

## INFORMATION SYSTEMS FOR PRESERVATION OF CULTURAL HERITAGE

Michelangelo BARTOLOTTA\*, Sabrina Di NARO\*,  
Mauro LO BRUTTO\*, Paola MISURACA\*\*, Benedetto VILLA\*

\*University of Palermo, Italy  
Department of Representation

[bevilla@unipa.it](mailto:bevilla@unipa.it)

\*\*Regional Centre for Cultural Heritage Inventory, Italy

[pmisura@tin.it](mailto:pmisura@tin.it)

Working Group V/5

**KEY WORDS:** Cultural Heritage, Database, Documentation, GIS, Internet.

### ABSTRACT

The preservation of the cultural heritage has become at present a subject of fundamental importance in Italy, above all because of the numerous unhappy events, due to not only natural reasons, happened in these last years.

Besides this problem is particularly urgent in Sicily, because of the existence of a considerable cultural heritage and in absence of a complete and systematic inventory.

To tackle such a complex subject, the use of informatics is required, since the traditional methods, based especially on paper documentation, are absolutely inadequate.

Particularly, this work deals with the cultural heritage inventory selected according to:

- *historical urban centres;*
- *archaeological sites;*
- *extra-urban architectonic assets* (castles, towers etc.).

To handle the great deal of information related to this heritage, a suitable GIS was designed, aimed at having different information (texts, photos, drawings, talking or music sounds, videotapes) and easy to be integrated and updated in future.

### 1 INTRODUCTION

The problem related to the knowledge of the territory is today of major importance to anyone who is empowered with taking decisions, both on a political and technical level. Such knowledge ought to be rigorous, deep and differentiated. In other words, it should enable to analyse every detailed aspect, every *subsystem* of the complex system formed by the territory. Therefore, it should not be considered as an end in itself, but it should rather be employed to forecast, direct and guide the transformations of the territory.

The availability of a larger and larger quantity of different territorial data makes it now necessary to face the problem of handling the territorial information through the modern information devices. After all, the market provides with highly powerful and sophisticated processors and computers, which can satisfy whatever demand.

The need for a rapid and effective handling of territorial information in Italy is even more urgent in the field of cultural heritage, keeping into account the extremely rich artistic wealth of our country<sup>(\*)</sup> and the delay in facing the problem of systematic cataloguing.

The situation is even more serious in Sicily, where the historic and monumental heritage which, according to some estimates, represents about 25% of the national heritage (fig.1), is often in conditions of extreme deterioration.

This work means to research the potential use of informatics in the field of the cultural assets. More particularly, we shall deal with the project of an information system, processed with the aid of a low cost GIS commercial programme (ArcView), oriented to the card-indexing of cultural assets of different kind (extraurban architectonic assets, archaeological sites, historical centres) which can be made of easy consultation through Internet.

---

<sup>(\*)</sup> According to UNESCO, about 7 per cent of world cultural heritage and about 13 per cent of European one is located in Italy (data updated until 1997).

## 2 GIS APPLICATION IN THE PRESERVATION OF CULTURAL HERITAGE

In the last few years, the interest in the problems related to the cognitive demands regarding the cultural and environmental heritage, has particularly been focussed on the ideas of protection and exploitation, with a much wider meaning than ever before.

