Sustainable Environmental Indicators and Their Impact on The Green Areas of Ramadi City

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Abstract. Cities are the bedrock of growth and sustainable development. At the same time, they are centers of environmental degradation that affect many of the problems, including urban expansion towards green areas, which are natural areas within urban communities, in sites dominated by vegetation, where they are of great importance at the city and individual levels, because of their multiple functions. Therefore, the research sought to diagnose the most important problems that the city of Ramadi suffers from through sustainable environmental indicators. One of the most prominent findings of the research is that green areas are often the weakest in the field of competition among other activities, it is often devoured by residential, commercial, and industrial sprawl. As the population increases, the demand for recreational services, including green areas, increases. These services decline and their scope decreases, which creates great pressure on what is available from them, and their performance decreases.

1. Introduction:

Green spaces are a very important element for any city that seeks to achieve the element of comfort, prevention, and hiking for its inhabitants. They are the lung of the city. They are the only space for entertaining and recreation in the urban environment, in addition to its aesthetic function by forming scenic views, which gives value to cities and residential neighborhoods. As a result of the population increase, it caused the emergence of various and different problems in urban centers, which led to their expansion both horizontally and vertically, where horizontally extended cities face the problem of overtaking the land uses, including green areas and parks, and the use of new lands, which are often not free from obstacles that hinder the process of sustainable expansion of cities and problems that know no borders to the environment, the most important of which is environmental pollution and the depletion of natural resources is affecting and the removal of trees, which caused urban desertification. Thus, sustainable development works through environmental indicators to protect the integrity of ecosystems and good handling of natural resources and their employment for the benefit of humans without disrupting the environmental components of land, water, and air, and their importance in maintaining the sustainability of human, animal and plant life.

The research highlights the importance of research through scaling up government and community environmental performance through its indicators, to achieve higher standards and standards agreed globally. To achieve the objectives of sustainable development through the integration of environmental management systems concerning the binding tasks of that goal to solve the problems of cities, including urban sprawl, the resulting waste of green, open, and recreational spaces in urban centers, the recycling of hazardous and non-hazardous remnants of agricultural and industrial activity, and to support the integrated management of solid waste.

Indicators of sustainable development provide a dynamic and accurate picture of the major problems of cities in urban agglomerations and the extent to which urban development goals have been achieved.
These indicators guide urban development decisions on the right track. From this point of view, several questions were raised:

- How sustainable environment indicators can be used to address the problems of urban sprawl on green areas?

The main objective of the research is to provide a theoretical framework on the impact of sustainable environmental indicators on urban problems, including urban expansion towards green areas.

Environmental indicators for sustainable development constitute an important tool in addressing the problems of cities, including the problem of urban expansion towards green areas.

To achieve the main goal of the research, the descriptive approach was adopted and the office method was used in collecting and studying data and information, as well as field visits to the city of Ramadi.

- Reviewing the knowledge framework for the concept of sustainable environment and its indicators.
- Clarifying the relationship between sustainable development indicators and the problems of cities.
- Determining the level of impact of urban development indicators on the problem of urban expansion of green areas.
- Choosing the research hypothesis according to the theoretical framework within realistic cities that suffer from the problem of urban sprawl on parks and green areas.

The research was classified into three main axes, the first axis representing the theoretical framework for the concept of sustainable environment indicators and the problem of urban expansion, while the second axis dealt with the practical study of the research problem represented by urban expansion towards green areas in Ramadi city, and finally the third axis dealt with conclusions and recommendations.

### 2. Indicators Of A Sustainable Urban Environment:

This paragraph reviews the indicators of the sustainable environment associated with urban development and their relationship to the growth and expansion of cities and incorporates a range of concepts of sustainable development as well as the problem of urbanization.

