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Adv. Geosci., 22, 59-65, 2009

www.adv-geosci.net/22/59/2009/

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## Mass movements in the Rio Grande Valley (Quebrada de Humahuaca, Northwestern Argentina): a methodological approach to reduce the risk

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**Abstract.** Slope processes such as slides and debris flows, are among the main events that induce effects on the Rio Grande sediment transport capacity. The slides mainly affect the slope of the Rio Grande river basin while debris and mud flows phenomena take place in the tributary valleys. In the past decades several mass movements occurred causing victims and great damages to roads and villages and therefore hazard assessment and risk mitigation is of paramount importance for a correct development of the area. This is also an urgent need since the Quebrada de Humahuaca was recently included in the UNESCO World Cultural Heritage. The growing tourism business may lead to an uncontrolled urbanization of the valley with the consequent enlargement of threatened areas.

In this framework mitigation measures have to take into account not only technical aspects related to the physical behaviour of the moving masses but also environmental and sociological factors that could influence the effectiveness of the countermeasures.

Mitigation of landslide effects is indeed rather complex because of the large extension of the territory and the particular geological and geomorphological setting. Moreover the necessity to maintain the natural condition of the area as prescribed by UNESCO, make this task even more difficult.

Nowadays no in-depth study of the entire area exists, therefore an integrated and multidisciplinary investigation plan is going to be set up including geological and geomorphological investigations as well as archaeological and historical surveys. The better understanding of geomorphological evolution processes of the Quebrada de Humahuaca will bridge the gap between the necessity of preservation and the request of safety keeping of the recommendation by UNESCO.

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Citation: Marcato, G., Pasuto, A., and Rivelli, F. R.: Mass movements in the Rio Grande Valley (Quebrada de Humahuaca, Northwestern Argentina): a methodological approach to reduce the risk, Adv. Geosci., 22, 59-65,



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