

Quantitative Coding in Thematic Maps: An Applied Study of the Distribution Maps of Wasit Governorate Residents

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The main objective of the research is how to represent the quantitative map symbols using geographical information systems and choosing the best quantitative symbol for each phenomenon that is represented on the map so that it is not chosen in an unconscious way, as each symbol of these symbols is carefully chosen in a way that suits the type, nature and characteristics of the phenomenon it represents, it is known that the content of the map is symbols taken to represent geographical phenomena and on the basis of which it adopts the process of reading and analyzing the map. We have mentioned three groups among the basic symbols used in geographic information systems are raster (local) and linear and spatial. The concept of quantitative coding and the importance of using symbols in maps, as well as the concept of quantitative map and the steps for preparing it in geographic information systems, an applied study on how to prepare them for Wasit governorate residents were clarified. And how to encode quantitative data in the geographical information systems (GIS) and choose the most appropriate ones in the representation of research maps, and an applied model for maps of the population of Wasit Governorate has been chosen according to the administrative units (judiciary) without relying on Wasit population estimates for the year 2018 By the Ministry of Planning, and the creation of a digital database to distribute the population of Wasit Governorate and produce maps representing both the numerical and relative distribution of the population and the representation of the general population density as well as the distribution of the population according to the environment (urban and rural) as well as the distribution of the numerical and relative population by sex (male and female) according to what Availability of data from the Ministry of Planning, which can be represented in

the form of maps and based on one of the GIS programs, which is the ARC GIS 10.4 program.

Key words: *Quantitative coding, Thematic Maps, Distribution Maps*

Introduction

The map is an effective way to interpret spatial distributions on Earth's surface. As for the geographer, he considers it a mainly reliable tool, and he cannot imagine himself without a map. For him, it is a means of research and study, and a guide wave to study geographical features, and he uses them as primary informational and cartographic sources for developing and preparing geographical maps, whether general or objective. A map is defined as a representation of a part or all of the surface of the earth based on the use of a suitable scale and a suitable projection and by the method of using point, linear and spatial symbols in that representation. These cartographic symbols are scientifically and accurately selected in order to help the map reader to identify them, distinguish them well, and read their specifications and characteristics.

The quantitative symbols are represented on the map based on statistical data, that is, they represent that data, regardless of their different images, with multiple quantitative symbols, and this type of maps shows the ability of cartography to creativity in selecting the appropriate symbols for each phenomenon, as the quantitative coding is based on the representation of various quantitative characteristics and characteristics (Statistical or tabular quantitative data) for one or two phenomena or a group of phenomena in various forms, whether they are real values or derived values. Selecting some of them in a way that suits the topic of research and applying them to the population distribution maps of Wasit Governorate, based on estimates of the governorate's population for the year 2018 according to its administrative units at the district level, producing digital maps and representing them in ways appropriate for each phenomenon.

The research problem is summarized by two questions

- 1) Is it possible to represent digital cartographic symbols for statistical data when using GIS programs in line with the phenomenon that is represented on the map
- 2) Are these symbols chosen carefully and in a scientific manner in order to facilitate the user's connection with the map and the understanding and perception of the meaning of these symbols?

Research hypothesis:

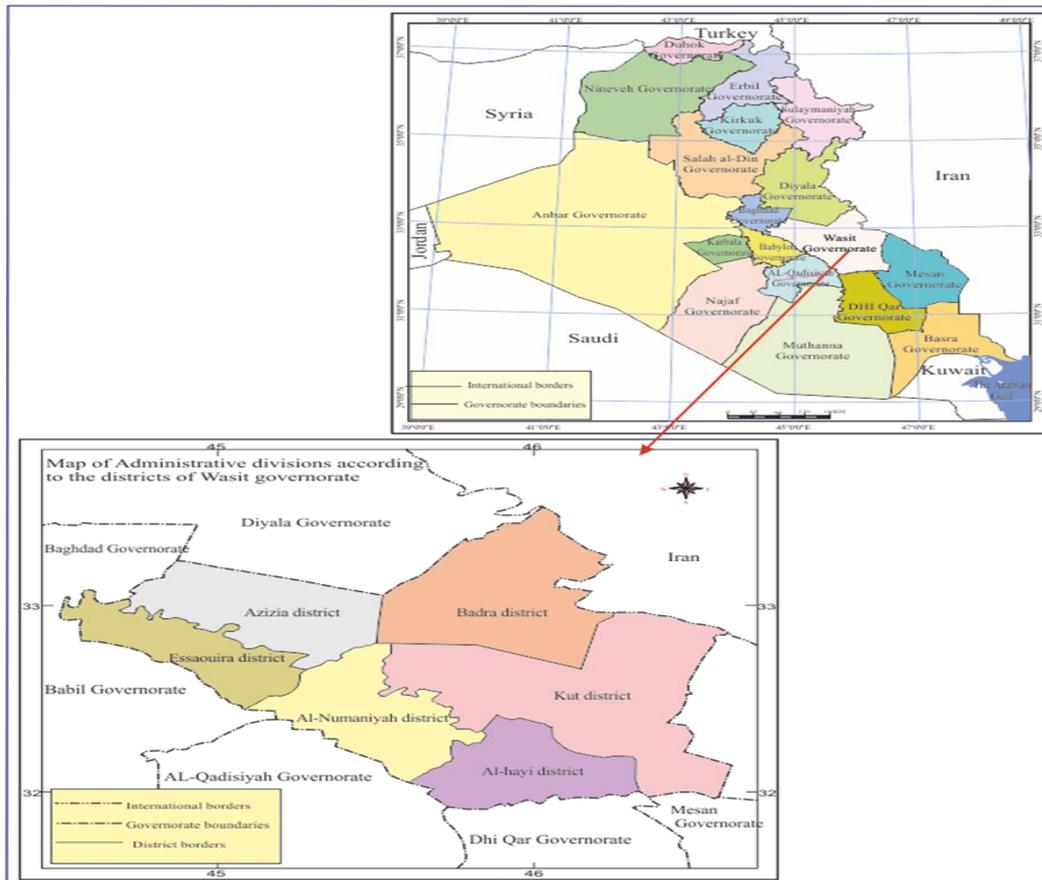
It is represented by the ability of geographic information systems programs to provide the largest number of quantitative symbols, which allow the mapmaker to rely on them in representation and choose the best ones in line with the phenomenon that is represented and this depends mainly on the user of these programs to be well experienced and experienced in selecting and representing statistical data. And in producing such types of quantitative maps. The importance of the research: The topic of the research has great importance by paying attention to ways that represent the symbols in the content of the map and by choosing it carefully. Although the GIS programs provide many quantitative and qualitative symbols, it is necessary to select the closest ones to represent the phenomenon. The goal of the research: the use of systems programs Geographic information in the production of maps with quantitative symbols that are represented in a manner consistent with the content of the phenomenon as well as clarify how to produce the quantitative map by addressing the stages of its preparation in one of the geographic information systems (ARC GIS 10.4) programs.

The spatial boundaries of the research are represented in Wasit Governorate, with its administrative boundaries according to the districts, and it consists of six districts. In terms of time limits, estimates of the Ministry of Planning's data for the year 2018 and some surveys and projections published in the Ministry were relied on. As for the geographical location of the search area, Wasit Governorate is located within its astronomical boundaries between the circles of latitude 33,30,02 and 31,27,5 north, and longitudes to the east 46,6,10 and 44,1,05 and it is bordered on the north by the governorate of Baghdad and Diyala and from the south by Maysan and Dhi Both Babil and Qadisiyah governorates are located to the west, and Iran is to the east, as shown on the map (Al-Shari'i, p. 191)

The structure of the research: It included important main and basic axes in the topic of the research, where the concept of quantitative coding and the importance of using quantitative symbols in the representation of maps were addressed, as well as how to encode quantitative data in geography. Information systems, as well as the concept of population maps, their classification and types, and clarification of the most important methods of quantitative representation in population maps and the types of quantitative symbols used in geographic information systems, as well as addressing the most important conditions that must be used when using geographic information systems to represent maps. Finally, the most important stages of producing the quantitative map were mentioned as an application study for Wasit Governorate, and a set of quantitative maps was produced according to the available data. For the year 2018 for residents of Wasit Governorate first/ the concept of quantitative coding for me: What represents me for the icons on the maps is done through the first two sides known as quantitative, and the other is known as qualitative coding. Or a group of phenomena in various forms, whether they are real values (numbers, lengths, areas, volumes) or derived values (averages, rates, ratios) (Al-Shari'i, p. 191) The quantitative map is produced through the use of values in the representation of a specific subject derived from the results Statistical

operations, for example, using ratios, density, or averages, and they may be from absolute real values such as population numbers, for example. These values are represented in their entirety to highlight spatial variance.

Map (1) : Wasit governorate location for Iraq



Source : 1) Public space survey , Administrative map of Iraq , scale 1:250000 ,2017
2) using program Arc gis 10.4

Regarding the phenomenon, its main focus is on showing the differences within the phenomenon that will be represented on the map rather than paying attention to its exact location on the map. Quantitative coding takes great interest in representing maps that form intent and continuous development in technology has been used when using their representation software in advanced geographic information systems, and when designing maps there is a set of methods known as symbolic representations of the data to be graphically depicted on these maps.

