SCIRES it
SCIentific RESearch and Information Technology
Ricerca Scientifica e Tecnologie dell'Informazione
Vol 8, Issue 1 (2018), 51-60
e-ISSN 2239-4303, DOI 10.2423/i22394303v8n1p51
© CASPUR-CIBER Publishing, http://caspur-ciberpublishing.it

THE TERRITORIAL INFORMATION SYSTEM FOR CULTURAL HERITAGE OF THE NATIONAL TERRITORY: THE CASE STUDY OF THE SOUTH-WESTERN AREA OF SALENTO PENINSULA

Barbara Pezzulla

Salento University - Lecce, Italy.

Abstract

Cultural heritage sites are threatened by a variety of natural factors and anthropogenic activities. Innovative and cost effective tools for monitoring systems and CH sites are needed to protect them. Towards this direction, the paper outlines an approach for digitally recording cultural heritage sites. This approach involves the implementation of the Territorial Information System for the Cultural Heritage of the Italian territory (SIT - "Sistema Informativo territoriale per i Beni Culturali del territorio italiano") for further management and analysis.
It is also for this reason that the SIT, with the primary purpose of high-level knowledge on documentation and management, is set up in such a way as to be functional to the protection and enhancement and, above all, to the planning of Public Authorities of territorial governance. The SIT is operational and tested in sample areas of central and southern Italy and is in continuous development in collaboration with research facilities (University and CNR) and tested in representative territorial areas such as the south-western sector of the Salento Peninsula, which is presented in this paper as a sample area.

Keywords

Ancient Topography, Geographic Information System, Cultural Heritage

1. *Introduction*

Thanks also to the increased attention of the media, which recently highlighted some serious phenomena of deterioration or abandonment of large archaeological and monumental complexes, even non-professionals are becoming aware of a very vast and complex phenomenon: the general situation of the Italian territory's cultural heritage, as of other countries of the Mediterranean area, is extremely far from satisfactory, both from a research point of view, and from that of protection and consequently of valorization (correctly understood as the increment of the national cultural values, or, more superficially, in a purely economic sense). In particular, there are substantial shortcomings with regard to the general knowledge of this heritage, which is obviously the prerequisite for any type of intervention. If you do not know about the existence of a cultural good, or have not analyzed and evaluated its characteristics and potential, it is impossible to preserve it, make it usable or use it as an engine of economic activity and development.

2. *Geographic Information System for Cultural Heritage*

The topic of analytical knowledge of the cultural heritage was already identified as a priority immediately after the Unification of Italy, at the time of the establishment of the General Directorate of Antiquities and Fine Arts of the Ministry of Education; then, with the involvement of great scientific figures of that time, and with exceptional results (which have remained unpublished for almost a century), the works began aimed at a systematic exploration of the territory and analytical census of the heritage on a "modern" cartographic basis for the preparation of the Archeological Map of Italy (this works were abandoned after a few years and subsequently taken up by the university). Numerous initiatives promoted by the Ministry of Cultural Heritage and Activities and Tourism (Cultural Fields, Risk Map of the Central Institute of Restoration,

Information Systems of the Central Institute of the Catalog and other MiBACT General Directions, etc.) and by many Universities and Research Centres have taken action in the past and are still working in this direction (Guaitoli, 2012).

Today, the problem is of great urgency, even more so because of the multiplication of transformation interventions of the landscape that often cause, without even becoming aware of it, the systematic destruction and the alienation of many goods, a large part of which are subject to risks of different entities, when not progressively destruction. The loss of the scientific knowledge of substantial parts of the national heritage constitutes itself an intolerable damage to every civilized nation; however, it entails even more serious consequences: above all, the frustration of any possibility of exploitation of what is destroyed. Cultural heritage, if managed compentently, can produce considerable opportunities for economic growth and work, without significant costs and without the consumption of resources, being an inexhaustible good; secondly, also the economic loss of the asset itself is serious, as it in many cases has a considerable material value. One may think, for example, of the phenomenon of illegal excavations, which involves every year loss of goods of great cultural interest but of the venal value of many hundreds of millions of euro, or the progressive degradation of improperly protected works of art.

With regards to the actions that involve cultural heritage, that is almost always in the national territory, two important needs can be identified:

- Knowledge of the cultural heritage in details. Knowledge must be analytical and supported by objective documentation, easily accessible also to operators from different sectors.
- Identification of modern, ductile tools, complete in the documentary base, to manage and process significant amounts of data, in order to have an increasingly effective and fast protective and preventive action, compatible design, of value-enhancement (if possible).
- Absolute integration between data and research tools and those for land management and planning.