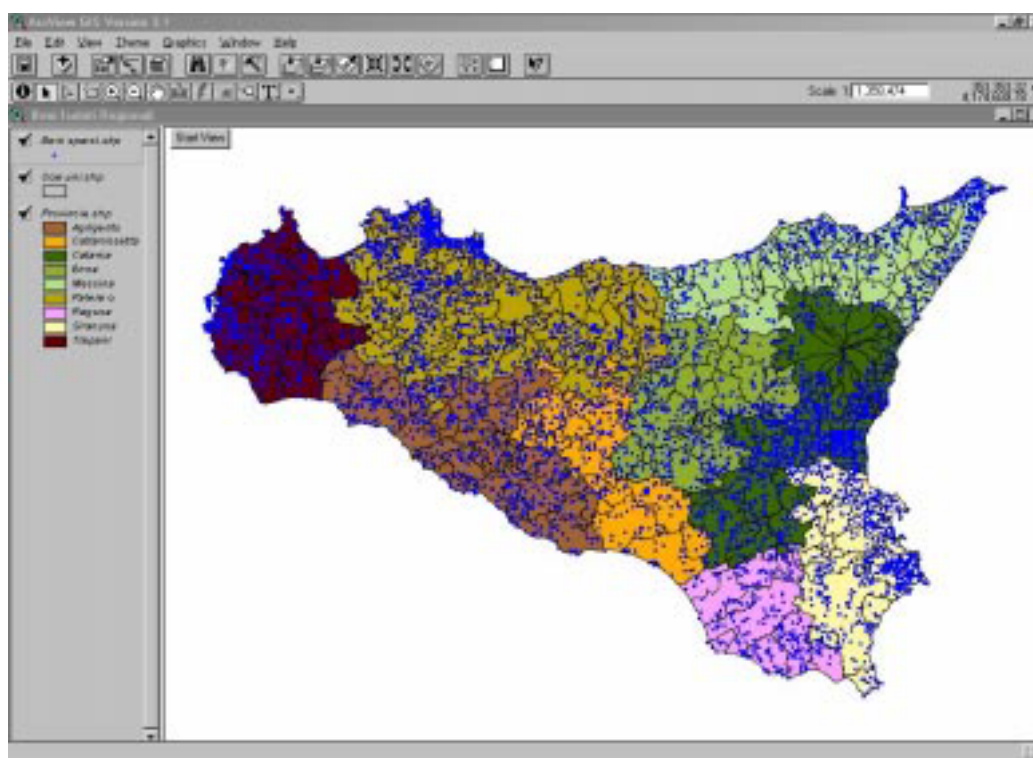


Figure 1. Location of the Sicilian cultural assets.

The criteria and the aims of protection have changed, so that it does not tend only to preserve and manage the existing assets as well as to proceed with legal and administrative measures (once the infringement has been ascertained), but also to exploit the assets through a more complete knowledge of them.

The enlargement of the idea of protection is to be considered as strictly correlated to the enlargement of the very idea of cultural and environmental assets. No longer valid is the selective aesthetic criterion on the basis of which only those works that responded to the characteristics of “rarity” and “utmost worth” could be considered as cultural assets. On the contrary, this definition applies to all works of art and to everything holding a value as historical, cultural, social, technical, scientific, and traditional evidence, as well as the landscape and the environment. The attention is further extended not just to the individual assets but also to the environmental context where all the works are sited, that is the territory. Therefore, the new idea of cultural asset broadens the boundaries of the heritage to be protected, thus widening the field of research for all those who have the task of proceeding with a scrupulous and accurate cataloguing of the existing assets, in order to spread the knowledge, but, above all, to use as an instrument for the town and territory development plan.

The first step towards the protection and the exploitation of the cultural assets consists in the complete and deep knowledge of all their metric and qualitative aspects and in their ensuing card-indexing.

Such knowledge can be achieved through a number of data of different nature (cartographic, historical, graphical, photographic, etc.) which can be gathered in relation to each individual asset.

Of course, for a faster and more effective handling of all this information, it is not possible to take into any account the methods traditionally employed by the many Agencies dealing with cultural assets, mainly based on files and paper documents. On the contrary, it is fundamental to use information systems, that are sophisticated processors, now widely used in territorial applications.

GIS favours the knowledge of the individual asset through progressing stages, going from the placing of the object in the site where it belongs, to the constant monitoring aiming to preserve it, and finally to a continuous up-dating of the information.

The huge amount of data provided by different Agencies (Services, Regional, Provincial and Municipal offices, local institutions, etc.) can no longer be handled efficiently with the traditional techniques. The informatic instrument becomes also necessary to realize an indispensable cartographic support, which should be versatile and adaptable to

varying scale requirements (from the overall picture to the planimetric details). Starting from the assumption that “an inventory of the cultural assets takes on any scientific value only if entirely linked to the territorial reality from which they originated and which keeps them”, it becomes clear how the census and the indexing of the assets cannot do without their physical and historical contextualization. In this respect, GIS appears to be the best means to relate the asset to the territory in an articulated way.

