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Land use change, landsliding and agricultural land degradation: a case history from the Southern Apennines, Italy

J. Wasowski (1), C. Lamanna (1), M. Dipalma (2), and D. Casarano (1)

(1) CNR-IRPI (National Research Council), Bari, Italy, (2) Università degli Studi di Bari "Aldo Moro", Dipartimento di Scienze della Terra e Geoambientali, Bari, Italy

This work builds upon our earlier study on the relative impacts of land-use change and climate on landslide activity in the municipal territory of Rocchetta Sant'Antonio (the Apennine Mountains) in the period 1976-2006 (Wasowski et al., 2010). Here, in addition to the recent high resolution satellite imagery we exploit historical airphotos to extend the documentation of land use changes and variations in landslide activity until 1955. Furthermore, the investigation of land use change is more detailed by considering an additional class, i.e. grassland pasture. We focus on a small catchment characterized by the predominance of clay-rich materials and known to be particularly prone to slope failures. The results demonstrate a pronounced change from the grassland pasture-dominated land use (over 50%) in 1955 to the wheat-based agriculture (over 75% of land) by 2006. The temporal series of landslide inventories also indicate significant variations in landslide activity in the same period. In particular, it is shown that the highest susceptibility to shallow landsliding (areal frequency over 10%) is recently registered on the sown fields, which initially (1955) have been used for pasture and grazing. Furthermore, the data reveal that with time the steeper and apparently more landslide-prone grassland pasture have been given over to new wheat cultivation. Although the relative influences of land use changes and climate variability on slope stability are not simple to quantify, the modification of the existing cover from the all-year-present grass to the wheat characterized by a few month growth period per year can affect the soil-water balance and, therefore, groundwater levels and effective strengths of slope materials. The strengths of soils can also be negatively influenced by the mechanical disturbance caused by tillage. Therefore, the introduction of ploughing for the new wheat cultivation on the often steep slopes that had originally been covered by grass is considered to be a likely factor of the increased susceptibility to landsliding. The reconstruction of the changes in land use and the associated increases in slope failure frequency thus offers a useful historical perspective to soil degradation risks and poses questions on the long-term sustainability of wheat agriculture in the Southern Apennines, as well as in other mountainous areas potentially susceptible to widespread landsliding.

References

Wasowski, J., Lamanna, C., Casarano D. 2010. Influence of land-use change and precipitation patterns on landslide activity in the Daunia Apennines, Italy, Quarterly Journal of Engineering Geology and Hydrogeology, 43, 1–17. DOI 10.1144/1470-9236/08-101