Environmental and Urban Land Use Analysis by GIS in AL-Shaab of Baghdad as a case study

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ABSTRACT

AL-Shaab municipality faces many problems in the distribution of services (health centers, police stations, kindergartens and local markets) since these services are sometime concentrated in some of its regions and nonexistent in others. Moreover, distribution systems of these services do not adhere to planning criteria that are made consistent with population concentration and population growth, urban expansion and other resident's needs.

The subject of this study is environmental and urban land use analysis for AL-Shaab municipality in Baghdad city. The main purpose is knowing the strong and poor regions of distribution facilities in study area depending on a planning standard and trying to find out a planning solution for poor regions to comply the municipality with a planning standard.

The researchers of this work selected AL-Shaab municipality for this work, being one of the important parts in Baghdad city, because its location, its high density of population, large area of the city, faces large problems in its urban planning and residential areas should depend on planning standard to show the weak regions in AL-Shaab municipality.

In this work, kindergarten, primary schools, intermediate and secondary schools, green zones, religious facilities, local markets, police centers, health centers and garages were studied. The results showed that there are a weakness distribution of kindergartens, police centers, local markets and health centers in the municipality, especially in 348 and 346 neighborhoods and a some weakness in other of facilities distribution in the other neighborhoods centers.

INTRODUCTION

The land use in any community reflects the economic and social development of the country, land use has a great importance in many countries because of development of its guide for the country's ability to achieve economic and social development. The importance of land use lies in its relation with people's live, because it offers services directly contact with people needs.

Land use studies show clear developments when appearance of Geographic Information System (GIS) and high ability of GIS for high accuracy spatial analysis, ability of GIS for spatial analysis pushes the researchers to access deeply to GIS technical hence to appear the important of using GIS in land use analysis.

Researcher seeks to high-light in environmental and urban land use analysis using (GIS) where it is a new addition in researches that studying land use by modern technique.

Study Area

AL-Shaab municipality is one of the main residential regions, which contain different levels of people and contain many important streets such as, AL-Madaris street, Adan street and AL-Aswak AL-Markazeastreet.

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AL-Shaab municipality is located in the north-east of Baghdad between the longitudes (44º18'18" E) and (44º27'33"E) east of Greenwich, and latitudes (33º28'33" N) and (33º22'44"N) north of the equator, as shown in map (1). It is bounded on the north with AL-Zehoor municipality within Baghdad city, on the east Diyaala province, on the south Safieddin AL-Hile street which separates AL-Shaab from AL-Sadr municipality and on the west AL-Jaeash channel which separates AL-Shaab from Adhamiya municipality, as well as it is bounded with the Tigris River from the north-west near AL-Muthanna bridge (north of Baghdad). AL-Shaab neighborhoods arranged in nine districts, as given in table (1) and fig (1).

Table (1): AL-Shaab municipality neighborhoods, sectors and districts

Neighborhood no.	Sector	District
348	AL-Basateen	SabeaaAbkar
346		
344		
321	AL-Baeedaa	AL-Selekh
315		
323		
319		
317	AL-Shaab	
327	Aor	
325		
337	AL-Shaab	AL-Thaaliba
331		
335		
339		
351	AL-Mahdee	
353		
357		
343		
359		
329	Aor	
345	Aor	AomALKabr O ALGazal
341		
333	AL-Shaab	Unknown

Source:[AL-Shaab municipality]

