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Article

Cartographic Analysis of the Phenomenon of Divorce in Al-Rusafa Sector Using Geographic Information Systems

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Abstract: The role played by maps in representing quantitative human population phenomena plays a major role in conveying information and creating a geographic information base that helps the map reader benefit from making sound decisions according to the data, using cartographic analysis tools in the environment of geographic information systems. This study focused on distributing, analyzing and representing the phenomenon of divorce, which is one of the major problems in our Iraqi society. It included three academic and applied topics, where the first topic was the general framework of the study, and clarified the important terms used in it, while the second topic explained the nature of population maps, their classifications and sections, while the third section explained the geographical distribution and the representation tools that enable the representation of the phenomenon of divorce in Al-Rusafa sector. The study concluded with important conclusions and recommendations that benefit officials and readers in a future vision.

Keywords: cartographic analysis, divorce phenomenon, cartographic design, digital cartographic model, population maps

1. Introduction

The phenomenon of divorce is a problem that disturbs life, especially since it is widespread in our Iraqi society, specifically in the city of Baghdad, due to the high population density in addition to the living and economic conditions that the society has suffered from, especially the areas lacking services, and the Rusafa Sector is one of the sectors that has suffered from a lot of neglect in services and the low standard of living, as a result of the old wars and the tragedies of terrorism- and to this day- these areas suffer from these conditions.

We, as researchers, must clarify the spread of this phenomenon, each in his own specialization, and find solutions and help directly or provide them to officials, and since our specialization focuses on drawing a realistic map and preparing geographic databases, through the use of the Geographic Information Systems program, which is easy to develop and prepare a database based on official data and draw maps and represent the phenomenon under study in the Geographic Information Systems environment, which contains many tools, specifically tools for representing quantitative data.

Maps and information are produced and exported in the form of tables, charts, or images that illustrate the distribution of this phenomenon, with symbols, shapes, and cartographic symbols that facilitate the reading of the map for officials and specialists in this regard, to help them in making sound and rapid solutions and decisions.

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First Section

General Framework of the Study:

Research Problem: Is there a role for digital maps that depend in their production on digital maps in showing a clear picture of the distribution of the divorce phenomenon in the municipalities of the Rusafa sector in the city of Baghdad?

Research Hypothesis: The use of cartographic methods in the environment of geographic information systems in analyzing, representing, and distributing the phenomenon of divorce shows a clear and rapid understanding of the nature of the population distribution of this phenomenon.

Importance of the Study: The study has two significant issues:

- The first: It is the applied importance that is represented in applying the tools of cartographic analysis in the environment of geographic information systems in representing and distributing the population phenomenon, and the future role of the impact of this phenomenon on society by giving a clear picture of the distribution of this phenomenon in the form of digital maps.

- The second: It is the scientific importance that works to create a geographic information base by collecting descriptive and spatial information and preparing modern maps of the phenomenon in the application of the geographic information systems program.

Research objective: The aim of this study is to highlight the methods of analysis and cartographic representation of the population phenomenon.

2. Methodology

The methodology followed in preparing this study is the objective methodology in determining the appropriate methods in the analysis and cartographic representation of the phenomenon under study, which is similar to the study area and the factors it contains that influence its completion. The map analysis method and the descriptive method have also been used.

Study boundaries:

Spatial boundaries of the study area: The spatial boundaries are represented by Al-Rusafa sector in Baghdad Governorate, as it represents the eastern part of the Tigris River that divides the governorate into two parts (Karkh and Rusafa). The Rusafa sector is represented by the districts: (Al-Zuhour District, Al-A'dhamiyah, Al-Shaab, Al-Sadr I and II, Rusafa, Al-Karrada, Al-Ghadeer, and Al-Mada'in), as shown in Map (1).

Temporal boundaries: It is represented by the year 2023 A.D**.**

Map 1. Geographical location of the study area

General Terms and Concepts:

1- Map analysis: It is the process of drawing the map in a way that enables the reader to interpret it by using line and position symbols following the direction method, changing the shape and color, and the analysis process is done through the symbols found on the map**.**

2- The phenomenon of divorce: It is a common social phenomenon in most societies, as it is a means of breaking up unhealthy relationships and dissolving relationships, and this phenomenon is linked to the development of family culture and social relations.

3- Map design: The map design process is a creative work that depends on using the best methods and means to accomplish a map work that is characterized by beauty, science and accuracy, and each branch of geography requires the cartographer to focus his information, applications and experiences in the process of drawing the map**.**

4- Digital cartographic model: It is known as the method in which a map with high specifications is produced that contains all the elements of the map from a drawing scale, geographical north, geographical coordinates, a drawing key, and an external frame in a digital form; i.e., it is linked to a database that can be updated or added to and a quantitative analysis of the phenomenon can be carried out.

