Mapping heritage: Georeferenced Heritage Assets Applied to the Cultural Characterization of Madrid (Spain)

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Abstract
This paper describes the cultural characterization of the landscapes of the Community of Madrid using a database of geolocalized heritage assets. In this sense, the concept of cultural characterization refers to the spatial study of different attributes resulting from the interaction between the population and its environment.

The methodology used is based on a virtual model of the Community of Madrid, in which more than 9,000 heritage sites registered by the Historical Heritage Information System of the Community of Madrid since 1990 are indexed. Our work consists of analyzing these elements in their spatial concentration, both as a whole and by type and period, and then comparing them with other territorial structures. The process allows us to deduce the links that maintain certain cultural expressions with a place and their permanence over time. As conclusions, some of the results obtained are presented, such as the identification of landscapes associated with historical factory complexes in the river basins, or the vestiges of Islam in the water meetings. Likewise, a relationship between the historical configuration of the territory of the Community of Madrid and the spatial systems formed by the BIC cultural assets is advanced.

Keywords
Cultural Landscape, GIS, Madrid, Heritage Assets

Introduction

The work described here consists in the elaboration of a database of cultural assets that will allow a future characterization of the cultural landscapes of Madrid. Cultural landscapes are a type of heritage of enormous dynamism and complexity. On the one hand, they imply a quantitative expansion of the spatial scale of cultural assets, since they are generally deployed over important territorial extensions. On the other hand, they imply a qualitative change in the traditional criteria for evaluating cultural heritage, which for the first time are shifting towards phenomenological aspects related to perception and cultural meaning. These issues represent an enormous challenge for public administrations, which have to identify, value, study and manage this new category of heritage from a very different perspective than the traditional one.

This paper focuses on the adaptation work carried out on the official georeferenced inventory of the historical heritage of the Community of Madrid. The work is part of a larger collaboration with the Community of Madrid: the CULTURESCAPES-CM project, which addresses the knowledge of cultural landscapes from an integrative approach. The program lasted three years, and the work has been continued with a second program, also funded by the Community of Madrid: "LABPA-CM: Contemporary Criteria, Methods and Techniques for Landscape Knowledge and Conservation".

The region amended its Historical Heritage Law in 2013 to introduce the typology of cultural landscapes, in line with the European Landscape Convention. The CULTURESCAPES-CM program was therefore developed to innovate in techniques and methods to approach cultural landscapes, while proposing intervention criteria and strategies for their creative management. The six objectives of the program are:

1. Landscape documentation in high-definition digital models.
2. Integrative methods for the appreciation of sensitive factors.
3. Identification and characterization of Madrid's cultural landscapes.
4. Relationship between cultural landscape, society and tourism.
5. Instruments of creative intervention oriented to territorial and economic development.
6. Internationalization, training and dissemination of knowledge.

The research presented here falls under Objective 3. The identification of the cultural landscapes of Madrid was carried out through interviews with experts, bibliographic research and GIS territorial characterization. The latter process allowed a reading of the geographical continuum of the region based on the presence of remnants of heritage value. The work was based on an existing database and most of the effort was invested in the reclassification of the elements contained in it. As a preliminary step to the description of the process developed, the following section deals with the origin and characteristics of this inventory.

The evolution of the Archaeological Charter of Madrid

In 1985, as a measure against the great urban expansion and infrastructure development, a new law for the protection of the historical heritage was passed in Spain. In the same year, the Community of Madrid implemented an Archaeological Charter Plan, which systematized the prospection of its entire territory in order to locate the archaeological sites to be protected (Velasco, 1991). The procedure developed was based on preventive archaeology. The assumption that a territory might contain sites of interest was enough to declare it a cultural property. This is a method with a certain peculiarity, as evidenced by the fact that some authors have called it the Madrid Model (Vázquez, 1996). For the purposes of this article, it is of particular interest because it led to the declaration of almost 5% of Madrid's territory as a protected area.

