# *Evaluation of Changes in Per Capita Green Space in Sulaimani City*

*Key words: Green Space, Per Capita, Sulaimani City*

*Pshtiwan Gharib Ghafur*

*University of Sulaimani, College of Basic Education, Department of Social Sciences, Assistant Lecturer (MSc)*

*Email: pshtiwan.ghafur@univsul.edu.iq*

*Abstract*

*In this current study, evaluation of changes in per capita of green space this study explains (2007-2016) in Sulaimani City and results compared with international standards. The lowest per capita was 9.2m$^2$ in 2008, and the highest per capita was 16.2m$^2$ in 2016. Currently, the total green space in Sulaimani city is 10%. Despite the green space is lower than the standards, its distribution tends to be various among different parts of the city. In some of the bigger parts of the city, the area of green space is considerably low and the population is high. Also, in the new areas of the city, the planned parks are not completed, and even if they are completed, their areas are smaller compared to the population size which is steadly increasing. The planned parks should be completed until the green spaces will increase in a reasonable percentage in Sulaimani City in the future.*

## *1. Introduction*

*More than 50% of populations live in cities and towns. Cities grow very quickly and large are becomes cities become greater. The number of large cities has increased tenfold since 1950 (UNPD, 2007:1). Urban population is expected to be 70 per cent of the world's population by 2050 (Heilig, 2012: 112). This growth rate of cities affects conservation areas and human lifestyles, and this is a point of interest for researchers and decision-makers (Dye, 2008:766).*

*Cities have been polluted due to increasing population (Blanco et al, 2009: 172). The pollution of the cities can be partly resolved by increasing green space. Green space can be defined as the green environment outside the urban buildings, which is mostly covered by vegetation (Wendel, Zarger & Mihelcic, 2012: 273). Venn and Niemela (2004) classified green spaces into two main types: officially allocated areas including parks, residential gardens, entertainment and landscape or natural areas such as natural reserves, river and marine mountains and areas around abandoned industrial sites.*

***Green space is an important contributor of sustainable development. Developments in urban green spaces need to consider multidisciplinary and integrative approaches such as economic, political, social, cultural, administrative and planning aspects to improve existing facilities and services, and to optimize urban green space policies (Haq, 2011: 601). Green space promotes physical activity, psychological well-being and the overall public health of the urban population (Wolch, Byrne & Newell, 2014: 234; Grahn & Stigsdotter, 2003: 4; Bratman et al, 2015: 41). Furthermore, green space provides environmental benefits in terms of ecological, pollution control and biodiversity and nature conservation (Haq, 2011: 602; Bolund, & Hunhammar, 1999: 295; Sorensen, Smit, & Barzetti, 1997: 8). Also green space provides some economic benefits, for example using less energy to cooling in summer and increasing property values such as houses (Heidt & Neef, 2008: 86; Haq, 2011: 602).***

***Like other cities around the world, Sulaimani is continuously growing. This growth is accompanied by some problems, such as air pollution. Increasing green space is one of the strategies used to solve the above mentioned problems.***

***Research Problems:***

***The research problems in this study including:***

***a. Did the green space standards are meet in the Sulaimani City?***

***b. Did green space area in the study area increased with the population number and the city area in time?***

***Research Hypothesis:***

***The research hypotheses are:***

***a. Green space standards are good tools to evaluate the quality and quantity of green spaces in the study area.***

***b. The amount of green spaces in the city affected by the economic crisis and the expansion of the City of Sulaimani.***

***Aims:***

***a. To what extent green space in the Sulaimani City deal with its population numbers and international standards?***

***b. Try to evaluate the quality and quantity of green space in the Sulaimani City.***

***Objectives:***

***What are the precise per capita green space and the rate of green space area in the Sulaimani City?***

***2. Methodology***

***In this research, quantitative method is used to analyse obtained data. Necessary data regarding green spaces in Sulaimani City was obtained from Sulaimani Gardens Directorate and Sulaimani Forest and Ranges Directorate. The Sulaimani City area for many years was calculated from aerial and the data obtained from Sulaimani Municipality by using ArcGIS. The population number of Sulaimani City was provided by Sulaimani Statistical Directorate. Despite collecting data from Government Directorates, data was also collected from the literature to fill the missing gap in the data availability.***

