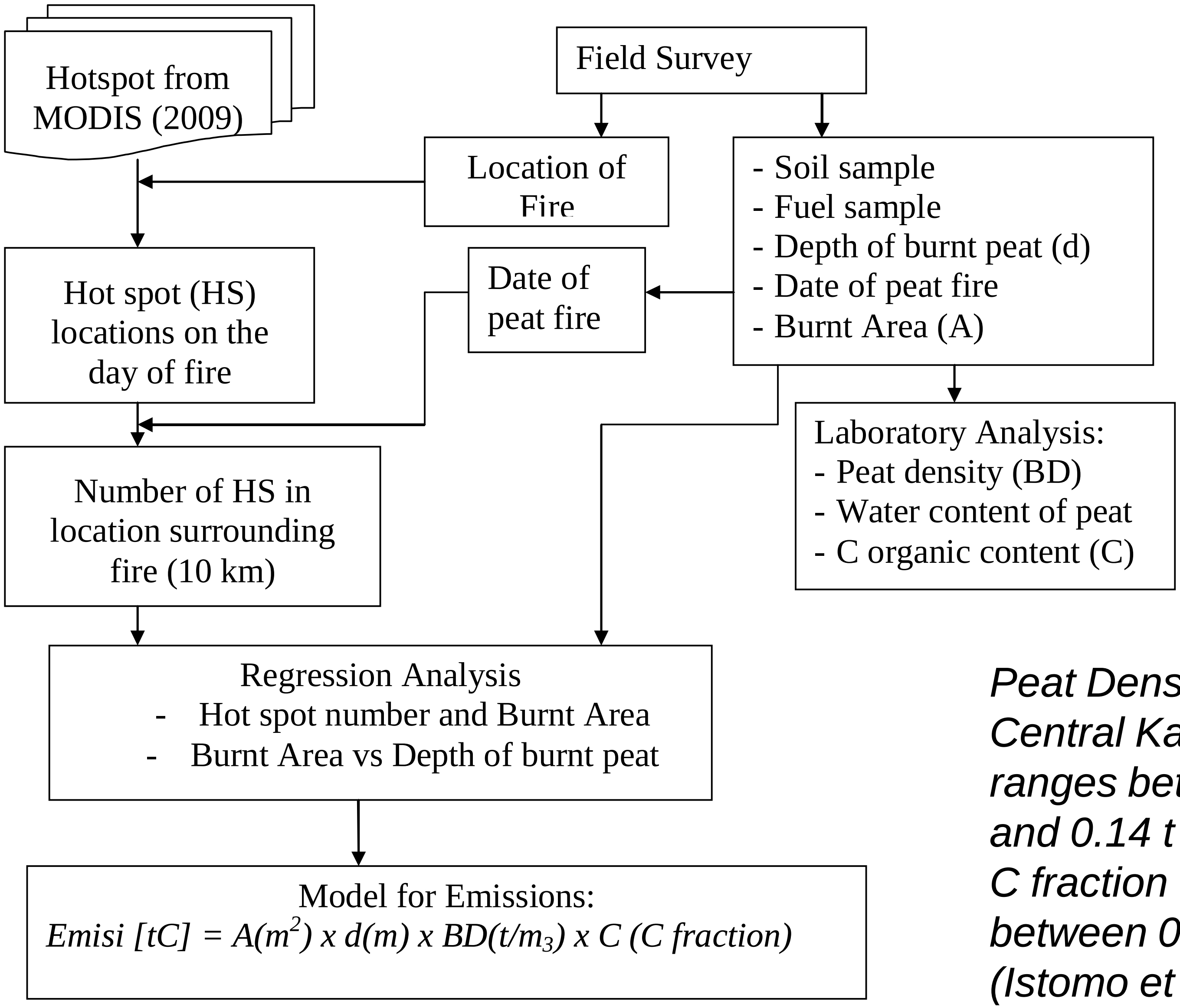
Land Cover Change Analysis for INCAS(Roswitiarti, 2010):

- INCAS Remotely-sensed Land Cover Change Program aims to provide wall-to-wall land cover change analysis for 1998-2010 (initial stage for 1998-2009) using Landsat data as the main data and other data (such as MODIS, SPOT, and ALOS PALSAR) to fill in cloud gaps. This produce a 25 meter pixel resolution
- The INCAS study will provide future assessments of land cover change. The data will be available on November 2010

