Historic construction of diffuse cultural landscapes: Towards a GIS-based method for mapping the interlinkages of heritage

Marina López Sánchez [a]*, Mercedes Linares Gómez del Pulgar [a] and Antonio Tejedor Cabrera [a]

[a] *Instituto Universitario de Arquitectura y Ciencias de la Construcción, Universidad de Sevilla, Sevilla, Spain*

*corresponding author: marinalopez@us.es

Abstract

The convergence of research on landscape and heritage holds great strategic potential for establishing novel connections between the heritage resources of a territory. This text reflects on the ability of the landscape to situate inherited assets within a framework of spatial coherence in relation to the peri-urban spaces of large cities, heritage areas of great historical depth that have been particularly aggressively exposed to the urban development dynamics of the second half of the 20th century. In order to address these often forgotten spaces, this text presents a system for heritage management argued from the standpoint of and towards the landscape and based on historical interpretation, cartographic analysis, mapping and digital documentation. Geographic technologies and graphic expression are basic pillars to integrate historical information with the language and resources of the disciplines involved in landscape planning and design, advancing criteria for a forward-looking landscape-based heritage management.

Keywords: cultural landscape; peri-urban areas; heritage; Geographical Information Systems; sustainable development

1 Introduction

The need to care for and protect the landscape has been consolidated in heritage research over the last two decades (Agnoletti, 2006; Bloemers et al., 2010; Kolen & van der Laarse, 2010; Longstreth, 2008; Scazzosi, 2004; Taylor et al., 2018; Taylor, 2016; Whelan & Moore, 2016). Since the beginning of the 20th century, the contemporary notion of landscape has been shaped by the geographical sciences (Sauer, 1925; Meining, 1979) and is now embraced by a wide field of multidisciplinary research (Antrop & Van Eetvelde, 2017). It is conceived as a rich space-time framework that expresses the historical relationships forged between humans and the territory they inhabit.

From this point of view, landscape has been consolidated as a focus of attention for the heritage sphere (Rössler, 2006). Its recognition as a heritage asset not only represents a new target for safeguarding and protection, but is also a solid demonstration of the ineffectiveness of the usual conservation practices when it comes to dealing with humanised and living environments, since the emphasis cannot be placed on static permanence but rather on controlled transformation and the creation of sustainable value (Poulios, 2014). From the landscape approach, the choice between conservation or development is proven to be obsolete (Appendino, 2017; Araoz, 2011). On the contrary, landscape is a strategic factor for the construction of a renewed integrative heritage management (Taylor & Lennon, 2010) based on the principles of sustainable development (Feria, 2012; Manero & García, 2016).

When the historical evolution of a place is understood through its landscape, the heritage resources found there cease to be understood as individual elements, as they are all read as an integral part of that landscape and its evolutionary process. In addition, the landscape begins in the moment at which relationships are established between the components of the territory, therefore the study of the historic landscape enables the detection of long-standing links between the heritage resources (Sabaté, 2005; Llop, 2011). These links, given that they are based on evolutionary events and circumstances that occur throughout history, can take on the form of a narrative. The landscape turns a "place with unique heritage pieces", that is, a territory where several resources recognised as cultural or natural heritage can be located, into a space built through a unitary reading whose overall value exceeds that of the sum of its parts (Calderón & García, 2016).

Therefore, the landscape retains an interesting potential as a strategy for a cohesive understanding of the heritage content of the territory due to its relational and narrative capacity. The landscape functions as a roadmap for finding the historical relations between the heritage resources, which at the end of the day are the beneficiaries, the ones that must be protected and valued.

This text presents a methodology for putting this conceptual framework into practice based on historical interpretation, cartographic analysis, mapping and digital documentation through GIS. Specifically, a three-step method is introduced for heritage management argued from the standpoint of and towards the landscape. It reformulates the tasks of documentation and registration of heritage as tools that advance criteria and strategies of planning and spatial design for territorial balance and sustainable development. To this end, the proposed methodology begins with a GIS-based procedure to detect and record the territory's heritage resources and their relationships (step 1). Consecutively, a *modus operandi* is developed to construct narratives through these links. The narratives aim to encourage the transmission to the population of the heritage relations that are identified (step 2). Lastly, the processes and tools for these relations and narratives to be able to act as the basis for a landscape design and planning project are considered (step 3).

The methodology that will be presented is considered to be potentially applicable to any urban or rural landscape. Nevertheless, it becomes especially relevant for landscapes with high levels of fragmentation, given that the method is aimed at creating heritage connections that strengthen a unitary reading. This paper will refer to these disjointed landscapes as *diffuse landscapes,* given the difficulty they present when being read, interpreted and understood. The peri-urban areas of the large and medium-sized cities are a paradigmatic example of these diffuse landscapes. The urban expansion model of the second half of the 20th century has formed an image of the peripheral areas as lacking an identity (Augé, 2008; Koolhass, 1997; 2002), largely compromising their heritage intelligibility. They have never been recognised as spaces with sufficient landscape or heritage value, remaining at the mercy of dispersed regional planning which, moving forward at the expense of real estate developments, industrialisation projects and new roads, has largely compromised their visibility as heritage spaces. However, their proximity to major urban centres makes them places with great historical depth and a considerable density of heritage resources. It is therefore necessary to reduce the serious situations of decontextualisation of many of the heritage pieces found in these environments through the development of mechanisms and spatial procedures that, due to the relational nature and the narrative potential of the landscape, improve their visibility and integration into the contemporary landscape (Hökerberg, 2013; Ureña & de Coronado, 2018). The heritage scenario must express itself in this respect in coordination with the landscape science, proposing mechanisms that react

to the hegemonic reproduction of a standardised and unsustainable model of development that entails the loss of cultural and ecological diversity (Magnaghi, 2012).

2 Case study

The methodology will be applied in a peri-urban area of the city of Seville (Spain) (Figure 1). The scope of the study is approximately 600 km^2 and includes eighteen municipalities in the north-western sector of the area of influence of the most populated city in southern Spain. The population of Seville is around 700,000 inhabitants and the total number of municipalities in the area studied has approximately 100,000 inhabitants. In selecting the field of study, the aim was to address a dispersed and landscape-diverse heritage network that nevertheless contains valuable heritage resources. The territory chosen is paradigmatic in this respect since, within a relatively small area, there is an agricultural landscape in the central area, whose land division system dates back to medieval times; a mining landscape that has been exploited since prehistoric times at the foot of the northern mountains; the landscape of the metropolitan area of Seville, which is located in the south of the area, in the privileged elevated position of the Aljarafe cornice; and, on both sides, the fluvial landscapes of the Guadalquivir and Guadiamar rivers.

