

Fig. 4 Daily rainfall (bars) and cumulative rainfall (line) for (A) 1987, (B) 1978, (C) 1989, and (D) 1979. All data are from the National Weather Service, Fort Worth, Texas.

Among the processes that conduce to natural hazards evaluation its usual to detach landslides, namely by its rapid movements and catastrophic consequences. In fact, those slides have the most important slope instability role in some of the case areas, such as Maior river basin, Lourinhã and Alcabrichel basins and north Lisbon area. In these areas we can observe a complex landslide typology : sheet, translational, complex and earth slides due to lateral sapping. The translational and complex slides (photos 1 and 2) involve large volumes of materials, important equipment costs and farming destructions.

The landslides are particularly frequents on the edges of the river beds, related with the hydrological regime (mainly when flash floods occur), and near the anthropic talus (photo 3).

Among the other mass movements and erosional processes responsible for environmental damages, we must point out rock-falls, laminar, rill and gully erosion and alluvial fans genesis.

Rockfalls affect coherent limestones and sandstones. They are very frequent in the Limestone Massif of Estremadura, although its presence in the other areas is common whenever lithological and structural conditions are favourable.

In badly consolidated materials the rill and gully erosion take place, namely when the topographic (slope degree) and vegetal cover conditions (low density) are propitious (photo 4). In lower slope degrees and in sandy clayish materials it occurs aggradation responsible for alluvial fan formation and farming destruction (photo 5)

## REFERENCES

- (1) FERREIRA, A.B. (1984) Mouvements de terrain dans la région au Nord de Lisbonne. Conditions morphostructurales et climatiques. Mouvements de Terrain, Colloque de Caen, Documents du B.R.G.M., n°83, Paris, 485-494.
- (2) FERREIRA, A.B.; ZÉZERE, J.L.; RODRIGUES, M.L. (1987). Instabilité des versants dans la région au Nord de Lisbonne Essai de cartographie géomorphologique. Finisterra, XXII, n° 43, Lisboa, 227-246.
- (3) FERREIRA, D.B. (1981). Carte géomorphologique du Portugal. Memórias do C.E.G., n°6, Lisboa, 53 p.
- (4) RODRIGUES, M.L. (1988). As depressões de Minde e de Alvados. Depósitos e evolução quaternária das vertentes. Diss. Mestrado Geografia Física e Regional, F.L.L., Lisboa, 208 p.
- (5) ZÉZERE, J.L. (1988). As costeiras a Norte de Lisboa. Dinâmica de vertentes e cartografia geomorfológica. Diss. Mestrado Geografia Física e Regional, F.L.L., Lisboa, 202 p.



Photo 1-Complex landslide of Cuebradas-Alentejo (Maior river basin), January 1990.

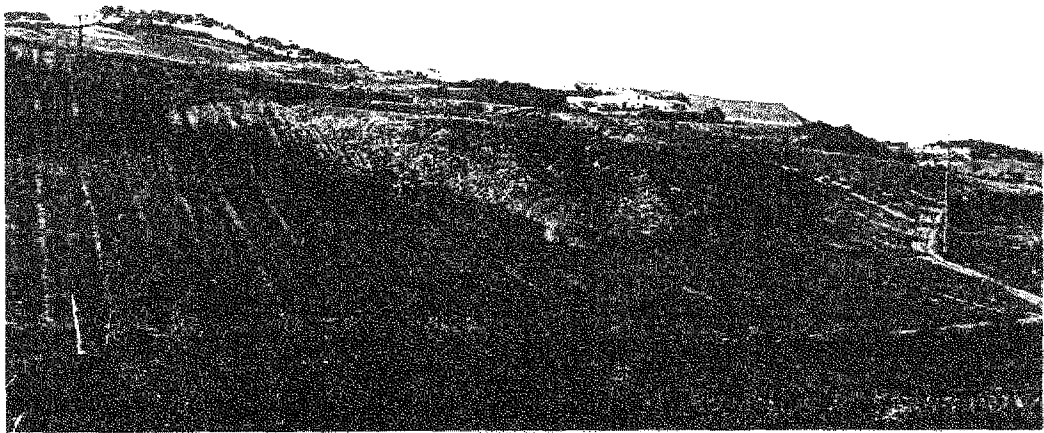


Photo 2-Complex landslide of Carnota de Baixo (North of Lisbon), December 1989.



