Side Event Workshop of COP19

JAPAN Pavilion (Level 1 Zone D Room 47), Warsaw, Poland, 13th November, 2013

“Evaluation of the High-Carbon Reservoirs: Tropical Peatland by Integrated MRV System”

Topics:

1) **Mapping on Carbon Stock and Carbon Flux in Tropical Peatland by Integrated MRV System (Prof. Mitsuru Osaki, Japan)**
2) Introduction to Indonesia Japan - Project for Development of REDD+ Implementation Mechanism (IJ-REDD+ Project) **(Dr. Gun Gun Hidayat, Indonesia)**
3) **Innovating on Wide-ranged Ecology Research by Hyper-sensor (Mr. Kazuyo Hirose, Japan)**
4) **Innovating on Earth/Climate Changing Observation by LCTF (*liquid crystal tunable filter*) on Microsatellite (Prof. Yukihiro Takahashi, Japan)**

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Side Event Workshop of COP19

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"Evaluation of the High-Carbon Reservoirs: Tropical Peatland by Integrated MRV System"

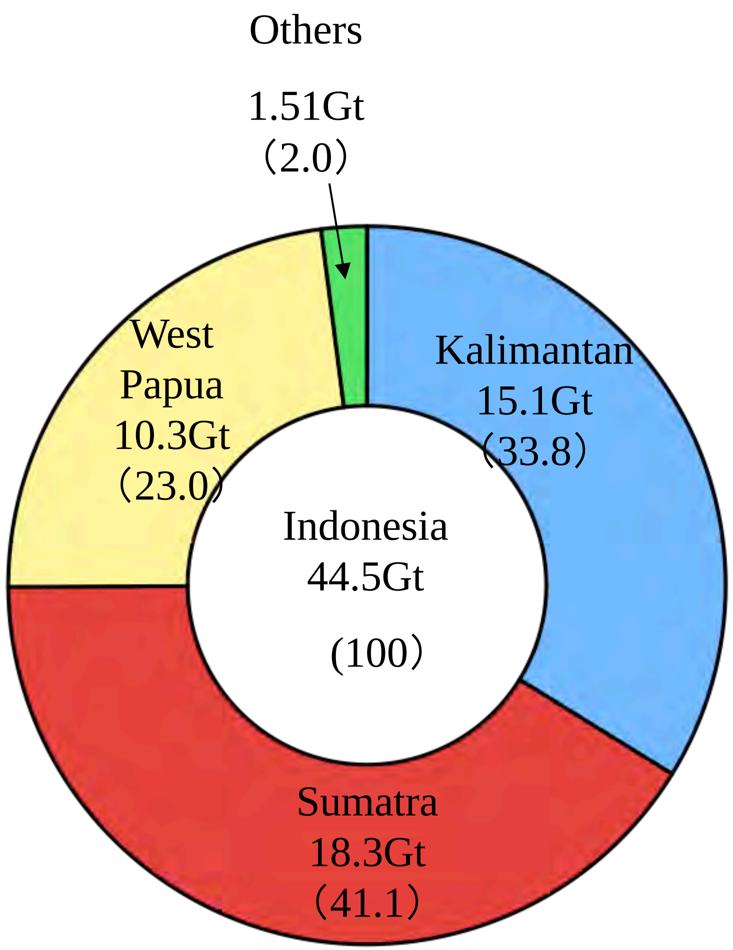
Mapping on Carbon Stock and Carbon Flux in Tropical Peatland by Integrated MRV System

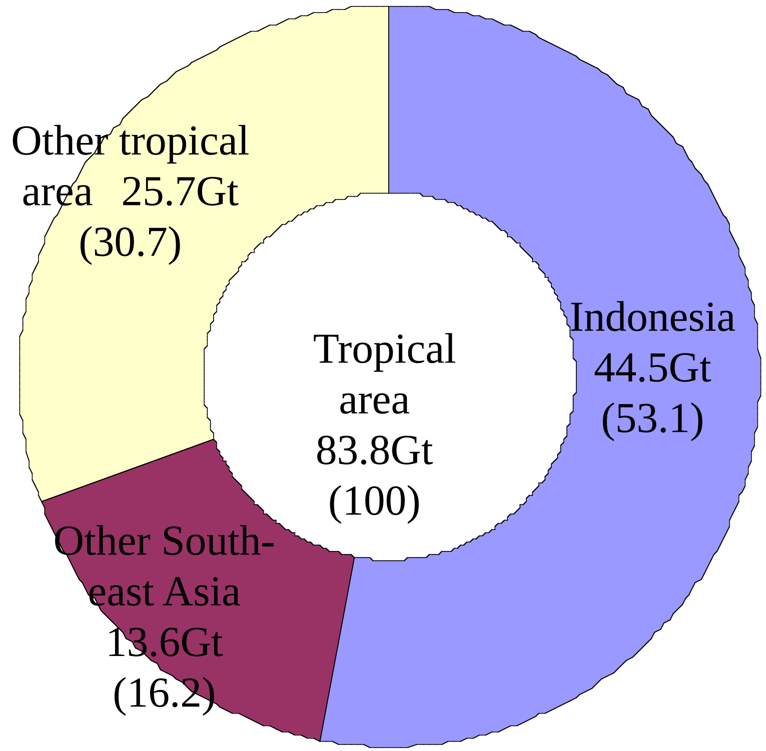
Prof. Mitsuru Osaki,
Research Faculty of Agriculture, Hokkaido University, Japan)

Introduction

Photo from Erianto Indra Putra (UNPAR)

