Emissions of Biomass Burning Simulated in Open Burning Combustion Chamber

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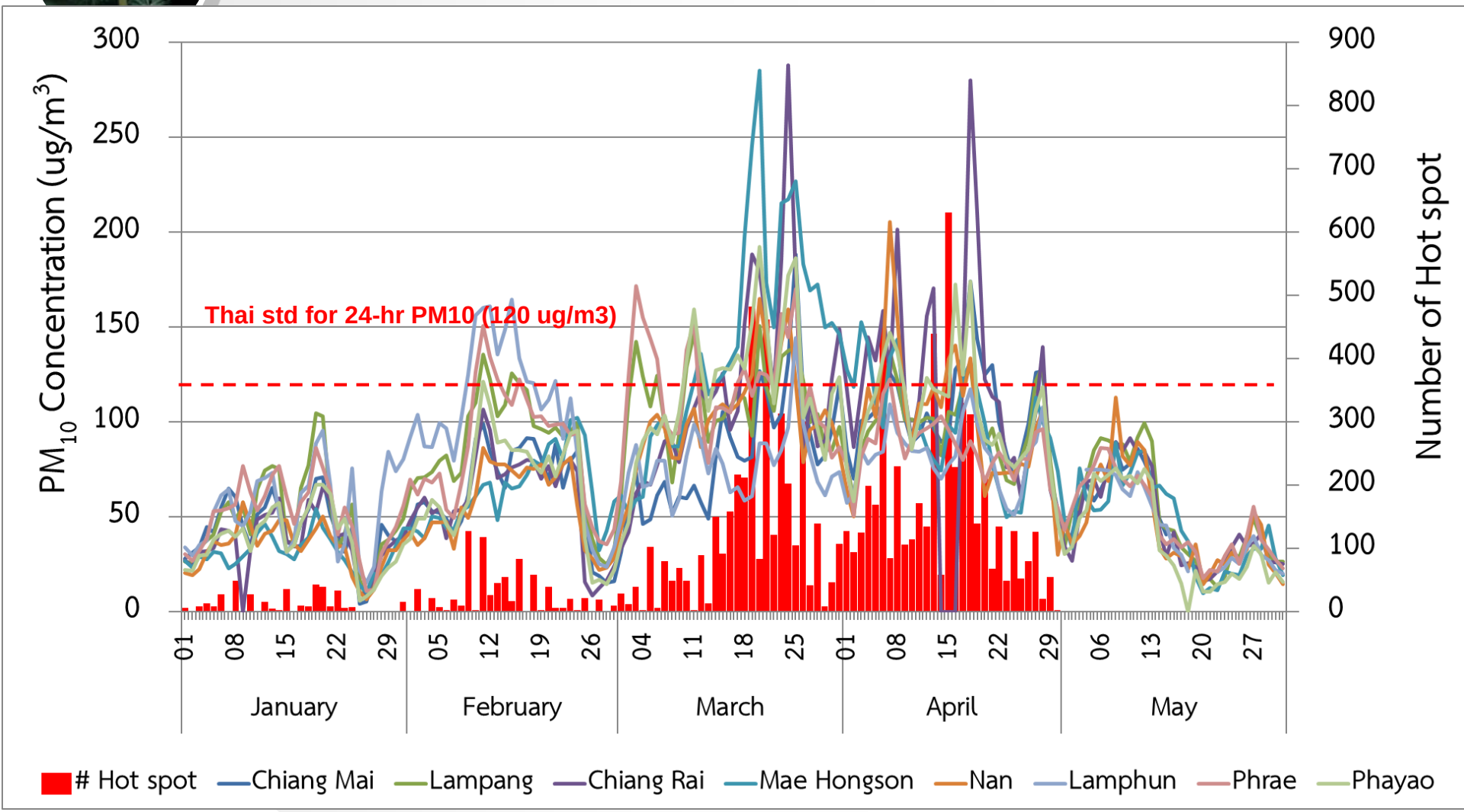
Air Pollution in Chiang Mai, Thailand

