

QUANTITATIVE ANALYSIS OF THE SOCIAL DIVISION OF SPACE AND SEGREGATION IN MEXICAN CITIES: CASE CULIACAN ROSALES, SINALOA, MEXICO

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Abstract

The analysis of the social division of space in urban contexts for understanding how fragmented this urbanized space and elements spatially reflect this division, this can certainly help clarify what are the main causes and potential effects of their dynamics has in relation with other social phenomena.

Although the phenomenon of the social division of space and segregation is inherent in the growth and development of all cities, in Latin America is evident from a morphological perspective because the forms of production of the houses are different, and because endowments spaces public of the best equipped areas of infrastructure and equipment are antagonistic depressed. This phenomenon and the problems it generates is so complex that for study and analysis should be addressed in an interdisciplinary way and framed in long-term processes.

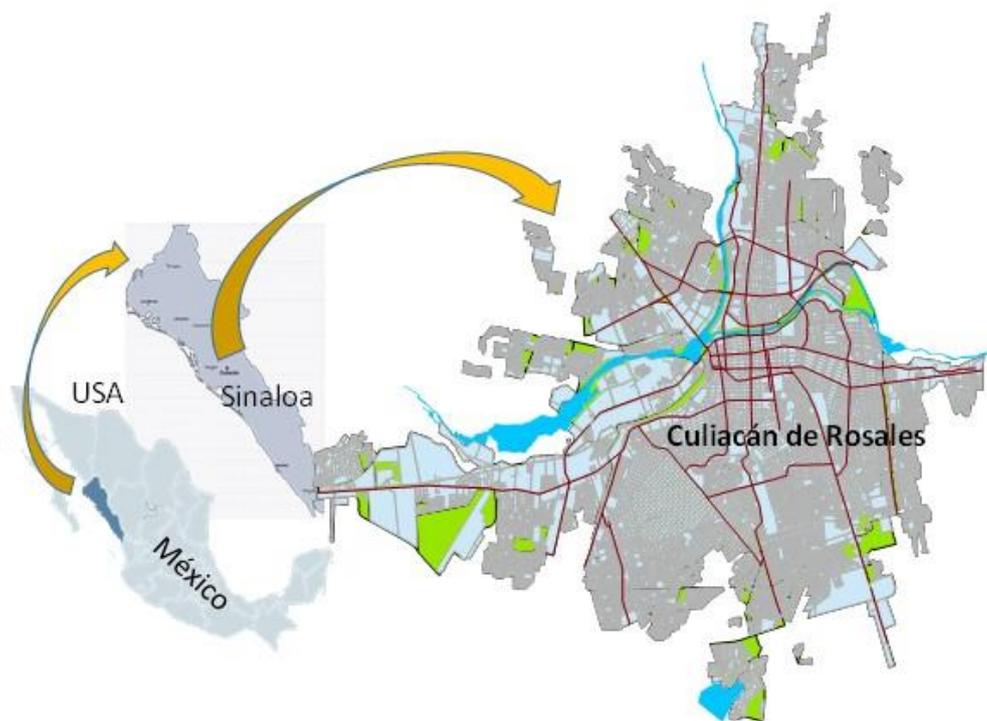
For the development of this work we have been used factor analysis with the method of the principal components to reduce the size of a large amount of variables related to housing produced, socio-demographic aspects and levels of education of the population living in the Culiacan Rosales, Sinaloa, Mexico.

Introduction

This paper is a first approach to the analysis of the urban phenomenon of the social division of space and segregation in Culiacan Rosales, and is part of the project applied scientific research, approved and funded by CONACYT¹ "geo-referenced analysis of the social division space in Culiacan Rosales, Sinaloa", Mexican city of agricultural base Sinaloa state capital located northwest of the Mexican republic (image 1)

We now know that the study of the social division of space in urban contexts for understanding how fragmented this urbanized space and elements spatially reflect that division which can help clarify which are the main causes and potential effects of their dynamics has in relation to other social phenomena. Not an easy task because we have understood that this is a complex phenomenon that accompanies the growth and development of cities and is a product of the interaction between the multiple manifestations of different socioeconomic population groups and levels of social heterogeneity that occur within these Saudi

Figure 1. Geographical location of Culiacan, Sinaloa, Mexico



Source: Prepared with information Digital Map of Mexico, www.inegi.org.mx

¹ The National Council of Science and Technology (CONACYT) is an autonomous body responsible for regulating and administering the grants the Mexican government grants to promote , strengthen , develop and consolidate scientific research , technological development and innovation in the country overall.