***The obtained data was analysed and then results were compared to Bristol City Council standards, WHO and UN standards. There are three specific standards which comprise the Bristol Green Space Standards:***

- ***Quality standards: a level of quality which all spaces should attain.***
- ***Distance standards: how far should people have to travel to reach a particular type of space.***
- ***Quantity standards: how much green space of different types there should be.***

***3. Study Area***

***Sulaimani City is administrative center of Sulaimani province which is located north east of Iraq (Muhammad, 2009:1). It is located between Longitude 45º20'E - 45º30'E and latitude 35º29'N - 35º38' N (map 1). The Sulaimani City area was 113.9 km$^2$ in 2016 (Sulaimani Municipality Directorate, 2016) and in the same year the population number was 702,882 person (Sulaimani Statistical Directorate, 2010:1). Green space types in the Sulaimani City are parks, gardens and road verges. Also, green space areas from graveyards in Sulaimani are about 162 dunam (Hussen, 2010: 91). Forests and resorts are mainly located in the western side of the city and Chavy Land tourism city situated in the north of the city which comprises a big proportion of the Sulaimani City green space.***

***4. Results and Discussions***

***Green space of Per Capita is being changed year to another (table 1). Per capita green space was 9.3 m$^2$ in 2007 and decreased to 9.2 m$^2$ in 2008. Later, per capita green space was continuously increased and reached 11.2m$^2$ in 2012. This increase in per capita green space was mainly due to the increase in green space by more than 900 thousand square meter in 2012. Increasing per capita green of space continued and reached 12.2 m$^2$ in 2013. Opening Chavy Land Tourism City, which covers 750 thousand square meter, led to this increasing in per capita green space in 2013. Later, by 2014 and 2015, per capita green space was decreased to 12.1m$^2$ and 11.9m$^2$ respectively.***

***Despite that population number was increased in the Sulaimani City in 2014 and 2015, the green space did not increase with the same pace due to economic crisis especially in 2015. In 2016, per capita green space increased to 16.2 $m^2$ due to the opening one thousand dunam of Hawary Shar Park. The work in building this park was started in 2011 has been opened and opened*** on ***22/5/2016.***


***Map 1. Sulaimani City Location and its Suburbs Boundaries in 2016 (Sulaimani Statistical Directorate- GIS Unit, 2016).***

***During the study period, the lowest per capita of green space was 9.2$m^2$ in 2008 and the highest was 16.2$m^2$ in 2016. This area of green***

***space in the Sulaimani City was more than the lowest WHO standards which is 9m$^2$ / person, and much less than the ideal standards that is 50 m$^2$ / person. Also, according to United Nations' standards, per capita green space should be 30m$^2$ / person. It is noted that, per capita of green space in the Sulaimani City would not reach the reasonable standards mentioned.***

| *Year* | *Green Space / m$^2$* | *No. of Population* | *Per Capita / m$^2$* | *UN Standard* | *WHO Standard* |
|---|---|---|---|---|---|
| *2007* | *5,017,479* | *538,700* | *9.3* | *30m$^2$/person* | *The lowest area 9m$^2$/person*<br>*Ideal area 50m$^2$/person* |
| *2008* | *5,104,979* | *554,861* | *9.2* | | |
| *2009* | *5,388,447* | *571,507* | *9.4* | | |
| *2010* | *5,595,360* | *588,652* | *9.5* | | |
| *2011* | *6,079,399* | *606,312* | *10* | | |
| *2012* | *6,989,654* | *624,501* | *11.2* | | |
| *2013* | *7,840,517* | *643,236* | *12.2* | | |
| *2014* | *8,032,655* | *662,533* | *12.1* | | |
| *2015* | *8,142,416* | *682,409* | *11.9* | | |
| *2016* | *11,392,416* | *702,882* | *16.2* | | |