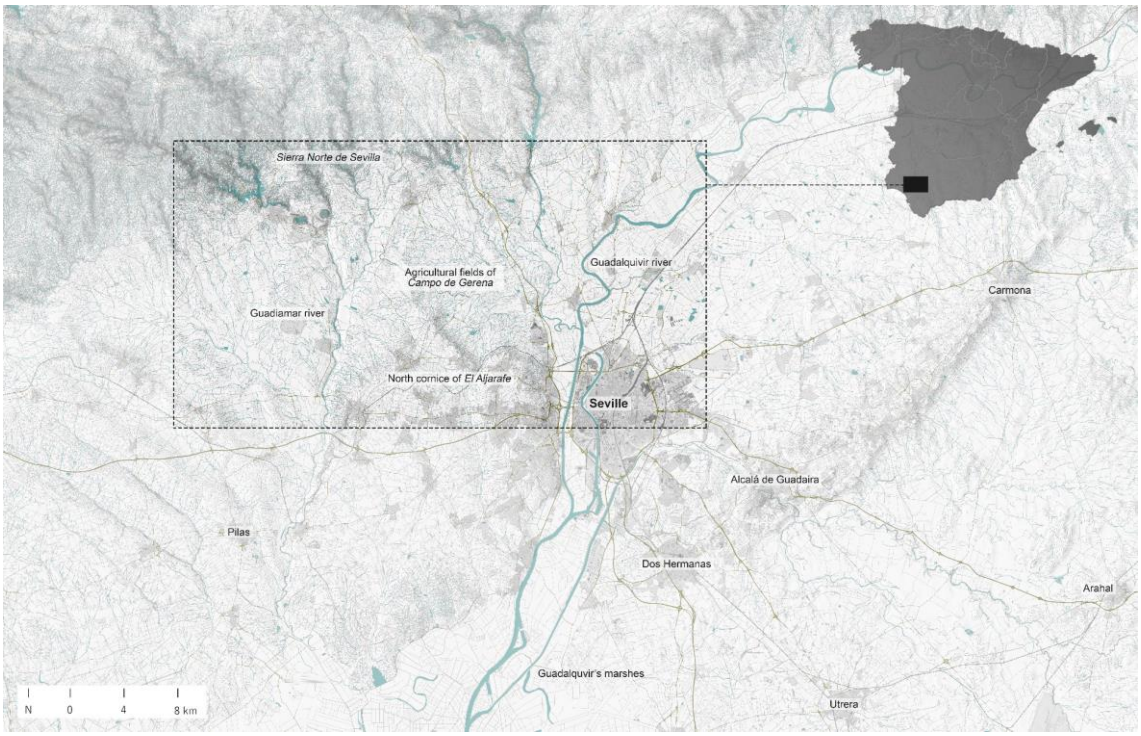

Figure 1. Area of study. Author: Marina López, 2020.

The area constitutes a complex heritage network of great landscape richness that covers a very wide time span; however, its resources are isolated in such a way that they do not establish relationships with other nearby assets or with the landscape they belong to. Consequently, the historical connections between them remain hidden from the population. It is a representative example of those areas located in the proximity of medium and large cities, where the landscape diversity and the historical depth of the territory coexist with fast roads, industrial areas, business parks or large commercial infrastructures that fragment the landscape and make it very difficult to appreciate it as heritage (Figures 2 and 3).

Figure 2. Photo of the North Cornice of El Aljarafe. Author: Marina López, 2020.

Figure 3. Photo from the North Cornice of El Aljarafe with Seville in the back. Author: Marina López, 2020.

3 Methods and Results

3.1 Methodological framework

The study is based on the historical reconstruction of the landscape from prehistoric times to the present day through contrasted archival research from eight different sources, comprising a historical bibliography, research work (eg. Cornejo, 2017; García, 2003; Garrido, 2011; Mejías, 2017; Rosa, 2003), archaeological maps (eg. Fernández et al., 2017; Hunt et al, 2017), municipal planning, heritage inventories, landscape catalogues (Zoido & Rodríguez, 2015), iconographic sources of landscape views and historical cartography, the latter being especially revealing of the values and meanings of the landscape. This method therefore shares techniques with the

consolidated line of research focused on advancing historical knowledge of landscape through the study of graphic sources (Alonso-Rodríguez et al., 2017; Chías, 2012; Giordano & Nolan, 2007; Maio et al., 2013; Pinho & Oliveira, 2009).

The historical reconstruction of the landscape is an analytical process mainly rooted in geography and archaeology that has numerous international benchmarks, such as the English historic landscape characterisation (HLC) (Alfred & Fairclough, 2002), the analysis of the territorialisation processes of the Italian territorialist school (Magnaghi, 2017; Poli, 2017) or the Dutch landscape biography approach (Kolen et al., 2015), among others. Their objective is to understand how nowadays landscape character has been shaped by historic processes and relate this information to present day decision-making in landscape planning. These approaches are in tune with the spatial turn in historical studies that Karl Schlögel has called for: "an expository form that focuses on the historical place has turned out to be the most appropriate way to make history present" (Schlögel, 2003). Compared to the approach most aimed at detecting the time depth and the change patterns of land use that characterise HLC studies, this research focuses on heritage assets.

The methodology matches the Italian experience in focusing on the relational capacity of the landscape, developed in phase 1 of the proposed methodology. This exercise is identified with the *Piani Paesaggistici Regionali* (Magnaghi, 2016), regional instruments of landscape planning that are presented from a structural interpretation of the landscape, understanding it as an integrating network of factors and processes that articulate the territory. The process indeed detects the *invarianti strutturali* (Maggio, 2014), which constitute the complex network of heritage elements and features that determine the character of a landscape. Structural invariants are organised into networks, so that each component of the landscape is linked to a higher structure that interrelates it with others, rather than functioning as an isolated piece in the territory. In addition, the methodology coincides with Dutch research in terms of the emphasis on the narrative potential of the landscape, considered in phase 2 of the proposed methodology. The study shares the Landscape Biography approach of situating heritage in a framework of spatial and temporal coherence in the present through the long-term stories contained in the landscape (Kolen et al, 2015; Roymans et al., 2009; van der Schriek, 2019). According to the biographical perspective on the landscape, the study of the evolution of a cultural landscape until today —as a long-term assessment of its constant process of renovation and revaluation— has an intrinsic potential to generate powerful and innovative narratives of the ways in which communities have used, organised and interpreted the territory over time (Kolen, 1995). The diachronic analysis of the landscape has the capacity to build narrative threads from which to offer a structured and attractive interpretation of the heritage fabric that sustains it (Kolen & Renes, 2015).

The specific contribution of the methodology proposed below is the development of a methodological sequence that is capable of turning these landscape relations and narratives into a specific spatial proposal that can be implemented by landscape design and planning professionals. This topic has been developed in phase 3 of the proposed methodology.

3.2 Step 1. GIS-based relational database

The first step is set in a GIS environment. The diachronic analysis of the landscape moves to an operational plane by a georeferenced record that collects all the currently existing heritage resources that contribute to transmitting the identified historical processes. The fundamental starting point of this work has been the Management and Information System of the Cultural Assets of Andalusia, MOSAICO, produced by the Documentation and Studies Centre of the Institute of Historical Heritage of Andalusia (IAPH) and implemented in 2011. Its information is

disseminated through the Digital Guide to the Cultural Heritage of Andalusia (Instituto Andaluz de Patrimonio Histórico, n.d.). The Documentation and Studies Centre provided the research team responsible for this work with a vectorial layer in *shape* (.shp) format referring to the scope of study that contained all the heritage resources currently recorded in the Digital Guide. This layer has been completed and updated through the diachronic study of the landscape. The novelty of the method with relation to MOSAICO is that a system based on the landscape to a greater extent promotes the detection of situations of anonymity, abandonment and risk of disappearance of the minor assets, as even they are not salient in terms of heritage significance, they could allow to explain the diachronic processes of landscape formation. With the expansion of the inventory, 751 heritage resources have been registered. Specifically, 439 archaeological sites, 131 architectural buildings, 63 heritage infrastructures, 56 historic roads, 22 urban ensembles, 16 intangible heritage manifestations, 14 spaces of commemoration and 10 elements of the natural environment. Each resource, while in constant interrelation with the other heritage pieces, provides specific interpretative keys on the analysed landscape. The resources are systemised through a standardised digital documentation process that establishes temporal, typological, and hierarchical associations between them through a controlled thesaurus of terms. The design of a repository of words allows to establish a semantic organisation, a vocabulary management and a conceptual structure from which to build a relational database. The repository began with the MOSAICO thesaurus, although it has been modified under the aim of increasing its relational capacity (e.g. amalgamating some terms). Although the methodology is considered potentially applicable to any area, the word repository will always have to be adapted to the specific features and components of the landscape being analysed.

