Geophysical Research Abstracts, Vol. 6, 02792, 2004
SRef-ID: 1607-7962/gra/EGU04-A-02792


# ANALYSIS OF LANDSLIDE OCCURRENCE IN THE COLLAZZONE AREA, CENTRAL UMBRIA, ITALY

M. Cardinali, M. Galli, F. Ardizzone, P. Reichenbach and F. Guzzetti

Consiglio Nazionale delle Ricerche, Istituto di Ricerca per la Protezione Idrogeologica, via della Madonna Alta 126, 06128 Perugia, Italy (Mauro.Cardinali@irpi.cnr.it)

In central Italy mass movements contribute to shape the landscape and represent a major hazard. Landslides occur every year in Umbria in response to pronged rainfall, rapid snow melting or earthquake shaking. Despite the abundance and frequency of mass movements, until recently the temporal and spatial pattern of landslides in Umbria remained undetermined. For the Collazzone study area, which extends for 89.9 km2 in central Umbria, we prepared a detailed multi-temporal landslide inventory map. The inventory map was obtained through the systematic interpretation of stereoscopic aerial photographs flown in the period from 1941 to 1997. Aerial photographs were taken in the summer of 1941 at 1:18,000 scale, on 30 August 1954 at 1:33,000 scale, on 13 June 1977 at 1:13,000 scale, on 1 July 1985 at 1:15,000 scale, and on April 1997 at 1:20,000 scale. Field surveys were carried out in the period from January to March 1997 and in the years 2002 and 2003.

Landslides identified on the aerial photographs were mapped at 1:10,000 scale and classified according to the type of movement, the degree of activity and the estimated depth. We mapped separately the depletion area and the landslide deposit, and we attributed a degree of certainty to each landslide in the inventory. The inventory map contains 2,501 landslides covering 14.99 km2, which corresponds to 16.7% of the entire study area. If plains and large valley bottoms are excluded, the mapped landslides cover 20.5% of the study area. These values are typical of central Umbria, where lake and continental deposits, Quaternary in age, crop out. The average density of mass movements is 28 landslides per square kilometer but, in places, the density of slope failures is higher, exceeding 50 landslides per square kilometer.

To investigate the spatial and temporal evolution of landslides we exploited the multi-temporal inventory map. We extracted from the multi-temporal map the landslides

that were classified as "active" in each set of aerial photographs or during the field surveys. This allowed us to prepare a set of six landslide maps, showing active landslides of different ages. We consider these maps as (or proxy of) "event" inventory maps. We analyzed the six event inventories separately and in combination. We first investigated the frequency-area statistics of the mapped landslides, and found them to be in agreement with the known statistics of landslide areas in central Italy. We then compared the abundance of active landslides in the different events maps. Most of the active landslides were mapped in the 1941 aerial photographs (43.95% of landslides and 59.98% of landslide area). These landslides were triggered by repeated, prolonged and intense rainfall events in the period between 1937 and 1941. The second most numerous landslides were mapped from the 1997 aerial photographs and field surveys (25.41% of landslides and 12.98% of landslide area). These landslides were triggered by rapid snow melting in January 1997. Lastly, we investigated landslide persistence, i.e., the possibility that a slope failure will occur in the same area where a landslide was recognized before. We found that only 32.2% of the landslides in the 1941 "event" inventory fell inside a pre-existing landslide, and that between 63.5% (1997) and 70.3% (1985) of the most recent landslides occurred inside a pre-existing mass movement. We argue that the 1941 "event" was particularly severe and significantly affected the morphology of the slopes in the study area. The younger "events" were less severe, and affected mostly the same areas affected by the 1941 "event". This information is important for a better understanding of landslide hazards and landscape evolution.