

Analysis of Land Uses In Iraqi Cities

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Abstract—Land use plans in Iraqi cities are traditional and don't seek to be sustainable and therefore could have negative impacts on the city from the environmental, economic, social and urban aspects. Consequently, the research aims to analyze the current and future of the land use for a set of Iraqi cities to reach the indicators of the gap between traditional and sustainable plans when planning for land uses.

The research conclusion is that most Iraqi cities are highly urban sprawl, both in reality and in the future expansion of the city. That is because it consumes a lot of agricultural land, cities with low population densities that are unsustainable, and most land uses are unsustainable focusing on reducing the agricultural and green lands in the city and increase residential uses (single type with very low density), and expand the areas of the streets that depend on the automated transportation more than sustainable transportation.

The research suggests that sustainable land uses in Iraqi cities should be as follows:

- Residential use: vertical housing pattern 30 %, horizontal housing pattern 15 %.
- Mixed use 12 %.
- Green, open and recreational areas 22 %.
- Sustainable transport 13 %.
- Public, community and government services 8 %.

I. INTRODUCTION

Sustainability is concerned with the provision of a livable environment for human beings, and the sustainability of multiple strategies, including the sustainability of land uses in the city. This improves the built environment and spaces to make them integrated with each other.

The aim of providing a sustainable place for people with comfort and well-being, is through making land uses sustainable by increasing mixed uses, adopting sustainable transport and increasing green, water areas.

The research problem is that there is no sustainable future vision for land use in Iraqi cities when master plans are updated.

The research aims at developing sustainable land use rates used when preparing or updating the master plans, or when evaluating existing master plans.

The research methodology was based on Descriptive and Quantitative Analysis of the land uses of a set of Iraqi cities whose master plans were updated, in addition to the analysis of two phases the reality and the future vision of the land uses. This could provide a clear understanding about adopting the concept of sustainability in updating land uses in Iraqi cities.

II. LAND USE AND SUSTAINABILITY

During the past decades, the concept of sustainable development has established itself as a new requirement for urban and metropolitan level public action, which involves the design and practice of urban and land-use planning (Osaragi & Nishimatsu, 2013, p. 31).

As more nations are implementing this concept in their development plans, it has created significant impacts on national policies and urban planning. The concern over sustainable urban development will continue to grow, especially in the developing countries which are undergoing rapid urbanization.

The conversion of agricultural land into urban land uses in the urbanization processes has become a earnest issue for sustainable urban development in the developing countries. This could be overcome through searching for better urban forms that can help to sustain development with focusing on the minimization of unnecessary agricultural land loss (Li & Yeh, 2000, p. 132).

In practice, land-use planning proved to be one of the most important areas in which conceptions of sustainable development are contested (Osaragi & Nishimatsu, 2013, p. 32). However, in recent decades, the landscape of cities has changed significantly because of rapid urban population growth. A major feature of fast-growing cities is urban sprawl, which drives the occupation of large areas of land and is usually accompanied by many serious cases including inefficient land use, high car dependency, low density and high segregation of uses (UN-Habitat, 2014, p. 1).

Sustainable urban development requires policies to reduce energy consumption, reduce pollution and protect natural areas as well as agricultural land. The reuse of urban areas and more effective use of sites is a possible strategy that could be followed in both developing and developed countries.

The need for understanding land-use changes in order to improve land management, assess future trends and ensure environmental sustainability has given a rise to the novel discipline of land-use science (Marceau et al. 2013, p. 52).

Urban fringe dynamics place a constraint on the open spaces that surround urban areas. This could limit the potential of these green areas for biodiversity, agricultural production and a wide range of other landscape services such as water regulation and storage, air quality improvement and recreational opportunities. Seeking a solution for the deterioration of these services has given rise to various forms of land-use policy that aim to steer urban fringe dynamics. Open space preservation policies in western countries generally aim to manage urban growth through a range of concepts such as zoning, urban growth boundaries, transfer of development rights and related financial instruments (Frenkel, 2004, p. 358).

Sustainable land use strategies have to respond to the following key issues (Halcrow, 2007, p. 210):

- a) Urban sprawl, leapfrogging and poorly serviced development in peripheral areas.
- b) Under-utilization of serviced vacant land and brownfield (derelict) sites.
- c) Over requisitioning of land for projects/activities that may be unnecessary and inappropriate
- d) Unacceptably long commuter journeys

Sustainable land uses require the following (Paola, 2006, pp. 12-16):

- a) Consider the needs of the community.
- b) Create viable and attractive developments.
- c) Consider mixed-use developments.
- d) Design to appropriately high densities.
- e) Build on previously used and derelict land.
- f) Protect local natural habitats.
- g) Enhance the potential of land use for pedestrians and cyclists.
- h) Include food production opportunities where it is possible.
- i) Makes good public transport viable and, walking and cycling attractive options.
- j) Encourages well-laid out urban areas with good quality buildings, well-designed streets, and good quality public open spaces.
- k) Allows people to get to work easily and to the services they need like local shops, post offices, schools, health and leisure facilities.

