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How do runoff and soil loss vary over time in subtropical areas?

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Brazil is seen as a potential world breadbasket in which an increase of around 40% in its current production is expected by the year 2050 to attend food demand imposed by world population growth. The disorderly intensification of agriculture results in erosion, losses and exhaustion of soil nutrients, abandonment of the area, and opening of new agricultural ones. The authors were motivated by the questioning of how significant the changes at surface runoff and soil loss over time are. Thus, this work aimed to investigate the temporal component (10 years) in the surface runoff and soil loss of a typical soil found in the Cerrado biome (Brazilian Savanah), an area that shelters a large part of the national agricultural production. The study area is located in Itirapina municipality, central region of the State of São Paulo, Brazil (22°10'S, 47°52'W, elevation of 790m). The region's mean annual rainfall is about 1486 mm and humid subtropical climate, with hot summers and dry winters. The soil type found is the Orthic Quartzarenic Neosol (RQo), which occupies approximately 15% of the Cerrado biome superficial area. Surface runoff and sediment yield are monitored in rectangular experimental plots (5 meters wide, 20 meters long, and 9% slope). Monitoring takes place in six plots kept under bare soil (three plots constructed in 2011, called P1, and another three plots constructed in 2020, called P2). Runoff flows downhill and is automatically registered through large tipping buckets and then stored in large boxes (360 liters). Runoff samples are collected after each precipitation event to identify the amount of sediment in the liquid sample. To study the pedological characteristics, soil samples were collected at different depths (15, 30, 60, and 90 centimeters) of the experimental plots in 2013 and 2022 and sent to

laboratory analyses such as granulometric, porosity, density, and hydraulic conductivity. It was observed that P1 has a runoff volume 10.3% greater than P2 under the same dimensions and slope. Runoff usually starts first and lasts longer at P1 than P2. P1 soil exposure to precipitation and solar radiation over 10 years modified the superficial pedological characteristics, causing: clogging of the pores, loss of superficial soil layer, particle breakdown, and deposition near the outlet plot. Currently, the sediment carried at P1 is rich in soil particles of larger dimensions while P2 has high clay contents. The differences in the hydrological responses of the experimental plots were confirmed through laboratory analyses demonstrating that P1 has lower clay, organic matter, and porosity contents in the plot surface layers compared to P2. Most runoff and soil loss monitoring are limited to campaigns covering isolated events up to 1 year, but records over a long time as given above are scarce, especially in tropical and subtropical areas, demonstrating its relevance to the soil research community.