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Visible and infrared spectroscopy to evaluate soil quality in degraded sites: an applicative study in southern Italy

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Land degradation processes like organic matter impoverishment and contamination are growing increasingly all over the world due to a non-rational and often sustainable spread of human activities on the territory. Consequently the need to characterize and monitor degraded sites is becoming very important, with the aim to hinder such main threats, which could compromise drastically, soil quality.
Visible and infrared spectroscopy is a well-known technique/tool to study soil properties. Vis-NIR spectral reflectance, in fact, can be used to characterize spatial and temporal variation in soil constituents (Brown et al., 2006; Viscarra Rossel et al., 2006), and potentially its surface structure (Chappell et al., 2006, 2007). It is a rapid, non-destructive, reproducible and cost-effective analytical method to analyse soil properties and therefore, it can be a useful method to study land degradation phenomena.
In this work, we present the results of proximal sensing investigations of three degraded sites (one affected by organic and inorganic contamination and two affected by soil organic matter decline) situated southern Italy close to Taranto city (in Apulia Region). A portable spectroradiometer (ASD-FieldSpec) was used to measure the reflectance properties in the spectral range between 350-2500 nm of the soil, in the selected sites, before and after a recovery treatment by using compost (organic fertilizer). For each measurement point the soil was sampled in order to perform chemical analyses to evaluate soil quality status.
Three in-situ campaigns have been carried out (September 2012, June 2013, and September 2013), collecting about 20 soil samples for each site and for each campaign.
Chemical and spectral analyses have been focused on investigating soil organic carbon, carbonate content, texture and, in the case of polluted site, heavy metals and organic toxic compounds.
Statistical analyses have been carried out to test a prediction model of different soil quality indicators based on the spectral signatures behaviour of each sample ranging.