



Distribution of the failure scars on the steep loess slope: influences of topography and rainfall

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The failure scar morphologies have long been a controversial topic on the Loess Plateau of China. However, the lack of normative data tests has hampered this vital field of research in the area. This study conducted a series of experiments in the laboratory to observe the sliding surfaces of different slope geometries and rainfalls and then performed a sensitivity analysis to quantitatively explore the triggering mechanisms of failure scars on the steep loess slope. The following six types of failure scar were found: translational face (Tf), upper concave (Uc), lower concave (Lc), polygonal-side (Ps), convex (Co) and irregular appearance (Ia). The sum occurrences of gravity erosion in an experiment corresponding to the failure scars Tf, Lc, Uc, Ia, Ps and Co amounted to 46, 27, 21, 3, 2 and 1% of the total, respectively. Meanwhile, the aggregate amounts of gravity erosion in an experiment corresponding to the failure scars Tf, Uc, Lc, Ps, Ia and Co amounted to 59, 18, 17, 3, 2 and 1% of the total. This implies that Tf, Uc and Lc were three major types of failure scar happening in the processes of gravity erosion on the steep loess slope, and especially the Tf was the most decisive one. For the occurrence in an experiment, the sensitivity parameters of slope height, slope gradient, rainfall duration and rainfall intensity on Tf, Lc, Uc, Ia, Ps and Co were comparable, which were from 0.3 to 4.0. Nevertheless, for the total amount in an experiment, the sensitivity parameters on Tf of slope gradient and rainfall intensity are outstanding, which were 5.5 and 3.7, respectively. That's to say, a relative dangerous failure scar, Tf, might appear if the slope grew steeper, or the rainfall became more intensive. The results provide an important implication for controlling the gravity erosion on gully slopes on the Loess Plateau.