The territorial database, which is of a connecting type, makes it possible to correlate the georeferenced location of the asset in the territory to the descriptive information, through tables, texts and pictures. Thus, it is possible to obtain information about the obligation decrees that may interest a single asset or a whole area, the unabridged text, the digital pictures of the protected object, and so on. By selecting an architectonic asset, it is possible to accede to a set of characteristic information related to the observation of the object itself, but also taken from different sources (a previous inventory, books, filing records, oral communication, notes, etc.). The territorial database is also able to visualize and represent detailed maps, and it can be easily brought up-to-date after new discoveries (e.g. in the case of archaeological sites) or after any changes that may occur in the environment. If the system is implemented on Internet, one can have remote access to information with a simple telematic connection.

The realization of a territorial information data base for the control and the handling of cultural and environmental assets presents several advantages, in work-planning and time-saving terms, for the public offices which operate in this field but also, in general, for whoever wants to learn about the cultural heritage in a thorough way.

### 3 CULTURAL HERITAGE INVENTORY

Since 1975, the self-governed Sicilian region, which enjoys a special constitution, has had the exclusive competence as regards its cultural assets. Of course, having this competence been transferred from the State to the Region, the latter has based its action on the whole of the wide tradition and experience in the field of the preservation of cultural assets acquired in Italy since the late nineteenth century. According to the Regional Law No. 80 of August 1<sup>st</sup>, 1977 – “Rules for the preservation, the exploitation and the social use of the cultural and environmental assets in the territory of the Sicilian Region” and consequently to the Regional Law No. 116 of November 7<sup>th</sup>, 1980 – “Rules on the structure, the functioning and the organization chart of the Administration of Cultural Assets in Sicily”, the regional legislation has further extended the very idea of cultural asset by defining it as follows:

- landscape assets, natural assets, naturalist assets and urbanistic assets;
- architectural assets;
- archaeological assets;
- ethnical and anthropological assets;
- historical and artistic assets;
- book-assets;
- archival assets.

The extension of the concept of cultural asset has therefore determined the growth of the traditional heritage, to be preserved through the most appropriate juridical and technical devices, always based on the knowledge, the documentation and the cataloguing of cultural assets.

The Regional Centre for the Inventory, the Cataloguing and the Graphic, Photographic, Aerial Photographic, Photogrammetric and Audio-visual Documentation is the technical and scientific organism in charge of the co-ordination and the organization of census-taking, cataloguing and documenting all cultural and environmental assets; it represents the heart of the regional documentation and it is, therefore, the seat where all the information deriving from any survey on the Sicilian cultural assets are collected, developed and systematically elaborated. Moreover, the Centre has the task of studying and co-ordinating the cataloguing methods for cultural assets.

On the basis of specific conventions between the State and the Region, the criteria and the catalographic methods adopted in Sicily are basically in line with the national ones. The method employed is the “territorial cataloguing”, centred on the adoption of a series of cards hierarchically linked and meant to cover the whole territory, without any gap or superimposition, so that it is possible to grasp not only the characteristic and distinctive elements of each catalogued object, but also the relations and the connections with other objects, as well as its inclusion in both a cultural and spatial context.

The cataloguing cards, now suited to the requirements of computer operations, are the final result of several years of research carried out by specialists who have endeavoured to identify and organize the essential information for the knowledge of cultural assets, endowed with extremely variable natures and characteristics.

From the “Lists of Monumental Buildings”, already used in Italy in the late nineteenth and early twentieth centuries, the card-indexing for cultural assets have been gradually developed and enriched also in relation to the theoretical and juridical development of catalogues, of preservation and of the very concept of cultural asset. The conceptual development has been followed by a new elaboration of the catalographic methods, determined by the necessity of introducing information systems as a means for the collection, the treatment and the handling of a huge amount of data and information.