#### 2.1 The concept of sustainable development indicators:

The concept of sustainable development has been defined as actions aimed at investing environmental resources to the extent that they achieve development, reduce pollution, preserve and develop natural resources, rather than drain them and try to control them. It is a development that takes into account the right of future generations to the natural resources of the planet's vital space. Besides, it puts the basic needs of the human being as the first place. Its priorities are to meet one's needs for food, housing, clothing, the right to work, education, access to health services, and everything related to improving the quality of his needs and social life. It is a development that requires that we take no more from the ground than we give, that is, that it requires solidarity between the present and future generations and guarantees the rights of future generations to environmental resources. The objectives of sustainable development are to improve the living conditions of all the world's people and to provide every individual with the means of well-being, health, and stability [1].

The indicator is defined as a measure that summarizes or reduces information expressing a particular phenomenon or problem. It answers specific questions asked by the decision-maker, and the indicators provide us with information on the activities, situations, phenomena, or processes that occur in our environment, that is, the identification of development priorities at all levels and the basis for developing policies and plans. On the other hand, the indicator in general is a tool for measuring the results of the achievement of the Goals, which may be a quantitative or qualitative measure used to
measure a specific phenomenon or performance and how activities operate during a given time series. These indicators reveal positive or negative trends in that phenomenon to identify weaknesses and strengths [2]. The sustainability of these urban indicators can be understood as the extent to which the city meets the needs and requirements of its residents by changing the circumstances it is going through. Or in other words, the extent of the flexibility shown by the city in providing job opportunities, comfort conditions, and the ability to accommodate the population it seeks to serve, which can make cities continue to live by changing unsustainable production and consumption patterns. Thus, these indicators mean quantitative or qualitative data for monitoring and evaluating the actual reality of the quality of life of a community and its problems, and evaluation and follow-up at the level of development planning as an indicator to improve this quality and confront these problems.

2.2 Classification and types of sustainable development indicators:

The development of numerical measures of sustainable development may contribute to highlighting the extent of the link between them and the economic and social aspects. We may have numbers, but they do not suggest that we want to know. “The illusion of certainty is more dangerous than the ignorance of certainty.” At present, we need to prepare good indicators for sustainable development, as each stage of development requires the use of a set of indicators, as they serve as a guide and wave in setting goals and planning decision-making processes to measure performance towards achieving sustainable development. Moving from the policy strategy requires indicators that measure progress and the achievement of policy objectives to implement the development strategy to better assess the impact of activities and influence decisions, where the balance between economic activities, social well-being, environmental needs in the development process and changing decision-making patterns is required [8].

Sustainable urban indicators can be classified into two main axes:

- **The policy axis**, in this axis, urban indicators are classified into indicators that measure goals and others that measure performance and progress towards sustainability in the planning stage to achieve the desired goals, and they are called "Enabling indicators", and these indicators have an important role in drawing and defining the vision for the results and goals to be achieved.
- **The axis of analysis and studies.** In this axis, urban indicators are classified into indicators that measure the impact on the urban environment, i.e. the variable factors and independent factors affecting the change of the target factor in the study, and they are called “fostering indicators.” They appear after the completion of implementation, and they have an important role in evaluating the results and the extent of their continued progress towards achieving the goals set.

In this context, the United Nations Commission on Sustainable Development adopted in 1995 an analytical framework that classifies indicators into four basic models:

- **Driving force indicators** that describe activities and processes and their interrelationships with social, economic, political, and institutional conditions, i.e. the variables that cause urban problems. It is often seen as a starting point for addressing issues that are necessary to prioritize action and policy.
- **Indicators of the current situation**, provide a picture of the current state of things. They measure the quantitative and qualitative status of urban development.
- **The response indicators** are related to development policies and programs and mechanisms to change the status quo, in which there are measures taken with regard to economic development in the urban environment.
Performance indicators, which are indicators to measure the effectiveness of various policies and programs in addressing the negative aspects of urban development and to correct the damage by moving towards sustainable development.

In the chapters of the Rio Conference document, the United Nations identified four main categories of sustainable development indicators: social, economic, environmental, and institutional. The main focus of the United Nations is to develop a list of sustainability indicators within the three dimensions of sustainable social, economic, and environmental development to assist planners and policymakers in understanding the broader potential.