Land Cover Change Processing Stream of INCAS (Roswitiarti, 2010):

- Scene selection
- Registration (geometric correction)
- Radiometric correction:
  - Sun correction (calibration)
  - Terrain correction
- Cloud masking and mosaicing
- Classification
- Land cover change

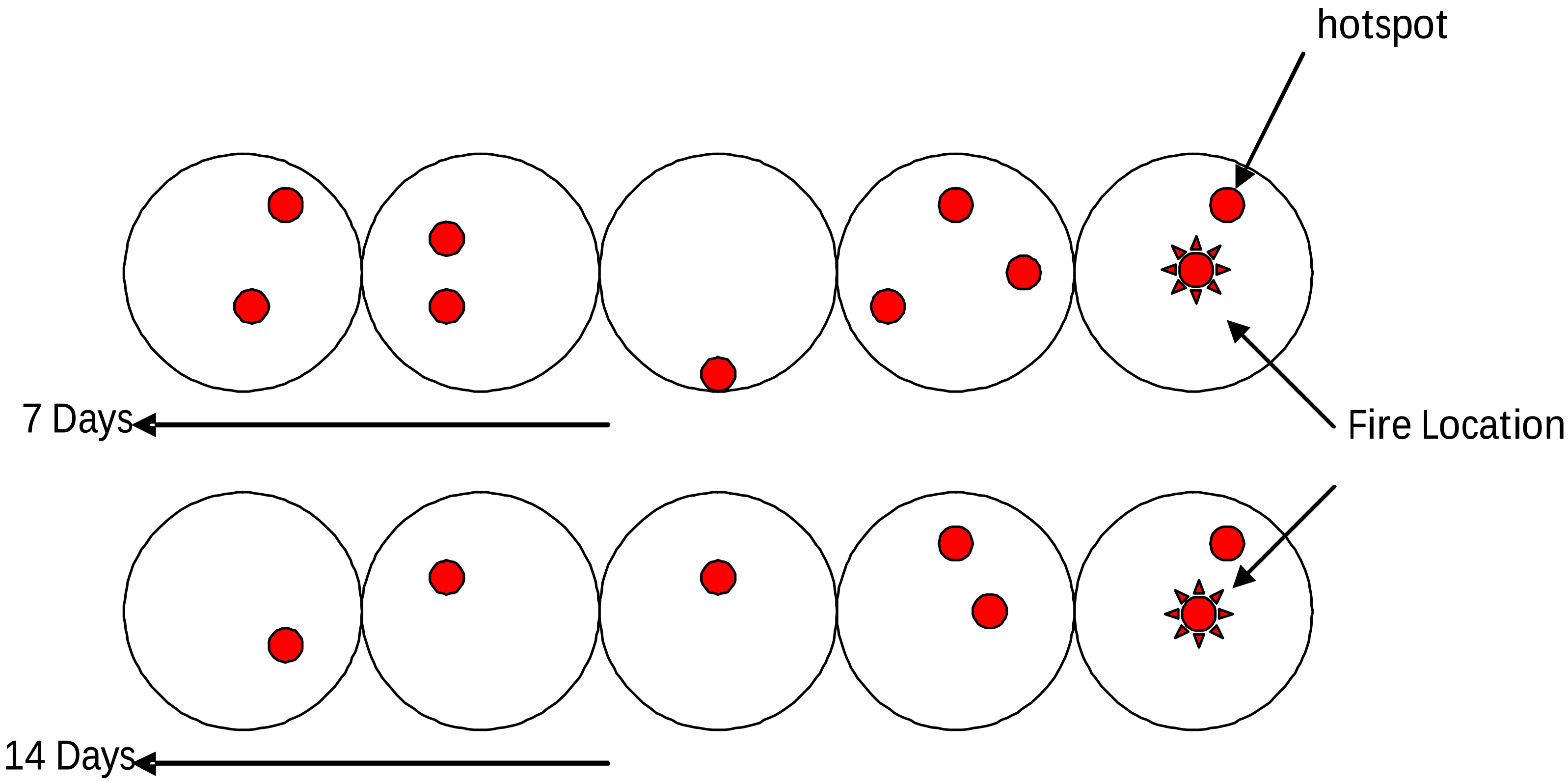
Methodology for Emission from Peat Fire (not used in the SNC)



