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The influence of vegetation cover and soil physical properties on deflagration of shallow landslides - Nova Friburgo, RJ / Brazil

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In 2011, the mountainous region of the State of Rio de Janeiro (Brazil) suffered enormous social and economic losses due to thousands of landslides caused by an extreme rainfall event. The mapping of the scars of these landslides in an area of 421 km^2 in the municipality of Nova Friburgo, RJ - Brazil resulted in a total of 3622, and 89% of these scars were located in areas covered by grasses and forests. Despite the unexpected result (64% of scars in forest areas), field evidence has shown that most of the forest fragments in the municipality are in the initial stages of succession and in different states of degradation, evidencing the need for a better understanding of the role of these forests in the detonation and propagation of landslides. Two slope forest areas with different ages (20 and 50 years) were evaluated in relation to the vegetative aspects that influence the stability of the slopes in each area. Hydrological monitoring, including precipitation, interception by manual and automatic method, soil moisture and subsurface flows were performed in two different areas: forest and grass. Soil moisture was monitored by granular matrix sensors and flows by collecting troughs in trenches at depths of 0 cm, 20 cm, 50 cm, 100 cm, 150 cm and 220 cm, which were also analyzed for biomass and length of thick roots (> 2 mm diameter) and thin roots (< 2 mm diameter) and for the soil physical properties (particle size, aggregate stability, porosity and hydraulic conductivity in situ). In the grass area, the lower soil structure in relation to the forest areas makes it difficult to transmit the water through the soil matrix. During the monitoring period, that area preserved the moisture in depths of 100 cm, 150 cm and 220 cm. The fasciculate root system of the grasses increased the infiltration of water at the top of the soil, favouring the formation of more superficial saturation zones in the heavy rains, due to the hydraulic discontinuities. In forest areas, infiltration by preferential paths allows the concentration of water in the depths in which they are terminal increasing the pore water pressure. Soil saturation in this area also occurred in heavy rains, but more deeply due to the rapid movement and redirection of water in depth by tree roots. This process was also responsible for the higher subsurface flows found in the forest, that is, the greater aggregation of the soil, the existence of interconnected macropores, ducts and roots facilitate the transmission of water in depth. Associated with the high rainfall and high relative humidity, these vegetation favoured the formation of saturation zones and increased pore pressures of the water, causing landslides on lands between 0.5 m and 2.0 m. The results of hydraulic conductivity show that the difference (lateritic = 10-4 cm/s; saprolitic = 10-5 cm/s) between the layers of the soil can generate zones of hydraulic discontinuity in extreme rainfall events, which would justify the predominance of shallow translational landslides at these same depths.