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Vanishing Green and the Loss of Iraq's Ecological Balance Due to Urban Expansion

Menghilangnya Lahan Hijau dan Hilangnya Keseimbangan Ekologi Irak Akibat Perluasan Kota

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Abstract

This study examines the impact of rapid urbanization on the green spaces of Baghdad, highlighting the environmental, economic, and social challenges posed by unplanned urban sprawl in developing countries. Using historical and descriptive methodologies, along with comparative analysis of urban growth, the research reveals that increased migration and weak governmental oversight have significantly reduced green areas, transforming potential parks into residential and commercial zones. The findings underscore the need for stringent urban planning and policy reforms to preserve and expand green spaces, aligning with global sustainability standards to enhance urban quality of life and ecological balance in Baghdad.

Highlights:

- **Urban Expansion:** Baghdad's rapid growth has significantly reduced its green spaces.
- **Weak Oversight:** Lack of strict regulations has led to the conversion of green areas into urban developments.
- **Sustainability Strategies:** Urges policy reforms and sustainable planning to enhance urban green spaces.

Keywords: Urbanization, Basic Design, Green Spaces, Overpopulation, Land Use

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Introduction

Baghdad, as one of the oldest cities in the world, is home to a rich history and ancient culture . However, in recent decades, the city has witnessed rapid urban growth and unprecedented expansion. This urban growth is due to several factors such as population increase, infrastructure development, and economic and social changes .

is of great importance because it has profound effects on the city's green cover. Green cover includes natural spaces such as gardens, parks, forests, plants, and other green spaces that enhance the environment and provide environmental, social, and economic benefits to society .

affect the green cover in Baghdad in multiple ways. For example, urban expansion may transform agricultural land and green spaces into sites for construction and urban development. This may cause the destruction of natural ecosystems, loss of biodiversity, and decreased air and water quality. In addition, urban growth can lead to increased unsustainable use of natural resources and sprawl Residential towards the remaining green spaces , then, understanding and analyzing the impact of urban growth on the green cover in Baghdad is very important. This study can contribute to providing valuable insights for decision-making and developing sustainable policies for urban planning and maintaining green cover in the city. The study can also provide basic information to the local community and those concerned with the environment and urban planning to achieve a balance between urban development, preserving the natural environment, and quality of life in Baghdad .

Method

Although the basic plan of Baghdad city has established the importance of green areas, population density, major weaknesses in the performance of regulatory and executive authorities, and lack of awareness led to the reduction of green areas to what they are today. There are violations in the urban structure of green spaces in the implementation of the basic plan of the city of Baghdad. This study uses a comparative analytical approach for the purpose of analyzing the changes in green cover and analyzing the causes of urban growth in the city of Baghdad by identifying the changes in green cover in the city during a predetermined period of time and analyzing the causes and factors that lead to such changes, as well as developing strategies to preserve green areas according to acceptable standards.

Results and Discussion

A. Overpopulation

Overcrowding can be interpreted as the relationship between population and resources. In the precise sense, it is the population crowding that is concentrated in a specific geographical area, often the city, due to the continuation of natural increase and continuous migration until the production pattern becomes able to absorb this population increase in its cumulative form, which has led to the existence of what is called a population surplus. Which later became a problem of profound dimensions [1] and therefore the definition of overcrowding is the imbalance that occurs due to the imbalance between the exploitation of resources on the one hand and the degree of population increase on the other hand [2].

Overcrowding is represented by many dimensions, the most important of which is the population dimensions, when the population problem, represented by population growth, increases to the limits that exceed the ability of resources to satisfy population needs, which creates overcrowding in certain areas of the city, especially poor ones, and then leads to the creation of many population problems. In some Arab cities, they were not able to grow. Urban development must keep pace with or catch up with population growth, meaning that the city grows and expands urbanly at a rate lower than population growth, which has resulted in population concentration on specific urban areas, which has led to an increase in population density [3]. Therefore, population overcrowding is an expression of a deficiency in urban development. About meeting the needs of the people living in the city.

1. Overpopulation and Green Areas

The world is witnessing a continuous increase in population size , as more cities and urban settlements are being created , and with this rapid growth, green spaces and the natural environment are under enormous pressure . Green spaces are vital in the urban environment and include gardens, parks, urban forests, bodies of water, and other public spaces containing plants, trees, and animals. These green spaces play an important role in improving the quality of life in cities and providing a healthy and aesthetic environment for residents [4].