The Archaeological Map of Madrid is the germ of what is today the database of all the immovable properties that make up the community's historical heritage (Bermúdez, 2016). At the beginning of the 1990s, this map was transferred into a

GIS-based model that has not stopped expanding since then. Beginning in 2010, a series of administrative changes were initiated that culminated in Law 3/2013 of Historical Heritage of the Community. The Archaeological Protection Area became the Historical Heritage Protection Area and, therefore, the Catalogue "became the responsibility of the entire General Directorate and was no longer to contain only information of an archaeological nature, but of all types of immobile historical heritage (industrial, ethnographic, paleontological, architectural, artistic or landscape heritage)" (Bermúdez, 2016: 419).

The resulting geographic information model is a collection of areas of very different sizes, with those of archaeological interest, as explained above, being larger than the rest. The latter, those added later, result from the delineation of a specific object or its environment, which, similar to the setting, would be "the area that surrounds [the property] and allows its proper perception and cultural understanding" (Region of Madrid, 2013, p. 11). Although each geometry has its own *raison d'être*, its attributes are subjected to a homogenization process in order to be included in the database. The disparate nature of the catalogued elements is mitigated to some extent by the classification of their characteristics into a set of common fields.

The following section analyzes the ways in which the information in the database has been treated with the aim of culturally analyzing the territory of Madrid. Although this is a critical study, it is recognized that the work developed by the current inventory of the Community of Madrid has included the "generation of criteria and working methods to be able to integrate all types of immovable assets of historical heritage" (Bermúdez, 2016: 421).

Methods

Information processing

First, a study of the density of culturally significant elements will be carried out, based on the digital inventory of the heritage of the Community of Madrid. The format of this inventory is that of a geographic information model. On the one hand, a set of geometries (areas) is represented geographically, and on the other hand, each of these shapes has associated attributes. The determination of the density of these elements is based not only on the study of concentrations, but also on the first differentiation between the type of geometry and the type of attribute. Depending on the solution adopted, the reading can vary considerably.

Geometries

Figure 1 shows a map of the 9,018 areas of cultural interest demarcated at the time of the study. At first glance, large protected areas can be seen in the basins of the Manzanares, Henares, Jarama and Tajo rivers. This is due to the aforementioned Madrid model, which was extensively covered in anticipation of what might be available. Due to its size, there is also a large patch in the west of the community, which contains the Real Sitio del Escorial. It can also be seen that we are faced with different types of surface development. Although they are all areas, some are marked with dots, because they indicate an object of reduced size; others with lines, because they include roads or canals, and others with extensive areas that extend in all directions.

Given the formal diversity, the first step is to geometrically equalize all entities. To do this, we reduce each entity to a point located in the geometric center of its area. In this way, we avoid a misunderstanding that the map produces. For example, looking at the large protected areas in river basins might lead us to think that these are the areas where the greatest concentration of elements are found. The larger areas do not delimit cultural landscapes, they define potential archaeological areas to ensure the protection of what may appear in the future, but the actual existence of the assets is not guaranteed. In addition, the same areas contain within them other smaller areas that are not visible when viewed as a whole. Figure 2 shows the conversion to points and a very different distribution from the previous one. The development of the work is based on this second map, although the negative consequences of working with point geometries are also explained in the conclusions.

At first glance, this new map shows us how the rest of the basins have as much or more importance than those that are completely delimited. We can see that the Tajo, to the east, and the Tajuña, a little further north, now stand out as having a notable concentration of elements, something that could not be seen in the previous map. Likewise, with the disappearance of the spot of El Escorial, this end of the community no longer has so much weight in the whole. From this map we can obtain a map of point densities (Fig. 3).

In this third map, we can see that there is a greater density of inventoried elements in the south, southeast and northwest. Like the river basins, the city of Madrid is

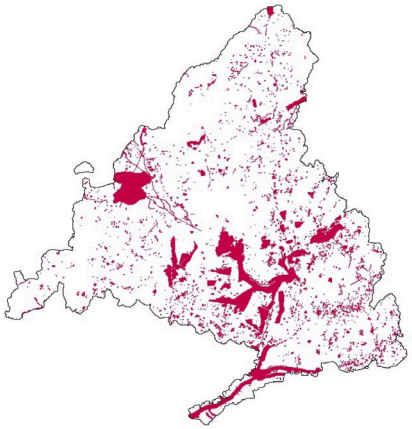

Figure 1
Map of the immovable historical heritage of the Community of Madrid (areas)

