Geomatics and Architectural Heritage: a Multi-layer Interactive Map of Tuscia-Italy

[1*]Alessia Bianco

[1]Ph.D., Italian Ministry of University, research and education, Italy.

ABSTRACT: The main aims of this research are the design and implementation of a multilayered and interactive geomatic map of cultural heritage of Tuscia, one of the richest and most complex cultural areas of Italy, thanks to the presence of different civilizations, from Etruscans and Romans to the Middle Age. Its cultural heritage is very rich, valuable and above all diversified, because including tangible and intangible manufacts and artifacts, placed in a peculiar natural context. For this reason the research finds to purpose a GIS (Geographic Information Systems) map able to match some of the geomatics options in the field of the cultural heritage with a double level database recording, defined according to the Midas standards. This GIS map of Tuscia was designed to be useful for two different kinds of targets: informal users, like travelers and schools, but first of all entities, institutions and organizations which protect, promote and manage that mentioned heritage.

Keywords: *Architectural heritage, Historic preservation, Geomatics, Tuscia.*

INTRODUCTION

A geographic information system (GIS) is an integrated hardware and software geomatic architecture, able to link geographic referenced information to multilayered interactive data (texts, images, XYZ data, etc.) for capturing, classifying, analyzing, displaying and managing them in terms of relationships, stratified data, using different representation tools, for example in the form of routes, maps, thematic charts, reports (Knowles, 2002). The application of GIS technology for cultural heritage is a recent and full of potentialities tool, thanks to its capability to link and to summarize really different kinds of data; for this reason is useful not only for professionals (public and government institutions and authorities responsible of conservation and preservation of the cultural heritage; technicians; scholars), but also for its public divulgation and dissemination Bianco (2015). One of the main and most interesting application of GIS technology for cultural heritage regards its capability to manage large heritage (for example in the case of Machu Picchu archeological site-Arkansas University 2007) and/or diffused heritage (for example the interactive map of the South African National Parks-San Parks 2011), because at the same time it's able to link multilevel data to multilevel geomatic and geographic references (Berg, 2001). heritage preservation is an innovative tool, also in terms of methodological approach; in fact the GIS map of Tuscia aims putting tangible and intangible heritage in its wider context, throughout a holistic heritage approach, particularly in the case of "minor" monuments, sites, manufacts and artifacts, and relating it more closely to the communities concerned in order to afford greater weight to identity and local cultural values.

Moreover, documentation databases in the cultural heritage sector are growing in importance. In addition to the classical documentation systems, like archives and libraries, new documentation systems are coming online.

These systems, using digitized technologies to documents the range of objects like archaeological sites, heritage environments, ruins as well as buildings and their maintenance condition, are one of the best strategy to reduce the number

*Corresponding Author Email: alessia.bianco3@istruzione.it

of separate documentation, unify the methodology platform (database types), implement automatic transfer of data among applications, integrate GIS functionality's, graphic documentation (photos, maps, drawings, sensors, etc.) and in this context the GIS map of Tuscia can be considered a positive example of this approach.

In fact, in the case of Etruria, a GIS application can be very useful because the main characteristic of this zone is that its heritage is placed in a very diversified geographic context (from mountains to coastlines) and its architectural heritage regards a really large historical range, from the Etruscan civilization (8th-4th century BC), through the Roman conquer (3th century BC) and to the Middle Age and for this reason it is crucial in the history of the Italian culture and architecture. The second relevant characteristic of GIS technology for cultural heritage is the possibility to link and manage very different kind of data (for example not only texts and images, but also audio or video files), very interesting in case of a GIS application for intangible and/or immaterial heritage (Junyong et al., 2008). In the case of Etruria this possibility is very useful, because the genesis of this research project starts from the idea to propose a sort of virtual abacus of the cultural connections between who lived in Etruria in the past (Etruscans, Romans, etc..) and the current times, not only in terms of material elements (adaptive reuse of infrastructures, like in the case of ancient aqueducts, later used as bridges or borders; archeological ruins in Medieval churches, etc..), but also giving evidence to a rich and complex intangible heritage (the influence of ancient languages, food, music and dance, religious and popular events in the current local dialects, festivals, etc.).