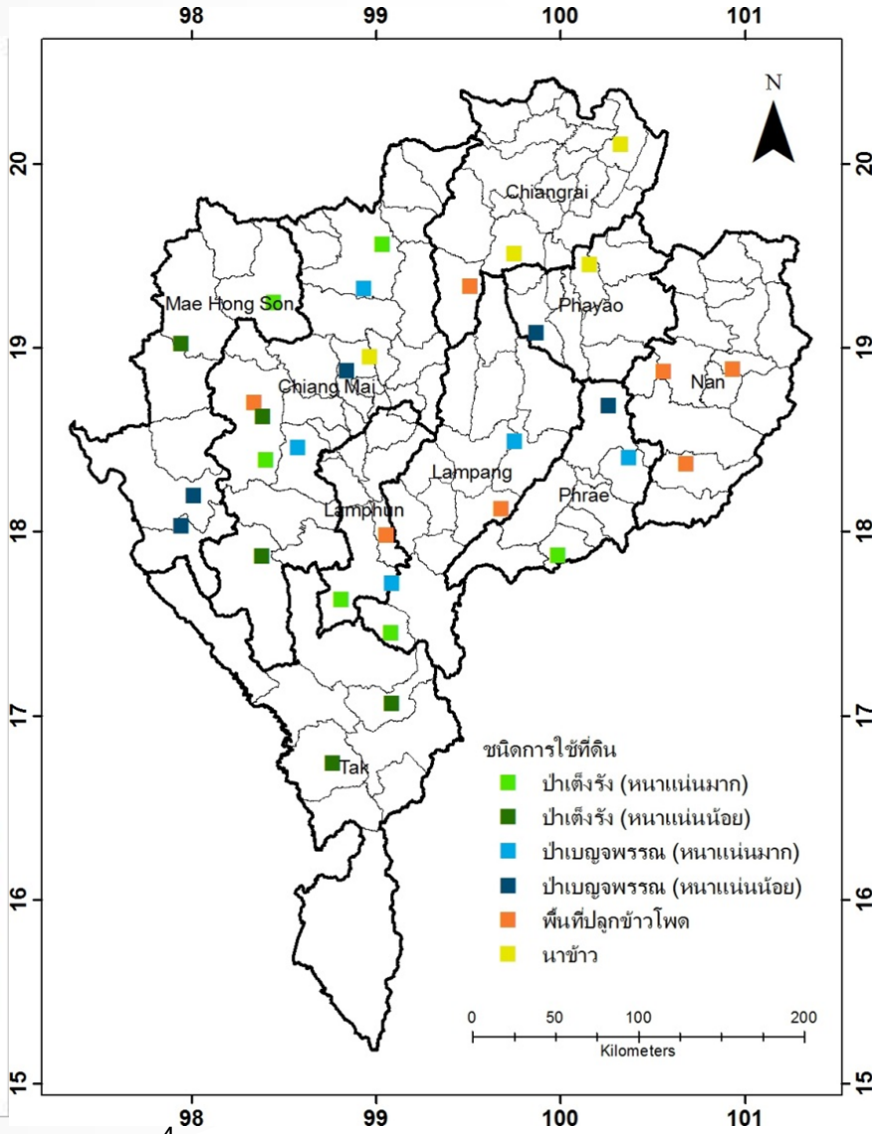
PM_{10} & Hotspot number in 2016 in Northern Thailand



