

Methane Emissions from Tropical Peatlands: Interacting Influences of Plant-processes and Groundwater Level



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Interacting Influences of Plant-processes and Groundwater Level on Methane Emissions

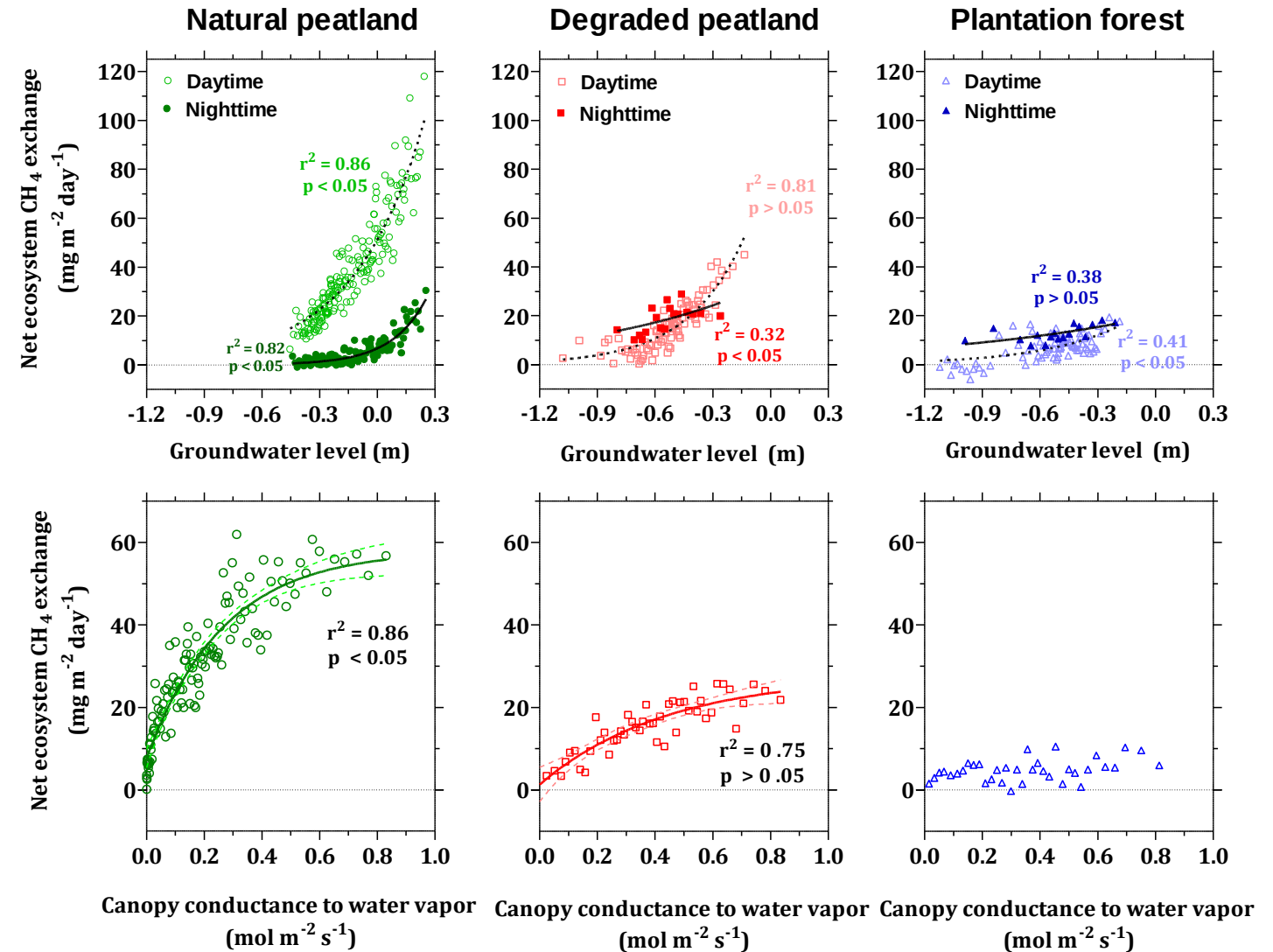
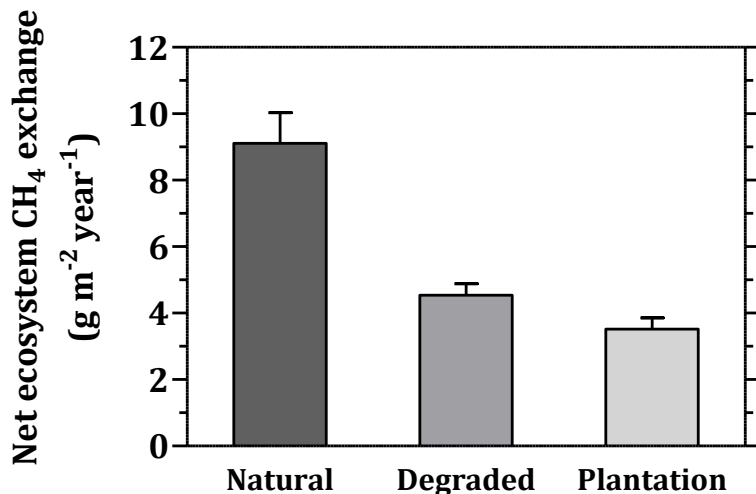
Study Sites: Three different land covers in tropical peatland of Sumatra, Indonesia

