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Spatial Variability of Soil Organic Carbon, pH and Electrical Conductivity and Its Influencing Factors in a Watershed of Coastal Region of Odisha, India

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ABSTRACT

Soil organic carbon (SOC), as a main component of the carbon cycle, contributes to biological and physico-chemical processes in the soil that influence plant growth and soil health. The pH of soil determines how acidic and basic the soil is, while the electrical conductivity (EC) of soil is used to determine the extent of soil salinity. Therefore, the quantification and spatial distribution of these soil properties are important for agricultural crop planning. In this study, the spatial variability of SOC, pH, and EC in soils of a watershed in Nayagarh (Odisha, India) was analyzed using geostatistical (ordinary kriging) techniques. The study revealed that the experimental semivariogram of SOC and EC fits well with the spherical model; however, the Gaussian model was found to be the best fit for soil pH. The coefficients of variation for SOC, pH, and EC were 15%, 7.63%, and 40.3%, respectively, which suggests SOC may have moderate variability. SOC had moderate spatial variability, as shown by the nugget to sill ratio. The geostatistical method was able to accurately assess the spatial variability of SOC content and its influencing factors at the study watershed. The findings could help decision-makers and farmers in developing more effective land resource management.

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EC; ordinary kriging; Ph; semivariogram; SOC; spatial variability; watershed

Introduction

Watershed management has become a key development approach in the Odisha region of eastern India due to the high livelihood dependency on subsistence agriculture, the hilly and steep topography, ongoing resource degradation, and the great potential for natural resource-based development. Nayagarh district of Odisha, India, with an area of 3890 sq km, is bounded by latitudes 190 53' 52"N and 200 34' 46" N and longitudes 840 29' 26"E and 850 27' 22" E. The Mahanadi, Burtanga, Kaunria, Kamai, and Budha rivers constitute the major drainage systems of the district. The cultivable portion of the total geographic area is about 38%, and just 13% is under irrigation. The population of the district primarily depends on agriculture. Paddy, maize, green gram, groundnut, sesame, mustard, linseed, and sugarcane are the main crops grown in the coastal region. Most of the district is made up of structural hills, which are governed by bending, faulting, and numerous criss-cross joints and fractures that make infiltration easier (CGWB 2013). The soils of the district are of Alfisols and Ultisols soil orders. The red soils have a light texture (loamy, sandy, and gravelly in texture), and with other alluvial soils make up the majority of Alfisols. These soils are typically devoid of lime concretions and poor in organic matter, nitrogen, and phosphate. The soil's pH ranges from 6.5 to 7.3. The production of paddy and other crops is suitable for these soils. Laterite and lateritic soils, as well as red and yellow

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