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GEOREFERENCING HISTORICAL DOCUMENTS: 
THE CASE OF THE DUME BOUNDARY

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ABSTRACT
Much of the information of historical documents about the territory and property are defined on textual form. This information is mostly geographic and defines territorial areas, its limits and boundaries. For the treatment of this data, we have defined one information system where the treatment of the documental references for the study of the settlement and landscape implies a systematization of the information, normalization, integration and graphic and cartographic representation. This methodology was applied to the case study of the boundary of the monastery-diocese of Dume, in Braga - Portugal, for which there are countless documents and references to this site, but where the urban pressure has mischaracterized very significantly the landscape, making the identification of territorial limits quite difficult. The work carried out to give spatial and cartographic expression to the data, by defining viewing criteria according to the recorded information, proved to be a central working tool in the boundary study and in understanding the dynamics of the sites in the various cultural periods.

KEYWORDS
Cultural heritage, Information technology, Information system, Historical documents, Landscape evolution.

1. INTRODUCTION
Knowing the genesis and evolution of a territory, characteristics and boundaries, involves collecting and processing data from documental, bibliographic, archaeological, toponymic and cartographic sources.

The case study of the genesis and evolution of the Dume monastic domain had as its main source the archaeological and documental data. The archaeological evidence from excavations and surveys made it possible to identify and characterize the sites and boundaries of the territory referred to in the documentary sources. The data related to limits, organization, inventory, possession and transmission of the properties and to the description of land assets, were mainly drawn from documentary sources, including the Liber Fidei (Costa, 1965; 1978; 1990), cartulary which compiles various documents relating to the heritage of Braga diocese. We’ve also consulted the census from the late eleventh century ‘dito do Bispo D Pedro’ (Costa 1997), the ‘Inquirições’ of 1220 (PMH, Inq.) and 1288 (Pizarro, 2012) and the ‘Memórias Paroquiais’ of 1758 (Capela, 2003). The data of the micro toponimia of Dume that allowed the validation of some of the older data, have been collected in the indices of Casais do Cabido and Mitra Bracarense.

The documentary sources have various textual references to sites, boundaries and confrontations in such a number and form that implies an organization and integration of the information, without which this study and treatment would be slow and difficult.

The Archaeology Unit of the University of Minho (UAUM) has developed one information system for the management of the information coming from the excavations, surveys and archaeological interpretation (2ArchIS) (Botica & Martins, 2008). From this system it is possible to view all the information, including to geo-reference the sites in a Geographic Information System. However, mapping historical documents involves creating references to sites whose meaning is wider than the archaeological site and also crossing all the references with the sites.
So, after we’ve identified the main sources of historical data, we established as a first priority to set a module for the Information System of historical documents, integrated with the already existing Information System of the Archaeological and Architectural Heritage (2ArchIS), allowing to organize, process and georeference all documents and references made to sites. This module, subsequently characterized, allowed the storage and the management of information coming from the archaeological and documental data, helping to identify the boundaries of the property of the former Dume monastery.

Connecting a Geographic Information System to the data of georeferenced sites, it is possible to represent the sites and documental references on current and ancient maps, whose reading and interpretation will support the study of human occupation and the evolution of the landscape, as demonstrated in this monastic set of Dume case study.

2. THE MONASTERY-DIOCESE OF DUME

The development of the Information System module for Historical Documents was applied to the study of the origin and chrono-cultural evolution of the human occupation in the monastic-diocese of Dume, its territorial expression and architectural evidence (Andrade, 2015).

The study of boundary of Dume was based on the existing archaeological data for the study area (Fontes, 1987; 1991-92) and the various documents that provide data on their domain, with special focus on confirmation of possession of the domain area, in 911 (Figure 1), the bishop of Sabarico Mondonhedo (Fontes, 2006).

The Dumiense monastic-diocesan domain was directly linked to the Roman domain. A considerable part of the known Roman villa structures were later reused, as well as bounding elements that are consistent with Roman times. Documentary data seem to indicate that the monastic limits have remained mostly stable until its extinction.

![Figure 1. Image of Document 19 Liber Fidei, 911 Confirmation.](image)

3. INFORMATION SYSTEM

The Information System of the Archaeological and Architectural Heritage (2ArchIS) developed by UAUM, was based on a relational database and implemented in MySQL. Integrates information from diverse sources as historical, archaeological, bibliographic and cartographic. The 2ArchIS was structured to store data characterization of archaeological sites, including its name, ownership and geographic location, by specifying the geographic coordinates. 2ArchIS still connects sites with archaeological data as stratigraphy, materials or epigraphy. Each of these elements may be associated with photos, drawings, topographic charts of the site as well as bibliographical and documentary sources.

However, the study of the evolution of the territorial contours takes one step further the association of sites with documentation, as it is already done in 2ArchIS. For this type of study, each document should be decomposed in References. Each reference is associated with two or more sites and should be recorded where and how in the Document these sites are related. Therefore, we developed a historical document management module, integrated with 2ArchIS system that link sites to References in a Document.
This module of historical documents management links the characterization and geo-referencing of the sites to the geographical, environmental and historical context. It also relates all references of a document. The type of reference, identification and other sites associated are interrelated between references.