III. SUSTAINABILITY CRITERIA FOR LAND USE

UN-Habitat supports countries to develop urban planning methods and systems to address current urbanization challenges such as population growth, urban sprawl, poverty, inequality, pollution, congestion, urban biodiversity, urban mobility and energy, through five criteria (UN-Habitat, 2014, p. 1):

- a) Adequate space for streets and an efficient street network: The street network should occupy at least 30 per cent of the land and at least 18 km of street length per km².

- b) High density: At least 15,000 people per km², that is 150 people/ha or 61 people/acre.
- c) Mixed land-use: At least 40% of floor space should be allocated for economic use in any neighborhood.
- d) Social mix: The availability of houses in different price ranges and tenures in any given neighborhood to accommodate different incomes; 20 to 50 per cent of the residential floor area should be for low cost housing; and each tenure type should be not more than 50 per cent of the total.
- e) Limited land-use specialization. This is to limit single function blocks or neighborhoods; single function blocks should cover less than 10 per cent of any neighborhood. The unilateral application of land-use specialization creates many single-function neighborhoods. That is the source of contemporary urban challenges including city congestion, segregation, car dependency, etc. Limiting land use specialization is important to create mixed land-use. There are two ways to adjust zoning policies and apply (UN-Habitat, 2014, p. 7):
 - to combine compatible land-uses into one block and neighborhood;
 - to introduce mixed land-use zoning while respecting market demand and cities' urban by-laws and regulations.

Land use ratios for sustainable Masdar City were as follows (Wagle, 2014, p. 8):

- a) Residential use 62 %.
- b) Commercial use 13 % + Retail 2 %.
- c) Community facilities 12 %.
- d) Light industries 11%.

IV. THE EXISTING AND FUTURE OF LAND USES FOR THE IRAQI CITIES

The cities were selected according to their potentials available in the city, for example:

- The cities of Basra and Amarah are characterized by their economic potentials such as oil and border crossings.
- The cities of Ramadi and Hillah have a high level of human potential.
- The city of Al Muqdadiya and Balad that they possess enormous agricultural potential with the characteristics of the green city.
- The city of Karbala is one of the most important Islamic holy cities with the characteristics of religious tourism.

1) Basra City

It is the center of Basra governorate, the third largest governorate in Iraq, located in southern Iraq, surrounded by countries of Kuwait, Iran and Saudi Arabia. It has a significant economic potential, including oil resources, seaports, border crossings and other resources (Fig. 1).



Fig.1. The location Basra governorate and Basra city in Iraq

Table (1) shows the following:

- The annual growth rate of the population and the area shows an excessive increase in the annual growth of the city area of 4.64% per annum compared with the annual population growth of 2.86%. This growth is unsustainable for land use.
- The city is characterized by a low density from 67 people/ha to 47 people/ha in 2030, which is an unsustainable indicator of the city's trend towards increasing urban sprawl rather than compact and proximity in the fabric of city, as well as increasing the area per person from 149 m² to 214 m² per in 2030.
- The plan 2030 of the city of Basra has been adopted to increase some rates of land use and others to reduce it, as follows:
 - Increase the percentage of residential use from 24.76% in 2009 to 34.28% in 2030, to accommodate the increased population growth and solve the housing problem.
 - An excessive increase in the transportation use from 2.29% in 2009 to 21% in 2030 to meet the economic development, especially the existing and future industrial. However, this increase is focused on the construction of highways and has not focused on providing a sustainable transport infrastructure such as walking and biking.
 - Increasing the percentage of industrial use from 3.52% in 2009 to 9.8% in 2030 as a result of the development in the oil sector and the possibility of establishing additional heavy industries in the future. However, it is a factor to increase pollution in the city.
 - The percentage of commercial and mixed use increased from 1.19% in 2009 to 2.8% in 2030, which increases the city's commercial activity and increases the future employment opportunities of the city as a result of the increase in household income and the expected economic growth of the city.
 - Increase the percentage of community services from 0.1% to 4.2% in 2030, to accommodate all future social needs from service and religious facilities.
 - A slight increase in the use of health and education, as health use increased from 0.43% to 2.2%, and educational use increased from 1.94 to 2.9% in 2030. This is a positive indicator of the increasing percentage of educational and health uses that are directly related to improving education, culture and community health.
 - The percentage of recreational uses, green and open spaces decreased from 15.89% in 2009 to 11.5% in 2030. This is an unsustainable indicator that works to reduce the level of well-being, environmental degradation and reduces the appropriate and adequate recreational areas for the population.
 - The decline in the use of public and civil services from 7.17% in 2009 to 3.4% in 2030, which is a negative indicator in reducing the percentage of areas allocated for providing services to the population and distributing them in an equal and harmonious manner in the city.

The future land use plan in Basra city is unsustainable by focusing on increasing the land use that pollutes the environment and reducing land uses that improve the environment and provide a healthy and suitable environment for people. In addition, it increases the excessive annual spatial expansion in the consumption of agricultural land and open space in the city.

