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A General Landslide Distribution for Triggered Event Landslide Inventories from 100-10,000 Landslides

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Large numbers of landslides can be associated with a trigger, i.e. an earthquake or a large storm. We have previously hypothesized that the frequency-area statistics of medium- to high-relief region landslides triggered in an event are well approximated by a three-parameter inverse-gamma distribution, irrespective of the trigger type. In this statistical distribution, the probability of landslides increase to a maximum value (landslide area with the most abundant number, or 'peak' of the rollover) and then decrease with a power-law tail with noncumulative exponent about −2.4. This maximum probability occurs at about 400 m^2. The use of this general distribution was established using three substantially complete and well-documented landslide event inventories: 11,000 landslides triggered by the Northridge California Earthquake, 4000 landslides triggered by rapidly melting snowmelt in the Umbria region of Italy, and 9000 landslides triggered by heavy rainfall associated with Hurricane Mitch in Guatemala. In this paper, we examine further this general landslide distribution by using an inventory of 165 landslides triggered by heavy rainfall in the region of Todi, Central Italy. Our previous studies have shown the applicability of our general landslide distribution to events with 4000−11,000 landslides. This smaller inventory provides a critical step in examining the applicability of the general landslide distribution to much smaller triggered event landslide inventories. We find very good agreement of the Todi event with our general distribution. This also provides support for our further hypothesis that the mean area of landslides triggered by an event is approximately independent of the event size. Fundamental questions still remaining include what controls the rollover in the inverse gamma distribution, and why there are strong differences between the noncumulative power-law exponent for medium and large landslide areas (−2.4) vs. rockfall areas (−1.1).