The initiatives of the University of Salento and research groups of the National Research Council have been concentrated in this direction for many years: in order to facilitate and accelerate the transfer of known (or progressively acquired) data from research in all the interested public sectors, it was deemed necessary to gradually bring together all the data deriving from ongoing research and those already existing in the Territorial Information System for the whole national territory, based on the integral heritage register, identified by the acquisition of all the data known from the bibliography, the counting of archives and research or previous projects, above all through the capillary survey of the areas under study, with the greatest possible operative openness (Guaitoli, 2003; Tartara, 2011). The SIT was created a few years ago as part of the activities of the CNR Strategic Project "Problematiche scientifiche e sviluppo metodologie di catalogazione Beni artistici e culturali di interesse per il Mezzogiorno" (Guaitoli, 1997). Today the SIT is increased by the data deriving from the research carried out by the Ancient Topography and Photogrammetry laboratory of the Salento University in collaboration with the HERILAB Laboratory of the CNR - IASI (the Institute for Systems Analysis and Computer Science)[1]. The System was built by optimizing the experiences and technologies developed in special research projects, tested through successive refinements in a series of sample territories representative of the national situation and to a large extent replicable in the southern regions of Europe and North Africa, and is progressively implemented with the results of the systematic topographic research activities of the University of Salento, of the Ph.D. in Ancient Topography (affiliated offices of the University of Salento, University of Rome "La Sapienza, University of Tuscia, University of Salerno), of the Council National Research, other related University sites. Being a product of public research, the System was conceived primarily as a mean to facilitate the expansion of scientific knowledge, with particular attention to archaeological heritage; therefore with the primary purpose of knowledge, study and dissemination of the material heritage of ancient

[1] The SIT, therefore, has as its main objective the complete cataloging of cultural assets for the purposes of knowledge and differs for ex. from the SIT of Risk Map previously mentioned, developed by the Istituto Superiore per Conservazione (formerly ICR), which has as its objective the identification of the factors of interest that may affect Cultural Heritage.

cities and the territory. It is based on a complex of geo-referenced mapping bases, intended as a unified technological environment for data interchange, in conjunction with other administrations and public institutions (MIUR, MiBACT, Regions, Provinces, Municipalities, Authorities for the protection and management of the territory, Units for the Protection of the Cultural Heritage of the Carabinieri and of the Guardia di Finanza), also according to the compatible planning. The organizational advantages of the applications of rational management and financing criteria to a unitary system can be used at all levels (cadastre, networks and services management, censuses, land planning and agricultural management, etc.) from all regional or municipal administrations and possibly also from other countries, applying and modifying it according to the national legal procedures (Fig. 1).

As to the geographical reference systems, the general codifications, the SIT is aligned on military and international standards, on the recently defined European criteria, on the National Geodetic Commission guidelines and on the ICCD specifications for Cultural Heritage.

The amazingly fast technological progress and the diffusion of the use of IT has allowed a notable improvement of the methodologies of management and documentation of the urban and territorial analysis activities and of archaeological cartography. In particular, there has been a qualitative leap both in terms of use and analysis of the topographic support bases and in the field of recording, processing and restitution and dissemination of individual evidence.

The IT tools or even the various systems of territorial analysis, both traditional and innovative, allow an increasingly refined management of data, but before being processed, the individual elements must be identified, classified, detected, documented; these operations, in the field and in the laboratory, almost exclusively require human activity, which implies the systematic intervention of highly specialized researchers. In fact, it has already been mentioned that in the Cultural Heritage sector, as in other disciplinary areas that affect the local territory, the essential tool to actually increase knowledge is systematic autopsy analysis, that is the full and capillary exploration of the study context, carried out by expert staff, which is configured as the only type of research capable of expanding, with the continuous contribution of new data, the knowledge of the archaeological and architectural heritage, thus favoring its conservation and enhancement (Guaitoli, 2001, 2002, 2009).

