



CULTURAL LANDSCAPE

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Cultural Landscape

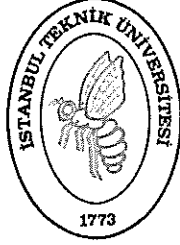
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HERITAGE LANDSCAPES IN ÉVORA SURROUNDINGS: A GIS APPROACH

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Keywords: *Cultural Landscapes; Roman and Medieval Cadastral Networks; Montados Landscapes; Heritage Value; GIS.*

Abstract

Évora (the Lusitanian Eborá), the most important town in Alentejo province (Southern Portugal) is involved by a cultural landscape where not only archeological sites and old built structures (walls, roads, bridges houses, etc.) of several epochs are present, but also old parcel networks and specific agro forestry pastoral systems, the montados, exist.

In front of a so big quantity of data, the authors have selected four main heritage valued landscapes:

- The holm-oak, cork-oak, or mixed montados landscapes.
- The old Augustan roman cadastral networks;

- The old Late Empire roman cadastral networks;
- The old Medieval ground parcels network;

Our first theme is related with holm and cork oak montados, traditional agro forestry pastoral systems classified by law. Beyond the productive function, these cultural landscapes present high biological, scenic and recreational value. In the area several different types with different levels of conservation are present. Other kind of heritage landscapes were also studied: two roman cadastral network involving Eborá (the roman Évora), of different periods and with different orientations, and a medieval parcels network located in the close surroundings of the city. An essay of heritage valuation of those heritage landscapes was also done. Firstly the selection of suitable criteria and related weighting coefficients was established in the sequence of debates with experts. Then the application of a linear combination permitted to estimate heritage value. GIS tools were very useful to the integration of such spatial themes and their analysis. It utilization permitted to determine the zonation of the most valuable heritage landscape areas around Évora. Otherwise the use of GIS database allowed the overlaying of the four heritage landscapes types, as well as the calculation of the networks limits density, permitting to define the most interesting areas to be preserved in land planning projects.

What is a heritage landscape?

Cultural Landscapes can be considered as 'illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal' (WHC, 2005, paragraph 47). This concept is then dynamic since cultural landscape is the product of a long-term, scientifically demonstrable nature/human interactive process (Fowler, 2006). Exploring how heritage demands newly focus on landscape, David Lowenthal (1993, 4) argues that 'the word landscape subsumes three vital concepts: nature as fundamental heritage in its own right; environment as the setting of human action and sense of place as awareness of local difference and appreciation of ancestral roots'. On the other hand 'linkages of present with past are felt to need not just isolated heritage icons but the cultural landscape's embedding framework' (Lowenthal, 1993, 5). The present character of many of these landscapes is a 'palimpsest of elements from the past and present' (Aplin, 2007, 430), where the persistence of plans law was more or less determinative, though the dynamics of the landscape morphology evolution can be considered, for certain authors, as a linear and ontogenetic model corresponding to the birth-life-dead scheme (Marchand, 2007, 3). Several types of values can be conferred to the cultural landscapes their attribution modes depending from the persons or group of actors. Being the heritage value one of these types, the most valued cultural landscapes concerning this aspect can be designated as 'heritage landscapes'. This kind of heritage is even considered by certain authors as a 'dynamic heritage', an evolution and transmission dynamic process that can be called 'transformission process' (Marchand, 2007, 4). The heritage landscapes can present a great typological diversity since: 1) they reveal specific interactions between humans and their environment; 2) they are associated with living traditional cultures; 3) they preserve traces of disappeared human land use types (WHC, 2004, cit. by Aplin, 2007, 430). In the surrounding area of the city of Évora (Central Alentejo, Portugal) it is possible to identify four different heritage landscapes: two roman cadastral network from different epochs, a medieval parcels network and the montado of holm- or cork-oak (or mixed). According to the World Heritage

Convention classification, if the montado landscape is clearly a type of continuing landscape, the three first ones can be placed between the relict (or fossil) and the continuing landscapes. In fact, if their evolutionary process (with their typical morphology and agrosystems) came to an end at some time in the past, and its significant distinguishing features are still visible in material form, on the other hand it can be considered that they maintain actually a certain active social role through the referred transmission process. The establishment of landscape hierarchization methods is desirable for land planning purposes but it is a very delicate matter due to the subjectivity of many judgments. Nevertheless semi-quantitative methods for the heritage value estimation can be contemplated. They can be very useful for conservation purposes specially during land planning projects. If the scientific analytical methods can be complex, an effort must be done to a shared understanding between researchers and the inhabitants. In fact the in the global landscape qualification the aspirations of the concerned populations must be integrated (Luginbühl, 2006).

