

## **Presentation UC416**

### **Conference**

User Conference

### **Presentation Title**

Inventory of historic landscapes and gardens in Portugal

### **Presentation Abstract**

An inventory to identify and locate the existing historic landscapes and gardens in Portugal is an important way to protect this fragile landscape units. The landscape heritage spread throughout the country and dating back from the Middle ages to our days, is a subject for which geographic information systems can be a very practical and precise tool, both for its recording, academic studies, classification and legal protection. Its promotion and use as a touristic product can also be useful for each region. Studies about this “ecological and artistic” heritage is dispersed in many publications, and manuscripts, scattered lists across different entities, outdated databases, unclear or missing locations and unfriendly access to each the information. The use of ArcGIS intends to restructure this dispersion of data by creating an interactive map of results in which access to the locations of landscape heritage in Portugal will allow easy knowledge of their geo-referenced location, search data and images of each element. The usefulness of this project is to create the framework for a database for historic gardens and landscapes, encompassing the whole country, including the islands and contribute to the national and international institutions in charge of heritage. It will use all previous experience from surveys and methods to classify the information, as well as to load the data bases. As a data base that started using Access as the base-software, its goals are both to be designed in such a flexible way that it can be updated, and as complete and accurate as possible. It means to serve, heritage related entities, academic research and the general public with a friendly interface.

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## **1- Introduction; an inventory of the landscape heritage for general use**

An inventory to identify and locate the existing historic sites and gardens in Portugal is a tool to protect, classify and study the existing heritage. Many of the Portuguese private gardens remained unknown well into the twenty century, both for cultural reasons and for the lack of interest on gardens as cultural monuments. When in 1981 the Florence Chart was issued by the ICOMOS committee on historic gardens, it defined clearly the attributes of this specific heritage and raised the scientific interest for the subject. An inventory of historic gardens and sites is requested by the Florence Chart and the countries that signed this international agreement were supposed to send their inventory to ICOMOS-UNesco. From the 90's on, more and more information has been collected, published and the interest for gardens as works of art was launched. Public international funding to restore historic gardens became available and more information about techniques and methods on garden restoration accumulated.

The method used to develop the project can best be described as an empirical method for it borrowed ways of proceeding from different disciplines. Because we aimed at a geo-referenced database, it started by a simple selection of how to divide the landscape in homogenous zones that should not be too many and should reflect the different landscape units from North to South and the islands of Portugal. The Nut European system was selected and 9 regions were identified to store the information in a regional way.

The data sources were many and coming from very different levels; published sources, old manuscripts, historic data and surveys collected during fieldwork from students, the existing database, and our own experiencing of visiting gardens as a researcher and teacher, photographs collected during the last 25 years of work on the subject.

The location and recording of precise geographic coordinates (WGS84) is an essential identity parameter for this project so for each garden the coordinates were provided from private entities and by exploring the interactive satellite imagery on the web (BingMaps, GoogleMaps).

At the launching of the project we had two software to start from; excel and ArcView, latter excel was replaced by access and at this moment new possibilities are being studied in order to better suit the amount of data gathered and the friendly access to information. The parameters that characterize an historic garden are diverse because they may come from botanical surveys to historic data, philosophical and artistic expressions of past periods of history and the knowledge of the place itself. The bodies of knowledge are both scientific and humanistic complicating the storage process. The mainframe for the database is an ongoing process so we will present the actual one admitting that much flexibility is required to allow for new inputs from other working groups, as other researchers will be called in to the project.

The most challenging moment of the project was the linking of the database in Access with the ESRI® ArcGIS® ver. 10.1 program. The latter was chosen for its good characteristics, as a software designed for landscape planning and design and very much related to the land. As Historic gardens are both landscape dynamic and changing units, and art expressions that can be interpreted as steady objects, the ArcGIS seem to be a very appropriate tool .

The final product has to remain aesthetically appealing, robust and visually useful i.e. getting immediate information from a point on the map, bringing into the screen the information, the pictures and the way to get there, or giving a name for the search system and getting a blink form the map. Other more elaborate search system may produce the immediate answers to: "find all baroque gardens from the Northern region" or "find gardens that grow camellias in the central region", and many other combinations that may arise in the course of loading the data base.

We used as a pioneer project to test the geo-referenced data base the collecting, organizing and storing of much information for a book to be handed in this year of 2013 which selected and describes 150 gardens scattered through all the 9 regions. The method for storing the information from basic elements of ownership and contacts to more complex bibliographic references was tested and fine-tuned as problems appeared to re-access the data.

