

Visual Impact On Wetlands: Consequence Of Building Sprawl In Rural Areas Of The West Of Spain

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EXTENDED ABSTRACT

Growing awareness of the recreational potential of wetlands, coinciding with urban sprawl in the late 20th century and the improvement of communications, has promoted recent human movements to rural areas (Dwyer and Childs, 2004). This has led to increasing tourist buildings in the rural surroundings of some wetland environments which seriously affect the attractiveness of the natural views. The abandonment of agrarian activities in many of these rural areas, is also damaging unique cultural landscapes that had been preserved over several centuries.

In this context, municipal planning has not evolved at the same rate as the issues imposed by the new rural urbanism so that current development fails to combine visual integration and functionalism. For that reason, the main objective of this research is to create a methodology based on GIS and infographics programs to determine which building parameter thresholds, related to size and design aspects, can minimize visual impacts in rural wetland surroundings in the Western of Spain.

To achieve this, firstly we carried out a diagnosis phase of a selected area in the north of Extremadura (central-west of Spain), to test the real urban situation of several rural municipalities (Figure 1). Thus, we reviewed different local planning legislation for each municipality in the study area, and we also chose several rural buildings to analyze the degree of compliance with local planning laws, especially regarding building parameters and design criteria. Results from the diagnosis showed that the lack of homogeneous criteria in the drafting of local planning laws, among adjacent municipalities, raises the necessity for researching the influence of non-subjective criteria such as building parameters, (height, volume), and design characteristics (colours and textures), that combine rural planning and environmental protection.

For that reason in a second phase of the study, (Figure 1), we will undertake a public survey which compares, for every building parameter

selected from the diagnosis phase: colour, texture,

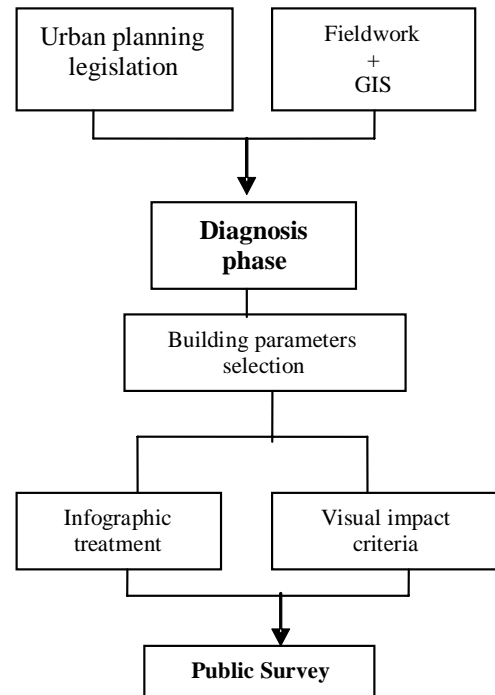


Figure 1. Methodological framework.

and scale (height and volume), a real photo with three modified ones. Two of these photos are created by comparing a pair of types of visual elements (colour, textures and scales), between a building and the background, and using Photoshop software, obtaining those combinations of these elements that reach visual continuity (VC) and therefore less visual impact, or on the contrary produce poorly compatible contrast (PCC) with higher impact (García 1998; García et al., 2003 and 2005). The third modified photograph will be obtained by changing real building parameters into the legal ones collected from the local planning laws in the study area. As a result, from the survey responses we will measure how far or how near are the real and legal photos from VC or PCC by testing observer preferences. The outcome of the study will be guidelines for future urban law, regarding the establishment of building thresholds.

1. INTRODUCTION

Wetlands have begun to achieve greater international recognition, attributable to growing ecological interest in their biodiversity and, more recently, an appreciation of the cultural heritage that many of them harbour. They have also awakened great interest in the interpretation and educational forms of tourism (ecotourism, cultural tourism) (Viñals *et al.*, 2003).

