



Landslide effects on soil-plant relationships in subalpine Central Pyrenees

Lucía Buendía and David Badía

Agrarian and Environmental Sciences Department, Technological College of Huesca, University of Zaragoza, Spain
(lubuendi@unizar.es)

Landslides are a widespread mass wasting feature in the high mountains which modify landforms and the coevolution of soils and grasslands. In the subalpine stage of Central Pyrenees, landslides generate longitudinal scarps along the slope, few meters high on the slipping surface (the C-horizon or R-layer), which is joined to the old surface by a talus (about 55°). Some authors hypothesize that changes in texture and / or porosity within the soil profile, related to grassland cover, facilitate slippage and total or partial loss of the original soil (Del Barrio and Puigdefábregas, 1987). This study aimed to characterize, by standard procedures (Klute 1986; Page et al., 1982), the morphological, physical and chemical properties of selected soil profiles on both, affected and non-affected slopes (by pairs) to relate soil-plant relationships with landslides occurrence. For each soil profile (5 per slope type), samples were taken systematically every 10 or 20 cm (in affected and non-affected slopes respectively) up to R-layer or until 1 m deep, resulting in 46 soil samples. The study was carried out near Ordesa y Monte Perdido National Park in the lower parts of the slopes of the concave relief of La Estiva, a summer grazing area, where deep soils were developed on limestones and gray marls (from Middle Tertiary, Eocene). The area is located in the subalpine stage (between 1700 and 1900 masl) with a subalpine climate (MAP 1300 mm/yr and MAT 7°C) (Fillat et al., 2008, Rivas-Martinez, 1990). Among the most remarkable results, we can indicate that the original soil has a fine-texture, well-developed soil structure, high water holding capacity and a lithological contact around 1 - 2 m deep. Altogether, these attributes enhance the occurrence probability of landslides. Landslides cause important soil losses (the new resulting soil is less than 40 cm deep) and differences in the chemical properties such as the increase in calcium availability generating changes on plant cover. Thus, original deeper and acidic *Nardus stricta* grasslands are replaced by new mesophytic grasslands.

References

- Del Barrio, G. & Puigdefábregas, J. (1987). Mass wasting features above the timberline in the Central Pyrenees and their topographic controls, *Pirineos*, 130: 29-51.
- Fillat, F. et al. (2008). *Pastos del Pirineo*. Consejo Superior de Investigaciones Científicas. Madrid, 319 pp. ISBN: 978-84-00-08614-5.
- Klute, A. (Ed.) (1986). *Methods of soil analysis. Part 1: Physical and mineralogical methods*. 2nd ed. American Society of Agronomy, Madison, Wisconsin, USA.
- Page, A.L. et al. (Ed.) (1982). *Methods of soil analysis. Part 2: Chemical and microbiological properties*, 2nd ed. American Society of Agronomy, Madison, Wisconsin, USA.
- Rivas-Martinez, M. (1990). Los pisos subalpino y alpino de los Pirineos y de la Cordillera Cantábrica: relaciones y diferencias. In: *Botánica Pirenaico-Cantábrica*. Monografías del Instituto Pirenaico de Ecología. CSIC, Jaca, 584 pp.