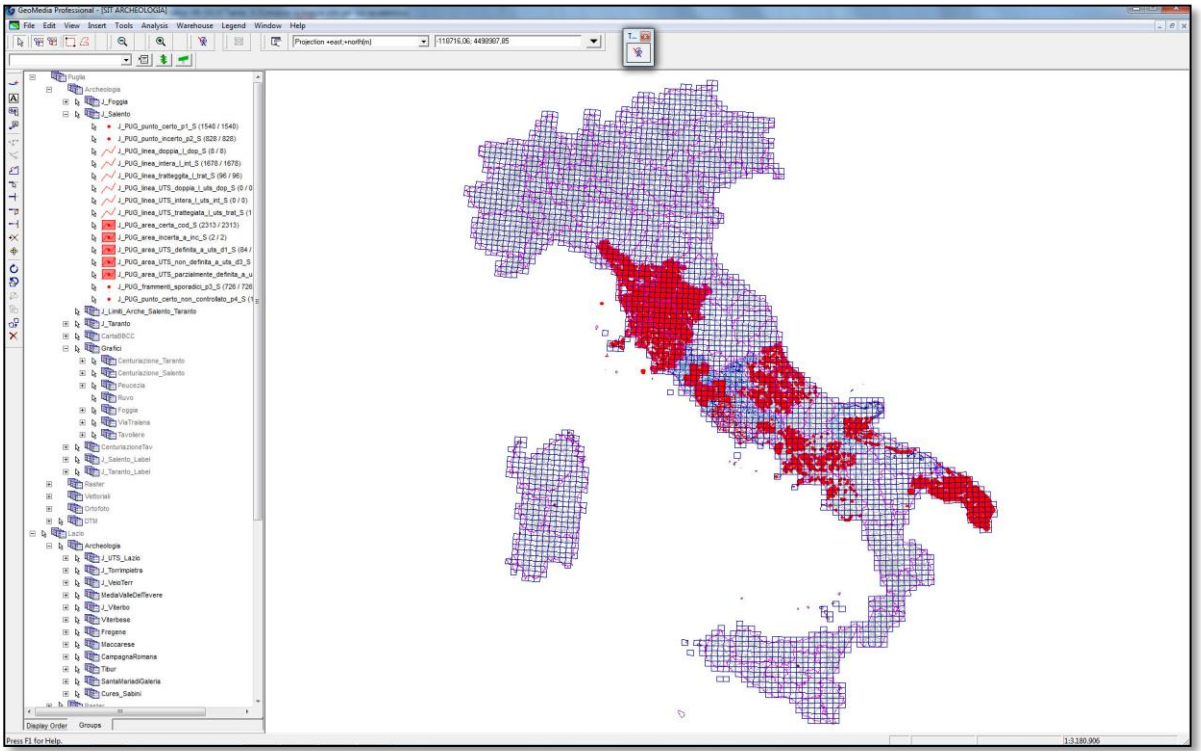

Fig. 1: Cultural heritage sites in the SIT of the CNR and Ancient Topography Laboratory of the University of Salento.

3. SIT organization

With reference to the organization of Territorial Information System, it is managed by high-powered software packages, continuously updated, in analogy with other national and international military and civil structures operating in the geographical and territorial field. For the graphic elaboration and the coding of the data we are based on the CAD software of most common use (Autocad, Bentley Microstation), and of specific softwares for the analytical and digital photogrammetric restitution, the georeferencing and the rectification of aerial images, the advanced cartographic processing[2]. For laboratory analysis, we use systematically the recent, but also historical, aerial investigation (from the first aerial shots of the national territory of the late 20th century, to the war photographs - shot by the Italian Air Force, the Royal Air Force, the United States Air Force, the Luftwaffe -, to the base flights of the 1950's of the Geographic Military Insitute (IGM), to the filming of private photogrammetric companies, to current flights, thematic or systematic, to the most recent digital documentation of satellite surveys or multiband sensors).

In constructing the system, priority was given to the precision in positioning each element, to the analytical detail in the description and interpretation of the data, to the consideration of the most varied possibilities of use for all aspects of knowledge and management.

At the base of the system is the general official vectorial reference framework, with administrative limits and associated database, the State official cartography (1:100,000, 1:50,000 and 1:25,000) in raster format with related databases and georeferenced toponymy, acquired in high definition and geometrically rectified. In order to operate directly on the territory, it is necessary to prepare the system for the use of continuously updated numerical mapping data, realized in the various reference systems by the various Administrations (Regions, Provinces, Municipalities) at the highest level of detail, so as to increase the level of precision and tolerances. All vector cartography must be aligned with unique, specially set coding, consistent with the lexicons of the ICCD.

For ancient and historical urban centers, and complexes of particular relevance, municipal maps are given in greater detail (1:1000, 1:2000) or, if necessary, to special cartographic bases, produced ex novo with analytical photogrammetric restitution finalized with the laboratory's tools of Ancient Topography and Photogrammetry, aligned to the highest levels of precision.

In short, the general reference framework is composed of:

- Cartographic bases of reference at various operational scales (Figg. 2-3);
- Targeted maps for ancient urban centers;
- Graphical and alphanumeric databases;
- Framework of associated documents;
- Topological levels.

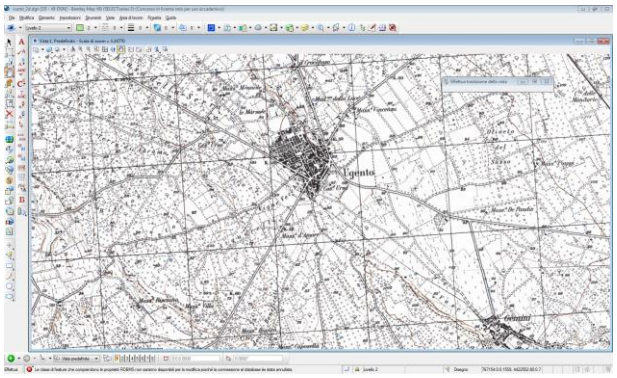

Fig. 2: Exemplification of IGM Cartography, scale 1:5.000 to the Ugento territory in the SIT.

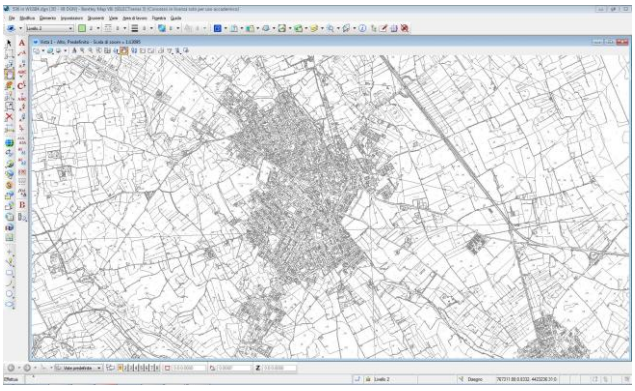

Fig. 3: The same territory represented on Regional Cartography, scale 1:5.000.

