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تقييم التوسع العمراني في ضاحية قدسيا بين عامي (2004_2021م)

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الملخّص:

ناقشت الدراسة التوسع العمراني الذي شهدته ضاحية قدسيا خلال الفترة الزمنية (2004-2021م)، حيث تم تقسيم فترة الدراسة إلى مرحلتين، كان لكل منها خصوصيتها الديموغرافية والعمرانية، باستخدام عدة مناهج وأساليب كمية أهمها: المنهج الوصفي التحليلي، والأسلوب الكارتوغرافي من خلال استخدام تطبيقات نظم المعلومات الجغرافية (GIS) في تحليل ديناميكية العمران في ضاحية قدسيا خلال مرحلتي الدراسة. تم الاعتماد على ثلاثة صور فضائية من القمر الصناعي Landsat7_ETM تعود للأعوام (2004_2010_2021). واستخدم الأسلوب الإحصائي في معالجة البيانات بواسطة عدة مؤشرات ديموغرافية وعمرانية أهمها: كفاءة استخدام الأراضي LCRPGR، معامل النمو العمراني UGC، مؤشر التوسع العمراني المتباين UEDI. تم التوصل إلى مجموعة من النتائج أهمها: التوسع المكاني للمساحات المبنية في ضاحية قدسيا والتي أدت إلى تحول حضري سريع من أراضي فضاء إلى مساحة مشغولة عمرانياً، فقد تزايدت مساحة الكتلة العمرانية العامة خلال فترة الدراسة بنسبة (28.5%)، وكان النمو العمراني مكثفاً حسب المؤشر UGC حيث أن قيمته بلغت أقل من (1) خلال المرحلتين، كما أثبتت نتائج المقاييس السابقة كفاءة التخطيط الإقليمي والمكاني في منطقة الدراسة من خلال الاقتراب إلى تحقيق حالة التوازن بين معدلي النمو السكاني والعمراني.

الكلمات المفتاحية: التوسع العمراني، تحول حضري، الكتلة العمرانية، ضاحية.

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THE EVALUATION OF URBAN SPRAWL IN QUDSAYA SUBURB BETWEEN THE YEARS (2004 – 2021)

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ABSTRACT:

The study discussed the urban expansion in Qudsaya Suburb during the time period (2004 - 2021 AD), in which the study period was divided into two stages, each had its own demographic and urban specificity, using several quantitative approaches and methods such as the descriptive analytical approach, and the cartographic method through the use of geographic information systems (GIS) applications in analyzing the dynamics of urbanization in Qudsaya Suburb during the two stages of the study. The study relied on three satellite images from the Landsat7_ETM satellite dating back to the years (2004 _ 2010 _ 2021), and statistical method that was used in data processing by several demographic and urban indicators, for example LCRPGR, Land Use Efficiency, UGC, and UEDI. A set of results were reached, the most important of which are: the spatial expansion of the built-up areas in Qudsaya Suburb, that led to a rapid urban transformation from empty lands to an occupied urban space. The area of the general urban mass increased by (28.5%) during the study period. The Urban sprawl was densification according to the UGC index, as its value amounted to less than (1) during the two stages. The results of the previous measures also demonstrated the efficiency of regional and spatial planning in the study area by approaching a state of balance between population and urban growth rates.

KEYWORDS: urban sprawl, urbanization, urban mass, suburb.

INTRODUCTION:

The phenomena of urban sprawl, often referred to as suburbanization, started at the end of the industrial era, and it has continued since throughout the world. (Belser, 1960). Urban sprawl indicates a state of characterizing a whole or part of an urban area at a given time. It means urban sprawl is a development process that contributes changes to land use patterns, with a variety of shapes and sizes(Yasin, and others, 2021). The stereotype of suburban in many western contexts is usually characterized as low-density, demographically homogenous, residential settlements for a relatively affluent middle class (Beauregard, 2006; Fishman, 1987) . Suburban growth has been particularly rapid in rece centres nt decades, and the suburbs continue to expand spatially on every continent, looking at development from the early nineteenth century to the present (Jussi, 2013). Half of metropolitan residents are in the suburbs, and suburbs are growing 160% faster than city (Thompson, 2013). people commute or migrate from the central city to the suburbs may be substantially higher than in the emptying and expensive downtown business districts (Paul, 2008). The internal migration in Syria contributed to augment the population pressure on the capital, Damascus, which caused a lack of services and an increase in the prices within the city centre. This led the inhabitants to move to the nearby suburbs in order to meet their service and residential needs, where the land is exploited and transformed into urbanized complexes that vary in use according to the variation of the function for which it was established. However, the high population growth resulted in expanding the suburbs, especially the study area, Qudsaya Suburb, where the urban mass has witnessed a remarkable urbanization between the years (2004 - 2021). Accordingly, this urban expansion will be discussed and evaluated during the study period.

1 - OBJECTIVE OF THE STUDY AND ITS IMPORTANCE

The importance of the study comes from the specificity of the study area as a standard, organized residential suburb; the recent movement of inhabitants to settle in city's suburbs, particularly the suburbs of big cities; determining the factors that made it an attraction centre for the population; and the agents that affected the urban growth during the study's two stages.

STUDYGOALS:

1- study the factors that led to suburb expansion.

2- evaluate the urban sprawl in Qudsaya Suburb during the study's two stages.

2 - STUDY AREA AND ITS LOCATION:

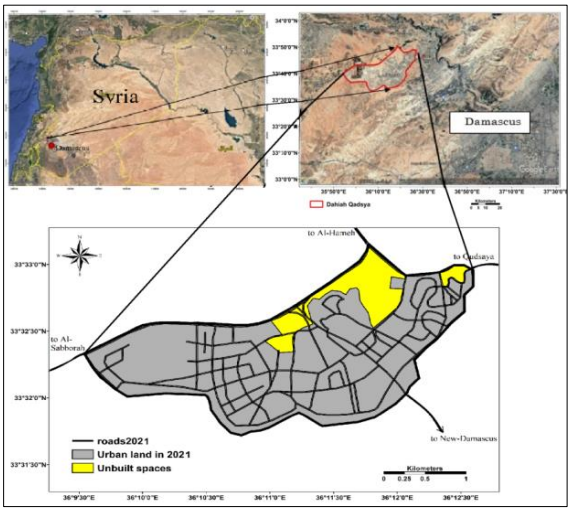

Figure 1. Map of astronomical and geographical location of Qudsaya Suburb.
Source: the author, using: Arc GIS.

Astronomically, Qudsaya Suburb is located between two latitudes ($33^0.31^\backslash.30''$-$33^0.33^\backslash.0''$) north of the equator, and longitudes ($36^0.9^\backslash.30''$-$36^0.12^\backslash.30''$) east of Greenwich, in the south-west part of Rif Dimashq - Damascus Countryside, governorate. Administratively, it is affiliated to Rif Dimashq Governorate, located in the northwest of Damascus City. Qudsaya Suburb is bordered by Dummar Town to the south; Alhameh Town to the northeast; the area of (Sahara and Dimas) to the north - it extends to be close Saburah (Al-Bijaa) to the west - and Qudsaya Town and Al-Sham New Suburb to the east.

3 - PHYSICAL CHARASTARISTICS OF THE STUDY AREA:

1-3- Geological Structure and Relief:

The study area is located in the Damascus Basin, which is covered by sediments that belong to the fourth period according to the geological map No. (2). We notice rocks unfolding that dates back to the quaternary era (lower stratum).

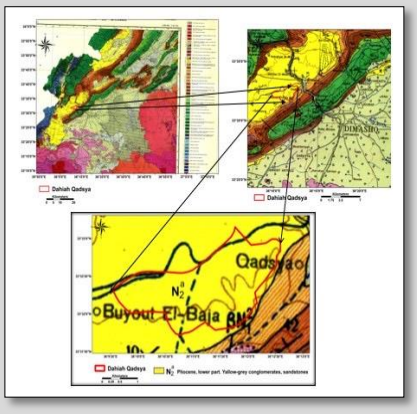

Figure 2. Geological map of Qudsaya Suburb.