5- Population maps: Population maps are important maps because they are concerned with changing the real reality of the characteristics of the population and their distribution on the surface of the earth, and facilitate the analysis of this distribution and knowledge of the factors affecting it. They are also concerned with showing the numbers

of the population and their movement, their composition, distribution, density, and the percentage of the urban population and population growth, as well as clarifying the rates and indicators used in such characteristics such as the birth rate, in addition to the qualitative, age, economic, social structure, and others.

Section Two

Population Maps, their Classifications, and Methods of Representing them Cartographically

- **Classification of Population Maps:**

Maps are the best and most important tools for analyzing the various human geographical phenomena, which help draw a clear picture in solving many problems of geographical distribution, and it is not surprising if their forms and types are multiple regarding the phenomenon studied. Therefore, the cartographer is concerned with preparing databases very accurately so that they appear on the map in a perfect manner. Therefore, what is important is to determine the main purpose for which the map has been prepared, and how to distribute the data and facts on the map in a scientific manner. This is the cartographer's entry into what is called map classification, which is arranging things and phenomena in an organized manner, and planned on specific geographical bases and standards for studying them. As for establishing an accurate and acceptable classification for different maps, many efforts have been made by cartographers, and it has become customary to classify maps into groups according to their information, content, scale, function, topics, …etc.

To classify population maps, there are two bases that can be relied upon, which are:

First: The objective basis (objective classification): which classifies maps according to their topics, describing population maps as specialized maps.

Second: Technical basis (technical classification): which classifies maps according to the cartographic methods used to represent different phenomena, as they can be classified into several categories:

1- Population growth maps, which include maps of population fertility, mortality, and internal and external population migration.

2- Population distribution maps, which include numerical and relative distribution maps, environmental distribution maps, density distribution, and actual distribution, in addition to population center of gravity maps, population concentration and dispersion maps.

3- Population structure maps: These are used to illustrate different patterns of population structure, and include age, gender, economic, and social structure maps, in addition to educational and ethnic structure maps. In this study, such classification of maps will be relied on, since the phenomenon under study is a social phenomenon.

There is a number of ways to represent the quantitative population phenomenon, which are:

First, Quantitative position cartographic representation: This type of map is widely used in economic and population distribution maps and is called unified symbol maps, as the point is considered a symbol for the components of a specific phenomenon, and when represented, the size of the point is unified, so one does not appear large and the other small. Here, the nature of the quantitative position variable or the nature of the quantitative position elements are focused on that represent the phenomenon within the environment of geographic information systems and cartographic representation tools, which are three methods of representation:

1- Using the point.

2- Using the circle that represents or reflects the extent of its ability to represent the quantitative position, is one of the oldest quantitative methods used to translate statistical data. Since the nineteenth century, it has been used as graphic forms to depict the results of population censuses. As for its use on maps, it was in the late nineteenth century when it was drawn to represent the population of Irish cities.

3- Using relative symbols (square, triangle, rectangle, circle, and other geometric shapes found in the ARC.GIS.10.8 program system, and it is possible to add any other symbols according to the subject of the phenomenon studied through the properties in the program).

Second, Linear cartographic representation: This method is widely used and can be customized for quantitative linear variables. Streamlined maps or movement maps are another type of quantitative representation of statistical data and are known as maps with small or medium drawing scales on which the geographical phenomenon is distributed using line symbols of different thicknesses that appear on the map between the original location of the phenomenon and the group of locations to which the geographical phenomenon is transferred.

Third, Quantitative spatial cartographic representation: The quantitative spatial distribution method is useful in clarifying a significant number of geographical phenomena distributed on the basis of spatial units, as it can be based on densities, percentages, or rates. In this method, which contains many quantitative spatial elements and is the most famous when representing population elements, several types of spatial symbols are used and are called relative spatial distribution symbols or percentage symbols. There are two types of these symbols:

1- Spatial symbols formed from precise points.
2- Thin parallel line symbols.

Population maps can be represented in GIS through five methods found in the cartographic representation tools in the (sympology) tool found in the properties of the map layer drawn in the (Arc.Gis.10.8) program, as shown in Figure (1).

They are as follows:

1- Quantitative representation by points (Dot density): In this method, population data is represented on the basis of point density, and each point is given a value, and the more the density of points increases, the value of the phenomenon increases. Usually, the distribution of these points is either actual, i.e. in the same places where the phenomenon actually exists, and this type gives clarity and accuracy in the distribution, or the points are distributed randomly and inaccurately.

2- Quantitative representation using charts: Representation in this way is done with different types of population information in the form of relative circles. (pie) is to represent the first type, while the second type can be represented (Bar/Colum) in the form of individual columns. The third type, which is the last in this method, is in the form of combined columns called (Stacked), and each type of representation has its own style of representation that the map maker needs.