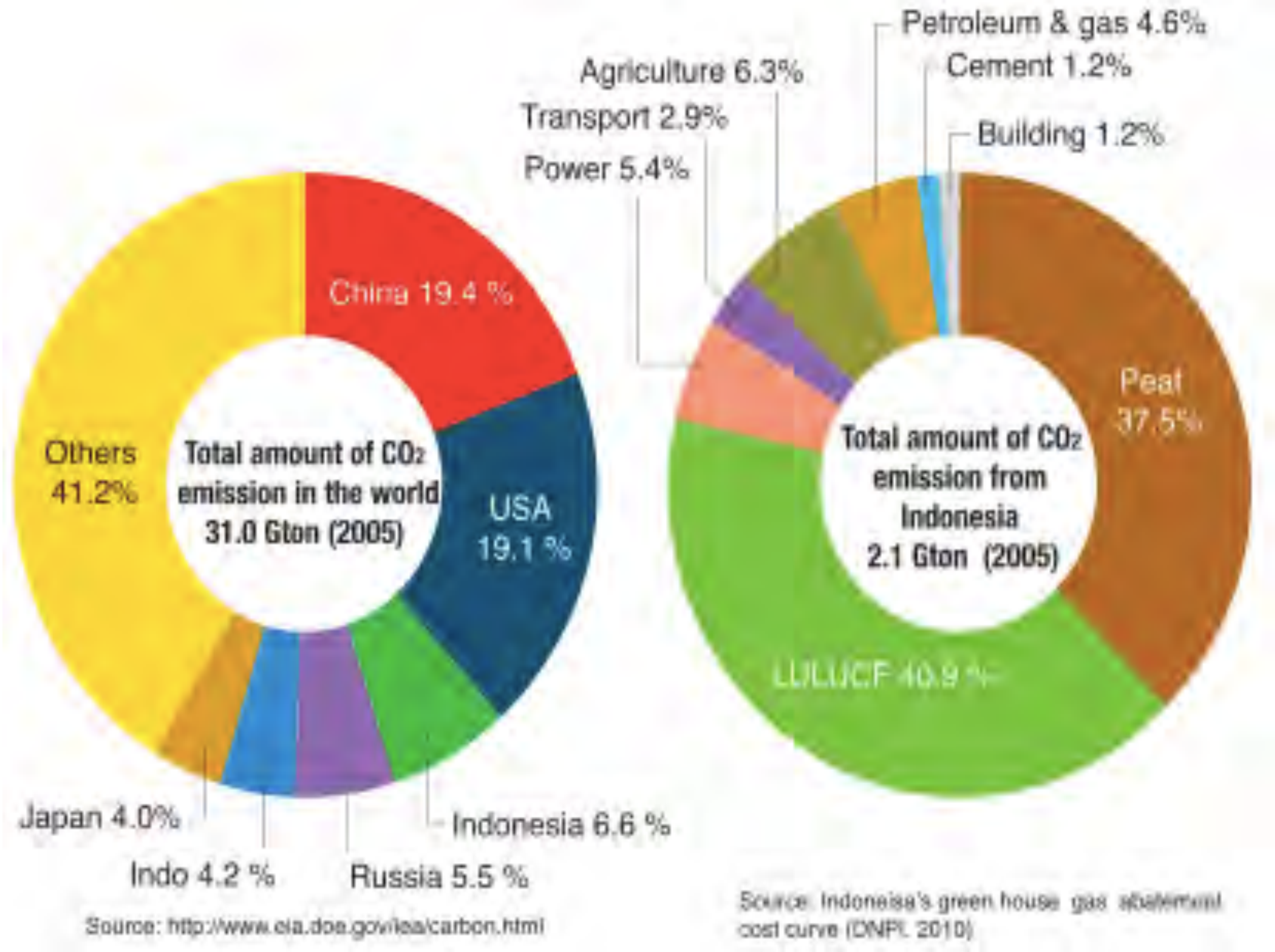
Amount of Carbon in Tropical Peat (GtC (%))



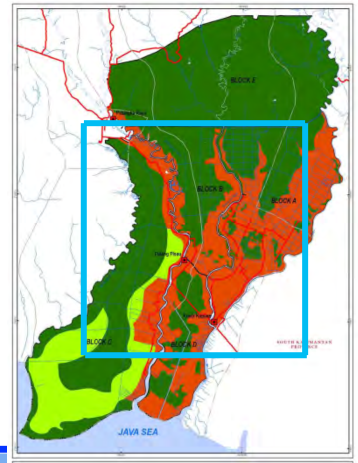


（From Maria Strack ed., 2008: Peatlands and Climate Change. International Peat Society, 223pp.）

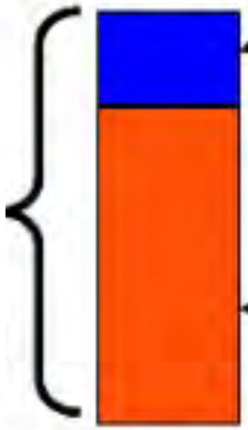
Total amount of CO_2 emission



COP15 Poster



Amount of carbon dioxide emitted annually from the tropical peatland per 1 million ha.
(Indonesia has 20 times the size of this tropical peatland.)



About 13% of the total emission from Japan in 1990.

Amount of carbon dioxide emitted by microbial degradation (About 3 % of the total emission from Japan in 1990.)

Amount of carbon dioxide emitted by peat fire (About 10 % of the total emission from Japan in 1990.)

Project Design for Mapping on Carbon Stock & Emission in Tropical Peatland

Photo from Oriento Indri Putra (UNPAR)

Main Project Sites

→Monitoring was started from 1997

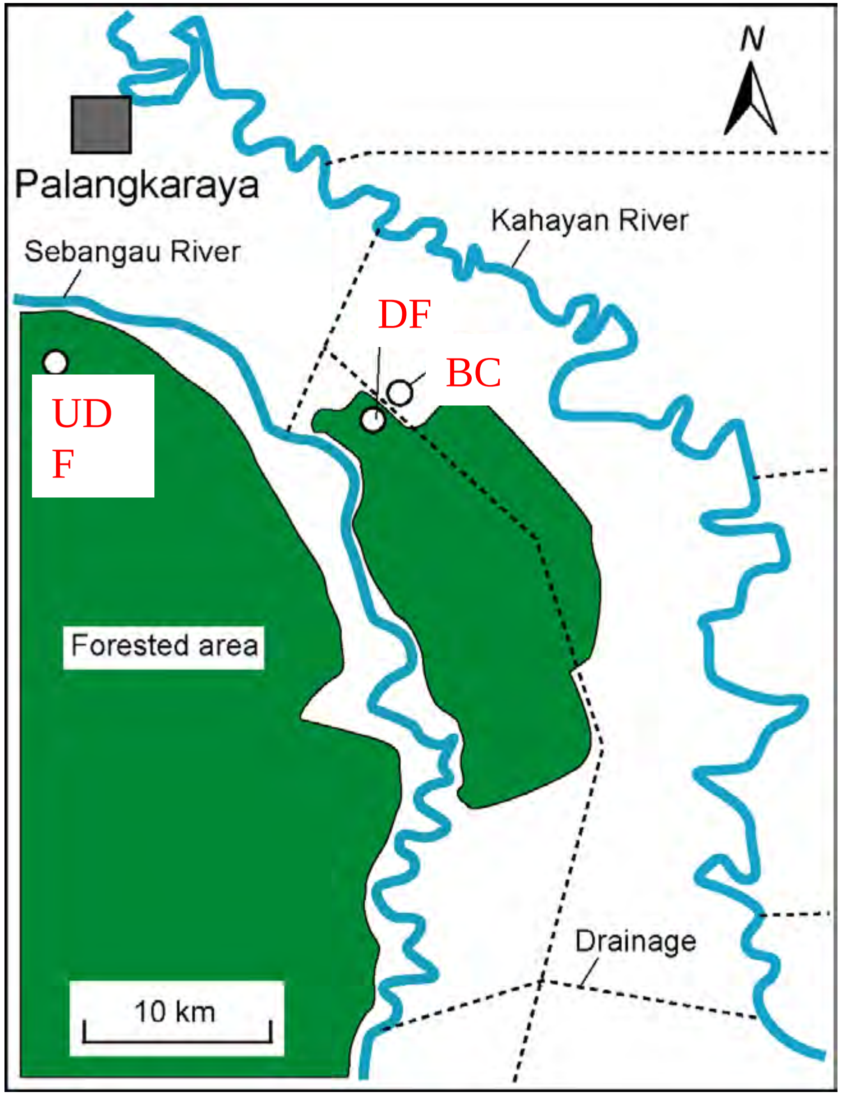
- Central Kalimantan, Indonesia
- Peatland area in Mega Rice Project site

