ABSTRACT

Several multivariate statistical analyses have been performed in literature to identify the most influential parameters on landsliding, so to predict and map where new landslides will occur within a landslide-prone area, while very few studies have applied statistical procedures to describe the spatial distribution of large landslide over large areas. This paper focuses on the applicability of landslide susceptibility zoning by means of statistical multivariate analysis. In the study area, attempts at testing the proficiency and limitations of multivariate statistical techniques have been developed. The chosen procedure is the one tested in the Eastern Spanish Pyrenees to study shallow landslides, which represents a successful example in the international literature (Baeza&Corominas, 2001). In this investigation the same procedure has been used to study large landslide distribution over the Italian Benevento Province, on a working scale of 1:25000.

Two examples have been developed. The first consists in the application of the statistical multivariate technique to characterize the actual landslide distribution, in particular to distinguish the two populations of active and dormant earthflows. The second attempt consists in the application of the statistical analysis to assess terrain susceptibility to produce earthflows or slides.

The results highlight the dependence of the analyses' reliability on the zoning purpose. Models based on the same statistical approach but applied to study different cases in the same area yield results that may be completely dissimilar in terms of consistence.

In the first case the results obtained are inconsistent, demonstrating that a clear distinction between active and dormant earthflows is not possible with the parameters taken into account. All the variables used in the analysis have been captured automatically. The lack of data and their quality influence considerably the reliability of the results.

In the second case the results obtained are consistent, demonstrating that: (i) the discriminant function allow to correctly classify nearly the 80% of earthflows; (ii) the variables selected as the most influential factors on stability are related to the watershed dimension, the superficial run-off, the lithology and the plane curvature; (iii) the analysis developed has good capacities of predict the occurrence of landslides.

Also in this case all the variables used in the analysis have been captured automatically. The results obtained can be considered very good, although they may be improved using also data gathered directly in the field.

The analyses developed considering the category of slides give nearly the same results. The discriminant function obtained and the variables caught as the most influential factors on slope instability demonstrate that a clear distinction between the two typologies of movements considered is not possible with the parameters taken into account. Some factors which play a significant role in the distinction between the two typologies of movements are probably missing in these analyses. The results may be improved by adding to the data set information relative to factors that are better linked to the processes that led to the occurrence of an earthflows rather than a slide.

Moreover, the experience gained from the applications of multivariate techniques in the two cases indicates that the amount and quality of available data exert a relevant influence on the reliability of the susceptibility model developed. The statistical analyses have been developed only using automatic capture data. However, the GIS-aided procedure should not detract from

field work since the database cannot be prepared in a reliable way with automatic data capture techniques exclusively. In addition, as the basis of the analyses is the same landslide inventory, which was constructed from aerial photography, the examples stress the importance of a correct characterization of the actual landslide distribution to produce reliable susceptibility maps. Uncertainties in landslide inventories restrict the applicability of susceptibility maps.