SBSTA 38 Research Dialogue
-Developments in research activities relevant to the needs of the Convention-
4 June 2012, 15:00 - 18:00, Maritim Hotel, Bonn, Germany

Plenary II: Emerging scientific findings: Ecosystems and GHG emissions and removals from sources, sinks and reservoirs, including from terrestrial ecosystems

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Estimation of carbon and their fluxes in tropical peatlands: Results from a Japan-Indonesia joint project

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Research Faculty of Agriculture, Hokkaido University, Japan

SATREPS:
Science and Technology Research Partnership for Sustainable Development
funded by
1) the Japan Science and Technology Agency (JST) and
2) the Japan International Cooperation Agency (JICA).

SATREPS is a Japanese government program that promotes international joint research targeting global issues, involving partnerships between **researchers in Japan and researchers in developing countries**.

SATREPS projects are expected to lead to outcomes with potential for practical utilization, and to enhance research capacity **in the developing country**.

SATREPS For the Earth, For the Next Generation

Japan Science and Technology Agency

http://www.jst.go.jp/global/english/about.html

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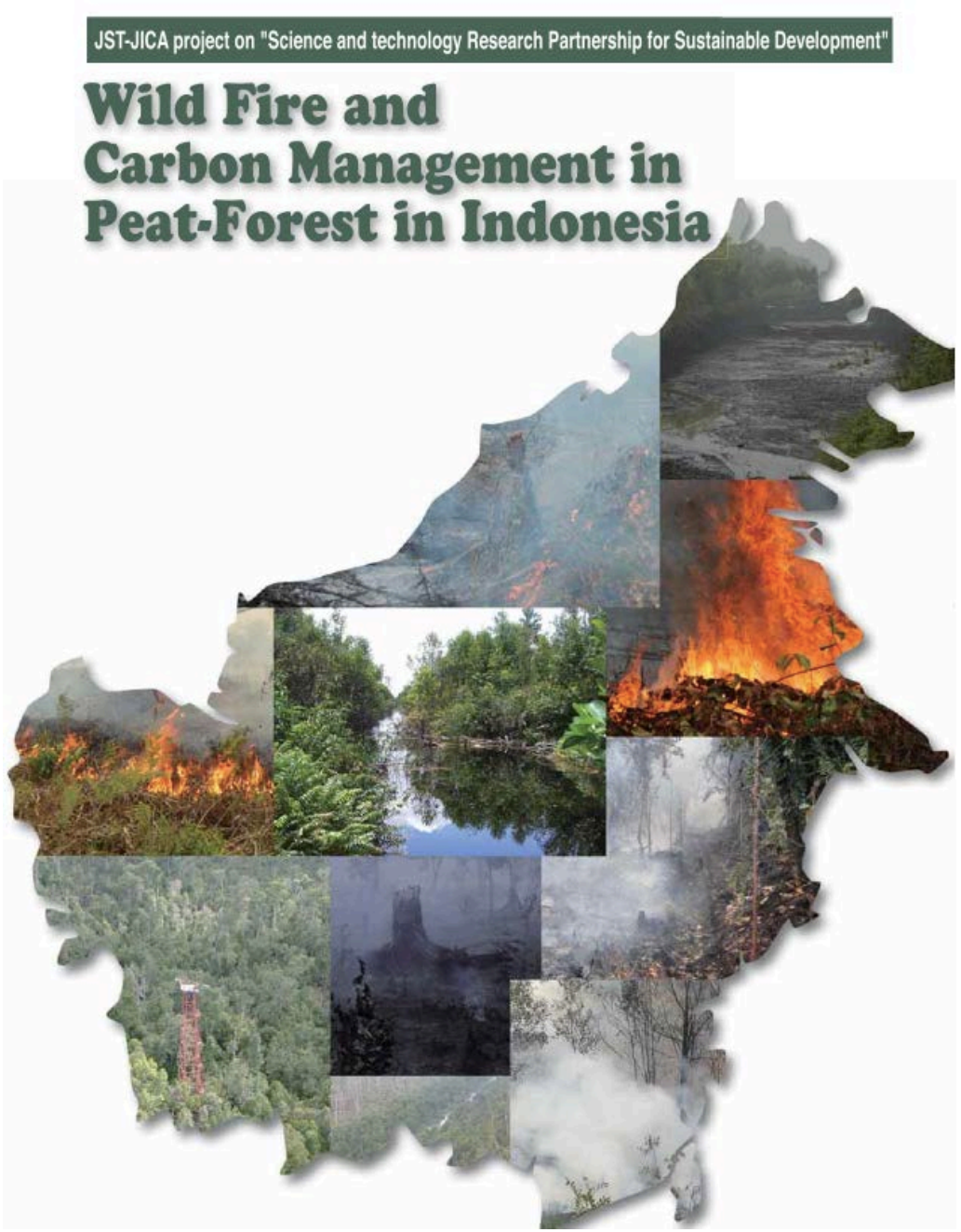
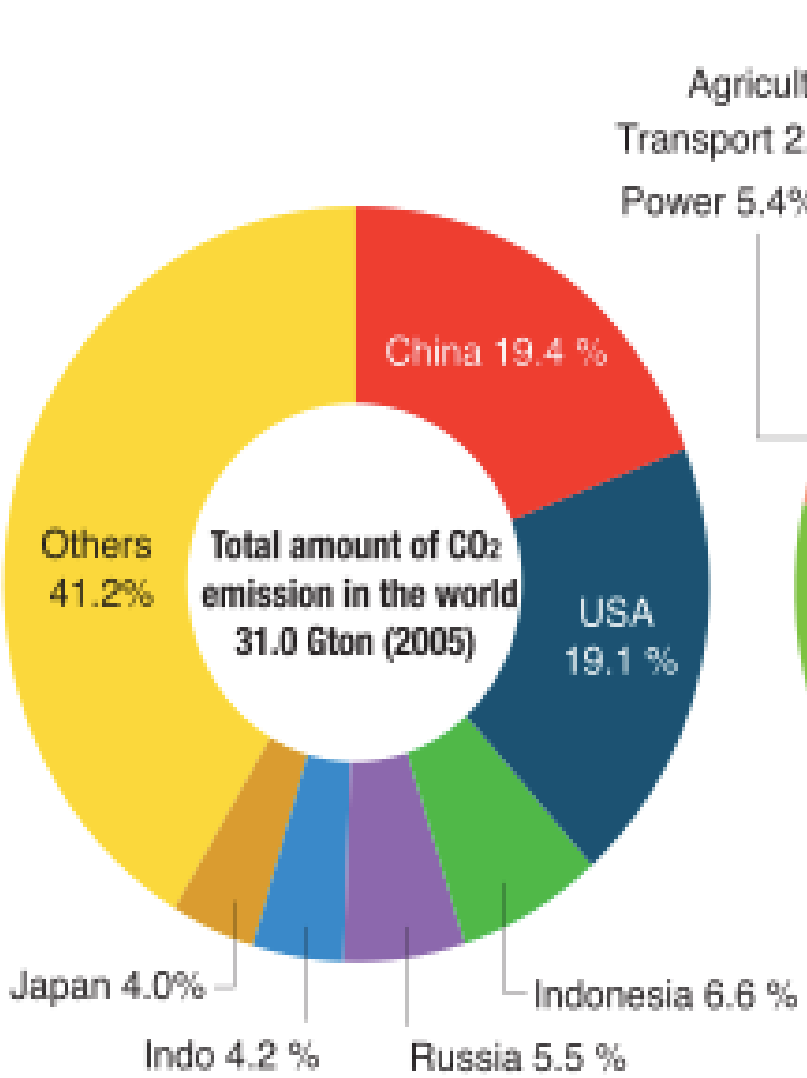
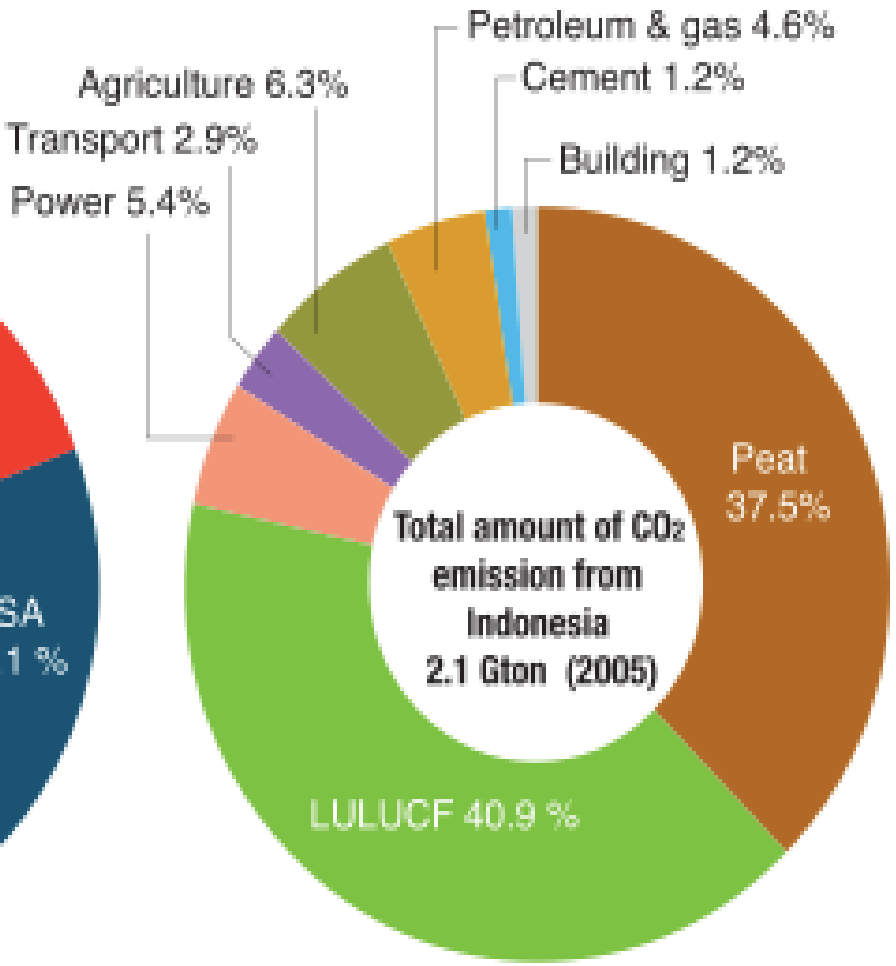