CO_2 observation towers at

UDF : (Un-drained Peat)

DF : (Drained Peat)

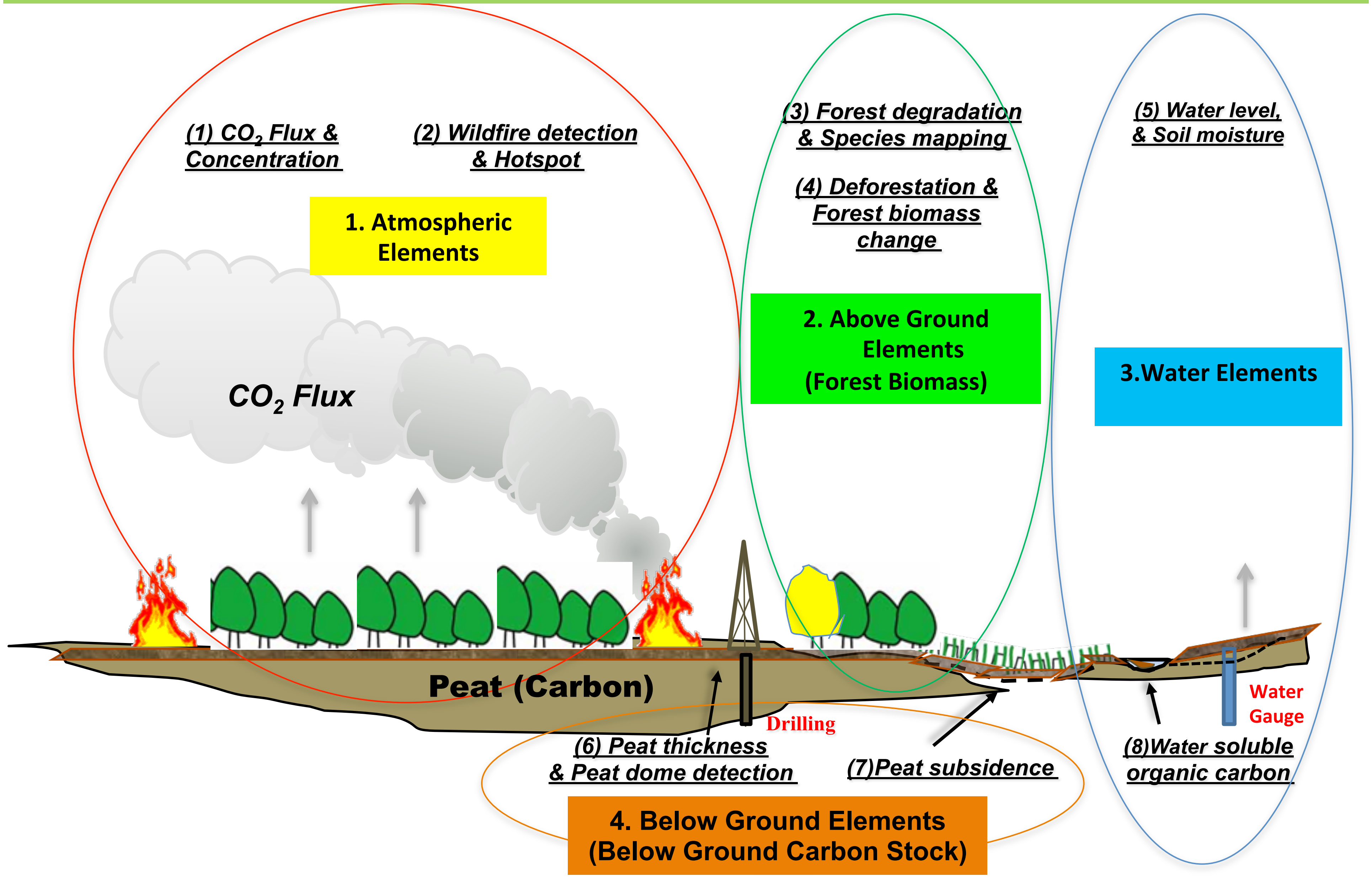
BC : (Burnet Peat)