Growing awareness of the recreational potential of wetlands coinciding with urban sprawl in the late 20th century and the improvement of communications, has promoted recent human movements to rural areas (Dwyer & Childs, 2004). Accelerated development of tourist buildings in the rural surroundings of some wetland environments, is seriously affecting the attractiveness of their natural views. The abandonment of agrarian activities in many of these rural areas, is also damaging unique cultural landscapes that had been preserved over several centuries. Sustainable landscape development must recognize not only ecology integrity but also human needs in a coherent planning process (Forman, 1990). Building sprawl in rural areas is a point pressure on these delicate landscapes.

Municipal planning has not evolved to deal with this new rural urbanism. Visual integration and functionalism are not being adequately combined. Furthermore, while all human senses are fundamental to landscape perception, most studies of landscape perception consider sight as the most important sense in environmental perception (Español, 1998).

On the other hand, computing development from the eighties, and especially from the nineties, has led to important advances in the resolution of these landscape planning problems (Hernández & García, 2001).

Recently GIS (Geographic Information Systems), have been applied in the calculation of several landscape variables (Bishop *et al.*, 2004), including models to determine the quality of the landscape. In the Spanish context, tools based on GIS and CAD (Computer Aided Design) technologies have been used in sustainable rural management and its conservation, including efforts to identify the best building emplacement with least visual impact combining design and landscape elements (Ayuga *et al.*, 2001).

The principal aim of this research is to understand the limitations of the existing municipal planning and to create a methodology based on GIS and info-graphics programs to determine which building parameter thresholds, related to size and

design aspects, can minimize visual impacts in rural wetland surroundings in the West of Spain.

After a description of the study area the research is described in three phases: a review of methodological issues, a diagnosis of the extent of the problem based on GIS and visual analysis, and a planned survey phase which will develop guidelines for future development.

2. STUDY AREA

The municipalities analyzed in the present study (Figure 1) are located in the *Valley of the Ambroz* (290 km²) situated in a rural area of the north of Extremadura (West side of Spain) (40°15'0.4"8 W- 6°01'10"8 N). In the high zones deciduous forests predominate, the chestnut tree being the

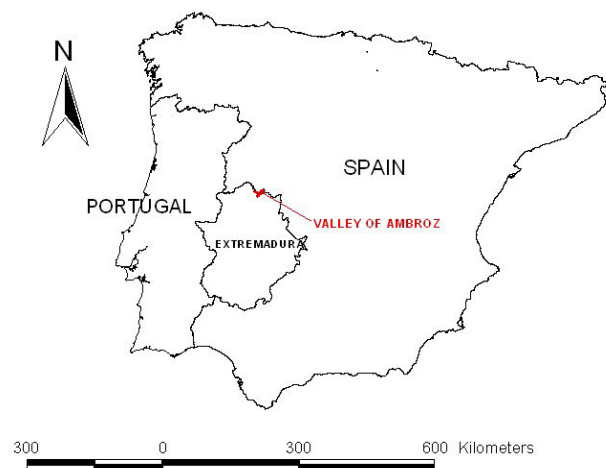


Figure 1. Map of the study area.

outstanding species, with an important nucleus of companies for chestnut products. On the other hand, water resources are essential for this region, not only for the agrarian activity, but also for leisure. Thus, the abundant rivers, gorges and wetlands of the North of Extremadura are tourist destinations for many people during the summer period.

From the fifties to eighties most of the municipalities of the study area underwent a

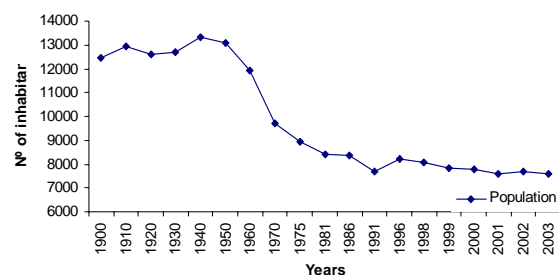


Figure 2. Evolution of Ambroz Valley population

massive abandonment as a consequence of emigration to the cities (Nieto & Gurría, 2004) (Figure 2). These tendencies changed at the beginning of nineties, coinciding with the introduction of several European initiatives in Extremadura (LEADER and PRODER projects) for the sustainable rural development, especially in those rural municipalities which had higher economic imbalances. Consequently, in 1990 the rural population in the study area has undergone a slight increase (Figure 2), dropping non significantly over the last decade and remaining constant till nowadays

However during the last decade the development of holiday residences has increased much more than the population (Figure 3) as a consequence of rural buildings developments for tourist activities. Tourist information in the region, shows that the creation of new hotels and rural houses has significantly increased the supply of top quality establishments (from 650 in 1997 to 1543 in 2004).

