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Soil erosion assessment using Geomorphological Remote Sensing techniques: an example from Southern Italy.

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In Southern Italy, soil erosion processes acting on agricultural lands are severe. The peculiar combination of geological, geomorphological, pedological and climatic features makes most part of the local landscape very vulnerable to the action of erosional processes. In most cases, soil erosion is strongly amplified by human activity. Because the economy of Southern Italy is largely based on agriculture, the soil loss induces remarkable economic damages. In this framework, an assessment of soil erosion at regional scale is of great importance. Remote sensing techniques can provide homogeneous data on large areas: thus, remote sensing represents a powerful tool in evaluating soil erosion at a regional scale. In particular, Landsat imagery are very useful in locating and mapping the areas subject to diffuse erosional processes.

The aim of this study is the assessment of the distribution and the mapping of newly-formed erosional landsurfaces by means of an integration of Landsat ETM 7+ remotely sensed data and field surveyed geomorphological data. The study has been performed on a 228,6 kmq wide area, located on the north-eastern slope of the Southern Apennine chain. The georeferenced Landsat ETM7+ satellite imagery has been processed using the RSI ENVI 4.0 software. The processing has consisted of RGB false colour compositing, contrast stretching, Principal Component Analysis (PCA) and decorrelation stretching and allowed us to better enhance the features occurring in the imagery. Such features have been then characterized during the field survey. Particular attention has been given to the newly-formed erosional landsurfaces, which have been detected, described and located with great accuracy using a GPS. We have then delimited the Regions of Interest (ROI) on the Landsat ETM 7+ imagery, i.e. polygons representing the “ground-truth”, discriminating the newly-formed erosional landsurfaces from the other features occurring in the imagery. A simple statistical analysis has then been conducted on the digital numbers (DN) values of the pixels enclosed in the ROI of the erosional landsurfaces, allowing us to determine the spectral response pattern of such landsurfaces. The erosional landsurfaces have been classified in the whole imagery using a Maximum Likelihood classification algorithm. A spatial analysis has finally been performed by converting the detected landsurfaces into vectorial format and importing them into the ArcViewGIS 9.0 software.

The above described procedures has allowed us to produce a Map of the newly-formed erosional landsurfaces in the study area. The landsurfaces at issue are scattered in the landscape and mainly located on slopes cut on clayey-marly deposits, Pliocene aged, on which carbonate-rich soils, locally with vertic properties, occur. The overall surface of the newly-formed landsurfaces in the study area is 29.3 kmq, which is 13% of the total surface. Comparing two satellite imageries dated back to June and August, respectively, it has been observed that the erosional landsurfaces were very evident in August, right after harvesting, and not so evident in June. This suggests that the harvesting could have played an important role in inducing erosional processes.

In conclusion, the study has allowed us to produce, in a relatively short time and at low expense, a map of the eroded landsurfaces. Such a result represents a first and fundamental step in evaluating and monitoring the erosional processes in the study area.