GIS as a tool for heritage and land-use planning studies an approach to the Lisbon Metropolitan Area

FILIPA RAMALHETE, JORGE ROCHA
Lisbon Metropolitan Area, Lisbon, Portugal

Abstract: The Lisbon Metropolitan Area (LMA) has a long and rich history as a region with a common heritage.
This heritage is strongly influenced by the fact that Lisbon, the capital, has been the core for the development of this area, and it also has a great number of local characteristics, that reflect the various realities we may find in the 19 municipalities that are a part of the metropolitan area.
The LMA, which is an independent institution with deputies elected by the 19 municipalities, has a GIS that covers the whole metropolitan area, that includes a lot of information on land-use planning for this area. One of the components of this GIS is an inventory of important heritage elements, which are classified (by the Portuguese Institute of Built Heritage) or non-classified.
This inventory includes diverse and rich information about the history and tradition of the Lisbon Metropolitan Area, and not only does it identify isolated heritage buildings, but also the historical cities and towns that exist in the 19 municipalities.
The paper reveals the inventory experience, and illustrates some of the analysis made possible by this GIS for the heritage of this metropolitan area.

Keywords: heritage, GIS, land-use planning

1. Introduction

The Lisbon Metropolitan Area (LMA) is located on the river banks of the Tagus estuary (one of the largest estuaries in Europe, with 325 km2), it spreads south towards the Sado estuary, in a continuum of buildings erected throughout the centuries within a landscape of exceptional diversity of fauna and flora. The southern bank is composed of 8 municipalities and has 658,320 inhabitants while the northern has a population of 1,897,860 inhabitants, from which 591,480 live in the capital, Lisbon, one of the 9 municipalities that is located on this bank (fig. 1).

The LMA has a long and rich history as a region with a common heritage. This heritage is strongly influenced by the fact that Lisbon has been this region's core for growth and development. Having a large city nearby influenced the history and economy of the various populations that occupied this territory and also those who wanted to conquer it, throughout the centuries.

But if it is possible to face this region as a whole, it is also necessary to be aware of the great number of local characteristics that reflect the various realities we may find in these 19 municipalities. Tracing the past by considering its common trends and also its diversity is another way to understand the present land-use patterns and the urban growth process of LMA.

This paper is based on the Lisbon Metropolitan Area GIS heritage database. LMA is an independent institution with deputies elected from by 19 municipalities that belong to this area. Its GIS includes a great deal of data on this territory, which involves not only heritage, but also land-use patterns, municipal and regional plans, statistic data, etc. This GIS's main objectives is to supply information to the various entities that work on the planning level and to promote the dialogue and elaborate joint and/or subsidised studies which may optimise the produced information.

The heritage database was created within the context of a larger project, held by the National Centre of Geographical Information in 1997, that aimed at producing a proposal for a metropolitan greenway network (greenways have been defined (LITLLE, 1990) as linear open spaces coinciding with natural corridors such as coasts, rivers and ridges and creating links with large and small natural reserves, historical and cultural sites and urban settlements).

Fig. 1 - Lisbon Metropolitan Area.

The database is presently being improved and updated. Therefore, the main purpose of this analysis is to show the value of using GIS as a tool for heritage and land-use planning studies, and not to present the projects' final conclusions.

2. The LMA heritage database

The heritage inventory created, for the greenway network project, includes the complete inventory of the natural and cultural values of the LMA. Considering heritage a crucial part of our collective memory, essential for the construction of a territory where identity references aren't vanishing as a result of urban growth (which we all wish was more sustainable), the main objective of this inventory is not just to create a solid base for the analysis of the greenway network proposal but also to construct an inventory, as complete as possible, which is able to supply accurate geographic and historic information on this region heritage.

The information was based on data supplied by the 18 municipalities (until 1999, when one of them was divided in two, LMA had 18 municipalities), geographical information, local and regional plans, field work and bibliographical research (fig. 1).

The heritage database includes built and archaeological elements, although some of the information on tradition and local festivities are also included. Part of these elements belong to the list of monuments classified by the Portuguese Institute of Built Heritage as national, public interest, or municipal value monuments. Being classified means that these elements and their surroundings must be protected and preserved and included in a long and complete inventory made for this purpose ("Lei n.º 13/85 de 6 de Julho, Património Cultural Português"). The remaining elements are considered "non-classified" and are a significant part of the total database.