Second the importance of using quantitative symbols in representing maps

Due to the large number of geographical features (natural or human) on the map, which has become difficult to read and interpret, it was necessary to find a way to reduce the crowding in the information of these phenomena, whose structures (qualitative and quantitative) symbols were used for the purpose of clarifying natural and human phenomena on the map, and to use

symbols The quantity that deals with the shapes and the representation of the geometric shapes of the various circles, columns, squares and triangles, and each of these symbols must be rules when representing the use of symbols of various kinds will be according to the well-known cartographic rules and theories, which are considered outside the place of trial, which in turn reflects the art of taste and the designer's map and the extent of his creativity In the work and use of quantitative symbols and b especially in populations it has a great influence in achieving a cartographer's communication. As the cartographic communication is a representation of a special symbolic system that depends on a group of symbols represented on the map in order to prepare and link them from the cartographer who represents (the sender) who numbers and designs the map to the receiver who represents (the map reader) who works on reading the map content and decoding it. . And extract information from it, then analyze and use it for various purposes. Some notation is graphical, that is, analogous to real-world geographical phenomena, and some are abstract. (esri, 1991, P10)

Third / quantitative data coding in geographic information systems

Geographic information systems are spatial computer systems that are used to collect, organize, encode, process, analyze and model data of a spatial nature (Stephen, 2006, P4). It is a geographic science one of the most important sciences that are concerned with the applied fields that benefit from computer technology, especially in automated mapping, in addition to the enormous limitations of geographic information that provided us with the technology of tabular information systems and use them in the preparation and production of high-quality digital maps. It depends on processing data as well as converting it into digital maps that can be relied upon for geographical and statistical analysis, as well as the ability of geographic information systems programs to provide huge numbers of symbols (quantitative and qualitative) and the possibility of their representation after carefully selecting them in order to understand and understand the meaning of those symbols. The map designer chooses the most appropriate way to represent the data, which is consistent with the quality of the data, whether it is quantitative or qualitative data, with the y quality of statistical tables that contain the data and the quality of symbols, signs and colors used at the level of programs used in geographic information systems. (Honor, p. 135) Coding of quantitative data in geographic information systems contributes to its development, and the maps designed in it highlight the amount and quantity of the geographical phenomenon in the place, that is, it depends on a quantitative basis in addition to providing various symbols in the representation of quantitative data.

Fourth / The concept of population maps, their classification and types

Population maps (population map) are concerned with drawing and clarifying the location, pattern and distribution of population and population groups in a geographical area or country on the surface of the earth, its multiple composition, its multiplication and the migration of the population (internally and externally) as well as its social characteristics (Debs 2015, p.75). Maps are generally categorized into a set of classifications, including by objective, some by

subject, others by scale, also by geographic location, and finally by methods of cartoonish wave representation. In this research, we will rely on the classification of population maps according to cartographic representation methods, which are based on a set of carefully selected cartographic symbols with a functional map that helps the reader to identify and distinguish them well and read their specifications and characteristics.

Population (quantitative) maps have a set of representation methods, including

1- The local quantitative representation method: which depends on the nature of the quantitative local variable or perhaps on the nature of the translated quantitative elements that we represent in the field of mapping and is divided into three methods, namely:

- A. Method of quantitative representation of the locus point.
- B. Quantitative positional representation using relative symbols (square, triangle, rectangle, circle ... etc)
- C. The method of local quantitative representation by using the circuit as a special circuit for the capabilities to reflect more than other local techniques and quantitative representation, so its concept despite the applicability of the same cartographic conditions for all the translated quantity.

2- The linear cartographic representation method: It is one of the widely used methods dedicated to representing linear quantitative variables. Its principle is limited to changing the line thickness to express the quantitative changes along the vector line.

3- The quantitative area representation method: It is a construct that contains many quantitative spatial elements, which are the most popular when representing population elements and using types of symbols, which are area symbols naturally called relative spatial distribution symbols or percentage symbols. Two types of symbols according to the constituent elements of these symbols, namely:

- A. Relative area codes consisting of specified points.
- B. Symbols for thin parallel lines.
- C. Types of population maps: This is a type of mapping population distributions and has different types, including:
 1. Population distribution maps: It includes (numerical distribution, proportional distribution and environmental distribution of the population) as well as qualitative distribution maps, population concentration maps and actual population distribution maps.
 2. Population density maps: It includes (maps of total net density or real agricultural and economic density and density)
 3. Population growth maps.