Therefore, environmental indicators are meant to measure representative considerations of environmental problems and know the direction of the indicator during a specific time, and provide important information to decision-makers and the local public about the situation, negatively or positively, for that part of the environment. That is, evaluating the state of the problem through numerical criteria, that the term environment embodies a large variety of systems and processes such as rivers, plants, animals, and oceans, and therefore it is important to choose indicators that include all categories and at all levels [10], As in Table (1).

Table 1. shows the most important sustainable environmental indicators affecting urban sprawl over green areas

| No | Environmental indicators |
|----|--------------------------|
| 1  | The allocated area of green areas per person m2 / person |
| 2  | The ratio of the green areas to the area of land uses in the city |
| 3  | Percentage of change in green areas by type |
| 4  | The percentage of air pollution with gases Co2 No |
| 5  | Rate of pollution by dust |
| 6  | The average area of recreational services m2/person |
| 7  | The extent of residents’ satisfaction with municipal services in green areas |
| 8  | Percentage of land degradation allocated for city expansion. |
| 9  | The number of random gatherings in green areas. |
| 10 | Percentage change in agricultural areas and orchards. |
| 11 | The rate of residents' satisfaction with the city's expansion on green areas. |
| 12 | Environmental impacts on transportation and traffic from the urban sprawl process on green areas. |

Source: the work of researchers based on United Nations, Preparatory Committee for the United Nations Conference on Housing and Sustainable Urban Development (Habitat III), 2016.

2.3 Methods of creating sustainable development indicators:

The main objective of all studies, participation, and data collection that are carried out with all development sectors is to produce a set of urban indicators that are consistent with the needs of cities. Therefore, these indicators may be aggregated, through a local network called the "Urban Observatory" that brings together stakeholders involved in collecting, analyzing, and disseminating data and information and putting them in the form of indicators that reflect issues of interest to society and have priority in the field of sustainable development. In this case, it is used to describe a complex case, easily [11]. There are two ways to create indicators:

- Build a system of indicators that can be used to judge the individual aspects of economic, social, and environmental development.
• Build comprehensive and integrated indicators by which levels of urban development, whether at a local, regional or international level, can be identified and evaluated in a complex manner. The main difficulty in compiling information in indexes is to determine the weight of the indicator without excessive loss of importance and subjectivity.

Usually, the information sector takes the “hierarchical shape” on which the indicators are built and extracted after a series of stages that these indicators go through, starting from defining the dimensions behind the concept of sustainable development, passing through the process of assembling and building indicators for the four most prevalent concepts of the dimensions of sustainable development, leading to the creation of synthetic indicators capable of competing and completing it as an indicator of sustainable urban development, where the principle of the hierarchy consists of a broad base of raw data that is collected and accumulated on the various areas of development from its official sources, and at the highest level of the ladder of that pyramid. These raw data, after processing, turn into a better picture, as they are classified into statistical tables with certain forms, and are classified according to many criteria that serve the goals of the decision-maker, and by scientific methods and methods that may be theoretical conclusions, mathematical equations, or advanced statistical methods that transform these statistics or extract indicators and measures from them. Some of these indicators can be compiled to extract a specific guide, for example, the Human Development Index consisting of several indicators, and this represents the top of the information pyramid, Figure (1)

![Figure 1. the principle of hierarchy for building indicators of sustainable development](image)

Source: the researchers work

2.4 Characteristics of sustainable development indicators:

Urban indicators are evidence of commitment to achieving the goals required to assess performance and achievement over a specified time. Thus, it is possible to identify the problems facing implementation and timely intervention to address them, and to achieve those goals, to establish several features and characteristics of development indicators that are agreed upon as criteria that can be used to select the indicators that meet the required targets, the most important of which are [6]:

1. Comprehensiveness, i.e. the adoption of comprehensible indicators, that is, providing a general picture of the city's mortgage situation in various social, economic and environmental fields without focusing on a specific aspect and neglecting other aspects.
2. Ease of understanding Choosing indicators that are easy to apply and understand for most of the population, and whose application and understanding do not require previous experiences and knowledge, meaning that the indicator has the relative ease of data collection.