- TABLE 1. LAND USE OF BASRA CITY FOR 2009 AND 2030.

Land Use	2009		2030		
	Area (ha)	Percentage	Area (ha)	Percentage	
Residential	4435	24.76 %	15917	34.28 %	
Commercial/Mixed	213	1.19 %	1314	2.8 %	
Industrial	630	3.52 %	4548	9.8 %	
Educational	347	1.94 %	1345	2.9 %	
Public and civil services	1285	7.17 %	1563	3.4 %	
Healthy	77	0.43 %	1005	2.2 %	
Community services (religious and social facilities)	18	0.1 %	1965	4.2 %	
Cultural and recreational (heritage, sports, recreational facilities)	510	2.84 %	601	1.3 %	11.5 %
Open space and agricultural land (agricultural, orchards, public open spaces)	2339	13.05 %	4714	10.2 %	
Transportation (infrastructure, shipping, airport, railway, parking)	413	2.29 %	9749	21 %	

Other uses (cemeteries, military, channels and land that can't be developed)	522	2.92 %	3709	8 %
Land designated for future development	7124	39.77 %	0	0
Total land use (ha)	17913		46430	
Population (person)	1200000		2171000	
Density (person / ha)	67		47	
per capita area (m²)	149		214	
Annual population growth		2.86 %		
Annual area growth		4.64 %		

Ministry of Municipalities and Public Works, General Directorate of Physical Planning (2012) "Basra City Development Strategy and Update the Master Plan" Report of the sixth phase, chapter III, p. 8, chapter IV p. 1, and chapter VI p. 1.

2) Amarah City

It is center of Maysan Governorate, located in the southeast of Iraq, bordered to the east by Iran (Fig. 2), a tribal city with a set of marshes, oil sites and border crossings with Iran, which are of an agricultural environment.



Fig. 2. Location of Maysan governorate and Amara city in Iraq

Table (2) shows the following:

- The population growth rate of the city is 2.3 %, which is acceptable with the national average of Iraq. However, the annual growth rate of the area of 4.18 % is high and doesn't correspond to the population growth. This could be considered as an unsustainable indicator based on the city's urban sprawl and the random expansion.
- The city is characterized by a low density from 112 people/ha to 74 people/ha in 2030, which is an unsustainable indicator of the city's tendency to increase urban sprawl rather than compact and proximity in the city.
- The plan (2030) of Amara city focused on increasing the per capita share of the city land from 89 m² per person to 135 m² in 2030, to achieve well-being and improve the standard of living. However, this area is unsustainable.
- The reduction of land use of residential, road and transportation networks by 16 %, and other uses (educational, commercial, governmental and security, mixed use) by about 3%. In contrast, this percentage increased for the land use of open space and recreational areas, sports and youth, culture and tourism by about 15 %. An increased

industrial use and public and health facilities also increased by about 4 %. This is a positive indicator of the increased green area and open space in the city.

- The plan focused on increasing the city's open space, recreational and cultural areas in 2030. The percentage of these land uses was 1.73 % in 2007, while the plan aims to reach 16.47 % in 2030, as a result of the shortage of these land uses in the city today. Therefore, it is noted that the urban sprawl of the city focuses on increasing the open space and reducing the built-up to achieve a balance between them.

The land use plan 2030 in Amara city was special the balance between built-up and open space, as the city was characterized by competence and proximity activities, and a lack of open space and green areas. This requires increasing the percentages of these land uses and achieve a balance between the built-up and open space.

TABLE 2. LAND USE OF AMARA CITY FOR 2007 AND 2030.

Land Use	2007		2030	
	Area (ha)	Percentage	Area (ha)	Percentage
Residential	1808.73	56.30%	3883.33	47.15%
Mixed use	4.01	0.12%	4.01	0.05%
Commercial and Institutional	55.85	1.74%	134	1.63%
Industrial and Warehouses	189.39	5.90%	719.85	8.74%
Education	143.05	4.45%	212.93	2.59%
Health	14.53	0.45%	69.09	0.84%
Administration and security	41.57	1.29%	51.87	0.63%
Religious	6.6	0.21%	20.2	0.25%
Cultural and tourism	3.14	0.10%	389.01	4.72%
Open space/recreation/sports/youth/cemeteries	52.39	1.63%	967.83	11.75%
Transportation and road network	800.78	24.93%	1492.32	18.12%
Public services	92.59	2.88%	292.34	3.55%
Total land use (ha)	3212.63		8236.78	
Population (person)	360800		608574	
Density (person / ha)	112		74	
per capita area (m²)	89		135	
Annual population growth		2.3 %		
Annual area growth		4.18 %		

Ministry of Municipalities and Public Works, General Directorate of Physical Planning (2009) "Amara Master Plan Update" Population and demographic characteristics Report, p. 3-7, 3-23 and 12-40.

3) Ramadi City

It is the center of Al Anbar governorate located in western Iraq and west of Baghdad governorate (Fig. 3), located on the international road linking Syria and Jordan. It is a city of tribal, desert environment, and includes various development potential including natural resources such as phosphate, lime and others, as well as the presence of international roads main and border crossings with Jordan and Syria.