[2] The dataset includes alphanumeric data, geographic information, italian toponymus and attachments: cartography (IGM 1100.00, 1:25.000, Regional Cartography 1:5.000, 1:10.000), aerial photography, recent and historical photos, remote sensing, LiSAR, plans, reports).

The operating levels are structured in:

- Area analysis, "Projects" (cities or large complexes, areas of special interest), realized on cartographies produced ex novo or on numerical cartographies of other bodies, re-elaborated and codified according to the criteria of the finalized cartography, with relative direct analysis of the ground.
- UTS Datasheet (Superior Topography Unit) taken from direct analysis, or derived from bibliography: great evidence (inhabited cities, important monumental complexes, roads, infrastructures, ports, places of worship, etc.) composed of series of UT cards, positioned on Regional or provincial technical papers with submetric tolerances.
- UT Datasheet (Topographic Unit) taken from the direct analysis and inserted into the system in real dimensions, with descriptions and detailed documentation, acquired using traditional or instrumental methods (total stations, differential GPS), positioned on regional technical maps.
- Constraints: archaeological, environmental and landscape, monumental, included in the cartography with precisions appropriate to the scale 1: 5000, with specially designed card, cadastral details and, where necessary, georeferencing of detail acquired with global stations and differential GPS.
- Topological levels: Georefenced toponymy, historical toponymic or source indications, specific contexts, hypothetical assignments or perimeters.

The elements that converge in the numerical cartography are associated to a specific database, developed in the Topography Laboratory according to the systematic direct analysis of the ground. The database is structured according to the spatial data and therefore contains specific information on the heritage, but also on the landscape context, on the conditions, on the characteristics and the methods of acquisition of the individual elements. Everything is connected in the GIS modules in relation to the precise geo-referencing and vector definition on the various bases and to the graphic representation of the terrain conditions and visibility, so as to be able to manage, with great operational power, the spatial and geographical queries typical of GIS, with the multiple and crossed possibilities of databases in a single alphanumeric and graphic system.

In the information system, in relation to the topographic data, and to the places of discovery or conservation, information is included, and, where necessary, documentation on the mobile, diagnostic materials, both from the point of view of the typological definition of evidence and the chronologies, acquired in a synthetic form, in order to respond to the primary need for knowledge and to make available to the various users the evidence of the interpretations proposed for the different evidences; the materials, synthetically indicated but stored in relation to the numbering of the individual evidences, may subsequently be the subject of specialized studies.

4. The south-western area of Salento Peninsula

Also the archaeological presences of the south-western sector of the Salento peninsula have been cataloged and documented in the SIT of the Ancient Topography Laboratory (Pezzulla 2012, 2017)[3]. The area of Ugento Municipality, in particular, which develops on the ancient settlement, has necessitated a specific area analysis project, which has been requested by the University from the Archaeological Superintendence of Puglia and, in relation to the drafting of the PRG (Scardozzi 2007). The work was carried out on the basis of a finalized cartography which, as expected, was produced from scratch and thanks to the direct analysis of the land. Both for the area of the town and for the remaining municipal territory, the main operations concerned the analytical census of all archaeological evidence and the subsequent analysis of the data. After the bibliographic and

[3] The territory is included in a three-year work of archaeological cartography of PhD. The results are presented in the publication of the author's doctoral thesis "Carta Archeologica del settore sud occidentale della Penisola Salentina I.G.M. F. 223, IV NE Ugento, F. 223, IV SE Gemini e F. 223, IV NO Posto Racale".

archival research, the study of ancient sources, the cartographic documentation (both historical and recent), aerial photography, etc., the work has provided for the positioning, the documentation and the codification of the archaeological presences detected on the ground in the course of the reconnaissance, the implementation of the relative descriptive alphanumeric cards, the vectorization of cartographic themes functional to the research (constraint areas, PRG etc., soil condition etc.), the elaboration of archaeological thematic maps and proposals of themes in function of the public fruition of archaeological heritage and territorial planning. It was thus possible to create, in addition to an ordered cadastre of archaeological presences, known both from bibliography and recognition, a tool which is useful firstly to the historical reconstruction of the development phases of the town and the territory of relevance, and secondly to define the strategies of management, protection, conservation and enhancement of the ancient presences and in any case of the cultural heritage complex, as a function of a correct management and administration of the urban and territorial context and of the social structure that lives in this territory. The knowledge of cultural heritage, associated with that of the environment in which it is located, allows not only to assess possible damage and therefore the necessary measures to avoid them, but also to estimate the priorities of the interventions and to set up a proper planning and management of the heritage, as much as the territory of reference. From this approach, therefore, the possibility of improving the conservative conditions of the assets and enhancing the importance of the most urgent and useful interventions of urban and territorial requalification is descended. Problems of this type can be addressed through the identification of guidelines for planning in line with the structural characteristics of the area and through strategies for the sustainable development of protection and management of existing resources.

