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Physico-chemical properties of soils and ecological zonations of soil habitats of Sundarbans of Bangladesh

By

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Abstract

Soil samples were collected during 6 to 10 April 2015 at thirteen different locations from the Sundarban mangrove forests (SMF) of Bangladesh and 7 physico-chemical properties were analyzed. Mean soil pH of SMF soil was slightly alkaline, 7.34, although the minimum value was found to be acidic, 6.2 and maximum was 8.6. Salinity of soils of SMF showed wide range of variations with the mean value was 7.79‰ and minimum and maximum values were 2.06‰ and 24.25‰ respectively. We have proposed ecological zonations in soil habitats of SMF according to Iversen (1936) based on salinity. It has been found that some locations should be considered as mesohaline zones and some as mesohaline to polyhaline zones which were previously designated as oligo-mesohaline zones and polyhaline zones by other workers. The mean values of other soil variables of SMF were moisture content (25.70%), conductivity (12.172 mS/cm), organic carbon (0.833%), N (1.72%), P (0.022%). Salinity showed significant positive correlation with N (r = 0.444, p = 0.000) and OC (r = 0.230, p = 0.019) and significant negative correlation with moisture (r = -0.309, p = 0.001), pH (r = -0.508, p = 0.000) and P (r = -0.939, p = 0.008). Highly significant difference was present in case of salinity among the locations (F = 15.52, P = 0.000) and layers (F = 9.23, P = 0.000) of SMF. Significant differences were present in pH among the locations of SMF (F = 22.11, P = 0.000). Principle component analysis (PCA) showed the cluster form between conductivity and salinity. The present study provides present status of edaphic features with changes in ecological zonations of Sundarban mangrove forests.

Keywords: Sundarbans, edaphic features, salinity, ecological zonation, Principle component analysis

References

1. Ahmed, A., Ohlson, M., Hoque, S. and Moula, M.G. 2010; Edaphic conditions of different chars under different hydrological regimes in the coastal zones of Bangladesh, *Dhaka Univ. J. Biol. Science*,19(1): 27-40.
2. Boto, K. G. and Wellington, J. T. 1984; Soil N Characteristics and Nutrient Status in a Northern Australian Mangrove Forest, *Estuaries*, 7(1): 61-69.
3. Das, D. 2012; Ecological studies on the planted mangrove forest of megna estuary at Hatia, Noakhali, *M. S. Thesis*.
4. Elser, J. J. and Hamilton, A. 2007; Stoichiometry and the new biology: The future is now, *PLoS Biology,* Vol. 5: 10.
5. Gupta, P. L. and Rorison, I. H. 1975; Seasonal differences in the availability of nutrients down a podzolic profile, J. Ecology, 63: 521-534.
6. Holmer, M., Kristensen, E., Banta, G., Hansen, K., Jensen, M. H. and Bussawarit, N. 1994;Biogeochemical cycling of sulfur and iron in sediments of a south-east Asian mangrove, Phuket Island, Thailand,*Biogeochem*, 26(3): 145-161.
7. Iversen, J. 1936; "Biologische Pflanzentypenals Hilfsmittel in der Vagetations for schung", *Dissertation. Medd. Fra Skallinglaboratoriet, Copenhagen*.
8. Jackson, M. L. 1973; Soil N chemical analysis. *Constable and Co. Ltd. London*.
9. Kathiresan, K., Rajendran, N. and Thangadurai, G. 1996; Growth of mangrove seedlings in the intertidal area of Vellar estuary, southeast coast of India,*Indian J. Mar. Science*, 25: 240-243.
10. Khan, H. and Brush, G. S. 1994; Nutrient and Metal Accumulation in Freshwater Tidal Marsh, *Estuaries*, 17(2): 345.
11. Lacerda, L. D., Ittekkotb, V. and Patchineelama, S. R. 1995; Biogeochemistry of Mangrove Soil N Organic Matter: a Comparison Between Rhizophora and Avicennia Soil Ns in South-eastern Brazil, *Estua. Coast. Shelf Science*, 40: 713-720.
12. Lin, G. and Sternberg, L. S. L. 1993; Effects of salinity fluctuation on photosynthetic gas exchange and plant growth of the red mangrove (*Rhizophora mangle* L.), *J. Exp. Botany*, 44: 9-16.
13. Lin, P., Su, L. and Lin, Q. Y. 1987; *ActaEcologicaSinica*7: 102.

14. Moreno, A. N. M. and Calderon, J. H. M. 2011; Quantification of organic matter and physical-chemical characterization of mangrove soil at Hooker Bay, San Andres Island-Colombia,*Proceedings of the Global Conference on Global Warming, July 11-14, 2011, Lisbon, Portugal*, pp: 1-7.
15. Nazrul-Islam, A. K. M. 2003; Mangrove forest ecology of Sundarban: the study of change in water, soil and plant diversity, *Oxford Univ. Press, New Delhi*, In: Sustainable Environment: a statistical analysis, Ghosh, A. K., Ghosh, J. K. and Mukhopadhaya, M. K. (Eds), pp. 126-147.
16. Odum, W. E. and Heald, E. J. 1972; Trophic analyses of estuarine mangrove community,*Bull. Mar. Science*, 22: 671-738.
17. Rambok, E., Gandaseca, S., Ahmed, O. H. and Majid, N. M. A. 2010; Comparison of selected soil chemical properties of two different mangrove forests in Sarawak, *Am. J. Environ. Science*, 6: 438-441.
18. Sah, K. D., Sahoo, A. K., Gupta, S. K. and Banerjee, S. K. 1989; Mangrove vegetations of sunderbans and their effect on the physicochemical and nutrient status of the soils, *Proc. Indian Nat. Sci. Acad. Part B: Biol. Science*, 55: 125-132.
19. Steinke, T. D. and Ward, C. J. 1988. Litter production by mangroves. II. St. Lucia and Richards Bay. *S. Afr. J. of Botany*, 54:445–454.
20. Sukardjo, S. 1994; Soils in the mangrove forests of the Apar Nature Reserve, Tanah Grogot, East Kalimantan, Indonesia, *Southeast Asian Study*,32: 385-398.
21. Suwa, R., Deshar, R. and Hagihara, A. 2009; Forest structure of a subtropical mangrove along a river inferred from potential tree height and biomass, *Aquat. Botany*, 91: 99-104.
22. Sylla, M., Stein, A., Breemen, N. and Fresco, L. O. 1995. Spatial variability of soil N salinity at different scales in the mangrove rice agro-ecosystem, *West Afr. Agri. Eco. AndEnvironment*, 54: 1-15.
23. Tam, N. F. Y. and Wong, Y. S. 1998; Variations of soil N nutrient and organic matter content in a subtropical mangrove ecosystem, *Water, Air, Soil N Pollution*, 103: 245 – 261.
24. Wakushima, S., Kuraishi, S. and Sakurai, N. 1994: *J. Plant Res.* 107: 39.
25. Walkley, A. and Black, I. A. 1934; An examination of the Degtjareff method for determining soil N organic matter and a proposed modification of the chromic acid titration method, *Soil N Science*, 37:29-38.