The social division and segregation of urban space

According to Martha Schteingart, urban research that studies and analyzes the social division of space became important in the cities of Latin America until the early nineties when *a significant amount of work on this subject were developed in the central region of Mexico the importance of the subject due to so unequal and inequitable manner in which the dynamic process of occupation of urban space (cf. Connolly et al., 1991; cf. Conapo, 1998; Suarez Pareyón, 2000; Garza, 1999; Rubalcava and Schteingart, 2000a and 2000b; Rodriguez et al., 1995; Duhau , 1998; cited by Schteingart, 2010, 9)*".

Although the phenomenon of the social division of space and segregation can also be observed in European cities, according to Carlos Marmolejo (2011), Latin America is evident from a morphological perspective because it is visible not only because the forms of material production housing are different, but also and above all because the endowments of public spaces in the areas of welfare are antipodes of depressed, so for study these urban issues should be addressed in an interdisciplinary way and framed in long-term processes (Veiga, 1999).

According to Emilio Duhau (2003), when the social division of space is studied in urban contexts should try to understand aspects such as levels it reaches, ie how socially divided is the urban space; how urban space spatially reflects this division; how can you explain their dynamics; and what effects or consequences with respect to other social phenomena. In this sense the studies made so far conclude that, in any city, the social division of space is the result of a dynamic long-term process in which multiple factors among which the principal is related to the logic of the market housing market and how it transforms the urban space reproduction incorporating the distribution of basic services, property, public facilities, the immediate environment and behavior of urban externalities.

Population dynamics of Culiacan Rosales

Of the five most urbanized cities in the state of Sinaloa and the northwestern region of Mexico, Culiacan Rosales is the main city since has experienced growth and unprecedented development because of the benefits it gives to host state powers which will inject dynamism always highly positive encouraged by the steady increase in population coming mostly from rural communities who migrate to the city due to low profitability that provide agricultural work on their land temporarily and multiple opportunities offered state capital city.

According to the census of population and housing INEGI from the sixties beginning to be seen population growth in Culiacan Rosales has had its effects on extensive land consumption.

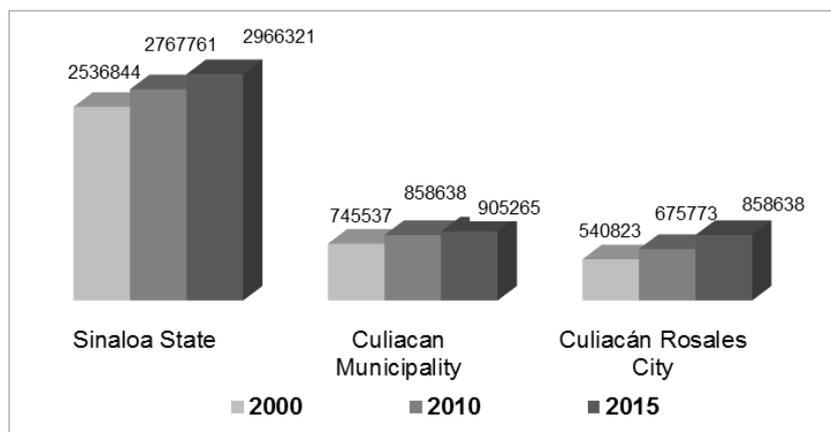
As shown in table 1 in the decade of the seventies the city had 169.657 inhabitants in the next ten years, growing at a rate of 7,32 percent, grew towards 306.824 inhabitants. In the next thirty years the city continued with a high growth rate such that by 2010 the census of INEGI registered a population of 675.773 inhabitants; amount currently in the through intermediate count every five years after 1995 this institute has published the city of Culiacan Rosales it has a population of 858.638 inhabitants, as shown in the graphic 1.