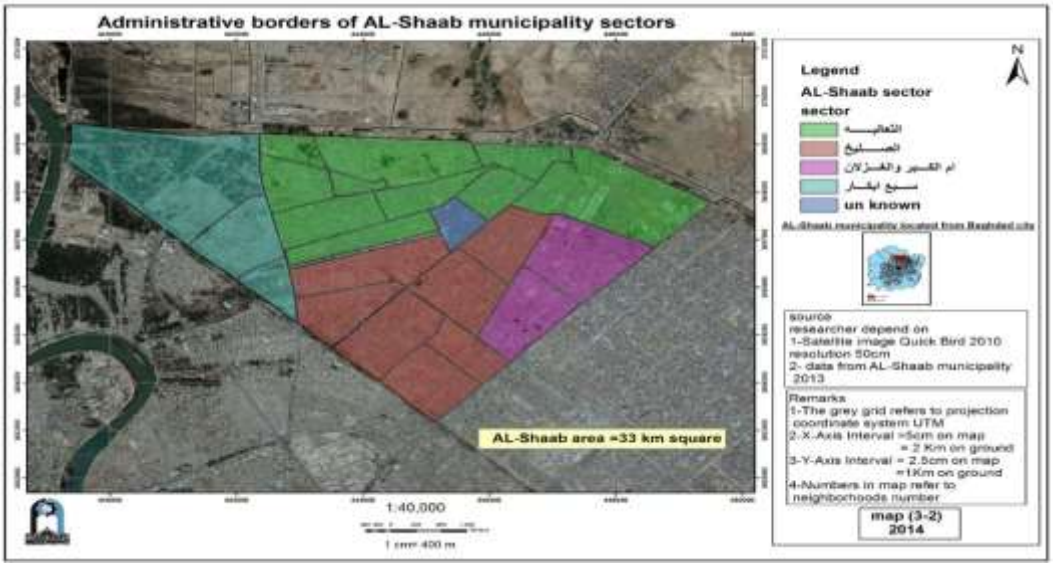


Figure (1): AL-Shaab sectors

Source: [Researcher depended on data from AL-Shaab municipality]

AL-Shaab Land Use classification analysis

AL-Shaab municipality land use classification to transportation, residential, commerce and business, public and infrastructural services, industrial and agricultural is shown in fig. (2) and table (2).

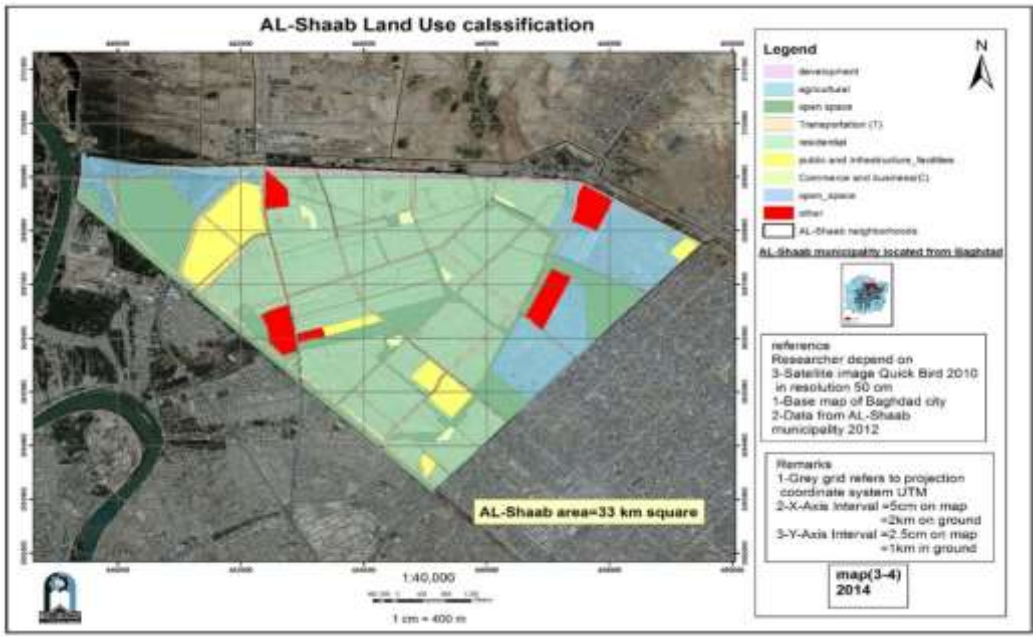


Figure (2): AL-Shaab Land Use Classification

Source: [Researcher depended on data from AL-Shaab municipality]\

Table (2): AL-Shaab Land Use Classification Analysis

land use type	area of land use m²	Percentage area of land use classification in AL-Shaab municipality
Transportation (T)	2528036	8%
residential	16248435	48%
Commerce and business(C)	437505	1%

Public and Infrastructural facilities (p)	2196654	7%
open space	5340506	16%
other	1305283	4%
Agriculture (A)	5250496	16%

Source: [Researcher depended on data from AL-Shaab municipality]

The analysis of the data for land use shows that the maximum percentage area of AL-Shaab municipality land use classification is residential land use and minimum percentage area of AL-Shaab land use is commerce and business. Because residential area ratio is 48%, so the main classification of AL-Shaab municipality is residential land use.