4. Population fertility maps.
5. Population composition maps: It includes (the distribution of religions, languages, nationalities and human races)
6. Maps of births and deaths rates: It includes (crude birth rates and crude or infant mortality rates)
7. Migration maps: it has many methods, including (birthplace method, residence length method, residence place method, biometric method, national growth rate method and survival rate method).

In our research, population distribution maps were dealt with because of their importance in population studies to understand the reality of the geographical distribution of the region's population. Population maps can be represented in geographic information systems by six types of symbols, which are as follows:

1. Quantitative point representation Do t density: In this method, population data is represented on the basis of point density, and a value is given for each point. The higher the density of the points, the greater the value of the phenomenon. Usually the distribution of these points is either physical that is, in the same places where the phenomenon is actually located, and this type gives clarity and accuracy in the distribution or it must be done. Their distribution is imprecise randomly without distributing accordingly. Sites.
2. Quantitative representation using graphs (graphs): In this representation is the way in which different types of population data are represented, for example, we use (circular (to represent in the form of relative circles), and this represents the first type while the second type is Representation method (bar / column (column columns are single, but the third and last type is called grouped columns) and stacked) and each of them has a special method of representation style resort map designer.
3. Quantitative representation by proportional symbol method (relative symbols): When acting in a relative symbol method, one takes into account the spatial variation of the value of the phenomenon in question, such as the symbol size in any location, the ratio of the value of the other places. Also, the distribution in this method is based on a specific unit of measurement by taking into account the value of the symbol width used in the representation, either on the basis that the values are represented in units that are not specified and are distributed through a logarithmic scale, and in this case the big difference between the data is the controller In the appropriate symbol, or in another way, by specifying the values in one of the units of measurement (length or area) which is the basis for representing the data on the map.
4. Quantitative representation by the method of color gradient (gradient colors): representation in this way by giving a color to the phenomenon, where the color is arranged from the highest value to the lowest value of the geographical phenomenon or vice versa, and the color is usually chosen according to the map designer due to the presence of many colors in programs GIS.

5. Quantitative representation by multiple quantitative distribution method: This type is one of the most popular methods of quantitative use and selecting bananas as it is through information software systems and can distinguish or show variance in two ways first by adding the representation of the volumetric data or the second by dividing the data of the Z range The categories are represented here on the map.

Sixth :Conditions to be followed when using geographic information systems to represent maps

The cartographic concepts that Khalida adopted in the representation of monuments is her basis that cannot be overlooked when producing maps on mainland GIS software and their use does not eliminate the basic rules of introducing natural and human phenomena. It has them on the map, but it works on transform manipulation methods, and set the formula for the mechanism that you can manipulate, represent, and scale (Jones, 1998, p. 4). It can be said that relying incorrectly on automatic coding does not allow good scientific work to be presented and expressed in relation to the inability of the user, his cartographic background, and ignorance that the automatic coding was found because the computer does not have the ability to think, judge and discuss. We conclude from this that the use of GIS programs in the representation of cartographic symbols of phenomena, whether natural or human, that has conditions and foundations for use, and these conditions are:

- 1.The user must have a great scientific background in coding and using color, as the computer does not have the ability to think and always asks questions through windows in order to be able to implement what is required of him. Information systems programs provide what then lists the written symbols, bitmap, which must be the best choice in representing the phenomenon of scientific accuracy, especially since the systems for the ability of geographic information systems to create and develop new symbols are mainly available within the program to be a new icon design and the derivation of another symbol through Combine two or more available symbols together or partially derive an available symbol.
- 2.The user is a GIS program with knowledge of map design (map base) and methods of representing variables are necessities that must have passed years and YK and n experienced assets are familiar of maps, especially in thematic maps. When talking about automatic digital maps, it is imperative to provide the scientific foundations when designing the technical foundations and scientific foundations. There are those who imagine that producing automatic maps without the need to follow these foundations, but the reality is completely different, so it is not permissible (Aziz 2018, p. 239)
- 3.It is assumed that the scientific user of GIS and not the technical user is familiar with modern mapping methods for the group of sciences specializing in it. By the methodology, we mean the genius of using different mapping methods to represent variables of the map's subject, i.e. (geographical sciences if it is geographic, geological sciences if it is geological, environmental sciences if a specialist in ecology and so on),