3- Quantitative representation using proportional symbols: The spatial variation of the value of the phenomenon in question must be taken into account when representing in this way, as the size of the symbols in any place will differ to the value of the symbols in other places, and the distribution in this way is based on a specific unit of measurement by taking into account the value of the observation of the symbol used in the representation, either on the basis that the values are represented in undefined units and their distribution is through a logarithmic scale, in which case the largest difference between the data is the controller of the most appropriate symbol, or in another way by defining the values in one of the units of measurement (length or area) and it is considered the basis for representing the data on the map.

4- Quantitative representation using the graduated colors method: In this method, the representation is done by giving a color to the phenomenon, and in it the color is graduated from the highest value of the population phenomenon to the lowest value of the population phenomenon and vice versa, and geographical information is usually chosen.

5- Quantitative representation using the Multiple Attributes method: This is done through the GIS program and the variance can be distinguished or shown in two ways: the first is by adding a volumetric representation to the data and the second is by dividing the data into a group of categories that are represented on the map layer.

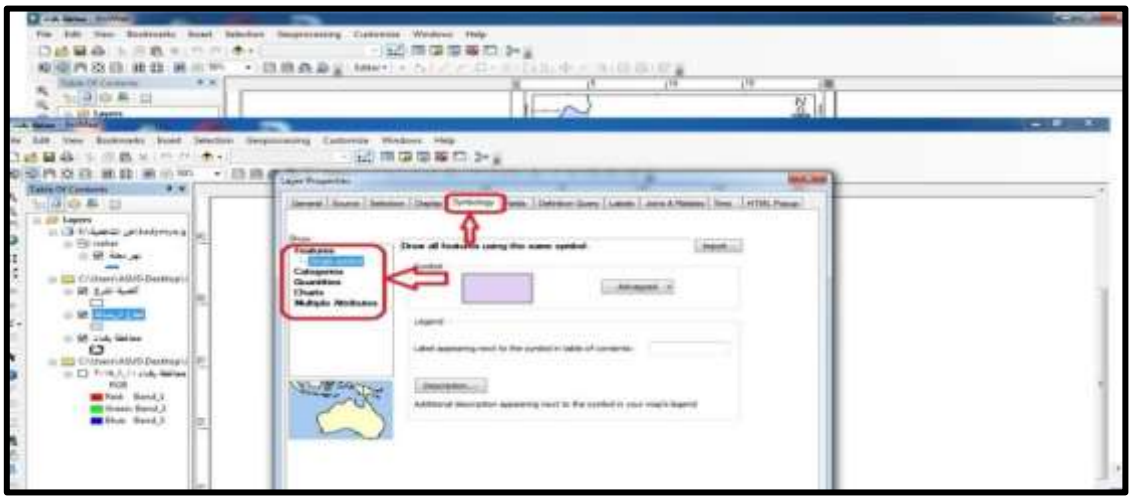


Figure 1. The coding tool and cartographic representation tools (sympology)

Source: Researcher's work based on Arc.Gis.10.8 program

3. Results and Discussion

Third topic

Cartographic Analysis of the Divorce Phenomenon in the Rusafa Sector Using Cartographic Representation Tools in the GIS Program Gis.Arc.Map.10.8

Geographic distribution of the divorce phenomenon:

Numbers recorded during the first months of 2023 reveal the occurrence of (10) divorce cases every hour, the largest share of which was in Baghdad Governorate. The highest percentage of divorce cases was recorded compared to other Iraqi governorates during the past 20 years, reaching (44%). Official statistics indicate that about (800 thousand) divorce cases occurred since (2004) until the seventh month of (2022) at a rate of (4500-4900 thousand) divorce cases per month throughout Iraq, where most marriage cases, at a rate of (20%) of them, end in divorce, according to official statistics from the Supreme Judicial Council. Divorce cases are distributed in the city of Baghdad, according to the presidency of the Courts of Appeal in the Rusafa and Karkh sectors, and according to the statistical data published on the website of the Supreme Judicial Council, and with regard to divorce cases in Al-Rusafa sector, which were distributed among the districts of the Rusafa sector, where the highest percentage of divorce cases was in the First Sadr District and the Second Sadr District, according to the data of the Personal Status Court in Sadr City, reached (3697 divorce cases) at a rate of (31%) of the total divorce cases in the districts of Al-Rusafa sector.