Nowadays all cards are structured for computer operations; the organization of the cards, no matter what type of hardware or software is used, is now quite well fixed and it works as a base for all data entry systems as well as the ordinary format for transferring and exchanging alphanumeric data, however acquired.

Today, in fact, in information terms, a cultural asset is defined as an entity which can be determined and described in a more or less particular and characterizing way – according to the appointed aims – through a set of data, called attributes. The whole of the attributes employed to describe an entity is termed “data structure standard”; the whole of the rules required for the correct information entry in a data structure standard is referred to as “data content standard”: it usually includes both general rules (valid for all types of data) and particular instructions aimed at providing specific entry rules, according to the peculiarity of the attributes that mark the different objects in the catalogue.

Obviously, whenever a data structure standard is defined in order to gather and collect information, at the same time the data content standard has to be defined, that is the whole of the rules and directions for its drawing up.

The attributes of the cultural asset, i.e. the data that help describe it in a data structure standard, may be grouped in categories:

- determining data: all those required to recognize the catalogued object with absolute certainty;
- historical data: all those related to the building events, to the development and transformation, in the course of time, of the catalogued object or to its legal and functioning conditions;
- description data of the object as a whole: all those inferable from the direct observation of the object itself, seen as an organic whole, in many different respects;
- analytical data: those which can still be inferred from the observation and the direct enquiry on the object, according to an analytical method, that is through the disassembling of an organic whole into its parts;
- administrative data: those regarding the legal condition of the object;
- documentary data: those related to the existing documents concerning the object.

In card-indexing all these data are organized in paragraphs within which they are grouped in fields, eventually structured in sub-fields, for each of which the specific content, the compulsoriness, if any, of a compilation, the possible repetitiveness, the size, the existence of controlled vocabularies or of terminology standards have been defined.

The demands of scientific knowledge determine the need for a deep description level that requires a special competence and, above all, long surveying and processing times, which do not suit the urgent requests to assess the conditions of the assets to preserve, in terms of quality and quantity.

The latest trends, also on a European level, point to a minimum level of information, enough to satisfy the basic requirements (in journalistic terms: who, what, where, and when) but such as to allow the utmost acceleration of the cognitive process carried out through the catalogue, better termed, then, as “inventory”. The current trend is, therefore, the utilization of basic cards, meant not as an end but as a starting point for a deeper analysis and, above all, as a speedy and easily comprehensible way to gather and to spread information. Thus, scientific knowledge becomes the objective to pursue through later investigations, with wider and wider description levels: from the inventory to the pre-catalogue and to the catalogue.

But even if we limit the informative attributes of cultural assets, their quantity and variety is such that the handling of the catalogue is a problem which has not found a final solution yet, though the progress in the informatic field and in the GIS field forestalls the possible solutions and the goals to achieve.

#### 4 THE GIS PROJECT

The realization of a cultural heritage information system is a particularly complex problem because of the great deal of elements to be considered. Moreover, the absence of national or regional guidelines, which set out a standard of information to be inserted into the same system, does not help the work.

On the basis of that, it is of great interest to develop local projects, which allow to analyze the various aspects of this problem.

Project “GIS for Sicilian cultural heritage inventory” arose from collaboration between the Department of Representation of Palermo University and the Regional Centre for Cultural Heritage Inventory to define, through a first experimentation, the operating procedures to follow for an informatic handling of Sicilian cultural assets.

GIS project was developed, using ArcView rel. 3.1 software by ESRI, for the sample area of the District Council of Trapani (in north-westerly Sicily), taking into consideration only some assets, within the considerable existing heritage, selected from the following :

- *extra-urban architectonic assets;*
- *historical urban centres;*
- *archaeological sites.*

Database was designed collecting information from disparate sources relating to Sicilian Agencies dealing with cultural heritage, available in different formats (files, drawings, photographs etc.).