The GIS application of Etruria for example is able to suggest the reciprocal distance between Rome and the other cities located in Etruria and it is possible to know how many days were needed to go from one city to another one, on foot or on horseback, crossing these data with others relating to the presence of small villages, monasteries, guest quarters, where

to find refreshment.

You can analyze different types of bridges or buildings, in relation to different types of areas (hills or mountains; seismic risk areas, flood risk areas, etc.), linking this information to historical data, ancient and recent images of these places, geographic maps, technical maps (e.g. geological and rainfall maps), risk maps, audio and video files, newspaper pages, website links, links to scientific publications and active, cloud and hypermedia databases of scientific and government authorities or entities (Themistocleous et al., 2016).

Tuscia and its cultural heritage
Short introduction

The current territory of Tuscia is related to the Viterbo Province-Lazio-Italy; but from 8th to 4th century BC it was part of the territory under the Etruscan civilization, which included large part of Tuscany, Umbria and Lazio, until the Roman conquest, when it was called Etruria (Fig. 1).

For this reason Tuscia is nowadays one of the most relevant Italian regions (Fig. 2), which preserves and expresses the ancient Etruscan culture, being characterized by a peculiar identity not only in terms of material heritage (art and architecture), but also thanks to its intangible heritage (local language, ancient festivals, traditional cuisine and genetic profile of the modern inhabitants) (Haynes, 2000)

Therefore mapping of the cultural heritage of Tuscia needed a technology able to consider and connect different kinds of data (images, audio, videos, etc.), finding in the geomatics an interesting and flexible solution, able to propose the usage of GIS technologies and, above all, prefer an information management technique, based on the idea to link informations and data about tangible and intangible aspects of the same manufact/artfact (for example linking historical pictures of a square with historical videos about the religious festivals annually performed in that square, which are interesting also thanks their ancient dances and songs).

Fig. 1: Tuscia in the Peutinger's map, 14th century-copy (Lavi & Lavi, 1978)

Fig. 2: Geographic location of Tuscia Etruria-Italy.

Cultural and Architectural Heritage of Tuscia

The history of Tuscia can be divided in three main phases, with a direct reverberation on its cultural heritage: Etruscan civilization (8th-4th century BC); Roman conquest (3rd century BC-4th century AD); Middle Age (5th-14th century AD).

About Etruscan civilization, this regards an evolved and complex confederacy of independent cities, which during the 8th and 7th century BC conquered large part of the Middle Italy, thanks to its high level of civilization. Etruscans, as probably demonstrated by recent DNA investigations on its current population, were from the Anatolian region and also for this reason never conquered, under the military and cultural point of view by Greeks, developing a really peculiar and unique culture in the area of Mediterranean Sea. Their language was reach, articulated, expressed in oral and written way and it can be partially found in the heritage of the roman language, Latin; under the political point of view every city was independent, but at the same time the Etruscan federation represented a very efficient way to find a compromise between independence of local communities and conquer of Middle Italy, obtaining a first form of Italic state, and being, according to the legend, the first founded of Rome and its civilization. In fact the cultural connection between Romans and Etruscans can be considered very close: a political system, born as a monarchy and later changed to republic; similar family system, above all considering the role of mothers and women, who were more emancipated than in other civilizations, Greeks included; a similar polytheistic religion, whit a peculiar interest in life after the death. In fact Etruscan necropolis are the most interesting and diffused examples of Etruscan architecture, being articulated in several different typologies (underground burial chambers; dome-shape tombs, etc.) in general decorated by refined frescos, which represent Etruscan life and very useful for understanding of their evolved life style (music instruments, food, clothes, festivals, houses) like a sort of detailed pictures of a mysterious civilization, given that there are very poor traces of their literature (Sprenger& Bartoloni, 1983). This civilization was conquered by the Romans starting from the 4th century BC and their contribution in the definition of the Roman identity and civilization was really important, as considered by the Romans themselves, who combined the Etruscan culture with the Greek identity of Magna Graecia in Southern Italy, conquered after the Etruscan conquest, with a sort of mutual influence which the Roman civilization produced and is still today the basis of the western world. At the end of the Roman Empire, in the 5th century AD, Tuscia, as well as the Empire and Italy, was slowly and progressively divided in political terms, with the consequences of rising of a very large number of city-states. Every city-state, at the aim to be independent and defend its identity, needed to build its city-wall, churches and cathedral, towers and castle, producing the incredible Italian architectural and cultural heritage (Fig. 3). During this phase Tuscia and its city-states define their identity on the Etruscan tradition, becoming a very specific cultural area, which still today has peculiar characteristics in the Italian context, making this territory specifically interesting and in need to be preserved and managed, considering the peculiarities of its tangible and intangible heritage.