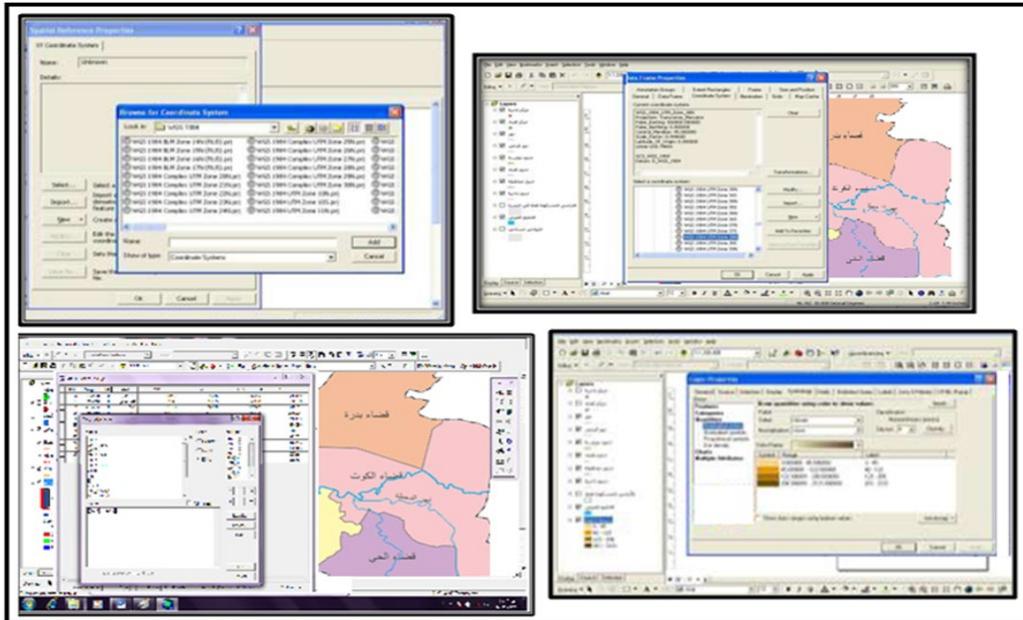
so that he can finally design and implement objective maps for his specific specialization.

4. The availability of a wide range of statistical map representation methods in GIS programs that are capable of converting geographical values into visual maps. These methods should not be used in most of them without referring to the disadvantages and advantages of each method to choose the most suitable one to represent the studied phenomenon.
5. To achieve a cartographer's connection between the map readers is a symbolic system that relies on icons, lines, text, and colors in order to prepare the message (map) or information and recommend it to me. The content decodes the codes and extracts information from them, then analyzes and uses it for any purpose (Debs, page 59). Geographers often use symbols in maps for the purpose of a series of coding facts or geographic distribution features that may require coding to generalize the characteristics of any change parameters by changing the metadata dimensions of the scale data (Al-Kassab, 2013, p.66).

Seventh / The most important stages of producing a quantitative map to represent its symbols. BASTEC is a long system of geographical data known to the residents of Wasit Governorate.

The administrative map was first approved as a basic map for Wasit Governorate and was used in the research, which is at a scale of 1: 250,000 for the year 2017, and then the geographical return process was implemented (the geographical reference (has any link to) the map with its true coordinates (x, y) on nature. Read M. or KM in order to properly deal with it scientifically and make (geolocation (in the program) ArcGIS 10.4 at least four specific locations that were identified on the map and entered directly using the addition of a control point, and these four points are known as coordinates on the map of Wasit Governorate, then Choose the hometown of UM Fitting Hometown Mercator Global Browser and Fix Zone Her and fix WGS 84)) which means the global system (World Geodetic System 1984) then the completed corrected map was worked on and the layers were created after forming ((the Raster and Line Linear phenomenon) And Polygon survey then create a digital database for Wasit Governorate in the characteristics table (table of characteristics and enter all numerical data for the population of Beltussian and proportional to the population of Wasit Governorate by regions for the year 2018 and the numerical distribution by environment (urban and rural (J)) As well as entering the number of population d according to gender (male, t and female), the general population density was calculated. The final stage was the quantitative coding process and the final output of the maps. It has been relying on geographic information system software (Arc GIS 10.4). It was chosen as the best symbol for each phenomenon represented on the map

Figure (1): shows some of the stages of preparing the map of the study area from the map projection and the possibility of coding it in the ARC GIS10.4 program



Source: Researcher according to ARC GIS 10.4.

Then the maps were produced with the best means, according to the program used, and thus a set of digital quantitative maps were produced for the people of Wasit Governorate.