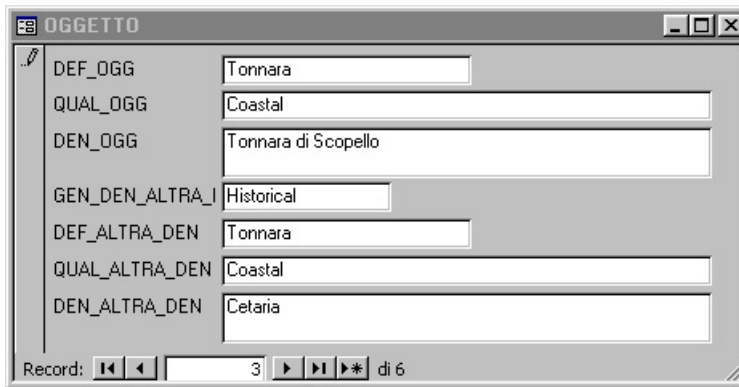


Figure 2. Example of dialog box.

All this information, transformed into digital data, were inserted within relational database, realized by Microsoft Access software and organized in appropriate tables according to suggestions of National Inventory Office.

To simplify the operations of handling and visualizing data, dialog boxes were designed within Access (fig. 2).

As general cartographic basis, digital orthophotomap of whole Sicily at scale of 1:25 000 was adopted. This kind of map offers the following advantages with respect to traditional one (Villa, 1995):

- unlimited information content;
- ease of up-dating;
- availability of digital (raster) format.

To increase the degree of detail, technical maps at larger scale (from 1:10 000 to 1:500) had integrated cartographic database besides.

#### 4.1 Results presentation

To consult the system and choose the kind of asset to visualize, an interface within ArcView was realized (fig. 3). Of course every considered kind provides for a different procedure to query database.

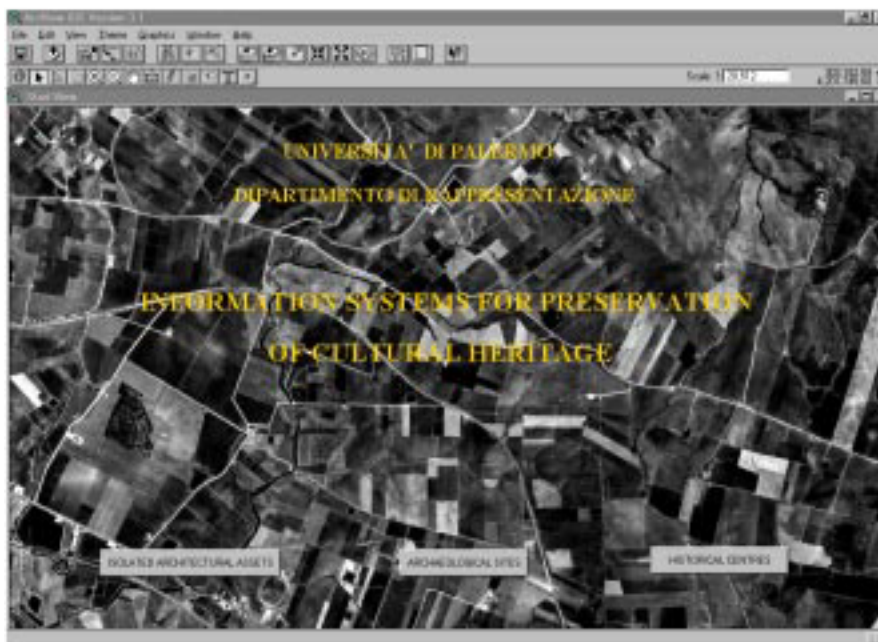


Figura 3. Starting display.

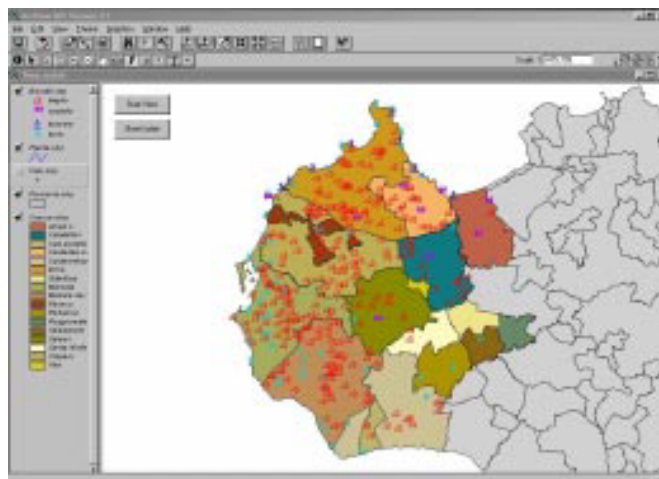


Figure 4. Cultural assets of the District Council of Trapani.

