Soil and geomorphological parameters to characterize natural environmental and human induced changes within the Guadarrama Range (Central Spain)


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INTRODUCTION AND OBJECTIVES

Mediterranean mountain ecosystems are often complex and are seen as important sources of biological diversity (FAO 2015). They play a key role in the water and sediment cycle for lowland regions as well as preventing and mitigating natural hazards especially those related to drought such as fire risk. However, these ecosystems are vulnerable to changes due to their particular and extreme climatic and biogeographic conditions. Some of the main pressures on mountain biodiversity are caused by changes in land use practices, infrastructure and urban development, unsustainable tourism, overexploitation of natural resources, fragmentation of habitats, air pollution, particularly when located close to large population centers, and climate change.

The objective of this work is to select soil and geomorphological parameters in order to characterize natural environmental and human induced changes within the newly created National Park of the Sierra de Guadarrama (approximately 50 km NW Madrid) in Central Spain, where the presence of the Madrid metropolitan area is the main factor of impact. This study is carried out within the framework of the Guadarrama Monitoring Network (GuMNet) of the Campus de Excelencia Internacional Moncloa, where long-term monitoring of the atmosphere, soil and bedrock are priority.

METHOD

At each station, a site specific geomorphological description, soil profile description and sampling was carried out (Schoenenberger et al., 2012). In the high mountain area information was obtained for monitoring frost heave activity and downslope soil movement (García-Bianco and Palacios, 2004). Basic soil laboratory analyses are being conducted to determine the physical and chemical soil properties and classification.

RESULTS

The soils show scarce development with ochric and umbric (Soil Survey Staff, 2014; IUSS Working Group WRB, 2015) as unique diagnostic horizons (Fig. 3-5).

These soils are strongly or moderately acid, which is favored by abundant rainfall and a parent material like gneiss and associated deposits. Under similar conditions of lithology, other soil forming factors such as geomorphology, climate and land use, provide differences in soil properties (Fig. 6) with regard to organic matter content and characterization which constitutes the main objective of a pedological monitoring.

Along with the intrinsic characteristics of the soils (Fig. 6), CO₂ emissions, moisture and temperature are basic factors related with soil carbon dynamics. The presence of pollutants like heavy metals, associated to emissions from urban areas, are considered as an indicator of soil degradation.

Geomorphological features of interest are mainly related to those that favor erosion and degradation processes and in this case shallow mountain soils are most at risk.

FUTURE TASKS

The soil and geomorphological parameters constitute a basis for site characterization in future studies regarding soil degradation; interaction between soil, vegetation and atmosphere with respect to human induced activities (e.g. atmospheric contamination and effects of fires); contributing to the knowledge of the carbon cycle, and the influence of heavy metal contaminans in the soils.

REFERENCES

- International soil classification system for naming soils and creating legends for soil maps.
- World Soil Resources Report No. 100, FAO, Rome.

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BACKGROUND IMAGE: Etor Lucio (GuMNet, March 2014)