http://www.census.hokudai.ac.jp/html/JSTJICA/index.html

Total amount of CO_2 emission

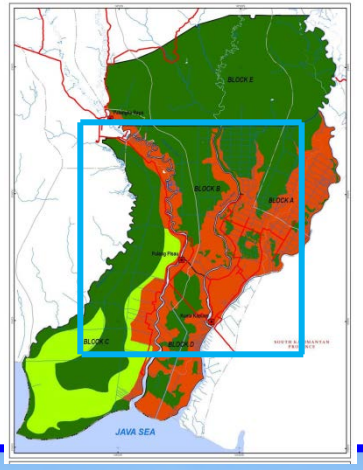


Source: http://www.eia.doe.gov/iea/carbon.html



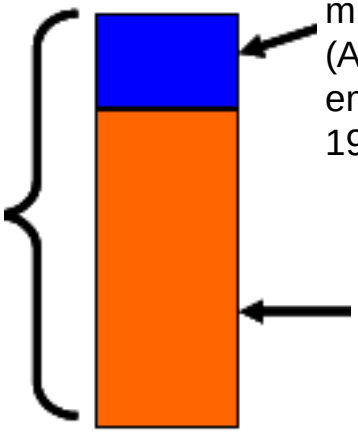
Source: Indonesia's green house gas abatement cost curve (DNPI, 2010)

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.)

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



About 13% 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.)

Main Project Sites

→Monitoring was started from 1997

Central Kalimantan, Indonesia

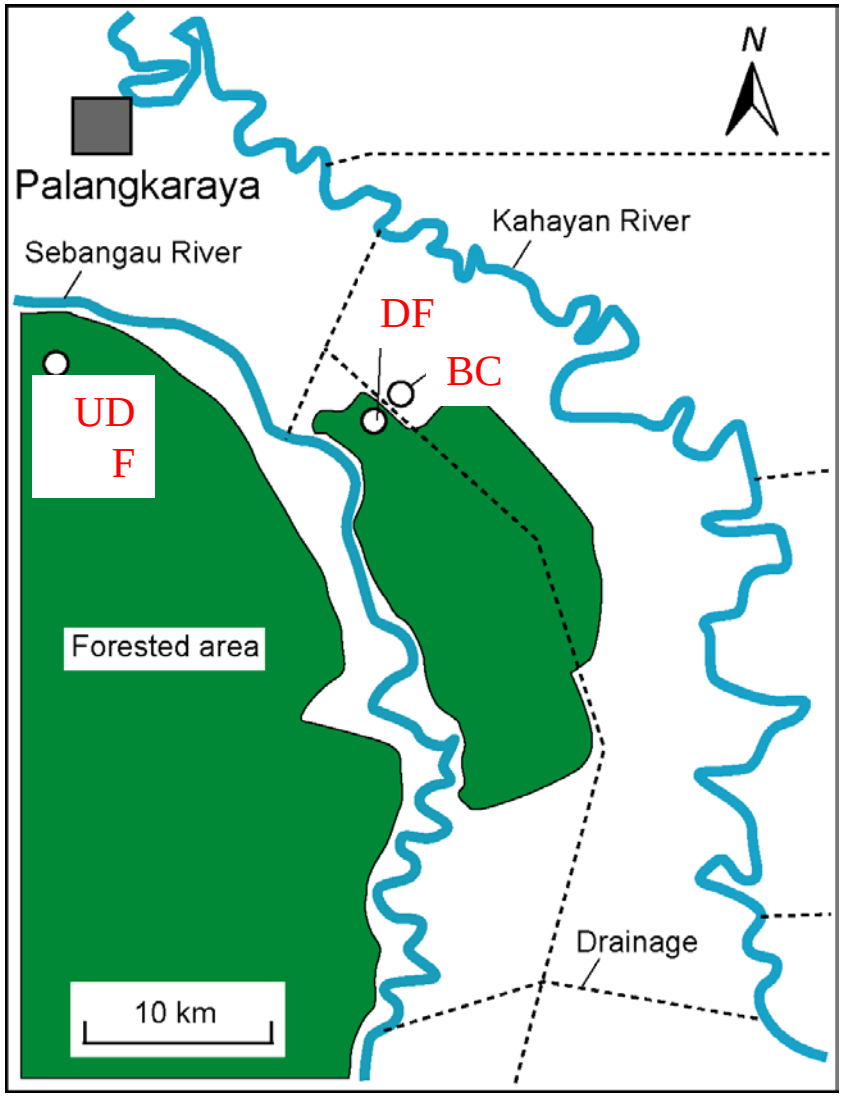
Peatland area in Mega Rice Project site

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.

Collaboration with Indonesia Institutes

Implementation Agency

-National Standardization Agency（BSN）

Executing Agencies

-Forestry Research and Development Agency (FORDA)

-Indonesian Institute of Sciences (LIPI)

-Indonesian National Institute of Aeronautics and Space (LAPAN)

-University of Palangka Raya (UNPAR)

-State Ministry of Research and Technology (RISTEK)

Collaboration Agencies

-National Council for Climate Change (Dewan Nasional Perubahan Iklim, DNPI)

-The Agency For the Assessment and Application Technology (Badan Pengkajian Dan Penerapan Teknologi, BPPT)