## 2- Methodologies

### 2.1. TERRESTRIAL DIVISIONS

The Portuguese landscape is varied for topographic and climatic reasons. As a consequence, the type of gardens and historic sites differ a lot form region to region. The organizational work scheme was rethought with the perception of the Portuguese historical garden's distributions divided by regions in order to provide a flexible search. The national terrestrial administrative divisions (Districts, Municipalities and Communes) and the "Nomenclature for Territorial Units for Statistical" (NUTS) implemented by EUROSAT (2003) in the framework of the European laws, were carefully studied and evaluated as a possible regional division. The NUTS system falls under the national legal framework (DL 244/202 November 5 ), with which the terrestrial units respect the national administrative structure, the socio-economic profile of each region and has been established to serve statistical purposes and the distribution of common European funds. For theses reasons the territorial division of the data base follows the NUT system and 9 regions were defined that included the Atlantic islands of Azores and Madeira.

### 2.2- Data Sources

The current information on this heritage is widely disperse and irregular throughout the country. To the present we have identified an uneven kind of elements dispersed through the specific regions of Portugal. Some have a significant number of publications, but many others have no information or have it in a disperse way with lists or inventories throughout different institutions. Locally within the municipal publications we found monographic descriptions about gardens, convents with gardens, or sacred places that are useful for the data base in-put. Nationally there was a database called Monumentos organized by DGEM (Direcção Geral do Património- heritage institutional body) where the information about historic gardens was supplied by the University of Evora This database collecting architectonic and landscape architecture information was a pioneer work initiated in the early 90's and served the general public from 1993. This *Architectonic Heritage Information System* ([www.monumentos.pt](http://www.monumentos.pt)) gathers more than 30.000 records of the Portuguese urban and landscape heritage, of which more than 500 are "green spaces" and 84 registers are in the category of "landscape". Under these concepts it included heritage gardens and special outdoor sites. These can be accessed through internet but as a pioneer product it has problems such as the unclear locations, the lack of user-friendly platforms, very few or no pictures and it has not been updated or completed.

The location and recording of precise geographic coordinates (WGS84) is an essential identity parameter for this project. Given the importance of georeferencing gardens as the main core aspect for the proposed objectives, the database inventory would stay incomplete without this parameter.

The aim of our project is to systematically organize all the available information on the subject and make it accessible, by creating a rigorous georeferenced database. As a data base that started using Access as the base-software, its goals are both to be designed in such a flexible way that it can be updated, and, as complete and accurate as possible. It means to serve, heritage related entities, academic research and the general public with a friendly interface. Should this database be complete, it may be acknowledged and serve different purposes, such as the inventory of historic gardens and its classification, its promotion, legal protection by national and international bodies, and the safeguarding of this heritage.

The acquisition of coordinates for each historical garden was provided by public bodies platforms (IGESPAR and IHRU-SIPA database<sup>1</sup>), from private entities and by exploring the interactive satellite imagery on the web (BingMaps, GoogleMaps).

## 2.3 Selecting the software: ACCESS and ArcGIS

### Geo-referenced Database (*GeoDataBase*)

Geographic Information System (GIS) was used to georeference each garden on the Access database. Eventhough the inventory was based on art historians' work, most sampled data on heritage of monuments and gardens were acquired from projects developed by landscape architects associated to Portuguese Universities with the precious help of their alumni. In this sense, the use of GIS software is the natural choice, given that its original genesis was developed by the landscape architect Jack Dangermond (co-founder of ESRI at 1969, release ArcInfo in the 80s) and former student in the Graduate School of Design in Harvard. ESRI® ArcGIS® ver. 10.1 program was chosen for its constant evolution characteristics, with excellent testing results and an essential operational tool for the development of georeferenced database, marine and terrestrial analytical maps and a useful tool for academic curricula introduced by universities, such as Instituto Superior de Agronomia in the early 1990's, in the Landscape Architecture Department<sup>2</sup>. It is mostly used in national state and local bodies, universities and architecture and urbanism offices.

Importing a coherent databases in the GIS programme and subsequent location of each garden within a map, implies the creation of two separate columns (Latitude and Longitude), which register the coordinates, preferably in decimal degrees. Once the columns are properly fulfilled, ArcGIS will georeference each element and distribute their location in the *Interactive Mapping for Results* (M4R).

The *Interactive Mapping for Results* generates, in a given map, detailed information of a specific georeferenced point. Regarding the objectives of this study, it gives the user the power to deepen the knowledge of a specific garden, while it provides a table with the queried elements of the database including the photographic inventory and other attached documents.