One of the main criteria in constructing the database was including not only the type of heritage usually referred to in municipal and national inventories, but also taking into account other types of buildings, often ignored by the traditional way of looking into a region's heritage, even though this broader concept of historical element goes back to the Venice Charter ("The concept of an historic monument embraces not only the single architectural work but also the urban or rural setting in which is found the evidence of a particular civilisation, a significant development or an historic event. This applies not only to great works of art but also to more modest works of the past which have acquired cultural significance with the passing of time.", *International Charter for the Conservation and Restoration of Monuments and Sites - The Venice Charter*, 1964). Therefore, elements such as windmills, tidemills, fountains, railway stations and traditional architecture were considered an important part of the social economy and history of this region and therefore they are included in the database.

The geographic maps used were based on a scale of 1:25000, and each element was marked with a dot on a MicroStation /MGE project, and it was associated with a record on the alphanumeric database, first in Excel format and finally in Access and Oracle database. The project was recently converted to an ArcView file (fig. 3).

It is worth mentioning that about half of the elements are located in the municipality of Lisbon, which reveals an enormous amount of heritage that can be found in this city, and it also reveals the fact that many inventories and studies have been made over the years in this area and the data are generally much more complete than in the rest of the LMA.

We can also verify that the northern bank has more elements than the southern one. There is not an easy explanation for this fact worth studying about, but we might say that the proximity to the capital, the existence of a natural barrier formed by the river Tagus and historical reasons (related to the Moorish occupation of the territory and the years of conquest and re-conquest lived throughout the medieval times) can be a part of the reason for such a difference in terms of "heritage density".

The innovative character of this database is given precisely by a large number of inventoried elements and also by the fact that having them available on a GIS allows multiple analysis, for example crossing different types of information or visualising them with a satellite photograph or orthophotomap as background.

Some of the analysis made possible by this database will be presented throughout the following chapter, illustrated by some historical data which will allow to understand the value of the elements and the importance of having such a system to interpret them. Nevertheless, we would like to refer the importance of considering the heritage a part of a wider context, where this data, beyond its first historical interpretation, can be useful in tourism planning, land-use planning policies and strategies, definition of cultural policies, etc.

3. Some examples of analysis

The examples given only concern the southern bank of the LMA (Setúbal Peninsula), as these are now being the subject of a research which allows a more complete interpretation and accuracy of the data available.

The Tagus river has been, due to its dimensions, specially in the estuary, an important natural and cultural barrier and a strong influence for local communities. It is almost impossible to deal with the history, culture and economy of this region, without considering its influence (the Sado estuary also played an important role, but on a higher local level). Therefore, we may notice the existence of a double standard: it operates as a barrier, both physical and cultural, but also as an unification element (if we consider that one of the bank's activities are strongly connected to the other).

In the Tagus estuary there are plenty of archaeological vestiges, from Pre-History to the Roman Empire. The Setúbal Peninsula was one of the main centres for the production of salted fish and *liquamen* (a sauce also made of fish). The salt used was also produced in the region. Boats sailed from this peninsula with the purpose of supplying the Roman Empire with these products, so popular at the time. To carry thess products to their destinies clay amphora were necessary. Some archaeological vestiges of pottery industries were found near soils where clay was abundant. Both activities were located near the river, to allow easy transportation (fig. 4).

Castles and other fortifications were built for the defence of the medieval cities and they became, throughout the centuries, strong marks of heritage and landscape structure. In this peninsula, we can find castles built upon the purpose of defence between the Moorish occupation in the year 711 and the 14th century. After the 15th century, other

fortifications were built, but basically maritime protection. All these castles and forts were located on strategic or high places. The following map shows an image of this strategic defence in these two periods of time (fig. 5).

During the Middle Ages, agriculture (specially wine) and salt exploitation (made already in roman times) were developed. The region's economy was rich and many activities were strongly connected. For instance, the Tagus estuary was probably the most important place in the country for the construction of tidemills. The southern bank of the estuary was chosen for this activity, due to its natural conditions (easy access by land and river and well protected from storms). Although tidemills were already common in Portuguese estuaries in the 13th century, it was afterwards, with the increasing of commercial traffic to the new discovered African and American territories (and later to India and the Farther East) that this activity became progressively more important. The flour was used to cook "biscoito" (a sort of biscuit) in ovens also located in this region, meant to supply all the needs of the long voyages (other industries were related with the naval activity, such as ceramic, glass and cooperage industries). 37 tidemills were then built and most of them worked until recently (one is now an ecological museum, still producing flour) (fig. 6).