3. The importance of choosing indicators that are directly related to current and future urban and population policies, and it is important to specify the expected result when developing the indicator.

4. Accuracy and clarity, the indicator must be characterized by accuracy and clarity and have minimum and upper limits, clear objectives, and specific sources.

5. Priority, meaning that priority should be given to the basic indicators that can be calculated using the available data, followed by the less important indicators related to urban policies.

6. Sustainability, which is, taking into account all economic, social, and environmental aspects and being able to adapt to the new reality by continuing to introduce modifications and changes that suit the current and new conditions.

7. Relativism, indicators must be able to be applied in any place and time, and that what is appropriate at a certain time does not have to be appropriate at another time, and what is appropriate for one place is not necessarily suitable for another place.

8. Measurability in terms of the indicator's ability to show the amount and size of urban problems in a quantitative, measured, and not hypothetical or situational way.

9. Independence, the indicator should not depend on other indicators to measure a single issue.

10. Complementarity, these indicators must be integrated in relation to each other within a single complementary cycle.

2.5 The concept of urban sprawl:

Any urban growth within or outside the city boundaries and the subsequent changes made through two forces are the internal forces of population need for different activities, resulting in shifts and changes in the architecture of cities, whether organized, planned, or randomly informal, not subject to any urban or architectural regulations or legislation or the external forces of global conditions and changes from technological development and information revolution. Urban growth in its spatial concept includes [5]:

- Functional changes and refers to a change in space and the subsequent changes in land use, and as a result, activity, and space should be among the basic elements of any system known as urban growth.
- Urbanization or (urban expansion), which is the stage that follows the increase in population. The researchers believe that urban growth is clearly and interactively linked with urban expansion, both of which represent a cause and a consequence of the other.

both (Harper and Goffman) defined urban sprawl as a general, multifaceted concept that refers to the spread and expansion of the city outside the limits set for it, and this means the expansion of the urban structure of the city and its spread (Sprawl) without committing to the boundaries of the areas in which the process took place. Urban expansion is linked to the changes and transformations presented by the population needs, as the migration of the population to the city leads to an increase in the demand for work, housing, and equipment, and this results in a more spacious urban area, which aims at an excessive consumption of the urban area (Urban overuse) to meet these needs. Urbanization is measured by the spatial change between two time periods, and it also means the expansion of the spatial scope of the urban structure of the city outside the current borders and may go beyond that to include the spatial field in the urban structure of the city’s territory [3].
2.6 Characteristics of urban sprawl:

The characteristics of urban expansion of cities are varied as follows, [4].

1. The number of the world’s population living in urban areas for the first time exceeded half in 2010. In line with this trend, it is estimated that by 2050, urban areas will be home to more than two-thirds of people, and the linear acceleration of urbanization will pose cross-sectoral challenges to urban planning and urban development policies.

2. Urban concentration in some countries and the growth of mega-cities under the name (city complexes), where more than 750,000 people live in each one of them. It is no longer an isolated or independent city, but rather has contact with its surrounding urban or rural centers. This pattern is more characteristic of Arab capitals than others, where investments and services are concentrated, thus becoming highly attractive to the population.

3. Expansion and growth of urban centers at the expense of green spaces, agricultural lands, and adjacent or surrounding areas of cities, and the growth is irregular and random.

4. Urbanization and accelerated urban growth, where urbanization was very rapid and even explosive in some countries and some Arab cities, the proportion of urbanization increased in Oman from 4% to 83% in the last forty years of the twentieth century and Yemen from 9% to 37% and in general, the urbanization rate increased from 36.5% to 60% in the Arab countries.

5. Variation in growth rates between rural and urban through the variation in the rate of urbanization, where it doubled year-on-year between 1950-1960, as the population growth rate of urban population at a rapid and rising pace between 1990-2025 in terms of number and size. It is known that urbanization stimulates economic growth, but the migration of people from rural to urban can be accompanied by a rise in inequality – both between urban and rural and within cities.

6. Among the features and characteristics of the expansion of cities in those countries is the weak relationship between urban transformations and economic, political, social, and technical changes.