It is followed by Baghdad Al-Jadeeda District, and according to the data of the Personal Status Court in New Baghdad, amounted to (2326 divorce cases) at a rate of (19.5%) of divorce cases in Al-Rusafa sector, then it is followed by Al-Shaab District,

amounted to (1370 divorce cases) at a rate of (11.5%) of divorce cases, according to the data of the Shaab Personal Status Court, followed by the percentage of divorce cases in the Adhamiya District, and according to the data of the Personal Status Court in Adhamiya, reached (1145 divorce cases) at a rate of (9.6%) of divorce cases out of the total divorce cases in the Rusafa sector, then it comes after it Al-Rusafa, where it reached (954 divorce cases) at a rate of (8%) of divorce cases in Al-Rusafa sector, according to the data of the Personal Status Court in Al-Rusafa, followed by Al-Karrada District, which reached (930 divorce cases), representing (7.8%) of divorce cases in the Al-Rusafa sector, according to the data of the Personal Status Court in Al-Karrada, and Al-Zahour District comes after it, which reached (883 divorce cases) at a rate of (7.4%) of divorce cases out of the total divorce cases in the Al-Rusafa sector. Then Al-Madain District comes represented by the Personal Status Court in Al-Madain, which reached (203 divorce cases) at a rate of (1.7%), and the Personal Status Court in Al-Nahrawan, which reached (239 divorce cases) at a rate of (2%), and the Personal Status Court in Al-Wahda District, which reached (179 divorce cases) at a rate of (1.5%), a total of (621 divorce cases) at a rate of (5.2%) of divorce cases in Al-Rusafa sector for the year 2023, which reached (11926 divorce cases), according to Table (1), Figure (2) and Map (2) which show the distribution of divorce cases from the highest value in the district of (Al-Sadr I and II) to the district of (Al-Madain).

Table 1.

No.	Judicial Name	Court Name	Number of Divorce Cases	Divorce percentage%
1-	Al-Sadr judiciary (first and second)	Personal status court in Al-Sadr City	3697	31
2-	Baghdad Al-Jadeeda	Personal status court in Baghdad Al-Jadeeda	2326	19.5
3-	Al-Shaab	Personal status court in Al-Shaab	1370	11.5
4-	Adhamiya	Personal status court in Al-Shaab	1145	9.6
5-	Rusafa	Personal status court in Rusafa	954	8
6-	Karrada	Personal status court in Al-Karrada	930	7.8
7-	Zohour	Personal status court in Al-Zohour	883	7.4
8-	Madain	Madain	203	1.7
		Nahrawan	239	2
		Al-Wihda	179	1.5
Total			11926	100%

100Source/Based on the official website (Iraqi Judicial Portal (electronic) e-cort.sjc.iq/statistics/sjc.iq/view

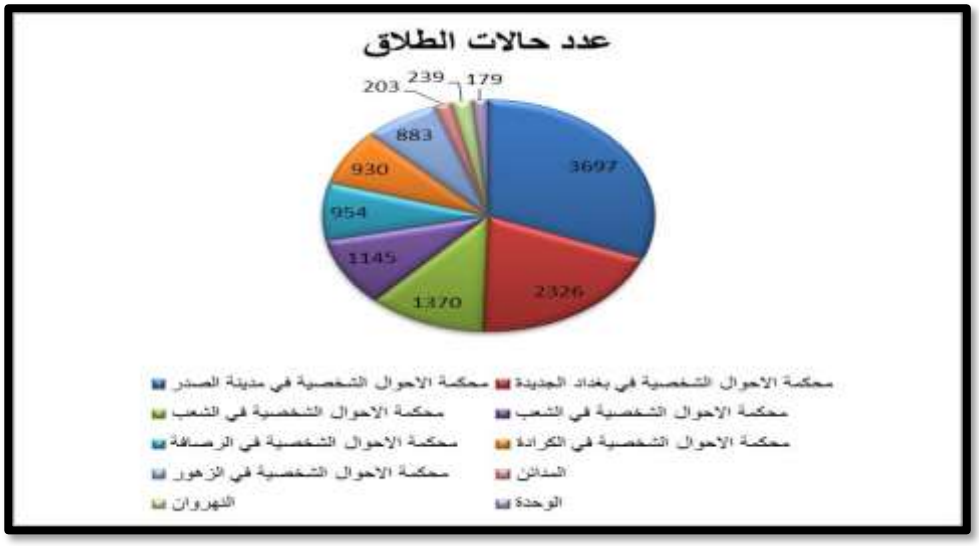
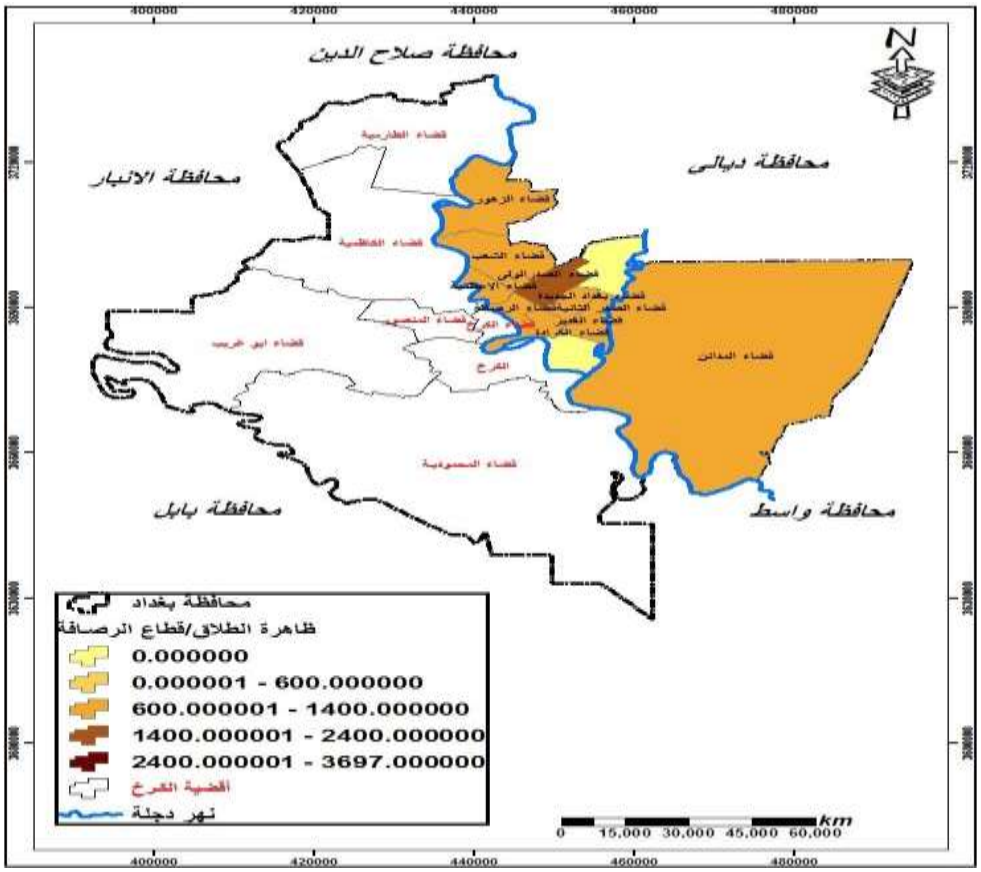