2. Overpopulation Affects Green Spaces in Several Ways

a. Overpopulation causes land use to change, as green spaces are converted into residential, commercial and

industrial buildings. This shift leads to a decrease in available green spaces and a reduction in biodiversity and ecosystem development .

b. The increase in population leads to increased needs for environmental and natural resources, such as water and energy. This leads to increased pressure on green spaces and affects the balance of the city's ecosystem .

are social gathering spaces and areas of interaction between residents. They provide opportunities for social communication and acquaintance between people, and are considered components of urban identity and belonging to places . Therefore, it is a complex and multidimensional issue in which urban planners, engineers, designers, and the public must cooperate together to find sustainable solutions that enhance the balance between urban growth and the preservation of green spaces. Thus, sustainable, comfortable and beautiful urban cities that provide a healthy and sustainable environment for residents can be achieved [5].

The development of the city and the increase in its population size may lead to a number of problems, including:

a. The natural increases in population resulting from the high birth rate, as well as the increase from the countryside to the city due to the economic factor, the abundance of job opportunities, and the abundance of services. All of these reasons led to an increase in the demand for housing units. The following is a figure that shows estimates of population growth in Iraq until 2020 [6].

Figure 1. Shows the Population Increase in the City of Baghdad for the Period between 2000

b. The absence of the rule of law after 2003 led to encroachment on agricultural lands and construction on them.

c. Issuance of a decision requiring the expropriation of agricultural and non-agricultural lands and their conversion to residential. An example of this is Resolution 117 of 2000 [7].

B . Green Spaces

Green spaces can be defined as that important and vital element in the city and they can take different forms and can occupy different and significant spaces and locations depending on the needs that follow them as well as the density of the urban center, which contains the largest part of it covered with green cover (meadows, flowers, Trees) Green spaces are defined as spaces inside or outside the city such that the largest portion of them is covered with plants. These spaces are used as gardens and rest areas. They contain areas designated for play and entertainment and open-air halls, i.e. swimming pools and playgrounds. They work to soften and purify the atmosphere and give a beautiful view. [8]

Accordingly, green spaces are the spaces in which the largest portion is allocated to various plant elements, some of which contain constructions, seating areas, fountains, water bodies, games, and perform recreational, touristic and environmental functions designated within the city's basic plan [9]

Figure 2. Shows the Types and Classifications of Green Spaces in the city of Baghdad

There is great importance in planning and designing open spaces and green spaces in cities and challenging the locations of spaces and their distribution patterns in cities, especially in Iraqi cities. The planning rates for green spaces within the spatial space of the urban environment depend on the local conditions of each city, and each individual of its residents is allocated a specific area of green areas, as follows: A table showing the per capita share of green spaces in the city of Baghdad and some Arab and international capitals [10], [11].

City	Per capita green space, m2 per capita
Cairo	1.5
Damascus	0,70
Eastern Saudi Arabia	5
Dubai	13.1
Manama	2.5
Baghdad	1
Rome	23.5
Brooks	29.2
Copenhagen	35
Glasgow	55.6

Table 1. Shows the per Capita Share of Green Spaces

C. The Basic Plan

The importance of the foundation plan is due to the interest in studying the components of the city (activities, activities, and population), in terms of the distribution of land uses and their future changes, the distribution of the population and their growth, and the changes that occur to them, and the street networks and transportation systems necessary to connect activities and ease of access between them. That is, the foundation plan is a practical framework that deals with The unity of time and space for these variables, and therefore any change in the components of the urban fabric must be consistent with what was determined by the basic design of the city, but if the opposite happened, it would confuse this fabric [12]Therefore, one of the characteristics of the basic plan is flexibility in planning and design, not rigidity, because the urban pattern must necessarily change its location and expand, and this makes it important to ask whether adaptation to the new functions resulting from changing land uses is relatively easy and whether expansion and change are a matter . It can be achieved with a minimum of control and with the least possible disruption to the basic design prepared for the city [13].

The main goal of the basic plan is to achieve a set of goals. These goals are related to all the social, economic, environmental, cultural and urban aspects of the city. These goals are:

- a. Work to develop a strategy to control and direct the city's growth during the period of developing the plan.
- b. Balancing the spatial distribution of activities and events during the planning period to ensure coordination of all activities provided by the city.
- c. Developing and protecting green spaces and natural areas within the city, not exploiting them for other purposes, and improving the general environment of the city .
- d. Organizing the distribution of population in the city and its surrounding areas .
- e. Interest in developing the city center [14].