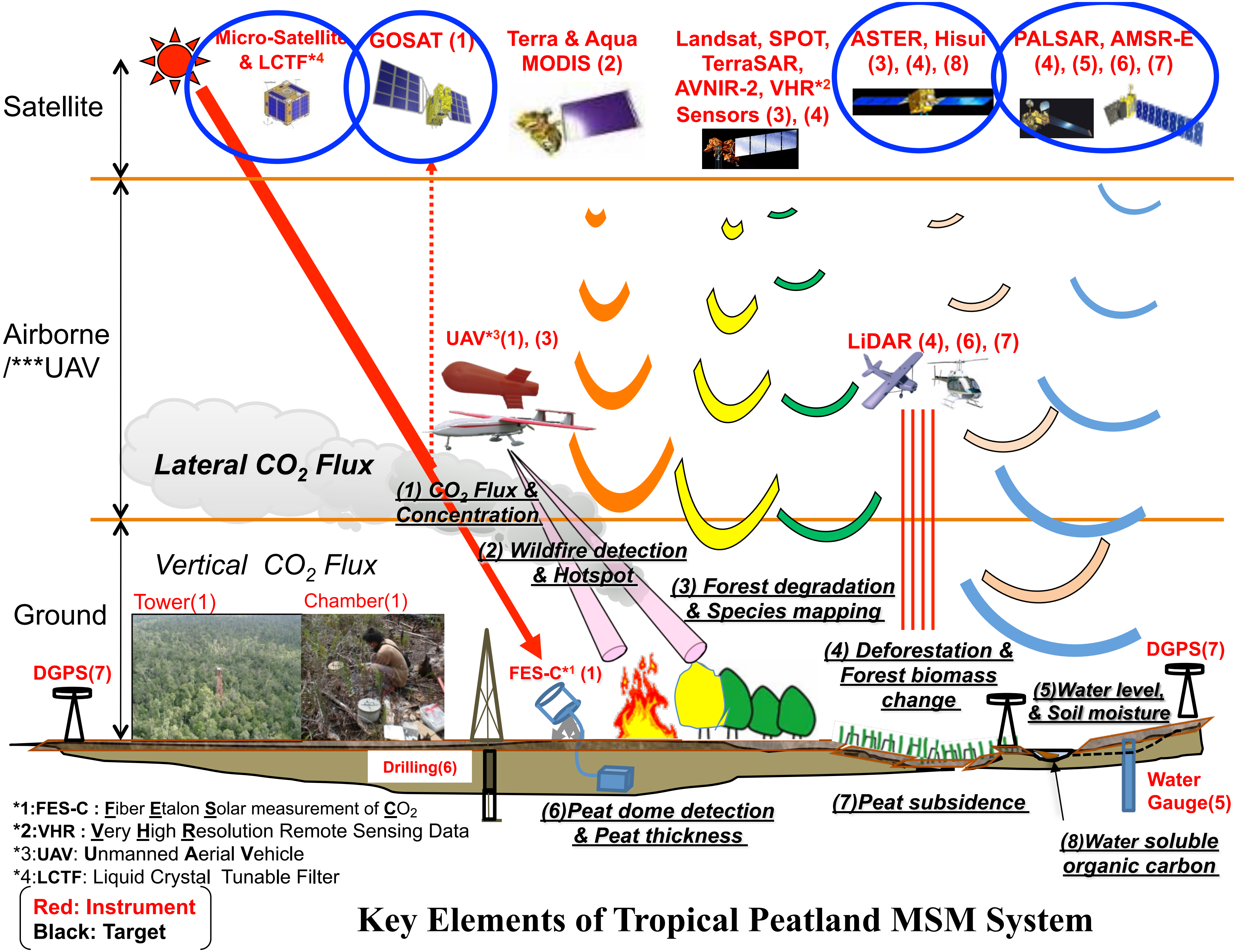


Various Study Topics:

- GHG Flux (CO_2, CH_4, N_2O) measuring
- Fire Detection and Protection
- Water Table Monitoring and Management
- Peatland Ecology
- Soluble Carbon Monitoring
- Peatland Subsidence Monitoring
- etc.

Key elements for integrated Monitoring-Sensing-Modeling (MSM) system of Carbon in peatland





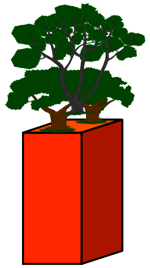
Key Elements of Tropical Peatland MSM System

Integrated Monitoring-Sensing-Modeling (MSM) system:

Carbon Stock

Photo from Erianto Indra Putra (UNPAR)

Peat Thickness Estimation (Shimada Model)



Shallow peat layer

Mineral Soil

Vegetation

(Physiology)

Adjust

Response

(cf. Lugo et al. 1990)

Phenology Classification

Hydroperiod

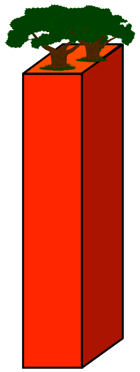
WET

DRY

Greater GWL fluctuation

Temporarily High flood condition

Hypothesis



Deep peat layer

Mineral Soil

Moderate GWL fluctuation

Permanently Wet condition

WET

DRY

Seasonal fluctuation of GWL is different; moderate at deep peat, while greater at shallow peat.

This might reflect the vegetation physiologically.

Idea of Peat Depth Classification

In Tropical Peat Swamp Forest, type of forest stand and its phenology are corresponded to Peat Depth, in terms of seasonal groundwater level fluctuations.

Its difference produce

spatial trends of plant activity in each season.

To detect these,

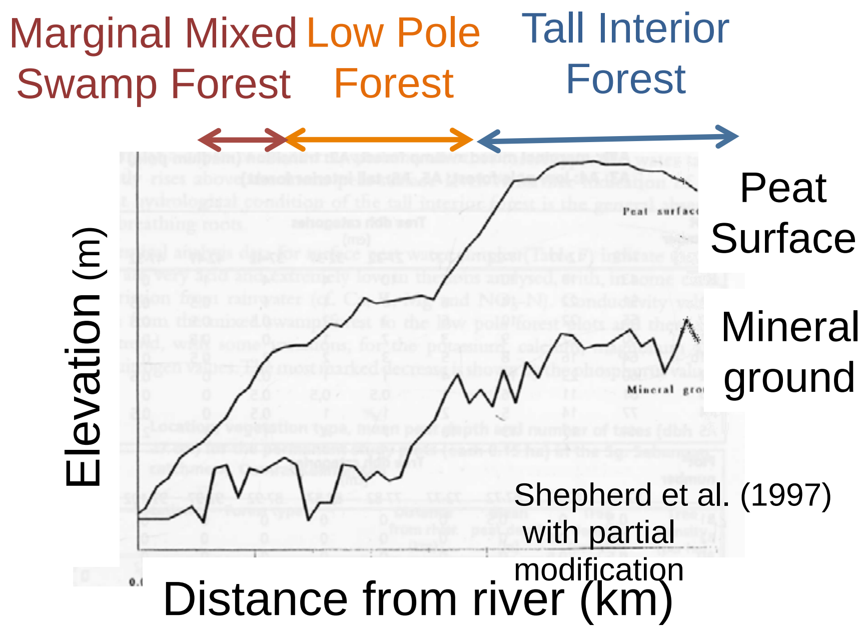
Supervised classification were conducted using **multi-temporal satellite scene** with **Peat Depth Database as training data**.