*The geodatabase storage model is based on a series of simple yet essential relational database concepts and leverages the strengths of the underlying database management system (DBMS). Simple tables and well-defined attribute types are used to store the schema, rule, base, and spatial attribute data for each geographic dataset. This approach provides a*

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<sup>1</sup> [www.igespar.pt](http://www.igespar.pt) and [www.monumentos.pt](http://www.monumentos.pt)

<sup>2</sup> In the early 90's the introduction of ArcInfo for teaching and research in the Landscape architecture Section at the Technical University of Lisbon was a joint initiative from Cristina Castel-Branco and Otilia Baptista Freire as landscape architecture teachers and Francisco Castro Rego as Dean.

*formal model for storing and working with your data. Through this approach, structured query language (SQL)—a series of relational functions and operators—can be used to create, modify, and query tables and their data elements.* (<http://resources.arcgis.com>)

ArcGIS allows the possibility to create a folder that holds its dataset files, which is essential for the demanding purposes of this project: georeferencing each garden and converting them into localized points; individually associating specific fields and store complementary heavy files (up to 1 Terabyte), such as photographic inventory or large image datasets.

The proper functioning of the queries created in Access is equally important for the objectives of this study. The user can profit from the structured relationship between tables, by creating maps with the distribution of historical gardens with specific characteristics. For example: Location by regions; Year of construction; Typical elements (tile panels, statues, hydraulic systems, special vegetation, etc.).

## **2.4-Identification of parameters**

Most Portuguese Heritage Inventories (SIPA) have 5 categories: Urban Aggregation, Gardens, Monuments, Landscape and Sites.

Each element identified is then associated to 48 parameters divided into 8 fields and registered in a spreadsheet:

1. Identification (*Identificação do imóvel*)
2. Documentation sources (*Fontes de informação de documentação*)
3. Author of spreadsheet Identification and date (*Elaboração da ficha*)
4. Definition of place (*Definição do imóvel*)
5. Technical data (*Características técnicas*)
6. Safe priority (*Grau*)
7. Conservation (*Conservação da cobertura externa*)
8. Heritage (*Património móvel*)

All the sheets have drawings and photographic documents attached.<sup>3</sup>

We questioned this process and studied other inventory methods from international sources and tried to create a simpler identification system and less parameters.

As part of the research for other georeferenced data bases dealing with gardens the Parks & Gardens UK project was studied and allowed for some comparative analysis, useful for our project.

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<sup>3</sup> Master Thesis by ESTADÃO, Maria Luísa and LIMA, Inês (2005) oriented by CASTEL-BRANCO, Cristina

The Parks and Gardens UK project is the result of some 30 years of work to collect and publish information about historic parks, gardens and designed green spaces in the UK.

Inheriting the work done by UK Database of Historic Parks and Gardens (UKPG). This project began in 1993 with the partnership between Association of Gardens Trusts and the University of York, which is currently managed by Parks and Gardens Data Services (PGDS)

With about 6,600 records, these can be easily found online through the maps (Google), by name, region, period, the organization that manages, type, context / main building, current use, vegetation / surrounding and missing gardens and park.