With regard to the *extra-urban assets*, four kinds (Castles, Towers, “Bagli” e “Tonnare”), typical buildings of Sicilian extra-urban areas, were sorted out. A different symbol was associated with each asset for its representation (fig. 4). Through video identification it is possible to query the system with reference to the main attributes (denomination, kind of object, qualification, location) or to more detailed information (repair, restoration, chronology, property, use destination etc.). Through the mouse tracking, it is possible besides to visualize the table with available information (photographs, drawings, texts, references etc.) related to each asset (fig. 5), listening also talking and music sounds. To visualize extra-urban assets on the map, it is necessary to select the image of the orthophotomap or the other available maps.

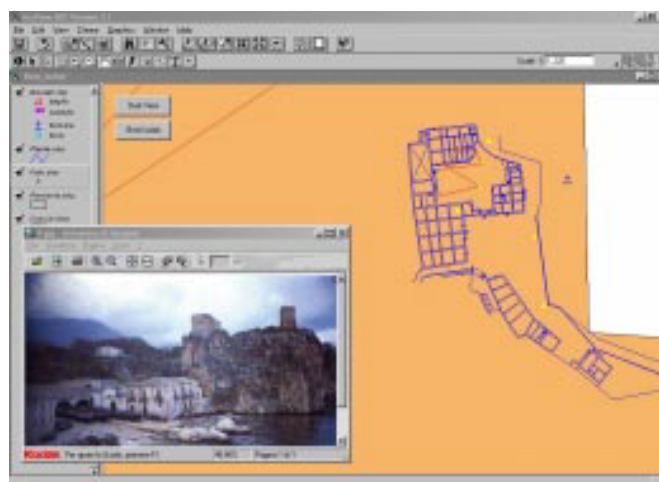


Figure 5. “The Tonnara of Scopello”.

To explore the *historical centres*, just as in the previous case, the visualization of the whole Sicilian territory can be started with location of the considered centres. At the present only Erice<sup>(\*)</sup> data was inserted. Its location can be always made on the orthophotomap from which it is possible to go on to detail map (at scale of 1:500) where all architectonic assets are localized.

Selective queries of database can be done with regard to attribute (for instance: “Which are the churches dating from a given historical period?”) and position alike. Photographic points of view of the assets are marked on the same map; therefore, by selecting the subject *photo* and positioning mouse on a particular visual point, the photo related to the required asset appears (fig. 6). To make even richer representation, through the *Hot Link* tool, a digital film (transformed into QuickTime format from videotape) about some architectonic assets of the town was inserted too.

<sup>(\*)</sup> Elimo-punic town dating from the period between IXth and IIIth century b.C.



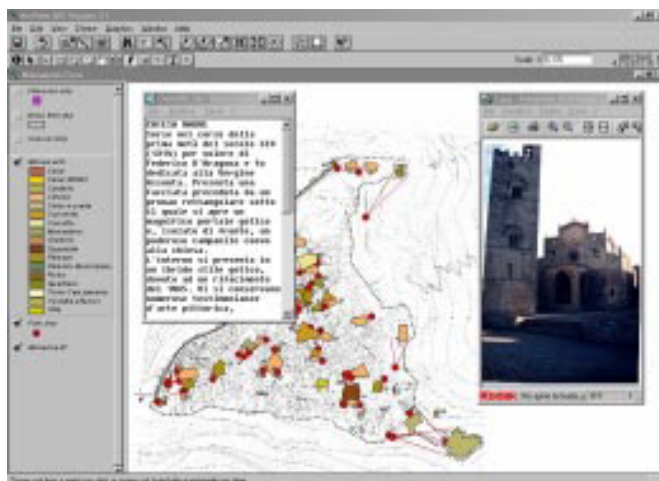


Figure 6. Location of the architectural assets on the historical centre of Erice.