***Table 1. Shows per capita green space in Sulaimani City and international standards (Researcher's work depending on UN-HABITAT, 2013:43; Khalil, 2014:526; Sulaimani Statistical Directorate, 2010:1; Sulaimani Gardens Directorate, 2016:7; Sulaimani Forestry and Ranges Directorate, 2016:1; Hussen, 2010:86,89,91; Xandan.org, 2016; Nalia Group.com, 2017).***

***The distribution of green spaces in the city varies from different parts of the city. In the new parts of the city which are situated in the surrounded circle of the city, the area of green space is low especially in eastern and north sides. In the new parts of the city, the planned parks have not been constructed or constructed but they have small areas compared to the number of residents (map 2). The number of people in the new parts of the city will gradulay.***

***Green space in some of bigger parts is low as new parts in the city and they have dense population for example, Hawarabarza and Azadi in eastern part of the city (map 3). Tourism areas in Sarchinar and forest areas are 267.54 dunam that are mainly situated in the western part of the Sulaimani City (Hussen, 2010:86). However, some parts of the forests were changed to commercial and residential area or dried.***

***Despite that the area of green space is not enough, a significant number of displaced and refugee people from other provinces of Iraq and Syria have come to Sulaimani City. These people also use green areas in the city as a recreation area. The number of displaced people from other provinces of Iraq and Syria were more than 120 thousands between 2014 and 2015 (Ministry of Migration and Displacement of Iraq, 2016:1). Therefore, this number of displaced people worsens the situation and decreased per capita green space much more.***

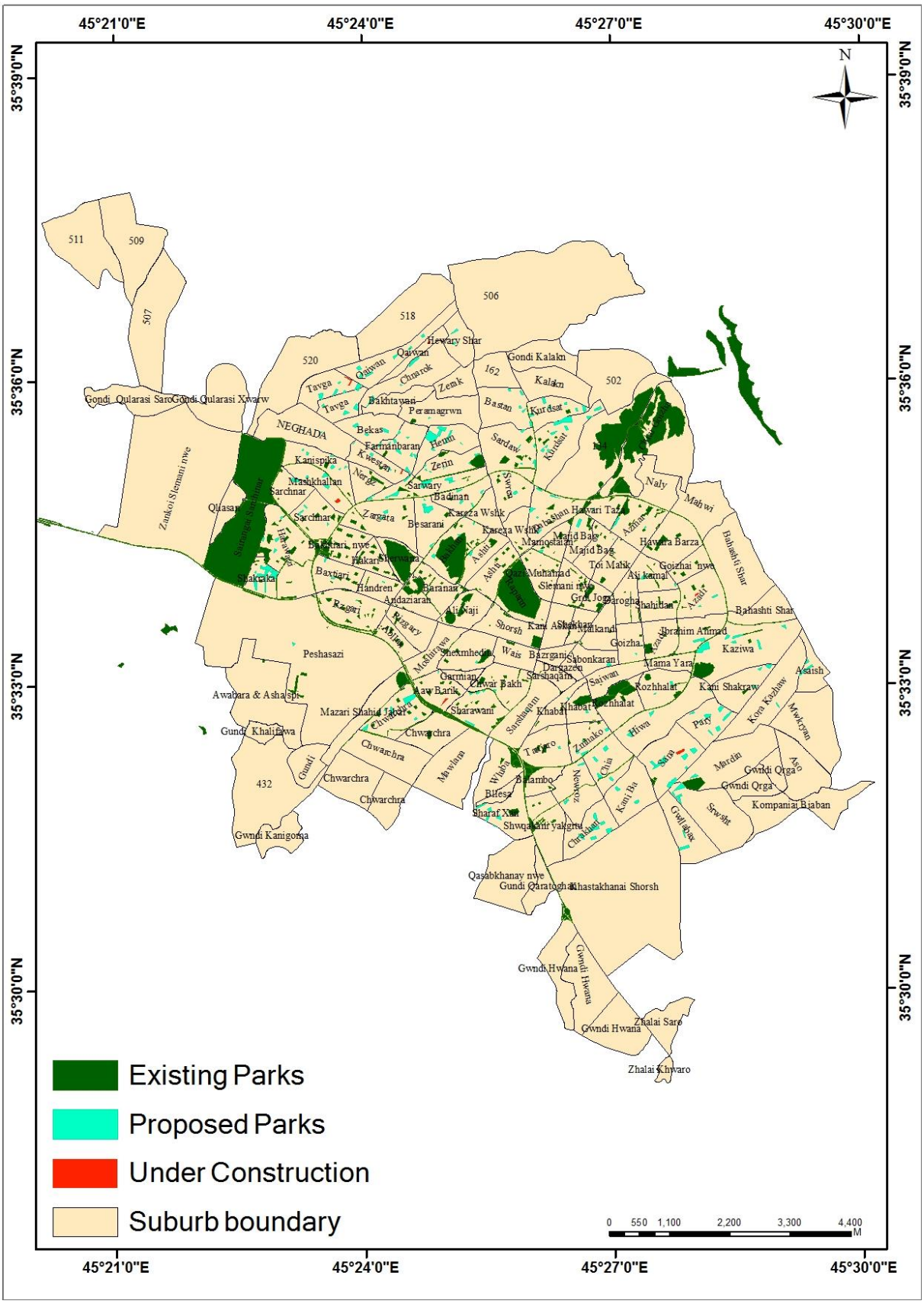
***Green space quantity is not enough and most of residents have to walk more than 300m to spend their time in a park. Also, some parks don't have sufficient quality due to:***

