



A GEOGRAPHICAL INFORMATION SYSTEM IN TUSCAN WETLANDS LAND USE CHANGES IN MODERN AND CONTEMPORARY AGE

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The object of the research project are the wetlands of Tuscany (historical outline, monitoring of the present situation and evaluation of the environmental and social-economical impact brought about by plans of tourist development) and foresees the organisation of environmental, social-economical and historical data in a GIS. The aim of the project is to create a geographical database about wetlands and to realise an atlas. The data are been acquired in time series and analysed with GIS tools. In particular, the work has focused on acquisition of landuse/landcover data from historical cartography and remote sensing as sources.

Wetlands stand for a remarkable ecosystem in terms of environmental wealth (geomorphologic distinctive features, typical vegetation or faunal associations) and cultural heritage as evidence of human activities related to this singular environment. Tuscan wetlands preserve interesting environmental contexts, but are menaced by urban and industrial expansion and stressed by pollution. Due to these observations these zones have been selected as study areas with the aim of analyzing landscape changes.

Case studies

Coastal wetlands and ex-wetlands

(originating from the formation of sand-dune bars created by sediment deposits of fluvial and marine origin)

1. coastal area around Lago di Porta, the residual coastal wetland in northern Tuscany (provinces of Massa and Lucca)
2. coastal Versilia, the area surrounding the Lago di Massaciuccoli (provinces of Lucca and Pisa)
3. Pisa coastal plain, from the mouth of Serchio river to Livorno
4. coastal plain south of Livorno around Cecina
5. southern Val di Cornia (province of Livorno)
6. Grosseto Maremma, with the areas of ex-lake/marsh of Castiglione and Laguna di Orbetello



Principal inland wetlands

(created by the gradual process of vast level areas which became marshland because they were interested by complex fluvial-lacustrine systems)

7. Bientina plain (provinces of Pisa and Lucca)
8. Padule di Fucecchio, the most significant residual inland wetland (provinces of Firenze and Pistoia)
9. Val di Chiana, completely reclaimed during XVIII and XIX centuries with the exception of Montepulciano and Chiusi lakes (province of Siena).



Methodology

Phases of the research

- reconstruction of time series about land use and other layers from different sources
- census and mapping of environmental and cultural heritage
- normalization and input of data in a GIS
- analysis of landscape changes through GIS tools

Layers acquired

- land use, as principal indicator of landscape transformation
- hydrographical network
- coastline position
- road network
- settlement system

GIS operations

- georeferencing of digital images of historical cartography
- digitization of layers from historical cartography
- normalization of data acquired from different sources, with different scales and formats
- study of a new classification system of landuse/landcover, with limited number of categories in order to allow the comparison and the interpretation of map data



Landscapes



Historical cadastres

The importance of historical parcel cadastres in geo-historical studies lies in geometric precision of such cartography and in the fact that these surveys give us an historical framework of the Tuscan territorial layout in detailed scale (the maps are in scale 1:2,500 and 1:5,000) before the great transformations that took place at the end of the 19th century.

In Tuscany three different cadastres was made up in the first half of XIX century: Leopoldine Cadastre in Tuscan Grand-Duchy (1817-1835); the Borbonic Cadastre in Lucca Duchy (1820-1860) and the Maria Beatrice Cadastre in Massa and Carrara Duchy (1820-1825).

The topographical survey was generally very accurate and the resulting maps have high quality for the period. The correspondent registers (Tavole Indicative) furnished with the maps permit assigning to every parcel its relative owner, land use, and an appraisal.

The acquisition of this fundamental source of information was made possible by the georeferencing of the sheets of the Vecchio Catasto Terreni and the acquisition of every single parcel by the digitizer. The features were thus given unambiguous reference codes (sheet and parcel number) and qualitative attributes (land use) taken from the Tables and inserted into the database.



Data sources



- large scale historical cartography (15th to 19th centuries)
- historical cadastral cartography (1820-25 and its updating until 1860)
- remote sensing (flights of 1937/2000 and satellite images)



- thematic paper cartography (Land use maps in scale 1:25,000 produced by the Tuscan Region in 1987)
- landuse/landcover vector databases (ISTAT Census project 1991 and CORINE Land Cover 2000)



- historical documents
- other digital vector layers (GIS of Tuscany Region; Tuscany Forestry Inventory, RENATO project, etc.)

The analysis performed in the zones chosen as study areas has pointed out, apart from a few exceptions, the radical transformation of the wetlands, but has also permitted us to register for assessment some significant remains of past territorial settlements, as well as individual environmental wealth (monumental trees, rare floral and faunal species, morphological appearances, etc.) and cultural heritage (monuments, old factories and rural buildings, traces of the historic road networking, toponyms, constructions linked to the hydraulic works of the past, etc.) and qualitative attributes (land use) taken from the Tables and inserted into the database.

Results

The comparability of information regarding past and present phenomena allows for the understanding of some transformation of the wetland and ex-wetland landscape focusing in particular on changes in land use.

The most significant phenomena are:

- almost total disappearance of all the vast wetlands which constituted the characterizing stretch of landscape in the first half of the 19th century.
- notable expansion of the edified and urbanized areas in general, that took place mostly since the 1950s: growth of the historical urban areas of Carrara, Massa, Pietrasanta, Viareggio, Pisa and Grosseto development of bathing seaside resorts along the coast (marinas) realization of road network infrastructures, railroads and airports
- preservation of the wooded areas (confirmation of quantitative datum, not always corresponding to the good quality of forest environment)
- re-naturalization of some environments with the reformation of circumscribed wetlands or the extensions of small areas which have survived the reclamation operations.

Trasformazioni di uso del suolo nella pianura grossetana dall'ottocento ad oggi.