1. Reasons for the Emergence of Cases of Land Encroachment within the Basic Design of the City of Baghdad

There are a number of reasons that affect the basic design of the city

- a. The concentration of investments in the city of Baghdad, which made the city a center of attraction for residents of other cities that were suffering from weak investments, which are cities that expel their residents due to the lack of development projects.
- b. The decline in the standard of living as a result of the decline in the level of individual income, which forces residents to work in projects that spread in the city, while the countryside suffers from an economic and social cost that prompts residents to migrate to Baghdad and live in homes that do not provide comfort requirements and lack health conditions.
- c. The increase in urban land prices and the high rate of housing rents, which prompted individuals to search for a way to get rid of the financial burden.
- d. Weak oversight by municipal agencies and their inability to monitor violations that encroach on lands belonging to the state.
- e. Greed for leased state lands in order to obtain lands. This results from the spirit of ownership among individuals to achieve personal interests [15].
- f. The spread of the phenomenon of chaotically built housing as a result of its construction with non-permanent materials.
- g. The spread of slums or areas that were built illegally and unplanned and lack the most basic services necessary for their continued existence. They are also characterized by low income levels and a low economic level, which makes living conditions difficult in these areas [16], [17].

Figure 3. Show the Green Areas in the City of Baghdad according to Paul Cerf's Design for the City of Baghdad

D. Land Uses

It is a set of sequential and interconnected procedural steps that are prepared and implemented with the aim of finding the optimal use of the land through studying and evaluating all existing and related economic and natural factors. This is a process that divides cities into multiple regions. Having different uses is a planning pattern known since ancient times, but there is another opinion that says that the process of dividing the city into different uses makes it intentionally divided. Modern trends in urban planning seek to create interconnection and integration between parts of the city, where one of the parts can provide a main function in addition to Secondary functions complementary to the main function [18].

The most important feature of the land use plan is its nature in referring to the sites of events, as while it indicates the various uses, it does not specify the location of the school or hospital, but rather gives and clarifies the relationships and principles related to them and their location. .

1. Spatial Distribution of Green Spaces in the City of Baghdad

It is noted from the standards assigned to green spaces that the city of Baghdad suffers from poor geographic distribution and small areas of open space, which is not proportionate to the growing size of the population or to the standard of living, which has provided the opportunity for large numbers of the population to own vehicles that facilitate the transportation process and encourage enjoyment. The number has increased. The population in the city of Baghdad increased from (3,841,265) in 1987 to (4,402,091) people in 1997 according to the general population census of Iraq [20]. Estimates of the Municipality of Baghdad showed an increase in the population to (5,605,462) people in 2007 and (7,032,535) people in 2013. It is noted from During the statistics, the size of the population is not proportional to the size of the green spaces in it, especially with the presence of some areas characterized by high population density, which makes them insufficient and inappropriate to serve the residents of those neighborhoods.

Green spaces occupy a low percentage of the city's area, as it does not exceed 4% with a total area of (14,557,295.52 m²), and the per capita share of it does not constitute (1.9 m²), distributed in the following manner [19].

- a. Green areas on both sides of the Army Canal
- b. Al-Kadhimiya Parks
- c. Al-Atafiya Park near Al-Sarrafiya Bridge
- d. Al Zawra Park
- e. Public parks along the Tigris River (Abu Nawas)
- f. Wedding Island
- g. Green spaces located on both sides of the eastern Baghdad train station
- h. For green areas of orchards (Krayat
- i. Green spaces within small parks in Mansour, as shown in the following figure [20].

Figure 4. Shows the Spatial Distribution of Green Areas in the City of Baghdad

E. Urbanization

It is one of the prominent manifestations of overpopulation, and the expansion of cities that accompanies these manifestations, which is one of the most difficult problems facing cities in the developing world today [20]. The industrial revolution that occurred in Europe in the nineteenth century is considered one of the most important events that affected the size and direction of the phenomenon of urbanization, which led to widespread migration from rural to urban areas, especially in developing industrial countries. Urbanization remains a prominent feature of our present era and a phenomenon that has begun to spread rapidly throughout the world. In various parts of the world [21] the concept of urbanization in industrialized societies has been linked to economic progress and industrialization, while in developing societies the concept of urbanization has been linked to the massive population increase, which has neither been closely nor remotely linked to indicators of economic change such as the development of industry, or an increase in surplus production. Urbanization also has an important social dimension, and this dimension includes the population and geographic distribution, behavior and attitudes of individuals living in urban areas and their suitability to urban life, its organizations and functions [22].