Population and Housing densities

Population net density for AL-Shaab neighborhoods has been found by ratio number of population in each neighborhood to area for that neighborhood, and unit housing density has been calculated by dividing the number of houses in each neighborhood by area for that neighborhoods, as shown in table (3) and fig. (3).

Table (3): population and housing densities

Neighborhood no.*	no. of population *	area in ha*	Population net density (persons /hectare)**	no. of houses *	units housing density(units/hectare)**
348	14307	491	29	1231	3
344	744	63	12	137	2
315	16274	128	128	1906	15
319	18024	170	106	2087	12
321	14802	138	107	1953	14
323	10040	86	117	1094	13
341	22688	162	140	2742	17
325	23480	157	149	1951	12
317	26155	170	153	2877	17
337	27257	120	227	2682	22
339	29640	130	227	3168	24
351	19555	99	197	1783	18
353	9683	29	331	835	28
357	32033	207	154	3488	17
331	20323	78	260	1750	22
327	25378	125	202	1750	14
329	23596	334	70	2863	9
343	12699	77	164	1536	20
345	20781	209	99	2261	11
359	5714	52	110	590	11
335	25440	86	294	1990	23
333	unknown	56	unknown	1033	19
346	14307	153	94	1549	10

Source: [Researcher depended on data from AL-Shaab municipality]

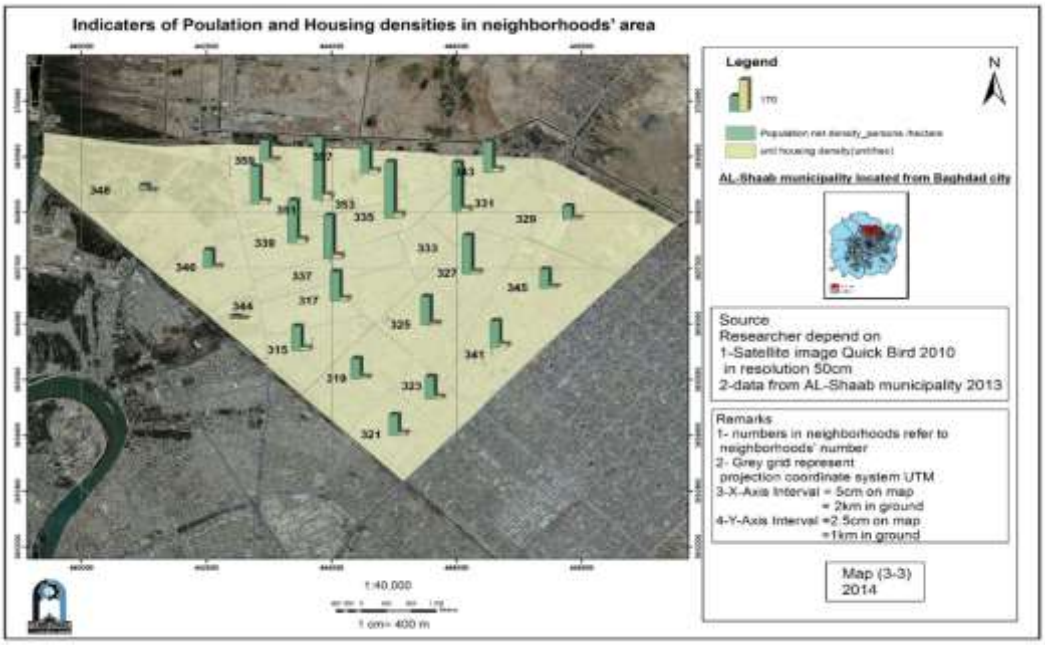


Figure (3): Indicators of Population and Housing densities

Source: [Researcher depended on data from AL-Shaab municipality]

Residential neighborhood's center

Basic services should be available in Residential neighborhood's Center, these services directly linked with people's live and their daily needs, and components of neighborhood's center are different according its size. These required services depended on minimum number of residential people that selected by planning standard for services, therefore the neighborhood's center should contain main services (religious, kindergarten, primary school, garden and commercial center) and contain secondary services found on all or some neighborhoods based on number of population will be serving such as, (secondary school and health center).

Table (4): Walking distance from neighborhood's center to services

service	walking distance from center of neighborhood m	No. of people
Mosque	800	3000
Kindergarten	300	1500
Primary school	500	3000
Intermediate school	750	6000
Health center	800	4000
Green zone	500	3000
Market	500	3000

Source: [Planning Standard for Neighborhoods' and Sectors' centers, 2003]

Model of Residential Neighborhood's Center analysis

AL-Shaab municipality contains 23 neighborhoods; to find each neighborhood's centerservices, one must make a model application in each neighborhood, as shown in fig. (4).