Fig. 3: Civita di Bagnoregio, one of the main ghost villages in Tuscia.

MATERIALS AND METHODS

GIS Map of Tuscia

The research consisted of the construction of an interactive digital georeferenced map, designed to collect, organize and systematize information concerning the tangible and intangible cultural heritage of Tuscia, with particular attention to a circumscribed area in the Viterbo Province, that is the municipalities of Bagnoregio, Bolsena, Capodimonte, Farnese, Ischia di Castro, Marta and Montefiascone, in order to provide extensive and detailed data at the same time. In this map each item is listed, geo-referenced, cataloged and contains text information in Italian and English language, together with historic and current images (pictures, drawings, sketches, etc.) and audio/video sources, with the aim to purpose a simple informational territorial multilevel GIS (Wade, & Sommer, 2016)

This recording was designed according to the Midas Heritage, one of the most common and authoritative standard in the field of cultural and archaeological heritage for recording tangible manufacts (Fig. 4); in the specific case of the interactive map of Tuscia, an innovative issue regards the possibility to match the Midas recording standard to GIS technologies, with the aim to include tangible and intangible cultural heritage, considering the peculiarities of this territory.

For this reason the GIS map for Tuscia includes two large typologies of database: the first one regards all the manufacts, above better described, which are more than two hundred; the second database is about no more than fifty manufacts. In fact the first database regards a minimum level of data and information, above described, and the second database is more detailed and, in general, regards the most valuable and interesting buildings or artifacts, in terms of their capability to express the culture and identity of Tuscia from the Etruscans to the Middle age. This second database regards also some items which need special protecting action, because exposed to natural risks or in consideration of their poor conservative conditions. This double level recording database was defined considering two different kind of targets: the first one, being larger and more generic, was designed for informal users, like tourists or schools, for promoting Tuscia and its heritage; the second database is aimed to be used by government authorities, national and local entities, scholars and cultural institutions,
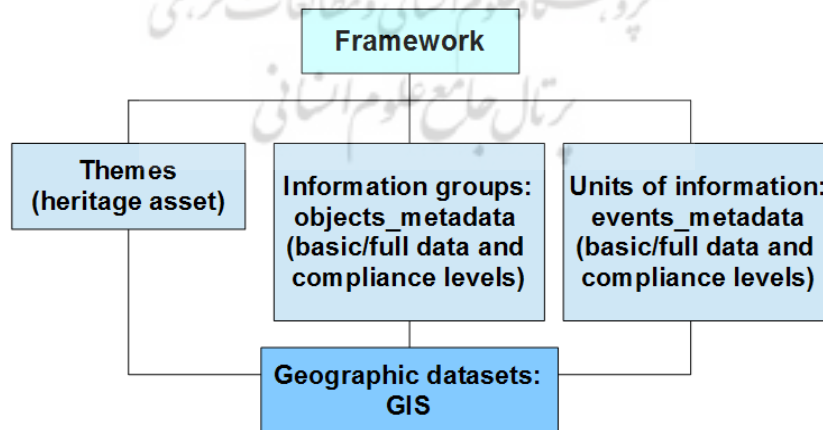

Fig. 4: GIS Map of Tuscia, according to the Midas heritage structure.

for protecting and managing this heritage, above all in case of emergency, related to anthropic or natural events, considering that medium-high seismic and landslide risk of this area (Canuti et al., 2009).