The work that is still presented today can be considered to be in progress, as we constantly intervene on the system to improve the quality of information and management and to adapt to the technological development of software and machines, in addition to the continuous increase in data deriving from the analysis topographic in progress. To date, research has led to the discovery and positioning of approximately 400 archaeological evidences of the territory (obviously excluding the single evidences of the ancient inhabited area of Ugento, which is object of specific analysis, just under 300), largely

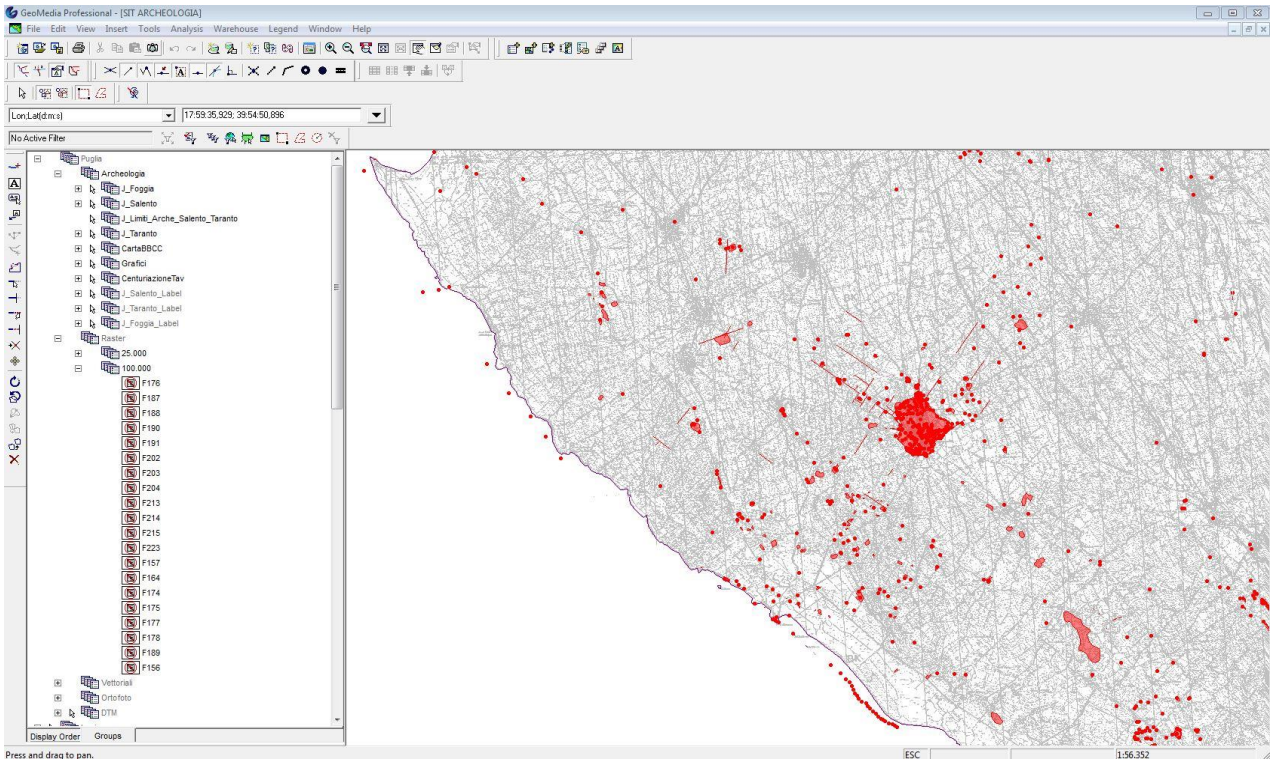

Fig. 4: Print screen from the cartographic database of the SIT with the location of the archived archaeological evidence south-western area of Salento Peninsula.

unknown or not positioned and subject to precise analysis, consequently not subject to protection by the bodies in charge for their valorization (Fig. 4).

By way of example, the print screens taken from the SIT alphanumeric database (relative to one of the Topographic Units (UT) of the Ugento territory are presented; each UT is identified, both in the alphanumeric database and in the cartographic database (Fig. 5) by a unique code consisting of the alphanumeric key of the IGM 1: 25.000 Tablet and a progressive number. The main form of the sheet is divided into fields (with related lexicons) identifying and describing the archaeological evidence: Object, Interpretation, Annotations; relating to the conditions: Damages, Current Status, Conservation, Risk and relevant to the period of recognition and filing. From this first mask it is possible to access other windows concerning the Localization, the condition of the Soil at the time of reconnaissance (type of agricultural work, readability of surface, vegetation coverage, etc.), the description of any preserved structures (Monument, Unit functional) or disintegrated on the surface (structural element), of movable materials found and pertinent the Dating and the Bibliography, when existing.

In urban and territorial planning, the Ancient Topography and the most modern systems of digitization of ancient evidences best deploy its potential and respond to the questions of the present with the most consolidated and clearest of its "analytical" answers: the Archaeological Map which constitutes the first phase of every serious project concerning the physical structuring of the environment, of the landscape, of the territory, of the city. At the same time it responds by also offering a vision of synthesis capable of restoring historical depth to the present context: not only as a reconstructive sequence of ancient territorial structures and not only in the usual terms of "protection and valorization of goods"; if anything, as a system of scientific and systematic knowledge of the historical processes that have determined the shape of the places in which we live, to try to guarantee the correct balance between the necessary evolution of forms and functions and respect for their ancient causes.