### 3.1 Data Base

This historical document management module has as its central element the site and its characterization, including the name, type, description, toponyms and geographic location, specifying the geographic coordinates of the location. Associated with the site we also have the characterization of the environmental context, particularly with regard to the deployment site, water resources and use of soils. We link the site to graphics, photos, drawings and topographic map associated. (Figure 2).

![Figure 2. Simplified database diagram of the 2ArchIS historical documents management module](image)

The documents were associated with general data such as font, description, bibliographic references, the document date, or date range, to link the document to a wider chronology, as the century or a cultural period. The type of act presented in the document, its object, value, issuer and addressee, can also be registered in database.

Each document can have one or more references to a site. Each reference is characterized by name and a link to the respective site. We can also add to references the old administrative location of the site, ancient toponyms, type of settlement, type or composition of the property and the delimitation.

All references of a document are associated with one or more sites and, as all sites are georeferenced, it is possible to map all references associated with sites, and define queries according to the type of reference which was made.

### 3.2 Back Office

For the storage and management of data from historical documents we developed a back office application, in PHP language, with the main menu shown in Figure 3.

![Figure 3. Back Office application main menu](image)

It is through this application forms that can be done the register the documentary sources, bibliography, archaeological, toponyms and cartographic images. All these items are integrated and linked to each other.

Historical documents are characterized according to the source, description, chronology, type, object and value of the act, as well as the issuer and addressee of the act.

Each Document can contain one or more References. The references are associated with a site, keeping the page(s) where the association is made, toponyms of the site, the current and ancient locations, and the type of settlement, property and delimitations. A reference relates always two sites and defines the type of relationship between them. The systematic processing of this information and its organization and visualization enables a better understanding of the dynamics of the landscapes and sites.
In the menu Relaciona elementos, references are associated with sites as well as the type of relationship existing between them. This relationship can be “delimitação”, “integra” or “integrado por”, “confinia” or “confinado” or yet “composto por”, according to the descriptors used by André Marques (A. Marques & David, 2013 pp. 8-9).

The Menu also allows to attach, to a Site or Document registered in the Database, graphic documentation, 3D models, images or videos, plus a glossary of terms.

4. GEOREFERENCING HISTORICAL DOCUMENTS

The case study of the genesis and evolution of the Dume monastic domain, focuses on the territory situated in a part of the current municipality of Braga and along the middle reaches of the basin of the river Cávado. The study area has a very ancient settlement dating back to an occupation of the Chalcolithic / Bronze Age (Fontes 2006; Andrade, 2015).

For each site in the Back Office application, were recorded all references made to them in the historical documents. For this purpose, the concept of the site is wider than the archaeological site concept where you can identify remains or ruins. For historical documentation management, you can consider a site even when there are only documentary references, since they clearly have evidences that can be identified in the landscape. The distinction between these two types of sites is registered in the corresponding form, making clear if the site has known archaeological remains or not.

Crossing the documentary references to sites with data from archaeological prospection and cartographic databases allowed us to validate the location of the sites. We use a Geographic Information System, the ArcMap from ESRI, to project sites in the current and ancient maps, making a connection to the MySQL Database by ODBC Drivers and using the coordinate fields X and Y of the database table Sítio.

Through the correlation between documents and archaeological data, we drawn a map with the settlements for the study area (Figure 4).

Some queries to references of each site allows us to select data according with filters like the date of documents or the type of relation established between the sites. So, to study the boundary of Dume Monastery we represent on the ArcMap all the sites that in "Doc. 19 Liber Fidei" document are direct or indirectly connected to” Boundary Dume Monastery”, namely:" Boundary Dume Monastery" " delimited " Cipo of Felgueiras "or" Castro Maximum " delimited "Monastery of the Boundary Dume".

The map uses different symbols that represent sites according to the kind of reference made to him. References a sites like "defines" or "is bordered by" are usually associated with sites like “Milestone”, “Road” or “Bridge”. These types of sites have an exact location and are usually delimiters or property markers. These sites are references for the study of territorial areas whose outlines are not always completely
known, as is the case of the Dume boundary and sites with types like Town, Village, Habitat, Necropolis or Farm.

The information system designed supported the analysis of the historical documents and allowed the display of sites with different attributes and make their overlapping in different maps to validate some of the data evidences, like some landscape changes. Those actions would be very difficult to perform without this capability offered by the Information System to cross data in a very effective way.

5. CONCLUSION

Historical documents describes space in very different ways and deals with a large amount of textual information with spatial expression. In addition we have a strong urbanistic pressure in many study areas where the landscape changes and it is quite difficult to develop the fieldwork.

Using the Information System for historic documents management and making the association of textual references to a georeferenced sites, it is possible to transform textual data into cartographic representations, to improve the analyze and understanding of the data. The information system and the suggested workflow, allows us to manage the complex amount of data in a rational way and to increase the productivity of the territory studies. This work can be improved if combined with algorithms that automatically extracting facts from documents.

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