Photo 3-Road destruction by sliding at Unhos (North of Lisbon), December 1989.

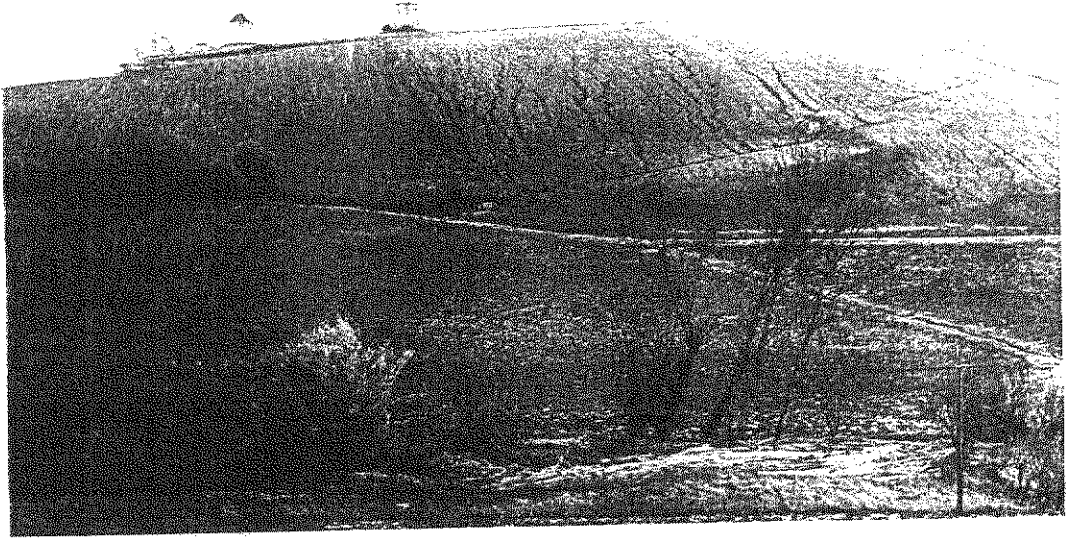


Photo 4 Rill and gully erosion at Serra dos Terreiros (Lourinhã area), December 1999.

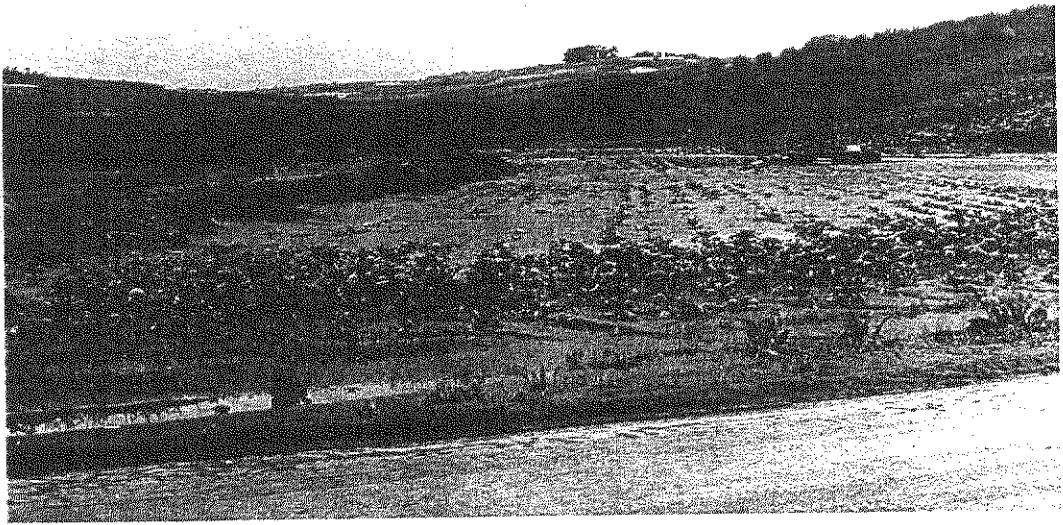


Photo 5 Alluvial fan at Madruço (near Lourinhã), December 1999.