Table 1. Increase Population of Culiacan, Rosales, Sinaloa

INCREASE IN POPULATION OF CULIACAN ROSALES, SINALOA		
CENSUS	TOTAL	GROWTH RATE
1970	169.657	7,32
1980	306.824	5,89
1990	408.890	2,98
1995	505.131	3,81
2000	538.835	1,52
2005	580.776	1,33
2010	675.775	3,36
2015	858.638	

Source: Own elaboration based on Census and accounts OF population and housing. INEGI

Graphic 1. Population dynamics of Culiacan, Rosales, Sinaloa



Source: Prepared based on information from the Census of Population and Housing. INEGI.

Methodology

For the development of this work we have applied the factor analysis with the method of the principal components to reduce the size of a large amount of variables related to housing produced, socio-demographic aspects and levels of education of the population living in the city Rosales Culiacan, Sinaloa, Mexico.

The aim of factor analysis with principal components method is to find out how likely is adequately represent the information contained in a large amount of variables from its reduction to a smaller amount of synthetic variables constructed as linear combinations correlated with the original variables with minimal loss of information contained in the original variables.

Principal Components is a very useful method when required to analyze urban problems involved in a lot of variables because it offers a high degree of flexibility by allowing save the results as new variables that can realize further analysis.

Although there is much systematized information related to urban spaces that allows, through complex analytical processes through specialized software² a reading of the phenomenon of social division and segregation that they exist, in this work have only been using variables Census Population and Housing 2010 INEGI, shown in table 2, presenting information related to the size and construction quality of private homes inhabited (VPH), population distribution, education level, availability of basic services³ and assets⁴; with the goal to build three synthetic indicators: 1) housing produced, 2) socio-demographic aspects and 3) the level of education, to help us show the social division and segregation that is present in urban areas of the city Culiacan Rosales.

Table 2. Groups of variables used for reducing dimension with principal components

HOUSING PRODUCED	SCHOLARSHIP	SOCIO DEMOGRAPHIC
VPH_PISODT	P15SEC_CO	POB0_14
VPH_1DOR	P15PRI_CO	POB15_64
VPH_2YMASD	P18YM_PB	POB65_MAS
VPH_2CUART	P15YM_AN	POCUPADA
VPH_3YMASC	P15YM_SE	PDESOCUP
VPH_EXCSA	P15PRI_IN	PSINDER
VPH_DRENAJ	P3A5_NOA	PDER_SS
VPH_C_SERV	P6A11_NOA	HOGJEF_M
VPH_LAVAD	P12A14NOA	HOGJEF_F
VPH_AUTOM	P8A14AN	PE_INAC
VPH_PC		
VPH_TELEF		
VPH_INTER		

Source: Census of Population and Housing. INEGI.

After repeating several times the reduction procedure variables with the method of principal components, including or eliminating variables, is resulted a major component which satisfies the requirements of the research and summarizes satisfactorily the information contained in the variable group original. The correct interpretation and reading of variables represented in this Principal Component lead name to identify him. In our case study indicators product obtained with Principal Components analysis of three groups of variables originals named we have: 1) Housing Consolidated (VIV_CONSOL), 2) Primary School (ESC_BASICA) and 3) Employed population (POB_ACTIVA) which later is explained in more detail its origin. With these indicators thematic maps of the city of Culiacan Rosales at the level of basic geostatistical Areas (AGEB⁵) using Geographic Information Systems (ArcGIS) in which clearly shows the social division and prevailing segregation in this city were developed. Soon they are presented and analyzed these thematic maps.

² ArcGIS, MapInfo, GeoDa, Digital Map, Segregation, SPSS, Excell, and others.

³ In Mexico are considered basic services piped water, sanitary sewer connected to the public network and electricity.

⁴ In the 2010 census are regarded as assets in housing availability television, refrigerator, washing machine, telephone at home, automobile itself, personal computer and internet.

⁵ A Basic Geostatistical Area (AGEB) is a geographical area occupied by a set of well-defined blocks of streets, avenues, walkways or any other feature of easy identification in the territory and whose land use is primarily residential, industrial, services or commercial and they are assigned only within urban localities (INEGI , 2010).

Consolidated Housing

The analysis of the variables that were represented in the Principal Component, shown in table 3, suggest the name of Consolidated Housing (VIV_CONSOL) as these show that households have floor of concrete or ceramic; they have 2 or more bedrooms and 3 or more rooms⁶, indicating that they are great; in the environment there is the infrastructure that provides basic services piped water, sanitary sewer and electricity; and also they have major assets as own car, washing machine, personal computer, landline at home and internet service. These features certainly indicate they are finished homes that have been consolidated in the urban space where they are seated.