Figure 2. Distribution of divorce cases according to personal status courts in Al-Rusafa sector

Source: Researcher's work based on data from Table (1)



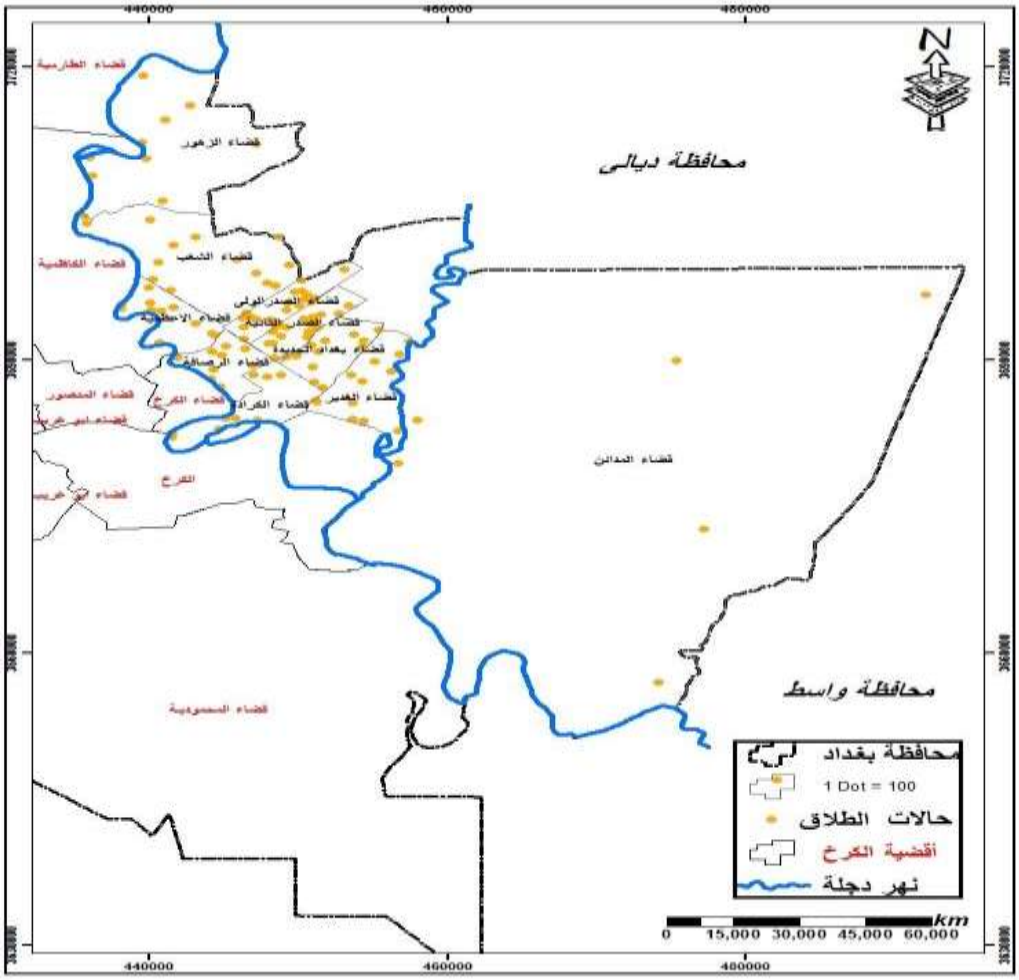
Map 2. Distribution of divorce cases in the Rusafa sector