The Évora surrounding landscapes as case study

The Évora main heritage landscapes

The Montados landscapes

The montado is a typical landscape from the south-western Iberian Peninsula, traditionally related with agro-forestry -pastoral systems where open formations of pure or mixed cork and holm oaks (and even other kind of trees) are part of the arboreous layer under which a rotation of crops / fallows / pastures takes place. In Portugal, they are located mainly in the province of Alentejo, south of Tagus river, in a geographical context characterized by gentle slopes and poor soils with a Mediterranean-Continental strong climate annual fluctuations. Traditionally, pigs, sheep and eventually other livestock, as bovines and sometimes goats, feed on acorns, shrubs and grasses under the trees, controlling the nutrient cycles (Pinto-Correia and Vos, 2004). The main forest products from these systems are wood (timber) from the top of trees and destined to firewood or charcoal, and cork, the main asset from the cork-tree montado. The real montado system (as a silvo-pastoral system) would start between 2500 and 1500 B.C. (Stevenson 1985, 1988; Stevenson and More 1988, cit. by Joffre et al. 1999). In which concerns the transformation of this system into an agro-silvo-pastoral system, some signs may be found in municipal by-laws of the 16th century, showing the existence of cereal breeding under arboreous cover, but it was during the 18th century, that this practice was generalised (Fonseca, 2003). Nevertheless it was mainly by the end of the 19th century that the great expansion of the cultivated montado happened (Ferreira, 2001). Important structural alterations in the economy of these systems took place during the 20th century: the Iberian black swine making the best use of acorns, prevailed until the sixties after which it suffered a great regression with the African swine fever; on the other hand, the growth of mechanised cereal culture was responsible for a great regression in the holm oak montado area and, since the seventies, the reconversion of the system into forestry-pastoral, with the increase of bovines and decrease in sheep production. This complex land use system has produced "one of the most aesthetically pleasing and biologically rich landscapes in Europe" (Pinto-Correia and Mascarenhas, 2001, 100). By these reasons, the montados are actually under legal protection (Decree-Law 140/99, April 24 – Annex B-1 (republished by Decree-Law 49/2005, February 24); Directive 92/43/CEE, May 21 – Annex I; Decree-Law 169/2001, May 25, with alterations; Decree-Law 155/04, June 30) and can be considered as heritage landscapes.

The Roman Augustan cadastral network

The Roman Évora (Ebora) was referred by Pliny (NH, IV, 117) as oppidum veteris Latii with the cognomen Liberalitas Iulia. It was founded by Augustus, registered as the Galeria tribe, and has had municipal status since those times. A study of the organization and arrangement of the Ebora landscape was realized between 1993 and 1995, in the context of a landscape ecological project developed in Évora University. The description of the study is presented in Clavel-Lévêque et al. (1995), Plana-Mallart (1995, 2002) and Mascarenhas and Barata (1997). In order to verify the existence of a roman cadastral network, a landscape morphological analysis, based on topographical maps and on the interpretation of 1958 vertical aerial photographs and satellite images (Landsat TM and SPOT), was carried out. Remains of a cadastral network with the same orientation as the urban structure Kardo Maximus and Decumanus Maximus (NW/SE orientation; about 30/31 degrees) were found. The restitution of the network remains allows a 20 actus module theoretical framework to be proposed. Surveys of the terrain have shown that many network limits are still manifest in elements such as cobblestones and stretches of hollow paths, rural tracks, banks, ancient stone walls, boundary stones, canalized water courses, etc.. Symbolic structures connected with the network lines and nodes, as wayside crosses, rural chapels and cemeteries, were identified. The land parcels resulting from this land planning operation would be granted to native people at the moment of the Ebora municipal foundation (Clavel-Lévêque et al., 1995).