In order to build the relational database, each heritage item of the record is associated with an attribute table composed of three data blocks. The first block aims to correctly identify and locate the heritage assets (Table 1; Figure 4). The next block establishes temporal and typological relationships between them (Table 2; Figure 5). The repository of words is especially relevant in this data block, as it guarantees fluid semantic searches from which to detect heritage networks resulting from such connections.

Table 1. Information provided in the attribute table of Block I: Identification.

BLOCK I: IDENTIFICATION	Nº of terms	Keywords
ID	-	-
Spatial shape	3	Point; line; area
Name	-	-
Municipality	25	E.g. La Algaba; La Rinconada; Santiponce; Guillena; Gerena, etc.
Coord. x	-	-
Coord. y	-	-
Context	3	urban; peri-urban; rural
Protection status*	15	E.g. World Heritage; Property of Cultural Interest; Protected Landscape, etc.
Heritage inventory it appears in*	18	Ej. Management and Information System of the Cultural Assets of Andalusia; Inventory of archaeological sites in the province of Seville; Inventory of Cortijos, Haciendas and Lagares in Andalusia.

* Heritage items can have more than one keyword in this field

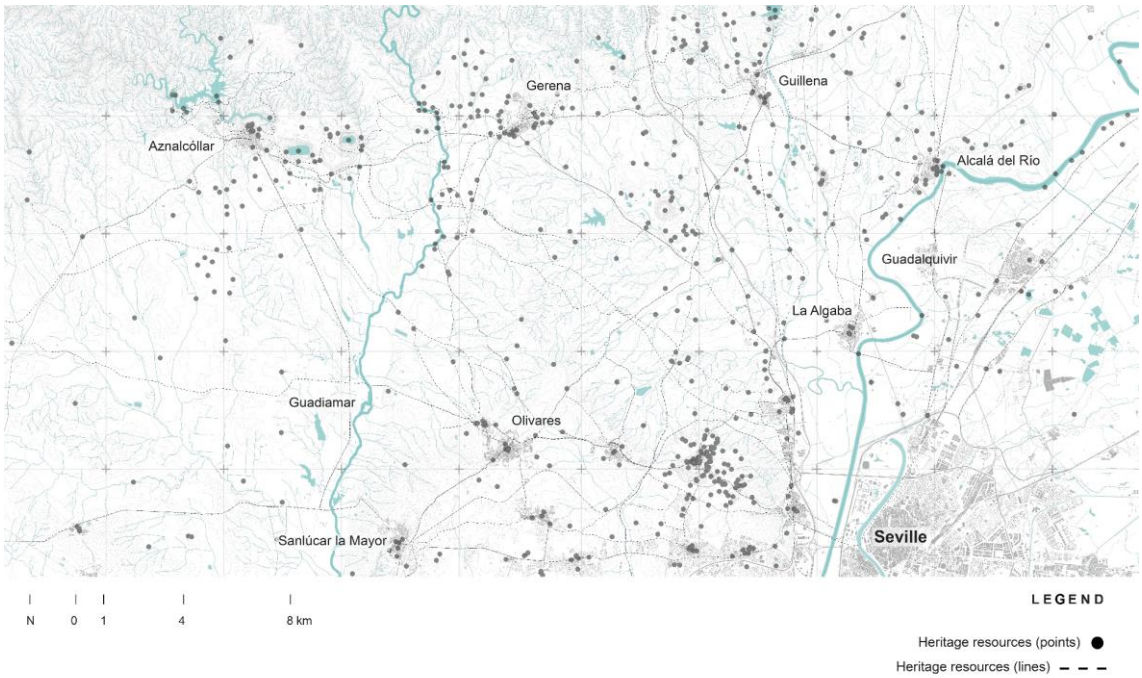

Figure 4. Map of the recorded heritage resources with the information of Block I: Identification. Author: Marina López, 2020.

Table 2. Information provided in the attribute table of Block II: Classification.

BLOCK II. CLASSIFICATION	Nº of terms	Keywords
Time period*	14	Paleolithic (PL); Neolithic (NL); Copper Age (CA); Early and Middle Bronze Age (BA-EM); Late Bronze Age (BA-L); Early Iron Age (IA-E); Late Iron Age (IA-L); Roman Age-Republic (RA-R); Roman Age-High Empire (RA-HE); Roman Age-Low Empire (RA-LE); Early Middle Ages (MA-E); Late Middle Ages (MA-L); Modern Age (MoA); Contemporary Age (CoA).
Basic classification*	8	Urban ensemble (URBAN); Archaeological heritage (ARCHAEO); Architectural heritage (ARCHI); Heritage infrastructures (INFRA); Historic roads (ROAD); Intangible heritage (INT); Natural heritage (NAT); Commemorative spaces (COM)
General typology*	12	Human settlement (HSETTLE); Funeral systems (FUN); Agricultural architecture (AGRI); Defensive architecture (DEF); Religious architecture (RELIG); Civil architecture (CIV); Residential architecture (RESID); Mobility infrastructures (MOB); Water infraestructures (WATER); Mining infrastructures (MIN); Electric infrastructures (ELEC); Railway infrastructure (RAIL)
Specific typology*	64	E.g. (for WATER) hot springs; cisterns; aqueduct; river port; dam; pond; irrigation ditch; watermill; water reservoir; deposit; hydroelectric power station; filtering station.

* Heritage items can have more than one keyword in this field

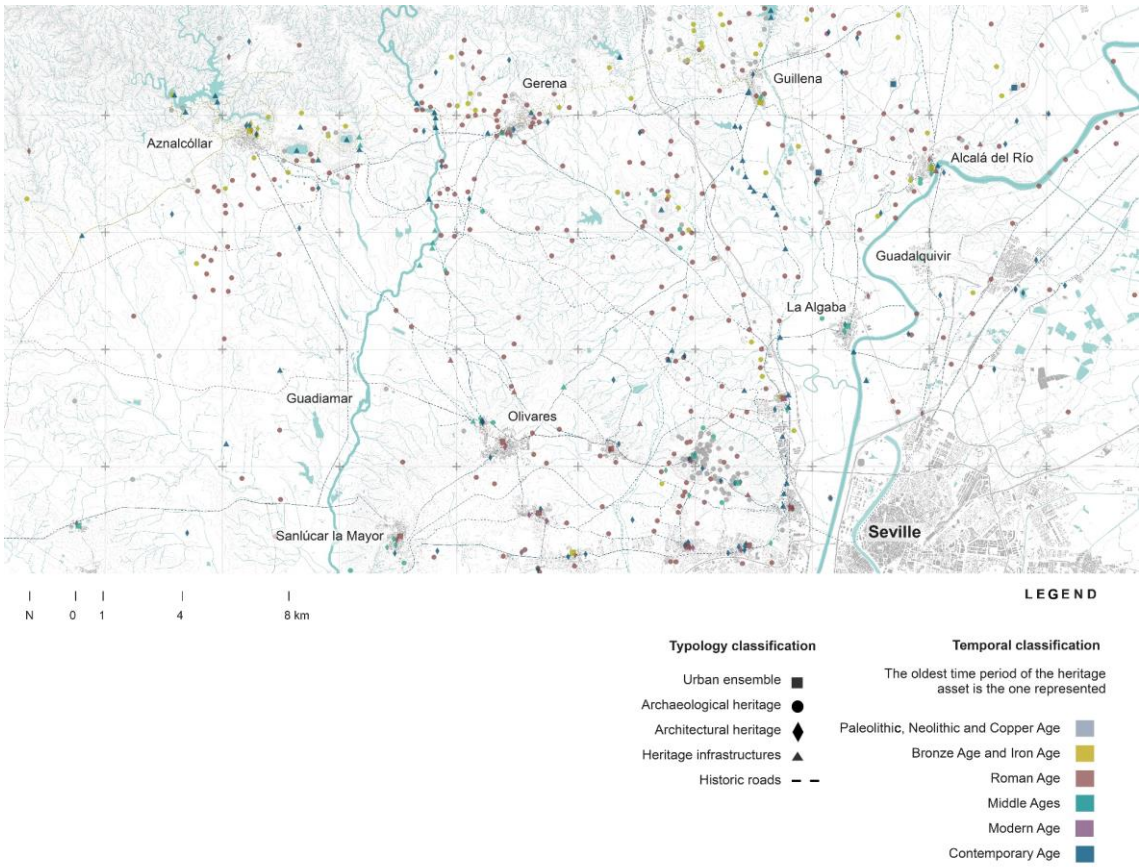

Figure 5. Map of the recorded heritage resources with the information of Block II: Classification. Author: Marina López, 2020.