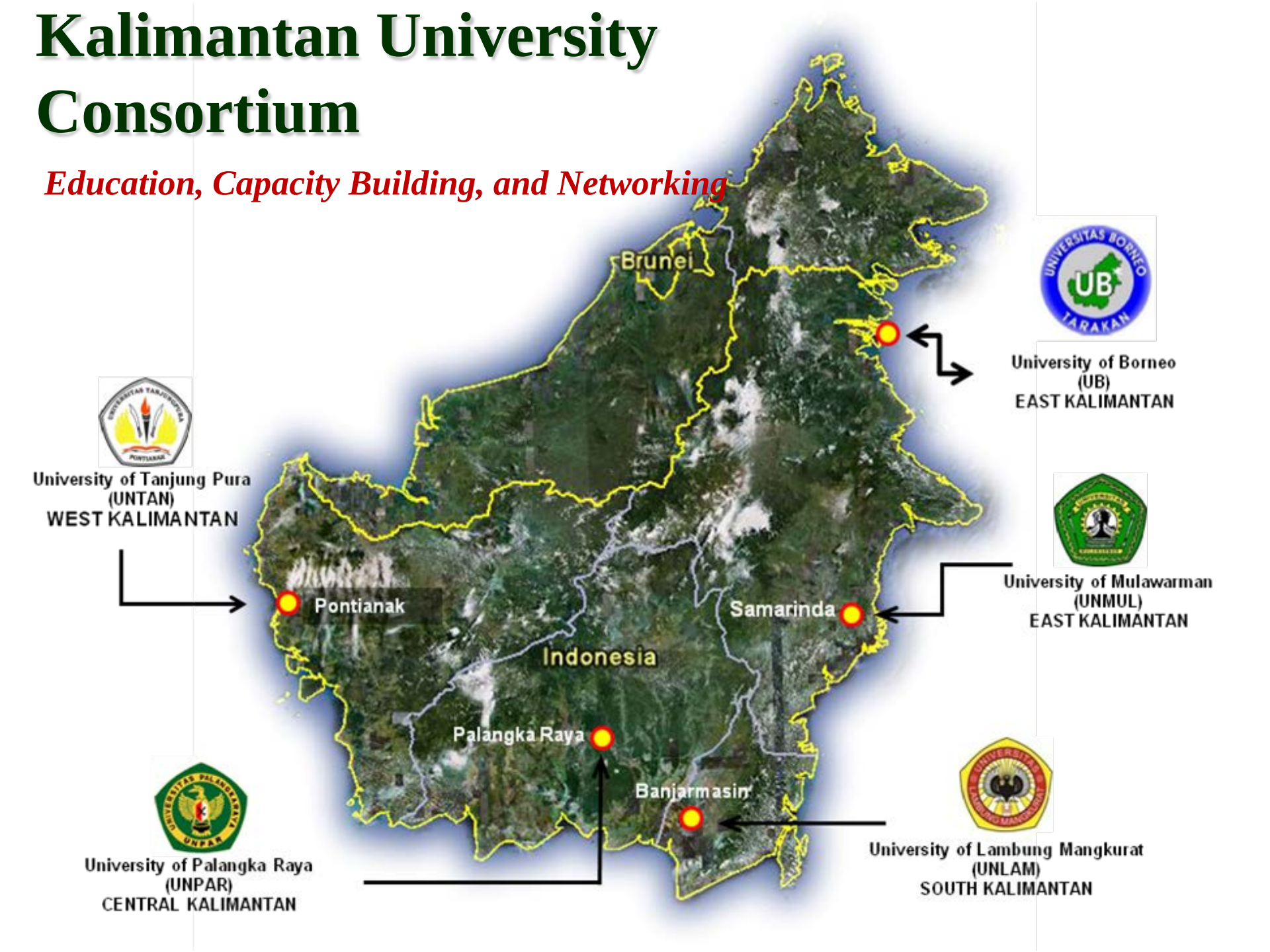
-Ministry of Energy and Mineral Resources (ESDM)

Collaboration University

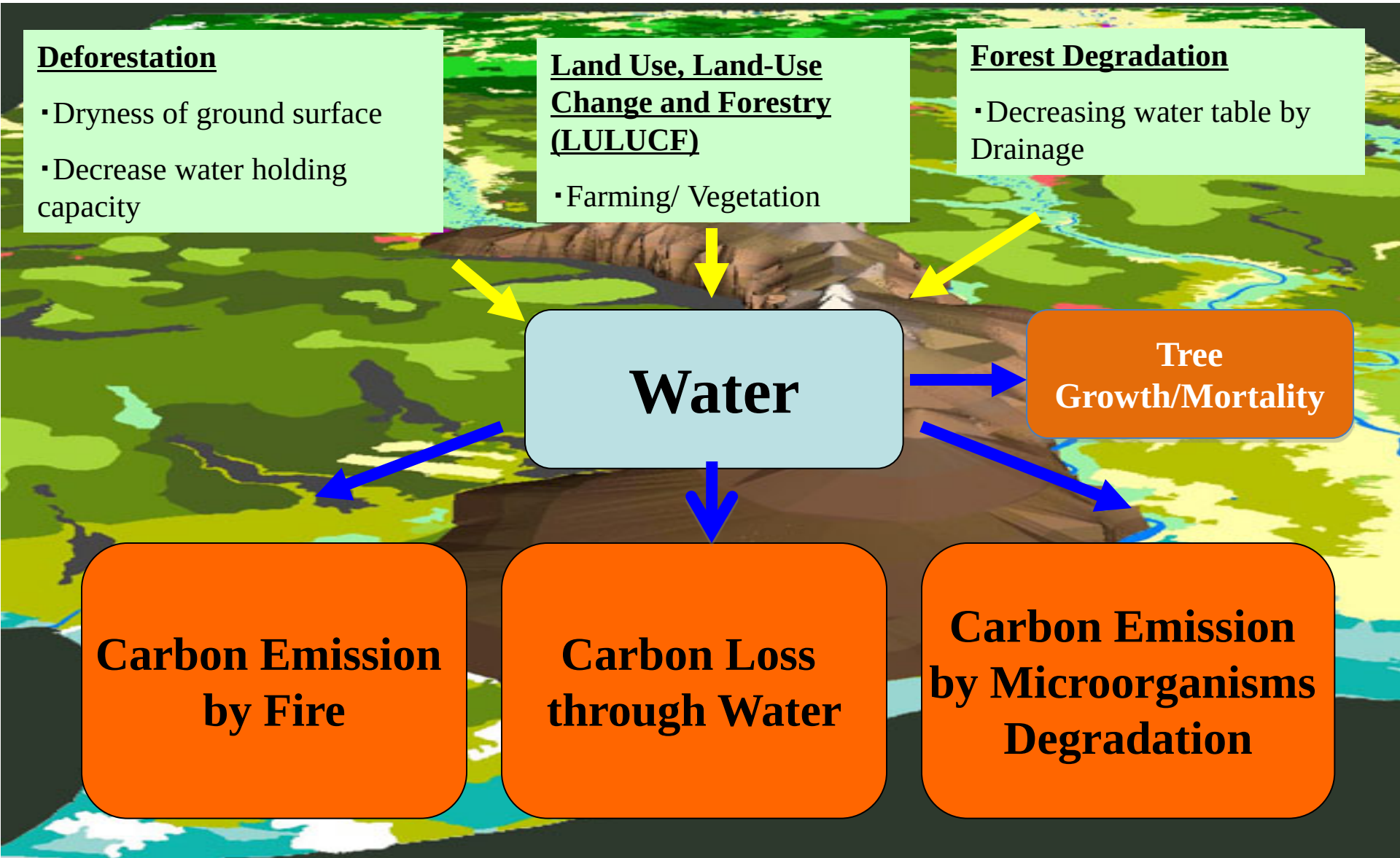
ITB, IPB, UGM, UI

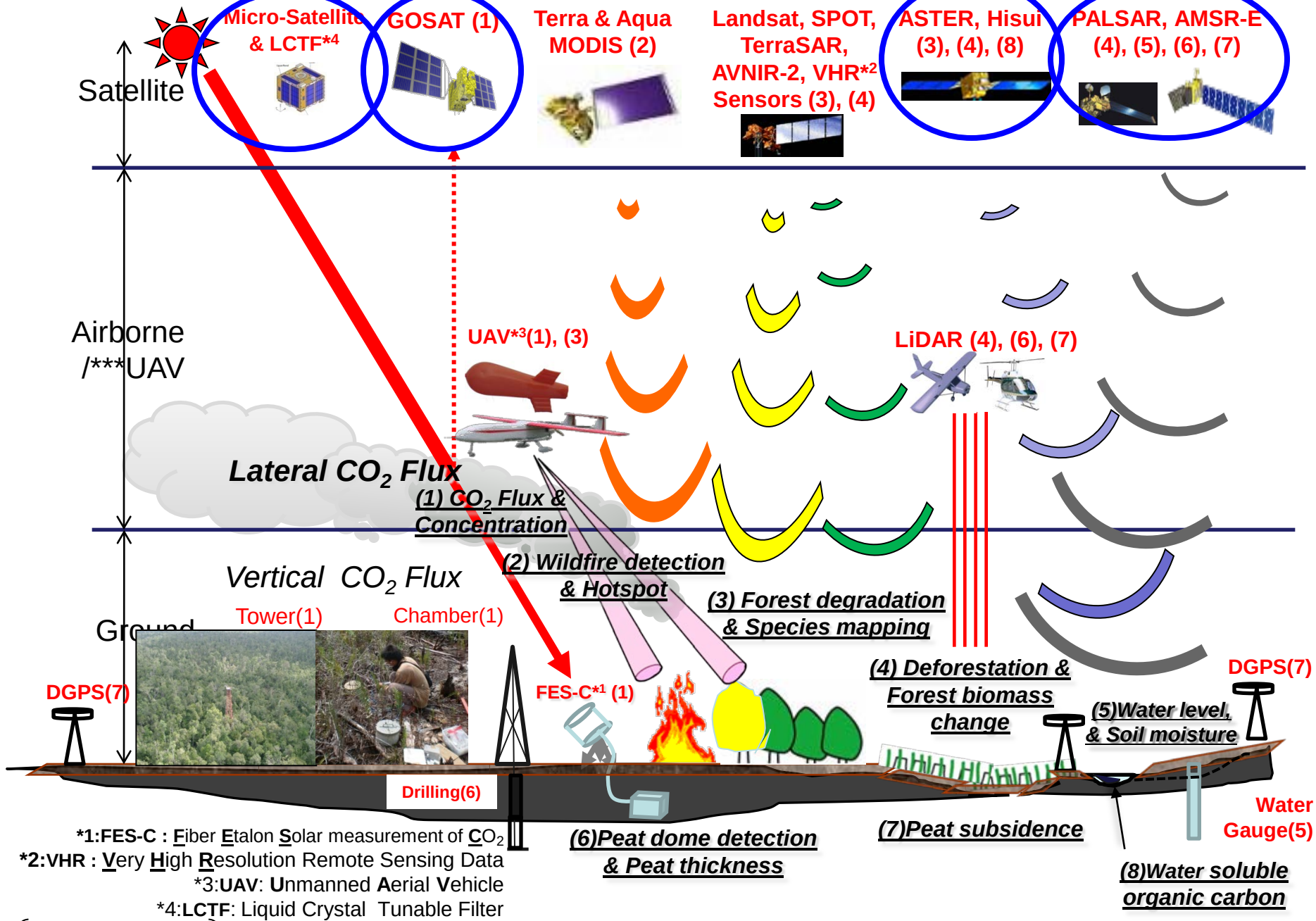
Kalimantan University Consortium

Education, Capacity Building, and Networking



What Factors Regulate Carbon in Tropical Peat?