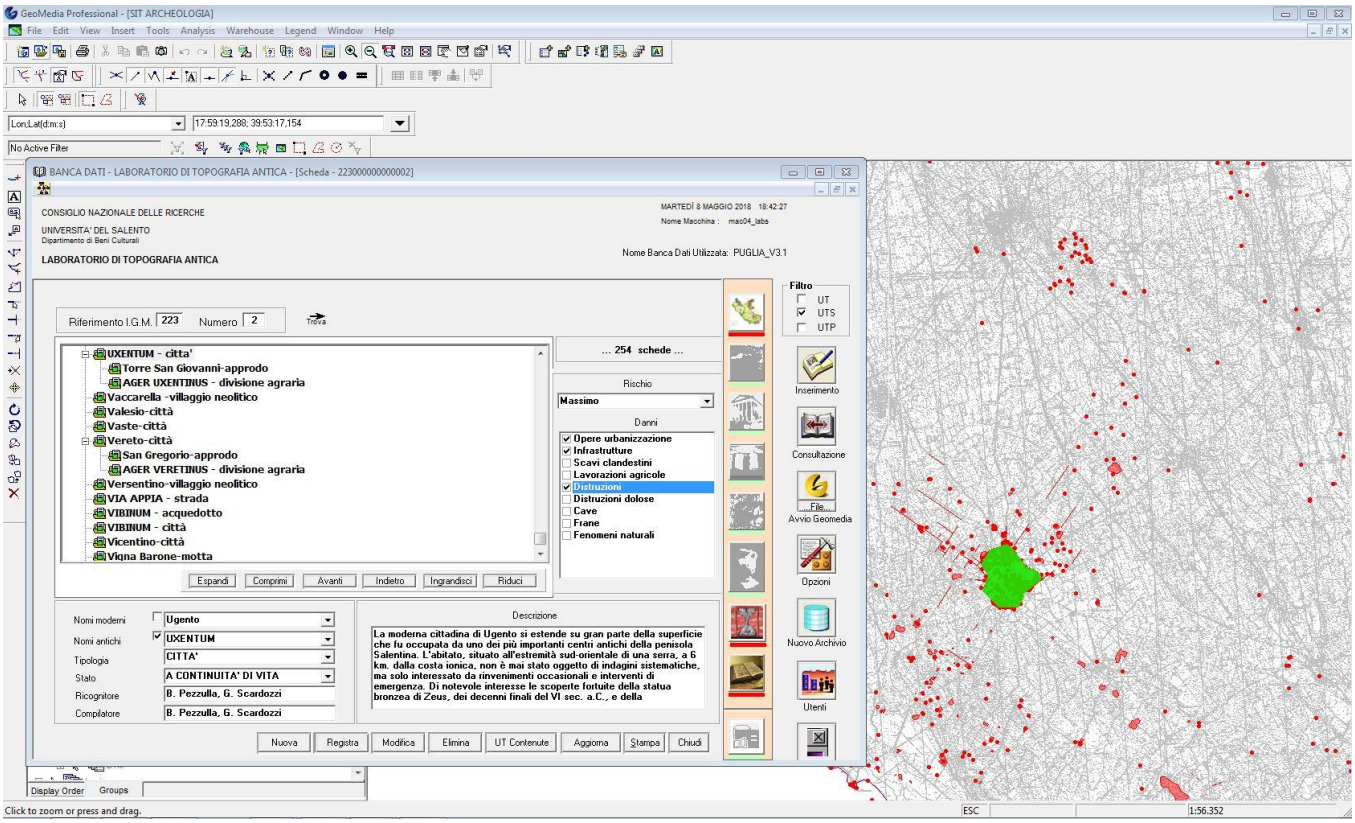

Fig. 5: Print screen from the cartographic database with the query window of a CH site.

REFERENCES

Agapiou, A., Alexakis, D. D., Sarris, A., & Hadjimitsis, D. G. (2014). Evaluating the potentials of sentinel-2 for archaeological perspective. *Remote Sensing*, 6, 2176–2194.

Agapiou, A., Nisantzi, A., Lysandrou, V., Mammouri, R., Alexakis, D. D., Themistocleous, K., & Hadjimitsis, D. G. (2013). Mapping air pollution using Earth observation techniques for cultural heritage. *Proc. SPIE 8795. First international conference on remote sensing and geoinformation of the environment* (RSCy2013). Retrieved from http://dx.doi.org/10.1117/ 12.2028234.

Attema, P., Burgers, G.-J., Van Joolen, E., Van Leusen, M., & Mater, B. 2002 (edd.) New Developments in Italian Landscape Archaeology. In *Proceedings of a three-day conference held at the University of Groningen (Groningen, April 13-15, 2000)*, Oxford BAR International Series 1091.

Azzena, G. (2011). Una logica prospettiva. In *SITAR Sistema Informativo Territoriale Archeologico di Roma. Atti del I Convegno. Roma, 26 ottobre 2010* (pp. 29-39). Roma, IT: Iuno Srl.