Urbanization has been defined as the process of geographical concentration of population and non-agricultural activities in an urban environment that is backward in terms of shape and size, or as a result of the interaction of many basic economic, social, cultural and environmental factors on an environment classified as urbanization, which leads to the spread of urban values, behavior and institutions

Or it is the process of population movement from rural to urban areas and the resulting increase in the number of population in urban areas over the proportion of the population living in the countryside. That is, it is the process of redistributing the population from the countryside to cities and to other urban centers. The operational definition of urbanization is: A process that expresses the movement of population from the countryside to the city due to factors of rural expulsion and factors of urban attraction to settle there [23]. The New Encyclopedia Britannica defines urbanization as the process of population concentration in cities or urban places, and this process occurs in two ways. The first is an increase in The number of urban localities and the second method is an increase in the size of the population of each locality separately .

Urbanization is also defined as the process that requires an increase in population growth as a result of natural increase and continuous migration from the countryside towards cities and the resulting process of annexation of areas towards cities [24].

We conclude from this that the urbanization process can take three main trends. The first trend is a spatial transformation, that is, a move from the countryside to the city. The second trend is an occupational transformation, that is, a shift from the agricultural profession and what follows it to the common professions in those cities. The third trend is a change in Behavioral patterns of an individual or society and the system and method of its daily life.

1. Study Area (Baghdad city)

The city of Baghdad has witnessed a remarkable growth in green spaces since the 1930s, starting with gardens and parks, passing through squares, planting sidewalks and open spaces intersecting between residential neighborhoods or separating main streets and roads, and all activities related to developing green areas to expand entertainment areas and increase the aesthetic value of the city until this growth took a trend. In contrast, since the ninth decade of the twentieth century, when delays began in completing the implementation of plans for development projects for developing the city, especially with regard to green areas, the role of the Baghdad Municipality was limited to preserving and developing the areas it implemented while continuing the process of planting large areas of open spaces, while it was distinguished by The period that began in 2003 was marked by stagnation in the expansion of green spaces due to the turbulent conditions the country witnessed, security chaos, weak oversight and neglect, as well as the forced displacement of large numbers of residents from inside and outside Baghdad. All of this encouraged encroachment on green spaces and changing their use for other purposes. The following is Figure (6).) It shows the uses of agricultural land according to the design of Paul Service 1965 [25].

Figure 5. Design of Paul Service 1965

2. Temporal Development of Green Spaces in the City of Baghdad

Interest in green areas and afforestation in the city of Baghdad dates back to the 1920s, when the first public park was established to have the features of modern parks (tree squares, trees, and vegetable hedges). Then the Secretariat Garden followed, and after a short period, an ideal garden was created, known as the Nation's Garden. This included attempts to plant some streets. Main areas such as Salihiya Street and Damascus Street in Karkh, and after the July 14 Revolution and as a result of the horizontal expansion that the city witnessed, the Municipality of Baghdad faced multiple problems in the green area, so it paid great attention to planting trees in residential neighborhoods and the streets connected to them to compensate for the lost orchards and to protect the city's environment. However, during In the 1980s and 1990s, there was delay in completing the implementation of plans for development projects for developing the city, especially with regard to green spaces, and the role of the Secretariat was limited to preserving some of the projects that had been established and with the beginning of the American occupation of the city of Baghdad, in light of the absence of oversight, the absence of state authority, and the displacement of residents from the countryside to the city. There was a large encroachment on agricultural areas at the expense of residential use, which led to a major imbalance in the areas allocated to green areas according to the basic design of the city of Baghdad. The following is a table showing the percentage of changes in the agricultural areas of the city of Baghdad from the year 2000 to the year 2020.

Fourth Stage (2015 - 2020)			Third Stage (2010 - 2015)			Second Stage (2005 - 2010)			First stage (2000/2005)			
Total Area km	Green Areas%	Other Use %	Total Area km	Green Areas %	Other Use %	Total Area km	Green Areas %	Other Use %	Total Area km	Green Areas %	Other Use %	
24060	.21	.78	.1313	35	.64	.1554	.40	.59	.25977	.45	.54	Total

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845	68%	32%		33%	68%	31	41%	59%	795 km	42%	58%	Rusafa
16589 16	38 . 94 %	61 . 06 %	1069 13	48 . 15 %	51 . 85 %	21425 83	64 . 67 %	35 . 33 %	12634 7 km	65 . 70 %	34 . 30 %	Total Karkh
40650 01	30 31%	69 69%	2382 13	41 74%	58 26%	22980 14	52 54%	47 46%	38612 5 km	55 56%	44 44%	Total B aghdad

Table 2.