The wheat used to make the flour wasn't produced in this region, it was transported by boat (all the tidemills had loading quays) from the big storehouses in Lisbon, or directly from the producing regions. Lisbon was the main centre and received from the south bank wood, salt, wine, stone for construction, glass, etc. All these products were transported by boat. Chronicles tell that centuries of boats crossed the estuary in those days, among those who sailed overseas and those who sailed on local transports. One of the main activities, located near the river, was the naval construction. This activity was extremely important until the middle of the 20th century, and today we can still find two small family industries: one for the construction of boats and the other for handmade sails for sailing boats.

4. Final remarks

GIS is nowadays a powerful tool in land-use planning and in the various studies related to it. It became extremely easy to cross information as the one presented here. This kind of tool allows an easy perception of the information, and may be used as a starting point to interpret the alphanumeric data available. GIS also made it possible to add an almost infinite number of information, update the old one or compare it with new data.

In what concerns protecting heritage, GIS allows a more accurate localisation, that can be verified with the help of orthophotomaps. But heritage GIS can play such a more active role in heritage protection: the inventories can be improved and their data used to help managing these resources, which represent an important part of our history, memory and tradition. For instance, GIS would be extremely useful in helping limiting the protection areas around classified buildings, and to managing works and constructions in those areas.

With all this information, an excellent base for cultural, tourism and built heritage planning can be created. Therefore, we can say that GIS would be a good support for decision making and planning. Nevertheless, the fact that it consists in a more sophisticated and highly qualified way to present a database shouldn't be set aside, in a world where the general aspect of information is gaining more and more importance. The interest on heritage, history, and cultural tourism is increasing, and producing high-quality information to promote each region's natural and cultural values is becoming essential - and GIS has, in this matter, an important statement to say.

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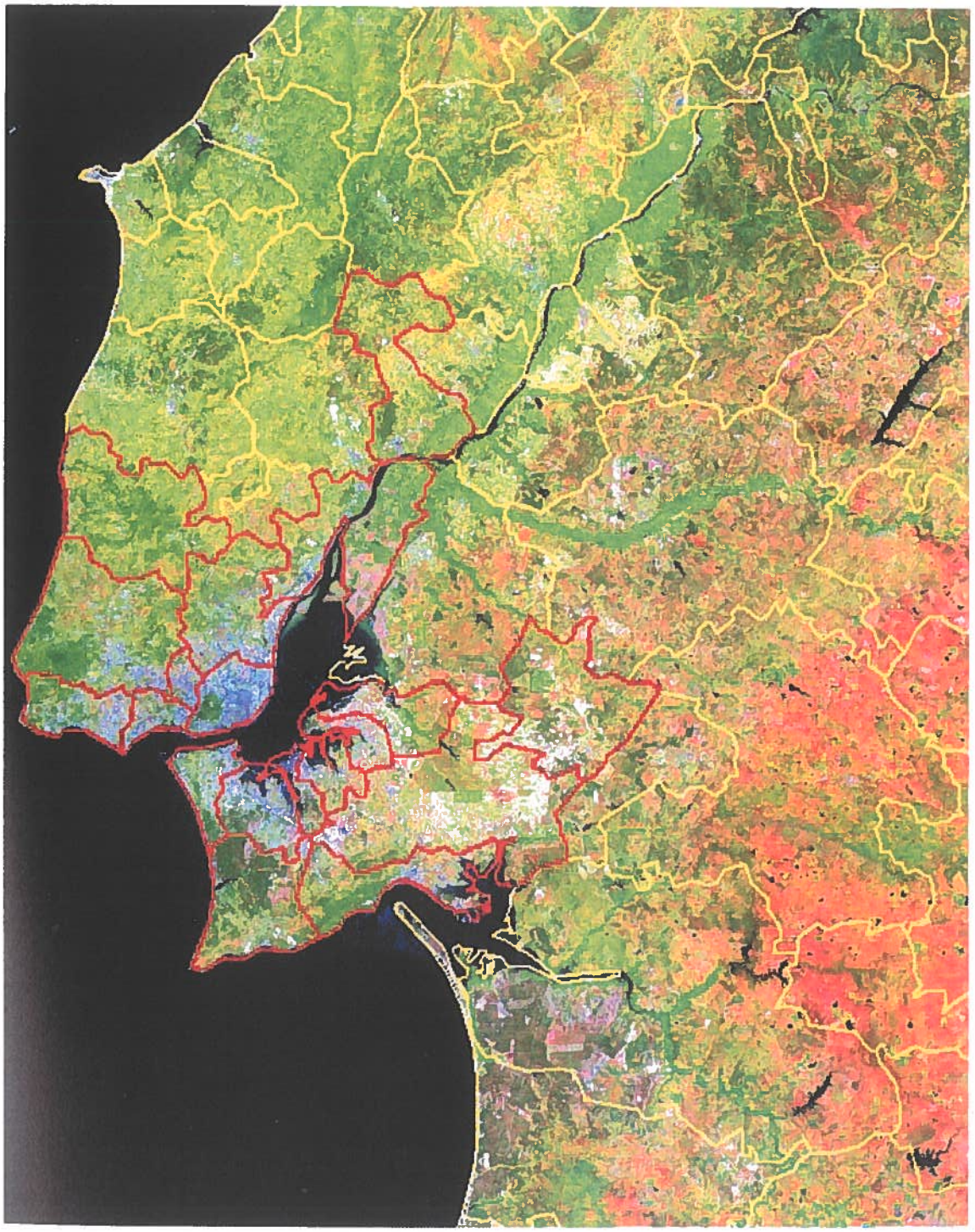