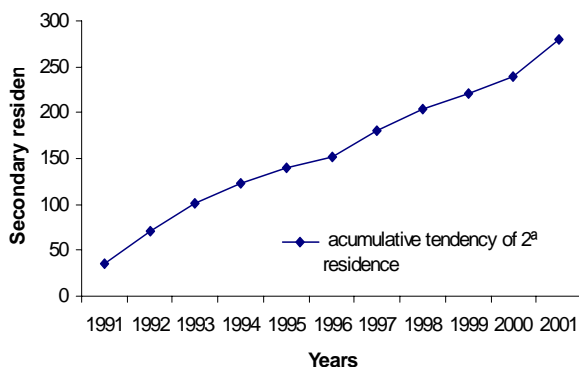


Figure 3. Evolution of secondary residence in Ambroz Valley.

There have been not only substantial changes in the rural population, also the main economic sectors have undergone variations over the last 50 years. Nieto & Gurría (2004) show a clear change in the evolution of economic activities of rural municipalities in Extremadura community between 1950 and 2001; thus in the middle of the 50s, 75% of population depended on the agrarian sector, this descended to 15% at the end of the 80s. The industrial sector has experienced a slight increase, especially in construction, but the services sector related to tourism has shown a greater increase from 15% in the 50s to a 60% at the present time. These data are also evident in the study area (Ambroz Valley) as it can be seen in Figure 4, where agrarian sector still retains a significant level of importance, in spite of tourism increase.

Furthermore the disordered increase of constructions as a consequence of building sprawl is normally concentrated in the surroundings of the

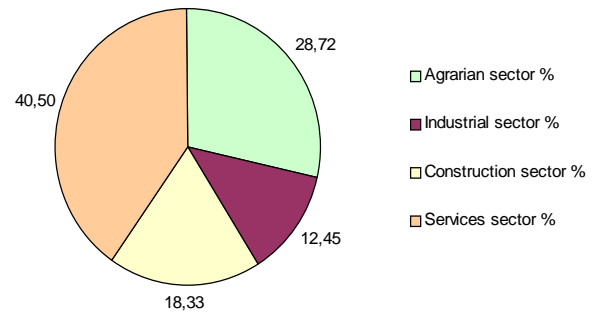


Figure 4. Economic sectors in Ambroz Valley

studied municipalities and close to the main reservoir of the study area. In response, there is a recent regional law for Extremadura community (LESOTEX, Law 15/2001 of land and landscape planning of Extremadura), that tries to give a coherent answer to the real problems of territorial and rural planning. Nevertheless many municipalities in the study area are still awaiting approval of their General Planning by the Administration in agreement with this regional legislation (LESOTEX). Municipal planning has failed to keep up with the necessities imposed by the new rural urbanism.

3. METHODOLOGY

3.1 Methodological Issues

To understand the problems that can arise from a building element in relation with landscape some aspects must be considered (Ayuga *et al.* 2001):

The landscape value. From the point of view of buildings' integration a simple quantitative method can be used (Cañas, Ayuga & Ortiz 1996). Therefore, the effect of the intervention can be considered and related to the landscape value. This concept is important not only to rate the quality or fragility of a landscape but also to determine the actual pressure in rural areas as a consequence of different human activities. We use GIS to map the land capacity to support urban activity (Figure 5). For that purpose some methodologies based on indirect methods to assess landscape value were used (Aguiló *et al.*, 2000). Moreover a complete analysis of the urban sprawl since 1997 was carried out especially in those areas with higher landscape quality (Figure 8).