Campana, S. (2011). Total Archaeology approach to overcome Rescue Archaeology: BREBEMI project (Italy). In Cowley, D. (Ed.). *Remote Sensing for Archaeological Heritage Management in the 21st century*. vol. 5, p. 33-41, Europae Archaeologia Consilium (EAC), Reykjavík, Iceland, 25-27 March 2010.

Campana, S. (2011). SITAR e archeologia preventiva. In M. Serlorenzi, (Ed.). *SITAR: Sistema Informativo Territoriale Archeologico di Roma* (p. 41-45). Edizioni Iuno, Roma - Palazzo Massimo, 26 ottobre 2010.

Campana, S. (2017). Vers l'implentation de la cartographie du continuum archéologique. Nouvelles perspectives et limites actuelles de l'archéologie préventive en Italie. In *Archèologies Numériques* (pp. 1-14). London, UK: ISTE Ltd.

Campana, S., & Forte, M. (2017). *Digital Methods and Remote Sensing in Archaeology. Archaeology in the Age of Sensing*. New York, US: Springer.

Campana, S. (2018). *Mapping the Archaeological Continuum: Filling 'Empty' Mediterranean Landscapes*. New York, US: Springer.

Carafa, P. (2012). Il Sistema Informativo Archeologico di Roma Antica. In A. Carandini, & P. Carafa, (Ed.), *Atlante di Roma Antica. Biografia e Immagini della città* (p. 44-55). Milano, IT: Electa.

Continenza, R., & Trizio, I. (2012). Tra strumenti classici e geodatabase 3D: il piano di ricostruzione post sisma 2009 del centro storico di Bugnara (AQ). *SCIRES-IT - SCIentific RESearch and Information Technology*, 2(2), 29-40.

Continenza, R., Redi, F., & Trizio, I. (2017). Heritage interpretation: a tool for conservation, protection and management of environmental and cultural heritage. *SCIRES-IT - SCIentific RESearch and Information Technology*, 7(1), 39-44.

Di Giacomo, G., & Scardozzi, G. (2014). GIS Cloud per l'archeologia. Strumenti open source per la gestione e condivisione dei dati (Roma 2014). *Archeologia e Calcolatori*, Suppl. 25, 93-112.

Guaitoli, M. (1997). Attività dell'Unità Operativa Topografia Antica. In Guaitoli, M. (Ed.), *Metodologie di catalogazione dei beni archeologici*, BACT 1,2, (pp. 9-44). Lecce-Bari, IT: Martano Edipuglia.

Guaitoli, M. (2001). I sistemi informativi territoriali in rapporto al patrimonio archeologico (Problemi della chora coloniale dall'Occidente al mar Nero). In *Atti XL Convegno di Studi sulla Magna Grecia (ottobre 2000), Napoli 2001. In: Convegno di Studi sulla Magna Grecia, vol. XL.*

Guaitoli, M. (2001). Il Rischio del Patrimonio archeologico. In Guaitoli, M. (Ed.), *Il Rischio archeologico,* Firenze, IT: All'Insegna del Giglio.

Guaitoli, M. (2002). Il territorio e le sue dinamiche. Osservazioni e spunti di ricerca (Taranto e il Mediterraneo), In *Atti XLI Convegno di Studi sulla Magna Grecia (ottobre 2001), Napoli 2002.*

Guaitoli, M. (2003). Introduzione. In Guaitoli, M. (Ed.), *Lo sguardo di Icaro. Le collezioni dell'Aerofototeca Nazionale per la conoscenza del territorio* (pp. 13-15). Roma, IT: Campisano Editore.

Guaitoli, M., & Cazzato, V. (2005). *Lo sguardo di Icaro. Insediamenti del Salento dall'antichità all'età moderna.* Galatina, IT: Congedo Editore.

Guaitoli, M. (2008). Metodologie per la conoscenza e la gestione dei Beni Culturali del territorio. Le attività del CNR per il Progetto "Sistema Informativo Territoriale della Regione Campania". In Aa. Vv. *Progetto "Sistema Informativo Territoriale della Regione Campania"* (pp. 37-62). Napoli.

Guaitoli, M. (2009). Metodologie per la conoscenza e la gestione dei beni culturali e del territorio. Le attività del Consiglio Nazionale delle Ricerche per il Progetto. In *Sistema Informativo Geografico Territoriale della Regione Campania*, (pp. 39-62). Soveria Mannelli: Rubettino Industrie grafiche ed editoriali).

Guaitoli, M. (2009). Metodologie per la conoscenza e la gestione dei beni culturali e del territorio. Le attività del Consiglio Nazionale delle Ricerche per il Progetto. In *Sistema Informativo Geografico Territoriale della Regione Campania* (pp. 39-62). Cosenza, IT: Soveria Mannelli, Rubettino Editore.

Guaitoli, M. (2012). Attività di ricerca per la conoscenza del patrimonio culturale del territorio di Ugento. In Guaitoli, M., Binetti, G., Montalbano, C., Occhilupo, G., Petruccioli, A., Pezzulla, B., & Scardozzi, G., *Contributo alla conoscenza dei Beni Culturali del territorio di Ugento* (pp. 9-16). Modugno, IT: Scirocco Editore.