Fig. 1 - Lisbon Metropolitan Area (Colour Composit of TM5, TM4 and TM1 from LandSAT, 1997).

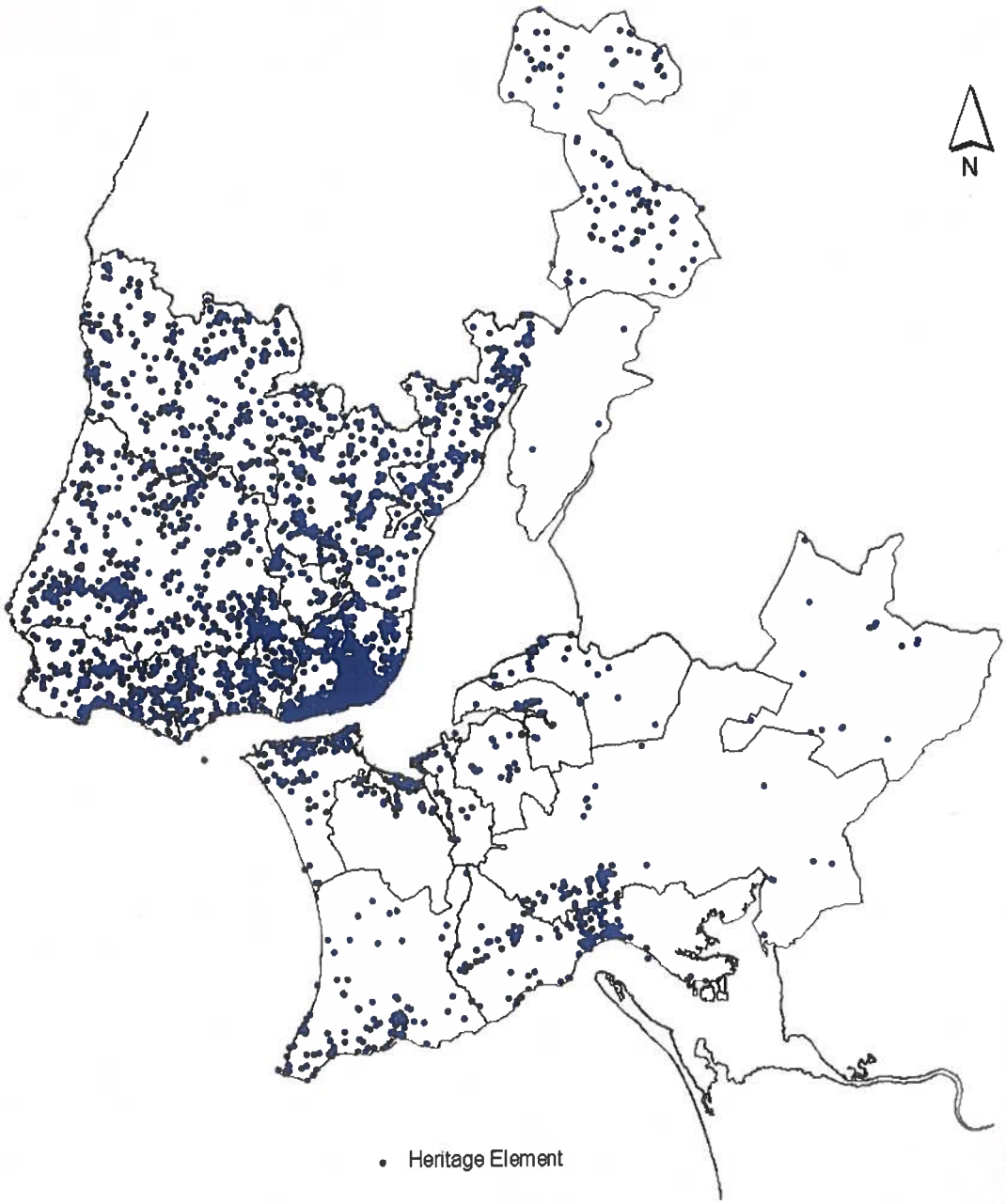

Fig. 3 - Lisbon Metropolitan Area heritage.