Fig. 3. Location of Al Anbar governorate and Ramadi city in Iraq

Table (3) shows the following:

- The population density in 2009 (62 persons/ha) and the projected density in 2033 (71 persons/ha) are low and unsustainable compared to the United Nations standards (150 persons/ha).
- The highest land use in Ramadi city is residential use 30.8 %, followed by green areas by 17.8 %, followed by the roads and transportation network by 11.6 % in 2009. While it is noted that in 2033, the increase in the percentage of residential use has to reach 36.5 %.
The percentage is low with a sustainable ratio of 62 % in Masdar city to provide a livable living environment, followed by an increase in the percentage of transportation network to 19.3 %. This increase encourages to use of private cars, especially since it does not include support for sustainable transport in the city. While the percentage of green areas decreased to 13.1 %, which is contrary to the principles of sustainability.
- Industrial use: the percentage of industrial use decreased from 5.9 % in 2009 to 4.3 % in 2033, due to the decline of the industrial sector in Iraq and the attempt to reduce the negative environmental impacts of industry on the city.
- Commercial use: the percentage of commercial use decreased from 1.4 % to 1.2 % in 2033, as well as the attempt to add mixed uses as a support for sustainability in cities, as it was added to commercial use not separately.
- Educational and health use: the percentage of educational use decreased from 7.1 % to 3.8 % in 2033, while the percentage of health use increased from 0.6 % to 0.9 %. Those uses need to be highly developed because they are directly linked to the development of society and the increasing level of education, culture and health of residents and the improving of the life quality.
- Recreation and water areas increased from 3 % in 2009 to 3.7 % in 2033. This is a positive indicator of the city as a desert city and needs to reduce the high temperatures. Recreational areas kept the same percentage of 2.5%, which is low for the city.
- Buildings and public services decreased from 5.2 % in 2009 to 2.2 % in 2033; this is a negative indicator of the low distribution and concentration of services in the city.
- Other land uses: not more than 13 %, a set of land uses related to transport and investment and a hierarchy of service centers in the city.
- The decrease of the per capita area in the city from 162 m² to 140 m². This reduces the level of well-being of the per capita, especially in Ramadi city, which is characterized by tribal character and desire of the population to own large houses. However, this indicator per capita is unsustainable and a high area compared to per capita area in Masdar city (78 m²).
- The land uses for Ramadi city has been concentrated 2033 on the increase in residential use (30.8% to 36.5%) and economic and transportation use (27.4% to 31.1%). In contrast, reduce the percentage of public service uses (16.9% to 13.1%) and green and blue (water) areas (23.3% to 19.3%).

The approach adopted to update the master plan and land use of Ramadi city is a traditional approach that doesn't depend on sustainability, especially that location of the desert for Ramadi city needs more compactness and proximity between activities with increased water and green areas to provide a favorable environment for the community.

TABLE 3. LAND USE OF RAMADI CITY FOR 2009 AND 2033

Land Use	2009		2033	
	Area (ha)	Percentage	Area (ha)	Percentage
Residential	1773	30.8 %	4306	36.5 %
Industrial	338	5.9 %	510	4.3 %
Commercial and Mix use	78	1.4 %	147	1.2 %
Education	410	7.1 %	454	3.8 %
Religious	21	0.4 %	23	0.2 %
Health	33	0.6 %	102	0.9 %
Public Buildings and services	298	5.2 %	264	2.2 %
Recreation	146	2.5 %	300	2.5 %
Green areas	1024	17.8 %	1549	13.1 %
Train station and railway	405	7 %	385	3.3 %

Water area	172	3 %	438	3.7 %
Cemeteries	207	3.6 %	110	0.9 %
Transportation and roads network	670	11.6 %	2276	19.3 %
Warehouse and oil stores	89	1.5 %		
Military area	79	1.4 %		
Special area	21	0.4 %		
Administrative and residential centers			591	5.1 %
Cultural areas			3	0.03 %
Tourist investment			304	2.6 %
Car Showrooms			17	0.1 %
International transportation garage			30	0.3 %
Total land use (ha)	5764		11809	
Population (person)	355909		841100	
Density (person / ha)	62		71	
per capita area (m²)	162		140	
Annual population growth		3.65 %		
Annual area growth		3.03 %		

Ministry of Municipalities and Public Works, General Directorate of Physical Planning (2012) "Ramadi City Development Strategy and Update the Master Plan" Report of Phase V, Final Outline of the Master Plan, pp. 25, 26 and 172.

4) Hillah City

It is the center of Babylon governorate, located in central of Iraq, south of Baghdad, surrounded by a group of governorates (Karbala, Najaf, Diwaniyah, Wasit, Baghdad) (Figure 4).