## 2.5 Building the Database

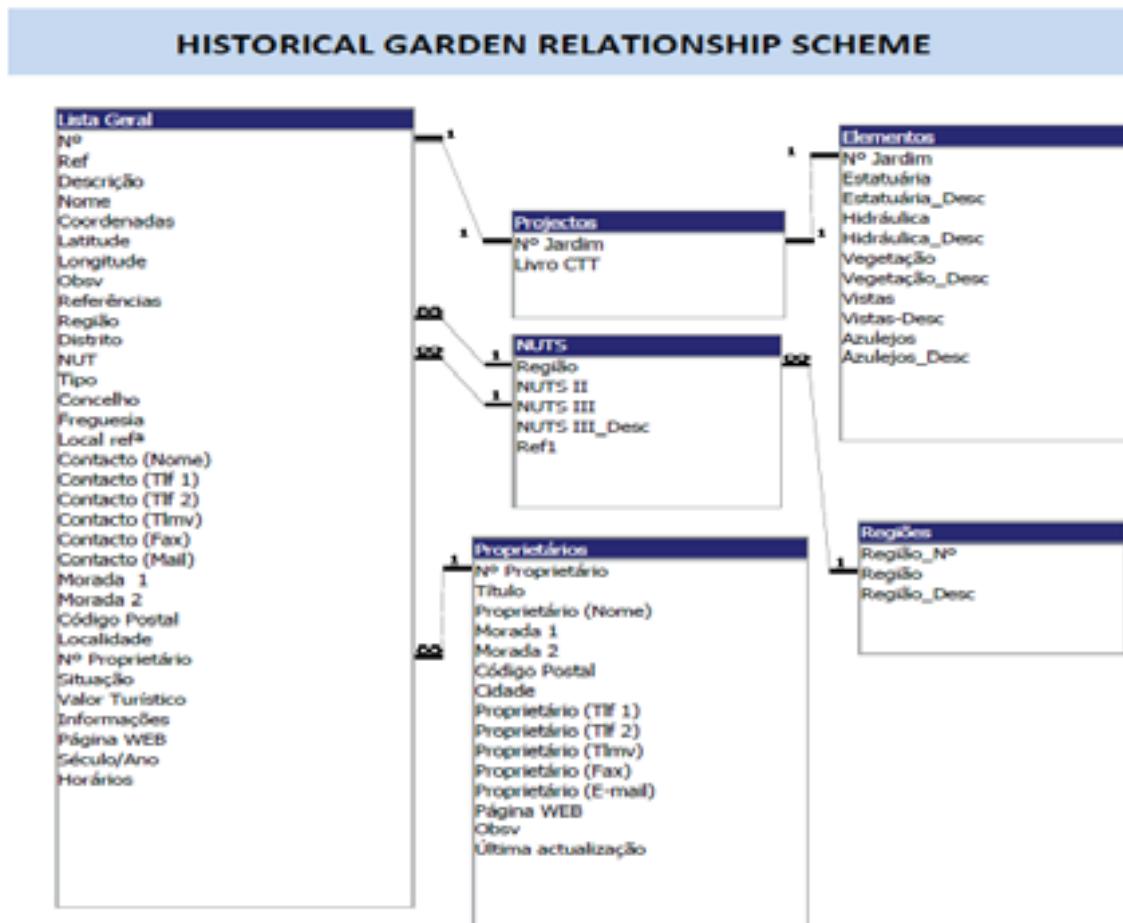
Collecting and organizing information on each recorded element was the first step and also the first exercise for the creation of the Heritage Database. In order to structure and organize different elements and parameters for the given gardens, Access (Microsoft® Office® 2010) was very useful to enable the relationship between the following tables:

- Garden ID
- Location
- Owner
- Evident elements
- Bibliographic references
- Photographic collection

The content of each table of the Access database on the Portuguese Historical Gardens, was created on the basis of published and documented inventories from projects developed by landscape architects associated to Portuguese Universities. A logical and coherently structured relationship between tables was created in regard to the queries and forms functions of this software (see **Figure 1**). Additionally in the database, the *coordenadas* field in the *Lista Geral* (Garden ID) table was separated in to *Latitude* and *Longitude* columns for further interpretation by the GIS software once the table was exported. The following calculation method, recommended by Arsénio (personal communication, 2013), to convert Cartesian degrees in to decimal degrees was used in the database for the *Latitude* and *Longitude* fields, respectively:

$$\begin{aligned} \text{Latitude} = & \text{Left}([\text{Coordenadas}]; 2) + \text{Middle}([\text{Coordenadas}]; 5; 2) / 60 + \\ & (\text{Middle}([\text{Coordenadas}]; 9; 2) + \text{Middle}([\text{Coordenadas}]; 12; 2)) / 360000 \end{aligned}$$

$$\text{Longitude} = -(\text{Middle}([\text{Coordenadas}]; 19; 2) + \text{Middle}([\text{Coordenadas}]; 23; 2)) / 60 + (\text{Middle}([\text{Coordenadas}]; 27; 2) + \text{Middle}([\text{Coordenadas}]; 30; 2)) / 360000$$



**Figure 1:** Relationship structure between Historical Gardens database tables in Access.

A sampling visit to each location would ideally provide the best quality data in this project. For 150 cases selected for the 2013 book, such sampling visits allowed the confirmation of previous acquired information, tested the system and updated information on each garden as well as it allowed to collect images for the photographic inventory and finally confirm exact coordinates (Latitude and Longitude).

