Root exudates compounds and microbial community composition regulates CH_4 dynamics in degraded tropical peatland

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Background

- Degraded tropical peatlands areas experience frequent flooding, due to enhanced peat oxidative decomposition and subsidence
- Flooding promotes abundances of ferns and sedges
- Vegetation composition change – quality and quantity of root exudate compounds (REC)
- REC may attract methanogens in rhizo-compartments (rhizosphere, rhizoplane, endosphere)

Approach

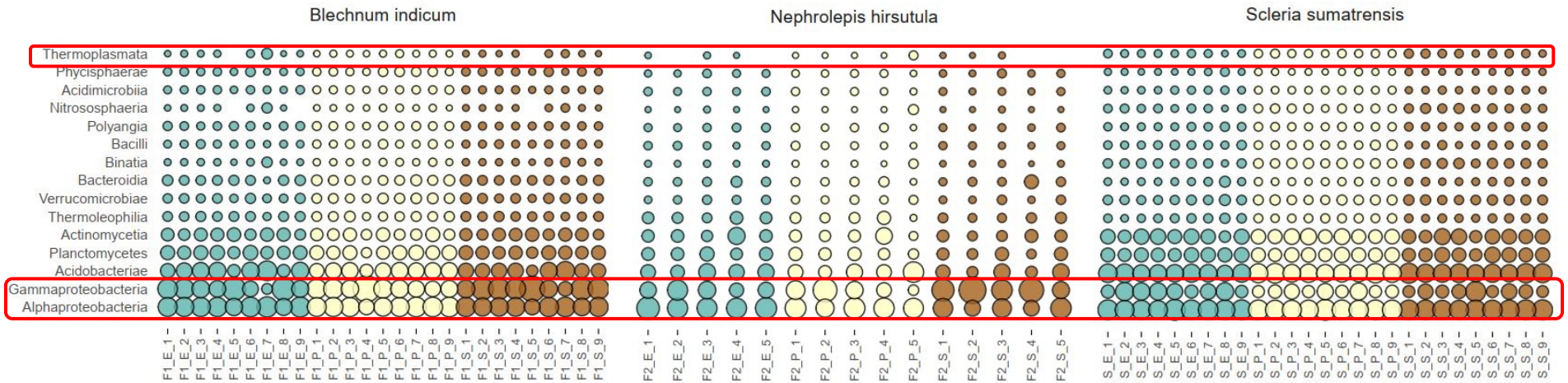
- Plant samples – fire-degraded tropical peatland, Brunei Darussalam (4°28'40" N, 114°18'19" E)
- Root exudates compounds (REC) – sedge *(Scleria sumatrensis)* and ferns *(Blechnum indicum, Nephrolepis hirsutula)*
- Targeted analysis for sugars (fructose, glucose) and organic acids (acetate, formate, lactate, malate, oxalate, succinate, tartrate)
- 16S rRNA gene amplicon sequencing for microbial community composition in plant rhizo-compartments (rhizosphere, rhizoplane, endosphere)

Findings

- REC significantly different among plant specie with sedge and fern *(Blechnum indicum)* secreting ratio of 2:1 for sugars: organic acids in contrast to trees in intact tropical peatlands secreting in 1:2
- Sedge harboured higher abundance of methanogens *(Thermoplasmata)* and lesser methanotrophs *(Gammaproteobacteria)* across all three compartments compared to fern species
- These findings further supports the higher sedge-mediated CH_4 emissions from fire-degraded tropical peatlands
- Post-fire vegetation composition can regulate labile C and microbial community composition, and hence affecting CH_4 emissions from fire-degraded tropical peatlands

Root exudates compounds

C compounds (µg/g)	*S. sumatrensis* (sedge; n=3)	*Blechnum indicum* (fern; n=3)	*Nephrolepis hirsutula* (fern; n=3)
Fructose	68.25 ± 3.22	197.16 ± 0.28	650.29 ± 3.68
Glucose	20.22 ± 0.50	45.14 ± 5.04	149.91 ± 4.83
Acetate	4.38 ± 0.12	4.94 ± 0.13	55.68 ± 0.78
Formate	1.07 ± 0.03	2.02 ± 0.25	5.60 ± 0.28
Lactate	12.04 ± 0.20	3.31 ± 0.17	0.00 ± 0.00
Malate	1.87 ± 0.08	0.32 ± 0.05	0.00 ± 0.00
Oxalate	2.42 ± 0.01	5.57 ± 0.05	59.20 ± 0.11
Succinate	3.00 ± 0.03	4.64 ± 0.12	179.35 ± 1.69
Tartrate	17.47 ± 0.09	15.74 ± 0.05	27.88 ± 0.84
Sugar: Organic acid	**2 : 1**	**2.4 : 1**	**6.6 : 1**



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