Content

The mapped manufacts and artifacts are classified and collected in a database, according to this classification:

a. general info: geo-references, accessibility (wheelchair users, blind users), logistics (opening hours, cost of tickets, reservations), transport (train stations, bus stations, car parks), security (police-hospitals);

b. natural heritage: public parks, historic gardens, hiking, trails, nature guides, naturalistic assets, panoramas;

c. archaeological manufacts/artifacts: archaeological sites, archaeological ruins, archaeological parks and underwater archaeological parks;

d. religious manufacts/artifacts: churches, convents, monasteries, shrines, chapels;

e. military manufacts/artifacts: castles, towers, city walls, fortresses, outposts;

f. urban manufacts/artifacts: towns, villages, hamlets;

g. industrial manufacts/artifacts: mills, oil mills;

h. others: museums, art galleries, libraries, archives.

RESULTS AND DISSCUSSION

The GIS map of Tuscia includes four levels of cataloguing survey:

a. territorial framework and cultural heritage identification: analysis on large scale was conducted to understand the territorial framework and to identify cultural heritage on vector-based maps. Topographic resources were consulted, such as archival fonts;

b. development of a set of file-cards for the heritage assessment:

through fieldwork was developed a set of file-cards for the assessment of the condition of different cultural aims. Such cards are based on standards developed by the Italian Central Institute for Catalogue and Documentation, though they have been adapted to suit the nature of cultural heritage of Tuscia;

c. sites identification data: this methodology of cataloguing focuses its attention on risks and its survey in made of two different condition levels, in terms of real vulnerability of cultural items. This work of cataloguing and monitoring is undertaken in order to check the actual evolution of heritage decay in the environment where they are situated and to estimate the damage caused by poor level of maintenance and scarce management;

d. intangible heritage identification and analysis: safeguarding the intangible heritage involved the collection, documentation and archiving of cultural property and the protection and support of its bearers.

The safeguarding and transmission of cultural practices and traditional knowledge, on the other, therefore call for a threefold approach, through two steps:

I. putting tangible heritage in its wider context, particularly in the case of old lost civilizations, relating it more closely to the local communities (Fig. 5);

II. translating intangible heritage into materiality, safeguarding intangible heritage calls for its "translation" from oral form into some form of materiality, pictures, audio or film records, included in the GIS map of Tuscia, although this could be regarded as "freezing" intangible heritage in the form of documents (Fig. 6).

This GIS map, developed through a streamlined and intuitive open source on line application, contains over two hundred items and about fifty of them have a more detailed description (Fig. 7), with the aim of its maximum dissemination to various types of targets, such as travelers and hikers, scholars and administrators.
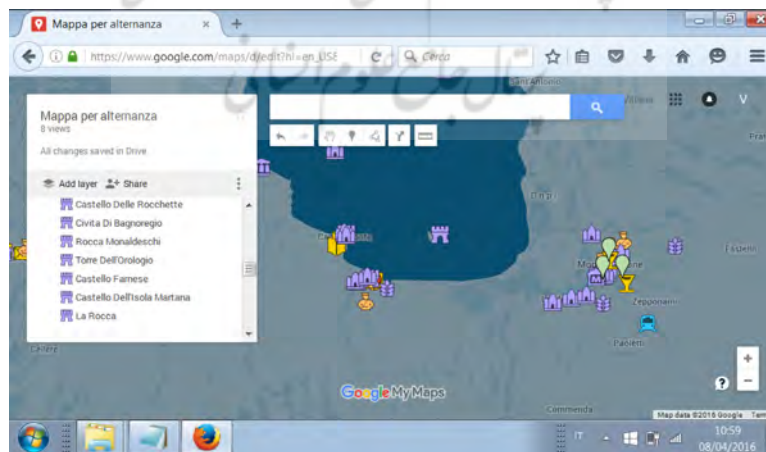