Index of Plant Activity: **NDVI**

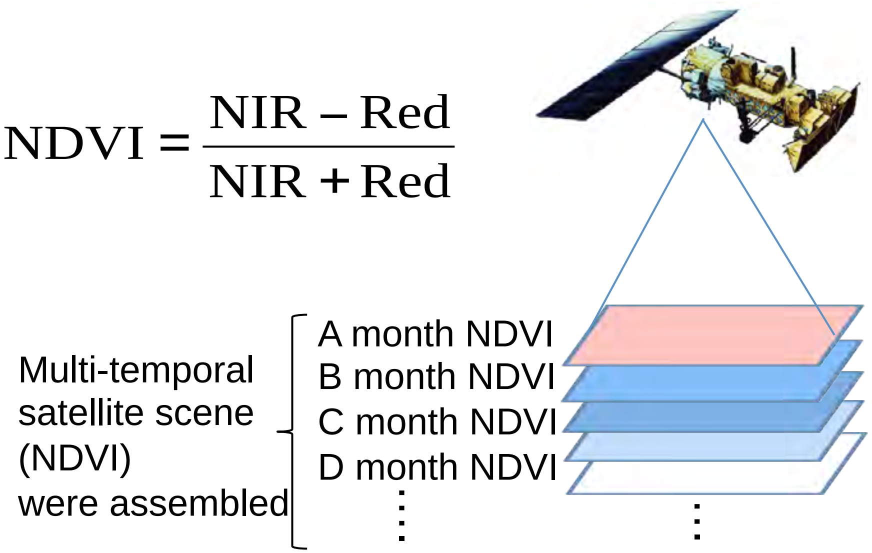
Target Period : **Early 90's**

Relatively Undisturbed Condition

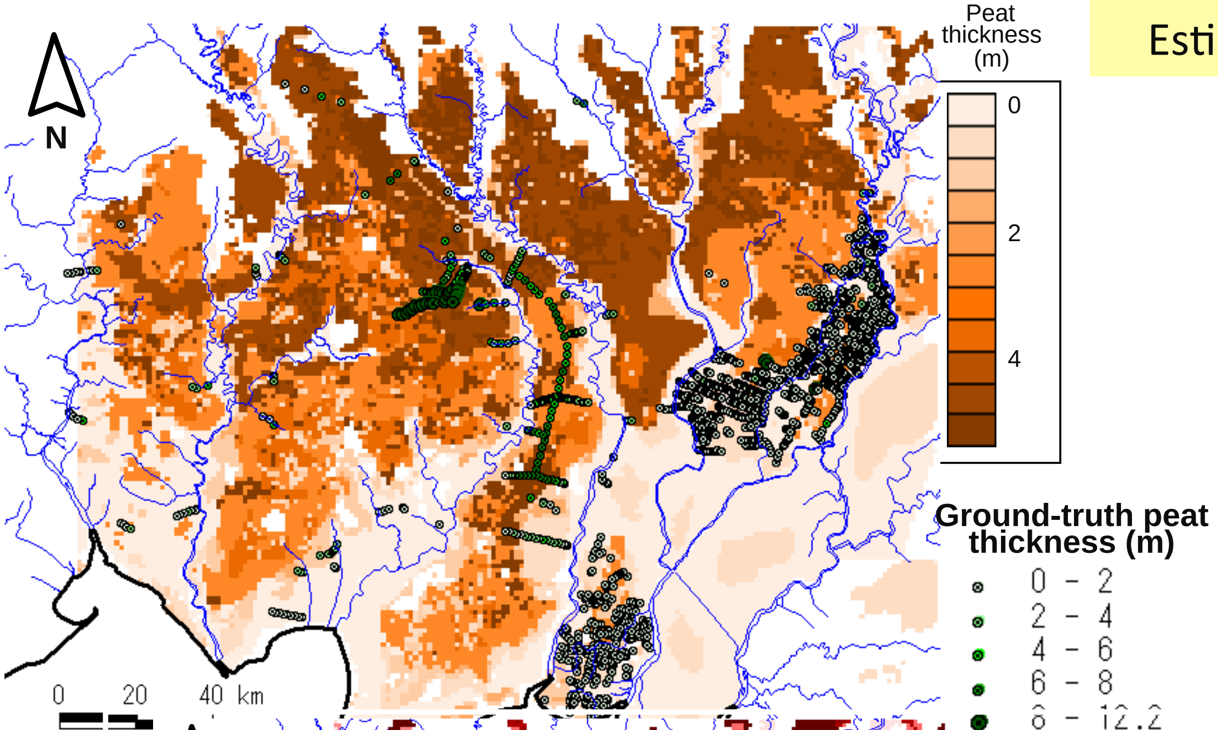
(Before Mega Rice Project)



$$NDVI = \frac{NIR - Red}{NIR + Red}$$



Estimated Map of Peat Thickness

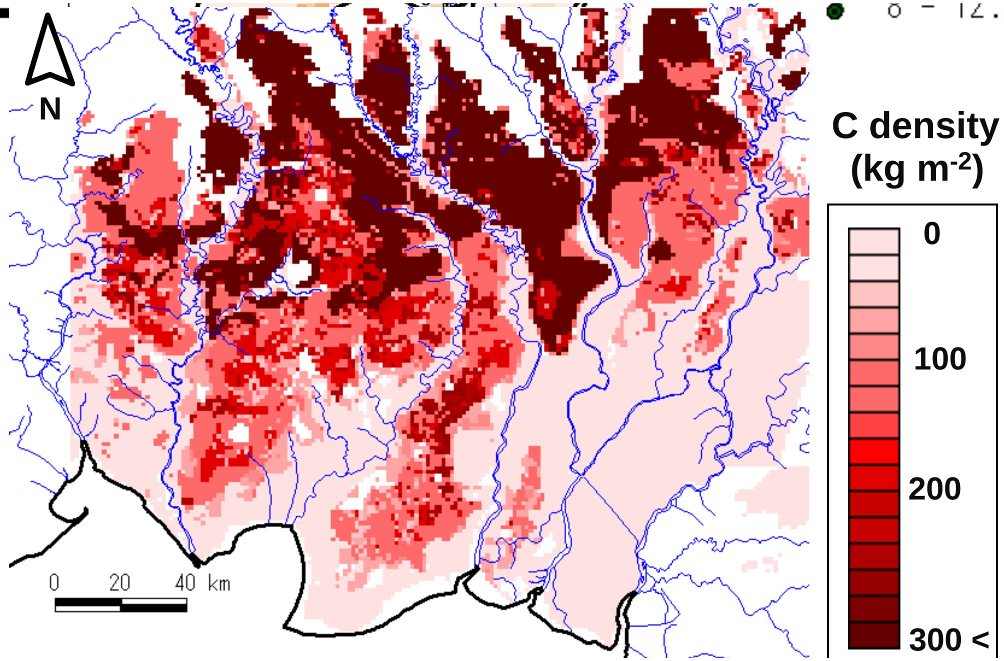


Root Mean Square Error (RMSE)

= 1.64 m

×

Distribution Map of C-density (Shimada et al. 2001)