As regard the *archaeological sites*, for the moment only the Archaeological Park of Segesta was considered in GIS project. This site, inside which some famous archaeological buildings (as the temple and the theatre) are located, was identified according to thematic map at scale of 1:2 000. Overlay with digital orthophoto (fig. 7) identifies largeness, ease of access, contour conditions.

As in previous cases, it is possible to query data base directly, to identify features interactively, to visualize photos, drawings or historical information.

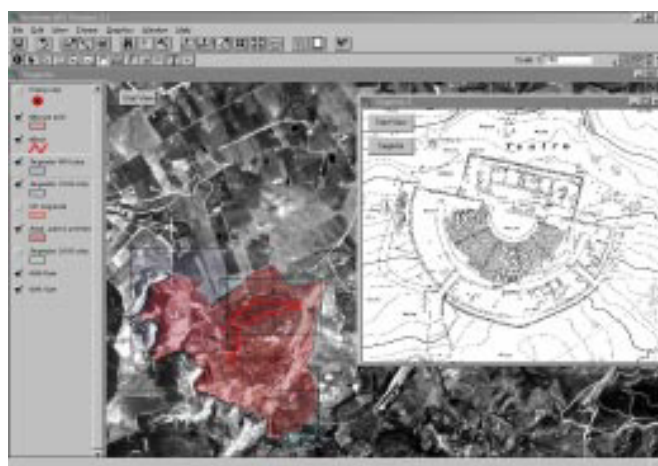


Figure 7. Location of the Archaeological Park of Segesta on the orthophotomap.

## 5 CONCLUSIONS

The realization of a GIS means a great step forward in the field of cultural heritage inventory and handling. The advantages of this informatic tool is clear enough also from this work, however limited it is.

But the goal of such a GIS should make information available and known not only to the public bodies appointed to protect and exploit the cultural heritage and to private specialists (such as architects, archaeologists, historians etc.) but also to ordinary people interested in querying this system for various reasons.

This chance is offered today by implementation of an information system on Internet.

Particularly, in the GIS project an experimentation was done regarding to 3-D visualization of the historical centre of Erice (fig. 8). This image was carried out from planimetric and altimetric information related to technical map, using 3D Analyst, an integrative package of ArcView. This software allows the landscape 3-D modelling and its handling within Internet through the VRML (Virtual Reality Modelling Language) graphic language.

The development of these techniques of visualization, absolutely more fascinating than traditional two-dimensional representations, and the possibility to query and explore the system, through Internet too, make imaginable a marked increase of the GIS applications in the field of cultural heritage.