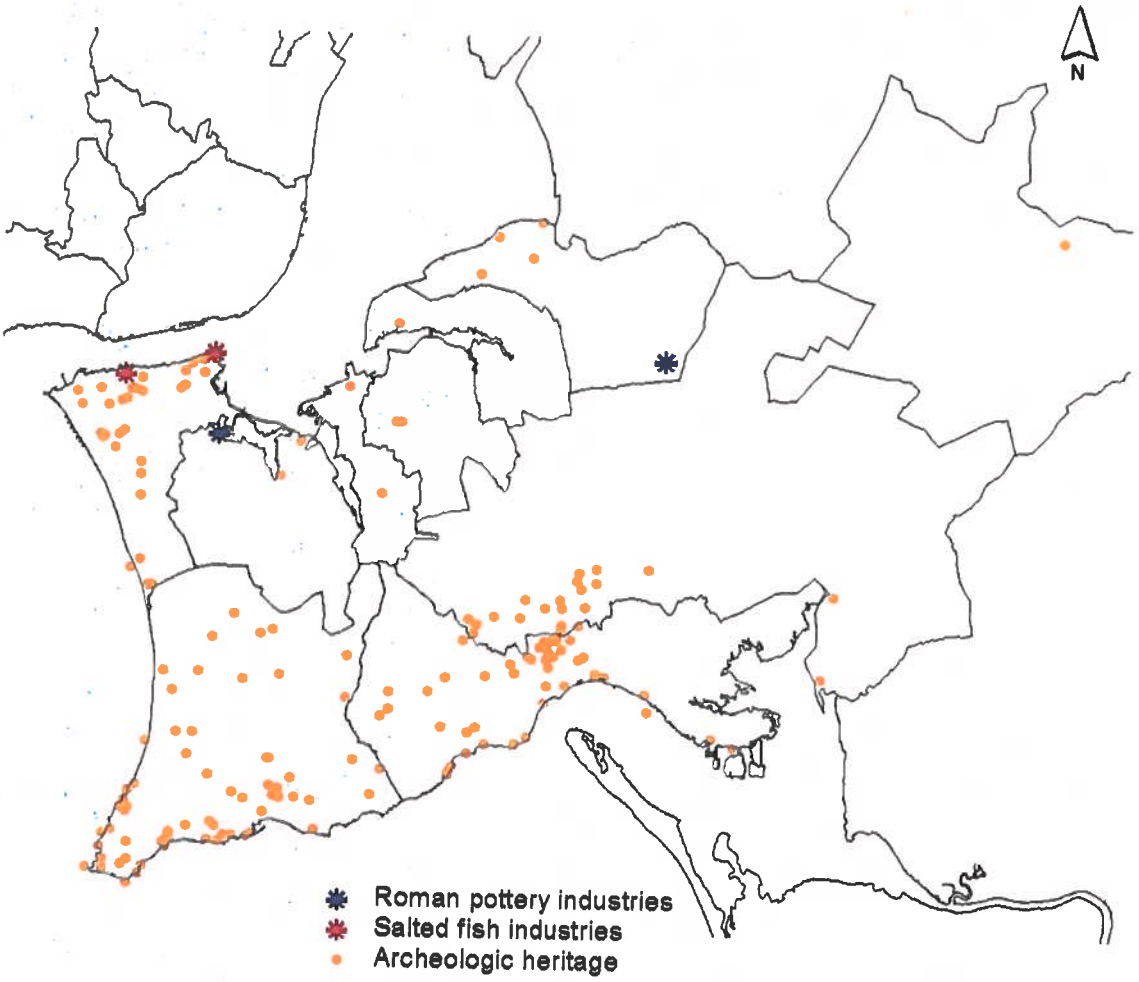

Fig. 4 - Archaeological heritage of the Setúbal Peninsula. Salted fish and pottery industries.