3.1 Mha

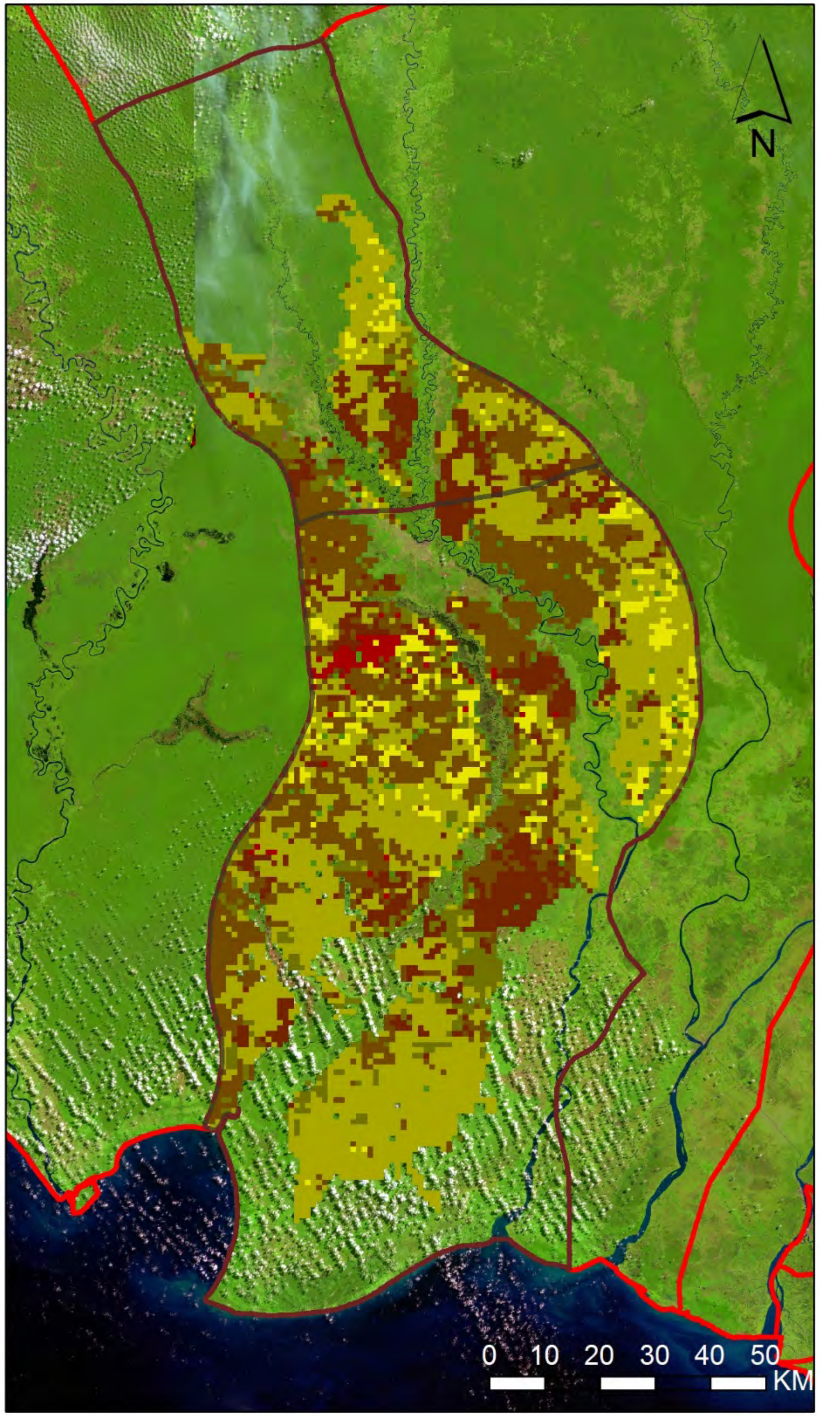
C-pool = 4.2 Gt

1.4 Gt Mha^{-1}

Classified map

- Classification were conducted within the area below
  - 1) Estimated Swamp Forest extent built from Landsat image (1994) and SRTM DEM
  - 2) PalangkaRaya & Pulang Pisau Regency where include core research area of SATREPS

- We are still trying to collect peat drilling data with depth infomation to rebuild the map



category 1 : <=0.5m
category 2 : 0.5–2.0m
category 3 : 2.0–4.0m
category 4 : 4.0–6.0m
category 5 : 6.0–8.0m
category 6 : 8.0m<

Integrated Monitoring-Sensing-Modeling (MSM) system:

Carbon Flux by Oxidation (directly measurment)