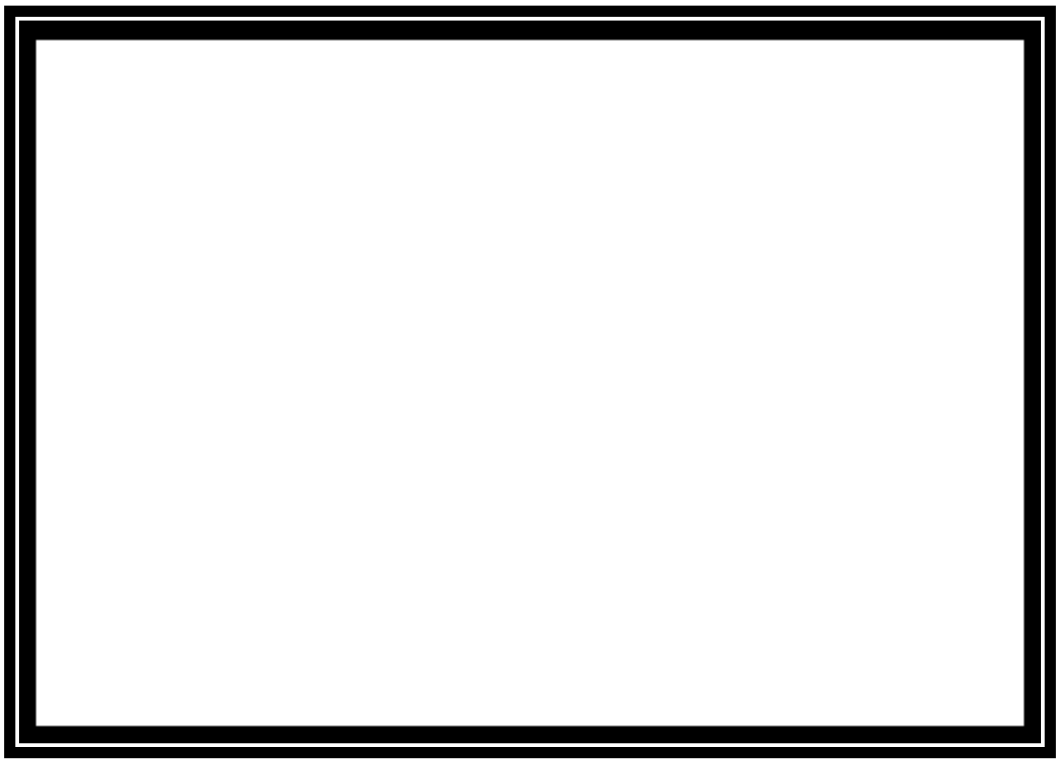
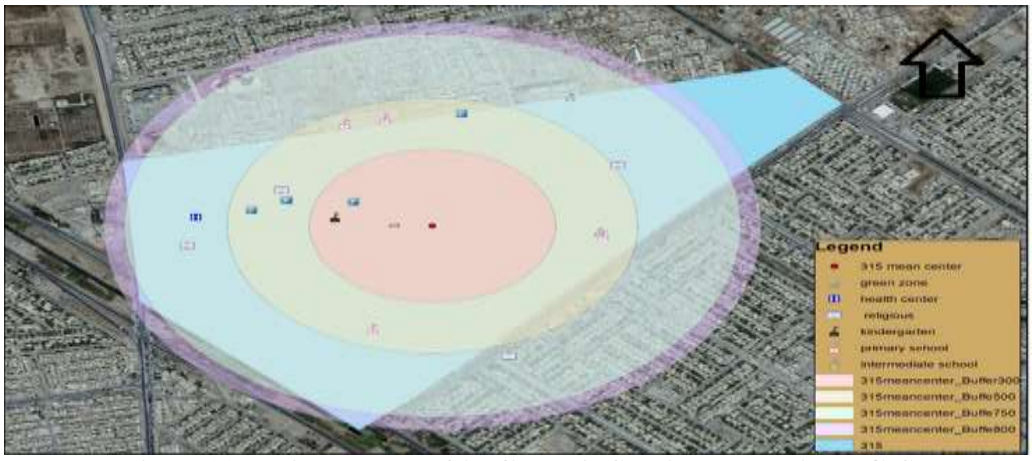


Figure (4): Model using for Residential Neighborhood's 315 Center Services analysis by GIS

Source: [Researcher depended on data from AL-Shaab municipality]

This model application is used in all neighborhoods centers, for example, neighborhood center 315, as shown in fig. (5).



