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A plant association approach to improve the accuracy of ^{137}Cs soil contamination mapping

C. Ballabio (1), M. Caccianiga (2), and R. Comolli (1)

(1) University of Milano-Bicocca, DISAT, Milano, Italy (cristiano.ballabio@unimib.it), (2) University of Milano, Milano, Italy

Plant associations are defined by their relative species frequencies. It is well known how each different association dwells within well defined ecological spaces; these spaces are defined, among the others parameters, also by the range of soil properties in which the association can be subsists. Thus it is theoretically possible to find a relations between plant associations and several soil properties. However this approach is usually infeasible due to the unavailability of detailed association cover maps.

However, nowadays the availability of extremely high resolution images and DEMs is making possible to use this data sources to produce reliable maps of plant associations. The detail of these data sources is so high that it is possible to effectively discriminate between different kind of herbaceous associations on a scale of few meters.

The study case here described involves the segmentation of high resolution pseudo-RGB images of an high-plain area in the Italian Alps. The aim of the study was to produce a map of different kinds of vegetation cover to be used as a spatial covariate in a study of soil contamination by ^{137}Cs; however the inference of several soil properties is also feasible.

To perform the classification task an ecological approach was used. This framework consists in a field survey of vegetation composition, the identification of plant communities by e-distance hierarchical clustering, and the use of the obtained classes and point observations to perform a pattern based image segmentation.

Pattern based segmentation utilise high resolution images to improve the classification task performance by using additional information gained over a defined neighbourhood. In order to discriminate between different textures, variogram derived statistics have been used along spectrally based data.

The results of the analysis show how an ecologically based classification can provide a classified map which can be used as a covariate to better discriminate between different ^{137}Cs contamination levels. When utilised in combination with other covariates, these plant association maps can effectively stratify the geographic and the features space, into domains within which the range of variation of the studied soil properties is smaller.

The use of plant association to derive soil properties is a particularly attractive approach, since the ecological space of these associations is related to specific, and rather defined, soil conditions. This way, once a relation between association and soil properties is established, it is relatively simple to spatially extend this relation to other similar areas were identical plant associations can be found.