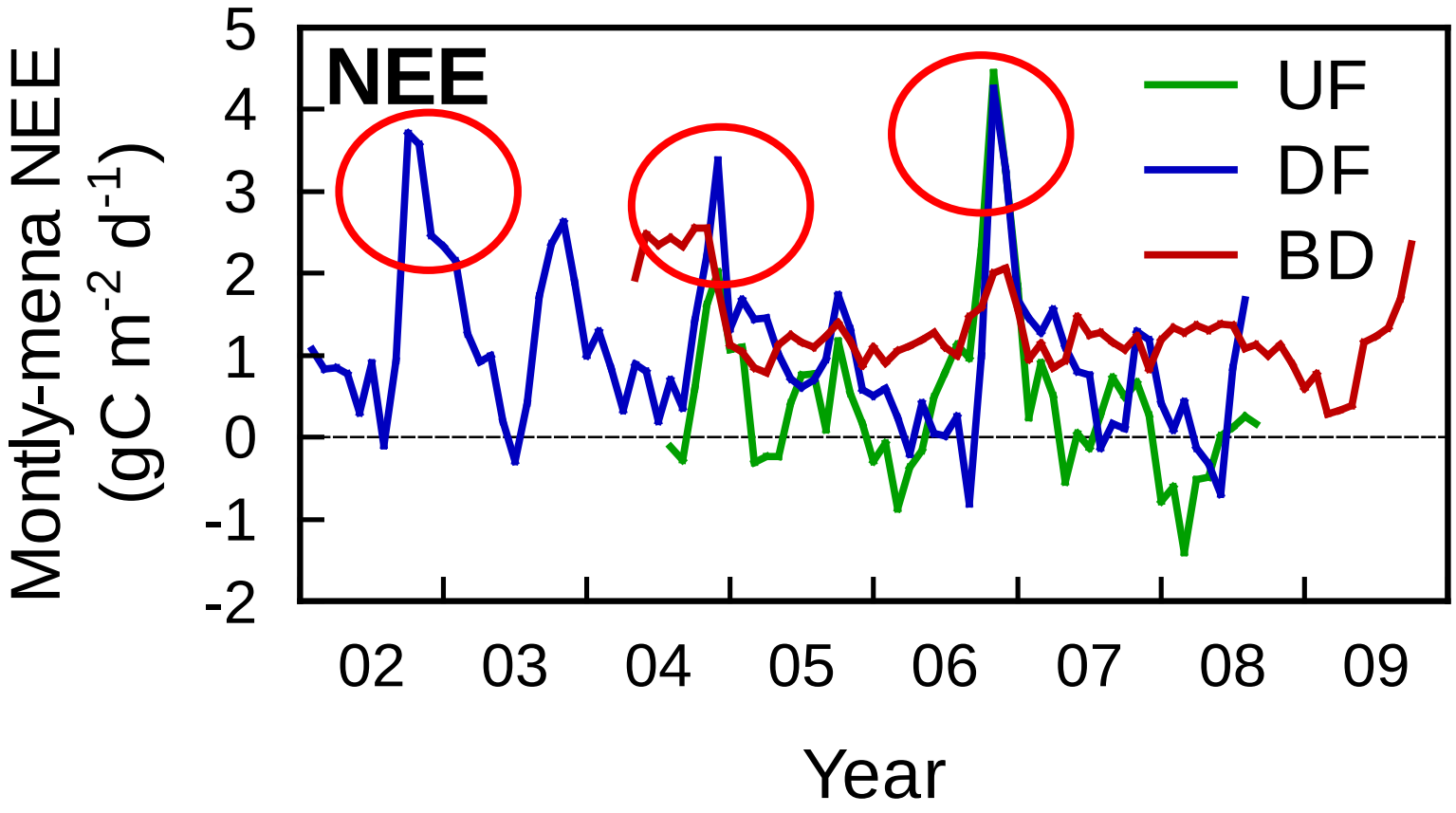
*1:FES-C : Fiber Etalon Solar measurement of CO_2
*2:VHR : Very High Resolution Remote Sensing Data
*3:UAV: Unmanned Aerial Vehicle
*4:LCTF: Liquid Crystal Tunable Filter

Red: Instrument
Black: Target

Key Elements of Tropical Peatland MRV System

Seasonal variation in net CO_2 exchange (NEE)