Eighth / The term j g the data of Sister R Alans with them in the representation of feces seeking the governor of Wasit:

1. Wasit Governorate site map for Iraq: The administrative map of Iraq was drawn by divisions of (the governorate) and the map of Wasit governorate according to the administrative units (regions) in order to highlight the location of Wasit governorate in relation to Iraq was represented by (the point (in determining the districts' centers either) the line) The Tigris River has been represented on the map as either (Polygon) units of qada'as, each of which is displayed on the map and the appropriate color code for them, as is evident in the map (1). It is the map of Iraq and its preservation among the maps that represent qualitative means, not quantitative, but research requirements must be met.
2. Map of the numerical distribution of the population of Wasit Governorate: The map was drawn by choosing the symbol (point density), where the value of each point was given 3000 Newton meters of choice and the appropriate point size to represent the phenomenon, as it is a clear map (2)
3. The relative distribution of the population of Wasit Governorate: The map was represented by using the relative graphical bar code. If a column displays the proportional distribution of population in each administrative unit, it will be represented

by glyphs using (bar / column). And the representation of the individual columns body for each administrative unit and a non-proportional mayor is easily read from the visible hand due to its simple linear shape that can overburden a visual pound with the help of a scale (10) suitable for column and color selection. Column scale has been made in the main map to illustrate the values as shown In the map (3)

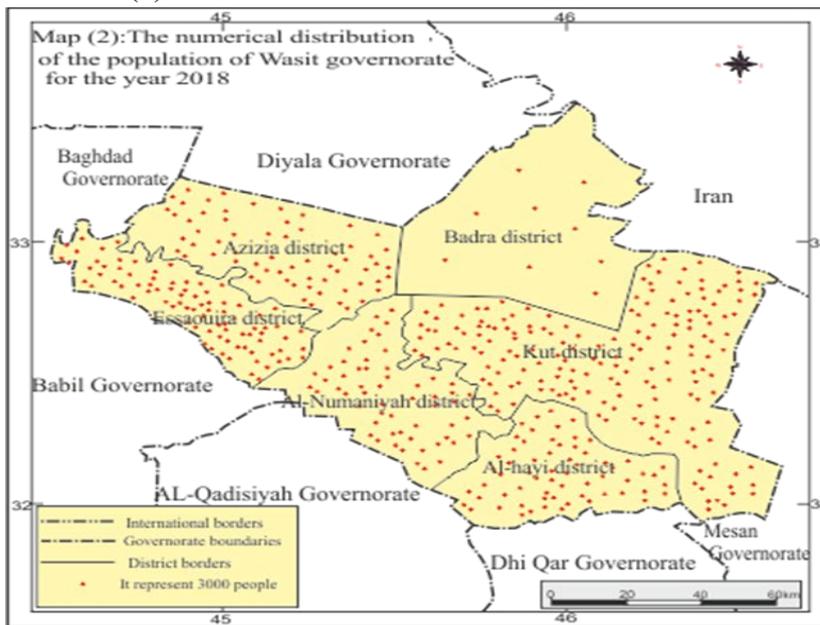
4. Map of the environmental numerical distribution of the population of Wasit Governorate: In this map, the relative circle symbol (circular) was chosen through (divided circles) to represent the environmental numerical distribution (urban and rural) of the population of the governorate. Within the circle, highlighting the difference in the size of the circle from one place to another, with the aim of highlighting the contradiction, as well as giving a color code inside the circle for both urban and rural areas, as shown in Table (1) and Map (4)
5. (Map of the environmental relative distribution of the population of Wasit Governorate: In this map also, the symbol of the relative constituency was chosen) circular through (proportional circles) to represent the environmental relative distribution of the population of (urban and rural)) in the governorate, but here the size of the constituency is determined in each administrative unit In the governorate and highlighting the differences in values within the directorate only, as shown in Map No. (5).

Table (1) Estimates of the population by environment (urban and rural) for the year 2018 in Wasit Governorate

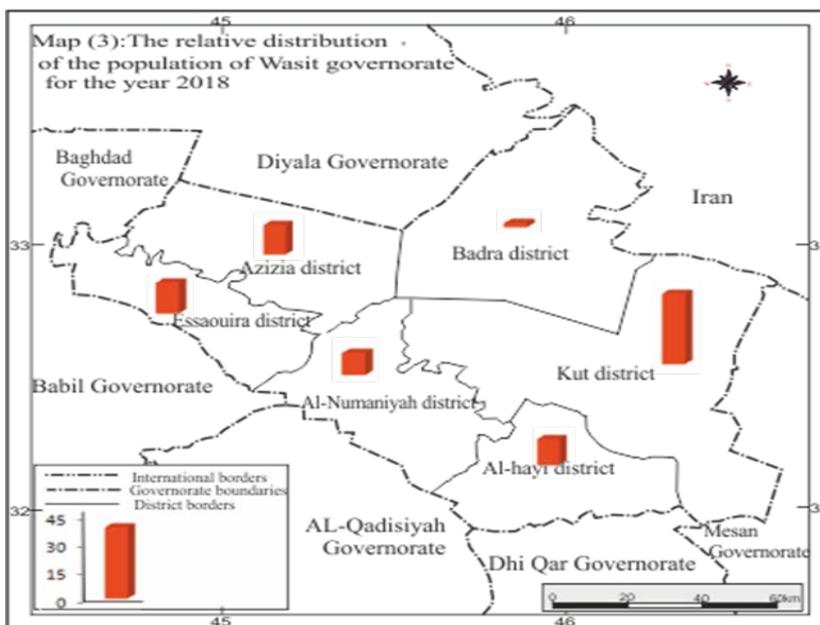
the countryside%	Rural population	Urban%	Urban population	%	Population	
21.4	117896	51	423745	39.2	541641	Al Kut District
16	88709	10	82782	12.4	171491	Al-Nu'maniyah District
15th	81442	13	106476	13.6	187918	District district
3	15147	2	13769	2.09	28916	Badra district
25.3	139332	12.2	101311	17.4	240643	Essaouira district
20	106414	12.2	101700	16	114 208	Azizia District
100	548940	100	829783	100	1378723	Total