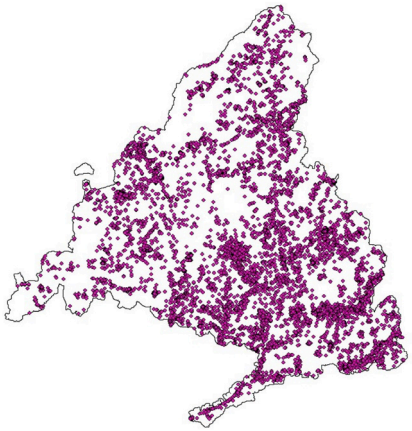

Figure 2
Map of the immovable historical heritage of the Community of Madrid (points)

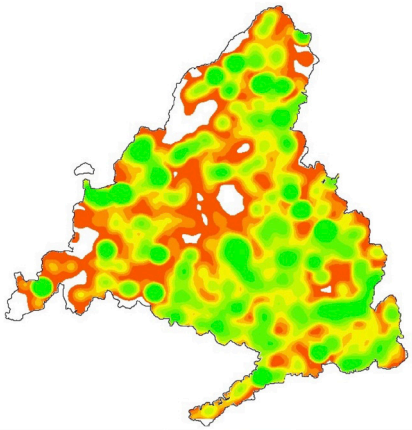

Figure 3
Density map of the immovable historical heritage of the Community of Madrid based on points

a great concentration of heritage elements, which contrasts with the great void left by Monte de El Pardo to the north. Finally, the Sierra de Madrid is also characterized by large concentrations of elements. In general, the operation carried out here is useful to see where the historical heritage is concentrated in the Community, but it does not offer a cultural reading of the territory. Having obtained a valid way of developing density maps, the next phase of the work consists in filtering the associated attributes.

Attributes

In the language of geographic information systems, an attribute is a parameter associated with a given geometry. As mentioned above, the classification of attributes developed by the Community of Madrid is the instrument for homogenizing the inventoried heritage. Thus, although an archaeological site differs from, for example, a mill both in its conception and in its demarcation, the attributes of both are ordered according to the same classes. There are a total of 11 classes defined by the Community of Madrid.

Thus, according to the above comparison, an archaeological site such as the Necropolis of Los Remedios (catalogued with code CM/0000/020) has the following attributes, based on the original classes (Table 1).

On the other hand, the attributes of a mill of industrial interest such as the Navallar Mill (code CM/0045/011) are (Table 2).

The problem that arises from such a classification is that it does not allow for easy cross-readings. Although the previous examples coincide in their archaeological interest and in their link to Renaissance culture, in the first case the culture is mixed with Visigothic, and in the second case the interest is mixed with industrial. Therefore, it is not easy to select all the geometries on the basis of a single attribute, unless it is done one by one. This is very laborious for 9,018 elements.

Interest	Period	Culture	Activity	Typology
Archaeological	Bronze, Altomedieval	Visigoth, Renaissance	Funeral Home	Residential complex, Cemetery

Interest	Period	Culture	Activity	Typology
Archaeological, Industrial	Plenomedieval, 16th, 17th, 18th centuries	Renaissance		Industrial, Services

Table 1 (above) Attributes of Necropolis of Los Remedios

Table 2 (below) Attributes of Navallar Mill

Therefore, the second phase of information processing is to rearrange the classes. In order to make the attributes easier to handle, each original class is broken down into the descriptions provided by the Community of Madrid. For example, it can be seen that the original class "Culture" has 6 attributes among the 9,018 elements: "Rock Art", "Megalithic", "Islamic" (including Mudejar), "Christian" (including repopulation), "Industrial Revolution" and "Civil War". Six new columns are then added to the table, one for each of these. This changes the attribute from descriptive to binary: for example, if an element fulfills the conditions for "Christian" and "Industrial Revolution", a YES is entered in that column, and a NO in the others that do not. The original classes are rearranged (Table 3).