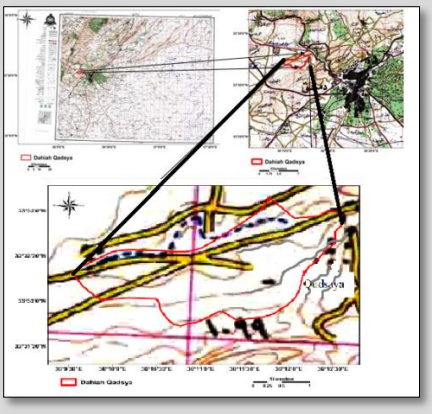

Figure 3. Topographic map of Qudsaya Suburb.

Source (2, 3): the author, using Arc GIS, based on data of General Company for Engeneering Studies.

Although studies related to the geological structure and surface features in the study area revealed that these factors were not sufficiently helpful for residential communities establishment, the housing project emerged bypassing all difficulties.

Qudsaya Suburb is located at the western slope of Qasioun Mountain, that forms a part of the Anti-Lebanon Mountains, at an altitude ranging between (725 - 1099) meters, as the map No. (3) shows. Its terrain is steep, with a percentage of (5 - 27).

2-3- Climate:

Qudsaya Suburb is characterized by a cold, semi-arid desert climate. The annual average temperature is (15.9 C°). It is noted from Figure No. (4) that January is the least hot month of the year, whereas the hottest is August. Its rains are wintery, and the maximum precipitation is in January as shown in Figure No. (5). We note a complete absence of the rain in the summer. The average annual precipitation was about 258 mm, and the annual average of relative humidity was (41.5).

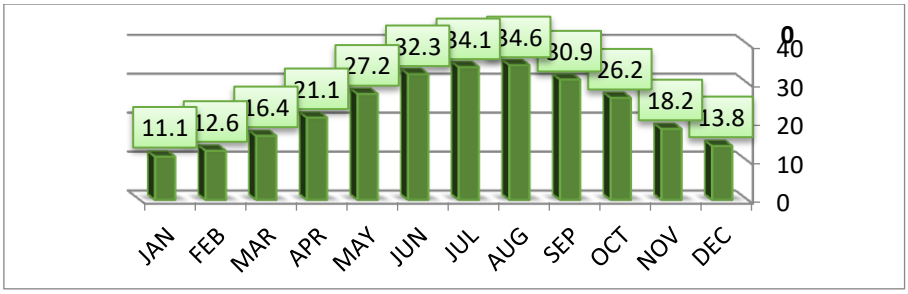

Figure 4. Values of Monthly Temperature Averages in Qudsaya Suburb (2004 - 2021)
Source: the author, using Excel, based on data of Syrian General Directorate of Meteorology.

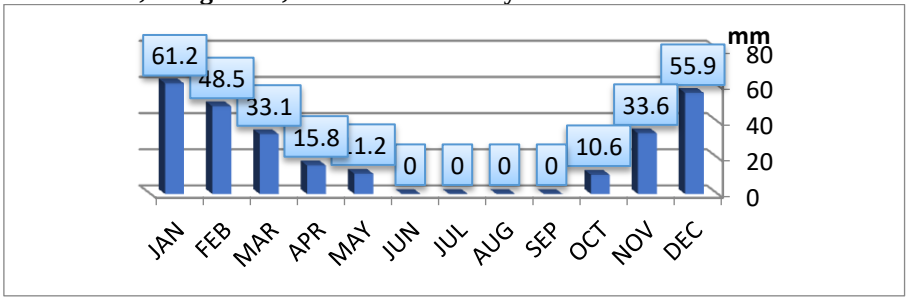

Figure 5. Values of the annual precipitation Averages in Qudsaya Suburb (2004 - 2021)
Source: the author, using Excel, based on data of Syrian General Directorate of Meteorology.

