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PHYSICAL CHARACTERIZATION AND STRATIFICATION OF URBAN LANDSCAPE BY MAPPING CASE: MEXICALI, BAJA CALIFORNIA

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ABSTRACT

Summary

The objective of this paper was to establish urban units, to study the landscape of Mexicali city and to define its physical characteristics. The method of mapping was utilized, to observe the territory using physical urban variables and socioeconomic strata that allowed relating the living possibilities of neighborhood inhabitants. The results show different territorial situations, through thematic maps by reading, between variables, interpreted through the concept of landscape in its actual situation. Aspects such as land use (zoning), urban structure and presence of green areas are observable, in a simplified way through this technique. The conclusion is that, the variables that matter for the study of urban landscape, corresponds to anthropic facts, where the domination of residential land use, is a starting point for landscape analysis, as it interacts with other observable uses: industry, commercial corridors, commerce and green areas.

KEYWORDS: Territory, Urban Landscape, Mapping & Urban Landscape Units

INTRODUCTION

The geographical observations and representations of the territory have advanced since World War II, the Cold War and the space race. A geography, linked to geo-informatics advancements and particularly, the development of geographical information systems (GIS) (Buzai, 2005), which have influenced the way of studying territory and landscape. Computational advancements allow simplifying the design. CAD (Computer Assisted Design) systems have revolutionized, the way of planning and designing urban and architectonic spaces; their development dates from the 1960s, with a vertiginous advancement in software and hardware, for engineering and design (Rojas y Rojas, 2006, 7). The technique of superposing maps has had a frequent use in physical representations of landscape, which has also been used, since the last century, to define territorial environmental units (McHard, 2000).

There are diverse antecedents in Mexicali city, for the use of maps, to simplify terrestrial data with the help of new technology. The Mexicali Municipal Institute of Research and Planning (*Instituto Municipal de Investigación y Planeación de Mexicali, IMIP*), exists since 2003. In 2005, the Urban Local Observatory of Mexicali (Observatorio Local Urbano) was installed, as part of an agreement between, the Baja Californía Autonomous University (*Universidad*

Autónoma de Baja California, UABC), the Mexicali Economic Development Committee (*Comité de Desarrollo Económico de Mexicali, CDEM*) and the Mexicali Economic Planning and Development Committee (*Comité de Planeación y Desarrollo Económico de Mexicali, COPLADEM*) (UABC, 2005), which have information and maps of the city, in their websites. The 2025 Population Center Urban Development Plan (*Plan de Desarrollo Urbano Centro de Población 2025*), was published in 2007 (Municipio de Mexicali, 2007).

The analysis method is based on, the terrestrial definition of urban landscape units. The identification of homogeneous cells is a fundamental part of the study of landscape characterization. Arriaza et al. (2004), proposes the definition of these units through GIS. Palacios and Lundgerg (2007) made a mapping, to observe the changes in a rural landscape. Cabrerizo and Rodríguez (2010) used urban cartography, to catalog everyday urban landscapes. Briceño et al. (2012) used GIS in their definition of urban landscape, cataloging eco-aesthetic valuation.

The advantage with the incursion of CAD in the definition of units is graphical simplification. These drawings allow the direct interpretation of the territorial state of relevant variables. Mapping techniques made helped in the reading of certain territorial conditions, through drawing and avoiding the information that complicates remote reading.

STUDY OBJECTIVES

This study has the objective of characterizing and identifying urban landscape units, in Mexicali city, Baja California and Mexico, for its physical dimensions and social stratifications.

METHODS

Theoretical Framework

The concept of landscape has evolved, from geographic to artistic considerations. With the European Landscape Agreement in 2000, it acquires a double connotation: on one hand, the geographical space remotely defined and observed; on the other, the perception of its inhabitants. This concept has been retaken by other international organizations, such as LALI (Latin American Landscape Initiative, 2012), which defines landscape as “a space/time which is a result of natural and human factors, both tangible and intangible, which, by being perceived and modeled by people, reflects the diversity of cultures” (LALI, 2012).

Territory and landscape are two complex and interrelated concepts. Both refer to, an area of the surface of the Earth that is delineated with the help of physical components that exist on the surface of a certain terrain, which can be seen or drawn in a number of ways. For De Bolós and Gómex (2009), *landscape sciences* should be considered as such, because, they contemplate systematic elements that have to do with physical aspects of the terrestrial globe and the subjective dimensions of perception.