This reorganization of the attributes optimizes the filtering by cultural characteristics. Thus, by selecting and studying the density of points based on a given property, the actual characterization work begins. As this is still in progress at the time of writing, only a few cases already studied can be shown. Figure 4 shows the spatial distribution of different heritage elements. From left to right, in the first case we can see how the Civil War heritage follows the spatial development of the battle front. In the second, we can see the relationship between the Islamic heritage and the rivers of the municipality, and in the third, the relationship of the industrial heritage with the rivers and the urban settlements.

Discussion

The designation of historical heritage as cultural property is more than a mere designation. The different nature of the elements included in the original catalogue of the Community of Madrid leads to very marked formal differences. In addition, the way in which their characteristics are classified is typical of a traditional inventory, more descriptive than operational. It is the treatment of geometry and attributes that leads us to optimize filtering and read the information homogeneously. The mapping of cultural assets is essentially different, since its purpose is not to describe an element, but to organize it in relation to others. That is, it is not so much the element itself that is of interest, but the spatial distribution of the whole. It is in the relational aspect that cultural property finds its *raison d'être*.

These relationships between elements are the basis for establishing cultural readings of a given space. By transforming the original inventory into a relational model, studies can be initiated that lead to distinguishing spaces based on how they reflect historical activities or cultures, that is, "searching around the world to identify landscapes that have emerged from, are associated with, or represent the great cultures. " (Fowler, 2003, p. 56).

ORIGINAL CLASS	NEW CLASSES
Activity	Farming Assistance Commercial Shows Industrial Funeral Home Military Religious Residential Services and infrastructure Transportation Others
Culture	Rock art Megalithism Islamic (including Mudejar) Christian (including repopulation) Industrial Revolution Civil War
Period	Prehistoric Romano Medieval s. XVI s. XVII s. XVIII s. XIX s. XX s. XXI
Interest	Archaeological Architectural Artistic Ethnographic Industrial Historical Paleontological Landscape
Typology	92 new classes.

Table 3
Reorganization of original classes

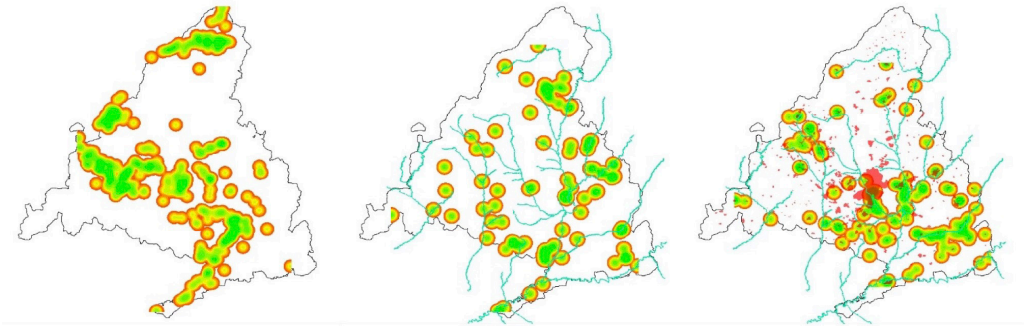

Figure 4
Historical heritage density surveys, from left to right: Civil War-related elements, Islamic-related elements, and industry-related elements

The proposed model, although it works correctly in terms of selection by attributes, offers certain problems in the geometric treatment. The point, in its state of zero spatial dimension, paradoxically helps and hurts the study. On the one hand, it represents a quick and effective way to geometrically standardize a series of areas, which makes it possible to ignore the problems derived from the peculiarities and motifs of each one. On the other hand, it eliminates the essential characteristics of these forms by reducing them spatially. An example of this dysfunction can be seen in the historical roads: the forms of linear development have a cultural influence that, although not very extensive, is fundamental to the structure of the territory. The correction of these deficiencies is more complex, since it involves recognizing the real spatial condition of each of the inventoried elements.

Acknowledgements
This research was funded by the project LABPA-CM: CONTEMPORARY CRITERIA, METHODS AND TECHNIQUES FOR LANDSCAPE KNOWLEDGE AND CONSERVATION (H2019/HUM-5692), funded by the European Social Fund and the Madrid regional government.

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