The Late Roman Empire cadastral network

Ebora city remained an important center throughout the Late Empire, epoch where land renormatio operations took place. They started during the Dioclecian government and his colleagues, almost all with tax purposes (jugatio), as identified in Lusitania, at Pax Iulia and Conimbriga (Mantas, 1990, 1996). One of the characteristics of these cadastrations is putting to use the existing roads to the Kardo and Decumanus ways. This type of situation is identified at Beja (Pax Iulia) and, according to collected data from Évora surroundings, a similar case occurred here with a cadastration assigned to the Late Empire. The analysis of maps, aerial photographs and satellite images allows the detection of traces of a cadastration subsequent to the Augustan one, with the centuria quadrata module (710 x 710 m). The cadastral network shows an orientation close to N / S, and is easily identified between Pachola farm area, northwards, and São Marcos da Abóboda farm, southwards. In these areas several milestones were identified and the presence of roman remains, including large villae, is generalized (Saa, 1963, 80-109 and 234-269; Bilou, 2004; Carneiro, 2009, 99-116). The remains extend, from east to west, since Fonte Coberta farm till Guadalupe village, more or less, scattered by roman habitats (in part unpublished: Archaeological Map in course). The systematic study of this cadastral system, is just in the beginning, and will oblige to realize an exhaustive field-work. Nevertheless its presence is ensured by the available information, either through an orthogonal way network and associated cross roads and other structures, or through the coincidence of certain cadastral alignments with administrative limits.

The Medieval cadastral network

If the land use of Évora region in the Islamic occupation period is very unclear, the situation is better known after the Reconquest, from the XIII century on; putting in evidence a close relationship between the agricultural systems and the pattern of the fields now arranged in rings around the city and with some agricultural specialities. Four rings of agricultural systems

could be distinguished (Barata and Vilar, 1995, cit. by Barata and Mascarenhas, 2002, 126-128): in the first one, the nearest to the city, dominated the "ferragiais" (irrigated green fodder fields), or in alternative, the kitchen-garden parcels under a rotation regime. In the second ring the vineyards prevailed and occupied the best soils near the streams margins. In the third ring were the farms enclosing various crop fields (extensive cereal culture) with grazing land. Finally, outside this last ring was grazing land. Nevertheless a cultural exclusivity inside each ring cannot be considered although a clear land use specialization in Évora surroundings existed. The field works and the analysis of the maps and aerial photos showed that several limits of the medieval parcels network are coincident with those of the roman period specially in areas near the city, in the East and Northwest quadrants (Mascarenhas and Barata, 1997). Nevertheless the medieval cadastral network could present parcels with irregular forms and various shapes (square, rectangular, long) depending more "on the morphology of the terrain and the conditions of water access than on any planning action. Also according to the land-owners' wealth and the quality of the soil, the field areas could be quite different" (Barata and Mascarenhas, 2002, 126).

The heritage value of Évora heritage landscapes

The natural heritage

● **The vegetation heritage**

The Montado, largely constituted by cork-oak (*Quercus suber*) and holm-oak (*Quercus rotundifolia*) and often by a mixed of both is a recognized high biodiversity value, protected by Habitat Directive (92/43/ECC) and included in Nature 2000 network. The Montado landscapes (Habitat 6310) with their peculiar land use and management systems allow the existence of *Poetea bulbosae* grasslands (Habitat 6220 *) and other valued vegetation as mediterranean temporary ponds grasslands (Habitat 3170*) and chasmophytic vegetation (Habitat 8220) existing in siliceous rocky slopes. On marginal, abandoned or declivous slope areas the scrublands evolve to serial maquis communities such as strawberry-tree (*Arbutus unedo*) shrubland (Habitat 5330).

There are also some important riparian forests like small leaf ash (*Fraxinus angustifolia*) thermophile woodlands (Habitat 91B0), willow woodlands of *Salix salviifolia* subsp. *australis* (Habitat 92A0), European alder (*Alnus glutinosa*) woodlands from permanent streams riversides (Habitat 91E0), tamarisk communities of *Tamarix africana* (Habitat 92D0) from intermittent streams and communities of *Ranunculus* sp. (Habitat 3260) from siliceous water streams. Finally other rare, endemic or menaced taxa can be find on study area: *Limodorum abortivum* (L.) Swartz, *Narcissus Jonquilla* L., *Halimum verticillatum* (Brot) Senen.