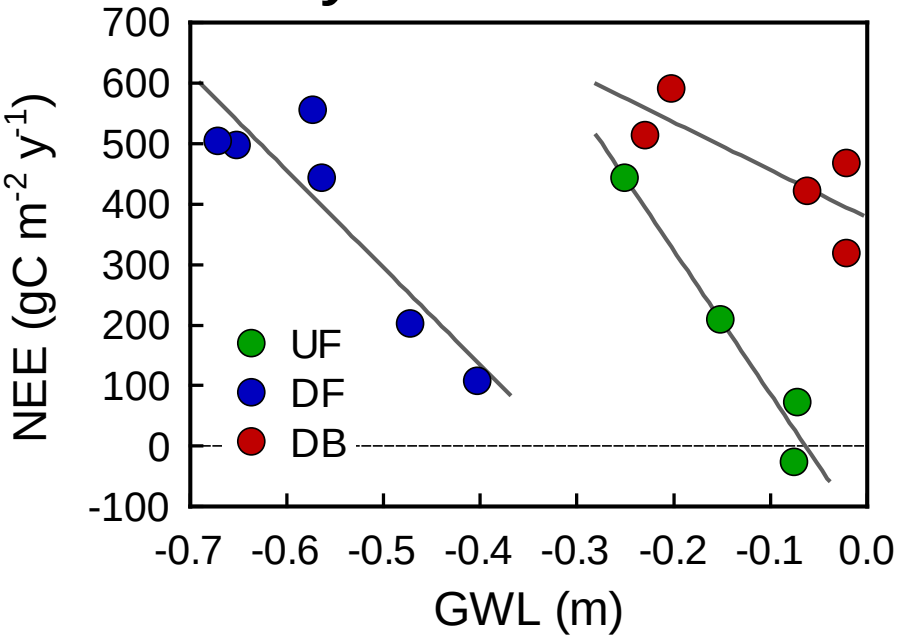
NEE = RE - GPP



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

Hirano Model

Annual NEE vs. Annually Mean GWL



UF *NEE*=-2376*GWL*-151

DF *NEE*=-1609*GWL*-510

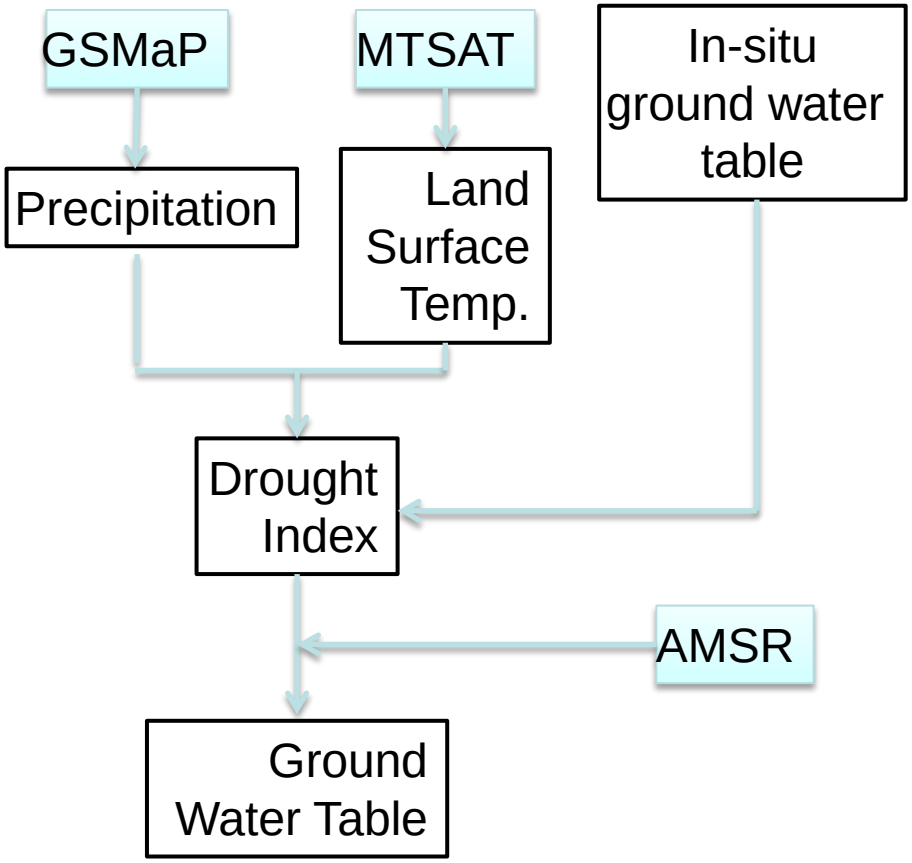
DB *NEE*=-789*GWL*-378

NEE: Net Ecosystem CO2 Exchange

Hirano et al.(2012), GCB

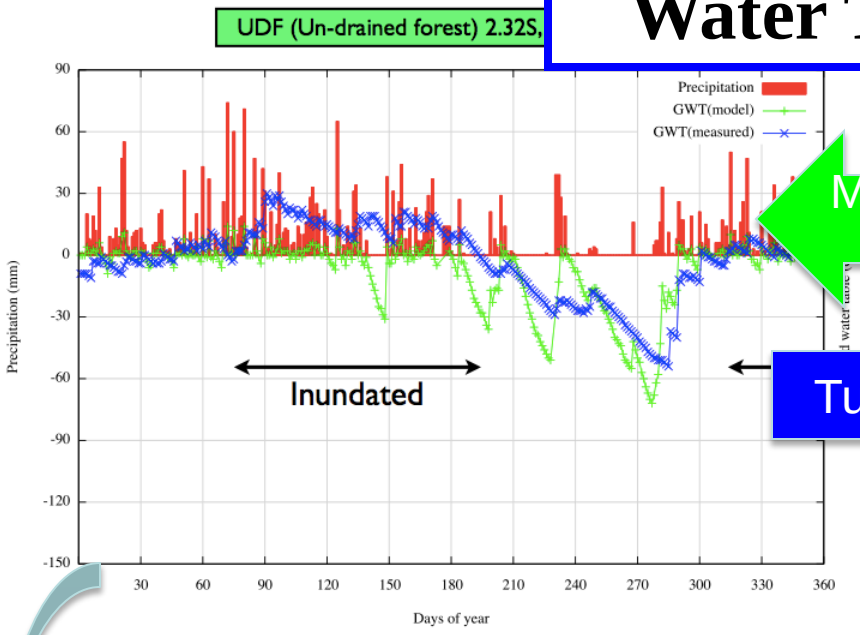
Takeuchi Model

GWT estimation by Remote Sensing Data



Takeuchi, Hirano, Anggraini and Roswintiarti (2010)