The location of the building. Many times the landscape integration of buildings depends more on adequate selection of the place than on any other consideration. To study the location in depth, planning limitations, opportunities, visual characteristics and the scene should be considered. GIS offer useful tools for these purposes (Hernández, García & Ayuga 2004a, 2004b). In the diagnosis phase a complete inventory of

buildings was carried out into the study area, to assess the degree of compliance with law.

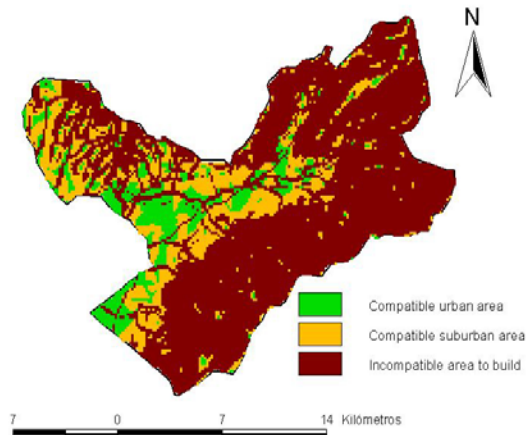


Figure 5. Land capacity for urban activity.

The colour, texture, lines, forms: that is visual elements that characterize the landscape. Once a place has been selected, a detailed study of the scene in which the building is going to be placed should be made. Different places from which the building will be seen should be analysed considering the importance of the places in terms of number of travellers or the interest of the people in those places. In each scene, the colour of the main elements should be considered (vegetation, soil, other buildings etc. (García *et al.*, 2003), the textures (García *et al.*, 2005), lines and forms (García, Hernández & García Navarro 1999), etc.

The aesthetic aspects of any object are defined by its main visual elements: colour, form, line and texture, to which might be added compositional reference elements such as scale and, in the case of

three dimensional scenes, spatial character (Español, 1998). Analysis of a building by means of its visual elements can help determine the best integration of it into the landscape.

Local planning laws give design and building guidelines directly related to the aforementioned visual elements; so different colours and building materials (textures) are recommended as well as restrictions on architectonic designs (lines and forms). Moreover some limits regarding to the construction size (height and volume) are fixed by law (scale). But how are the criteria in these recommendations established? After our diagnosis phase, we could not find any scientific criteria in the drafting of these building guidelines although most of planners have followed traditional building techniques.

In the diagnosis phase we analysed the building parameters related to the main visual elements, to determine common tendencies in the drafting of planning laws and also the degree of compliance with them. In the survey phase we will determine which of these parameters is the most important in terms of visual quality and which thresholds for each one can improve the integration of a building into a landscape. From the survey conclusions some guidelines for colour, texture, volumes, strength lines and harmonies of new buildings in rural areas in accordance with traditional buildings will be prepared. The definition of such buildings, and the elements that characterize them should be a task carried out by the local authorities, helped by national and international rules and guidelines.

To study these aspects in designing a new building two main tools have been already developed, the first one based on a GIS deals mainly with the location problems (Hernández *et al.* 2004a, 2004b, 2005) and the second one based on photographic treatment deals with the design of construction and