Source: Researcher's work based on data from Table (1)

Using cartographic representation tools to represent the phenomenon of divorce in Al-Rusafa sector

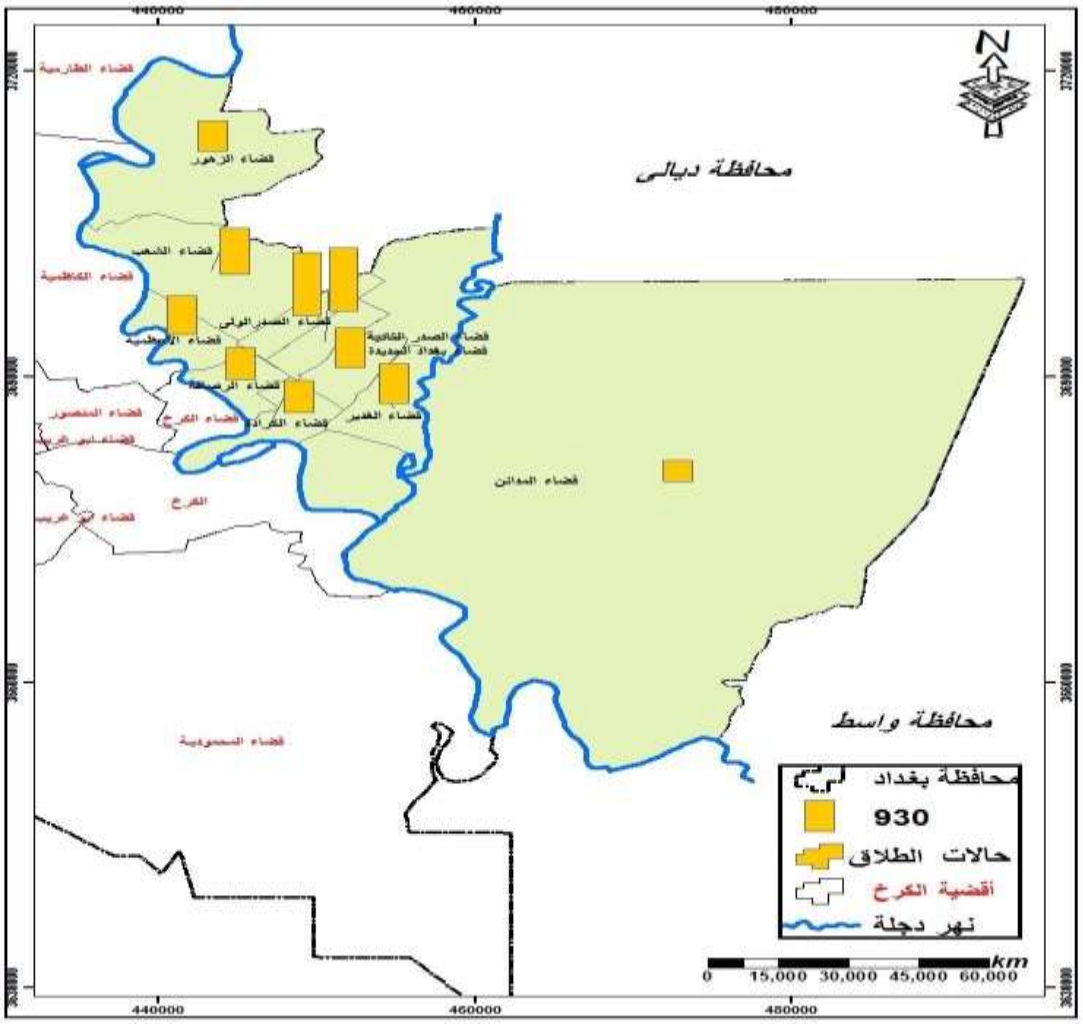
To represent this quantitative demographic phenomenon with a social dimension or structure, which is the phenomenon of divorce in Al-Rusafa sector, the cartographic representation methods will be used to represent the phenomenon under study to provide an applied image of the quantitative representation of demographic phenomena, which is explained in the following ways:

1- Point cartographic representation (point maps): This type of representation for small, medium or large-scale maps uses the symbol of equal-sized points, and these points have a quantitative significance determined by the type and quantity of the geographical phenomenon to be represented on the map, and they are distributed on the map as close to the location of the geographical phenomenon as possible. Point maps are among the most difficult methods to prepare and create, and the reason for this is the necessity of determining the relationship between the meaning of the point and the point and the area on which the point will fall, then signing the point in its correct place and drawing it in a regular artistic manner. This method of representation is found in the GIS program, but it does not focus on the occurrence of points on the map in their correct places, but rather scatters the points in a geometric or random manner above the place of the phenomenon to be represented pointwise, so the map turns from a statement of actual distribution into a random distribution map. This problem can be overcome in the GIS program, by achieving accuracy in the mathematical operations, including choosing the size of the point and its quantitative significance based on statistical data, and by applying the equations that include it in the size of choosing the quantitative significance, and it may be in an automatic applied form that can be changed at the appropriate time and as quickly as possible until an ideal map is produced that expresses the geographical phenomenon and its distribution, as shown in Map (3). It shows the representation of the phenomenon of divorce in the Rusafa sector using this method in distributing divorce cases on the districts using a point significance, which represents (100) divorce cases for each point distributed on the districts in the Rusafa sector. Map (3) represents the distribution of the phenomenon of divorce in Al-Rusafa **sector using points**.



Map 3. The distribution of the phenomenon of divorce in Al-Rusafa sector using points
Source: Researcher's work using Arc.Map.Gis.10.8 program

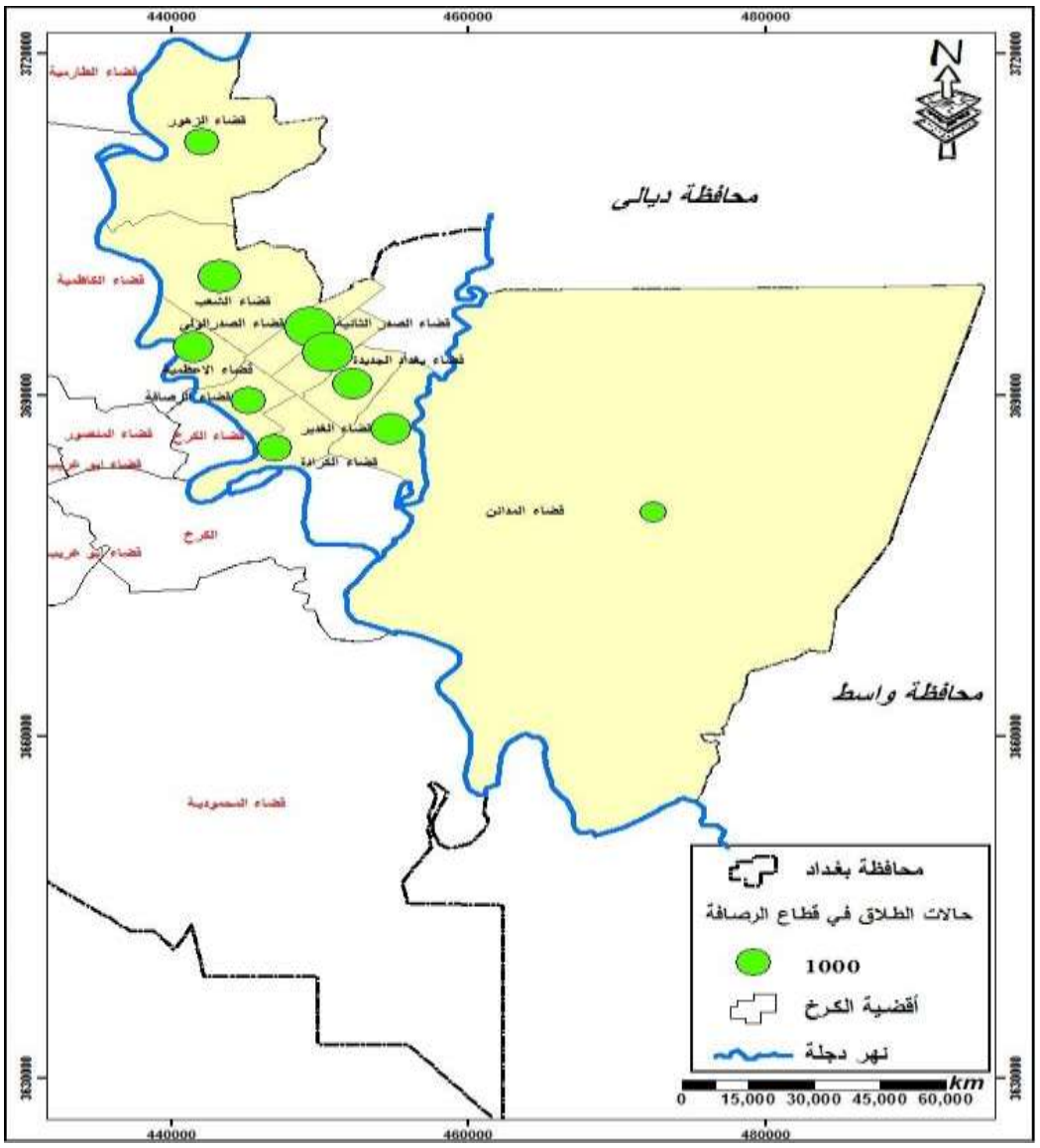
2- Cartographic representation with relative bar graph symbols: There is one way to represent relative bar graph symbols, which is one of the simplest forms of relative symbols and the easiest to work and design. It is one-dimensional symbol, and therefore represents the size of the phenomenon through its lengths. This method is characterized by its ease and flexibility, as it organizes the columns in crowded areas on the map. It is also characterized by its ease of reading from a visual perspective, due to its simple linear shape that can be estimated visually or with the help of a scale. Geographic information systems are distinguished by their capabilities to encode this type of maps. These systems contain, in their applications in cartographic representation, representation by individual columns, in which the phenomenon of divorce in the Rusafa sector will be represented in Map (4). These systems also contain capabilities represented by changing the properties of these columns, such as changing the size, color, and shape, and they can be displayed in a three-dimensional manner, according to the map director and the technical quality in producing and producing the map, to reach the recipient or map reader in an ideal and clear way.