Source: Republic of Iraq, Ministry of Planning, Central Bureau of Statistics, estimates of the population of Iraq for the year 2018 Table (189 p. 284)

6. The map of the numerical distribution of the people of Wasit Governorate by gender (males- females): It is represented by the method of graphical columns, and it is intended to use two columns to illustrate two phenomena, as in this map the numerical distribution of two phenomena. The population of Wasit Governorate was explained by gender, where the first column shows the number of males and the second column represents the number of females in the administrative unit. A color for males and another color for females were chosen according to the availability of the program, as shown in Table No. (2) And Map No. (6).



Source : Table(1) using program Arc gis 10.4



Source : Table(1) using program Arc gis 10.4

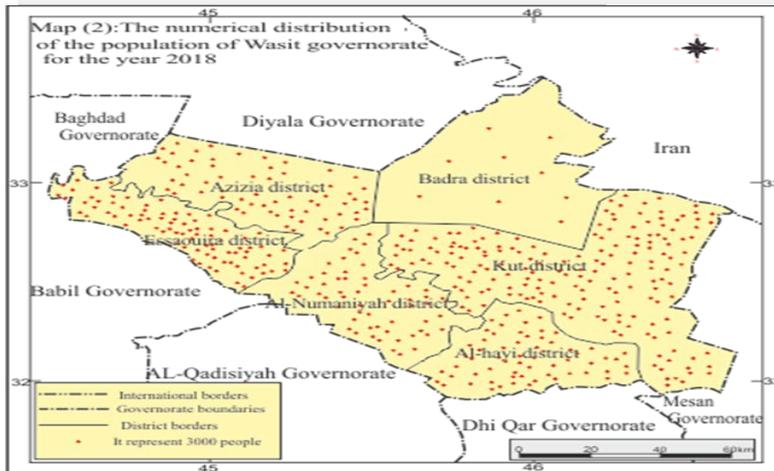
Table (2) Population estimates by gender (male - female) for the year 2018 in Wasit Governorate

Female percentage	Male percentage	Number of females	The number of males	Districts
39.2	39.2	268163	273478	Al Kut District
12.4	12.4	84925	86566	Al-Nu'maniyah District
13.6	13.6	93053	94865	District district
2.0	2.0	14320	14596	Badra district
17.4	17.4	176 119	121467	Essaouira district
15 th	15 th	103059	105055	Azizia District
100	100	682696	696027	Total

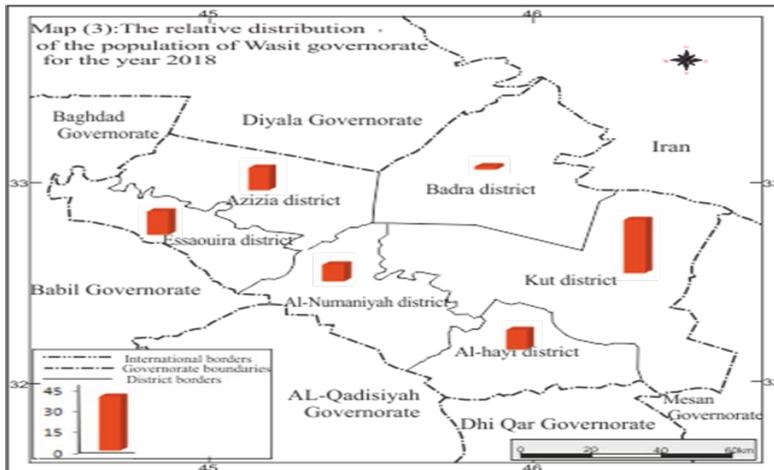
Source: Republic of Iraq, Ministry of Planning, Central Bureau of Statistics, Iraq Population Estimates for the year 2018, Table (189, p. 284)

7. Map of the proportional distribution of population by gender (males and females) in Wasit Governorate:

And it was represented by the combined graphical method (stacked). One column was used to represent the proportional distribution of males and females to illustrate two phenomena, as in this map the proportional distribution of the population of Wasit Governorate was represented by gender in the same proportion of males and the proportion of females in the administrative unit and a color was chosen for males and another color for females According to the presenter of the program, as shown in Table (2) and Map (7).