***a. When some of these parks have been built international standards were not with out taking.***

***b. The dwellers don't have environmental awareness concerning green spaces in order to protect them in an adequate manner.***

***Moreover, most of the parks don't have basic facilities so that visitors can use them, for example, games for children and toilet…etc.***

***The proportions of green spaces in the world's cities are different compared to international standards. Per capita green of space in Jeddah is only 0.9$m^2$ and %70 of residents should walk more than 500m to reach a park (Khalil, 2014: 526). In Khorramabad 6.9$m^2$ / person (Beiranvand, Bonyad & Sousani, 2013: 321), Tehran 11.2$m^2$ / person, Stockholm 75$m^2$ / person, Boston 117 $m^2$ / person, Los angles 54 $m^2$ / person, San Francisco 47 $m^2$ / person, Chicago 30 $m^2$ / person (Maleki et al, 2012: 805), Leicester 35 $m^2$ / person, Birmingham 93 $m^2$ / person and London 215 $m^2$ / person (Sadler et al, 2010: 236).***




***Map 2. Distribution of Green Space in Sulaimai City Suburbs in 2016 (Sulaimani Statistical Directorate - GIS Unit, 2016).***

***Some of the above cities which situated in developing countries per capita green space is less than standards, and also, some cities in developed countries***

***per capita green space is lower than standards such as Luxembourg City and Milan (Roo, 2011: 4). This means that not having enough green space is a problem in most cities in developing countries that they don't have a strategic plan to develop and expand their cities or may exist but don't apply well.***