● **The faunistic heritage**

The Évora faunistic heritage is hardly related with agriculture and silvo-pastoral activity in the region. The study of the diversity was applied to thirteen sample areas around Évora, where field surveys of mammals, birds, reptiles and amphibians took place. As a result of this action, 63 bird species (Rabaça et al 1995), 18 mammal species (Marques 1997), 11 amphibians' species and 10 reptile species (Raimundo 1995) were registered (Batista 2000). Some rare and vulnerable species were identified, like *Streptopelia turtur* and steppe species, like *Tetrax tetrax* and *Otis tarda*. Mammals like *Genetta genetta* and *Lutra lutra* are also threatened by several anthropogenic activities like intensive agriculture and uncontrolled hunt. It occurs also

some less frequent reptiles like *Macroprotodon cucullatus* (cobra-de-capuz), and *Hemidactylus turcinus* e *Emys orbicularis* species, which have indeterminate status. The Évora region has a medium to high fauna heritage value, which needs to be preserved.

The built heritage

The importance of Évora along the times is mainly related with its location near a remarkable landscape site: the Distribution Centre of the Sado, Tejo and Guadiana basins, and the relatively abundant hydric resources. These conditions help to understand why agricultural and shepherd activities took place in that area since longtime, and why it was the main passage way of the center-south road of Lusitânia, particularly in the roman, medieval and modern periods (Barata and Mascarenhas, 2002). So around this old city numerous traces of human intervention such as pre-historic habitats, megalithic monuments, hillforts, roman villae, convents, monastic and secular farms, can be found. During the STRIDE project (Mascarenhas, coord., 1995) a built heritage (archaeological and architectonic) survey was realized and the heritage value of each monument could be estimated through a linear combination function where several criteria and weighting coefficients were used (Mascarenhas, 1995).

Method of heritage valuation of cultural landscapes

The same general method used to the estimation of the built heritage value was applied to heritage landscapes. For this essay, the selection of suitable criteria and related weighting coefficients was done in the sequence of debates with experts (Table 1).

Considering four classes of valuation (High; Medium-high; Medium-low and Low), it was possible to appraise the importance of each landscape concerning each criteria (Table 1). Considering a general scale of values (convenience scale), a number was assigned to each class, allowing the linear function application and the heritage value (Y) estimation:

$$Y = \sum_{i=1}^n a_i \cdot X_i$$

n - number of criteria; a_i - weighting coefficient; X_i - value concerning criteria i)

After the conversion to the 0-100 scale, the results of the heritage value for each landscape were the following: Montado landscape: 57,7 ; Augustan roman cadastral network: 51,2 ; Late Empire roman cadastral network: 50,4; Medieval parcels network: 37,4.

GIS tools for the heritage landscapes integration

For the integration of the different cultural landscapes it was used ARCGIS 9.3 software. Montado landscape was extracted from Corinne Land Cover level 5 (CLC N5) map at scale 1:10.000 (Batista in press), elaborated using digital ortophotomaps from 2005 (from DGRF 2006) and field validation at the end of 2008. We selected the montados areas, regarding all the forms that it appears in the field: disperse montado, open montado, dense montado, with pasture or scrubs, in pure forms (*Quercus suber* or *Quercus rotundifolia*) or mixed (at times with other species as olive trees). The Augustan roman cadastral network, the Late Empire roman cadastral network and the Medieval parcels network analogical maps, resulting from field surveys and aerial photo interpretation, where digitalized allowing the realization of four heritage landscapes maps for the study area (figure 1). The overlaying of these landscapes types (figure 2), as well the calculation of the networks limits density, permitted to define the

Table 1.
Selected criteria and weighting coefficients utilized in the estimation of cultural landscapes heritage value through a linear combination function and valuation of the Évora heritage landscapes. Only four valuation classes were considered: H - high; MH - medium/high; ML - medium/low; L - low