2.7 Drivers of urban expansion:

Urban expansion has increased significantly in recent years as a result of increasing population growth and the construction of randomized buildings and communities. Most of the area's land is filled with buildings and residential houses, but most of it was agricultural land, which is occupied by the majority of the population of the region. It is one of the problems that call for urgent solutions to avoid negative impacts on the region and agricultural land and to make urbanization more inclusive, more resilient, and even more sustainable in a changing global environment. This was the result of several motives, including:

1. Economic motives

The development of the economic side, despite its positive aspects, has negative aspects as well. As a result of the development of the city and the creation of industrial, commercial, and service areas in some cities, this will inevitably lead to a rural exodus towards these cities, owing to the availability of jobs and the presence of services, resulting in the improvement of the standard of living and the expansion of the geographical size of the city and then the emergence of the suburb through this expansion.

2. Social motives

Urban expansion is considered as a social principle, as social motives affected the region in a short period, as they contributed effectively to the society and the individual in particular, who began to think of any means to first obtain a shelter for him without looking at the place and its consequences, such as urban encroachment over agricultural land, allowing it to be divided, as well as the
establishment of some population centers in them, and the establishment of more than one building on one piece of land because its ownership belongs to more than one person. In addition, another result is the tendency of the residents of the region to work in government, professional, or office jobs and leave the agricultural work, which led to the neglect of agricultural lands and their use for construction instead of agriculture.

3. Political motives
Some political decisions and pressures can lead to the expansion of one city without another, such as creating development poles or attractions, which leads to an increase in demand for urban real estate, or the absence of an actual strategic will to organize interventions in the short, medium and long term, and the ideological changes that occur in societies from one period to another, and the lack of realization Balance between housing, environmental architecture, and quality to control urban sprawl. Consequently, the expansion of these areas results in the urban explosion and the creation of urban suburbs for cities.

4. Technology Motives
Among the important and main drivers through which cities are created and expanded is technological development. With the emergence of industrialism, many cities have formed and expanded further, with increased technological progress and the lack of effective participation in sharing good practices and experiences in science, technology, and innovation for sustainability in key urban sectors, particularly in developing countries, with a particular focus on least developed countries. This is what led to the emergence of the industrial suburb of cities.

2.8 The relationship of urban expansion and green spaces to sustainable environmental indicators:
Green spaces are spaces within urban agglomerations, most of which are covered with trees, plants, and flowers. They have received attention since time immemorial as ancient civilizations witnessed a development in the field of interest in gardens. It is a kind of green space where it forms part of the urban environment in the city and plays an important role in balancing the urban sector because it improves the urban living environment and sustainable development, which takes into account the integration of different dimensions of human development, reduces the effects of economic development and places people at the center of all development. As a result of rapid urban transformation, which has affected the nature and quality of life of the city, many problems have been created, including the urban expansion of unplanned land uses. Large green areas and parks have disappeared to be replaced by slums. At the level of the individual, the deterioration of his/her psychology and his/her efficiency as a result of permanent congestion in urban areas leads to constant anxiety, fatigue, and suffocation as a result of widespread urban overcrowding. This has led to the loss of the city's identity and aesthetic features, the lack of distribution of city land use, the loss of environmental, economic, and security balance, the increased cost of infrastructure, and the shortage of agricultural and recreational areas.

3. The Field Study - Ramadi City Is A Case Study:
This focus includes a review of the field practical study of the city of Ramadi.
3.1 Geographical characteristics of the study area
- the site
The city of Ramadi is located between two latitude circles (33-23) and (33-27) to the north, and between two longitudes (43-12) and 43-20) to the east. Thus, it is located within the semi-tropical widths. The city of Ramadi represents a modest geographical area at the end on the right bank of the Euphrates River, in the southeastern part of Anbar Governorate, and from the air, it appears as a longitudinal city [7].
- Area and Population
The area exploited is about 7,191 hectares out of the total area of the master plan for 2012, which is about 15,170 hectares. According to the administrative division approved by the Ramadi Municipality Directorate, the city consists of eight municipal sectors and thirty neighborhoods. It is an urban center that is the result of the population gathering in that area of 235,406 for the year 2020, it generates a range of land-specific functions and uses that change and evolve according to the needs of the population.