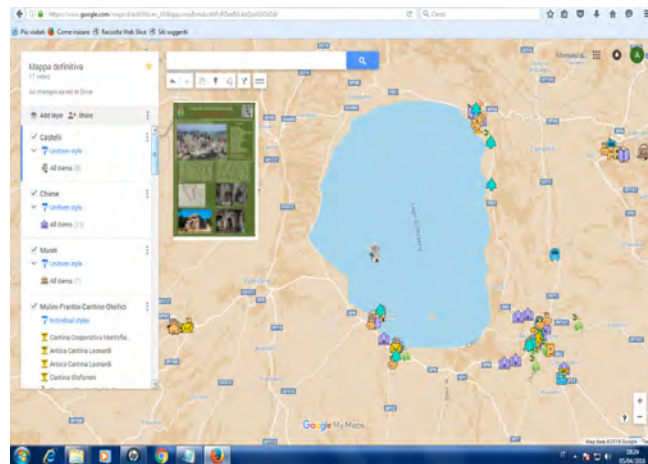Fig. 5: GIS map of Tuscia, first level mapping.

Fig. 6: GIS map of Tuscia, second level mapping.

It must be emphasized that this map is the first GIS tool of this area, although it includes above all data (photos, old maps, videos, etc.) which are not unpublished and are in large part readily available from digital and analogic sources.

The free and open source dissemination, through a public website, of this kind of GIS maps:

- can allow authorities to quickly obtain very different kinds of data and information, to be used for the protection, conservation and valorization of Etruria and its tangible and intangible heritage (in the case of regular management, but also in case of

Fig.7: One of the detailed recording database sheets.

exceptional events, such as an earthquakes or severe weather events, during which often it becomes difficult to even find technical maps of the affected areas, because not infrequently own the buildings of public authorities (local technical offices civil protection, etc.) are particularly damaged by these severe events);

- can be a useful tool for scholars and researchers, in order to obtain scientifically reliable information and multi-criteria data, about history, geography, architecture, etc.;

- can be a democratic and informal instrument for every curious person for experiencing a virtual tour of an interesting and little known cultural heritage in Europe.

CONCLUSION

The experience of the Gis map of Tuscia is a positive example of how geomatics for heritage can be focused on several and different aims, including:

Documenting, cataloguing, preserving and enhancing the cultural heritage of ancient civilization and their heritage, via the creation of an integrated database, that analyses tangible and intangible heritage;

Identifying decay levels, structural vulnerabilities and conservative state data about manufacts and artifacts, above all in case of natural risks, as well as earthquakes and landslides or anthropic events, like wars of armed conflicts;

Defining cultural heritage risks, editing geo-referenced risk maps;

Proposing guidelines for cultural heritage conservation, whose methodological model can be applied in other contexts, and promoting the adoption of this innovative multilevel integrated database tool for technical operators and policy maker;

Developing a database, able to interrelate conservation and prevention policies, based on web-GIS technologies;

Supporting risk management plans for cultural heritage preservation, which are less used in case of "minor" heritage, and mainly planned for natural disaster or catastrophes, even if is ascertained the huge potential for cost savings in mitigation policies development and heritage maintenance.