Table 3. Principal Component Matrix

CONSOLIDATED HOUSING (VIV_CONSOL)	
VPH_PISODT	.979
VPH_2YMASD	.991
VPH_3YMASC	.993
VPH_EXCSA	.978
VPH_DRENAJ	.980
VPH_C_SERV	.981
VPH_LAVAD	.997
VPH_AUTOM	.988
VPH_PC	.939
VPH_TELEF	.965
VPH_INTER	.903

Extraction method: principal component analysis.

a. 1 extracted components.

The spatial distribution of these houses we can observe in the thematic map shown in image 2. Negative values of census tracts, represented with light colors indicate that households with opposite characteristics are located in these spaces Culiacan Rosales described; ie , have one or two rooms -are smallest ones; they have some deficiencies in infrastructure and provision of services; and do not have all assets. Households with these characteristics more precarious and critical are located in small spaces the periphery just north and south of the city. These are irregular settlements that are urbanizing process where families self-constructed your home.

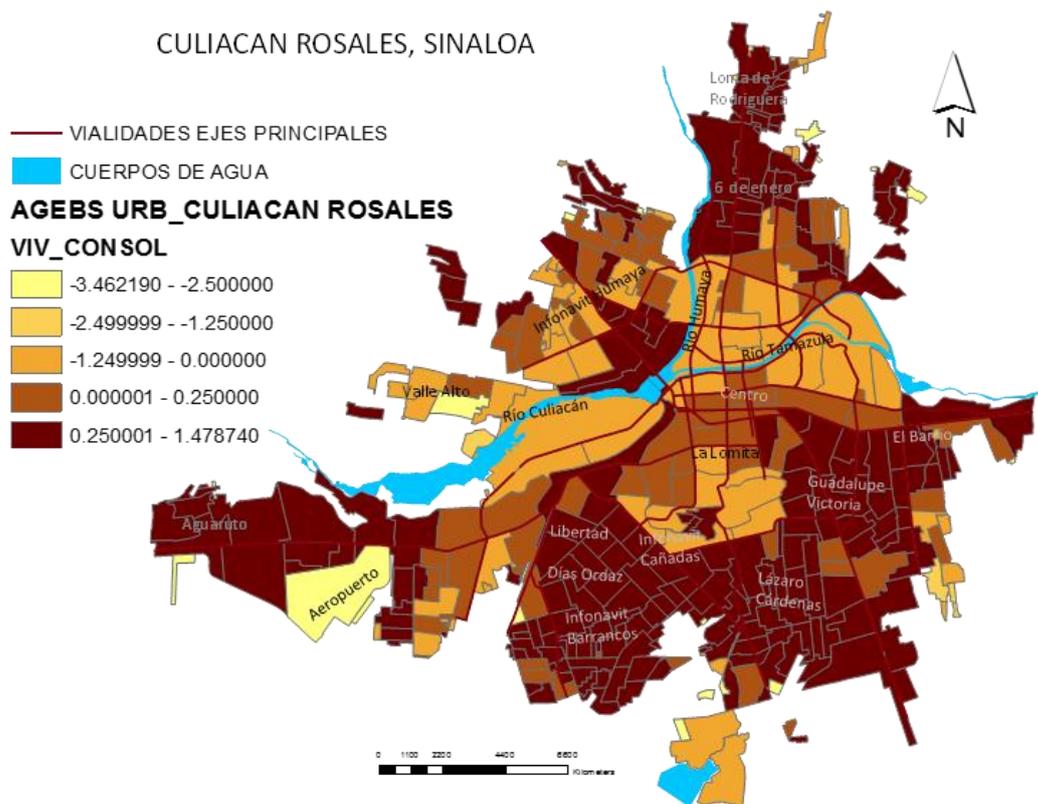
⁶ According to the conceptual framework defined by INEGI is considered as room to living space delimited by fixed walls that rise from the ground at least to a height of two meters, and ceiling of any material having sufficient surface to accommodate an adult bed at least four square meters, where everyday activities such as resting, sleeping, eating and cooking are performed, among others. They are not considered rooms bathrooms, hallways, open galleries and lobbies.