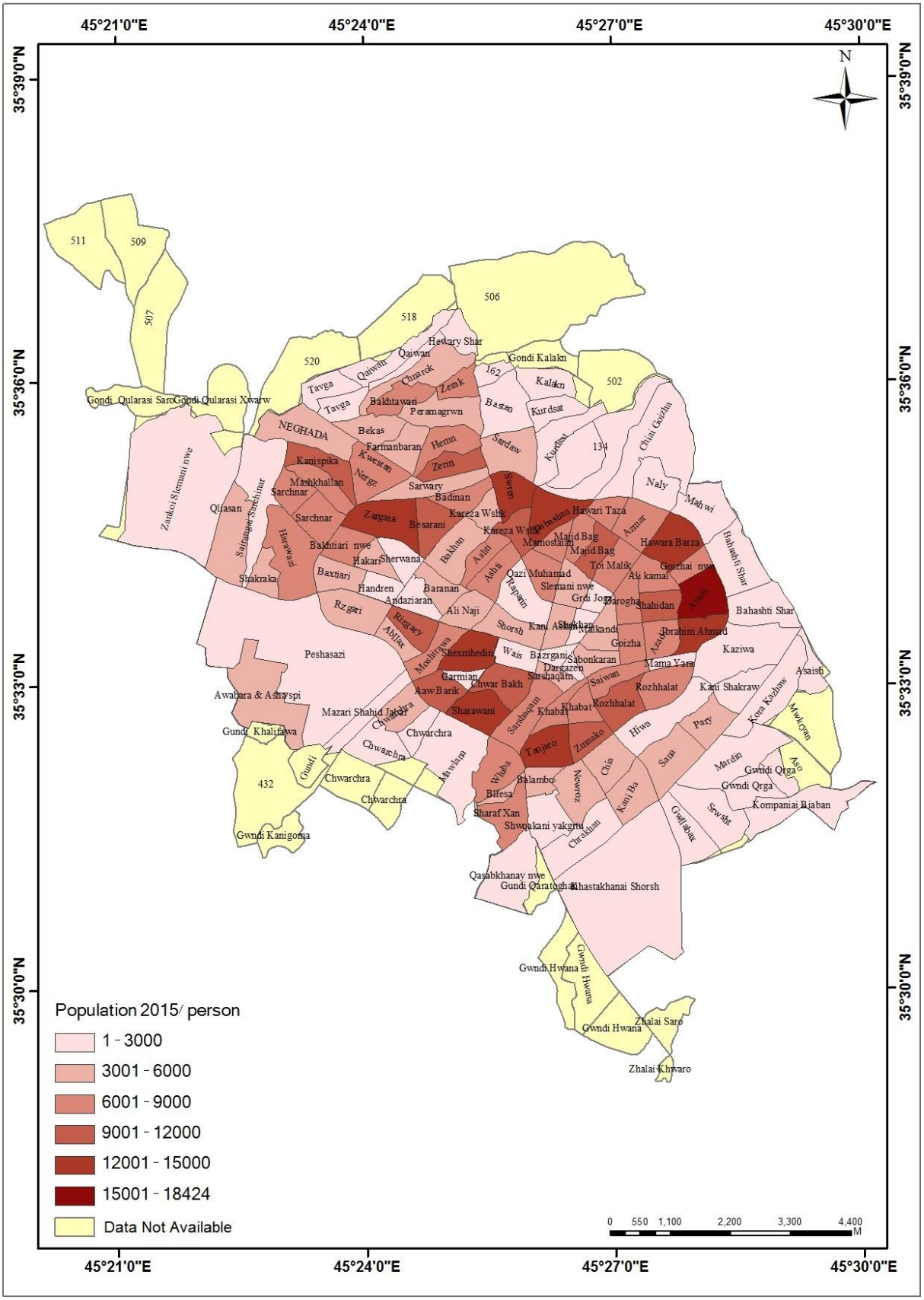
| *Year* | *Green Space/$m^2$* | *Sulaimani City Area/$m^2$* | *Green Space %* |
|---|---|---|---|
| *2007* | *5,017,479* | *57,796,987* | *8.7* |
| *2010* | *5,595,360* | *68,063,581* | *8.2* |
| *2014* | *7,282,655* | *73,582,164* | *9.9* |
| *2016* | *11,392,416* | *113,885,058* | *10* |

***Table 2. Green space Percentage in the Sulaimani City from 2007 – 2016 (Researcher's work depending on Sulaimani Gardens Directorate, 2016:7; Sulaimani Manucipality Directorate, 2016).***

***The presence of green spaces with percentage in the Sulaimani City is accounted for 8.7% and 8.2% of the city area in 2007 and 2010 respectively (table 2). The percentage of green space was increased to 9.9% in 2014 and 10% in 2016.***

***Green space is lower in the Sulaimani City compared to other cities in the world. Green space in Amman city is 12% (UN-HABITAT, 2012: 67), Leicester 25%, Birmingham 33.7%, London 38.4% (BOP, 2013: 2) and in Hamburg 16.8% (European Green Capital, 2011: 16). The presence of green spaces in cities indicate that to what extend these green spaces can provide different services to residents in terms of environmental, economic, social and psychological services.***