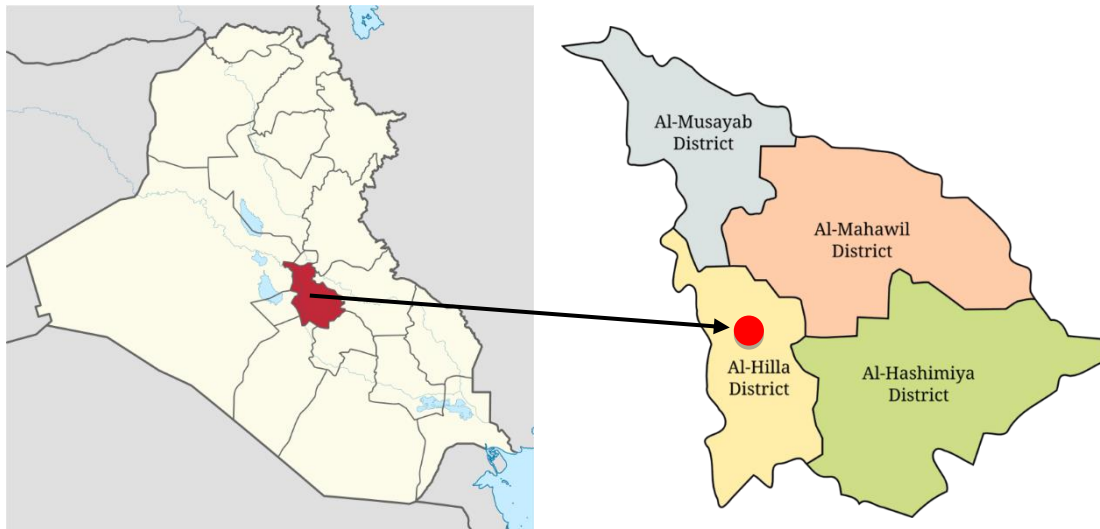


Fig. 4. Location of Babylon governorate and Hillah city in Iraq

Table (4) shows the following:

- The annual growth rate of the population is 2.51 %, and the annual growth of the area is 4.26 %, which is an indicator of the urban sprawl of the city by a large percentage. Which affected the low density from 89 people / ha in 2006 to 59 people / ha in 2030, as well as increasing the per capita area in the city from 112 m² in 2006 to 169 m² in 2030, which is an unsustainable indicator of the city.
- Land use in the city decreased by 13.43 % in 2030 from existing (2006), as residential use decreased by 4.55 %, educational use by 3.11 %, administrative and security use of 1.83 %, commercial use by 1.68 %, and other land

uses (mixed, Industrial, health, religious, infrastructure) by 2.26 %. This indicates that there are sufficient land uses for the city's existing in 2006 according to the standards.

- The percentage of open areas, sports, youth and recreation increased from 1.98% in 2006 to 10.4 % in 2030. The increase in the percentage of cultural tourism use increased from 0.2% in 2006 to 2.53% in 2030, which indicates the apparent lack of recreational and recreational uses in the city in the year 200 6. They need to be increased to meet the standards and requirements of the community.

The land use plan focused on increasing the city's open space and recreational areas to meet the needs of the future population to provide a suitable and sustainable environment. However, this expansion has been the result of urban sprawl and the exhaustion of the city's surrounding land. This represents an unsustainable indicator of the expansion of land uses.

TABLE 4. LAND USE OF HILLAH CITY FOR 2006 AND 2030.

Land Use	2006		2030	
	Area (ha)	Percentage	Area (ha)	Percentage
Residential	1724.6	51.27 %	4275.6	46.72 %
Mix use	70.4	2.09 %	110.5	1.21 %
Commercial	135.1	4.02 %	214.4	2.34 %
Industrial	217.3	6.46 %	532.9	5.82 %
Education	204.9	6.09 %	272.9	2.98 %
Health	30.8	0.92 %	83.8	0.92 %
Cultural / tourism	4.2	0.12 %	231.3	2.53 %
Open Spaces / Sports / Youth / Recreation	66.6	1.98 %	1123.5	12.28 %
Religious	12.3	0.37 %	29.3	0.32 %
Administrative and security	106.8	3.17 %	122.9	1.34 %
Infrastructure	111	3.3 %	237.5	2.6 %
Transportation	680	20.21 %	1916.7	20.94 %
Total land use (ha)	3364		9151.3	
Population (person)	299560		542630	
Density (person / ha)	89		59	
per capita area (m²)	112		169	
Annual population growth		2.51 %		
Annual area growth		4.26 %		

Ministry of Municipalities and Public Works, General Directorate of Physical Planning (2009) "Hillah Master Plan Update" Report of Phase VI, Chapter III, pp. 8 and 49.

5) Al Muqdadiya City

It is the second largest district in Diyala governorate, located in eastern Iraq, is a fertile agricultural area include large agricultural areas and orchards, located on an international road linking Iraq to Iran (Fig. 5).