The intermediate color represents urban spaces (AGEB) where housing is made by homebuilders in large blocks with sizes and standardized quality. In these urban areas is the three rivers development and the island Musala.

The darker color represents neighborhoods as January 6 north, Libertad, Diaz Ordaz, Guadalupe Victoria, Lazaro Cardenas, Barrancos and Cañadas at south. These settlements had an irregular origin with self-help housing and that over the years and continuous efforts of its inhabitants have been consolidated. In similar situation are housing settlements as Loma de Rodriguera north, El Barrio east and Aguaruto the west that had an origin of rural town and that the extensive growth of Culiacan Rosales City has “con-urbado” and are now part of the urban area of the city.

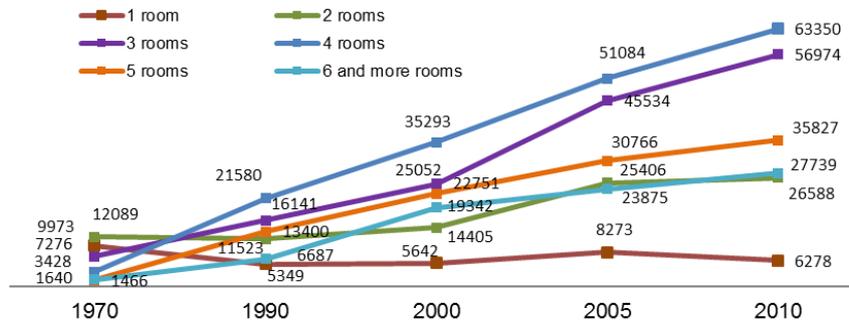
A more detailed analysis of census statistics on the size of housing built analysis contained in the 2010 Census is shown in graphic 2. Here we can see that Culiacan Rosales has a total of 216.756 VPH of which the 2.90 percent had only a room, 12.3 percent have two rooms, 26.3 percent have three rooms, 29.2 percent have four rooms, 16.5 percent have 5 rooms and the remaining 12.8 percent are households with 6 and more rooms. According to the chart 2, the trend is towards the houses with four rooms that are identified with the building housing developers in subdivisions and large assemblies consisting of two bedrooms, living- dining, kitchen, utility room and one bathroom.

Figure 2. Segregation housing characteristics



Source. Prepared by the outcome of the main component

Graphic 2. Size of private dwellings



Source. Prepared based on information from the Census of Population and Housing. INEGI.

Level of schooling

The analysis of the variables of schooling group are represented in the Principal Component are shown in table 4. This shows that relate to school-age population not attending school (NOA), illiterate (AN), unschooled (SE), who did not finish primary (IN) and the population if finished primary and secondary education (CO). These variables thus show the level of schooling⁷ of different population groups living in the city of Culiacan Rosales and so is the name that has been put to this indicator.