PM10 data obtained from PCD, Thailand

Biomass sample collection

Biomass samples were collected from 9 provinces in Northern Thailand



Maize residues



Rice straw



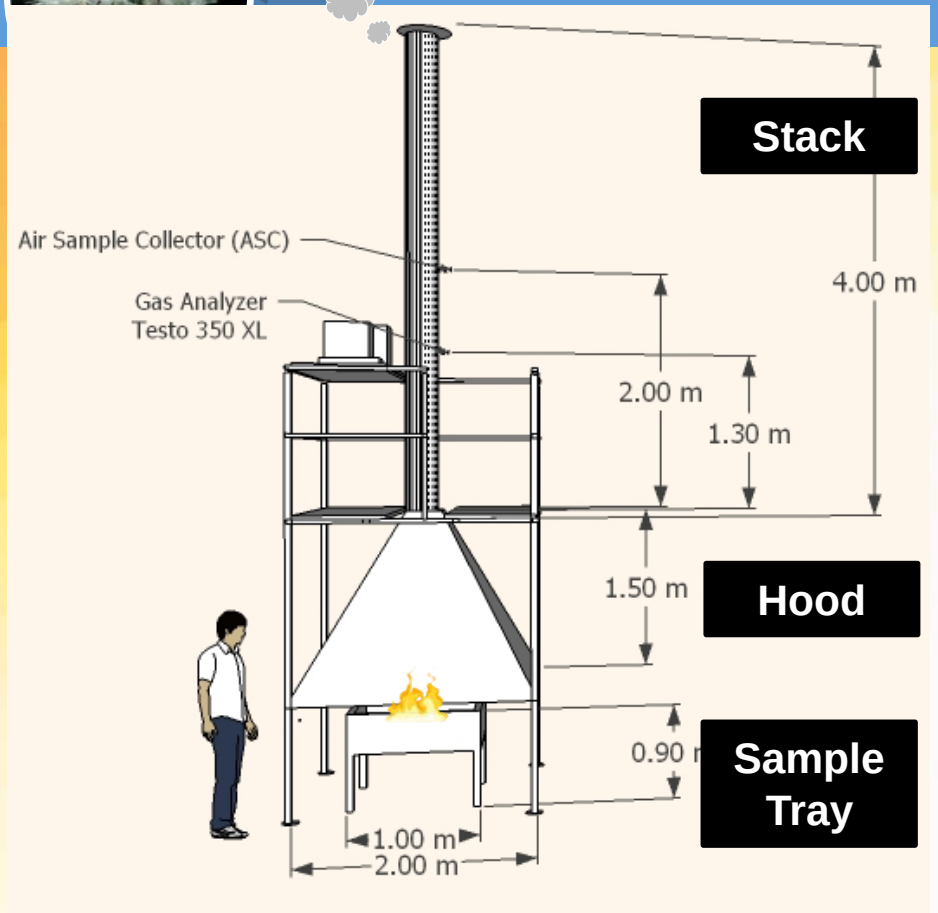
Leaf litter in mixed deciduous forest (MDF)



Leaf litter in dry dipterocarp forest (DDF)



Open System Combustion Chamber





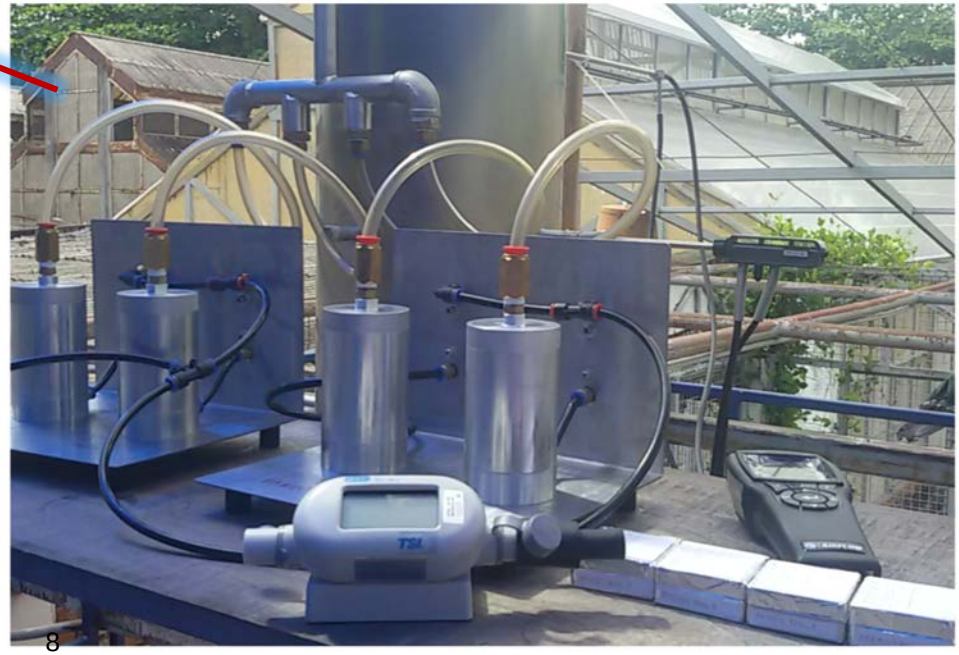
Biomass samples for burning experiment



Burning experiment

PM sampling

PM samples on quartz fiber filters



Air flow meter

Gas measurement

Air flow rate (m/sec)

