Soil-water-vegetation relationships in a toposequence located in the Ecological Station of Assis, São Paulo, Brazil

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Abstract

The "Cerrado" bioma is being fragmented due to the human and agricultural occupation. To maintain the biodiversity, ecological corridors must be created by the revegetation and the restoration of the degraded areas. It can only be ameliorated upon the knowledge of the soil's natural dynamics and distribution. The aim of this work was to characterize the behavior of soil water flow and soil physical properties, distributed in a toposequence under native vegetation. The study area was in a permanent plot installed in the Assis Ecological Station, São Paulo, Brazil. The predominant vegetation is the closed "cerrado" or savanna woodland. The soil physical, hydraulic characterization depended on soil morphology. The morphological study was carried out by structural analysis and by description of soil profiles arranged in five key positions on the slope. Disturbed soil samples were taken for chemical, particle size and soil particle density analyses. Undisturbed samples collected in cylindrical cores were used to define the soil water retention and bulk density. Soil blocks were impregnated and polished for image analysis to obtain the distribution of pores in number, shape and size. In wells perforated in three sectors of the toposequence the field saturated hydraulic conductivity was determined. The soil moisture monitoring "in situ" was obtained by sensors installed in the main horizons of the pits and calibrated for each soil horizon, during the period of November 2003 to November 2004. The nearest rain volume data were collected too. Digital photos of the soil profiles were acquired for the determination of the root distribution. The soils were classified, from the top backslope down to the footslope, as Rhodic Haplustox, Typic Haplustox and Epiaquic Haplustult, with a homogeneous color transition and the predominance of a sandy loam texture. In the soil surface on the toposequence, a little number of complex pores with equivalent diameter over 1,000 µm occupied almost the total pore area, characterizing the predominance of a structure formed by the packing of single grains. The porosity was higher than in the other horizons. This behavior caused lower water retention even with the highest organic matter content. On the surface, the oscillation of the soil moisture is closely related to each rain event. The roots were distributed in ramified or grouped roots in the surface layer and individually in the deeper horizons. In Oxisols, the presence of microaggregates in the B-horizon was characterized by a number of complex pores with equivalent diameter over 1,000 µm larger than in the soil surface but in minor area than in the surface layer. This conferred higher water retention, larger number of micropores and lower oscillation of soil moisture than in soil surface. The structure of the deepest B-horizon of Epiaquic Haplustult was denser, featured by an expressive rounded or vugh porosity with diameters between 30 and 1,000 µm. This conferred the largest content of clay, with the highest water retention, imperfect drainage and lowest hydraulic conductivity. The other soil horizons in the toposequence presented greater hydraulic conductivity. The landscape influences the physical, hydraulic and morphological soil properties in the toposequence. So the water content is limited in the dry season and partially in the humid season too, which can define the floristic pattern of the closed "cerrado" in this permanent plot.

Key-words*:* cerrado, oxisol, landscape, soil water, water retention, soil moisture, porosity, image analysis, root distribution

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