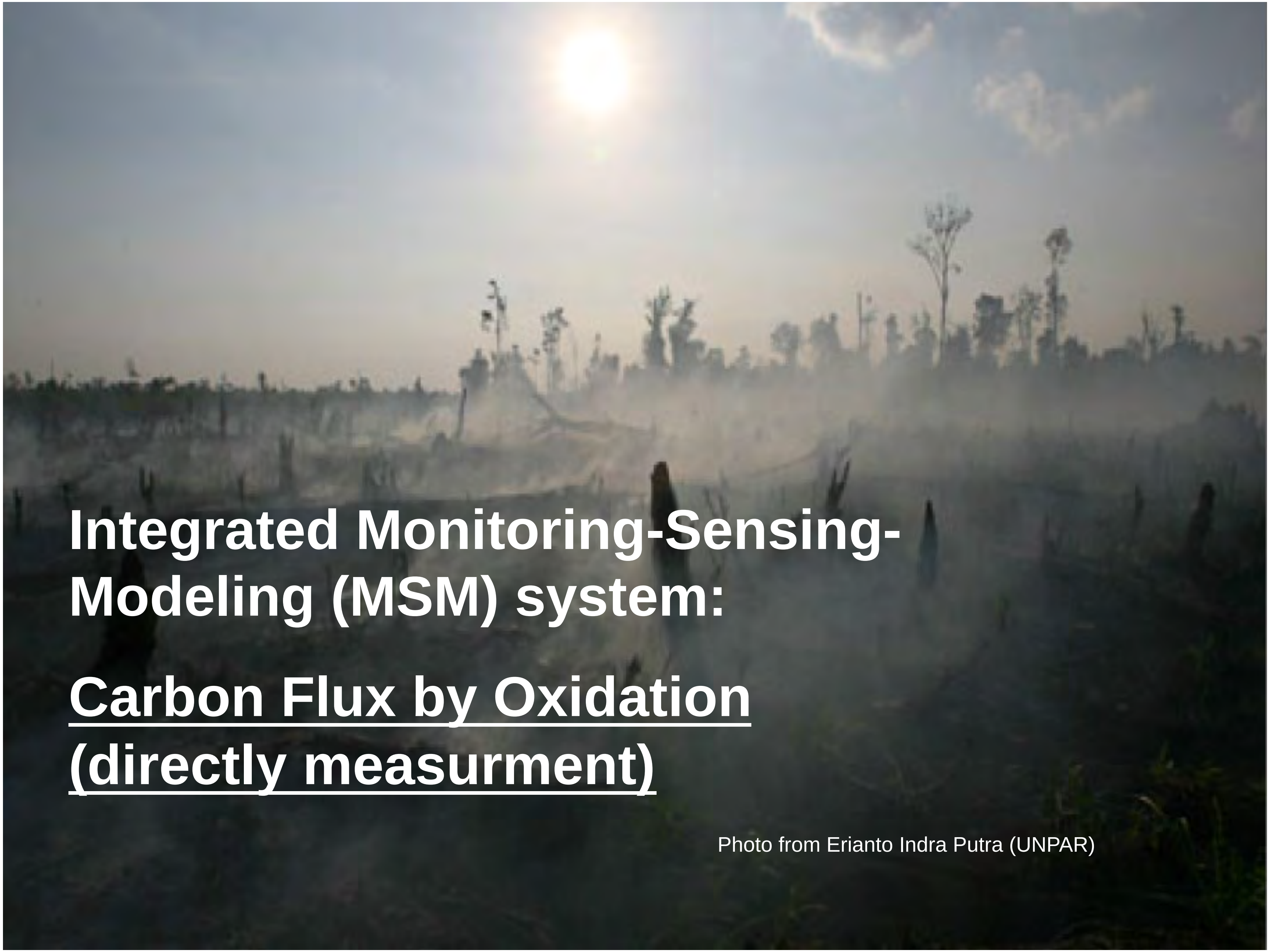
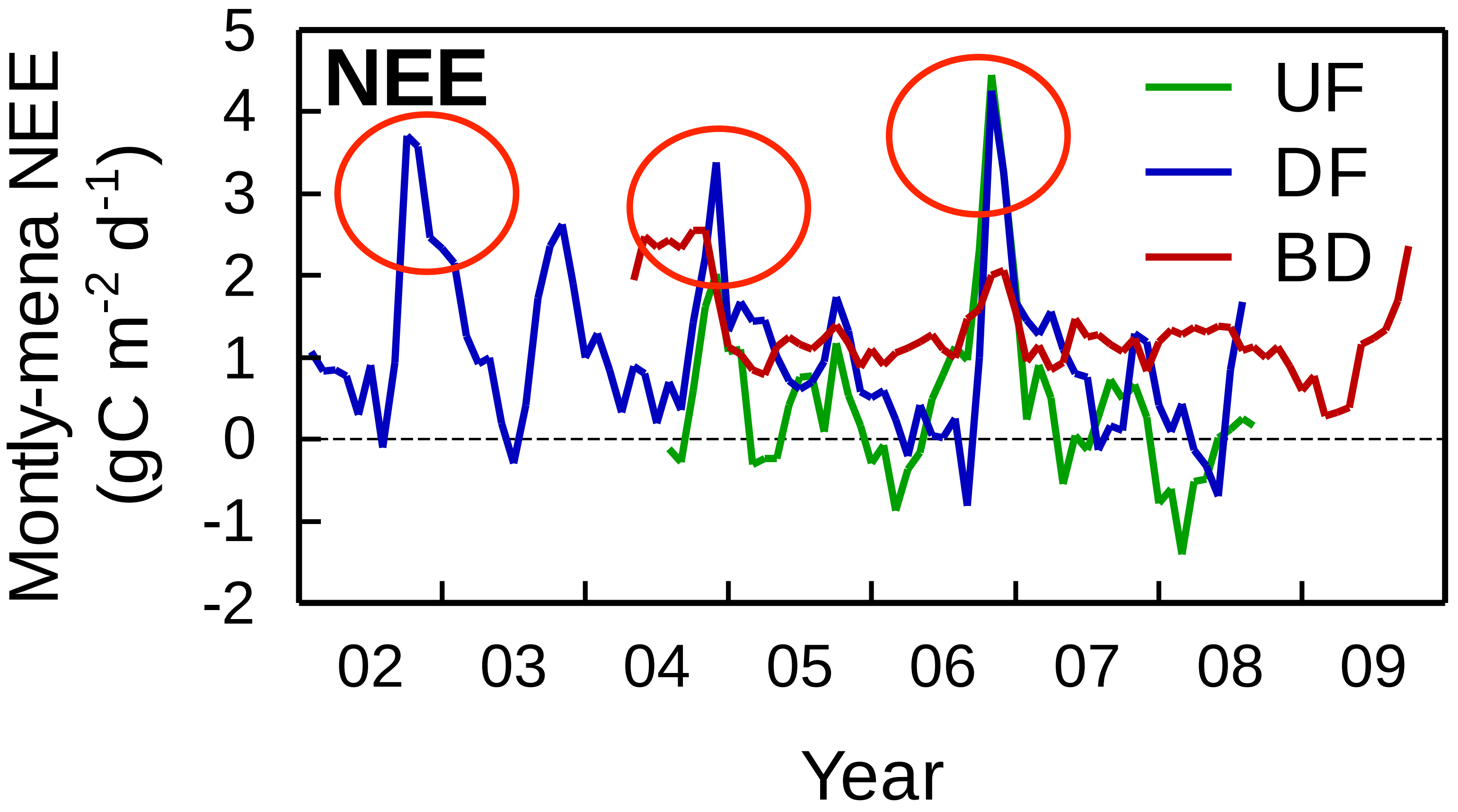


Photo from Erianto Indra Putra (UNPAR)

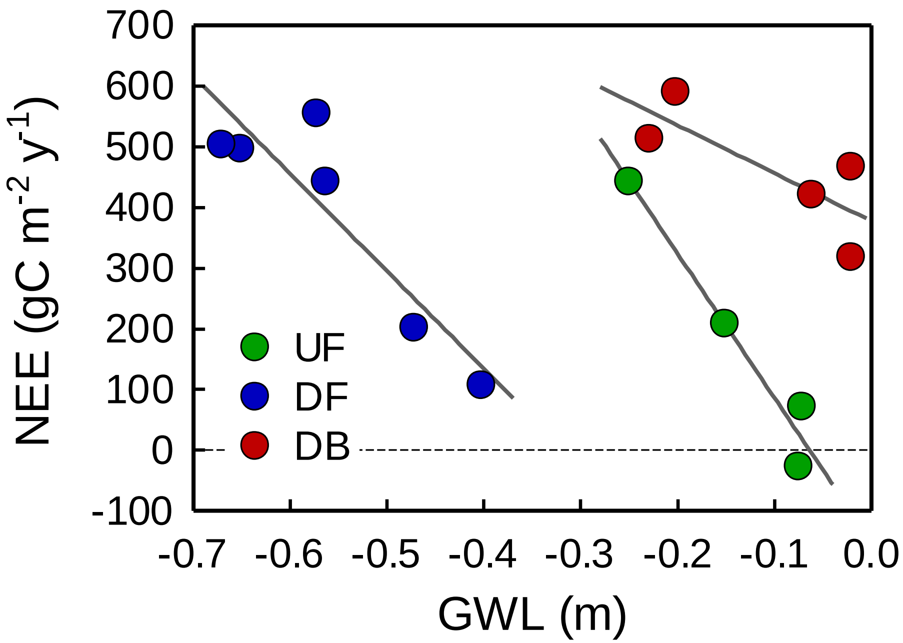
Seasonal variation in net CO_2 exchange (NEE)

NEE = RE - GPP



Large increases were found in the dry seasons of 2002, 2004 and 2006, El Niño years, because of shading by dense smoke and the enhancement of oxidative peat decomposition due to low GWL.