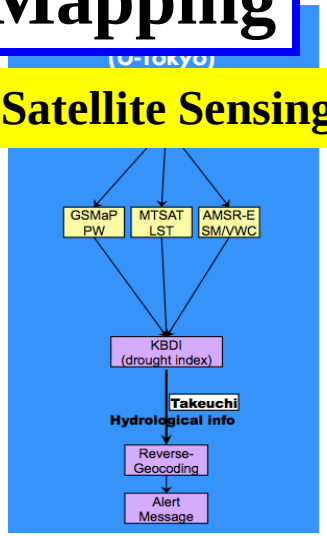
Water Table Mapping



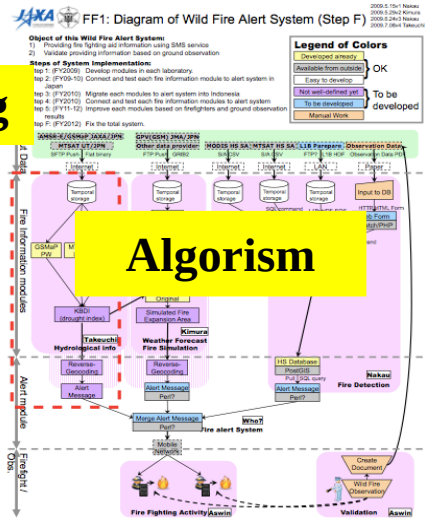
Modelin g

Tuning

Satellite Sensing

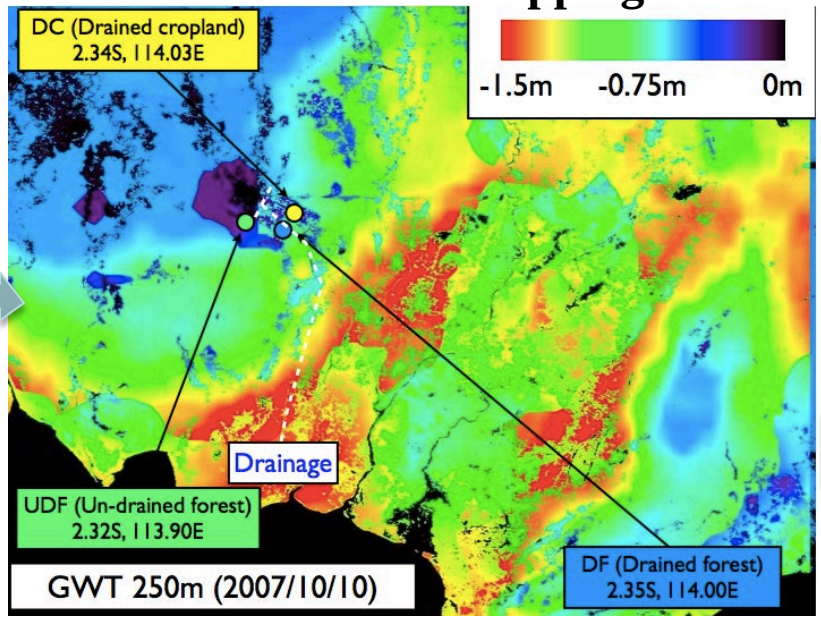


Algorism



By Wataru Takeuchi, University of Tokyo, Japan

Water Table Mapping



Input

Coefficiency between Water Table Level and

1) CO2 emission by Oxidation

2) CO2 emission by Fire Factors

Output

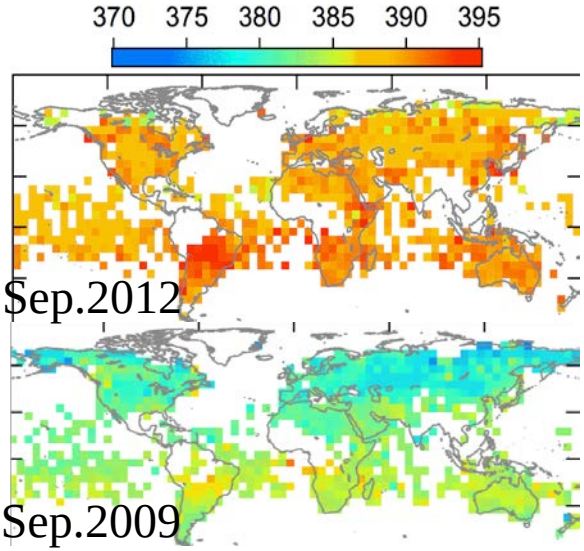
Mapping of

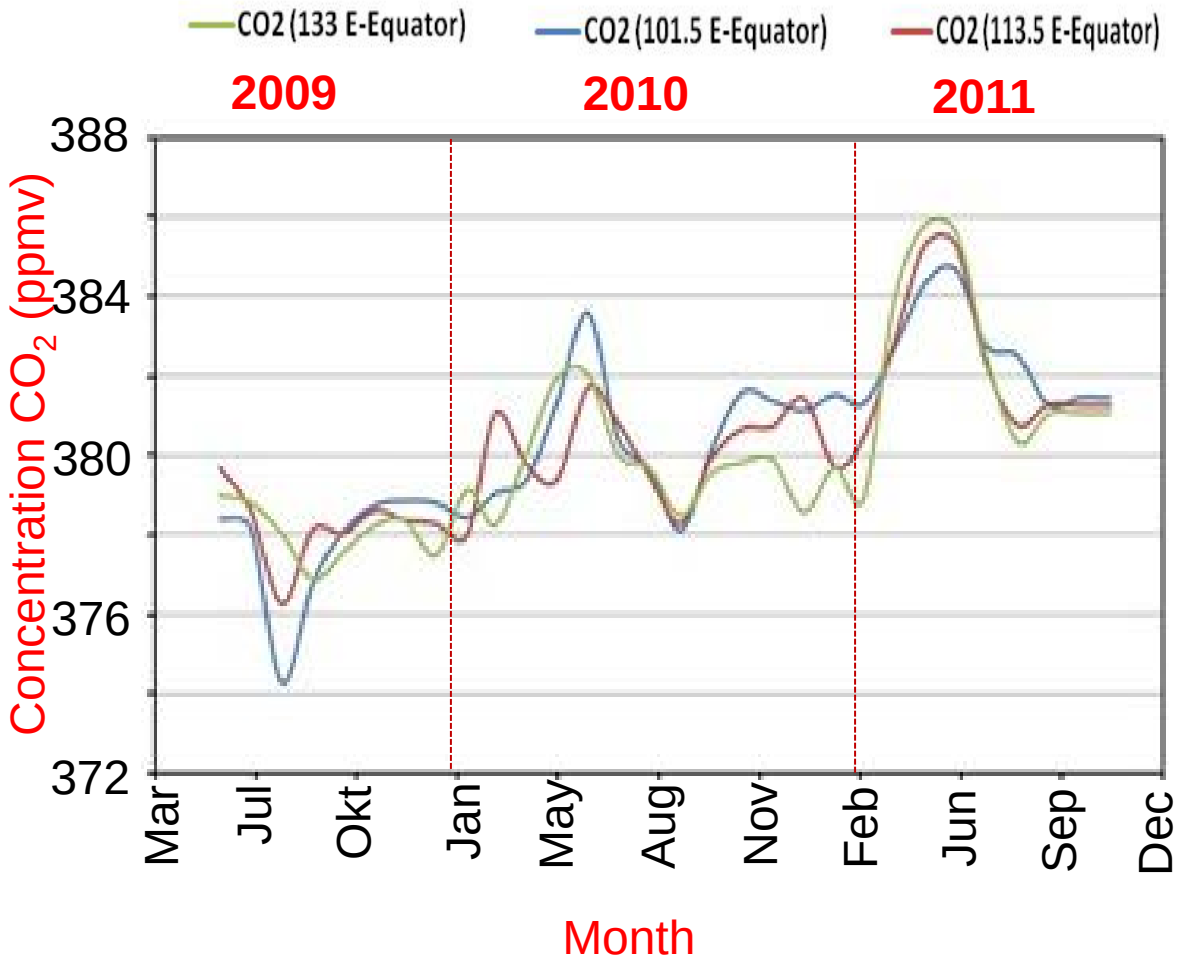
1) CO2 emission by Oxidation

2) CO2 emission by Fire Factors

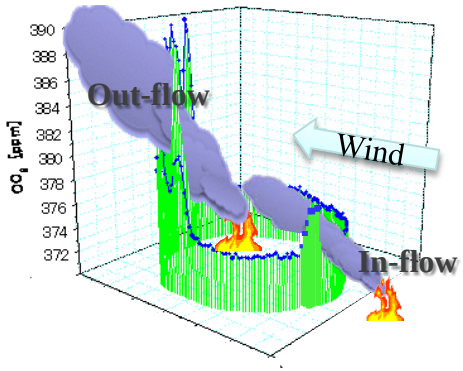
Seasonal Variations of CO_2 Concentration by GOSAT

GOSAT cover few tropical area because of cloud cover.



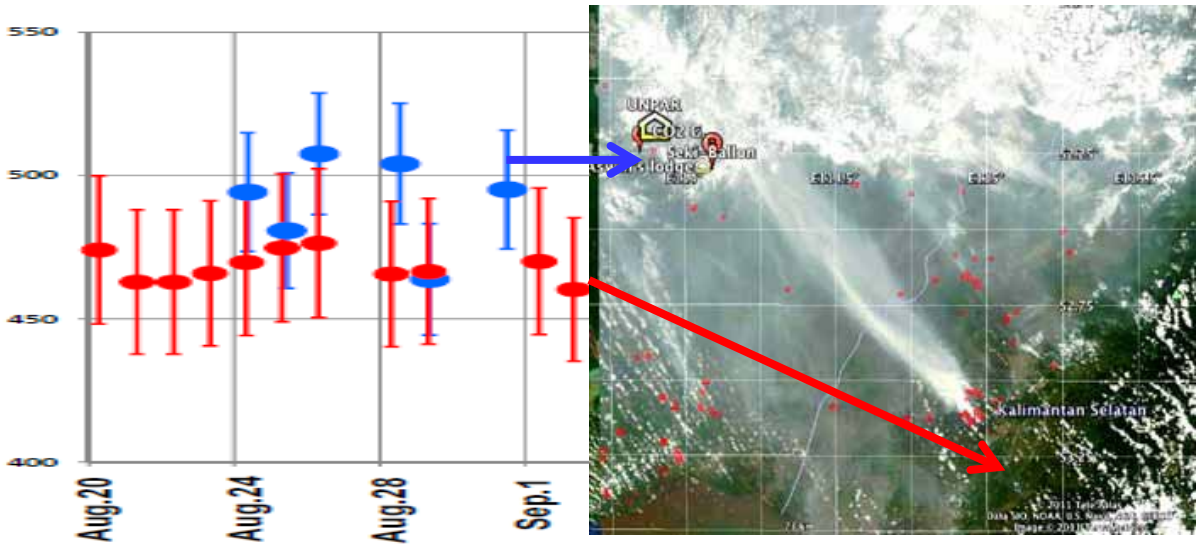


CO_2 flux estimation from peat fire



The ground base column concentration sensor with optical fiber technology (FES-C)

There are notable difference in the CO2 mixing ratios (ppm) between the out-flow point of Parangka Raya and the in–flow point of Banjaru Baru, which were obtained with use of FES-C in August , 2011.



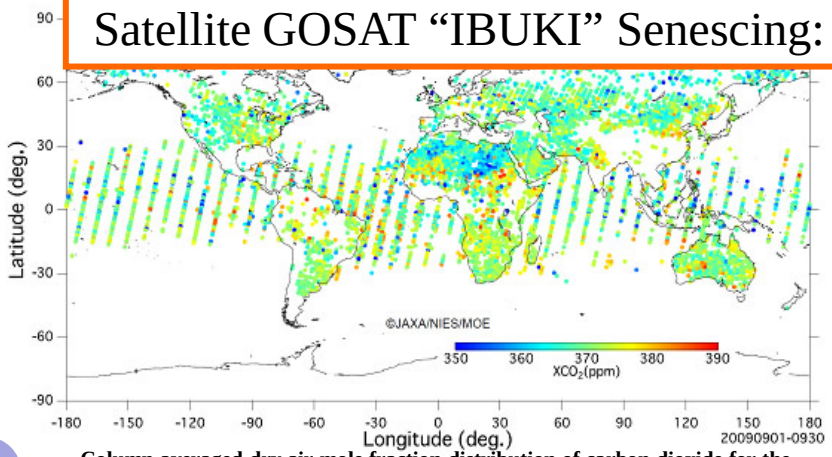
Simulation on CO2 Mapping

Top-down
- satellite
- airplane
- inverse model

Integrated, practical carbon budget map

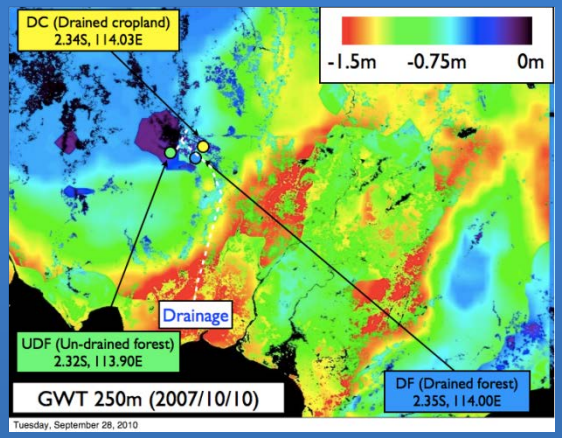
Bottom-up
- field survey
- flux obs.
- process model

