

An innovative multi-source approach for environmental monitoring of landfills

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This paper describes the application of downscaling approach, based on the products obtained by remote sensing and in situ survey, for the geo-environmental analysis of landfill site, located in the San Giovanni in Fiore Municipality (CS) in the Southern Italy (Calabria District).

The aim of the study focused on the optimization of techniques for the monitoring of landfill area by optical remote sensing, which represents a crucial issue since usual investigation methods are expensive and time-consuming.

This approach integrated data with different spectral and spatial resolutions extracting parameters descriptive of superficial condition. The use of remote sensing provided a synoptic perspective considering time and spatial ranges which were useful for the monitoring of different environmental matrices and the assessment of biogas and leachate migration. Indeed the multispectral data of Worldview 2 (2012) and Pléiades (2014 and 2015) operating in the range from visible to near-infrared, were adopted for the retrieval of indices descriptive of the vegetation and soil targets with high spatial resolution.

The orthophoto dataset integrated the temporal analysis not covered by spectral imagery showing a general increasing of land consumption and highlighting area with no or senescent vegetation cover. These evidences, due to the intensive human activities and to geological, hydraulic and land cover conditions, provided the general setting of the area and its evolution identifying ongoing processes in the study area.

The Multispectral Infrared and Visible Imaging Spectrometer (MIVIS) airborne sensor extended the remote sensing analysis up to the thermal domain highlighting superficial anomalies of landfill capping linked to local phenomena such as biogas migration or local humidity into the ground.

The dataset of products obtained by remote sensing data processing was validated by in situ analysis. The evidences of ground anomalies were collected by field surveys and nocturne thermal acquisitions.

Moreover, a photogrammetric survey was achieved for 3d model production of the landfill to perform the correct estimation of the warning areas.

This downscaling approach can be considered a performing methodology of investigation than the current classical methods, which require a great deal of work at local scale. Indeed the results revealed the effects of anthropic activities highlighting areas where in situ measurements could be advantageous to characterize the environmental conditions. The research activity is part of the POR CALABRIA FESR 2007/2013.