The concept of landscape is useful for territorial studies, territorial planning and ordering, as it supports the disciplines that retake it, as an aesthetic, artistic or sensible construct, for designing space and improving urban image. In this way, landscape studies operate from remote observation and from the level of the observer. Urban landscape is a concept that emerges at the possibility, of improving the way in which the city was developed. Ferrer (2011) exposes that, the processes that take place in the city, allow the emergence of the urban landscape. These dynamics of physical, social, economic and political processes are materialized and thus observed in the urban landscape. According to Pérez (2000), this concept implies a relation between, the rural and the urban environment, which allows for an aesthetic sense that

occurs in the relation between human beings, culture and nature, giving a value to the landscape, in rural-urban integration. Urban landscape is a spatial category that differs from rural and natural for its transformations, artificiality, activities and diverse perceptions.

Methodology

There have been many discussions regarding quantitative and qualitative procedures. The first consist in, identifying components with concrete measurements, which determine the quality of the landscape. In the second study, the subjectivity of the inhabitants, as preferences or non-numerical judgments (De la Fuente, 2010, 12; Dávila, 1994, 69; Gutiérrez and Delgado, 1994, 141; Schwartz and Jacobs, 1991, 62), which identify components with concrete measurements of the quality of the landscape? Techniques such as mapping, satellite images, specialized photography and pixel determination and measurements of visual images are used (De la Fuente, 2010, 14).

This research was carried out with cadastral information and satellite images, of the territory, which allowed characterizing Mexicali city in its physical dimension and social stratification. Landscape units defined in rural and natural categories from geological, hydric and biophysical aspects, were not important for the urban landscape of Mexicali city, so the procedure was, to delineate anthropic units. Streets and land use are predominant, while strata are observed in the neighborhood. The variables being analyzed were: land use, primary roadways and types of neighborhood, according to socioeconomic strata are, water bodies, green areas and historical growth.

Development

For the development of this study, the 2015 cadastral map of the city and the base map were elaborated. The information was downloaded into this drawing, by physical variable and layer. The procedure consisted of the following steps: 1. Gathering information in maps, satellite images, land register and planning. 2. Drawing by variables, creating "spots". 3. Stratification starting from residential landscape, using the rating of the land tax, as exposed in the Municipal Income Law (2015). 4. Analysis of each layer of the drawing and its interactions with other variables.

Each map, high lightens the urban variable, for the international line delineated in red and the official limit of the urban area in black. The uses and destinations of the land were delineated, on the base map of the Municipal Land Register.

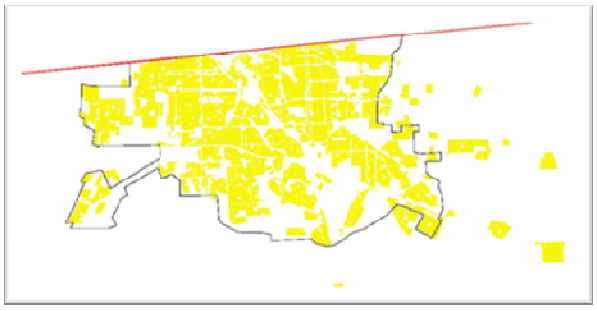

Figure 1: Residential Zoning Map

(**Source:** Mexicali Research and Planning Municipal Institute)

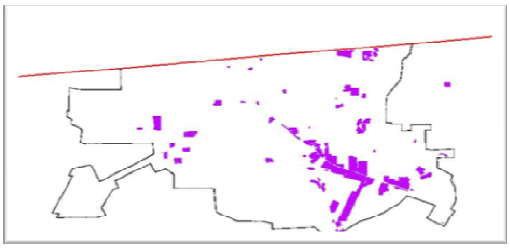

Figure 2: Industrial Zoning Map

(**Source:** Mexicali Research and Planning Municipal Institute).

Figure 3: Commercial Zoning Map

(Source: Mexicali Research and Planning Municipal Institute).