Figure(5): Neighborhood 315 Center's Services analysis by GIS

Source: [Researcher depended on data from AL-Shaab municipality]

Table (5) Services of centers AL-Shaab neighborhoods analysis by GISapplications

ID	health center	mosque	kindergarten	primary school	intermediate school	green zone	Market
315	√	√	√	√	√	√	X
317	X	√	X	√	√	X	X
319	√	√	√	√	√	√	√
321	X	√	X	√	√	√	X
323	X	√	X	√	√	√	X

325	√	√	X	√	√	√	X
327	√	√	X	√	√	√	X
329	X	X	X	X	X	X	X
331	√	√	X	√	√	√	X
333	√	√	X	√	√	√	√
335	X	√	√	√	√	X	√
337	X	√	X	√	√	X	X
339	X	√	X	√	√	√	X
341	X	√	X	X	√	√	X
343	X	√	X	√	√	√	X
344	√	√	X	X	X	X	√
345	X	X	X	X	X	√	X
346	X	√	X	√	X	√	X
348	X	X	X	X	X	√	X
351	X	√	√	√	√	√	X
353	X	√	X	√	X	√	X
357	X	X	X	√	X	√	X
359	X	√	X	X	√	X	X

Source: [Researcher depended on data from AL-Shaab municipality]

Analysis by Buffer Zone Method

In this work, spatial analysis has been depended on planning standard of walking distance for (religious).

Buffer Analysis for Religious

The religious buffer distance is 800 m, and that means each religious serves for each house which is located in the zone of 800 m from that religious as shown in fig. (6).

Figure (6): Buffer zones for Mosque AL-Shaheed

Source: [Researcher depended on data from AL-Shaab municipality]

Each religious buffer's percentage effected in neighborhoods has been calculated by using an application (clip) available in the analysis tools for each buffer in neighborhoods, then using an application (calculate area) available in spatial statistics tools to calculate the buffer's area effected in each neighborhood and then divided by the total area of buffer, as shown in table (6).

Table (6): show mosques located and percentage effected of it in neighborhoods

Mosque name	Mosque located and percentage effected in neighborhoods
AL-Sada AL-	located in 315 neighborhood it's buffer effect 15% in 344 neighborhood, 41% in 315 neighborhood, 13% in 317 neighborhood and 31% out of city

Neaaem	
AL-Ferdos	located in 327 neighborhood it's buffer effect 19% in 341 neighborhood, 16% in 325 neighborhood, 41% in 327 neighborhood and 24% in 345 neighborhood
AL-Ansar	located 339 neighborhood it's buffer effect 7% in 317 neighborhood, 35% in 337 neighborhood, 41% in 339 neighborhood, 1% in 351 neighborhood, 5% in 353 neighborhood and 11% in 335neighborhood
Saeed-Haidar	located in 351 neighborhood it's buffer effect 3% in 348 neighborhood, 29% in 339 neighborhood, 46% in 351 neighborhood, 8% in 353 neighborhood, 3% in 357 neighborhood, 6% in 359 neighborhood and 5% in 346 neighborhood
AL-Zahraa	located in 319 neighborhood it's buffer effect 7% in 315 neighborhood, 49% in 319 neighborhood, 3% in 321 neighborhood, 12% in 323 neighborhood, 27% in 325 neighborhood and 2% in 317 neighborhood
AL-Ridha	located in 325 neighborhood it's buffer effect 27% in 319 neighborhood, 1% in 321 neighborhood, 19% in 323 neighborhood, 5% in 341 neighborhood and 48% in 325 neighborhood
mosque	located in 321 neighborhood it's buffer effect 34% in 319 neighborhood, 48% in 321 neighborhood, 7% in 323 neighborhood and 11% out of city
Zaid Bin Thabit	located in 321 neighborhood it's buffer effect 47% in 321 neighborhood, 11% in 323 neighborhood and 42% out of city
Badria	located in 323 neighborhood it's buffer effect 7% in 321 neighborhood, 34% in 323 neighborhood, 28% in 341 neighborhood, 5% in 325 neighborhood and 36% out of city
Abid Allah Bin Aomar	located in 319 neighborhood it's buffer effect 12% in 315 neighborhood, 52% in 319 neighborhood, 9% in 321 neighborhood and 27% out of city
AL-Sedeekeen	located in 319 neighborhood it's buffer effect 4% in 315 neighborhood, 39% in 319 neighborhood, 1% in 321 neighborhood, 12% in 323 neighborhood, 42% in 325 neighborhood and 2% in 317 neighborhood
AL-Noor	located in 315 neighborhood it's buffer effect 13% in 344 neighborhood, 50% in 315 neighborhood, 28% in 317 neighborhood and 9% out of city