- ✓ O_2
- ✓ CO
- ✓ NO
- ✓ NO_2
- ✓ SO_2
- ✓ CO_2 **

Gas analyzer

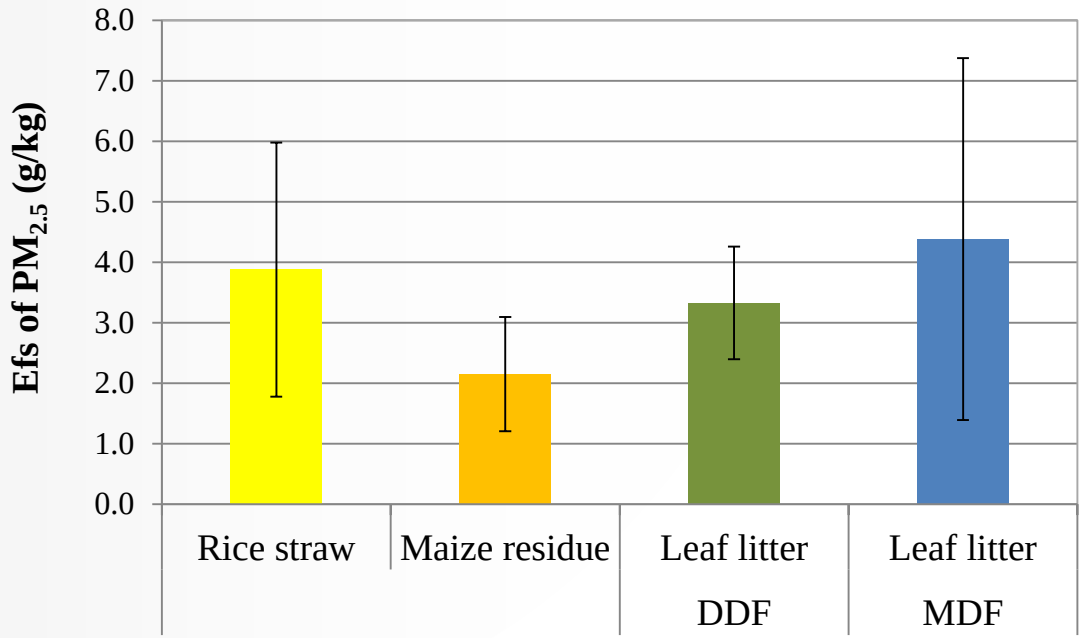
Testo 350 XL

Rice straw	Maize residue	Leaf litters: DDF	Leaf litters: MDF

- $PM_{2.5}$ samples were collected on quartz fiber filter.

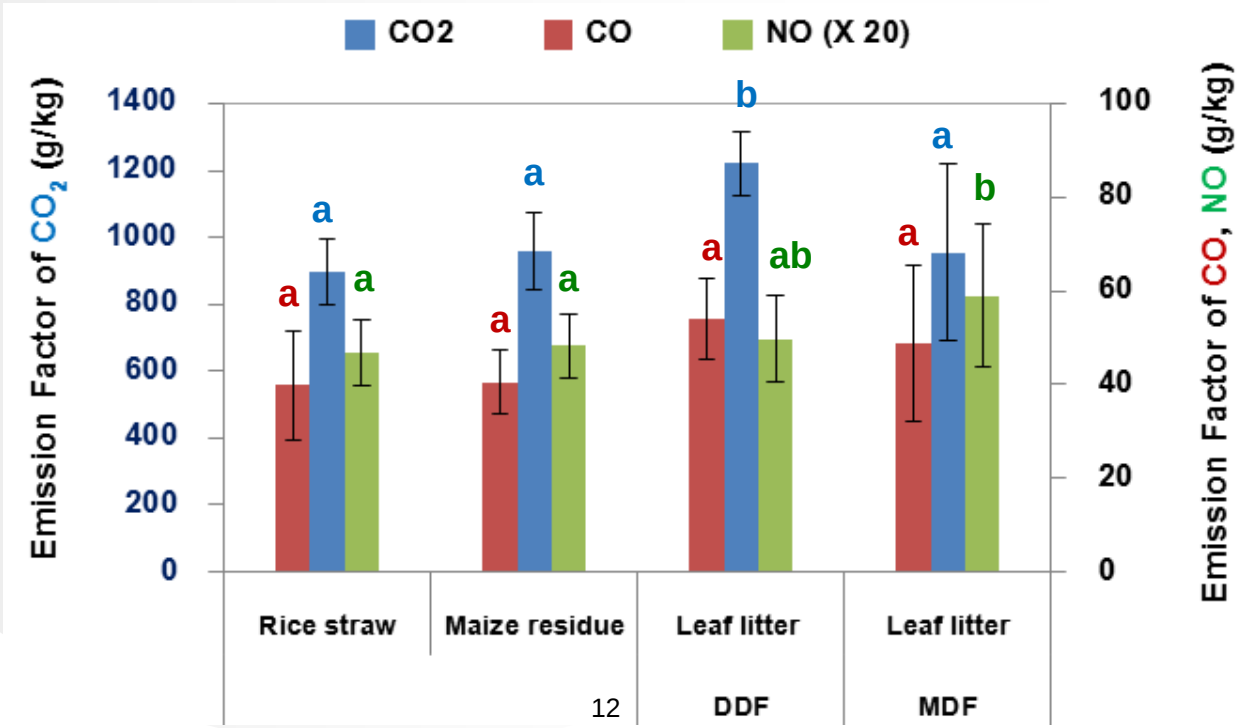
Emission factors of $PM_{2.5}$ from biomass burning