Approach: Eddy Covariance

Measurement Period: 2016-2020

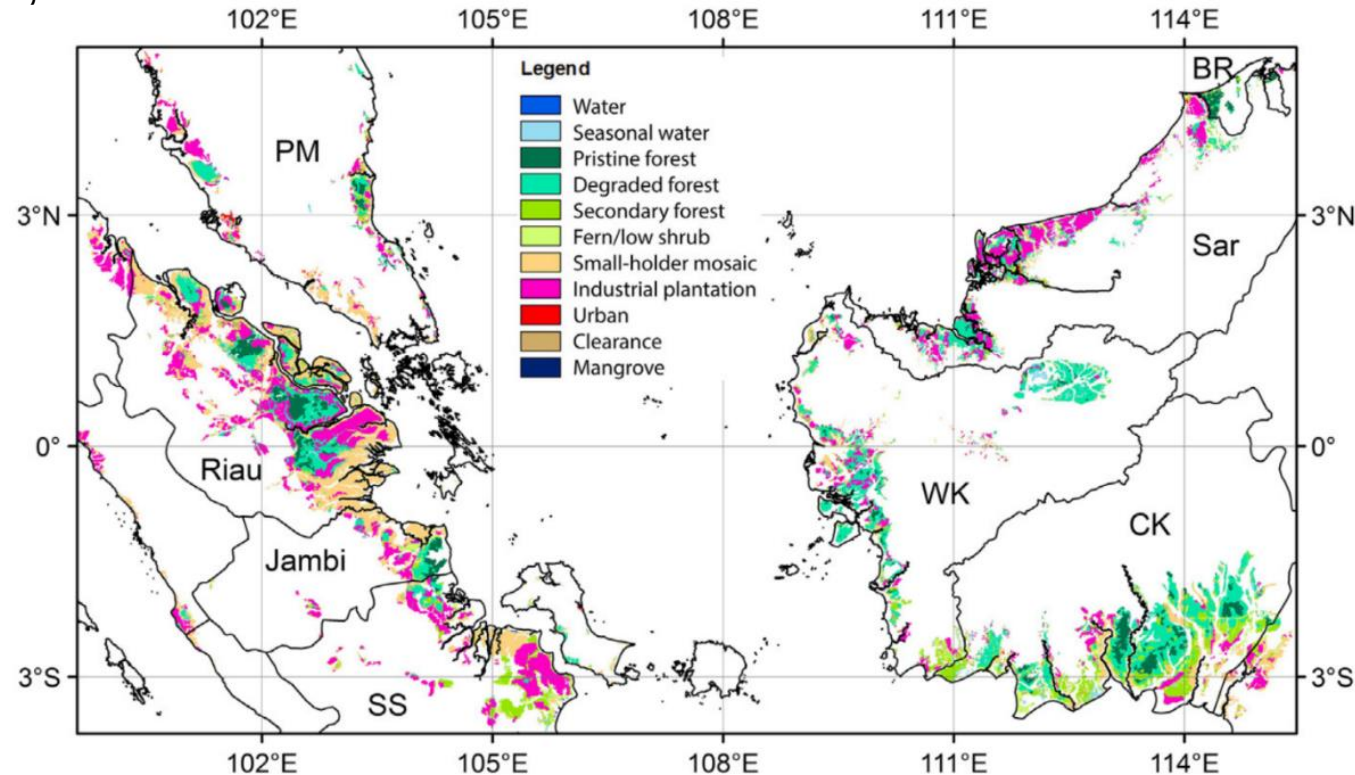
Key Findings:

- CH_4 emissions increase as groundwater levels increase
- High groundwater level supports vegetation-mediated transport during daytime => dissolved CH_4 can be taken up by the root system and emitted to the atmosphere.



2015 Land Cover in Peatlands of Malaysia and Indonesia

- More than one-third of tropical peatlands are situated in Southeast Asia, with different level of hydrological and forest cover regimes;

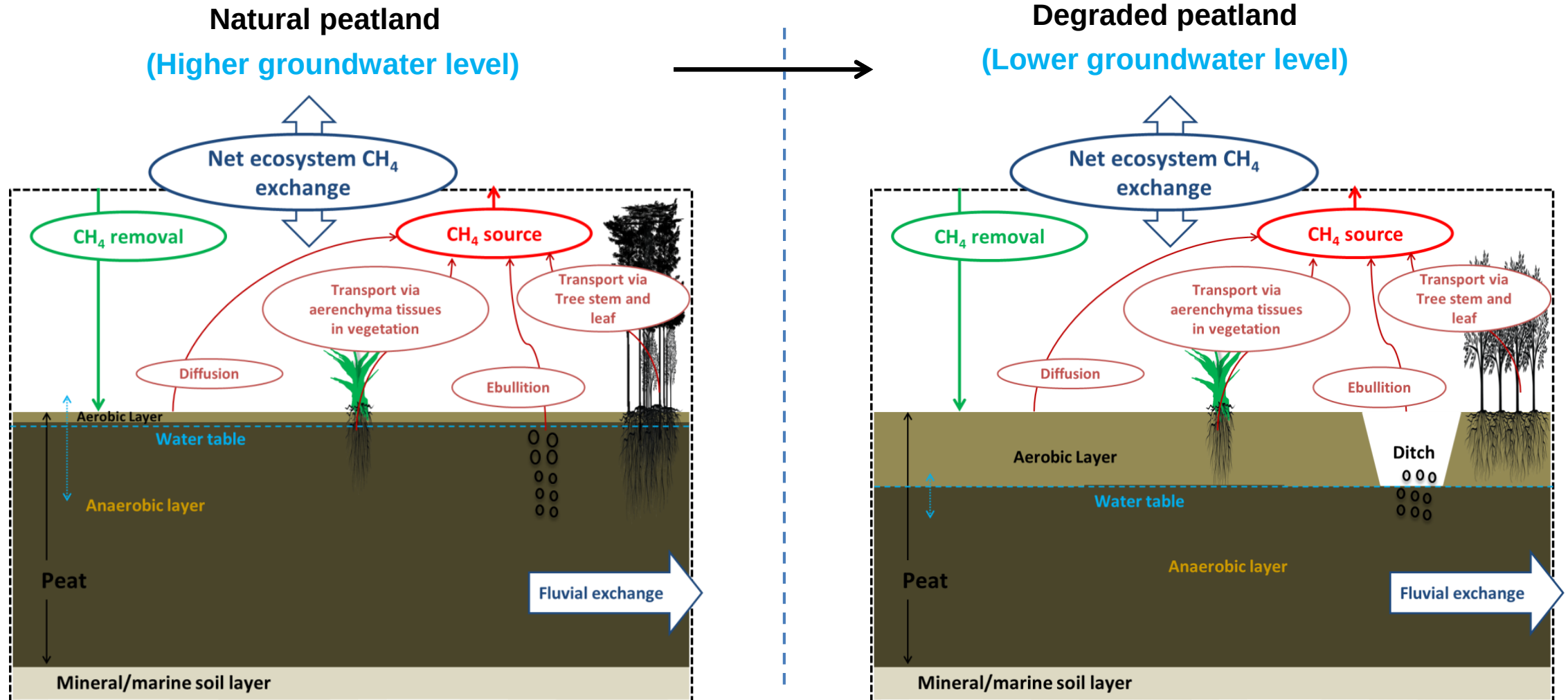


Source: Miettinen et al. 2016

- Limited research related to ecosystem-scale methane exchange;
- Published data display a large range of methane emission estimates;
- Knowledge gaps in our science on tropical peatland methane cycling.

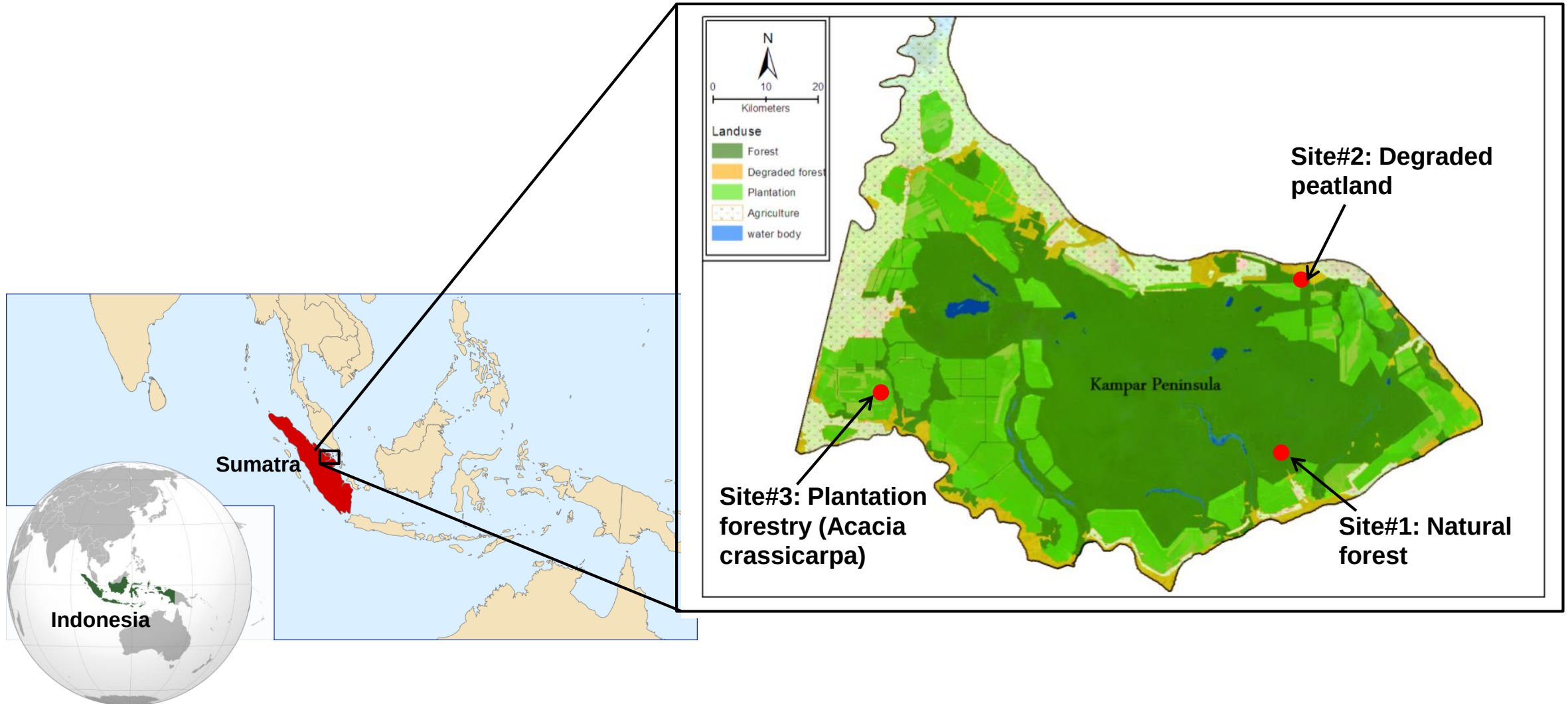
Peatland Degradation Modifies Methane (CH_4) Dynamics