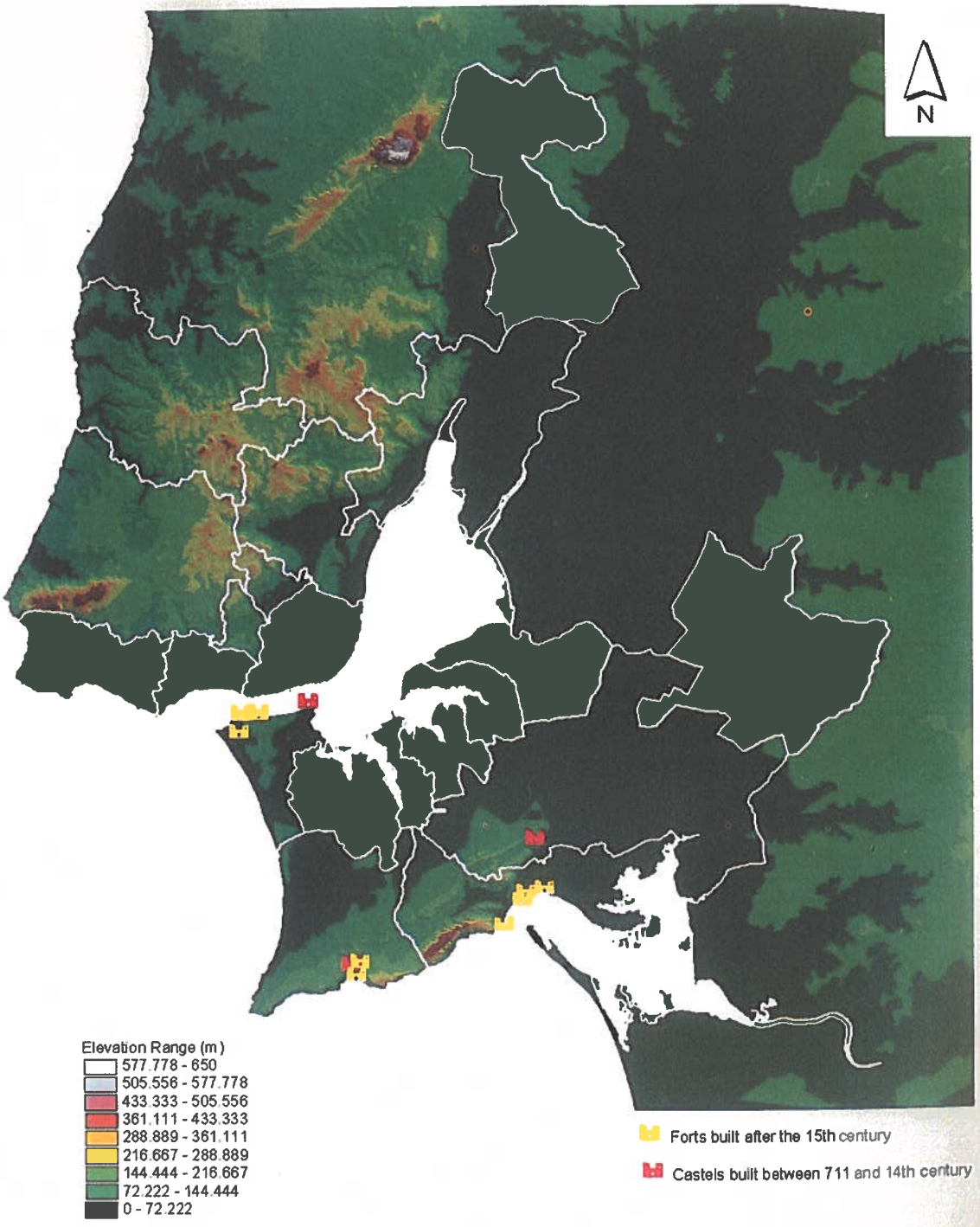

Fig. 5 - Castles and forts in the Setúbal Peninsula, with altimetry data.

Fig. 6 - Tidemills in the Setúbal Peninsula with Colour Composit of TM5, TM4 and TM1 from LandSAT, 1997 as background.