This approach was developed according to the Convention for the safeguarding of the intangible cultural heritage-2003, which defines the notion of universality as a tangible and intangible heritage which is in the universal interest and for this reason its safeguarding whereby the heritage belongs primarily to local communities and authorities, like in the case of Tuscia region[1]. For this reason the last and crucial step of this research regarded the divulgation of the GIS map of Tuscia on the territory, with a specific interest in the Regional authorities, which are in Italy the main institutions in the field of heritage preservation, also considering that the Lazio Region, as consequence of a recent seismic crisis, which involved large part of the Central Italy in the recent months, is planning to improve its urban master plan whit a specific focus on conservation and prevention policies. Considering the peculiarities of the Etruscan civilization and its reverberation in the Tuscia heritage, the results of the

GIS map of Tuscia are also an opportunity to reflect about a recent expansion of heritage concept to a wider definition, has highlighted the need to identify and to catalogue cultural heritage in accordance with clear, unambiguous but also flexible rules, as suggested by the Convention on the Protection and Promotion of Diversity of Cultural Expressions-2005[2].

In fact a database, based on geographical information, allows considering the cultural heritage completely such as systematic features of the territory and the natural or human-created landscape.

This is an expression of the collective system of relationships existing between artifacts and communities, between local system and cultural expressions and between artifacts and the context itself in the past and in current times[3].

ENDNOTES

1 see Bouchenaki, 2003; Agapiou et al. 2015.
2 see Schorlemer& Stoll, 2012.
3 see Coletta, 2014.

REFERENCES

Agapiou, A., Lysandrou, V., Alexakis, D. D., Themistocleous, K., Cuca, B., Argyriou, A., ... & Hadjimitsis, D. G. (2015). Cultural heritage management and monitoring using remote sensing data and GIS: The case study of Paphos area, Cyprus. *Computers, Environment and Urban Systems*, 54, 230-239.

Berg, E. (2001). National registries of sites and monuments in Norway-developing GIS-based databases. in: Z. Stancic, T. Velanovski, T. (eds.), Computing Archaeology for Understanding the Past, Oxford. *BAR International Series*, *931*, 133-138.

Bianco, A. (2015). Applications of geographic information system technologies for cultural heritage: a proposal for Via Ignatia. *Proceedings of the BRAU-2 conference*, vol. 2, pp. 257-272, Sarajevo, June.

Bouchenaki, M. (2003). Introductory lecture-The Interdependency of the Tangible and Intangible Cultural Heritage. In *Proceedings of the International Scientific Symposium: Place, memory, meaning: preserving intangible values in monuments.*

Canuti, P., Margottini, C., Fanti, R., & Bromhead, E. N. (2009). Cultural heritage and landslides: research for risk prevention and conservation. In *Landslides–Disaster Risk Reduction* (pp. 401-433). Springer, Berlin, Heidelberg.

Coletta, T. (eds.). (2014). ICOMOS: *The role of the integrated conservation of cultural heritage for a creative, resilient and sustainable city*. Milan: FrancoAngeli.

Haynes, S. (2000). *Etruscan civilization: a cultural history*. Los Angeles: Getty Publications.

Junyong, L., Mu, Z., Jing, L., Jing, Y., & Lu, L. (2008, December). Design of the intangible cultural heritage management information system based on GIS. In *2008 International Conference on Information Management, Innovation Management and Industrial Engineering* (pp. 94-99). IEEE.

Knowles, A. K. (2002). *Past time, past place: GIS for history*. Redlands: ESRI Press.

Levi, A., & Levi, M. (1978). *La" Tabula Peutingeriana."*. Edison.

Schorlemer, S., & Stoll, P. T. (Eds.). (2012). *The UNESCO

Convention on the protection and promotion of the diversity of cultural expressions: explanatory notes. Springer Science & Business Media.

Sprenger, M., & Bartoloni, G. (1983). *The Etruscans: their history, art, and architecture*. New York: HN Abrams.

Themistocleous, K., Agapiou, A., Cuca, B., Lysandrou, V., Tzouvaras, M., Michaelides, S., ... & Fernandez, J. (2016, April). The protection of cultural heritage sites from geo-hazards. In *EGU General Assembly Conference Abstracts*(Vol. 18, p. 9360).

Wade, T., & Sommer, S. (eds.). (2016). A to Z GIS: *An illustrated dictionary of geographic information systems-second edition*. Redlands: ESRI Press.