RESULTS AND DISCUSSIONS

From its physical landscape context, the municipality of Mexicali is a region that has natural, rural and urban landscapes, clearly defined in satellite images. The population center is localized north of the territory, which has grown from the International Border Gate and the railway. The first urban conformation in the 1900-1910 decade, was defined in what is now known as, the Historical Center or, First Square of the city, delineated mainly by the International Line, the Río Nuevo and the agricultural infrastructure, with a growth tendency towards the Southeast, where new developments were established (Second Section). The mark of the river is still visible in the structure of zoning, allowing for housing development of lower socioeconomic strata in the West side, while larger infrastructures were developed, for the following decades in the East. Popular neighborhoods were established, towards the South and the West. In this way, streets, commerce, schools and other equipments have followed a similar pattern, observed as homogeneous in a city level.

The definition of the urban landscape units, based on physic-environmental conditions was observed not to be relevant, as the city lacks “green” connections, where the inner-city forest is the representative of recreational public green area, inside the urban area and urban development, focuses transportation solutions on particular means (cars). The urban structure lacks green corridors and loss of water bodies is observed, in the visual landscape. Mexicali city does not possess remarkable patrimonial value elements, in a city level because; the historical characteristics are concentrated in two of the oldest neighborhoods. The city had a concentric growth until the 1940s, giving way to a progressive dispersion which is more pronounced, since the 1990s.

The physical characterization that matters, for urban landscape is carried out through land use, urban structure and socioeconomic stratification, with landscape units based on 12 strata, that allowed covering the city territory. In this mapping of socioeconomic strata, it was observed that, the highest levels (1 to 5) are focused on the East side of the city.

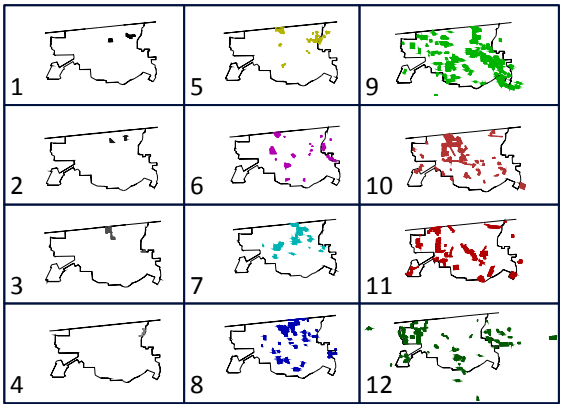

Figure 4: Socioeconomic Level Maps of Mexicali City

Original compositions Developed from the Municipal Income Law (2015).

Table 1: Summary of Elements Found in the Mapping of Mexicali City

Variable	Remarks Regarding Urban Landscape and Visual Landscape Units
Residencial zoning (housing).	Predominant citywide. This map does not distinguish categories that allow for differentiation.
Industrial zoning.	Industrial and mixed zones. Defined zones around the main industrial nucleus in the González Ortega zone.
Comercial zoning.	Reinforces the Historical Center and the Second Section.
Equipment.	Distributed through the city with a tendency to main streets.
Comercial centers and malls.	Reinforces the Center and urban corridors.
Public schools.	Uniformly distributed throughout the city. Three spots are distinguished: the State High School, the UABC Campus and the UABC Health Science faculty.
Green areas.	The city forest, the golf club and the sports units are prominent. There are no green corridors.
Water bodies.	The water bodies do not have enough connectivity to be considered representative of the urban landscape.
Urban corridors.	The West, East and Southeast areas are prominent.
Main roadways.	They structure the city, there are streets that are unfinished or with a changing condition.
Historical growth.	Concentric growth until the 1940s, disperse development since the 1990s.
Historical patrimony.	The Historical Center and the Second Section are accentuated in the map by the presence of patrimonial buildings.

Original Composition from Maps Information

The following map summarizes different aspects, from thematic maps (figure 5). The types of neighborhood 1 and 12 were delineated for housing, allowing for the localization of socioeconomic contrast. Road connectivity is expressed, in a city level with the primary roadways (black lines). Two industrial nuclei are observed, both in the East side of the city. The Historical Center is high lightened in black, because of its importance, in the genesis of the city, commerce and services. The orange line is the zone of, patrimonial value buildings. The gray line is the growth of the city, until the 1940s. The green areas are four cells of the same color, which interacts with two of the water bodies. The pink dots are the commercial places of the highest range.