Source: [Researcher depended on data from AL-Shaab municipality]

Analysis by Clip zones method

In this research , the analysis by clip is used to calculate the percentage area of AL-Shaab municipality neighborhoods served by (religious).

Clip Analysis for religious

The percentage area of each neighborhood served by the religious buffers is calculated by using an application (clip) available in the analysis tools between the religious buffers and AL-Shaab neighborhoods as example neighborhood no. 329 shown in fig. (7), then using an application (area calculation) available in spatial statistics tools of clip between religious buffers and AL-Shaab neighborhoods and then dividing the area of each neighborhood clip by the total area of neighborhood. The number of religious buffers effected in each neighborhood is calculated by using an application (select by location) available in data management tools for buffers in each neighborhood, as shown in table (7).

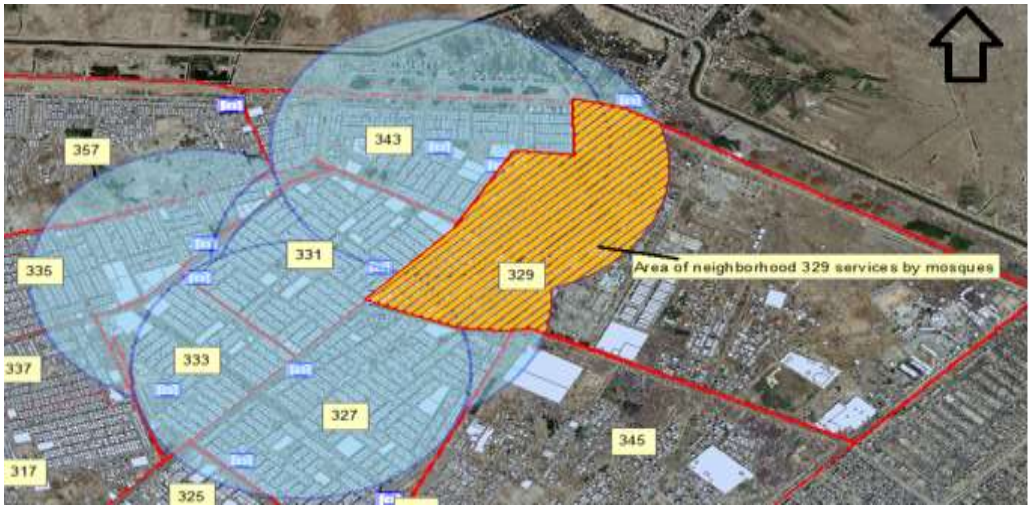


Figure (7) :Clip zones for Mosques in neighborhood 329

Source: [Researcher depended on data from AL-Shaab municipality]

Table (7): Percentage Neighborhood's Area Services by Mosque zones and Number of Buffer Effected in every Neighborhood

Neighbor no.	Neighbor area m²	Service area of neighbor by religious facilities m²	percent of neighbor service by religious facilities	no. of buffers effect in neighbor
348	4912736.538	99442	2%	3
344	632261.5573	528590	84%	4
315	1275140.441	1275140	100%	8
319	1702888.835	1702889	100%	9
321	1378397.387	1378397	100%	9
323	856807.4436	856807	100%	8
341	1620458.764	1605303	99%	6
325	1571132.934	1570474	100%	12
317	1703895.394	1641498	96%	14
337	1196694.49	1196694	100%	14
339	1301645.859	1301646	100%	11
351	994012.7483	936240	94%	8
353	292159.3124	292159	100%	6
357	2074428.44	1696915	81%	8
331	780764.9046	780765	100%	10
327	1252084.407	1252084	100%	10
329	3336334.74	1030889	36%	6
343	770110.4791	770110	100%	7
345	2089808.951	877453	42%	5
359	519978.1864	275098	53%	2
335	863021.3387	863021	100%	12

