Developing sustainable practices to reduce socio-economic impacts and enhance the sustainability of tropical peatlands

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Abstract (300 word limit)

Southeast Asian peatlands are undergoing degradation through drainage and deforestation, accompanied with forest fires. This is occurring at unprecedented rates for agriculture and human settlement purposes. Exposure of carbon-rich peat to air has resulted in enhanced microbial-mediated peat oxidation emitting high levels of potent greenhouse gases (GHGs). Peat oxidation results in land subsidence thus increasing risk of flooding that can affect the livelihoods of millions of people. The overall aim of this study is to provide an in-depth understanding of how land-use change and peat management practices affect the microbial ecology and physicochemical processes leading to peat oxidation and release of GHGs. We have used molecular marker–based approaches (microbial and metabolic profiles) that revealed the profiles were most influenced by variations in water table and land-use patterns, followed by age of drainage and peat thickness in that order. Plantations with mixed cropping had the least subsidence rates, where land subsidence is a proxy for peat loss by oxidation. We aimed to determine the functional potential of peat microbiome that is associated with peat oxidation from contiguous land-use types: degraded forest, degraded land and oil palm plantation sites. Metagenomics analysis revealed that genes belonging to aromatic compound biosynthesis and degradations were mostly associated with degraded forest and degraded land. *Actinobacteria* and *Firmicutes* were among the most abundant taxonomic groups, demonstrating their linkages in oxidation of tropical peatlands. The overall findings of this study will be useful in peatland management by providing a basis to focus early efforts on hydrological interventions and improving sustainability of oil palm plantations by adopting mixed cropping practices.

Image

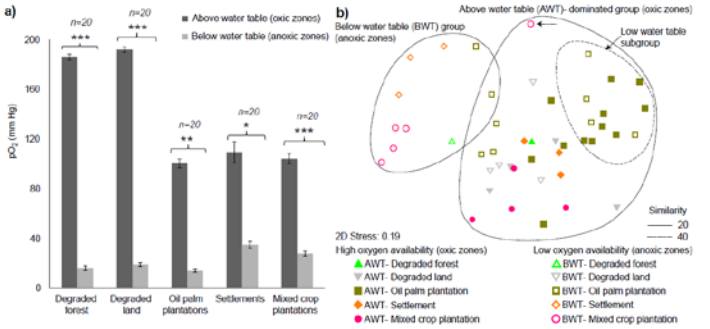


Fig. 2. Oxygen levels (pO_2), mm Hg **(a)** and nonmetric multidimensional scaling (nMDS) ordination plot based on Bray–Curtis similarities calculated from presence/absence data of 16 S rDNA TRFs abundances **(b)** at above (oxic zones) and below (anoxic zones) water table positions in different land-use types. Level of significance in **(a)** is * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$, and n = total number of independent measurements.

Recent Publications (minimum 5)

1. **Mishra S.**, and Swarup, S. (**2017**): "Scientific tools to improve estimation of greenhouse gas emissions from land use change in peatlands", 8th ASEAN Working Group on Climate Change (AWGCC) meeting, Yangon, Myanmar
2. **Mishra S.**, et al., (**2016**): "Developing sustainable practices to mitigate impacts of climate change on natural and managed tropical peatlands", International Conference by IPS and MPS, 15th International Peat Congress, Aug 2016, Sarawak, Malaysia
3. **Mishra S.**, et al., (**2016**): "Increased CO_2 emissions due to rewetting of degraded tropical peatlands under oil palm plantations", International Conference by IPS and MPS, 15th International Peat Congress, Aug 2016, Sarawak, Malaysia
4. Saxena G., et al., **Mishra S.**, Umashankar S., Mitra S., Zhou J., Andersen G., Kjelleberg S., and Swarup S. (**2015**): "Ecogenomics reveals metals and land-use pressures on microbial communities in the waterways of a megacity", Environmental Science & Technology, 49(3), 1462-71.
5. **Mishra, S.**, et al., (**2014**): "Microbial and metabolic profiling reveal strong influence of water table and land-use patterns on classification of degraded tropical peatlands", Biogeosciences, 11, 1727-1741.
6. **Mishra S.** and Doble M. (**2008**): "Novel chromium tolerant microorganisms: Isolation, characterization and their biosorption capacity", Ecotoxicology and Environmental Safety, 71(3), 874-879



Biography (150 word limit)

Dr. Shailendra Mishra uses genomics-derived framework to explain the complexity of microbial ecosystems by combining meta-omics (metagenomics and metabolomics) with associated metadata (geochemical and physiological data) using multivariate statistical methods. His research interest in the peatland ecosystem is aimed at developing an in-depth understanding of peat–oxidation processes due to microbiome functioning, which leads to high greenhouse gas emissions from tropical peatlands. In urban ecosystems, his research is focused on understanding the microbial assemblages and their associated functions in sediment and water phase of urban waterways in Singapore.

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