Fig. 5. Location of Diyala governorate and Al Muqdadiya city in Iraq

Table (5) shows the following:

- Annual population growth rate (3.47%) greater than the annual growth of area (2.07%). This is an indicator of an increase in population density (from 35 to 46 people/ha), as well as a reduction in the city's per capita area from 284 m² to 216 m². However, this area and density is unsustainable and leads to large consumption of arable land.
- Land use decreased by about 23 % in Al Muqdadiya city, as follows:
 - The decrease in residential use by 14.5 % in 2030 as a result of a large surplus currently unused as housing and lack of infrastructure services for this use.
 - The decline of agricultural areas by 8.21 % and its conversion to other land uses, this is a negative indicator of the city, especially as the city is characterized by the nature of green, which includes more areas of orchards and water resources.
- Land use increased by 19.56% in Al Muqdadiya city, as follows:
 - The city's open space and green areas increased by 5.7 %; this is a positive indicator in providing green and recreational areas for the city's residents.
 - Increase in road and transportation use by 3.6 % from the existing, to meet the city's future urban expansion with the increase in industrial and commercial uses of the city, up to 25.6%, which is a high percentage that encourages the use of the private car.
 - Industrial use increased by 2.92 % because of the large economic potential and natural resources in the city, which encourages increased industrial activity in the city. However, it increased the pollution rate in the city, especially that most of the industries are environmentally polluted.
 - Increase in educational use by 2.6 %, due to the apparent lack of education and the attempt to reduce the gap between the existing and the future.
 - The city's administrative use has increased by 1.38%, to meet future requirements, increase the city's administrative activities and improve the services provided to the population, a positive indicator of the city.
 - Commercial use increased by 1.15 % to expect the city to be an international trade center linking Iraq with Iran and other countries, this is a positive indicator of the city.
 - The increase in health, religious, cultural and sporting uses in a small percentage to a total of 1.83 % of the existing. This percentage is very low because of the importance of those uses in the city, which is working to improve the health and cultural level of community.

Although Al Muqdadiya city is a green city that includes many orchards and agricultural areas within the city, the future expansion has led to the exhaustion of green areas and the encouragement of the increased use of private cars. This has environmental and health effects on the population.

TABLE 5. LAND USE OF AL MUQDADIYA CITY FOR 2010 AND 2030

Land Use	2010		2030	
	Area (ha)	Percentage	Area (ha)	Percentage
Residential	899.36	40.7 %	883.62	26.2 %
Commercial	34.15	1.55 %	89.15	2.7
Industrial	41.48	1.88 %	159	4.8 %
Educational	53.07	2.4 %	167.36	5 %
Government administration and public services	2.65	0.12 %	50.13	1.5 %
Infrastructures	2.79	0.13 %		
Health	4.7	0.21 %	28.3	0.9 %
Religious	10.47	0.47 %	28.19	0.8 %
Tourism and Recreation	11.09	0.5 %	13.39	0.4 %
Cultural heritage	0.44	0.02 %	12.29	0.4 %
Sports and Youth	0.5	0.02 %		
Security	8.26	0.37 %	43.49	1.3 %
Transportation	4.91	0.22 %		
Transportation	486.22	22 %	851.88	25.6 %
Open space and green	37.57	1.7 %	244.82	7.4 %

areas				
Agricultural areas	612.43	27.71 %	649.7	19.5 %
Public services			14.23	0.4 %
Other land use			27.47	0.8 %
Energy			64.38	1.9 %
Total land use (ha)	2210.08		3327.84	
Population (person)	77956		154359	
Density (person / ha)	35		46	
per capita area (m²)	284		216	
Annual population growth		3.47 %		
Annual area growth		2.07 %		

Diyala Governorate, Directorate of Physical Planning (2013) "Al Muqdadiya City Development Strategy and Update the Master Plan" Report of Phase 5, p. 8, 35 and 84.

6) Balad City

It located in Salah ad din governorate, north of Baghdad. It has large green agricultural areas within and around the city, and society is characterized by tribal traditions (Figure 6).