Luzio, K. (2017). 3D archaeological map: contribution of the reconstruction of the ancient landscape of the west-central area of Salento (Italy*). SCIRES-IT - SCIentific RESearch and Information Technology*, 7(1), 9-16.

Mell, P., & Grance, T. (2011). The NIST definition of cloud computing. Recommendations of National Institute of Standards and Technology, Gaithersburg, Special Publication 800-145. Retrieved from: http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf.

Miele, F. (2011). La conservazione della memoria materiale e immateriale. Sistemi informatividi catalogo e territoriali in Campania, In *Archeologia e Calcolatori*, 22, 7-34.

Moscati, P. (2008), Webmapping in Etruscan lasndscape, in Djindian, F. et al. (eds.), *Webmapping dans les sciences historiques et archologiques, Actes du Colloque international (Paris 2008)*. In *Archeologia e Calcolatori,* 19, 17-30.

Muzafar, A.B., Razef, M.S., & Bashir, A. (2011), Cloud Computing: A solution to Geographical Information Systems (GIS). In *International Journal on Computer Science and Engineering*, 3, 2, 594-600.

Niroshinie, F., Seng, W.L., Wenny, R. (2013). Mobile cloud computing: A survey. In *Future Generation Computer Systems*, 29, 84-106.

Pezzulla, B. (2012). Schedatura sintetica delle presenze archeologiche. In In Guaitoli, M., Binetti, G., Montalbano, C., Occhilupo, G., Petruccioli, A., Pezzulla, B., & Scardozzi, G., *Contributo alla conoscenza dei Beni Culturali del territorio di Ugento* (pp. 69-106). Modugno, IT: Scirocco Editore.

Pezzulla, B. (2012). Il territorio di Ugento nel Sistema Informativo Territoriale del Laboratorio di Topografia Antica dell'Università del Salento. In Guaitoli, M., Binetti, G., Montalbano, C., Occhilupo, G.,

Petruccioli, A., Pezzulla, B., & Scardozzi, G., *Contributo alla conoscenza dei Beni Culturali del territorio di Ugento*(pp. 107-118). Modugno, IT: Scirocco Editore.

Pezzulla, B. (2017). Topographic analysis and photo interpretation of historical and recent aerial images. A case study: the ancient civo settlement (Taviano-LE), *SCIRES-IT - SCIentific RESearch and Information Technology*, 7(2), 51-62.

Scardozzi, G. (2003). *Ugento*, in M. Guaitoli (Ed.), *Lo sguardo di Icaro. Le collezioni dell'Aerofototeca Nazionale per la conoscenza del territorio* (pp. 343-346), Roma, IT: Campisano Editore.

Scardozzi, G. (2005). Ugento. In V. Cazzato, & M. Guaitoli (Ed.), *Lo sguardo di Icaro. Le collezioni dell'Aerofototeca Nazionale per la conoscenza del territorio. Insediamenti del Salento dall'antichità all'età moderna* (pp. 62-66), Galatina, IT: Congedo Editore.

Scardozzi, G. (2007). *La cinta muraria di Ugento*, Presicce, IT: Edizioni Leucasia.

Scardozzi, G. (2010). Il contributo delle fotografie aeree storiche e recenti e delle immagini satellitari ad alta risoluzione alle ricerche di topografia antica: casi di studio dall'Agro Falisco (Viterbo), dal Salento (Lecce) e da Hierapolis di Frigia (Turchia). In F. D'Andria, (Ed.), *Il dialogo dei Saperi. Metodologie integrate per i Beni Culturali* (pp. 433-461), Napoli, IT: Edizioni scientifiche italiane.

Scardozzi, G. (2012). L'abitato antico di Ugento. In Guaitoli, M., Binetti, G., Montalbano, C., Occhilupo, G., Petruccioli, A., Pezzulla, B., & Scardozzi G., *Contributo alla conoscenza dei Beni Culturali del territorio di Ugento* (pp. 43-58). Modugno, IT: Scirocco Editore.

Scianna, A., & Villa, B. (2011). GIS application in Archaeology. In Archeologia e Calcolatori,22, 337-363.

Semeraro, G. (2011). Banche Dati, GIS E WEB GIS: breve storia delle tecnologie applicate ai beni archeologici nel laboratorio di informatica per l'archeologia dell'Università del Salento. *SCIRES-IT - SCIentific RESearch and Information Technology*, 1(2), 125-144.

Serlorenzi, M. (2011). SITAR, Sistema Informativo Territoriale Archeologico di Roma. In *Atti del I Convegno (Roma 2010)*, Roma, Iuno Edizioni.

Serlorenzi, M., Lamonaca, F., Picciola, S., & Cordone, C. (2012). Il Sistema Informativo Territoriale Archeologico di Roma, SITAR. In *Archeologia e Calcolatori*, 23, 31-50.

Tartara, P. (2011). CNR GIS for Cultural Heritage: territorial analysis and damage to Cultural Heritage. In *Resources of the territory*, I, (p. 171-178). Istanbul, Turkey, 22-25 November 2011.