- Involves lowering of groundwater level, as well as modification of vegetation cover and water surface;
- Reduces production, increases oxidation and modifies emissions pathways;



Study Sites: 3 Different Land Covers in Tropical Peatland in Sumatra, Indonesia

- Situated in Kampar Peninsula, ombrotrophic (acidic and nutrient-poor) peatland of ~700,000 ha largely formed within the past 8000 years;



Research Priorities/Objectives

1. Determine the magnitudes of net ecosystem CH_4 exchange over tropical peatlands while incorporating all existing source and removal pathways;
2. Understand the link between CH_4 exchanges and associated changes in the environmental variables.

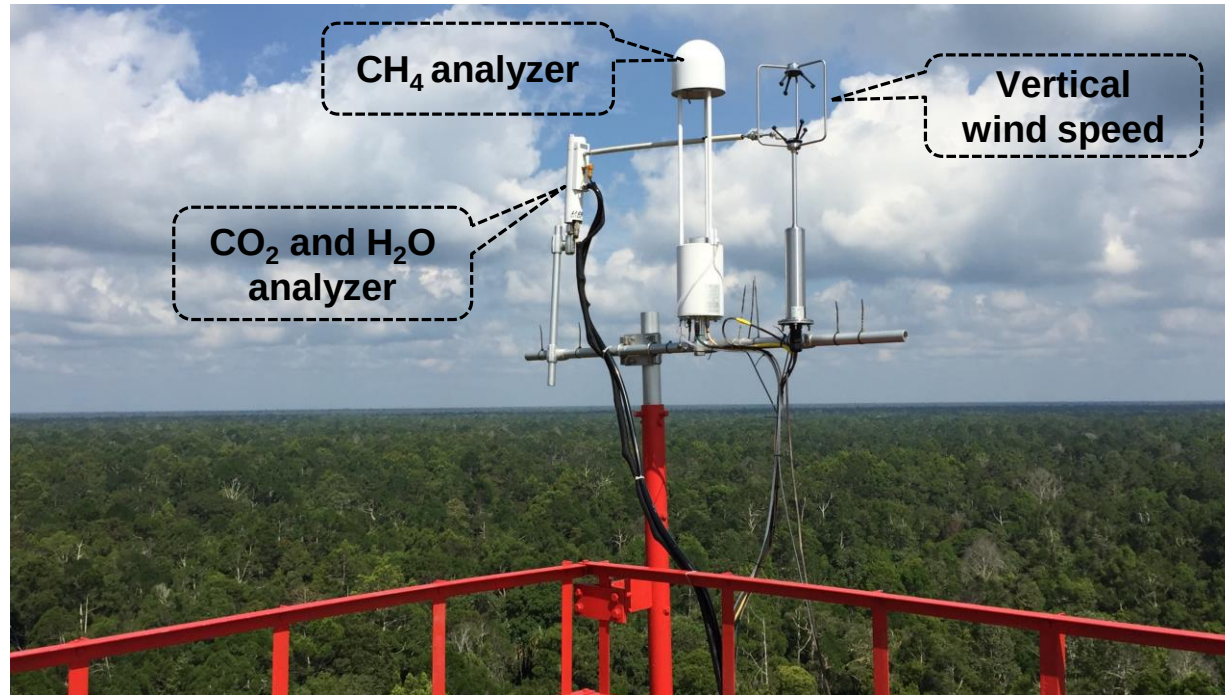
Importance: understanding present and future role of tropical peatland in global methane cycle => Greenhouse Gas inventories and providing guideline for responsible/wise/sustainable land-use policy