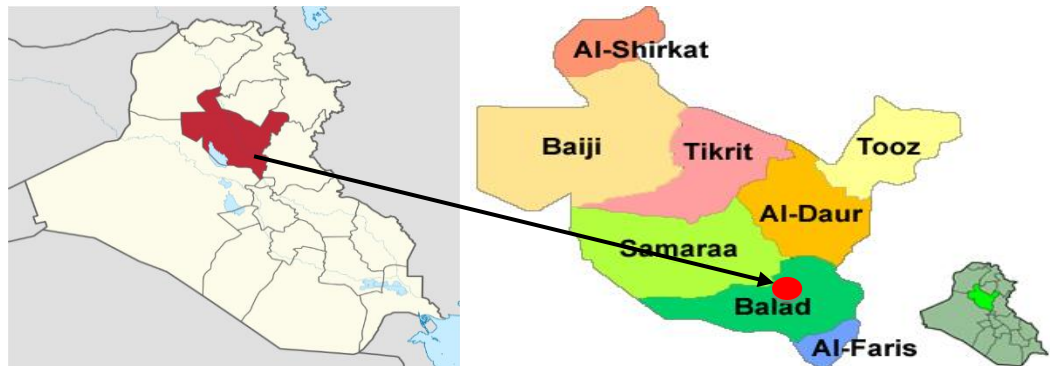


Fig. 6. Location of Salah ad din governorate and Balad city in Iraq

Table (6) shows the

- The city is characterized by the fact that the annual growth of the population and the area is different, as the growth of the population increase by 3.13 % per annum While the growth of the area is very low by - 0.16 % annually. This is a sustainable indicator of the preservation of the land surrounding the city. However, bear in mind that this could not be considered as a city expanding in terms of horizontally and the preservation of the city's boundaries.
- The percentage of built-up areas in the city increased from 31.8 % in 2009 to 57.3 % in 2035, a difference of 25.5 %. While the open spaces uses (green and water) decreased from 66.3 % in 2009 to 31 % in 2035, a difference of 35.3 %. This indicates a significant exhaustion of agricultural areas and open spaces within the city's borders. In addition, it has changed the morphology of the city from a green city to built-up city and reducing the level of well-being and recreation of the population.
- Increased residential use from 21.1 % in 2009 to 50.3 % in 2035, to accommodate the future population of the city because it is of tribal character and the size of the family is high.
- Increased industrial and production use from 1.2 % in 2009 to 3.6 % in 2035 to increase support for industries related to agriculture such as food industries.
- The land use plan for Balad city (2035) focused on making the city a major economic and administrative center in the region, allocating 11.7 % for mixed uses to give it importance as a future growth pole in the governorate.
- The percentage of agricultural areas decreased from 58.4% in 2009 to 15.9% in 2035. This is an unsustainable indicator in transforming agricultural areas into built-up areas.

Balad is a green city that includes many orchards and agricultural areas within the city's boundaries. The city's plan (2035) has suggested increasing the built-up area to accommodate the future expansion of the population by exhaustion the green land in the city instead of preserving it.

TABLE 5. LAND USE OF AL BALAD CITY FOR 2009 AND 2035.

Land Use	2009		2035	
	Area (ha)	Percentage	Area (ha)	Percentage
Residential	446.3	21.1 %	1019.8	50.3 %
Mixed use	0	0	236.2	11.7 %
Public Services	37.7	1.8 %		
Recreational	5	0.2 %	25.7	1.3 %
Public places	190.9	9 %	15.4	0.8 %
Transport infrastructures	1	0 %	14.6	0.7 %
Technical infrastructures	5.6	0.3 %	12.4	0.6 %
Industrial and production	24.3	1.2 %	72.5	3.6 %
Agricultural area	1235	58.4 %	323.1	15.9 %
Parks, Lakes and landscape	148.3	7 %	44.7	2.2 %
Water areas	18.9	0.9 %	52.8	2.6 %
Gardens and Orchards			208.7	10.3 %
Total land use (ha)	2113		2025.9	
Population (person)	55200		122957	
Density (person / ha)	26		61	
per capita area (m²)	383		165	
Annual population growth		3.13 %		
Annual area growth		- 0.16 %		

Ministry of Municipalities and Public Works, General Directorate of Physical Planning (2007) "Balad Master Plan Update" Report phase IV, chapter II, p. 26, chapter IV, p. 25 and chapter VI, p. 1.

7) Karbala City

It is the center of the Karbala governate, located in the Middle of Iraq, one of the most important holy cities in Iraq, a city that attracts high religious tourism and has agricultural potential, orchards and industrial (Figure 7).

