LCLU INFORMATION SYSTEM FOR OBJECT-ORIENTED NOMENCLATURE

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INTRODUCTION

Land Cover/Land Use (LCLU) information are very important to organize a spatial data infrastructure for landscape planning and monitoring. Nowadays it can be done in terms of a LCLU Information System that results suitable for being quickly and more frequently updated, augmented with other cartographic data and socioeconomic interpretation to carry out different analysis.

According to INSPIRE guidelines (2007) [4], Land Use and Land Cover goes by two different concepts. Land cover is defined as the biophysical feature type present on the surface of the earth (i.e. vegetation, water, different soils, rock, barren land etc) while land use looks beyond the spectral class signatures, being related to some anthropogenic activity, which can be socioeconomic or cultural and also multiple for the same polygon's surface. In this context, the chance to work with LCLU databases makes the landscape mapping more dynamic and suitable to handle with both the above mentioned criteria (biophysical and socioeconomic). Moreover such LCLU databases should be organized in different levels of information detail in order to satisfy the landscape scale of interest (the selected MMU).

Last it is important to define how and which kind of new information can be deduced. In the present state of environmental mapping, hierarchical inventories such as Corine and Murbandy/Moland strictly categorize landscape polygons in terms of "hard" and predominant thematic class, without taking directly into account their inner "fuzzy" components only used in some case to create more detailed subclasses [3]. In this way these nomenclatures assign to polygons one, and only one, class of the nomenclature, fitting, in this way, for producing thematic cartographic maps with their correlated static legends.

In this context the philosophy of a LCLU Information System, storing all the thematic attributes related to each polygon, is reasonable to out-step the majority thematic class assignment, making the classification approach more flexible and bounded up with the inner polygon characteristics and their changes. Moreover, giving a more detailed inner description, a LCLU information system can simplify and normalized the sub-thematic extraction in terms of membership class percentages, especially useful working with automatic classification approaches.

METODOLOGY: T-MAP APPROACH

In this context, T-MAP software, developed by the Spin-off Company SI2G [7], works in an open source GIS environment and organized into an user friendly modular structure that allows to enhance its performance in particular in terms of landscape classification and change detection analysis, giving a new approach to describe extracted landscape segments. In particular, to fulfill automated land cover mapping, T-MAP combines the pixel-based and object-based approaches into a hybrid classification solution that makes use of a segmentation tool and a rule-based thematic categorization to sort meaningful segmented regions in terms of membership attribute percentages and shape parameters [5, 6]. Categorizing according to the predominant class attribute (modified Winner Takes All approach), the output can be an "hard" thematic map (i.e. Corine nomenclature) characterized by a good performance, comparable with other object-based thematic assignments but characterized by an innovative point: the capability to store and describe each classified polygon with all its membership class percentages. T-MAP's strong and innovative point is also a detailed accuracy assessment by means of stability map that help the user to recognize stable regions from the instable ones which should be verified before being used [2]. In this paper, this innovative approach, falling into line with the Object Oriented Data Model, is tested with different multi-spectral image at different ground (SPOT, IKONOS, ADS40) and presented in its different steps: segmentation and training definition (Fig.1), pixel-based classification and following rule-based class categorization (Fig.2 and Fig.3).

Hereafter some experimental results show how the presented approach works well especially when the polygon is not homogeneous or characterized by more dominant cover classes. In these experimental results, it is in fact more realistic to use the stored LCLU membership information to preserve inner land cover membership descriptions. In Fig.2 the underlined polygon (ID 1602) is "hardly" classified as Pastures (CLC class 230) even if there are two predominant classes (Pastures and Vineyards) that could together better describe the polygon. It is confirmed by a low value for the stability index (0,52).

In other cases it is possible, analyzing different membership percentages, to extract different CLC classes by means of a rule based system, adopting threshold (i.e. going into the CLC complex coltivation pattern class) (Fig.3).