***The National Health Services in the UK have a plan to build houses in a new city to provide better health for its inhabitants. The presence of green spaces in a reasonable proportion is one of the basic points taken into account (BBC News, 2016:1). People can take more advantages from existence green spaces in cities that they have a rational quality and quantity.***




***Map 3. Population Density in Sulaimani City Suburbs in 2015 (Researcher's work depending on Sulaimani Statistical Directorate, 2010).***

***In the Sulaimani City master plan, some parks have been planned and with the completion of all these parks, green space will increase in the future.***

***Hawary Shar Park which covers four thousand dunam of which only one thousand has been opened, with completion of other three thousand dunam, green space will increase dramatically in the Sulaimani City (Muhammad, 2016:1). Also, there are some of other parks under construction for example, Wais Park which covers 500 dunam and Raziana Park which covers 160 dunam (Sulaimani Directorate of Forestry and Range, 2016:1).***

***The percentage of green spaces as per capita green space is varies from one city to another in the world. As an example, in Europe in Riego de Calabria City in Italy green space is only cover 1.9% of the city, but in Ferroli in Spain covers 46% of the city area (Sadler et al, 2011: 245). This variance within the presence of green space between cities came from cities' master plans. The importance of green spaces in all cities of the world reflects the strategic plans of cities' decision makers.***

## *5. Conclusions*

***The lowest per capita green space was 9.2$m^2$ in 2008 and the highest was 16.2$m^2$ in 2016. Despite that green space increased in the city and the lowest standard of UN which 9$m^2$ / person was reached, the highest international standard have not be achieved. According to UN standards per capita green space is 30$m^2$ / person, and also according to WHO standards ideal green space is 50$m^2$ / person.***

***During the study period, the highest percentage of green space in the city was 10% in 2016 and the lowest was 8.2% in 2008. Despite that the green space was lower than standards, its distribution was also different in the city. In some bigger of the city, green space was low and the number of residents was high, for example in the Hawarabarza and Azadi areas. Furthermore, in some new areas of the city, the planned parks have not been built or have small area compared to the number of residents in the neighborhoods which is continuously increasing. It means that the quality and quantity of green space in the city was not at international standards and most of the residents should walk more than 300m to reach a green space. The planned parks should be completed until the green spaces will increase in a reasonable percentage in the Sulaimani City in the future.***

# تقييم تغيرات نصيب الفرد من المساحة الخضراء في مدينة السليمانية

**الكلمات المفتاحية: منطقة خضراء، مدينة، السليمانية.**

**م.م. بشتوان غريب غفور**

**جامعة السليمانية، كليّة التربية الأساسية، قسم العلوم الاجتماعية**

***Email: pshtiwan.ghafur@univsul.edu.iq***

**الملخص**

وضح هذه الدراسة تقييم التغيرات نصيب الفرد من المساحة الخضراء خـــــلال السنوات (٢٠٠٧-٢٠١٦) في مدينة السليمانية ومقارنة نتائجها بالمعايير الدولية. وقد سجل أدنى نصيب الفرد ٩.٢ م٢ في عام ٢٠٠٨، وبلغ أعلى نصيب الفرد ١٦.٢ م٢ في عام ٢٠١٦. وفي الوقت الحالي، يبلغ إجمالي المساحة الخضراء في مدينة السليمانـــية ١٠٪. وعلى الرغم من أن المساحة الخضراء أقل من المعايير الدولية، فإن توزيعها يميل إلى أن يكون مختلفا بين أجزاء مختلفة من المدينة. في بعض الأجزاء القديمة من المدينة، مساحة الفضاء الأخضر منخفضة إلى حد كبير بالمقابل عدد السكان مرتفعا. كما أنه في المناطق الجديدة من المدينة، بسبب عدك اكتمال الحدائق المخططة، وحتى لو تم إكمالها، فإن مساحاتها أصغر مقارنة بحجم السكان الذي يتزايد باستمرار. وينبغي اتمام الحدائق المخطط لها حتى تزداد المساحات الخضراء بنسبة معقولة في مدينة السليمانية في المستقبل

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