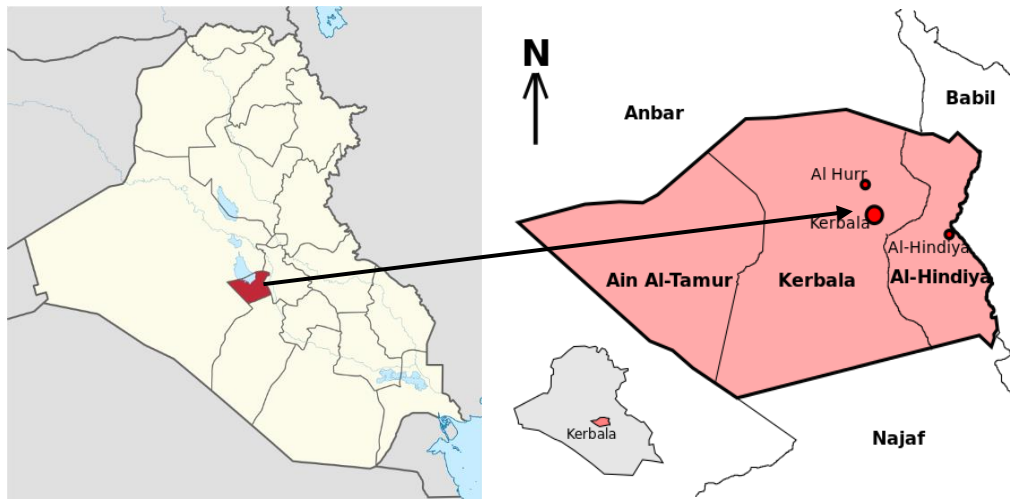


Fig. 7. Location of Karbala governorate and Karbala city in Iraq

- The annual growth of the population is very high at 3.99 % as a result of the security stability in the city. This encourages emigration from other Iraqi cities and the annual growth of the area by 2.08 %. Thus, this indicates the consumption of vacant land and surrounding land in the city, especially agricultural.
- Increased percentage of land use of the following:
 - Residential use: The percentage increased from 40.5 % to 48.38 % due to expectations of increased migration to the city. The reason for that is the security stability and holy city that attracts people.
 - Industrial use: The percentage increased from 2.2 % to 12.08 % to accommodate the current unemployment and future employment, as well as to exploit the large natural potential available in the governorate.
 - Commercial use: The percentage increased from 0.9 % to 3.37 % to accommodate the need of the city and the increase in visitors from outside the city to the holy shrines.
 - Warehouses: The percentage increased from 1.6 % to 8.66 % because the city is a center for producing and exporting dates out of Iraq, therefore, it needs to provide large stores to collect dates from all over Iraq.
 - Transportation: The percentage increased from 1.5 % to 4.8 % to accommodate the urban expansion of the city and to preserve the city's compactness, as the city has a compact traditional layout.
- Decreased percentage of the following land uses, which represents uses that could support sustainability in the city:
 - Public Services: The percentage decreased from 7.3 % to 3.33 %. This leads to a decrease in the level of well-being and the provision of a healthy, educational and service environment for the community.
 - Open space and green and agricultural areas: The percentage decreased from 36.6 % to 19.39 % as a result of the horizontal expansion of the city and its exhaustion by other land uses. This is an unsustainable indicator that has the negative effects on the city from the environmental, health and psychological aspects of the community.

Karbala is the most important holy religious city in Iraq, its religious and high population attractions, with a compact urban fabric. It surrounded by many orchards and agricultural areas. The plan (2030) of the land uses focused on making the city a strong multi-source economy (tourism, industry, trade) and making the city a major growth pole in Iraq because of its religious significance. The plan (2030) focusing on the consumption of the agricultural area surrounding the city and its transformation for residential and economic uses.

TABLE 7. LAND USE OF KARBALA CITY FOR 2007 AND 2030

Land Use	2007		2030	
	Area (ha)	Percentage	Area (ha)	Percentage
Residential (including streets in neighborhoods and green squares)	4374.64	40.5 %	8381	48.38 %
Industrial	230.44	2.2 %	2092	12.08 %
Commercial	95.86	0.9 %	583	3.37 %
Warehouse	175	1.6 %	1500	8.66 %
Educational	256.82	2.4 %	576 (Public services)	3.33 %
Health	29.56	0.3 %		
Religious	14.36	0.1 %		
Cemeteries	484.3	4.5 %		
Public facility (green and parking)	901.37	8.4 %	1391	8.03 %
Transport and roads	165.59	1.5 %	832	4.8 %
Agricultural area	3044.98	28.2 %	1967	11.36 %
Vacant area	1018.23	9.4 %	0	0
Total land use (ha)	10791.13		17322	
Population (person)	603675		1483684	
Density (person / ha)	56		86	
per capita area (m²)	179		117	
Annual population growth	3.99 %			
Annual area growth	2.08 %			

Ministry of Municipalities and Public Works, General Directorate of Physical Planning (2007) "Karbala Master Plan Upgrade" Setting and Evaluating Alternatives Stage Report, p. 2-5 and 5-26.

V. CONCLUSION

- 1) The cities of Karbala, Ramadi, Al Muqdadia and Balad are attractive to the population due to various reasons including security stability and the existence of economic potential such as agriculture. The lowest annual population growth is in the city of Amarah because of the exodus of residents as a result of population migration to other governorates looking for jobs.
- 2) We note that the city of Balad maintained the boundaries of the master plan of the city and not expand beyond its borders. While the rest of the cities have expanded the pattern of urban sprawl, that have multiple negative effects.
- 3) The population density of most Iraqi cities is low when compared with the sustainable densities (150 people/ha) as a result of relying on the horizontal housing pattern and not expanding vertically pattern, therefore, it is noted that the percentage of residential use in Iraqi cities is between 21 – 56 % of the total area of the city.
- 4) The percentage of industrial use in Iraqi cities is between 1-12 % of the total area of the city. Most of them were based on heavy and medium industries and did not rely on light industries.
- 5) The highest percentage of commercial and mixed use is 12 %. Most of the master plans of Iraqi cities lack of mixed use, which is a tool for sustainability.
- 6) The percentage of green, agricultural and recreational areas in the existing of Iraqi cities is between 1-66 %, while the future percentage is between 11-32 %. This indicates that there is consumption of these lands This provides a viable environment and achieve sustainability for the uses of the land.
- 7) The percentage of roads and transportation in Iraqi cities is up to 25 %. This percentage encourages the use of private cars. The reason for that is the land use plans in Iraqi cities don't focus on sustainable transportation in order to encourage the community to use means of sustainable transportation.

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