4- POPULATION GROWTH IN QUDSAYA SUBUEB:

Table No. (1) shows that the percentage of population increase reached (37.6%) during the first phase between the years (2004 - 2010), and (63.8%) in the second phase between the years (2010 - 2021). That is because of the increase in population growth rate from (19.3%) during the first stage to (23.4%) in the second stage.

Table 1. Population growth and its density in Qudsaya Suburb (2004 - 2021)

PGR‰	Percentage of population increase	Population Density (people/Km2)	Area (km2)	Population.	year
–	–	9.2	3.64	33571	**2004**
19.3‰	37.6%	12.2	4.39	53862	**2010**
23.4‰	63.8%	27.5	5.41	148924	**2021**

Source: the author, based on data of The Central Bureau of Statistics (CBS) in Damascus.

The high population growth in the first stage is attributed to the internal migration from the capital, Damascus, to Qudsaya Suburb for many reasons. Firstly, it is considered as an attraction centre for the inhabitants as a standard, modern and organized suburb. Secondly, the availability of services in the suburb. Thirdly, the low construction prices when compared to the areas within the city centre. Finally, it is close to the capital, Damascus.

As for the second stage, we notice a steadily rising population growth, especially after the year (2011) due to the war on Syria and the displacement of a large number of families from the Syrian interior, that includes Rif Dimashq and unstable areas, to the study area as it constituted a safe haven for them. This resulted in a sudden demographic shift , and an increase in population density as shown in Table No. (1).

5- STUDY METHODAS AND TOOLS:

The current study aimed to evaluate the urban expansion in Qudsaya Suburb through two stages, in which it relied on population numbers estimates, based on the last census of the year (2004 AD). In addition, the use of the GIS and remote sensing techniques - that were available during the study period - was essential to show the spatial disparity in the development of urban spaces. In order to reach the required results, several indicators and statistical methods were used as follows:

$$\mathbf{PGR} = (\mathrm{In}\frac{\mathrm{Popt+n}}{\mathrm{Popt}})/t \qquad (1)$$

where Popt is the total population for a spatial unit in the initial year, Popt+n is the total population in the final year for a spatial unit, and t is the number of years between the two measurement periods (Parth, 2022).

$$\mathbf{LCR} = (In\frac{\mathrm{Urbt+n}}{\mathrm{Urbt}})/t \qquad (2)$$

where Urbt is the total built-up area for a spatial unit for the initial year using CORINE land cover data (km2), Urbt+n is the total built-up area for a spatial unit for the final year using CORINE land cover data (km2), and t is the number of years between the initial and final measuring periods (Parth, 2022).

$$\mathbf{LCRPGR} = \frac{\mathrm{LCR}}{\mathrm{PGR}} \qquad (3)$$

where LCR is the land cover ratio and PGR is the population growth ratio. The LCR is an indicator of area expansion, while PGR describes the demographic change. The positive values of the former indicate a growing built-up area and the positive values of the latter indicate a growing population (Parth, 2022).

$$\text{population change rate} = (P^2\text{-}p^1/t) \div (P^2+p^1/2) \qquad (4)$$

Annual Urban Expansion Rate and Urban Growth Coefficient

$$AUER_i = [(ULAi\ ^{t2}/\ ULAi\ ^{t1})^{1/t2\ -t1} - 1]x\ 100 \qquad (5)$$

Where AUERi is the annual Urban Expansion Rate, ULAit2 and ULAit1 are the area of urban built-up land at time t2 and t1, respectively. Once the rate of urban expansion was quantified, Urban Growth Coefficient was calculated to determine whether urban growth is sprawling or densifying. The coefficient formula is (Wazzan, 2021; Akubia and Bruns, 2019).

$$\mathbf{UGC} = \frac{\text{Rate of urban Expansion}}{\text{Rate of Urban population Growth}} \qquad (6)$$

UGC greater than 1 indicates a sprawling growth ... On the other hand, a UGC of less than 1 signifies densification (Wazzan, 2021; Akubia and Bruns, 2019).