Source: Boer et al., 2009

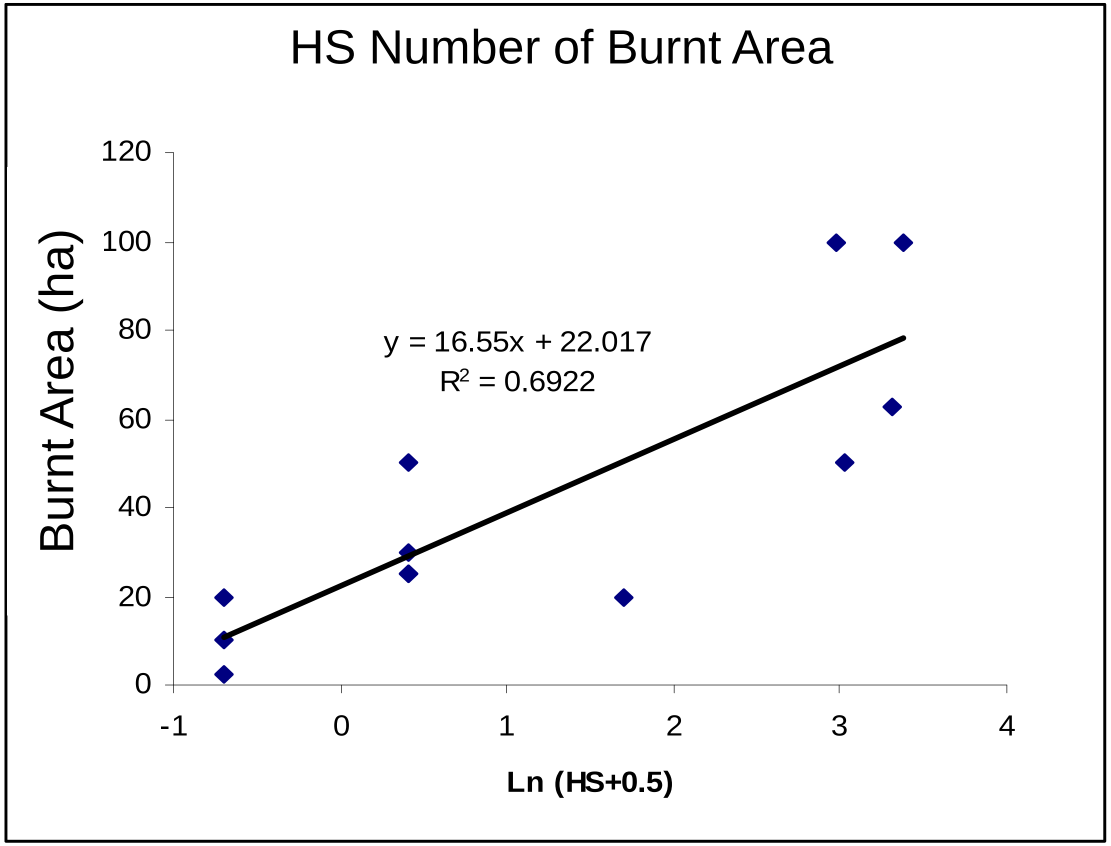
Peat Density (BD) of Central Kalimantan ranges between 0.10 and 0.14 t m^{-3} while the C fraction varied between 0.40 and 0.56 (Istomo et al, 2006)

Process of Developing relationship between HS density and Burnt Area and Depth of Burnt Peat