The third block aims to establish a hierarchy of the recorded heritage pieces based on the role they currently play in the landscape (Table 3; Figure 6). First, information is provided on whether the heritage asset is nowadays recognisable or whether, on the contrary, it is invisible because it is a buried archaeological site. Second, the resources have been measured, on the one hand, by their structural value (STv), which refers to the capacity of heritage to express long-term territorial processes. On the other hand, they have also been measured by their identity value (IDv), which determines how much heritage impacts the local population nowadays. The structural value is obtained from the assessment of the state of conservation (SC) of the heritage asset and its historic-cultural relevance (HR). The identity value is the result of four variables, which are social recognition (SR), physical accessibility (PA), level of adaptation for receiving visits (AV) and frequency of appearance in tourist guides (AG). From the analysis of both values, a three-level hierarchy of heritage resources is obtained, consisting of central poles, structuring heritage, and historical traces. In this way, the inventory incorporates an assessment of the current capacity of the heritage resources to transmit the cultural values they represent. This is a novelty compared to MOSAICO, as its table of attributes refers to topics exclusively linked to the historical-heritage value of the assets (historical period, chronology, typology, style etc.), while the proposed model also assesses the present-day legibility of the heritage resources. Tolina Loulanski (2006) defines this process as a transition from objects to functions and, consequently, from conservation to sustainable development. Overcoming an exclusively contemplative vision of heritage ensures its survival in periods when their original uses are already obsolete. If heritage does not find a purpose in line with the present which justifies the need to extend its useful life, it will inevitably end up becoming an obstacle.

Table 3. Information provided in the attribute table of Block III: Hierarquy.

BLOCK III. HIERARCHY	Nº of terms	Keyword	Associated value
Recognisable	2	Yes; No	
State of conservation (SC)	5	destroyed/missing; Low; Medium; Good; Very good	Destroyed/missing = 0 Low = 1 Medium = 2 Good = 4 Very good = 6
Historic-cultural relevance (HR)	3	Low; Medium; High	Low = 0 Medium = 3 High = 5
Social recognition (SR)	3	Unknown/low; Medium; High/Very high	Unknown/low = 0 Medium = 3 High/Very high = 5
Physical accessibility (PA)	3	No indications + Difficult access area; No indications + Easy access area; With indications	No indications + Difficult access area = 0 No indications + Easy access area = 3 With indications = 5
Level of adaptation for receiving visits (AV)	3	No visits allowed; The item can be visited, although the place is not accommodated for it; Visits are allowed and the place is prepared for visits.	No visits allowed = 0 The item can be visited, although the place is not accommodated it= 3 Visits are allowed and the place is prepared for visits = 5
Frequency of appearance in tourist guides (AG)	3	Null/low; Medium; High/very high	Null/low = 0 Medium = 3 High/very high = 5
Structural value (STv)	5	Null; Low; Medium; High; Very high	STv= EC + RP STv Null = 0 STv Low = 1-4 STv Medium = 5-6 STv High = 7-8 STv Very high = 9-11
Identity value (IDv)	5	Null; Low; Medium; High; Very high	IDv= RS + AF + AV + GT IDv Null = 0 IDv Low = 3-9 IDv Medium = 10-12 IDv High = 14-16 IDv Very high = 18-20
Hierarchy level	3	Central poles (CP); Structuring heritage (SH); Historical traces (HT)	Hierarchy level = STv + IDv CP>20 9<SH≤20 HT≤9

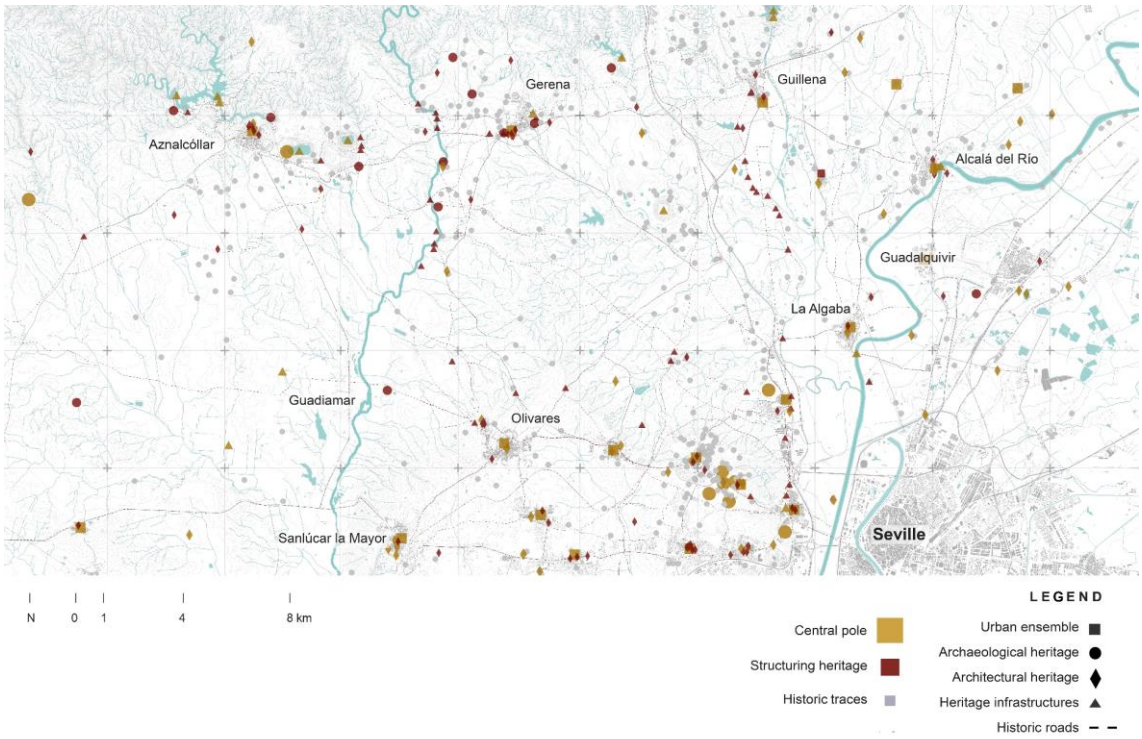

Figure 6. Map of the recorded heritage resources with the information of Block III: Hierarchy. Author: Marina López, 2020.

3.3 Step 2. Narrative construction

The first step of the methodology was to create historical and typology-based connections between the heritage assets. The next step consists of transforming these linkages into narratives supported by the landscape. For example, the fortifications, towers and other heritage resources that correspond to the typological classification "Defensive Architecture" can result in a story about the defensive capacity of the territory. For this, it is necessary to construct a narrative supported by the findings that have resulted from the diachronic analysis of the landscape. These findings will shed light on the political, social and geographic circumstances that may motivate the locations of the defensive pieces and the territorial role they have historically played. The diachronic analysis will also enable the incorporation of landscape features into the narrative that, due to their nature, cannot be incorporated into the inventory (e.g. a topographical elevation, a scenic background etc.).

