

A LAND SYSTEMS DATABASE OF ITALY

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Introduction

Several soil survey activities are currently being carried out in Italy, especially at the scale of Administrative Region. The need for a common methodological reference urged the activity of the project "Pedological Methodologies: criteria and procedures for the creation and up-dating of the soil map of Italy (scale 1:250,000)" (Costantini, 1999; Costantini and D'Antonio, 2001; Costantini, 2002). In this ambit, a set of geographic levels was set up, relating the highest level, the soil region, which characterises the pedolandscape at the continental level (Finke et al., 1998), to the lowest level, the land element, which is usually the most detailed level of photo interpretation (1:10-25,000). The geographic level of main interest in the soil map of Italy is the land sub-system, which has a reference scale of 1:250,000, immediately above which there is the land system level, with 1:500,000 as a reference scale.

This study was conducted to validate the methodology set up by the "Pedological Methodologies" project and create a land system database of Italy. The database provides an inventory of main Italian landscapes at the reference scale and is a useful tool in the creating of the land sub-systems databases. It is also conceived to permit the linking of the existing soil information to the main Italian landscapes and the correlation of soil typologies at a national scale.

Structure of the database

The formative elements of the geodatabase are the polygons, the limits between polygons, and their attributes. The number of attributes of the limits between polygons is rather low and they give information regarding the nature of the limit, i.e. morphology, lithology, land use, urban area, water body, soil region. The attributes of polygons on the other hand are numerous and have different use and meaning. A first distinction separates discriminating from describing attributes, the former being the attributes used to single out the polygon, whereas the latter, the describing attributes, are utilized to describe the polygon, but not to delineate it. We can go further and distinguish discriminating attributes as geographic or semantic attributes. Geographic discriminating attributes are land characteristics which can be recognised and followed on a suitable image, or thematic geodatabase, and then reported among the attributes of boundaries between polygons. Semantic discriminating attributes are land characteristics that distinguish a polygon from another, through the recognition of a different pattern, but they don't have continuity at the scale of the study. The specific combination of land uses, for instance, is almost always a characteristic that distinguishes polygons, but it cannot be used to delineate them. Being appreciable at a reconnaissance scale, the wide forest and prairie covers of some of the highest Alps and Apennines constitute an exception.

Among describing attributes are the identifiers, such as code and name of the area, but also the attributes implemented to add specific information, such as the classification of relevant soils found inside the delineation and their pedoclimate, and the terrain components of the polygon, the latter being the possible combinations between the first two main lithology and the first three main land uses. That means six possible components, plus a seventh one for additional combinations, which can be significant in characterizing the most complex landscapes.

Sources of the land systems database

The physiographic attributes were assigned using the Digital Elevation Model of Italy at 250 m and the Joint Operations Graphic (JOG) topographic map at 1:250,000. The lithology was derived from the 1:500,000 geological map of Italy (Servizio Geologico d'Italia, 1978). The land use attributes came from the

Corine-Land Cover database (Cumer, 1994). Each thematic layer was checked on Landsat TM5 satellite images. The images were taken in the summer and autumn of 1990-92.

Besides the aforementioned databases, available for the whole of Italy, some existing regional soil databases at the reference scale, provided by the regional soil services, were also used.

Classes of the discriminating attributes

The physiographic legend was derived from Soter (FAO, 1995). Major landforms were established according to main morphological process (water erosion; fluvial, aeolian and marine deposition, reclamation; tectonic; volcanic; glacial and karst), slope, hypsometry, kind and degree of drainage. A regional landform was added to give a morphological and chronological distinction of the Po Plain.

The lithology and land use legends were specifically created to group the formations of the geological map, as well as the classes of Corine-Land Cover, according to their supposed influence on soils.

Land systems mapping methodology

The database was built up step-by-step. The first step led to the delineation of physiographic different polygons inside soil regions. As a general rule, the mapping of land systems were nested inside soil regions, but the boundaries of soil regions were redefined according to land systems. The mapping approach was interpretative, based upon satellite and JOG images, DEM hillshade, classes of hypsometry and slope, and regional information, when available. The following stage was the division of polygons with similar lithology. The characteristic pattern of land uses of each polygon was considered especially during this second phase. Finally, the descriptive attributes were added.

The terrain components came from the elaboration of the discriminating items, the relevant soils from the soil database of the Italian National Centre of Soil Cartography (www.soilmaps.it), the pedoclimatic classification from original elaborations obtained with the Epic model (Costantini et al., 2002).

Validation

The land system database was distributed to several Institutions dealing with soils, in particular to regional technical bureaus. In fact, the realization of the database was carried out in the ambit of the project "Pedological Methodologies: criteria and procedures for the creation and up-dating of the soil map of Italy (scale 1:250,000)", and the main authors of the in-progress soil map of Italy are the regional soil services.

The validation process is still going ahead and proceeds concurrently with the creation of the land sub-systems database at 1:250,000 scale.

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Table 1 - Attributes of land systems

<i>Code</i>	<i>Description</i>	<i>Use of the item</i>	<i>Example</i>
St_code	Joining of the physiography, lithology and land use codes	Descriptive	152MSMA412040
St_descr	Local name or geographic description	Descriptive	Hills of the sandy Pliocene in Tuscany
St_sreg	Soil region	Geography discriminating	61.3
St_frpr	Major landform: set of physiographic, morphogenetic and morphometric characters, and drainage pattern	Geography discriminating	152
St_frreg	Regional landform: morphological and chronological distinction of the Po Plain	Geography discriminating	PW
St_litpr	Main lithology	Geography discriminating	MS
St_litsec	Subordinate lithology	Geography discriminating	MA
St_usuo1	Dominant land use	Semantic discriminating	41
St_usuo2	First subordinate land use	Semantic discriminating	20
St_usuo3	Second subordinate land use	Semantic discriminating	40
St_reg_idr	Soil moisture regime	Descriptive	Xeric
St_reg_ter	Soil temperature regime	Descriptive	Thermic
St_sg_WRBd	Relevant soils (WRB 98)	Descriptive	Calcaric Cambisols
St_sg_STd	Relevant soils (Soil Taxonomy 99)	Descriptive	Typic Haploxerepts
Elem_terr_1;	Terrain component	Descriptive	152MS41
Elem_terr_2;			152MS20
Elem_terr_3;			152MS40
Elem_terr_4;			152MA41
Elem_terr_5;			152MA20
Elem_terr_6			152MA40
Altro_ET			152MS60

