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Soil functioning in an agroextractivist system in the Eastern Amazon region under family farming management

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Family farming has been identified as a major modifier of Amazonian vegetation cover. These small establishments have had problems with the availability of water resources, soil quality and, consequently, low crop production. Amazonian soils studies have generated data that make up a database about the changing soil conditions as a result of the land use modifications. The objective of this research is to understand the soil degradation processes that occur on two toposequences, under native forest and pasture, in a family farming establishment. The study area is located in the Piranheira Praialta Agroextrativist Settlement Project in the county of Nova Ipixuna, Pará, Brazil. Two toposequences were chosen, one under native forest and the other under pasture. Pits were opened in different landscape positions (upslope, midslope and downslope) for soil morphological, micromorphological and physical characterization. Samples were taken for soil particle distribution, bulk density, particle density, hydraulic conductivity and image analysis. The soils were classified according to World Reference Base (WRB-FAO, 2006) as Plinthic Acrisol Clayic, Haplic Cambisols Dystric Skeletic and Haplic Plinthosol Clayic Dystric. The results show that all the studied profiles presented higher contents of sand in the surface horizons and an increase in clay in the subsurface horizons. This indicates heterogeneity of the particle soil distribution in the soil profiles along the different landscape positions. Higher bulk density values are found in the surface horizons due to the sandy texture of these horizons. Under forest, soil bulk density varies from 1,260 to 1,580 Mg m3, and under pasture bulk densities were higher varying from 1,270 to 1,710 Mg m3. Soil particle density results obtained in both land use systems were very similar in all horizons varying from 2,580 to 2,630 Mg m3 under forest and from 2,580 to 2,670 under pasture. Image analysis results showed a significant decrease in the soil porosity between the surface and subsurface horizons of all the profiles in both land use systems. In the forest, changes in the total area occupied by pores between the surface and subsurface horizons occurred at a depth of 65 cm and the values varied from 24.15% to 6.15%. In the pasture, these changes occurred closer to the soil surface at a depth of 20 cm and the values varied 23.76% to 5.04%. Irregular pores dominated in the surface horizons whilst rounded pores dominated in the subsurface horizons in both land use systems. These morphological and physical attributes influenced the hydraulic conductivity values, which presented higher values in the surface horizons decreasing in the clayey subsurface horizons. The analyzed attributes showed a tendency of a higher degraded soil under pasture with elevated values of soil bulk density, rapid reduction in soil porosity closer to the soil surface and changes in the hydraulic conductivity properties.