The narratives can also incorporate historic testimony that cannot be seen in a specific heritage element. For example, there may be research evidence of the presence of a relevant human settlement through the study of documentary sources. However, it may occur that this information has not been able to be corroborated by archaeological search. The stories enable the transmission of this historic evidence to the listener or reader.

The methodological process to build the narratives is based on the relations stablished in the database. In our case study, six connections are identified due to belonging to a similar historical period and five due to typology (Figure 7). These connections are represented in the form of virtual networks to emphasise the interpretive link that exists between the resources.

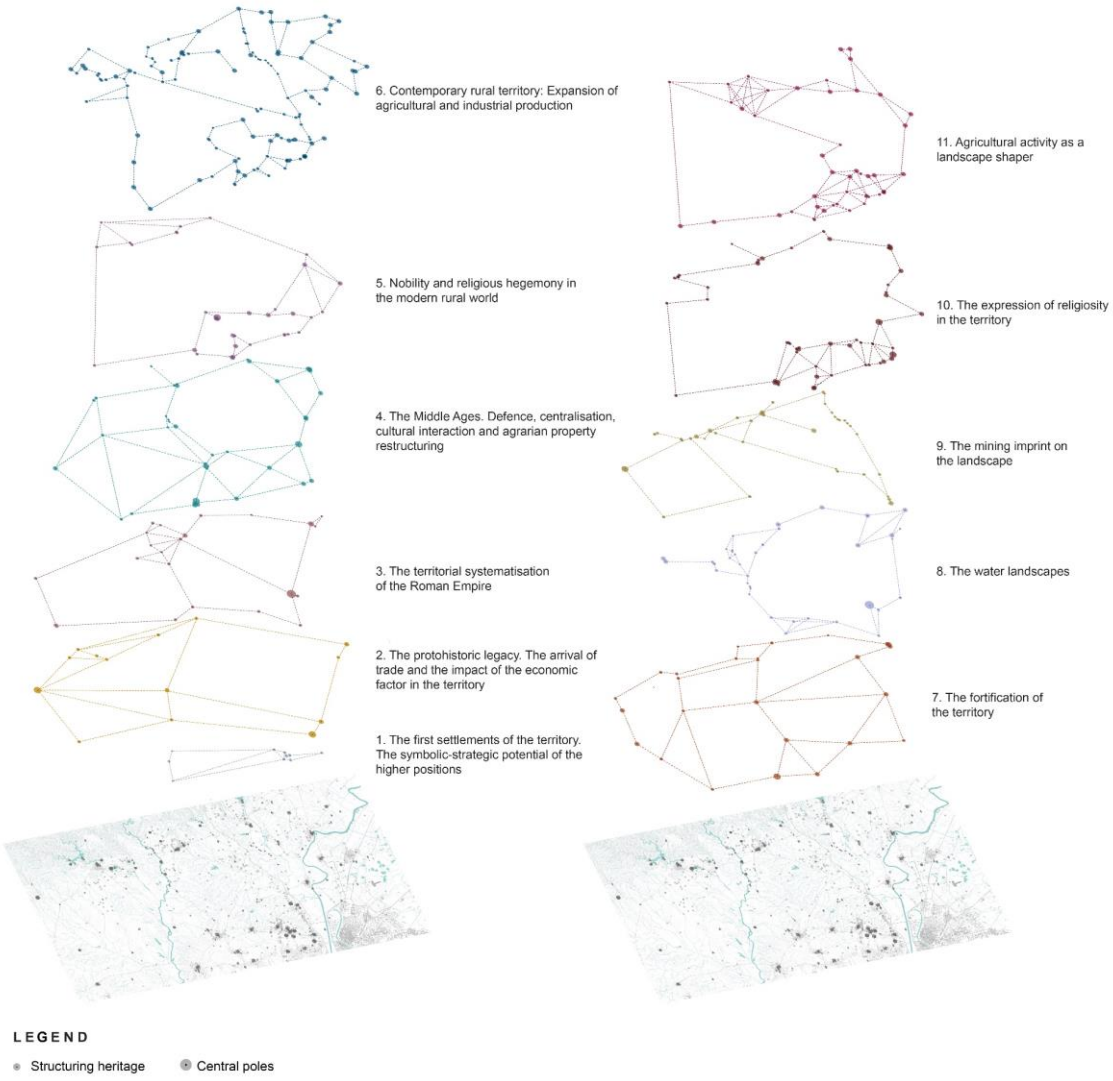

Figure 7. Diagram of the eleven virtual networks. Author: Marina López, 2020.

Based on these networks and supported by the information obtained through the diachronic analysis of the landscape, narratives are constructed mainly in the form of verbal information, although they are also accompanied by historical maps, photographs and other complementary graphic sources. Therefore, we obtain eleven virtual networks that assemble heritage elements that are historically or typologically related to each other and eleven narratives that accompany the networks and enable the understanding of these heritage relations through the interpretation of the landscape in which they are found.

Six of the narratives developed introduce the historical phenomena that shape the analysed landscape: 'The first settlements of the territory. The symbolic-strategic potential of the higher positions' (1); 'The protohistoric legacy. The arrival of trade and the impact of the economic factor in the territory' (2); 'The territorial systematisation of the Roman Empire' (3); 'The Middle Ages. Defence, centralisation, cultural interaction and agrarian property restructuring' (4); 'Nobility and religious hegemony in the modern rural world' (5); and 'Contemporary rural territory: Expansion of agricultural and industrial production' (6). Furthermore, five narratives revolve around the specific features that shape the character of the analysed landscape: 'The fortification of the territory' (7), 'The water landscapes' (8), 'The mining imprint on the landscape' (9), 'The expression of religiosity in the territory' (10) and

‘Agricultural activity as a landscape shaper’ (11). These eleven stories manifest the ability of the landscape to develop narrative threads from which to value territorial heritage in a structured and interrelated way.

The networks will include the three-level hierarchy of heritage resources of central poles, structuring heritage, and historical traces. Therefore, it is possible to find out whether the network is comprised of high visibility heritage elements that are in a good state of conservation, or whether, alternatively, most of its elements are less recognised heritage testimonials. This information is useful for finding out the real communicative capacity of the narrative. The combination of central poles with other heritage elements of local significance in the same narrative seeks to improve the situation of abandonment in which many minor heritage pieces are found. It also aims to provoke the interaction and mutual reinforcement between the different heritage resources of a territory, so that they stop being managed as isolated and decontextualized elements. It is also intended to reduce the tourist pressure on the most important monuments of the area.

3.4 Step 3. Implementation of narratives in a landscape project

The narratives are not just about story-telling but a proposal to enhance the landscape. In fact, they do not constitute a closed and invariable proposal; rather, on the contrary, they represent a specific way of valuing the current landscape through its heritage content. The narrative is already a project per se. They represent a specific response for the strengthening of the bonds between heritage management and landscape planning and design (López et al., 2020a), as they are aimed at increasing the interest of architects and landscape planners in history and heritage as sources of inspiration and spatial quality (Janssen et al., 2012). These professionals will be the ones that will create the necessary spatial conditions for the transmission of the proposed narratives in the territory. In this way, narratives shape historical knowledge into an operational tool that requires the approach and the resources of spatial design-related disciplines (Galindo & Sabaté, 2009). The goal of the narratives is to bridge historical information provided through archaeological reports, the analysis of historical cartography, etc., with proactive scenarios.

To achieve this objective, the method continues with the transformation of the virtual networks into accessible physical connections for the public (Figure 8). For this, GIS visibility and network analysis in combination with weighted overlay analysis have been used. The network analysis provides the most efficient routes to connect the heritage resources in terms of time and distance. Its results are laid over a map of five gradients of suitability of the territory for the heritage interpretation of the landscape, which has been obtained by a weighted overlay analysis that considers the historic depth of the land use, the visibility of the territory and its levels of visual and acoustic contamination. Both the definition of the routes and the boosting of their interpretive capacity (e.g. through signage) and social use (e.g. through rest areas) are the aims of the landscape project. Landscape planning and design thus become mechanisms of heritage legibility.