Descriptives								
rasafa								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1.00	8	45.4187	17.59971	6.22244	30.7050	60.1325	12.85	65.66
2.00	8	35.3250	21.54210	7.61628	17.3154	53.3346	.00	61.60
3.00	8	21.6825	12.21273	4.31785	11.4724	31.8926	1.95	36.48
Total	24	34.1421	19.48374	3.97710	25.9148	42.3693	.00	65.66

Table 3. Descriptives

ANOVA					
rasafa					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2270.430	2	1135.215	3.690	.042
Within Groups	6460.739	21	307.654		
Total	8731.169	23			

Table 4. ANOVA

Multiple Comparisons						
Dependent Variable: rasafa						
LSD						
(I) VAR00002	(J) VAR00002	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00	2.00	10.09375	8.77004	.263	-8.1445-	28.3320
	3.00	23.73625*	8.77004	.013	5.4980	41.9745
2.00	1.00	-10.09375-	8.77004	.263	-28.3320-	8.1445
	3.00	13.64250	8.77004	.135	-4.5958-	31.8808
3.00	1.00	-23.73625-*	8.77004	.013	-41.9745-	-5.4980-
	2.00	-13.64250-	8.77004	.135	-31.8808-	4.5958

Table 5. Multiple Comparisons

Figure 6.

Descriptives								
karkh								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1.00	6	65.6967	18.79321	7.67230	45.9744	85.4189	37.32	91.74
2.00	6	64.6683	20.96100	8.55729	42.6711	86.6656	23.20	78.20
3.00	6	38.9367	20.29483	8.28533	17.6385	60.2348	.00	59.63
Total	18	56.4339	22.72688	5.35678	45.1321	67.7357	.00	91.74

Table 6. Descriptives

3. Differences Test for the Karkh side

ANOVA					
karkh					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2758.547	2	1379.274	3.436	.059
Within Groups	6022.144	15	401.476		
Total	8780.691	17			