Biomass	Efs of $PM_{2.5}$ (g/kg) (n = 3)
Rice Straw	3.80±2.09[b]
Maize Residues	2.11±0.91[a]
Leaf Litters (DDF)	3.48±1.36[b]
Leaf Litters (MDF)	4.20±2.74[b]



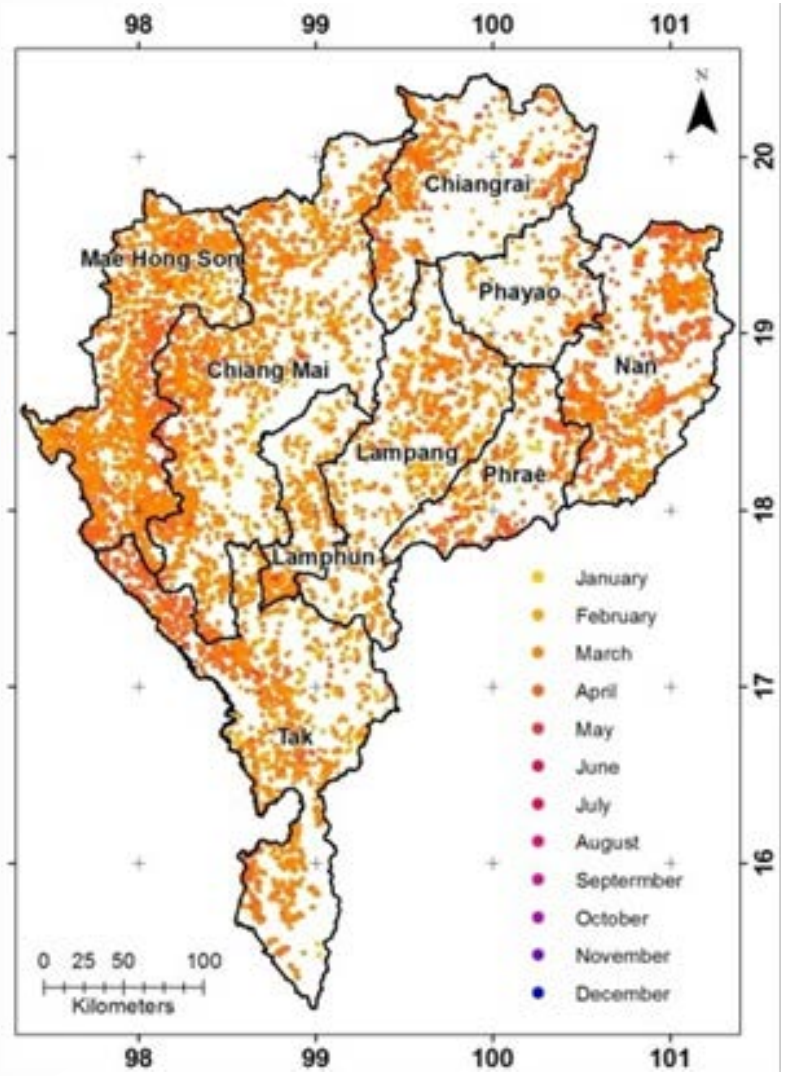
Emission factors of CO_2, CO and NO from biomass burning

