Elucidating woody vegetation patterns in relation to soil and topography in tropical Africa: the case of Nech Sar National Park in Ethiopia.

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Abstract

Although soils and topography are reported to be key factors determining vegetation patterns, there are very few studies on this topic in tropical Africa. Given the relatively young age of the soils of Nech Sar National park, we hypothesised that the woody vegetation would be related to both topsoil and subsoil characteristics. As topography also determines soil characteristics, we investigated whether soil and topography could be considered independently. The abundance of woody plant species was measured in 19 stratified randomly selected plots of 20 m × 20 m. At the centre of each plot a soil profile pit was dug and samples were taken from each horizon. Topographic characteristics were derived from a 30 m × 30 m digital elevation model. TWINSPAN and Detrended Correspondence Analysis (DCA) were used to identify major patterns in species composition. Factor Analysis was used to assess the variability of the soil characteristics and the correlation between them. Differences between the vegetation groups in-terms of stand and environmental characteristics was tested with the Mann-Whitney U test. DCA axes describing the major variation in vegetation patterns were correlated with soil and topographic characteristics. Forest vegetation was found on Fluvisols and Gleyic Cambisols while bushland was found on Andosols and Vertic Cambisols. The vegetation gradient from forest to bushland (DCA-1) was correlated with both topsoil and subsoil characteristics reflecting parent material and alkalinity; these could however not be dissociated from topography. In contrast, variation both within the forest and the bushland (DCA-2) was not correlated with environmental characteristics. We attribute this variation to disturbances such as collection of firewood or logging or to the absence of large browsers or scarcity of wildfires. This study calls for giving equal attention to topsoil and subsoil for elucidating woody vegetation patterns. Though vegetation patterns vary with topography, a comprehensive understanding requires insights into soils.

Key words: : Andosols; Bushland; Cambisols; Digital Elevation Model; Fluvisols; Riverine Forest; Soil Characteristics; Topographic Characteristics