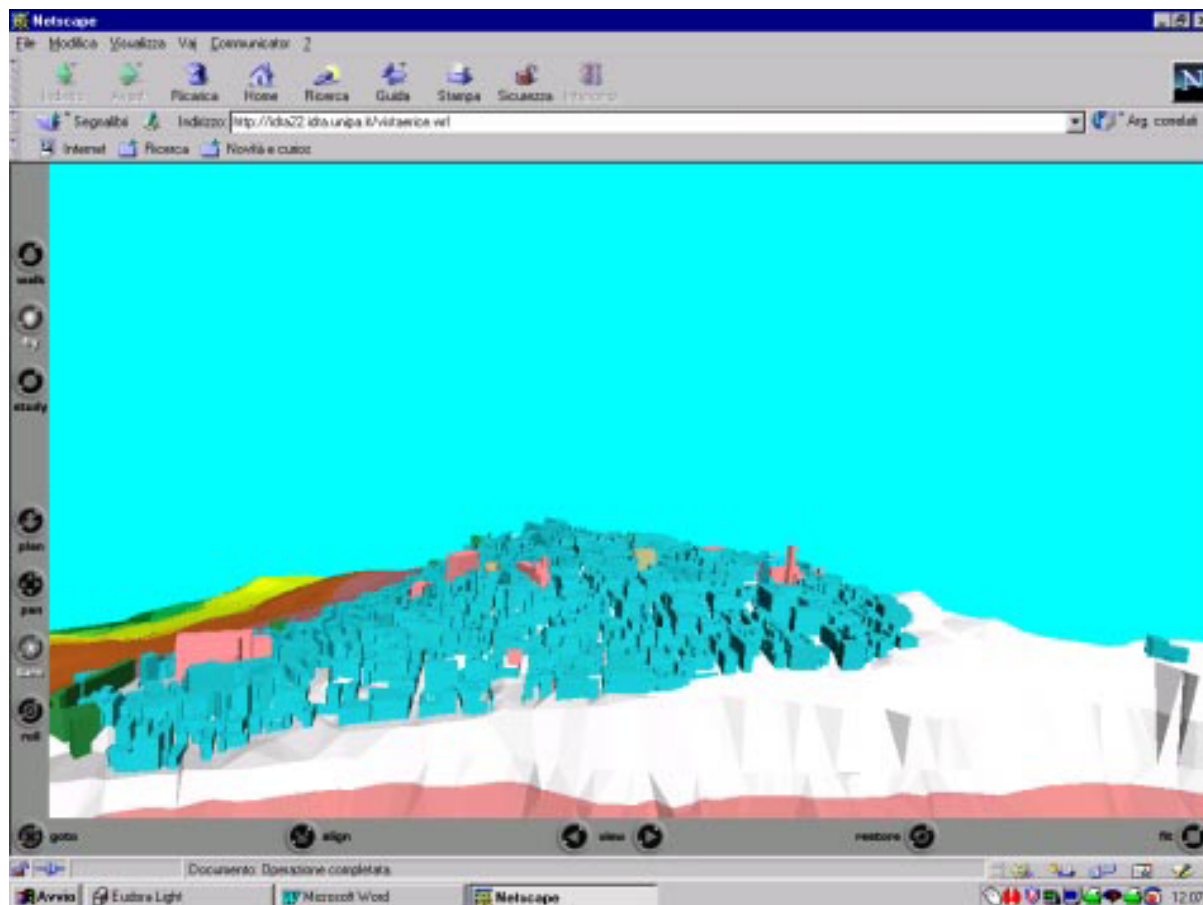


Figure 8. 3-D view of the historical centre of Erice through Internet .

## REFERENCES

- Alessandro S., Villa B., 1996. L'esperienza dell'ortofotocarta della Regione Sicilia. Documenti del Territorio, N. 33, pp.55-64.
- Biasini A., Galetto R., Mussio P., Rigamonti P., 1992. La Cartografia e i Sistemi Informativi per il governo del territorio, Franco Angeli Editore, Milano.
- Burrough P.A., 1986. Principles of geographical information systems for land resources assessment. Monographs on soil resources n. 12, Oxford Science Publications, Oxford.
- Corti L., 1992. Beni Culturali: standard di rappresentazione, descrizione e vocabolario. Franco Cosimo Panini Editore, Modena.
- Magnati Cianetti M., 1985. Sulla Catalogazione dei Beni Culturali e Ambientali, problemi legislativi e operativi esempio su una schedatura di rapida compilazione e relativa ai beni ambientali e architettonici, ICCD, Roma.
- Peveieri G., 1995. GIS Strumenti per la gestione del territorio. Editrice Il Rostro, Milano.
- Scanu G., Madau C., 1998. Sistemi informativi territoriali e valorizzazione dei beni culturali, 2° National Conference ASITA, Vol. 2, Bolzano, Italy, pp.365-375.
- Taylor D.R.F., 1989. Geographic Information Systems, the microcomputer and modern cartography. Pergamon Press Pubb.
- Villa B., 1995. L'ortofotocarta digitale come base del piano territoriale paesistico della Regione Sicilia. Documenti del Territorio, N. 30/31, pp.50-59.