Table 7. ANOVA

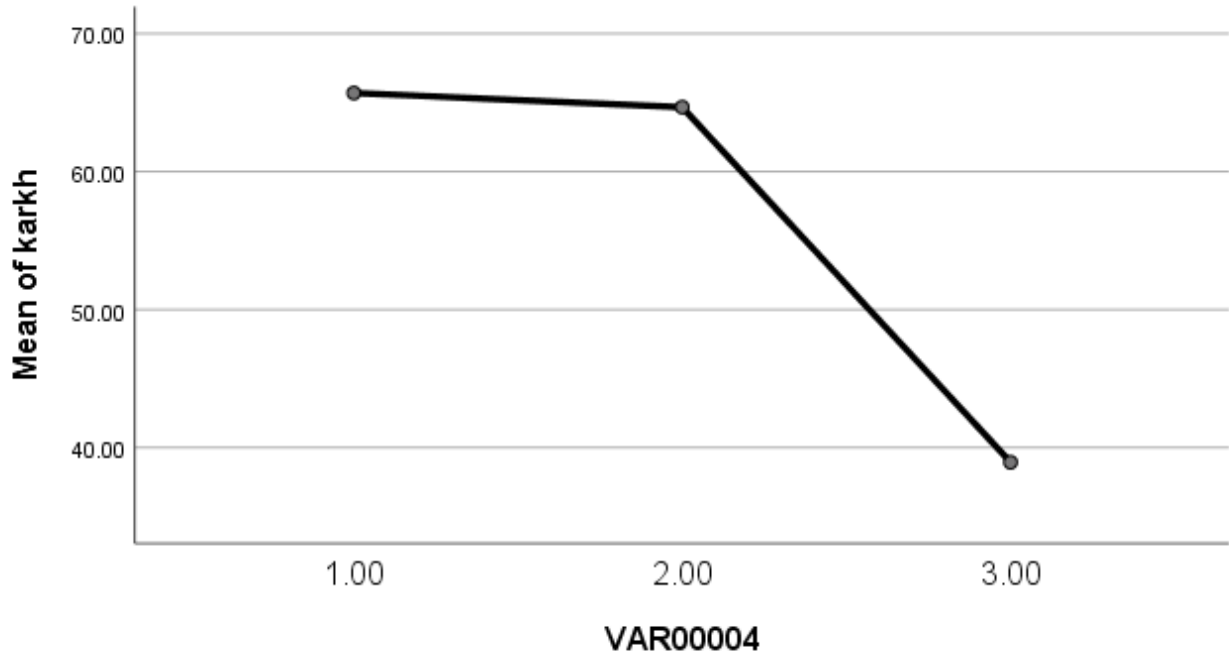


Figure 7.

4. Comparison of Karkh and Rusafa side

Descriptions								
green								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Meaning		Minimum	Maximum
					Lower Bound	Upper Bound		
1.00	14	54.1093	20.27500	5.41872	42.4029	65.8157	12.85	91.74
2.00	14	47.9007	25.41556	6.79259	33.2262	62.5752	.00	78.20
3.00	14	29.0771	17.81133	4.76028	18.7932	39.3611	.00	59.63
Total	42	43.6957	23.49005	3.62459	36.3757	51.0157	.00	91.74

Table 8. Descriptions

Multiple Comparisons						
Dependent Variable: green						
LSD						
(I) fact	(J) fact	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00	2.00	6.20857	8.08959	.447	-10.1542-	22.5713
	3.00	25.03214*	8.08959	.004	8.6694	41.3949
2.00	1.00	-6.20857-	8.08959	.447	-22.5713-	10.1542
	3.00	18.82357*	8.08959	.025	2.4608	35.1863

3.00	1.00	-25.03214-*	8.08959	.004	-41.3949-	-8.6694-
	2.00	-18.82357-*	8.08959	.025	-35.1863-	-2.4608-

*. The mean difference is significant at the 0.05 level.

Table 9. Multiple Comparisons

ANOVA					
green					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4757.580	2	2378.790	5.193	.010
Within Groups	17865.504	39	458.090		
Total	22623.084	41			

Table 10. ANOVA

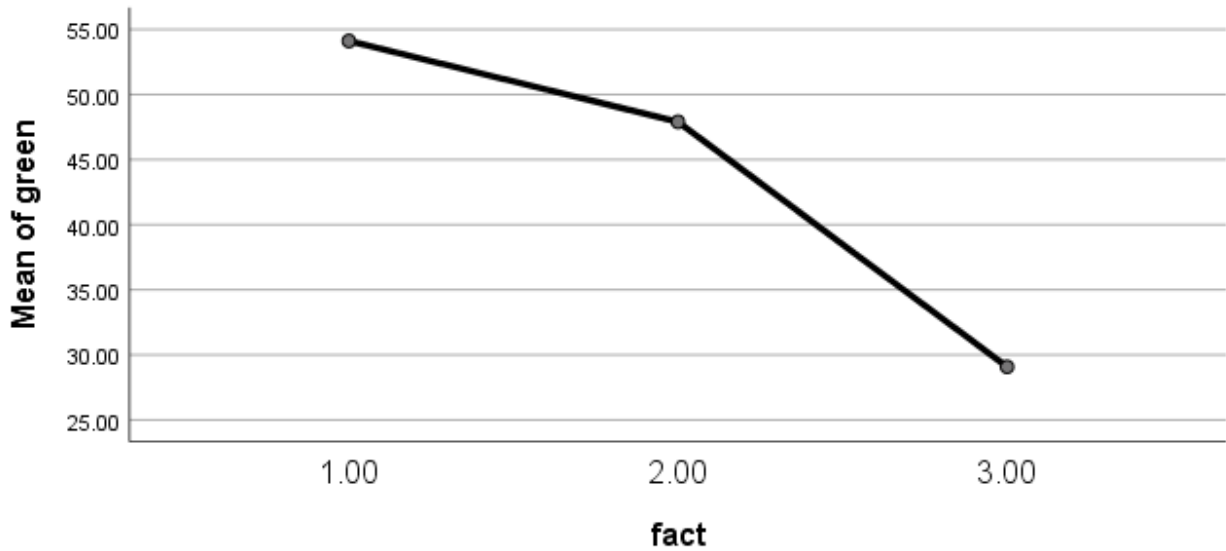


Figure 8.