Satellite GOSAT "IBUKI" Senescing: CO2

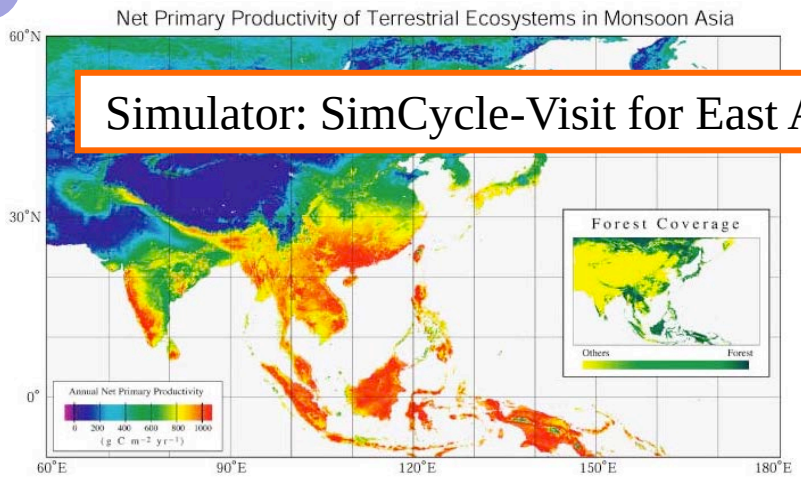


Column averaged dry air mole fraction distribution of carbon dioxide for the month of September, 2009, obtained from IBUKI observation data (unvalidated) By JAXA

Carbon-Water Simulator

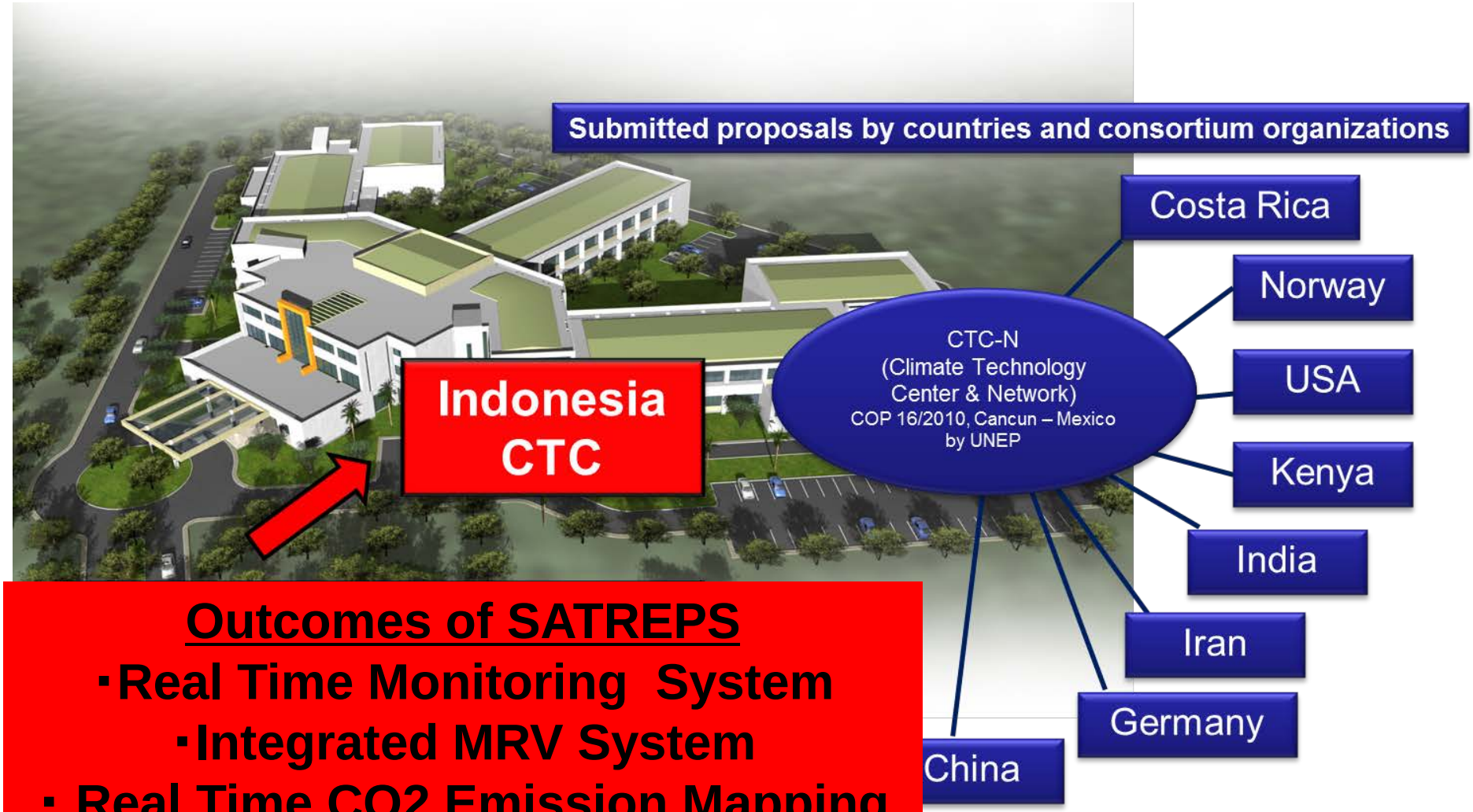


Simulator: SimCycle-Visit for East Asia



- **Carbon Emission by Fire**
- **Carbon Loss through Water**
- **Carbon Emission by Microorganisms Degradation**
- **Tree Growth/Mortality**

■Indonesia CTC (Climate Technology Center) at BPPT



Outcomes of SATREPS

- **Real Time Monitoring System**
- **Integrated MRV System**
- **Real Time CO_2 Emission Mapping**

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Thank you for your attention!