- **Tropical peatlands** => dominated by tree species
- **Sources:** Multiple & heterogeneous in space and time
- **Quantification:** Difficult using traditional chamber technique



Approach: Eddy Covariance Technique

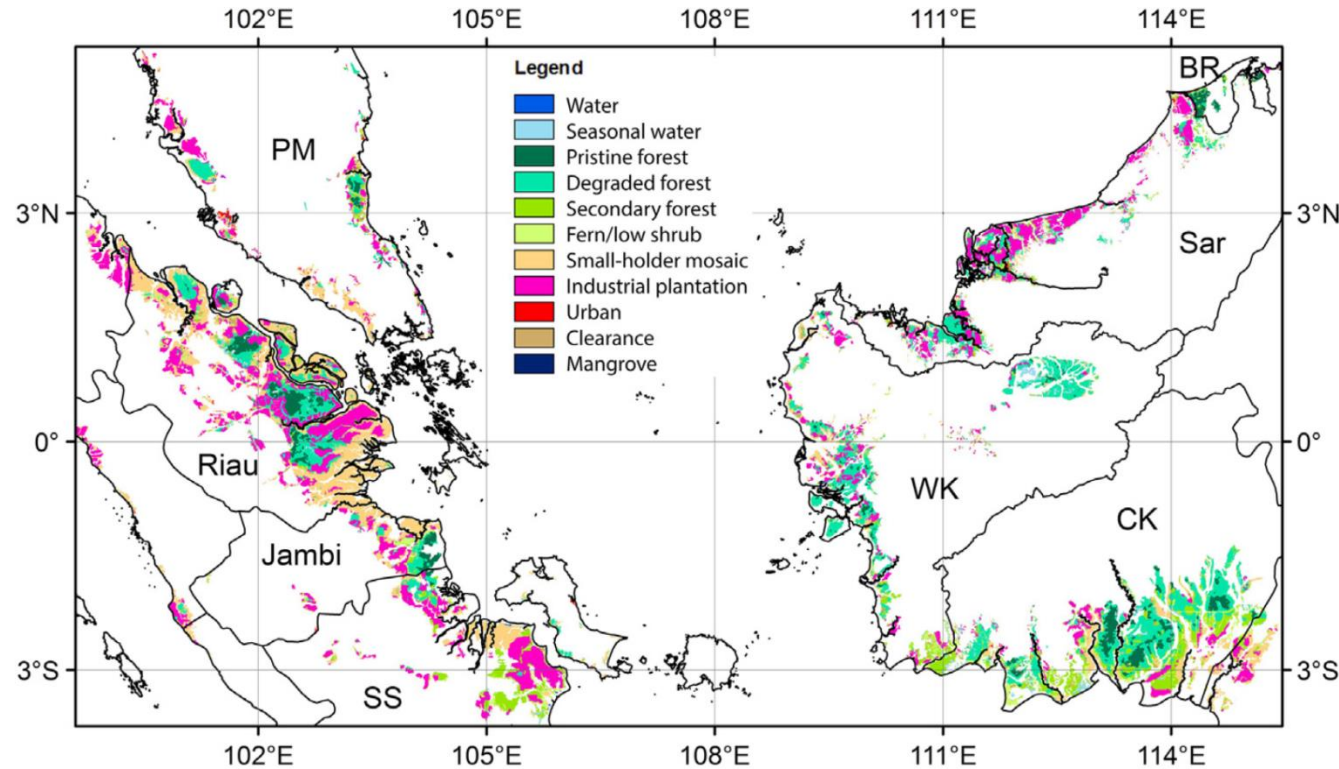
- Measures net balance of all vertical CH_4 source and removal pathways;
- Provides high frequency measurements (every 30 min) => temporal variability;
- Provides ecosystem-scale measurements (> 200 ha around the tower) => spatial variability;



- 4 years measurements (Oct 2016-Sep 2020) above canopy (41 and 51 m above ground surface at top of the tower)

Impact of Land-use and Climate at Regional to Global Scale?

- Land-use and climate change => modify local hydrology and thereby root zone inundation



Source: Miettinen et al. 2016

- Modelling/extrapolation opportunity?**