The spatial variability of physicochemical parameters of mangrove soil and mangrove species in Negombo Lagoon, Sri Lanka

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Abstract

Mangrove forests are unique and invaluable ecosystems due to their role in biodiversity, coastal protection, and carbon sequestration. This study examined spatial variability of selected physicochemical parameters of mangrove soil and species distribution at the Negombo lagoon. Eighteen sampling sites were selected based on judgmental sampling techniques. A 10 m x 10 m area was selected within the 1 km x 1 km grid to get the replicate soil samples from 0 − 15, 15–30 and 30–45 cm depths from the surface. Further, a vegetation survey was conducted to identify mangrove species in the same 10 m x 10 m area. Soil temperature, pH, salinity, and soil organic matter (OM) were analyzed using standard laboratory methods. Results show that temperature varied spatially from 25.2 °C to 30.0 °C, with the highest temperature recorded in the topsoil layer. Soil pH and salinity spatially varied from 5.39 to 8.31 and 0.56 % to 8.83 %, respectively. Soil organic matter spatially varied from 2.56 % to 15.7 % and increased with the increasing depth. Soils with high salinity tend to reduce OM by accelerating the mineralization of OM. Correlation analysis showed a positive relationship between salinity and OM ($r = 0.57$; $P < 0.05$). Rhizophora apiculata, Rhizophora mucronate and Avicennia marina were associated more in soils with high salinity (3.72 % − 7.15 %) and neutral to weakly alkaline pH. Bruguiera gymnorrhiza was more prevalent in soils with higher salinity (7.69 % − 8.83 %) and lower pH, while Lumnitzera racemosa was found in acidic to slightly alkaline pH but with low salinity (1.35 % − 1.92 %) soils. Sonneratia caseolaris was recorded in soils with the lowest salinity (0.83 % − 1.04 %). The findings offer valuable insights for decision-making processes for conserving and restoring mangrove forests, providing effective and sustainable environmental management strategies.

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