Urban Expansion Differential Index:

$$\mathbf{UEDIi} = \frac{(\mathrm{ULAi\ t2 - ULAi\ t1}) \times \mathrm{ULA\ t1}}{(\mathrm{ULA\ t2 - ULA\ t1}) \times \mathrm{ULAi\ t1}} \qquad (7)$$

Where UEDIi indicates the Urban Expansion Differentiation Index of unit I; ULAit1 and ULAit2 indicate the areas of urban land of unit I at times t2 and t1, respectively; and ULAt2 and ULAt1 indicate the total areas of urban built-up land in the study area at time t2 and t1, respectively. This index basically compares urban expansion of a given unit. Generally, the UEDIi of a region, has a mathematical constant of 1. This serves as the reference point for identifying the urban development hotspots in the region. Three reference categories of UEDIi can be deduced: (1) when the constitute spatial unit has a differentiation index > 1, it is considered as a "fast" growing area in relation to the region; (2) when the differentiation index is < 1, the area is classified as a "slow" growing area relative to the region; and (3) when the differentiation index of

the district is equal to 1, it is regarded as a "moderate" growing area in relation to the region (Wazzan, 2021; Akubia and Bruns, 2019).

Table 2. LCRPGR Classes.

period	LCRPGR Classes	PGR	LCR
2004_2010	0 < LCRPGR = 0.6	= 0.3 > 0	= 0.2 > 0
2010_2021	0 < LCRPGR = 1	= 0.2 > 0	= 0.2 > 0

Source: the author, based on the previous equations.

Table 3. Values of $AUER_i$, UGC, $UEDI^i$.

	2004_2010	2010_2021
ULAI t_1 km^2	3.64	4.39
ULAI t_2 Km^2	4.39	5.41
ULA $t_1.t_2$	6.20	6.20
$AUER_i$	3%	%2
UGC	0.2 > 1	0.1 > 1
$UEDI^i$	1.7 < 1	1.4 < 1

Source: the author, based on the previous equations.

6- DISCUSSION:

The study period was divided into two main stages, the first extended between the years (2004 - 2010), whereas the second was between (2010 - 2021). Each stage had its own special demographic and urban characteristics.

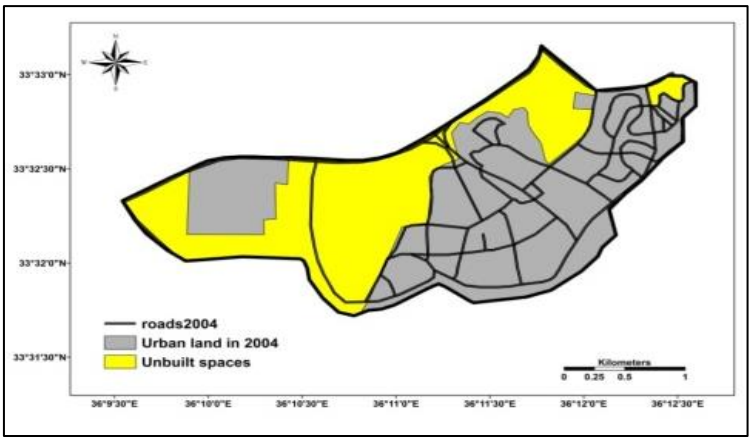

Figure 6. Map of Qudsaya Suburb's urban mass (2004).
Source: the author, using Arc GIS, based on a satellite images for the year (2004)