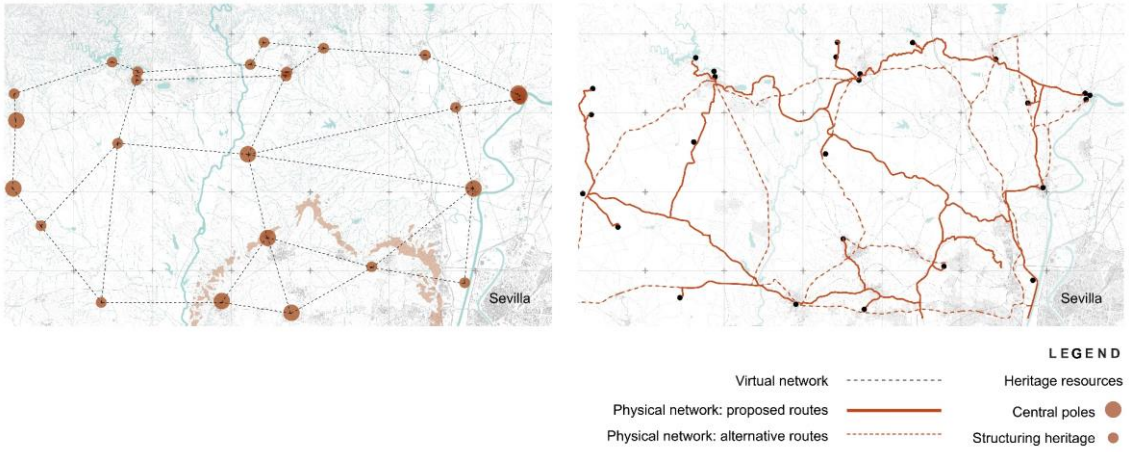

Figure 8. Transformation of the virtual network into the physical network. Narrative 7 'The fortification of the territory'. Author: Marina López, 2020

As well as the landscape project, the methodology will conclude with the implementation of a website that enables the user to access the narratives and find out about the routes associated with them. In this manner, synergies are produced between a digital environment and an *in situ* experience of the landscape. The complementarity between the consultation and viewing of digital information available on the heritage content of the territory and the subsequent visit to the landscape creates a comprehensive experience.

4 Discussion

This method represents the overcoming of conservationist positions through the 'protection through transformation' approach that ultimately aspires to fuse cultural history, created in the past, with planning and design, which aim to project the future. The proposed method responds essentially to the will to develop a GIS-based heritage management technique from which to construct a practice of informed design.

In any territorial area with a significant density of heritage resources, it will certainly be possible to cite several studies aimed at deepening historical knowledge (archaeological excavations and their reports, historiographic analyses, etc.). In the same way, there may also be other initiatives aimed at reflecting on possibilities for social use (architectural projects, tourism revitalisation plans, etc.). However, it is precisely the lack of transdisciplinary communication between both spheres that compromises a successful landscape project in the first place. With this in mind, the proposed method is presented as a practical resource that is used to promote transdisciplinary actions on the landscape. The method builds a framework that requires coordination and dialogue between historians, archaeologists, anthropologists, etc., responsible for the diachronic analysis of the landscape and the processes for creating an inventory and constructing the narratives, and geographers, architects, tourism professionals, economists, etc., responsible for transforming the historical research into a product for society.

A renewed vision of the role of GIS as a transdisciplinary environment aspires to make this technique a common language that encourages the constant development of cross-sectional perspectives that enrich the design exercise and give it the necessary arguments to face the inherent complexity of the landscape (López et al., 2020b). It is a step in advancing a science-based design (Burgers et al., 2014; Chen et al., 2014; Kolen et al., 2014; Wang & Gu, 2020), since GIS has potential to work as an environment that involves the fields that are traditionally

concerned with planning and design with those that acquire fundamental knowledge on how landscape systems operate and have operated (Goodchild, 2010). The interaction between historic analysis and landscape planning and design can create the necessary conditions to discover a new balance between conservation and development in the heritage field.

It will also be essential to integrate the perspective of the local population in the method, so that the current historical research-rooted narratives can be completed with others that incorporate the local perspective, thereby tackling the necessary approach of the landscape as a cultural phenomenon and social construction. The need for public participation is fully confirmed by the disciplines that converge in heritage and landscape management and planning (Fredholm et al., 2018; Stenseke, 2009; Thorkildsen, & Ekman, 2013). The definition of a public participation protocol represents the subsequent line of research from which to advance in the consolidation of the proposed model.

5 Conclusions

The research presented reacts to a flat and standardised land management, exclusively associated with quantitative parameters and unrelated to the specific landscape character. Said model of management, planning and territorial development has generated a multitude of diffuse landscapes that require a heritage approach in order to be reshaped under the principles of sustainable development. The specific heritage meaning and content of the territory, those that characterise it and make it different, bring us closer to the complex challenge of territorial sustainability.

The impossibility of approaching this priority goal without a transdisciplinary effort that integrates the characteristic long-term view of the heritage scenario in landscape planning has been confirmed. However, the development of protocols to assume such commitments, going a step further from the analysis of specific case studies, is less common at this time. The methodological route described, with its determined purpose to move from a static-delimiting to a dynamic-planning approach to heritage, offers a strategic line in this regard. Exploring its practical application in other territorial areas and developing its link with participatory processes are two lines of research to explore in the consolidation of the proposed method.

The cultural heritage is the legacy of our ancestors, a scientific and educational resource from which to understand the historical occupation of human beings on planet Earth. But, in addition to this traditional statement, nowadays heritage constitutes a strategic resource for avoiding general criteria and automated dynamics in spatial planning and design.

Acknowledgments:
The authors thank the Documentation and Studies Centre of the Institute of Historical Heritage of Andalusia for the heritage information provided.

The authors are also very grateful to the reviewers of this journal for their constructive feedback.

Biographical note for each author:

Marina López Sánchez Architect (School of Architecture, University of Seville 2016). Marina is currently a PhD candidate in the Doctoral Programme in Architecture of the University of Seville. The thesis explores innovative heritage management mechanisms argued from the standpoint of and towards the landscape and based on historical interpretation, cartographic analysis, mapping and digital documentation through GIS. In 2017 she received financial support for her research via the grant “Formación del Profesorado

Universitario" of former Spanish Ministry of Education, Culture and Sport. She teaches architectural design in the Higher School of Architecture of Seville.

Mercedes Linares Gómez del Pulgar. Associate Professor Doctor of Architectural Graphic Expression in the University of Seville. Specialist in Historical Heritage, she is a researcher of the XIXth Century Architecture, City and Landscape. Research Award Archivo Hispalense (2014) and Extraordinary Doctorate Award of the University of Seville (2013-14). She has won numerous national and international awards for her architectural work with TEJEDOR_LINARES & Asociados (www.tejedorlinares.com).

Antonio Tejedor Cabrera. Full Professor of Architectural Projects in the University of Seville. Extraordinary Doctorate Award US 1997-98. Specialist in sustainable interventions in Historical Heritage and Cultural Landscapes, he has been a consultant for the Andalusian Institute of Historic Heritage (1990-2001) and a member of the Andalusian Commission of Archeology (1997-2003). He has received the following international awards: Vote of Louvor from the University of Lisboa (2012); PRAM International Award for Restoration and Mediterranean Architecture (2013) and Finalist (second classified) in II MEDITERRANEAN LANDSCAPE AWARD (2007).

Disclosure statement:

The author declares there is no conflict of interest.