## 2.6- Linking the data base

Linking two different software was the most challenging part of the project because different options could be taken in selecting the software and also different alternatives for the way to guarantee their linkages. As the start of the project we passed from a simple excel table to a more structured database in Access. Then we needed to link it to ArcGIS to identify all the historical gardens (points) and their

attached information dispersed all over the country. For this link to work there was need to add the OLE DB (Object Linking and Embedding Database) connection button to a toolbar in Arc Catalog. Only after that can the connection be started. To use the Access tables we had to browse it through the OLE DB connection and add it to ArcMap. Nevertheless we believe that links established between access tables cannot be imported by the OLE DB connection, although the Access queries are still available. To use the linked table, we must first create a query in Access only after that can we link the tables through the query in the OLE DB connection. Because there are many unsolved problems, the link Access with ArcGIS we should try to use Personal Geodatabase. But another problem can be expected because this product has a limited storage capacity and so is not compatible with our project and its large amount of image files.<sup>4</sup>

### **3-Final product and conclusions**

The authors had in mind to create a digital way of storing complex and heavy information about historic gardens and sites. There are many other ways but using the ArcGIS was an immediate choice. Also many questions were, and are still open to whether the data base software should be Access or SQL. For the moment, the choice is still on Access and if needed the data on Access can be transferred to another kind of software.

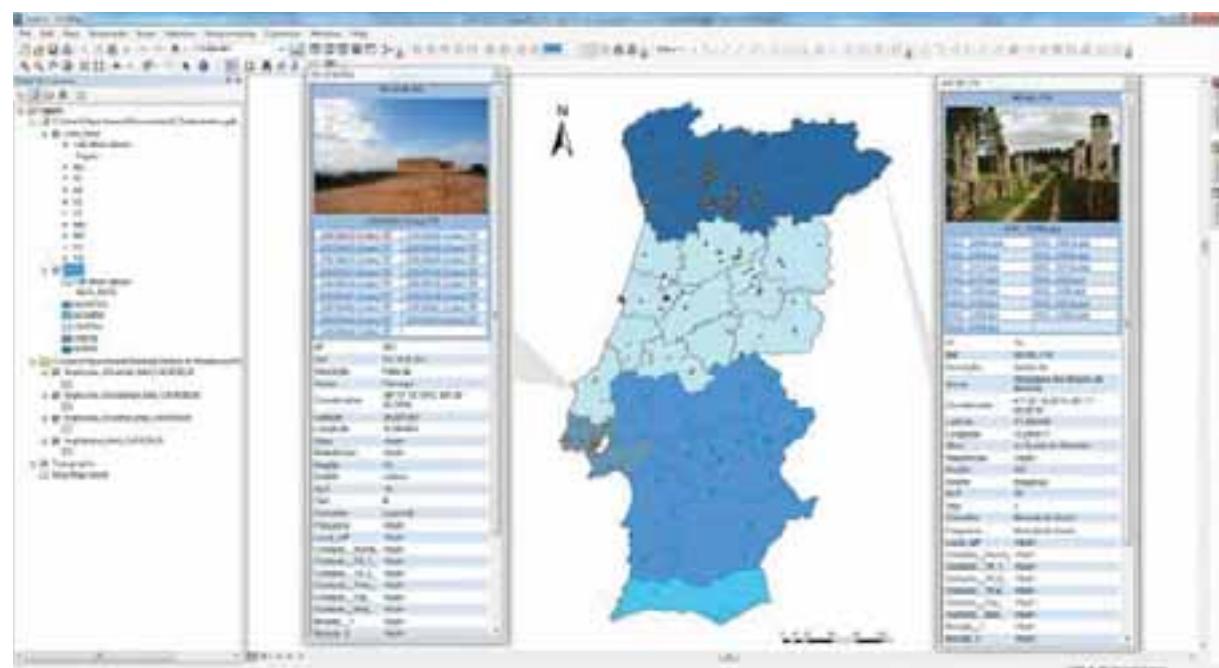
This product must have three main elements; to be flexible to adapt to new and more adequate software, to be easy to access and friendly to use and to assure precision and rigour for the user.

The product will be an open end product and made in three phases. The first part is almost finished and establishes the framework of this geo-referenced data-base. It used the on-going project of “The gardens of Portugal” a book to be launched in 2014 as an experimenting device to test the way the data base would be used in the future for professionals but also for people travelling and visiting gardens. A second phase is expected to load the data base. It will be important to create a system that controls the information that goes in and to make sure it is reliable in order to have a robust and precise product. A third phase will start when the kind of information about gardens start to become very diversified. Changes are expected in the database and we aim at a flexible product capable to adjust to new tables that can be added and links that can be developed between tables. The link between software is the most demanding part of the project and must be developed in order

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<sup>4</sup> We are thankful for the support provided at 11<sup>th</sup> Esri Portuguese User Conference

to reach the final product: to point at a garden in the map and get its information or to search for a garden or a group of gardens and see them show up in the GIS map.



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