Source : Table(1) using program Arc gis 10.4



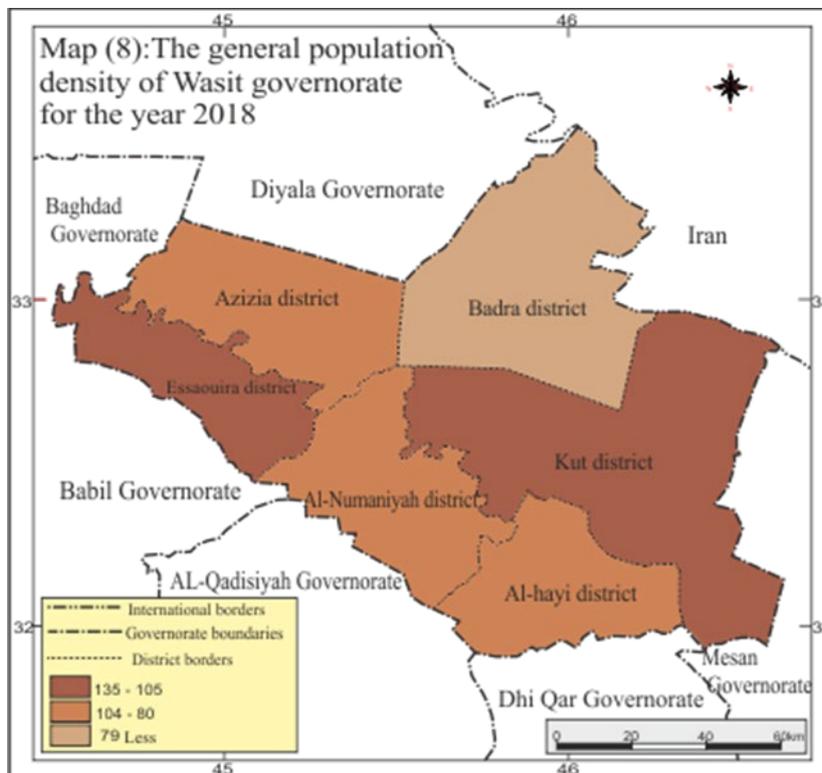
Source : Table(1) using program Arc gis 10.4

8. Map of population density distribution in the province of SPA i: In this map, the density is calculated by dividing the population by the general space for each expenditure. The general population density was represented by using the gradient color deception method (gradient colors) from top to bottom, and a suitable color was chosen for the gradient to facilitate the distinction between The categories represented in the map as shown in Map No. (8).

Table (3) General density according to population estimates for the year 2018 in Wasit Governorate

Density / km2	Space	Population	Districts
105	5144	541641	Al Kut District
81	2116	171491	Al-Nu'maniyah District
94	1999	187918	District district
8	3650	28916	Badra district
135	1777	240643	Essaouira district
84	2467	114 208	Azizia District
80	17153	1378723	Total

Source: From the researcher's work without reliance on the Republic of Iraq, the Ministry of Planning, the Central Bureau of Statistics, estimates of the Iraqi population for the year 2018, table (189, p. 284)



Source : Table(3) using program Arc gis 10.4

Conclusions

1. The study showed that GIS programs have the ability to draw and encode quantitative maps due to the different available quantitative symbols, and that their use reduces the effort and time spent in preparing the map due to its ability to deal with different geographical data. Regardless of its size and processing, as well as the ability to choose codes accurately and flexibly in the field of code operation.
2. The possibility of geocoding and coloring for information systems and technical guidance and the map provided by the components of the balanced design in one of the scientific foundations of the map where any good map is designed with the scientific foundations in the map easily achieved by the reader.
3. The best symbols can be chosen in the representation of maps in order to provide a wide range of map symbols of various types and forms in the programs (GIS), and this depends on the experience of the map designer, then we must be familiar with the rules and shapes. The basis for choosing the appropriate code for each geographical phenomenon.
4. The ability of information systems programs to prepare a digital database of any size, and any modification to it can be made according to the emerging variables of the phenomenon and thus produce digital maps.
5. A set of scientific foundations and rules that must be followed when representing me for every phenomenon, as the selection of symbols is not random and we are according to the principles of water in order to fit the apparent actress and to check maps between the map contact who reads the map.



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