Source: Boer et al., 2009

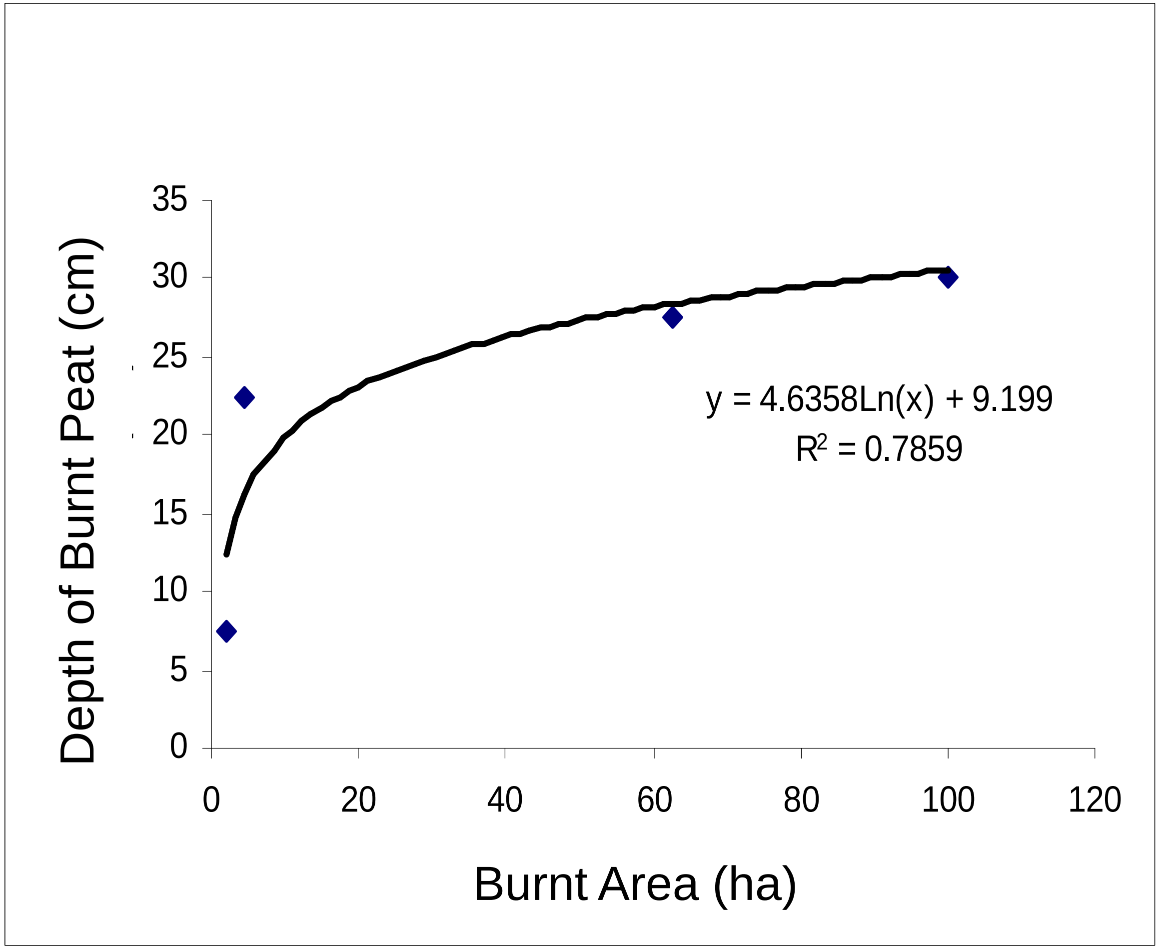
Relationship between HS vs Burnt Area



Source: Boer et al., 2009

Burnt Area can be estimated from the total number of HS in the pervious one week prior to fire events using domain of 10 km (radius)

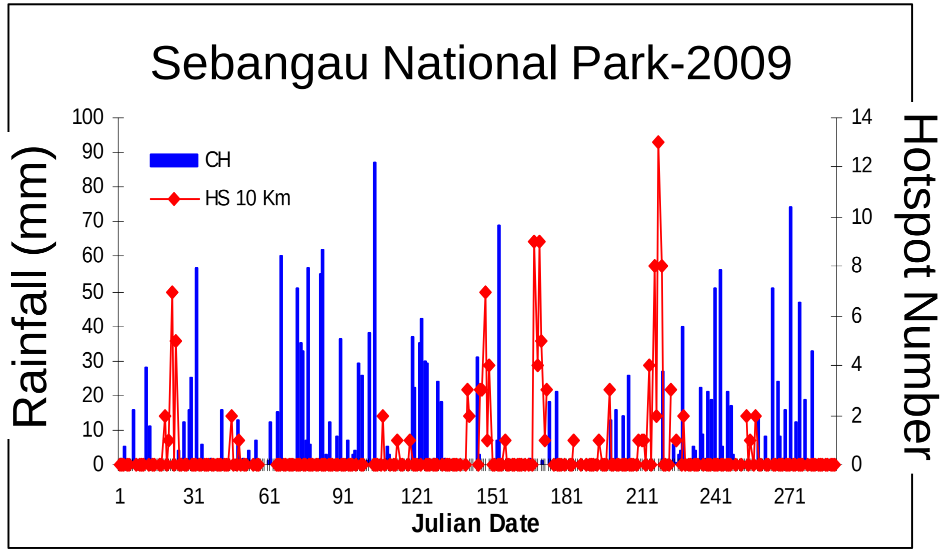
Relationship between Burnt Area vs Depth of Burnt Peat