Biomass Type	Emission Factor (g/Kg) (n = 3)			Ref.
	CO_2	CO	NO	
Rice straw	898±99[a]	39.8±11.8[a]	2.34±0.35[a]	*This study*
Maize residue	956±116[a]	40.5±6.9[a]	2.42±0.34[a]	
Leaf litter (DDF)	1220±96[b]	53.8±8.7[a]	2.49±0.46[ab]	
Leaf litter (MDF)	954±263[a]	49.0±16.7[a]	2.95±0.77[b]	
Amazon Forest biomass	1565±128	50.3±17.1	2.74±0.75	Neto et.al. (2013)
Rice straw	1105.2±189.3	53.2±17.9	-	Zhang et.al. (2013)



Application of EFs

- EFs of pollutants can be used for estimation of emission rate (ER) based on hotspots and area burned.



2017-2019

HAZE FREE THAILAND PROJECT

Monitoring and Analysis of Ambient $PM_{2.5}$ Chemical Composition and Its Toxicity in Northern Thailand

Site 1
Mae Hia (MH)
Chiang Mai

Site 2
Nanoi, Nan

Low volume air sampler (PQ200; BGI,USA)

$PM_{2.5}$ collected on Quartz filter paper (Whatman, UK)

Minivolume air sampler (MV; Air metric, USA)

7-SEAS; 7-South-East Asian Studies

- National Central University (NCU), Taiwan
- Laboratory for Atmospheres, Goddard Space Flight Center, NASA
- Faculty of Science, CMU