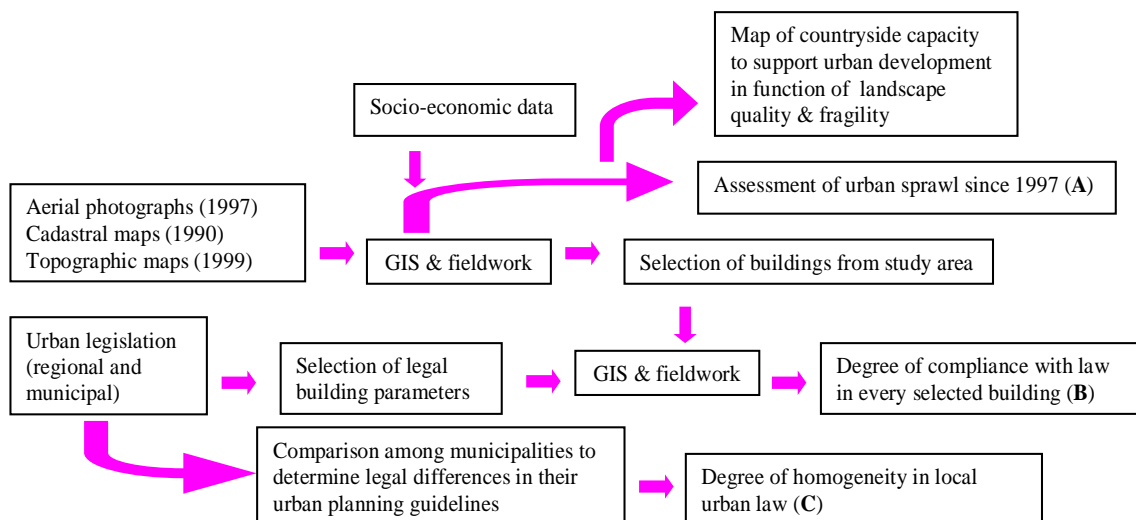


Figure 6. Methodological diagram

visual elements (García *et al.* 2003, García *et al.* 2005). The latter will be the basis of the survey phase.

3.2 Diagnosis Phase

Considering these previous ideas, in the first phase of the research, an exhaustive urban planning diagnosis of the study area, was carried out as follows (Figure 6):

A) Analysis of the urban sprawl since 1997: location of zones with greater planning pressure based on the quality and/or fragility of the landscape. For this purpose we used orthophotos taken in 1997 as well as a countryside inventory of those constructions built after this date. With this information and data from tourism, we analysed which municipality had greater likelihood of urban planning problems and generated a map of the land capacity to support urban activity, including quality and fragility assessments of the landscape, Figure 5. This process determined what zones are optimum to develop and which, by their greater quality, must be preserved.

B) Inventory of constructions from the study area and their degree of compliance with the local urban law, (constructive building parameters and criteria of design). By using GIS, with the digital orthophotos, the polygons and parcels from cadastral maps, constructive building parameters and design criteria, were analysed for 54 constructions from non building lands with some special level of protection. Through exhaustive fieldwork the aforementioned parameters were analyzed for every selected construction as well as those (colour and texture) related to aesthetic design.

The constructive building parameters were selected from the municipal general planning. They were:

- Risk of formation of urban nucleus:
- Maximum building area
- Minimum plot size
- Minimum distances to edges, highways, river banks, wetlands,...
- Maximum building height.
- Maximum number of floors.
- Building occupancy rate
- FAR: Floor to area plot ratio
- Design criteria: colour and texture.

C) Comparison of the different municipal urban plans to determine the degree of homogeneity in the drafting of them, especially in those municipalities that are adjacent.

3.3 Survey Phase – Visual Elements.

García 1998, completed by Hernández & García 2001, undertook a perception survey using 30 photographs of buildings, many of which were computer simulations. These were shown to 150 people drawn from different age groups, educational backgrounds and locations. The first objective was to establish a hierarchy of visual elements (Español 1995) and to learn people's preference criteria. The second was to look for limit values of perceptual contrast (Table 1). The values obtained were reported by García *et al.* 2003; Hernández *et al.* 2004a.

1. How would you rate the integration of the building(s) in the scene in this photograph?				
<i>Very Bad</i>	<i>Bad</i>	<i>Acceptable</i>	<i>Good</i>	<i>Very Good</i>
2. What characteristic(s) of the group of buildings or their construction components would have to be modified to improve their integration into the scene in this photograph?				
<i>Colour</i>	<i>Texture of the materials</i>	<i>Lines and Forms</i>	<i>Scale</i>	<i>Spatial Location</i>

Table 1. Questions posed in García 1998 and Hernández & García 2001.

The answers to the second question in García 1998 and Hernández & García 2001, showed the importance and influence of visual elements in the integration of buildings into their environment, and also the potential of public survey in the measurement of observer preferences. Colour was the most rated element.

In this context, the next phase in the present research, is to design a public survey to assess actual legal thresholds for each building parameter (scale: height and volume) and for each design criteria (colour , texture) established by planning laws.