3.2 land uses in Ramadi City:

The basic plan of any city expresses the activities that the population needs in the form of land use and depends on the planning standards in organizing those uses, but in many cases this plan is exposed to inaccuracies in implementation, exposing the city to many problems affecting its functional efficiency. Consequently, there is a defect in the required standards, and this is what we notice in the study area.

The city of Ramadi is one of the cities that gradually emerged and developed through different historical stages. Its functional internal structure has developed to meet the needs of its residents, especially after the increase in population numbers, as it turned from two small localities, namely Al-Aziziyah and Al-Qattanah, to a large city containing a group of urban land uses that vary in their spatial distribution. This can be seen from Table (2) and Map (1) (2).

| Land use          | Area (hectares) | Percentage (%) | Approved planning standards per capita m² |
|-------------------|-----------------|----------------|------------------------------------------|
| Residential       | 2565,48         | 35,7           | 50                                       |
| Commercial        | 176,7           | 2,5            | 8                                        |
| Industrial        | 203             | 2,8            | 2                                        |
| Entertainment     | 287,83          |                |                                          |
| Green areas -     | 882,5           | 12,3           | 30,4                                     |
| agricultural lands and orchards |            |                |                                          |
| Transport         | 2313            | 32,2           | 25                                       |
| Education         | 399,4           | 5,5            | 9,3                                      |
| Health            | 104,1           | 1,4            | 1,8                                      |
| Religious         | 105,1           | 1,5            | 0,125                                    |
| administrative    | 266,4           | 3,7            | 2,9                                      |
| Total             | 7191            | 100            |                                          |

Source: From the work of researchers based on
- Ramadi Municipality Directorate - Urban Planning Division, the basic design of the city of Ramadi for the year 2012.

Through the table, we note the use of (green areas), which is the focus of our study, which included two types of land in the city of Ramadi. The first type is represented by green areas, which have an area of (734) hectares, while the second type may include orchards interspersed with housing, with an area of (148.5 hectares), where the second type of green areas was limited only to the third and seventh sectors, while other sectors from Ramadi city lack orchards. Therefore, the total area of this use is (882.5), which constituted (12.3%) of the total area of the city of Ramadi.
3.3 The Reality of Green Areas After Urban Expansion:
Public parks are important recreational areas that residents want to spend time in and are often found within residential neighborhoods at the city level, as it is an important outlet for the city and a requirement to change the local climatic conditions in the city, and the environmental aspect represents the basic element in human life because it is the environment in which he lives. If this environment is free from pollution problems and other problems, the effects of this will be reflected on human health and sustainable development, because development needs healthy people. If the opposite happens and
the environment is polluted, it will have negative effects. This is unfortunate, many people are ignorant of it. Therefore, these recreational areas contribute to providing a comfortable environment for the residents of urban areas and give the city an environmentally aesthetic and healthy appearance that reflects positively on the city’s residents, because beauty in the soul is pleasure, joy, and comfort so that the elements of the city perform their functions to the fullest. It is not enough for the residential neighborhood to be healthy and comfortable, but it must be beautiful at the same time. This beauty can be achieved by creating green spaces around the buildings, where attention is one of the important contemporary indicators to judge the extent of the country's development.

The change in land uses is a shift in the type of land use in time and space. The change results in the emergence of problems in the region, due to the lack of recognition and prediction, which leads to the need to prepare stages for temporal treatment and to determine what is required for the development of the region in all economic and social directions. The different activities generate patterns of land uses. There may be more than one activity within the same use. The most influential factors on the change of land use in the city of Ramadi and the rest of the cities, in general, can be considered [12].

Population size is a factor affecting demand for and stability in recreational services. The whole population is meeting a constant increase of 1.5% 1.7% per year, generating considerable pressure, and the range of recreational services is falling, and their efficiency is decreasing[13].