Thank you for your kind attention

วช. NRCT

สกว TRF

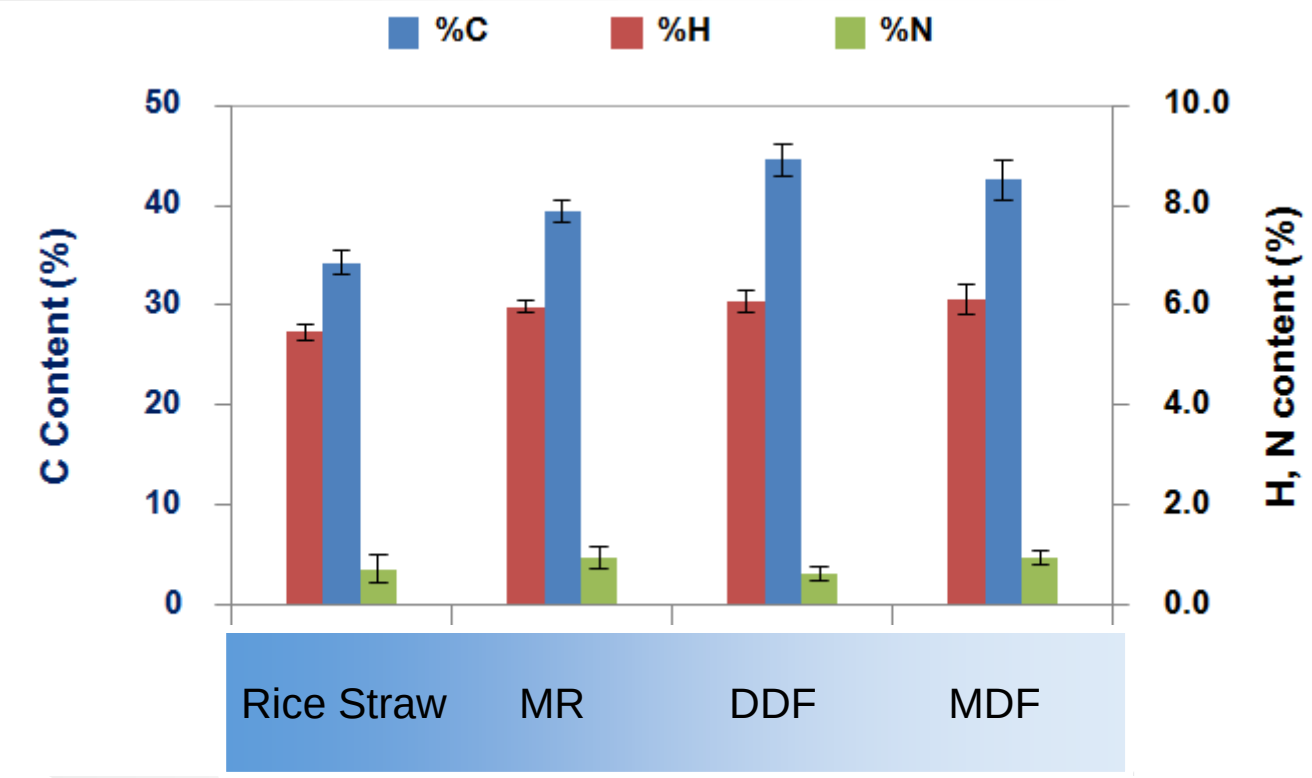
ENVIRONMENTAL SCIENCE

ECRL
Environmental Chemistry Research Laboratory
Chiang Mai University

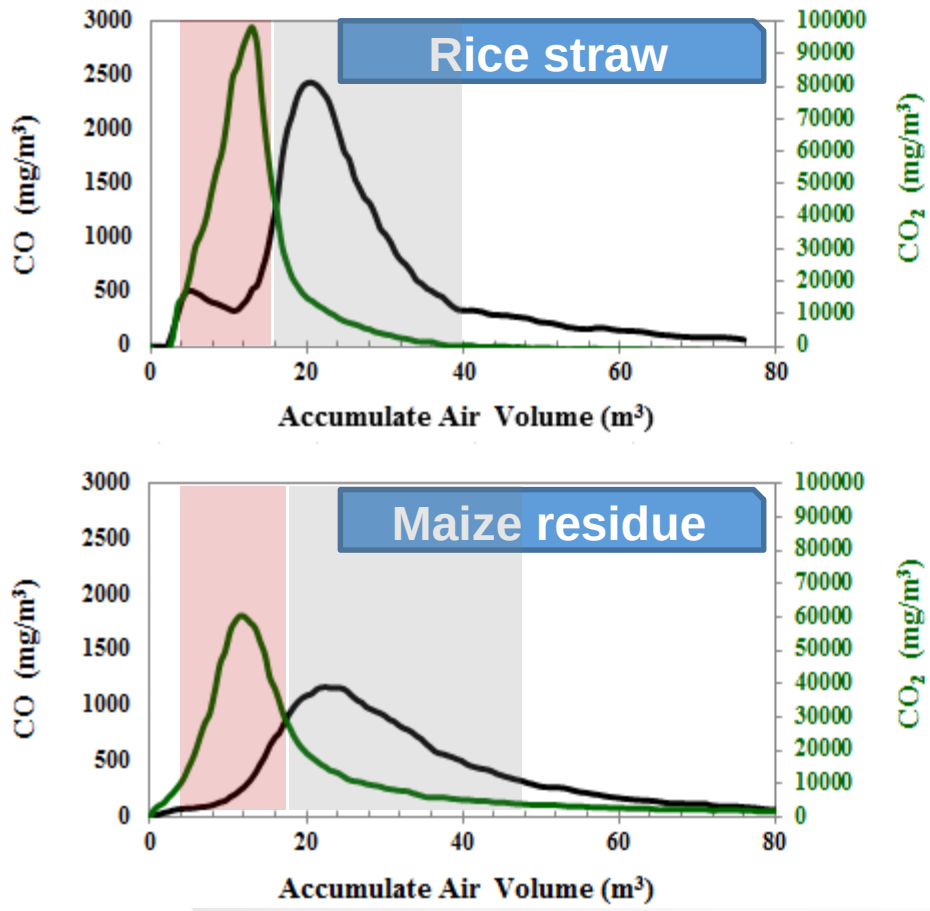
C,H,N content

Biomass	% Content (n = 3)		
	C	H	N
Rice Straw	34.3±1.2[a]	5.47±0.16[a]	0.72±0.27[a]
Maize Residues	39.4±1.2[b]	5.97±0.13[b]	0.93±0.21[b]
Leaf Litters (DDF)	44.6±1.6[d]	6.09±0.22[b]	0.62±0.15[a]
Leaf Litters (MDF)	42.6±2.0[c]	6.11±0.30[b]	0.94±0.13[b]

Sig diff. ($p<0.05$)



CO and CO_2 concentrations during biomass burning



Amount of CO2 emitted was about 20-25 times larger than CO.