Funding information:

This research has been supported by the Consejería de Economía y Conocimiento of the Junta de Andalucía through the project "GISPARQ. Gestión Inteligente y Sostenible del Patrimonio ARQuitectónico: innovación digital y gestión integrada para la conservación, el turismo y la economía de la cultura" (US-1263780)**.**

Main author also would like to thank the Spanish Ministry of Universities for financial support via a research grant: "Formacion del Profesorado Universitario" (FPU16/02768).

ORCiDs for all authors:

Marina López Sánchez: http://orcid.org/0000-0002-7074-7279

Mercedes Linares Gómez del Pulgar: http://orcid.org/0000-0002-6323-1020

Antonio Tejedor Cabrera: http://orcid.org/0000-0002-1668-086X

References:

Agnoletti, M. 2006. *The conservation of cultural landscapes*. Wallingford: CABI.

Aldred O., and Fairclough, G. 2002. *Historic landscape characterization. Taking stock of the method. The National HLC Method Review*. Swindon: English Heritage and Somerset County Council.

Alonso-Rodriguez, M., A. Alvaro-Tordesillas, and E. Carazo-Lefort. 2017. "Infographic restitution of the historic centre of the Spanish town of Oviedo". *Computers, Environment and Urban Systems* 64: 154-168. doi: 10.1016/j.compenvurbsys.2017.01.009

Antrop, M., and V. Van Eetvelde. 2017. *Landscape Perspectives. The Holistic Nature of Landscape*. Cham: Springer.

Appendino, F. 2017. “Balancing Heritage Conservation and Sustainable Development - The Case of Bordeaux”. *IOP Conference Series: Materials Science and Engineering* 245(6): 062002. doi: 10.1088/1757-899X/245/6/062002

Araoz, G. F. 2011. “Preserving heritage places under a new paradigm”. *Journal of Cultural Heritage Management and Sustainable Development* 1(1): 55-60. doi: 10.1108/20441261111129933

Augé, M. 2008. *Non-places: An introduction to supermodernity*. London: Verso.

Bloemers, J.H.F., H. Kars, A. van der Valk, and M. Wijnen, eds. 2010. *The Cultural Landscape Heritage Paradox. Protection and Development of the Dutch Archaeological–Historical Landscape and its European Dimension*. Amsterdam: Amsterdam University Press.

Burgers, G., M. de Kleijn, M., and N. van Manen. 2014. “Urban Landscape archaeology, geodesign and the city of rome”. In *Geodesign by Integrating Design and Geospatial Sciences*, edited by D. J. Lee, E. Dias, and H. J. Scholten, 183-192. Cham: Springer.

Calderón Calderón, B., and J.L. García Cuesta. 2016. “Heritage and territory in Spain: fundamentals and strategies for managing territorial culture”. In *Cultural Heritage & territorial development*, edited by F. Manero Miguel and J.L. García Cuesta, 51-105. Cizur Menor: Thomson Reuters Aranzadi.

Chen, Y., A. Dang, and X. Peng. 2014. “Building a Cultural Heritage Corridor Based on Geodesign Theory and Methodology”. *Journal of Urban Management* 3(1–2): 97–112. doi: 10.1016/S2226-5856(18)30086-4.

Chías, P. 2012. “Territory and cartography. Landscapes and interpretations. Graphic, cartographic and literary images: Cádiz as a case study”. *EGA Expresión Gráfica Arquitectónica* 19: 38-47. doi: 10.4995/ega.2012.1356

Cornejo Ortíz, S. 2017. *Del conocimiento a la protección del patrimonio en pequeños municipios del Aljarafe sevillano* [From knowledge to the protection of heritage in small municipalities of the Sevillian Aljarafe]. Doctoral thesis. Universidad de Sevilla.

Feria Toribio, J.M., ed. 2012. *Territorial Heritage and Development*. London: CRC Press.

Fernández Flores, A., A. Rodríguez Azogue, and S. García-Dils de la Vega, S. 2017. *Carta Arqueológica Municipal de Alcalá del Río, Sevilla* [Municipal Archaeological Charter of Alcalá del Río, Seville]. Sevilla: Junta de Andalucía, Consejería de Cultura.

Fredholm, S. et al. 2018. “Conservation of historical landscapes: What signifies 'successful' management?”. *Landscape Research* 43(5): 735-748. doi: 10.1080/01426397.2017.1335864

Galindo González, J., and J. Sabaté Bel. 2009. El valor estructurante del patrimonio en la transformación del territorio [The structuring value of heritage in the transformation of the territory]. *Apuntes: Revista de estudios sobre patrimonio cultural* 22 (1): 20-33. Retrieved from: http://www.scielo.org.co/pdf/apun/v22n1/v22n1a03.pdf (accessed 09/10/20)

Garrido González, P. 2011. *La ocupación romana del Valle del Guadiamar y la conexión minera* [The Roman occupation of the Guadiamar Valley and the mining connection]. Doctoral thesis. Universidad de Sevilla.

García Fernández, F.J. 2003. *El poblamiento turdetano en el Bajo Guadalquivir* [The Turdetan settlement in the Lower Guadalquivir]. Doctoral thesis. Universidad de Sevilla.

Giordano, A., and T. Nolan. 2007. "Civil War maps of the Battle of Stones River: History and the modern landscape". *Cartographic Journal* 44(1): 55-70. doi: 10.1179/000870407X173850

Goodchild, M. F. 2010. **"**Towards Geodesign: Repurposing Cartography and GIS?" *Cartographic Perspectives* 66: 7-22. doi: 10.14714/CP66.93

Hökerberg, H., 2013. "Contextualising the periphery. New conceptions of urban heritage in Rome". *International Journal of Heritage Studies* 19 (3): 243-258. doi: 10.1080/13527258.2011.651739

Hunt Ortiz, M.A., J. Vázquez Paz, and P. Garrido González. 2017. *Carta Arqueológica Municipal de Aznalcóllar* [Municipal Archaeological Charter of Aznalcóllar]. Sevilla: Junta de Andalucía, Consejería de Cultura.

Instituto Andaluz de Patrimonio Histórico. Junta de Andalucía (n.d.). *Guía digital del Patrimonio Cultural de Andalucía* [Digital guide of the Cultural Heritage of Andalusia]. Retrieved from: https://guiadigital.iaph.es/ (accessed 13/10/20)

Janssen, J., E. Luiten, J. Renes, and I. Rouwendal. 2012. Heritage planning and spatial development in the Netherlands: changing policies and perspectives. *International Journal of Heritage Studies* 20(1): 1-21. doi: 10.1080/13527258.2012.710852

Kolen, J., J. Renes, and R. Hermans. 2015. *Landscape Biographies. Geographical, historical and archaeological perspectives on the production and transmission of landscapes*. Amsterdam: Amsterdam University Press.

Kolen, J., and J. Renes. 2015. "Landscape Biographies: Key Issues". In *Landscape Biographies. Geographical, historical and archaeological perspectives on the production and transmission of landscapes,* edited by J. Kolen, J., Renes, and R. Hermans, 21-47. Amsterdam: Amsterdam University Press.

Kolen, J., Renes, J., and Hermans, R. 2015. *Landscape Biographies. Geographical, historical and archaeological perspectives on the production and transmission of landscapes*. Amsterdam: Amsterdam University Press.

Kolen, J., N. van Manen, and M. de Kleijn 2014. "History Matters: The Temporal and Social Dimension of Geodesign". In *Geodesign by Integrating Design and Geospatial Sciences*, edited by D.J. Lee, E. Dias and H.J. Scholten, 173-181. Cham: Springer.

Kolen, J., and R. van der Laarse. 2010. *Reader in Landscape and Heritage*. Amsterdam: Amsterdam University Press.

