



Assessment of shallow landslides susceptibility using different mapping techniques, Serra do Mar, São Paulo State, Brazil.

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The Serra do Mar is frequently affected by heavy rainfall that triggers numerous mass movements. Since 1960 these events have been studied by geoscientists, especially geomorphologists. Many of these processes (e.g., shallow landslides) occur in steep slopes with forest cover, contributing to sediment increase in the drainage network. When these processes are associated to heavy rainfall, debris flows can be triggered, reaching gentle areas, where are located more than 70 industries. In January, 1985, thousands of shallow landslides occurred during heavy rainfall (379.4 mm/48h), in two small basins, Copebrás and Ultrafértil, where were mapped 356 and 108 scars, respectively. Considering the role of topography in the control of shallow landslides and the difficulty of surveying and monitoring field data, the aim of this study was to evaluate the role of topographic factors (angle, aspect and curvature) in the distribution of shallow landslides occurred in this event. To reach this aim, we elaborated slope angle, aspect and curvature maps through the Digital Elevation Model (DEM). This was generated by digital topographic maps in 1:10,000 scale with 5 m equidistance. The mapping of shallow landslide scars was made by aerial photograph interpretation in 1:25,000 scale. For the Copebrás basin we used a DEM with 2 m resolution and for the Ultrafértil watershed we used a 5 m resolution. The mapping of the shallow landslide scars was made by aerial photograph interpretation in 1:25,000 scale, based on analysis of visual features, absence of vegetation and different textures of the orthophotos. For the Copebrás basin only the upper portion of the scars were mapped, and in the Ultrafértil basin we mapped the entire scars, considering the deposit zones. The second step of this research comprised the combination of topographic and scars maps, and the analyses of three indexes. The frequency (F): the cell numbers for each class of topographic parameters (angle, aspect and curvature); the scars concentration (SC): the number of cells, each class affected by landslides and total cells in the basin, and the landslides potential (LP): number of cells of each class affected by the scars and the total cells in that same class. The results have shown an important topographical control in the shallow landslides distribution. The Frequency (F) of topographic classes was similar when compared to other studies in the Serra do Mar. Both basins have most slope angles between 30° to 40°. However, the LP index suggests that the susceptible areas are the angles between 40° to 50°, LP=6.3% (Copebrás) and LP=4.1% (Ultrafértil). In relation to aspect in the Copebrás basin predominant slopes oriented towards SE quadrant (F=22%), and in the Ultrafértil basin oriented towards E quadrant (F=27%). However, in spite of the NW class occupies less than 10% in each basin, this class showed to be more unstable, LP>7%. In Copebrás basin, although the concave slope has been less frequent (F<20%), this class showed a very high LP (3.3%). The convex (F=50%) and concave (F=43%) classes predominated in Ultrafértil, but straight slopes were more susceptible (LP=7%). This result may be related to mapping techniques of the scars, because for the Ultrafértil basin we included the deposition areas that can be reached in straight slopes. The results demonstrated that topographical conditions were important control in the shallow landslides triggered in 1985. Thus, the understanding of the relationship between the landslides distribution and topography can help to identify susceptible areas in the Serra do Mar.