Map 4. Cartographic representation by bar graphs

Source: Researcher's work using Arc.Map.Gis.10.8 program

3- Cartographic representation with relative spatial position symbols: Despite the existence of some difficulties in the process of representation by bar graphs and their application, hence the use of area instead of length in representing the quantitative phenomenon using the area of geometric shapes (such as square, circle, triangle, etc.), there will be limit concerning the representation in these methods to the representation by relative circles to represent the phenomenon of divorce in Al-Rusafa sector as shown in Map (5), as it is one of the oldest quantitative methods used to translate statistical data since the nineteenth century. It has been used as graphic forms to depict the results of population censuses, while its use on maps was in the late nineteenth century when it was drawn to represent the population of Irish cities, and geographic information systems contain high potential for representing this type of maps based on statistical data in geographic information bases specific to the geographical phenomenon.



Map 5. Cartographic representation with spatial position symbols Relative circles
Source: Researcher's work using Arc.Map.Gis.10.8

4. Conclusion

The phenomenon of divorce is one of the population problems with a social dimension, as it negatively affects the emergence of society and its social structure. Given the high number of divorce cases in Iraqi society, it has been found appropriate to find an actual explanation of this phenomenon by representing it on maps for the reader who follows such phenomena from officials, society, and all those concerned with this matter to find appropriate solutions as quickly as possible and with the least effort. Through this research, the following conclusions have been found:

1- The number of divorce cases increased in the two districts (Al-Sadr I and II), as the number of divorce cases reached (3697) cases, representing (31%) of divorce cases in Al-Rusafa sector, compared to the rest of the districts in Al-Rusafa sector, in which divorce cases vary from one district to another, as a result of human factors and high population density in these two districts, in addition to the social factors and reasons in them.

2- The importance of what geographic information systems provide in terms of the possibility, speed and accuracy in delivering information to the recipient from specialists and the map reader, by choosing the appropriate symbols and colors in preparing the map.

3- It became clear through the representation of the data of the study phenomenon, the use of point, linear and area cartographic representation tools to represent the phenomenon, which makes it possible to represent the phenomenon in more than one way to represent the quantitative map.

4- The ease of knowing the actual distribution of the phenomenon through the use of scientific cartographic methods and the use of cartographic analysis tools in a geographic information systems environment.

5- The possibility of creating a geographic and information database that can be used to find solutions and appropriate decisions related to this phenomenon.

5. Recommendations

Since the study is an applied study to represent the phenomenon of divorce on a map, it is found to be logical to recommend the following:

1- Paying attention to holding introductory courses on the geographic information systems program and its high capabilities in speed and accuracy in finding solutions and making appropriate decisions, to prepare cadres capable of dealing with this program in the relevant departments and institutions.

2- Due to the high potential of Geographic Information Systems (GIS) in choosing the appropriate method in representing all human and natural phenomena, the method that gives a faster visual perception of vision and cartographic representation is chosen.

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