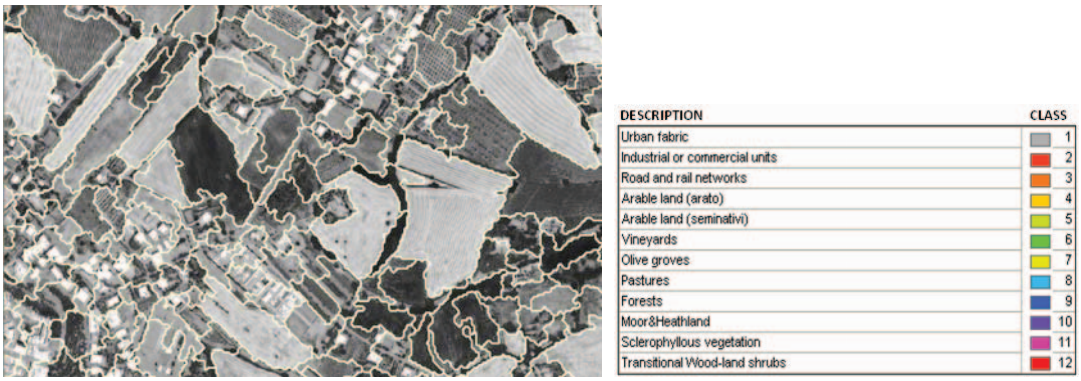

Fig.1 Segmentation step and training definition for the automatic classification

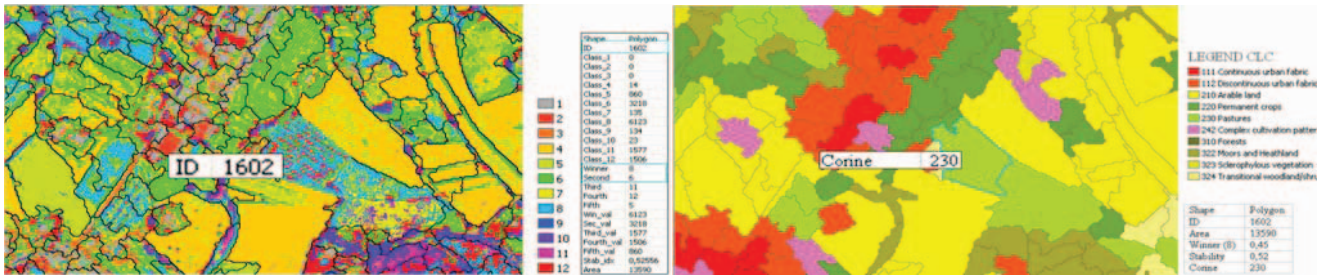

Fig. 2 Pixel-based classification (polygon ID 1602) and "Hard" approach for the CLC thematic classification

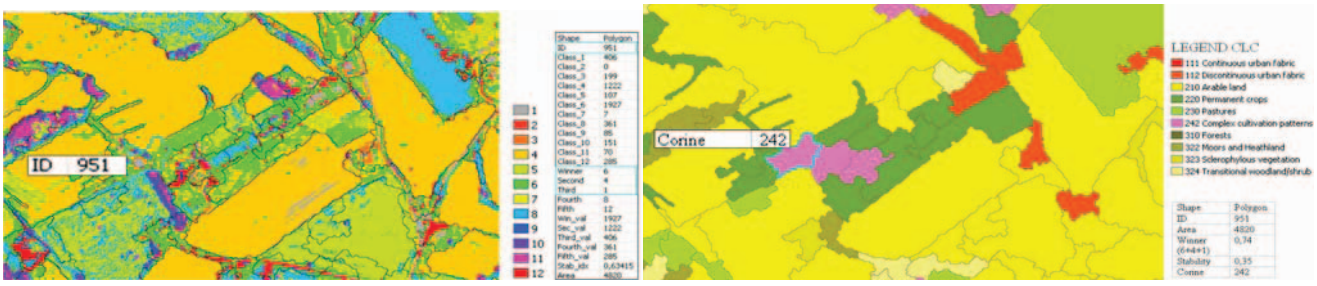

Fig. 3 Pixel-based classification (polygon ID 951) and "Hard" approach for the CLC thematic classification (Stability related to remaining classes)

CONCLUSION

The proposed LCLU information production, according to the SIOSE project [1] and its Object Oriented Model, leaves new possibility to describe landscape objects open. It is based on a data model that is multi-purpose, multi-criteria, interoperable and direct to data sharing.

In particular the proposed T-MAP approach, oriented to the landscape description rather than its "hard" classification, mainly connect meaningful segmented regions with different and stored cover class percentages, making them available to custom-designed or standard nomenclatures (i.e. Corine) and environmental indicator definition. This new approach is found to be dynamic, augmentable with different databases and interchangeable between different nomenclatures.

Moreover the community of GIS users that have to deal with several Information Systems (coming from different environmental thematic classifications) can find this new philosophy more flexible and adjustable to their necessity.

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