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Imaging spectroscopy and GIS analysis to detect salinity problems in soils

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Soil salinization is a mayor problem for agriculture and soil conservation and has focused great interest by its socio-economical and environmental implications. Poorly drained soils developed under arid or semiarid weather conditions are highly suitable to salinization. Extensive areas in the southeast coast of Spain have semiarid conditions and severe problems of salinization by poor drainage, mineral weathering or irrigation with low quality water. Imaging spectroscopy is an area of remote sensing focused in the mapping of specific ground materials by detecting specific chemical bonds, analysing reflectance/absorbance of hyperspectral (or multispectral) images. The detection of soils under incipient salinization processes could be useful to adopt preventive soil management practices. Imaging spectroscopy and GIS analysis are used to detect the suitability of soils to suffer problems of salinization using as reference a salt flat. A halite reference reflectance spectrum (λ = 0.3951 to 2.56 μm) is used to perform a Spectral Feature Fitting (SFF) analysis in a multispectral VNIR-SWIR image acquired by the ASTER sensor onboard the TERRA satellite. SFF resulting halite maps were combined in a GIS (Geographical Information System) with field observations of saline soils in the reference salt flat. Logistic regression was used to identify salinization suitable soils based on the halite map and field observations. Halite maps were highly sensitive to the ground characteristics showing a great accuracy in the detection of the reference salt flat. Well drained soils (like coastal sand dunes formed by carbonates grains) and frequently leached soils (like golf green

courses) were identified by minimum presences of halite in halite maps. A total of 81 points corresponding to saline soils in the salt flat were used in the logistic regression in combination with the halite maps. A regression model for the study area (Alicante province) was obtained with a ROC value of 0.8573 which indicates a good adjustment of the model. Agricultural soils around a brackish water wetland were identified as highly suitable to salinization. Furthermore, other (non reference) salt areas were also identified accurately. As conclusion, imaging spectroscopy has been successfully used to produce mineral maps that can be used to develop geographical analysis of great interest for soil conservation.