Table 4. Principal Components Matrix

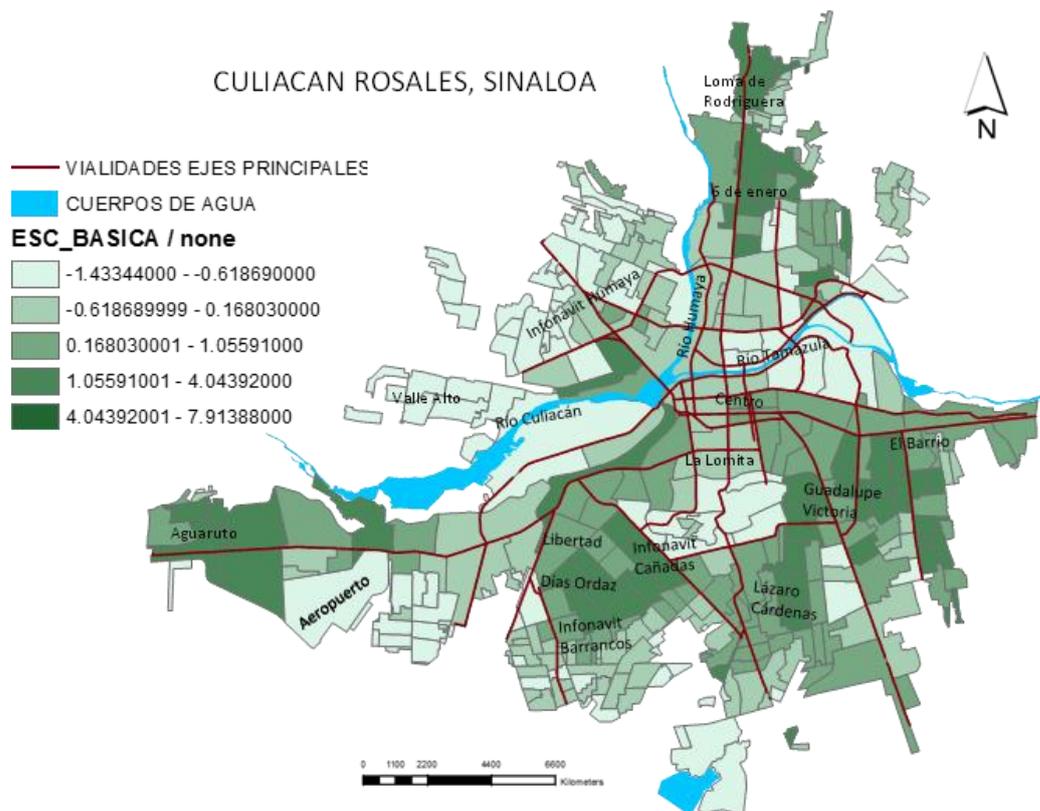
Scholarship level (ESC_BASICA)	Components	
	1	2
P6A11_NOA	.598	.603
P12A14NOA	.754	.372
P8A14AN	.590	.582
P15YM_AN	.836	-.366
P15YM_SE	.840	-.404
P15PRI_IN	.861	-.330
P15PRI_CO	.826	-.119
P15SEC_CO	.656	.068

Extraction method: principal component analysis
a. 2 components extracted

⁷ In the Mexican educational system required 6 years of schooling to achieve grade, 3 years to complete high school, 3 years more to finish bachiller and 5 years more to finish a degree, that is , it takes 9 years schooling for completing basic education and 8 years more, 17 continuous years at least to finish and complete a degree.

The distribution of population groups with different levels of schooling we can see in the map shown in image 3. In this map the lightest color represents urban spaces (AGEB) where the population has a higher educational level –Bachiller, college career, and even masters-. In these spaces average housing settlements built by building developers in housing complexes that have adopted, justified by violence and insecurity are located, the mode of gated community living people of high average level that has made a college career. Among these spaces is high valley, the west, the island Musala east located in urban development three rivers, the surrounding colonies to La Lomita, who originally lived there the population with greater economic power and now have been the descendants they have done university studies.

Image 3. Segregation by level of education



Source. Prepared by the outcome of the main component

Moreover in urban areas of the city marked with darker colors the population lives with lower levels of schooling, reached at most complete basic education is considered to complete high school. These spaces are the Loma de Rodriguera neighborhoods to the north, Aguaruto to the west, the Diaz Ordaz, Cañadas, Barrancos, Lazaro Cardenas neighborhoods to the south and to the east El Barrio neighborhoods, which correspond to the origin as described above.

Table 5. Principal Components Matrix

Employed Population (POB_ACTIVA)	Component 1
POB15_64	0.927
POCUPADA	0.95
PDER_SS	0.863
PE_INAC	0.756
HOGJEF_M	0.832

Extraction method: principal component analysis.

a. 1 extracted components.