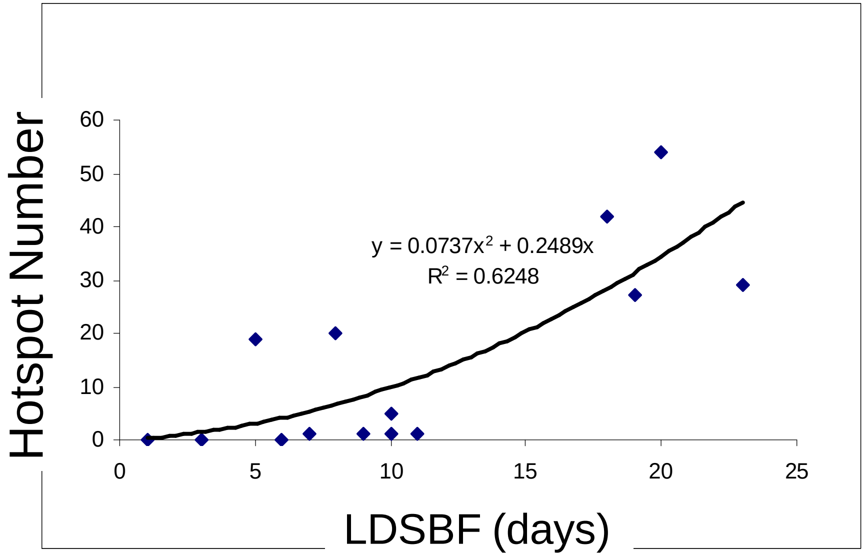


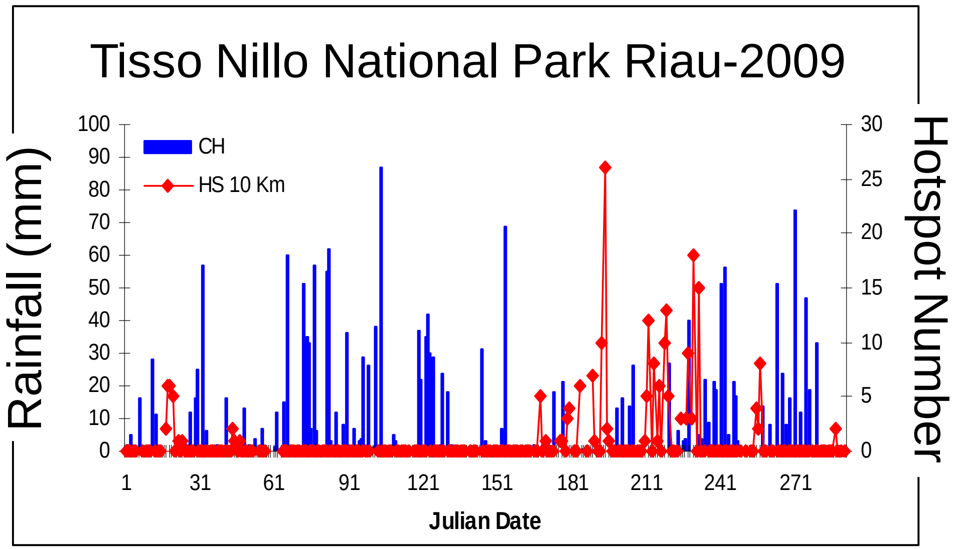
Depth of Burnt Peat can be estimated from burnt area. The higher the burnt area and deeper the depth of peat being burnt.

