

## Assessment of acidification hazard by acid sulfate soils in the critical zone of Muthurajawela marsh, Sri Lanka

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Muthurajawela marsh, located on the western coastal belt and about 10 km north of Colombo City, is the largest peat bog in Sri Lanka. The northern end of the marsh connects to the Negombo lagoon, forming an integrated, tidally influenced coastal wetland ecosystem. Both Muthurajawela marsh and the associated coastal ecosystem have unique biodiversity and are home to a number of endemic fauna and flora species. The marsh is ecologically important as a floodwater basin, wildlife habitat and breeding ground for many fish and crustacean species. Economically, it provides multiple benefits to people in the vicinity by supporting livelihood activities. Being located in a rapidly developing and densely populated urban area, the marsh is greatly exploited at an alarming rate by various anthropogenic activities (e.g. landfilling, infrastructural developments and illegal human settlements etc.). The critical zone of the marsh is known to contain acid sulfate soils (ASS), i.e. sulfidic soil materials and their oxidized products. Anthropogenic and natural activities (e.g. drainage and prolonged droughts) in and around the marsh may expose the underneath sulfidic soil materials resulting in their oxidation which can generate substantial amounts of acidity. Acidity and trace metal elements mobilized by the acidity may pose a severe threat on the components of the critical zone (i.e. vegetation, soil, ground and surface water) in the marsh. However, the current status of the acidity and its potential impacts on the critical zone of the marsh are unknown. The main objective of this study was to assess the acidity hazard in the marsh by quantifying the “Net Acidity” level using the Acid-Base Accounting (ABA) approach. Soil profiles up to 1.5 m were collected from northern, middle and southern regions of the marsh. All three soil profiles contained substantial amount of net acidity with appreciable amount of potential sulfidic acidity (PSA) as indicated by the chromium reducible sulfur (CRS) content. In all three soil profiles, the CRS values below 0.5 m depth exceeded the recommended threshold sulfur and net acidity values of 0.06 % S and 18 mol H<sup>+</sup>/t respectively set for the medium texture (i.e. clayey sand to light clay) soils. The field data were consistent with the lab results. The field pH peroxide test (i.e. pH<sub>FOX</sub>) data of all depths in three soil profiles also indicated the presence of sulfidic sediments (i.e. pH<sub>FOX</sub> < 4.5) with high to volcanic effervescence when reacting with hydrogen peroxide. Presence of sulfidic materials in all three soil profiles was further supported by the natural incubation pH (pH<sub>INC</sub>) data: when soils were incubated under natural environment pH<sub>INC</sub> dropped to < 4.5 before 19 weeks. The results revealed that Muthurajawela marsh contains hypersulfidic soil materials within the critical zone that can generate appreciable amount of acidity (i.e. PSA) in the event of exposure. Under such exposed conditions, the acidity and the trace elements mobilized by the acidity can cause detrimental impacts on soil, vegetation, ground and surface water in the marsh and thereby can adversely affect the entire ecosystem of the Muthurajawela marsh and the people living in the surrounding area. The study suggest that it is critically important to minimize any kind of disturbance of soil in Muthurajawela marsh to protect the ecosystem.

Keywords: Acid-Base Accounting, Hypersulfidic, Chromium Reducible Sulfur, Wetland, Anthropogenic activities, Net acidity