Real pictures were taken during the diagnosis phase and were modified using Photoshop software. For each building parameter and design criteria, a real photo was selected and modified to represent different visual impacts combining pairs of visual elements (colours, textures, scales) between the building and the background. These modified images (Figure 7) we call 'infographs'. We assume that those showing poor compatible contrast, photos with high visual impact, will be the worst rated by the observers. Those modified to obtain visual continuity or low visual impact, have more possibility to be well rated. But what will happen with those inphographs modified to reach the actual legal threshold for each building parameter?

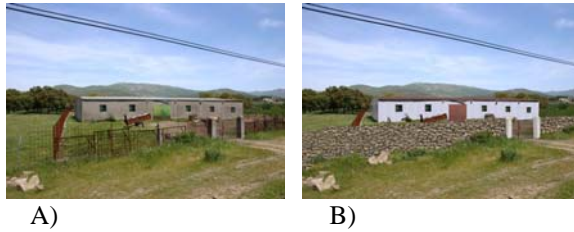


Figure 7. Inphotographic examples of a building. A) Real picture. B) Legal picture.

When survey phase is completed the responses of the observers may offer some ideas about how we can improve legal building parameters (colours, textures, scales), for good integration of a building into the landscape.

4. RESULTS

From the diagnosis phase we found:

A) *Analysis of the urban sprawl since 1997:* the municipalities close to the main wetland of the study area were those with greater urban planning problems (Figure 8). This photograph represents the risk of formation of urban nucleus in areas considered by the local urban law as non building lands and close to the main wetland of *Hervás*, one of the key tourist locations of the *Ambroz Valley*. These zones have a low quality as a consequence of degradation by building activities, while some adjacent zones with greater quality are threatened by the imminent disordered expansion of tourism.

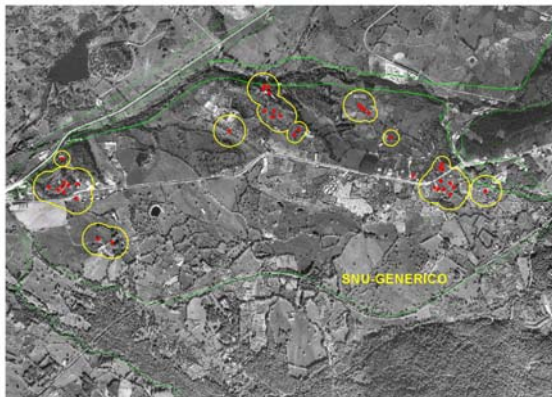


Figure 8. Areas with higher planning pressure.

B) *Inventory of constructions and degree of compliance with urban law.* Results show that from all the constructions inspected (a total of 54), 61% do not comply with the local constructive building parameters; 24% comply with the constructive parameters but infringe characteristics of design; the location of 6 % of the constructions is illegal despite the compliance with the other criteria; only 9% are totally allowed.

C) *Comparison of municipal planning.* A clear lack of homogeneity in constructive parameters and design criteria is observed, especially between

adjacent municipalities with similar physical characteristics and environmental quality.

Results from survey phase are not yet available.

5. CONCLUSIONS AND RECOMMENDATIONS

The main conclusions and recommendations are:

1. The urban sprawl in non-building lands with certain quality or degree of protection by autonomic laws, and the lack of update of local urban legislation, make necessary rigorous and objective planning of tourism activity for its correct arrangement in a short-term.
2. The low degree of compliance with the law raises the necessity to create and to apply more rigorous planning and stronger sanctions for irregularities, with the purpose of controlling urban sprawl, especially with respect to environmental and design criteria.
3. There is clear heterogeneity in the establishment of building parameters even in areas having similar physical and socio-economics characteristics.
4. The necessity to unify criteria in the drafting of municipal planning, through territorial plans that include more than one municipality, is evident.
5. The creation of a scientific and objective methodology for the establishment of planning parameters from an environmental point of view, would allow sustainable development. For that purpose the coming results from the public survey should be taken into account, recognizing that there is currently a clear lack of scientific criteria related to visual impact and also to the integration of human activities into the landscape.

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