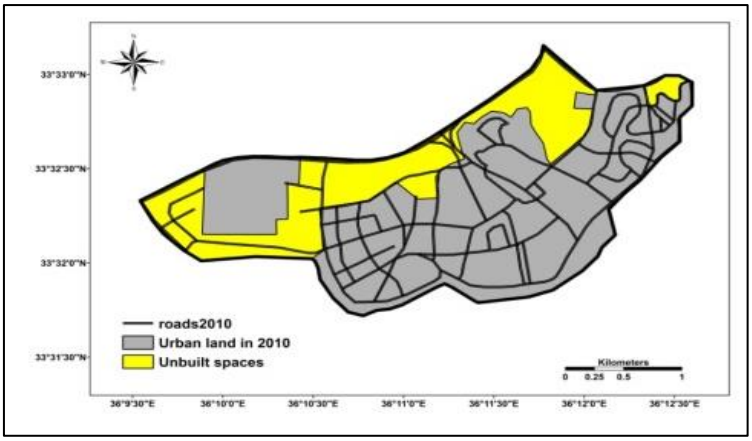

Figure 7. Map of Qudsaya Suburb's urban mass (2010).
Source: the author, using Arc GIS, based on a satellite images for the year (2010).

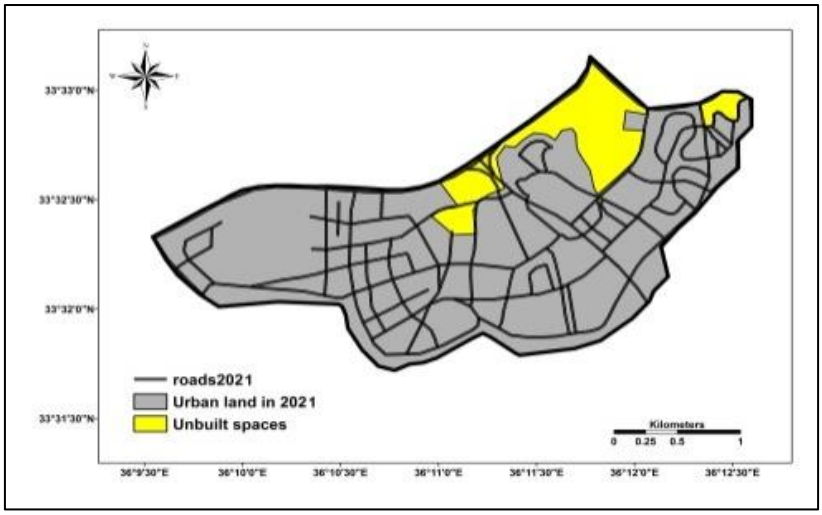

Figure 8. Map of Qudsaya Suburb's urban mass (2021).
Source: the author, using Arc GIS, based on a satellite images for the year (2021).

Comparing the two maps No. (6, 7) makes the urban growth in the first stage clear. We notice that the built-up area expansion is absolutely increased by (0.75 km2) with a percentage of (12.1%) of the current total area. The value of (AUERi) during this period reached (3%). Since the urban sprawl is an inevitable result of population growth, the table No. (2) shows that the value of (LCRPGR) reached (0.6) in the first stage, which is greater than the value of the fixed number (0). This reflects the high values of both (PGR) and (LCR), and indicates a semi-balanced population and urban growth during this period. This is due to the availability of sufficient areas for construction and low construction prices, in an attempt to encourage the inhabitants to settle in the suburbs in order to decrease the pressure on the capital, Damascus, in both stages in general, and provide a greater number of houses for the people who were displaced from the neighbouring areas that witnessed wars to Qudsaya suburb. Thus, the urban expansion was an urgent necessity in the second stage, especially the post-2011 period. This is clearly evident when comparing the two maps (7, 8). The table No. (3) shows that the built-up area at the beginning of the second stage reached (4.39 km2), which is equivalent to (70.8%) of the total current area, while at the end of the same stage, it reached (5.41

km2) by (87.2%) of the total area, and the absolute increase of the urban area during this stage reached (1.02 km2) by (16.4%) of the total area. We also notice the high value of (AUERi) that was (2%) during this stage. Although this stage of the increase in growth rates had its own demographic peculiarity, the value of (LCRPGR) indicates that the population and urban growth was balanced, as the value of (PGR) and (LCR) were equal, and the value of (LCRPGR = 1), due to the high Index value (UEDIi) in both stages. This indicates that the study area has a rapid urban growth because the values of (UEDIi) are greater than the constant (1), as it reached (1.7) in the first stage and (1.4) in the second. We also notice from Table No. (3) that the value of (UGC) in both stages is less than (1), which explains that the urban growth in Qudsaya Suburb densification. In which "Cities growing faster than 1-2 per cent per year need to ensure there is enough land to accommodate people and this could be at least twice the size of the existing land area (Vicky, 2014)".