Criteria	Weighting coefficient	Heritage landscapes			
		Montados	Augustan Roman cadastral network	Late Roman Empire cadastral network	Medieval cadastral network
<i>Built heritage</i> (architectonic and archaeological) richness	3	L	ML	ML	L
<i>Natural biotic heritage</i> (vegetal and animal) richness)	3	MH	ML	ML	MH
<i>Natural abiotic heritage</i> (palaeontological, geological and geomorphological) richness. Weighting coefficient	3	L	L	L	L
<i>Rarity of the heritage landscape type</i>	4	ML	H	H	ML
<i>Antiquity</i> of the coherent spatial structures of the heritage landscape	2	L	ML	ML	L
<i>Scientific potential</i> : potential offered by the heritage landscape concerning the archaeological and/or historical and/or geographical research. Existence of index related with the importance of the landscape to the evolution or alteration of theories actually accepted.	4	H	MH	H	H
<i>Recreation potential</i> : potential offered by the heritage landscape concerning the amusement usufruct.	1	H	ML	ML	ML
<i>Didactic potential</i> : potential offered by the heritage landscape concerning the educational activity	2	MH	MH	ML	H
<i>Historic record</i> : quality and development of the realized landscape research and of the related documental production	1	H	H	MH	L
<i>Conservation statute</i> : importance of the classification statute if existing.	3	H	L	L	L
<i>Symbolic importance</i> : connection of the heritage landscape with historical and/or religious events.	2	MH	MH	MH	ML
<i>Coherence degree</i> of the spatial structures related to certain(s) epoch(s). Weighting coefficient	4	ML	H	MH	MH
<i>Conservation degree</i> of the spatial structures (identification marks) of the heritage landscape (as, for example, walls, terraces, canals, hedgerows, tree corridors, paths, cobbled roads, etc.)	3	MH	MH	ML	ML
<i>Aesthetical quality</i> of the heritage landscape when observed from terrestrial sites.	2	H	L	L	ML
<i>Monumentality</i> : grandiosity of the heritage landscape when observed from terrestrial sites. It is in a great extent reflex of the topographic insertion of the spatial structures. Weighting coefficient	2	H	MH	MH	ML
<i>Rango</i> : surface occupied by the heritage landscape	2	MH	H	H	L

most interesting areas to be preserved. The density calculation was made with linear density tool from ARCGIS spatial analyst tools. This tool calculates the density of linear features in the neighborhood of each output raster cell. Density is calculated in units of length per area unit. Conceptually, a circle is drawn around each raster cell center using the search radius. The length of the portion of each line that falls within the circle is multiplied by pixel values. The result is a map density with 633 m ratio and 25 meter pixel (figure 2). This synthetic map can be then used as a land planning important tool.

Conclusions

After have identified, analysed and drawn maps of four different heritage landscapes in the surroundings of Évora, the authors have realized an essay concerning the application of a heritage valuation method as well as a GIS treatment allowing the landscapes cartography

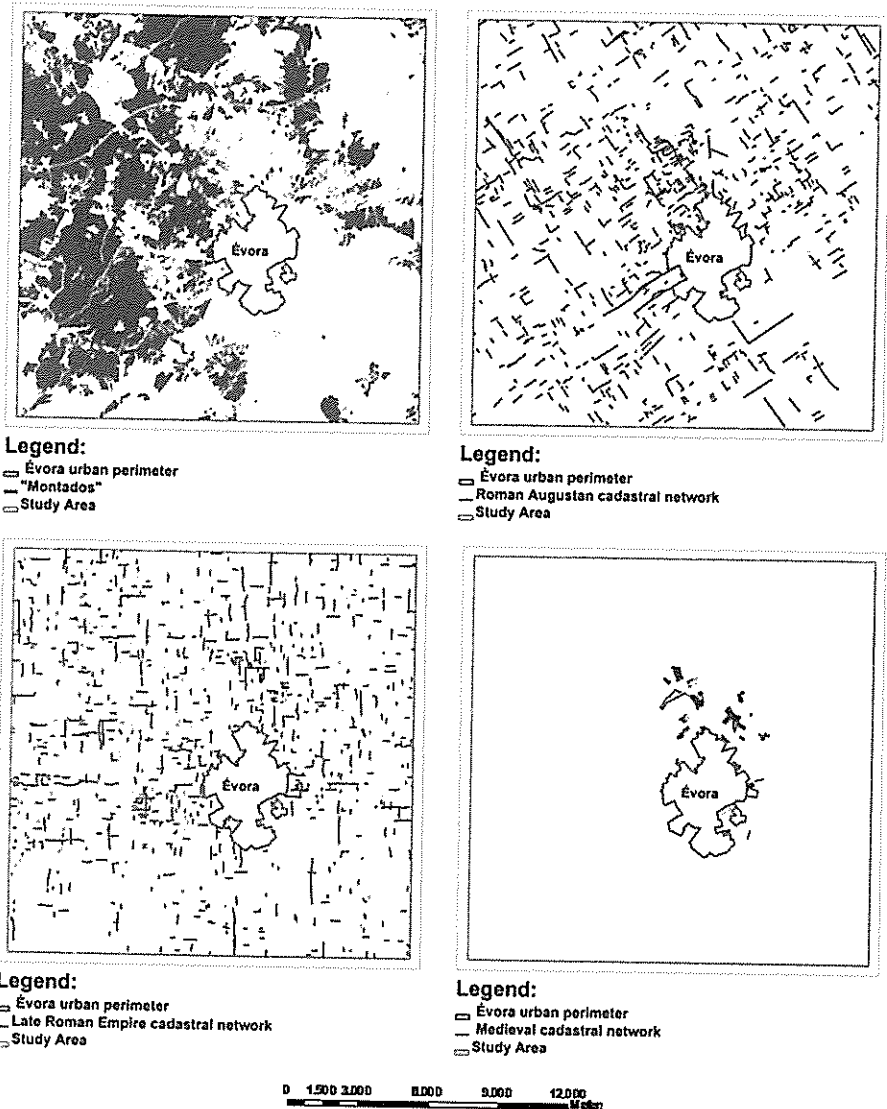
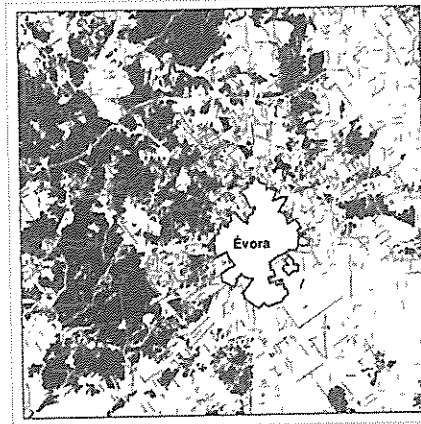
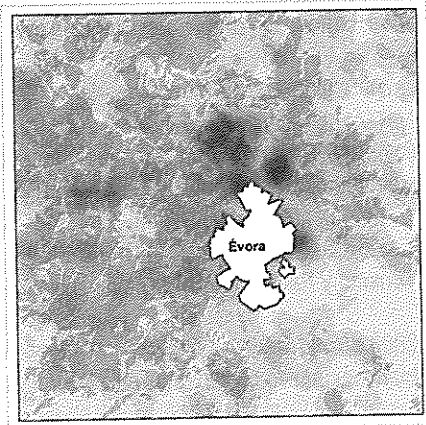