- The value of the land, the diversity in the use of the land, the proximity to the city center, and the congestion, as many of the planned areas as green areas and spaces between residential units in most of the city’s neighborhoods, were used for throwing household waste in the rate of 50% and their use changed from green areas to rubble areas or bypassing them with other uses. This is what we observe in the neighborhoods of the study area, , and the reason for this is due to the poor environmental awareness of the population, as well as the backwardness in the techniques of household waste collection and the weakness of urban management.

One of the most prominent changes that occurred in green areas after the urban expansion is a change in land use from agricultural use and orchards to residential use, as this change occupies an area of (97,2) hectares, which is equivalent to approximately (1.35%) of the city area.in the suburbs urbans farmers transform large areas of orchards into large homes for themselves and their families and leave their work in agriculture to other businesses that give better financial returns due to the lack of government support for the agricultural sector. This is what we notice in several sectors of the city of Ramadi and concentrated in the fourth municipal sector, where the percentage of this change reached 97.2 hectares, and the change from the use of green areas to residential use as well. This change constitutes an area of (90.4) hectares, which is equivalent to (1,25) hectares of the city area. The sixth sector is considered the most changing sector with a percentage of (65.2), followed by the third sector with a percentage of (11) and then the first with a percentage of (8.6), as in Table (3).

Table 3. shows the distribution of the area of changes in orchards and green areas in the city of Ramadi 2020

| Sector No. | Area of changes in the municipal sectors in the city of Ramadi |
| --- | --- | --- | --- | --- |
| | (Hectares) | The area of change from orchards to housing | Change area from green to residential | The area of change from green to commercial | The area of change from green to industrial | The area of change from green to transportation roads |
| First | -- | 8,6 | -- | -- | -- |
| Second | -- | -- | -- | -- | 0,87 |
| Third | -- | 11 | -- | 2,45 | -- |
| Fourth | 97,2 | 5,6 | -- | -- | -- |
The above table also shows the change from green areas and orchards to commercial uses of 14.3 hectares, equivalent to 0.21% of the city area. It is concentrated in the sixth and industrial sectors at a rate of (0.033%) of the city area. This change is concentrated in the third municipal sector and transportation methods at a rate of (0.01%) of the city area.

3-4 Evaluation of sustainable environmental indicators according to the SDGs 2030 agenda in the Ramadi city:

The 2030 Agenda seeks to provide a global, integrated, transformative, and human rights-based vision for sustainable development, peace, and security that applies to all people and all countries, including the most developed ones. It consists of seventeen goals set by the United Nations Organization for Sustainable Development. These objectives are considered general, and a group of less general objectives is included under them. Among the goals, goal (11), which is the focus of our study, which seeks to build sustainable cities free from problems as much as possible, and to strengthen environmental, social, and economic ties, and goal (11.7) to provide public green and recreational areas for all people. It is possible to reach the list of indicators below that achieve the goal of the research and compare what is in the city of (Al-Ramadi) with the internationally proven environmental standards and determinants to show the environmental development gap, diagnose the current situation, identify problems and stages of planning to reach the achievement of the required goals and the standard standards specified for them.

| No. | Indicator                                                                 | Global index value according to SDGs 2030 | The value of the indicator in Ramadi city | environmental development gap |
|-----|--------------------------------------------------------------------------|--------------------------------------------|------------------------------------------|-------------------------------|
| 1.  | Percentage of use of recreational services from public services.         | %25                                        | %4                                       | Shortage                      |
| 2.  | The space allocated for one person from the recreational services in the city | 25 m2/person                                | 10,6                                     | Shortage                      |
| 3.  | The space allocated for one person from the recreational services in the city | 7 m2                                       | 3,4 m2                                   | Shortage                      |

* Sustainable Development Goals "SDGs", It is a set of goals set by the United Nations, also known as the Global Agenda 2030, which is a global vision and call to action to end poverty, protect the planet and ensure that all peoples enjoy peace and prosperity by 2030.
4. The percentage of the use of green areas from the land uses in the city.

| Percentage of use | %7-6 | %5 | Shortage |
|-------------------|------|----|---------|