Source: Boer et al., 2009

Relationship between HS Number in 10 km domain and rainfall events/dry spell



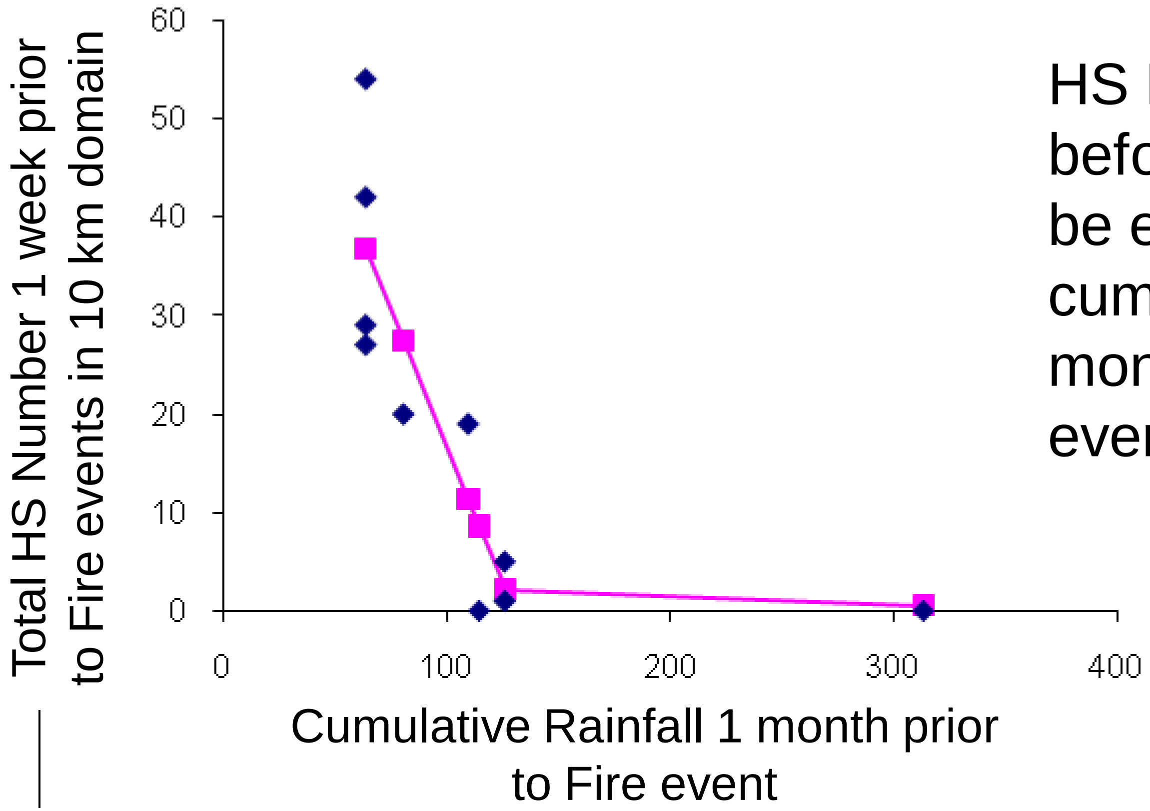




HS Number has significant relationship with length of dry spell. The hotspot number increased exponentially with the increase of length of dry spell