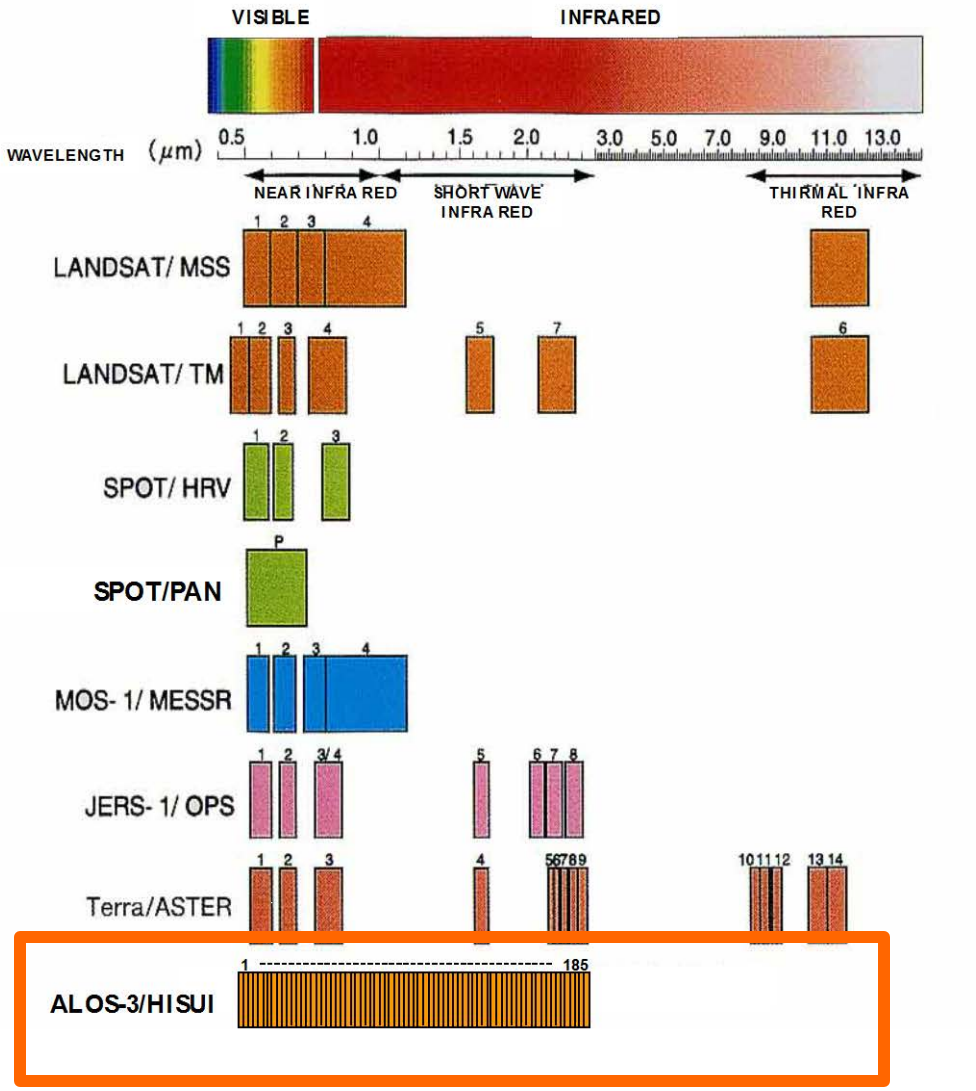
Kalampangan area, Central Kalimantan

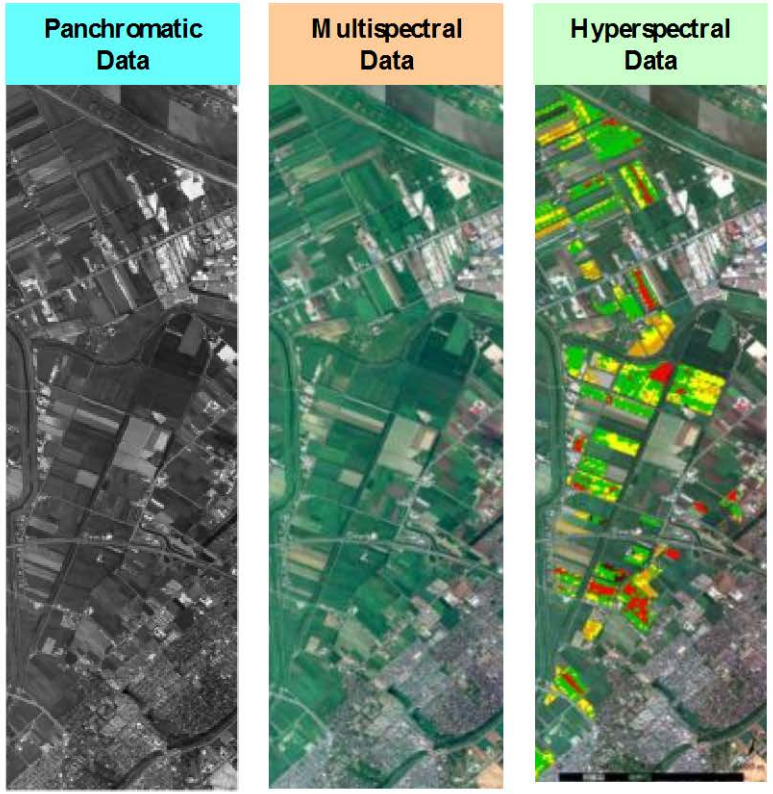
Appendix:

Q: How to estimate Forest Degradation and LULUCF?

A: HISUI (Hyper-spectral Imager SUIte) will be available for these estimation soon.

What is Hyperspectral , Multispectral data ?

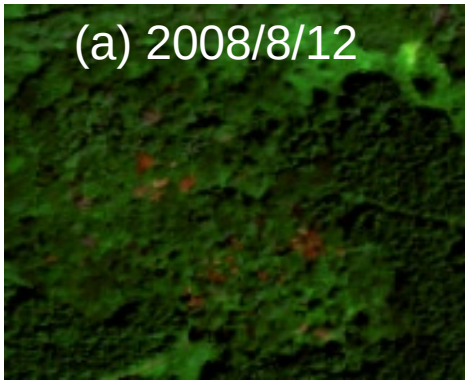


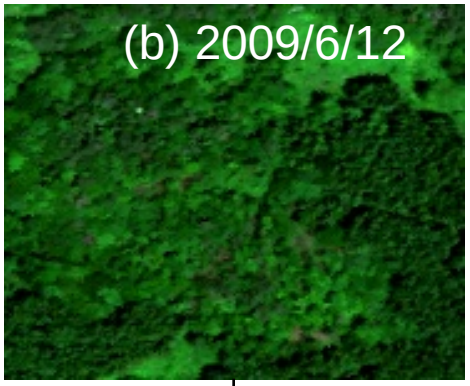


Hyperspectral data provides vast amount of information.

Forest Degradation Monitoring by HISUI-Hyper using airborne

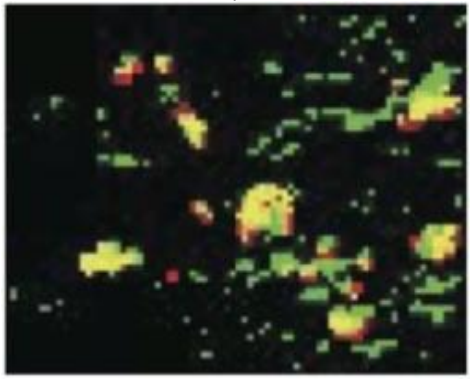
Using NDWI as a indicator of water stress, blast disease of oak tree is detected in the early stages. This result shows that the analysis using hyperspectral data can monitor the health condition which multispectral analysis (or visual examination) can not detect.





Extract water stressed trees using NDWI (NDWI<-0.2)

Extract dead trees



Validation of extraction result

Red : Dead trees in Fig.(c)
Green : water stressed trees in Fig.(b)
Yellow : Corresponding area of estimated water stressed trees in June and dead tress in August.

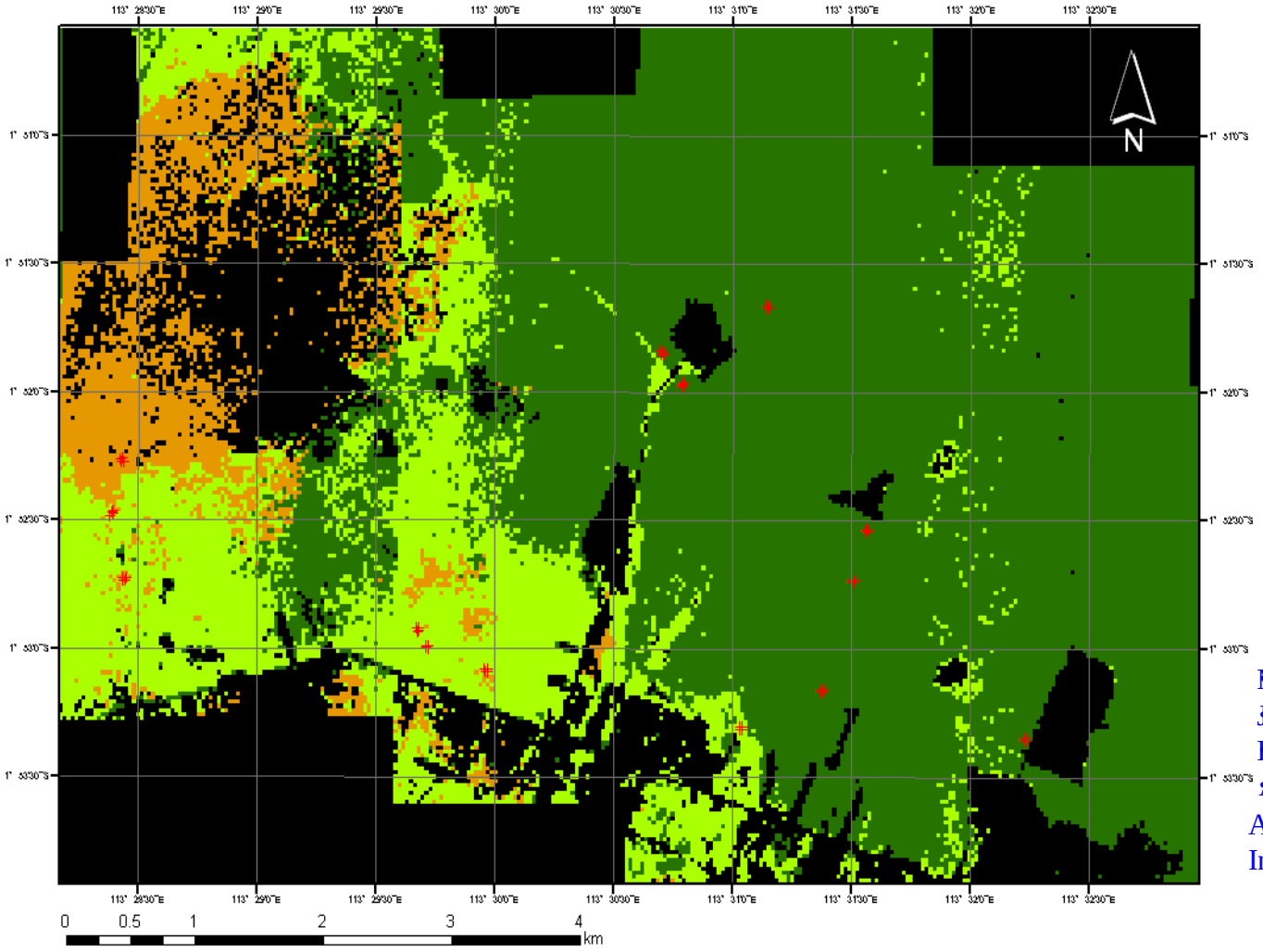
Normalized Difference Water Index (NDWI)

$$NDWI = \frac{NIR - SWIR}{NIR + SWIR}$$

(NIR : 880nm, SWIR : 1240nm)

Forest type classification for LULUCF by HISUI-Hyper using airborne

Forest type in tropical forest in peatland



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Hokkaido University
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