

Assessment of the role of physicochemical properties of the soil on the formation of badlands around Chitrakoot, India

Nikhilesh Singh¹, Medha Jha¹, Sanjay Tignath², Bhola Nath Singh¹, and Arghya Chattopadhyay³

¹Indian Institute of Technology BHU Varanasi

²Government Science College

³Banaras Hindu University Institute of Agricultural Sciences

June 6, 2021

Abstract

The present paper attempts to study the causative physicochemical properties of the soils, which effectively portray its dispersive and deteriorating conditions, which have led to the formation of badlands in the Mandakini River watershed Chitrakoot area, India. Following investigations were made on the soil samples collected from the field: i) grain size distribution ii) various physicochemical properties and nutrient content of the soil. The clay minerals were detected and identified with the X-ray diffraction (XRD), Fourier transform infrared (FTIR), and High-Resolution Scanning Electron Microscopy (HRSEM). The spatial maps of all these parameters were prepared in a GIS environment, and overlay analysis was performed. The results show that the soil has a silt loam texture with high bulk density. The low values of plastic limit, liquid limit, and plasticity index show the non-cohesive nature of the soils. Higher bulk density has decreased the porosity as well as permeability in the soils. This impact on porosity and permeability has reduced the favourable conditions for vegetation, and the soils contain low organic matter. Apart from the bulk density, the presence of calcrete and illitic clay mineral (low in content) has also reduced the permeability of the soils, further increasing runoff. The overlay analysis based on the liquid limit, plasticity index, bulk density, and drainage frequency shows that the area is thoroughly affected by badland processes. Three zones were categorized as severe, very severe, and extremely severe depending upon their conditions gully channel processes.

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