Figure 1. The Évora heritage landscapes: Montado landscape, Roman Augustan cadastral network, Late Roman Empire cadastral network and Medieval cadastral network.

and the delimitation of the richest areas in terms of heritage landscape quality (networks marks density and montados covering). This zoning can be very interesting for conservation purposes since the preservation of the old network marks aid to understand the morphology of the successive landscapes in space and time. Nevertheless it is convenient 'to decide what degree of interference or stitching in of new uses is permissible' (Esposito and Cavelzani, 2006, 412). One of the most interesting aspects related with the conservation of these marks concerns their transmission mode along the time based on an auto-organisation process, and their role in the ulterior frames. This is an interesting theme for a further GIS based research by the authors, in the Évora region, since many of these marks have conditioned the morphology of the later parcels networks and the great majority play yet a part as limits of properties in land, of ground parcels, roads, canals, etc.. Another possible further research theme con



- Legend:**
- Evora urban perimeter
 - Roman Augustan cadastral network
 - Medieval cadastral network
 - Late Roman Empire cadastral network
 - "Montados"
 - Study Area



- Legend:**
- Evora urban perimeter
 - "Montados"
 - Study Area
 - Cadastral network density (633 m)
 - density /m²
 - 0 - 0
 - 0,01 - 0
 - 0,01 - 0
 - 0,01 - 0
 - 0,01 - 0
 - 0,01 - 0,01
 - 0,02 - 0,01
 - 0,02 - 0,01
 - 0,02 - 0,01
 - 0,02 - 0,01

0 1.500 3.000 4.500 6.000 7.500 9.000 10.500 12.000 Meters

Figure 2.
The overlaying of the four Évora heritage landscapes types and synthetic map presenting the Montado landscape and the cadastral limits density.

cerns the ecological landscape role of these limits (Caravello and Gioacomin, 1993) seeing that many of them are materialized by hedgerows, trees alignments and other kind of vegetation corridors with their functions of connectivity and habitat, among others. Contrasting with some other aspects that are rapidly homogenising cultures through the globalisation, the preservation of heritage landscapes are a good contribution to the maintenance of lands with distinctive character.

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