Source: Boer et al., 2009

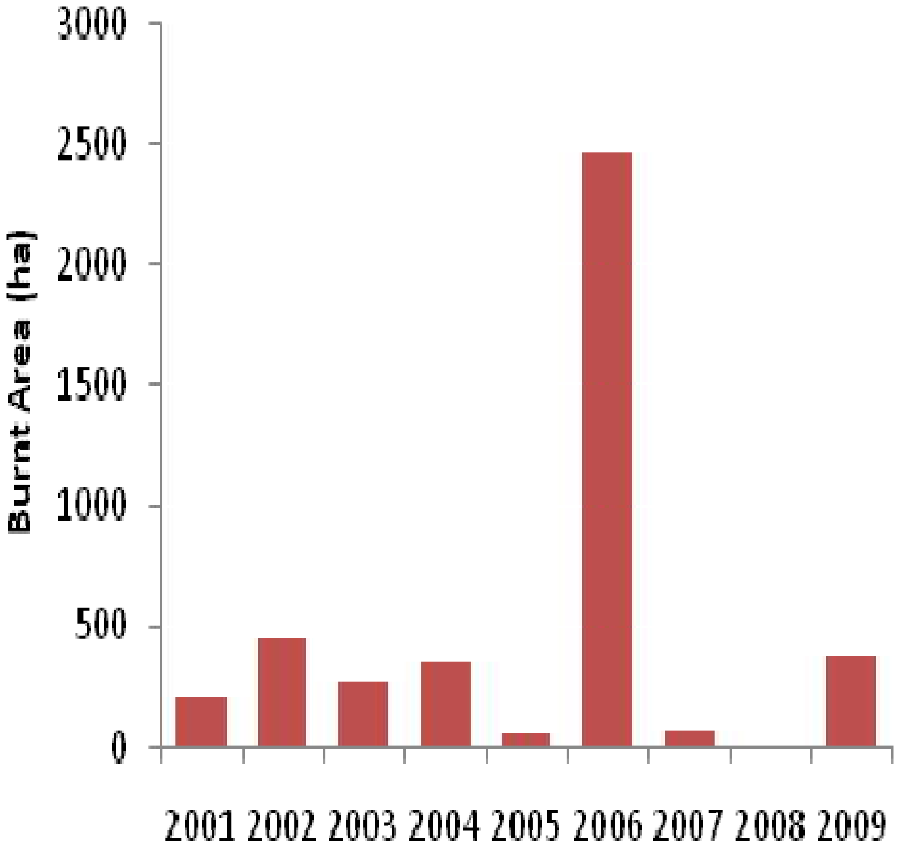
Relationship between I month cumulative rainfall and Hot Spot Number (For Prediction of fire risk)

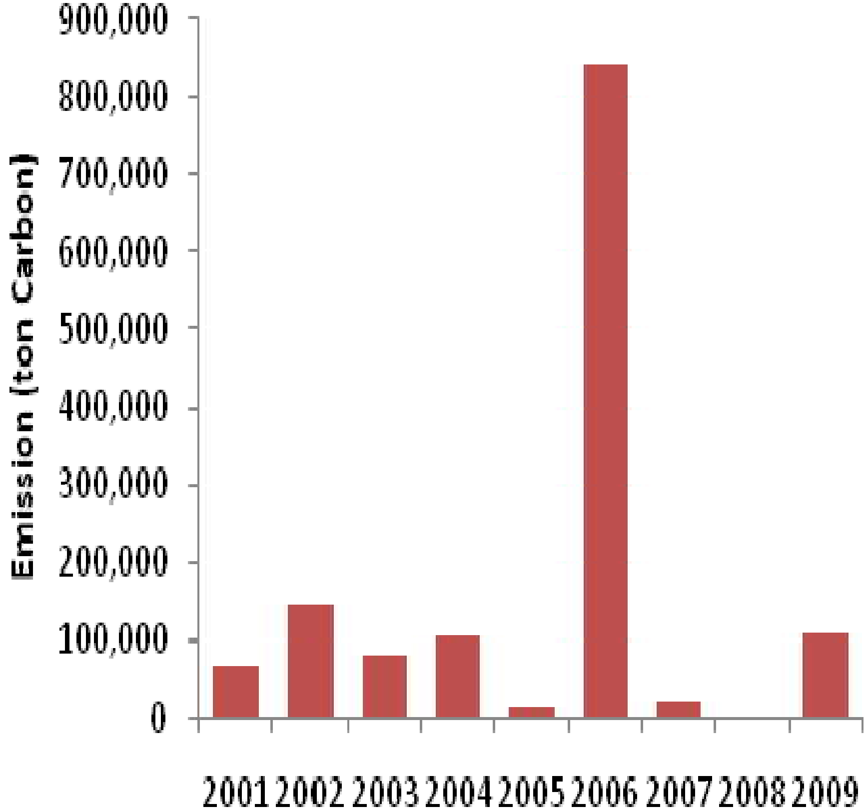


HS Number 1 week before the fire events can be estimated from cumulative rainfall one month prior to the fire events