Annual NEE vs. annually mean GWL



Hirano et al., 2012

A negative linear relationship for each site
→ Enhancement of oxidative peat decomposition under low GWL

Slope: UF > DF > DB → Undisturbed peatland is more sensitive.

Annually mean GWL is a robust indicator to assess annual CO_2 balance.

Oxidative peat decomposition vs. GWL in burnt site

With 6 automated chambers

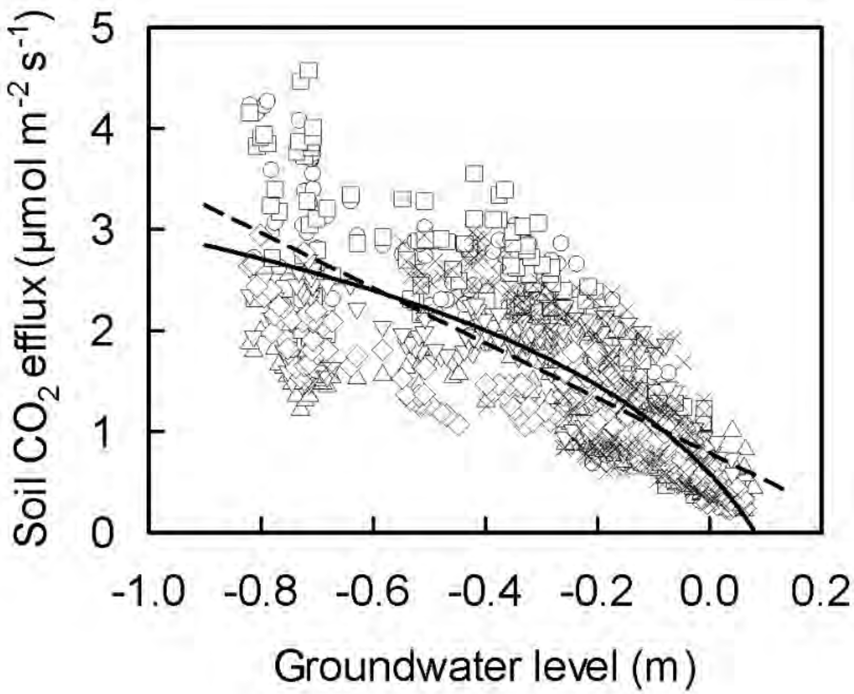
From 2004 to 2005

Fires

Little vegetation

→ Heterotrophic respiration (oxidative peat decomposition)

Peat decomposition (RS)



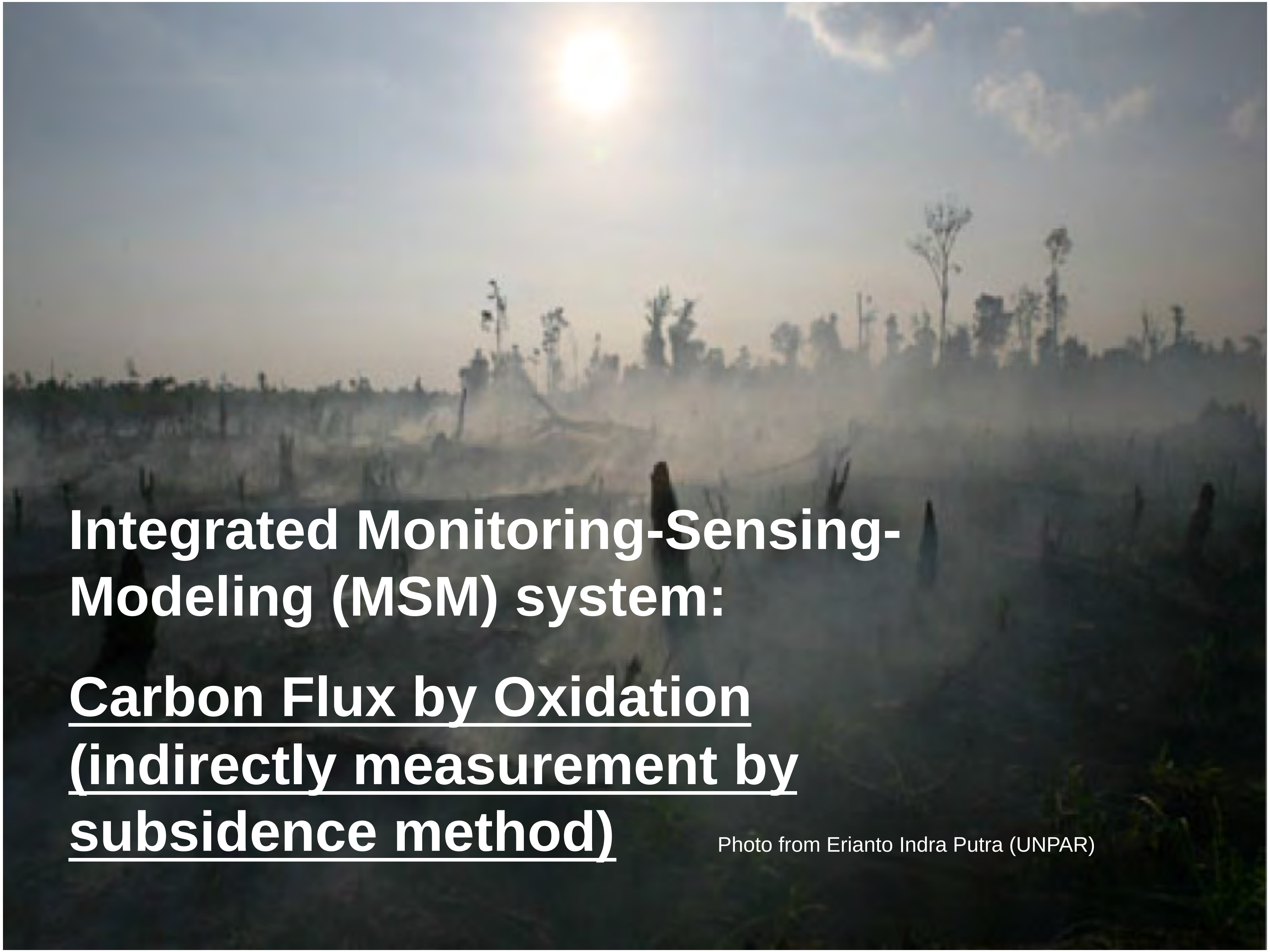
From a simple relationship,

GWL lowering by 0.1 m

↓

Additional peat decomposition of 89 gC m^{-2} y^{-1}

Hirano et al., 2013 (GCB)



Integrated Monitoring-Sensing-Modeling (MSM) system:

Carbon Flux by Oxidation (indirectly measurement by subsidence method)

Photo from Erianto Indra Putra (UNPAR)

Subsidence and GHG emissions

Photo: Jyrki J, Johor Bahru, Malaysia