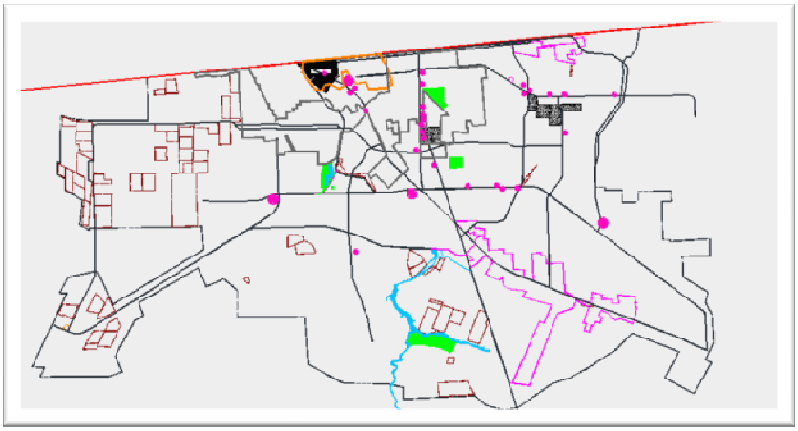

Figure 5: Mexicali Landscape Units Map

Original Composition from Information of Thematic Maps

To discover the interactions of the inhabitants with its environment, the types of residential landscape are fundamental, to observe the physical and social characteristics of the urban landscape. Neighborhoods represent a minimal landscape unit that has its different socioeconomic strata, constructive and visual characteristics. Starting from residential zoning, strategies of urban territorial improvement can be elaborated considering the inclusion of the citizens, the inhabited territory and the services at disposal.

Subcategories of urban landscape were distinguished, in order to gather territorial information. Residential use is predominant, while industrial and commercial uses are next, in geographic coverage; at the same time, there is a continuous interaction through roadways and commercial axes that interconnect active units, such as the Historical Center, the international border line, commercial nuclei and the Civic Center.

The city's territory as a plane, where human activities were of larger agglomeration, compared to other landscapes is denoted on different images. It is fundamental, to observe the physical base because, it is a landscape that is regularly in expansion. Atomized urban expansion is observed, since the 1990s. The nuclei in the margins are neighborhoods of different strata, but rich neighborhoods are built in the East (figure 5).

The territorial complexity of the city, its elements in maps, traces a series of intertwined territorial conditions, which would be better to analyze in different ways. The city has diverse physical components that can be studied from different disciplines. The concept of landscape can integrate distinct visions. The city as an anthropic fact, should stimulate actions towards the creation of urban ecosystems, visual quality zones, aspects related to culture and projects, that care for the improvement of the public finances and the people, which would allow a sustainability in the development of the territory and the relation of, rural and urban areas and the natural environment, in which they are located.

Physical analysis studies, allow researching the city structure to create urban territorial units. In this case, the subcategories that have contributed to survey the landscape are residential, industrial and commercial zoning, as well as green areas, which are representative of the territorial coverage, according to the thematic maps, though other uses can be included. Neighbourhoods, as an integral part of urban landscape, were the substantial types, to define results in stratified comparisons.

CONCLUSIONS

Due to the complexity of cities, research on urban landscape should be contemplated, because the city offers a variety of difficulty, at the first approach of physical and socioeconomic data, so in this study, the delineated areas of the city's contemplated residential, industrial and commercial land use, with 12 types of neighborhood, according to the land tax rate, which made the reading of the actual landscape situation easier.

The technological advancements in the observation of the territory, such as GIS, satellite photography, cadastral mapping and digital distribution of information, are useful technical media for current landscape studies.

In this process of cartographic identification, the position of the inhabitants is observed according to the socioeconomic strata and the interaction with other relevant spaces that structure the city. This study has allowed the observation of territorial details that should be considered in the construction and improvement of the city, in urban studies, partial plans and physical projects that involve the structural composition of the landscape image. Aspects such as vegetation, pavement, building and other physical elements should be attended through administrative activities in order to create better spaces.

The landscape of Mexicali city is a set of urban physical elements, felt and lived by people, where territorial planning, decision-making and urban and landscape management play a primordial role in its construction. Mexicali is a city of few visual contrasts changing through time; even though it is not a historical patrimonial city, certain urban elements could be reinforced for eco-aesthetic improvement: the creation of green areas in low socioeconomic strata neighborhoods in the West and outskirts of the city, better urban accessibility to different locations, landscape planning starting from ecological, aesthetic and sustainable elements, urban densification and the creation of services according to the new points of interurban development.

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