Source: Boer et al., 2009

Based on the equations, emission can be estimated: Sebangau National Park





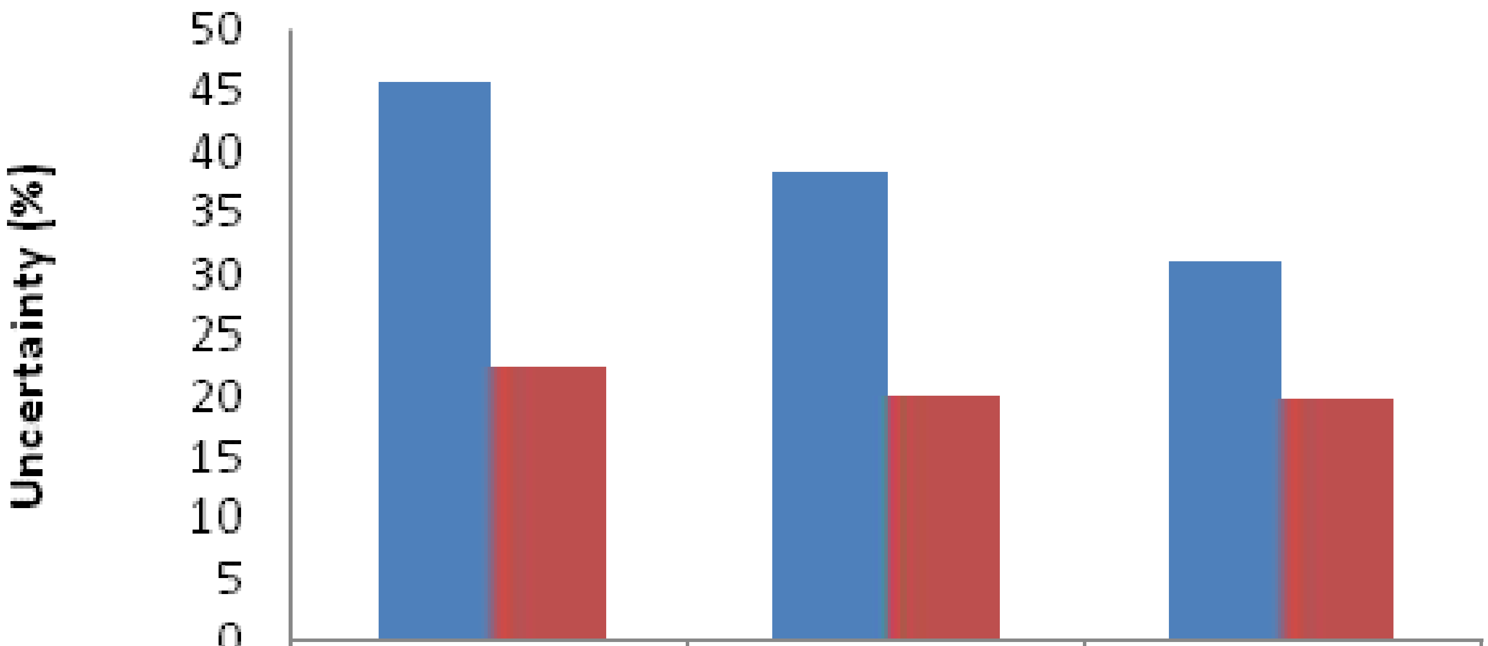
Source: Boer et al., 2009

Uncertainty Analysis

No.	Source/Sink Categories	Current (%)		Improved (%)	
		AD	EF/RF	AD	EF/RF
1	Energy and transportation	15	5	Same	Same
2	Industry	25	5	Same	Same
3	Agriculture	15	30	Same	Same
4a	Change in forest and other woody biomass	25	50	15	25
4b	Forest and grassland conversion	30	75	15	25
4c	Abandonment of managed land	25	50	Same	Same
4d	Soil emissions	50	75	Same	Same
4e	Peat burning (van der Werf et al. 2007)	25	50	15	25
5	Waste	50	50	Same	Same

Source: SNC (2010)

Uncertainty Analysis



	2000	2004	Trend
Current	45.8	38.4	31.0
Improved	22.4	20.0	19.8

Source: SNC (2010)

Concluding Remark

- LULUCF and peat fire is the main source of GHG emission in Indonesia.
- Improvement of emission estimate from peat land will reduce the uncertainty of the emission estimates
- The algorithm for estimating area and depth of peat burnt from hot spot number can be improve by using domain. Further research using more observed dataset is required