Employed population and social security

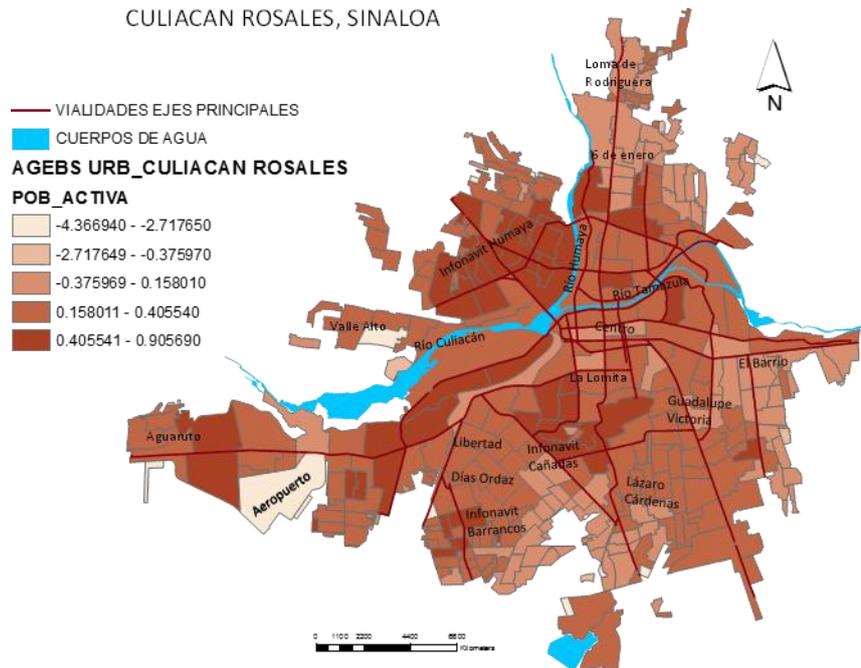
The analysis of the variables social group and occupation variables are shown in table 5. This shows that relate to age population -15 to 64 years, the economically active population is occupied in some formal productive labor activity and therefore has no affiliation to social security provided by the agencies responsible for these areas as the Mexican Social Security Institute (IMSS), the Institute of Security and Social Services for State Workers (ISSSTE) and the Popular Insurance, mainly. I also consider this group to people who do not work as adults 65 and older, people who have some permanent incapacity that prevents them from working and young people under 15 who attend school.

We also consider variables in this group of women who are heads of households, among these are single mothers, divorcees and widows. Therefore this indicator has appointed him Employed Population (POB_ACTIVA) partly because we are analyzing the economically active population living in the city of Culiacan Rosales, Sinaloa.

The distribution of the active population in urban areas of Culiacan Rosales can be seen in the thematic map shown in image 4. In this light colors represent urban spaces, AGEB level, where the non-working population lives and which therefore have no social security. The population in this situation is located on the outskirts of the city both north and south, east and west, surrounding the city as the Loma de Rodriguera, El Barrio and Barrancos neighborhoods, among others. By contrast the population engaged in formal employment that has social security therefore is located in AGEB marked with darker colors. Some of the neighborhoods where people live with these characteristics are found in the Humaya sector, the Lomita, Guadalupe Victoria, Lazaro Cardenas and Libertad to the south and to the east of Culiacan Rosales city.

Image 4. Indicator of occupation and social security

CULIACAN ROSALES, SINALOA



Source. Prepared with the result of Principal Component

Final thoughts

In the elaborate thematic maps can be seen clearly social division and segregation that is present in the city of Culiacan Rosales as in all Mexican cities that has studied this social phenomenon. In this first approach to the analysis social division of space, taking as a case study agricultural city of Culiacan Rosales, capital of Sinaloa, through the analysis of variables of VPH, the demographic of the population, availability of infrastructure and assets we see that small houses built with a single room are located on the outskirts of the city in irregular colonies newly established where basic services have not yet reached by the absence of infrastructure or are present but noted serious deficiencies, but also they are located within the city in consolidated neighborhoods where the population has a low level of schooling and are segregated "islands" divided and contrasting with urban spaces immediate environment equipped with the best infrastructure and facilities the city offers.

In educational level of the population is also causing social division and this is reflected in the urban space when we observe that people with similar levels of schooling live in neighborhoods, housing developments and subdivisions with homogeneous morphological and social characteristics.

As for the availability of assets in the VPH although some are not considered essential for the development of everyday life availability of car or truck own, landline or home , personal computer and Internet use are indicators good quality of life and necessary to enjoy the benefits

offered by the city and achieve the appropriate level of well-being that the fact of living in the city.

In addition the assets are the complement of the housing that the current consumer society in which we live (Bauman, 2007) has made necessary and indispensable for people who inhabit them to enjoy a good quality of life. However, in situations of clear inequality, as those in the urban spaces of our cities, reflect a strong social division as seen in urban areas of the city of Culiacan Rosales, Sinaloa.

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