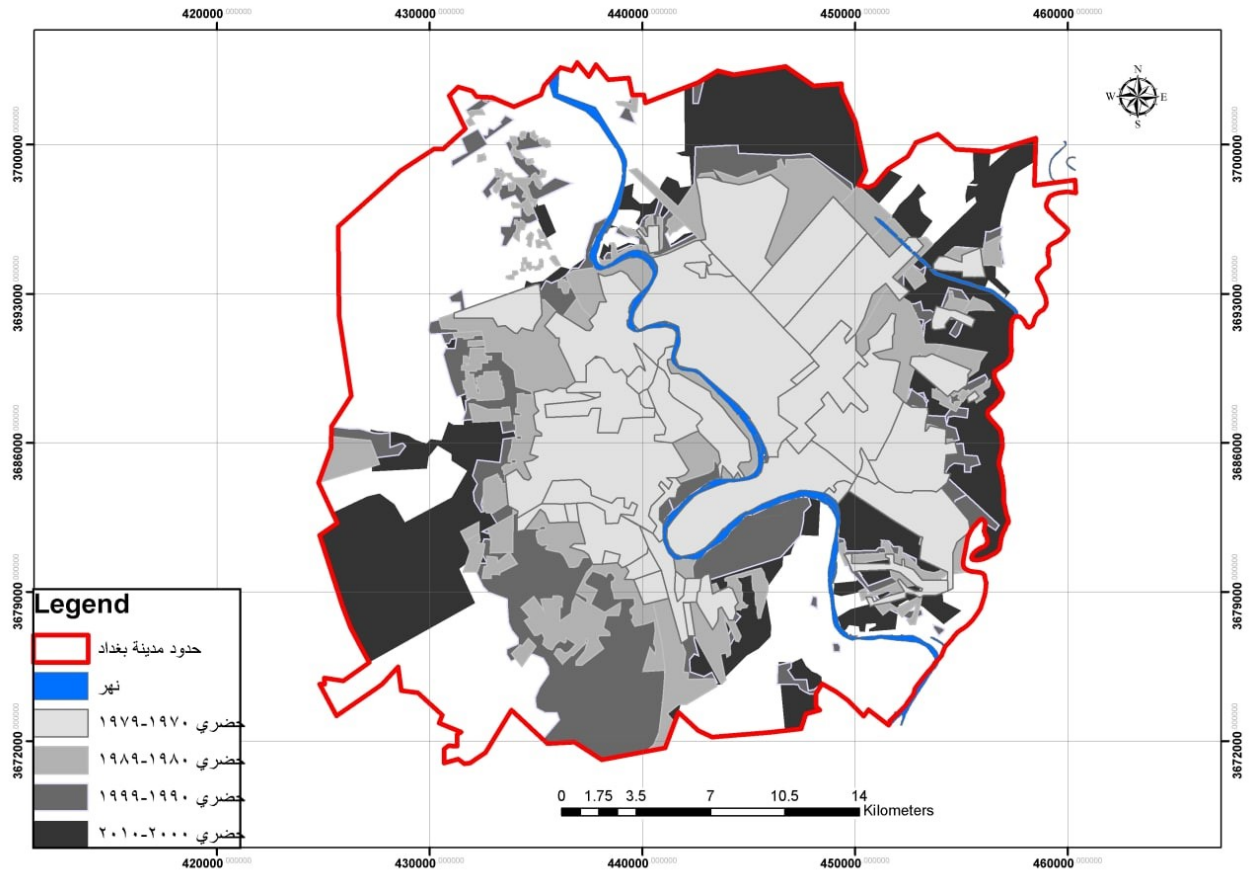


Figure 9.

Figure 10.

Figure 11.

Conclusions

The capital represents a population center for urban residents as a result of the concentration of investments in it and thus the provision of job opportunities, which led to the displacement of large numbers of residents and their residence on the margins of the city as encroachers on state lands. Weakness and absence of government control over various building and construction works, which led to the emergence of encroachment areas that spread outside the basic plan, such as converting a number of agricultural areas into car showrooms or exploiting the spaces between residential areas that are supposed to be parks into warehouses. High land prices and rental allowances, compared to a deficit in the number of housing units, high rates of population growth, and an increasing number of families. Cases of transgression have been increasing in recent years as a result of wars, military operations, the absence of the rule of law, and lack of awareness, as well as the increase in cases of forced migration, which has doubled the phenomenon of transgressions. Decisions issued allowing the construction of residential homes at the expense of agricultural lands and orchards.

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