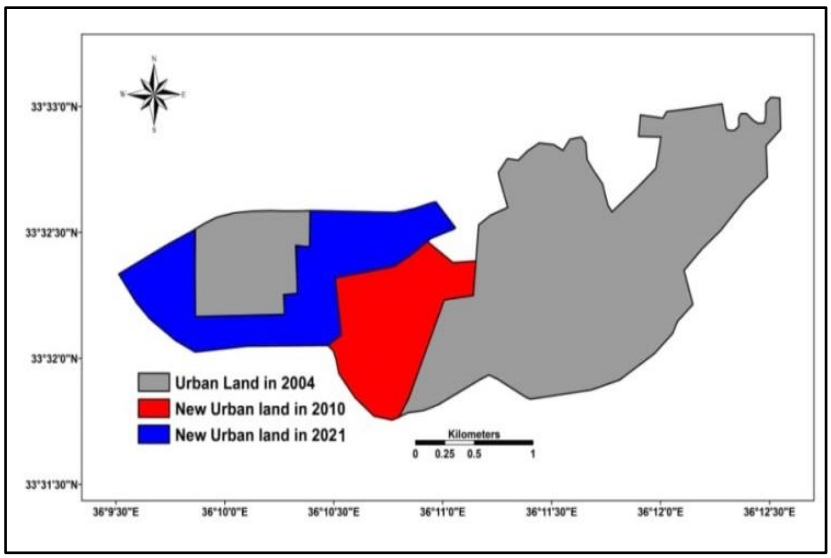

Figure 9. Map of built-up area Evolution in Qudsaya Suburb through the years (2004, 2010, 2021). Source: the author, using Arc GIS, based on the previous three maps.

Map No. (9) reflects the urban mass development in Qudsaya Suburb during the years (2004 - 2010 - 2021). We notice that the urbanization extends to the west during the two study stages to meet the inhabitants' housing and service needs. We also notice that the suburb has expanded by 1.77 km² till 2021, at a proportion of (28.5%) of its total area for the year 2004 AD.

7- FINDINGS:

1 - Qudsaya suburb witnessed a rapid urban expansion during the study period. It is proven that the area added to the suburb between the years (2004 - 2021) reached (1.77 km2) with a change rate of (28.5%).

2 - The urban expansion in the first stage is attributed to the citizens' tendency to settle in the suburbs for the low construction prices, within the framework of the state's plan for encouragement of that, to decrease the population pressure on the city centers. As for the second stage, the urban expansion was an inevitable result of population increase due to the displacement of people from the areas that witnessed wars to Qudsaya Suburb.

3 - The results of the used measurements reflect the efficiency of the organized regional and spatial planning of Qudsaya suburb, when approaching the state of balance between urbanization and population despite the steady demographic shifts.

4 - The results of the study indicate that the urban growth is densification, which explains that the urban and population growth rate is high, that requires using more land to accommodate this increase.

4 - It is evident that the behaviour of urban sprawl was in one direction, which is the west, in parallel with Damascus_ Beirut international highway.

8- Suggestions:

1 – Controlling the migration flows towards Qudsaya Suburb to avoid any regional or spatial imbalances that may result in negative consequences such as building prices increase and public services pressure, in addition to encouraging the displaced to return to their freed areas.

2 – working on increasing the social services in Qudsaya Suburb in order to reduce the population movement towards the city centre for getting these services.

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