5. Percentage of residents' satisfaction with the level of recreational services management in the city.

| Percentage satisfaction | %90 | %15 | Shortage |
|-------------------------|-----|-----|---------|

6. Deprivation rate for drinking water services index

| Deprivation rate | %99 | %44 | Shortage |
|------------------|-----|-----|---------|

7. Deprivation rate for sanitation services index

| Deprivation rate | %99 | %66 | Shortage |
|------------------|-----|-----|---------|

8. Percentage of those who rely on clean alternative energy

| Percentage of reliance | %40 | %5 | Shortage |
|------------------------|-----|----|---------|

9. Percentage of air pollution in the city

| Carbon | Nitrogen | Shortage |
|--------|----------|---------|
| 0.5    | 0.3      | More than 1.8 |

10. Percentage of noise pollution in the city

| Percentage of noise pollution | 30-35 dB | 70 dB | Shortage |
|-------------------------------|---------|-------|---------|

Source: Ramadi Municipality Directorate - Urban Planning Division, Urban plan for the master plan of the city of Ramadi, for the year 2012

Table (4), we find that there is significant underdevelopment and shortcoming in the recreational sector in the city of Ramadi, which is much less than what was decided in the basic design of the city, and the area of recreational services reached (287.83) hectares and constituted (4%) of the area of public services in the city and (0.57%) of the total area of the city, while the area allocated for one person is (10.6), it is much less than the percentage of use according to the specified international standard (25 m²), while it appears that the indicator value for the areas allocated per person for land uses for green areas (3.4 m²) which is below the sustainable environmental standard according to International and local standards by (7 m²). The area of using green areas, among other uses, reached (5% m²), which is also low in the percentage of use according to the specified criteria, at a rate of (6-7%). Therefore, the deterioration of the specific areas of green areas led to the emergence of many problems, including pollution of all kinds and the encroachment on those areas, whether industrial, commercial, or residential, which led to environmental depletion of natural resources in the study area due to urban mismanagement in it. As for the deprivation rate for the sanitation services index, it reached (44%). This indicates the shortage in the provision of sanitation services throughout the city of Ramadi because it is limited to parts of the cities of Anbar Governorate, as well as the dual sewage system between rainwater and heavy water drainage, the old networks and their inadequacy with the size of the population and urban expansion, while the percentage of deprivation for the services indicator drinking water (66). The reason for the increase in the percentage of deprivation in this indicator is due to the continuous interruption of electric power and abuses on the public network, as well as the inefficiency of distribution networks and their expansion over large areas without taking into account the population density when planning and designing those networks, in addition to the old network and poor maintenance which leads to depriving a large part of those areas of potable water due to the inability of the networks to cover it. With regard to the alternative energy based on wind and sun, which are sustainable sources of electricity production and for reducing emissions and air pollutants, the province of Anbar and the study area are among them very suitable or so-called promising areas for alternative energy production for electricity generation, but through a table (4) we note a very large deficit across the province of Anbar rather than at the city level due to the lack of financial allocations necessary to implement efficiency projects.
4. Conclusions

This focus discusses the main conclusions drawn from the field study and presents a set of conclusions related to the theoretical and practical framework. Recreational use decreased significantly, as the per capita share of this use reached (10.6) m² / person, and the percentage of green areas for each person is low, reaching (3.4 m²) below the sustainable environmental standard, despite international standards that gave importance to this use after residential use, as it is the only outlet for the population, but due to poor urban management, it prevented it from being used correctly. The city of Ramadi suffers from a low level of recreational services, whether in terms of actual need or in terms of neglect in the field of management and coordination, as well as a deficit in some services despite green spaces that are higher than the international standards approved for major cities. This is a good factor in its sustainable development and exploitation, but it suffers from poor planning and follow-up, as some gardens and orchards are exploited for other uses. It was found through the study that there is a strong relationship between sustainable environmental indicators and the problems of cities, including the problem of the age of urban sprawl and its impact on life in urban centers, where indicators play a role in diagnosing and treating those problems. Ignoring the role of green areas in urban sustainability from developing the planning directions for the basic design of the city of Ramadi.

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