Kolen, J. 1995. "Recreating (in) nature, visiting history. Second thoughts on landscape reserves and their role in the preservation and experience of the historic environment". *Archaeological Dialogues* 2: 127–159. doi: 10.1017/S1380203800000453

Koolhaas, R. 2002. Junkspace. *October* 100: 175-190.

Koolhaas, R. 1997. The Generic City. *Domus* 791: 3-12.

Llop Torné, C. 2011. La valoración y dinamización de los paisajes y el desarrollo económico local [The valuation and dynamization of landscapes and local economic development]. In *Retos y perspectivas de la gestión del paisaje en Canarias*, edited by M. Simancas Cruz and A. Cortina Ramos, 413-436. Gobierno de Canarias.

López Sánchez, M., A. Tejedor Cabrera, and M. Linares Gómez del Pulgar. 2020a. "Guidelines from the Heritage Field for the Integration of Landscape and Heritage Planning: A Systematic Literature Review". *Landscape and Urban Planning* 204: 103931. doi: 10.1016/j.landurbplan.2020.103931

López Sánchez, M., Tejedor Cabrera, A. y Linares Gómez del Pulgar, M. 2020b "Arquitectura y Sistemas de Información Geográfica: Hacia un Proyecto de Paisaje Informado" [Architecture and Geographic Information Systems: Towards an Informed Landscape Project]. *Proyecto, Progreso, Arquitectura* 22: 72-87. doi: 10.12795/ppa.2020.i22.04

Longstreth, R., ed. 2008. *Cultural Landscapes: Balancing Nature and Heritage in Preservation Practice*. Minneapolis: University of Minnesota Press

Loulanski, T. 2006. "Revising the Concept for Cultural Heritage: The Argument for a Functional Approach". *International Journal of Cultural Property* 13: 207-233. doi: 10.1017/S0940739106060085

Maggio, M. 2014. *Invarianti strutturali nel governo del territorio* [Structural invariants in territorial governance]. Florence: Firenze University Press.

Magnaghi, A. (2017). "La storia del territorio nell'approccio territorialista all'urbanistica e alla pianificazione" [The history of the territory in the territorialist approach to urbanism and planning]. *Scienze Del Territorio* 5: 32-41. doi: 10.13128/Scienze_Territorio-22229

Magnaghi, A. 2016. *La pianificazione paesaggistica in Italia. Stato dell'arte e innovazioni* [Landscape planning in Italy. State of the art and innovations]. Florence: Firenze University Press.

Magnaghi, A. 2012. *Il territorio bene comune* [The common good territory]. Florence: Firenze University Press.

Maio, C.V., D.E. Tenenbaum, C.J. Brown, V.T. Mastone, and A.M. Gontz, A.M. 2013. "Application of geographic information technologies to historical landscape reconstruction and military terrain analysis of an american revolution battlefield: Preservation potential of historic lands in urbanized settings, boston, massachusetts, USA". *Journal of Cultural Heritage* 14(4): 317-331. doi: 10.1016/j.culher.2012.08.002

Manero Miguel, F., and J.L. García Cuesta, eds. 2016. *Cultural Heritage & territorial development*. Cizur Menor (Navarra): Thomson Reuters Aranzadi.

Meinig, D.W., ed. 1979. *The Interpretation of Ordinary Landscapes: Geographical Essays*. New York: Oxford University Press.

Mejías García, J.C. 2017. *Formaciones sociales del III Milenio A.N.E. en Valencina* [Social formations of the III Millennium A.N.E. in Valencina]. Doctoral thesis. Universidad de Sevilla.

Pinho, P., and V. Oliveira. 2009. "Cartographic analysis in urban morphology". *Environment and Planning B: Planning and Design*, 36(1): 107-127. doi: 10.1068/b34035

Poli, D. 2017. Processi storici e forme della rappresentazione identitaria del territorio [Historical processes and forms of identity representation of the territory]. *Scienze Del Territorio* 5: 42-53. doi: 10.13128/Scienze_Territorio-22230

Poulios, I. (2014). Discussing strategy in heritage conservation. Living heritage approach as an example of strategic innovation. *Journal of Cultural Heritage Management and Sustainable Development* 4 (1): 16-34. doi: 10.1108/JCHMSD-10-2012-0048.

Rosa Jiménez, C.J. 2003. *Transformaciones metropolitanas en el territorio cultural del Aljarafe Sevillano* [Metropolitan transformations in the cultural territory of Aljarafe Sevillano]. Doctoral thesis. Universidad de Sevilla.

Rössler, M. 2006. "World heritage cultural landscapes: A UNESCO flagship programme 1992-2006". *Landscape Research* 31(4): 333-353. doi: 10.1080/01426390601004210

Roymans, N., et al. 2009. "Landscape biography as research strategy: The case of the South Netherlands Project". *Landscape Research* 34(3): 337–359. doi: 10.1080/01426390802381185.

Sabaté Bel, J. 2005. De la preservación del patrimonio a la ordenación del paisaje [From heritage preservation to landscape planning]. *Identidades: territorio, cultura, patrimonio*, 1: 15-33.

Sauer, C. O. 1925. "The Morphology of Landscape". *University of California Publications in Geography* 2 (2): 19-53.

Scazzosi, L. 2004. "Reading and assessing the landscape as cultural and historical heritage". *Landscape Research* 29(4): 335–355. doi:10.1080/0142639042000288993.

Schlögel, K. 2003. *In Space We Read Time: On the History of Civilization and Geopolitics Bard Graduate Center cultural histories of the material world Cultural histories of the material world*. New York: Bard Graduate Center

Stenseke, M. 2009. "Local participation in cultural landscape maintenance: Lessons from Sweden". *Land Use Policy* 26(2): 214-223. doi: 10.1016/j.landusepol.2008.01.005

Taylor, K., A. St Clair, and N. Mitchell, eds. 2017. *Conserving Cultural Landscapes: Challenges and New Directions*. London: Routledge.

Taylor, K. 2016. "The Historic Urban Landscape paradigm and cities as cultural landscapes. Challenging orthodoxy in urban conservation". *Landscape Research* 41(4): 471-480. doi: 10.1080/01426397.2016.1156066.

Taylor, K., and J. Lennon. 2011. "Cultural landscapes: a bridge between culture and nature?" *International Journal of Heritage Studies* 17(6): 537-554. doi: 10.1080/13527258.2011.618246

Thorkildsen, A., and M. Ekman. 2013. "The complexity of becoming: collaborative planning and cultural heritage". *Journal of Cultural Heritage Management and Sustainable Development* 3(2): 148-162. doi: 10.1108/JCHMSD-10-2012-0053

Ureña, J. M. de, and Coronado, J. M., 2018. "El patrimonio urbano como oportunidad para recualificar las periferias metropolitanas: especial referencia a Madrid" [Urban heritage as an opportunity for urban renewal of peripheral metropolitan areas: special reference to Madrid]. *Ciudad y Territorio Estudios Territoriales (CyTET)* 50 (195): 85-100. Retrieved from https://recyt.fecyt.es/index.php/CyTET/article/view/76611

van der Schriek, M. 2019. “Landscape biographies of commemoration”. *Landscape Research* 44(1): 99-111. doi: 10.1080/01426397.2018.1427710

Wang, S., and K. Gu. 2020. “Pingyao: The historic urban landscape and planning for heritage-led urban changes”. *Cities* 97: 102489. doi: 10.1016/j.cities.2019.102489.

Whelan, Y., and N. Moore. 2016. *Heritage, Memory and the Politics of Identity: New Perspectives on the Cultural Landscape*. London: Routledge.

Zoido Naranjo, F., and J. Rodríguez Rodríguez. 2015. *Catálogo de paisajes de la provincia de Sevilla* [Landscape catalogue of the province of Seville]. Sevilla: Centro de Estudios de paisaje y territorio, Consejería de Medio Ambiente y Ordenación del Territorio.