333	556788.6427	556789	100%	9
346	1528745.801	1437926	94%	4

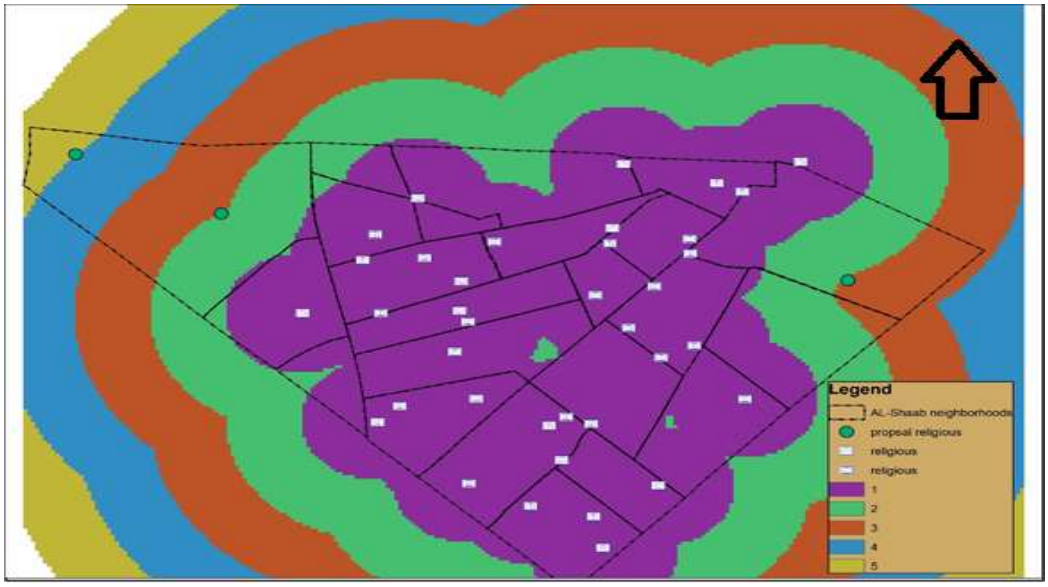
Source: [Researcher depended on data from AL-Shaab municipality]

Analysis by Reclassify

In this research, a reclassify analysis is used to identify the poor services zones in AL-Shaab municipality to select the best location for new services and to find a planning solution to comfortable municipality with planning standards.

Reclassify Municipality for religious Facilities

The defined interval of AL-Shaab municipality reclassify for religious Facilities is 800 m, and AL-Shaab city's classification has 8 zones: zone no. 1 serves by the religious Facilities, and other zones do not serve by religious Facilities, total area of AL-Shaab municipality served by religious Facilities equal to 23926332 m² that represented 72% from AL-Shaab. Increasing the degree of classification means regions being more worse service by religious. AL-Shaab municipality has got 106 primary schools, it needs 3 religious to be comfortable with the planning standard, these religious located between two zones do not served by schools to serve two zones at once shown in fig. (8).



Figure(8): Reclassify of Mosques Facilities

Source: [Researcher depended on data from AL-Shaab municipality]

Conclusions

1-GIS works on the production land use maps contain dimensions and metrics as well as adding a linear scale, legend, direction and coordinates, sources and frame. The study showed a large scientific importance of the map as a way to collect research data and an effective way to display the search results and link them with their presence.

2-This study shows the lack of planning elements in the distribution of services in the municipality in proportion to the number and distribution of the population on residential neighborhoods in the city.

3- The use of GIS envisages accuracy, effort and cost and gives accurate and fast results, and the application of GIS is working to provide the possibility dealing with high amounts of data processing and analysis. GIS technical can be considered an active tool for land use analysis.

Recommendations

1- Increasing interest in map studies applied to study the cities and disclose the reality, evaluate and develop appropriate solutions of land use

2- It is important to regulate distribution of the land use in a suit with the number and distribution of the population, and there is a very necessary study for the relationship between the distribution of the population and the distribution of land use.

3- It is necessary to update the master plan by scientific development methods in a suit with the number and distribution of the population.

4- Work on the environmental and urban land use analysis should be done for other services in the municipality, such as infrastructure (water networks, sewer networks and the current electric power and streets) and an environmental and urban analysis must be conducted for all uses of the land, depending on the quantity and type principles.

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