



Rock fragments in topsoils as indicators of land degradation: a procedural framework and its application to NE Portugal

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The presence of rock fragments (RF) in soils still requires more insights into its significance and its effects on edaphic, hydrological and geomorphological processes. In fact, the role of RF in these processes does not match with the limited importance given to its presence, as deduced from the precision and reliability when assessing the abundance of RF in soils. On the other hand, addressing their significance in soils and landscapes requires an integrated approach to the above mentioned processes that is currently not considered.

In vast areas of the Mediterranean Basin, soils have high RF contents. This is taken as an evidence of the low soil quality and their marginal suitability for agricultural use, adding to other land features such as steep slopes, shallow soil thickness and low fertility status. Furthermore, such areas also depict high risk or clear evidence of runoff erosion and, therefore, are subject to potential or effective degradation threat.

This paper aims at presenting a procedural framework for addressing the significance and role of RF in topsoils, and its application in NE Portugal.

The framework comprises a conceptual model for estimating the potential RF contents for a given area, considering the integrated contributions of size selective export of soil particles by erosion, weathering effects on RF distribution within the soil profile, and, as a feedback effect, that of surface RF on erosion rates. In a second step, the procedural framework considers the scoring of the soil degradation status due to erosion, the comparison between the estimated potential and the actual RF contents of topsoils. This allowed the identification of areas threatened by soil degradation as those having RF contents larger than the potential one. The model was calibrated and the framework applied to the soil units in NE Portugal, using the Soil Map data base of this 13 000 km² region, namely analytical results, and descriptions of soil profiles and soil units (legend FAO/UNESCO, 1987).

In a region where soils with high RF contents (> 30 % by volume) are widely represented (26 % of the area), results show that more than 50 % of the region is covered by soils having surface RF contents larger than the potential ones. While the most degraded soils are found in the drier areas of NE Portugal, where soils with high RF contents cover more than 90 % of the area, soil degradation also threatens the more humid areas, where soils on the high RF content class cover 6 % of the area but those with RF contents above the potential represent 73 %.

Our results confirm soil survey staff observations on the degradation status of soils in the study area, hence encouraging the use of topsoil RF content within the proposed procedure, as indicators for identifying degraded areas.