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To cite this article: M. S. Jumaah *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **761** 012055

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Role of Green Spaces and Their Impact on Climate Design and Ecosystem Efficiency

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Abstract: Anbar Governorate suffers from clear negligence in achieving a balance between the natural and constructed components and their impact on the local climate, especially in terms of providing green spaces, the components of the natural environment are affected the climate, which is characterized by its harshness in the hot dry region, which requires developing solutions for its climatic design and achieving the efficiency of its ecosystem, as well as providing green spaces commensurate with the nature of the city and its population, and from here the research problem identify the role of green spaces in climate design and achieve efficiency High for the ecosystem. The research reached many proposed solutions through which it is possible to overcome the difficulties and challenges facing green spaces within the cities of Anbar Governorate, including preserving and protecting green spaces, raising their efficiency and increasing their area, as well as converting unused lands into green spaces, as well as reaching many Among the recommendations that would highlight the role and importance of green spaces in achieving the environmental and aesthetic balance of Anbar Governorate cities.

1. Introduction

Green spaces are one of the components of the urban landscape of cities, especially those with a hot dry climate, and they have special standards and controls in addition to their various and multiple functions, as they represent the face and personality of the city as it leads to protecting the environment from pollution, which affects the health aspect of the human being, as well as providing shading, raising relative humidity and air purification. It reduces noise and modifies the temperature, also it performs planning and aesthetic functions as it works to define cities and separate different facilities, beautify and coordinate squares and streets, likewise areas for human comfort. Green spaces have a wide interest since different ages and ancient civilizations, and Arab art has a special way of dealing with it, especially in cities, but in the modern era it has developed a lot, benefiting from the experiences of peoples in this field in addition to what modern science has provided in terms of machines, developments and research that have helped them to reach an advanced degree of sophistication commensurate with the urban development of cities, and despite the multiplicity of goals that planners and designers seek to cultivate plants and create green spaces, the goal in hot dry areas is to achieve a sustainable climate design and environmental efficiency for the city in terms of providing a healthy environment for people inside The city without prejudice to the right of future generations to fulfil it, as well as its aesthetic, engineering and climatic properties, and that choosing plants and determining their places of cultivation is one of the most important elements of the success of green spaces within cities. Plants in general, and trees and shrubs in particular, have the ability to control direct and reflected solar radiation and provide shading, especially in the summer, and control the winds by blocking them, reducing their impact or changing their course to protect the city from sandstorms and strong dust-laden winds, filter it to air, and protect soil from erosion. And control it by



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increasing the relative humidity, and thus it can provide a suitable local climate for humans, especially in cities with a hot and dry climate. Where the research aims to study the role of green spaces and their impact on improving the local climate of desert cities with a hot and dry climate, including Anbar Governorate (study sample) and achieving the sustainability of its climate design and the efficiency of its ecosystem [1, 2, 3] .

1.1 The concept of green spaces

Green spaces constitute the bulk of the open spaces of cities, and most researchers call them the designation of green open spaces. The civilization of nations is measured by the extent of its interest in green spaces for its great role in improving the urban environment and reducing the levels of pollution experienced by cities, and improving the city's climate in general, the microclimate in particular. Its positive role in psychological, health and social influence, as it leaves a good effect, brings comfort and calm in the souls, and affects the urban landscape of the city through its design and coordination. The effect of green spaces on the climate varies from one region to another depending on many factors such as the topography of the land, proximity or distance from water sources such as seas and rivers, height above sea level and vegetation cover density, and that the effects of this area are more pronounced in areas with a desert or semi-desert climate. (Hot and dry) as in most Arab countries, so it is necessary to take care of it and increase its areas in such climatic conditions [4]. Green spaces are defined as those areas that are for the most part covered with greenery [5]. Also defined green spaces as open spaces within the city that aim to connect the individual with nature through this natural environment to improve the general surrounding conditions, and are designed according to the considerations of sculpture and architecture [6].

1.2 Climate design concept

Climate design means the mutual influence between the natural and manufactured environment and its response to many concepts about the impact of human activities and the achievement of its thermal temperatures by crystallizing the idea of climate design based on the fundamental change and transformation of systems, ideas and strategies as a result of technological progress, scientific discoveries, requirements and economic treatments that result in the emergence of mechanisms and design proposals that are efficient and capable of facing the challenges of unsuitable environmental conditions in cities with desert or semi-desert climates, and are subject to an integrated evaluation framework as the goals of climate design [7].

There are several basic design goals that climate design seeks to achieve in cities with desert and semi-desert climates, as follows:

User satisfaction of the urban environment: The goal of all design processes is to reach a solution that satisfies the user of the urban environment, which will directly affect the architectural environment, thus creating an integration in achieving an urban design that is satisfactory for the users of green spaces in approaching the limits of thermal comfort in its entirety.

Achieving thermal comfort: the climate design seeks to achieve the greatest possible thermal comfort for the occupants of green spaces by improving local climate conditions through the use of certain mechanisms that work to make thermal comfort variables (air temperature, relative humidity, air movement, solar radiation) within thermal comfort limits or close to them depending on time and space variables.

Reducing negative impacts on the environment: Climate design seeks to achieve the greatest possible protection of the environment by minimizing negative impacts on its basic elements (air, water and soil) through an integrated methodology that begins with planning any urban project through its implementation, occupancy and maintenance, and ending with recycling operations for its structural components.

Achieving energy consumption and material costs: Climate design seeks to achieve suitable localized climate conditions throughout the year for any site, which indirectly reduces the use of mechanical

equipment to control its climatic conditions by adopting methods that reduce the temperature of the outer space.

Achieving high aesthetic and visual values in the urban environment of cities: the climate solution must be integrated with engineering designs visually and aesthetically in any urban gathering, and this can be achieved by adopting the visual instinct that deals with shapes as the natural organic forms such as trees and plants are more psychologically acceptable. Building blocks with strict geometric shapes and colours, as green colours fall on the retina automatically without any nervous stress or shed on the human eye lens, which falls within the limits of visual comfort for users of green spaces [8, 9].

1.3. Classification of green spaces within cities

1. Classification of green spaces within cities according to the degree of utilization, and is divided into:
A-Green spaces of limited utility, such as parks and wooded sites in the squares of small areas, children's playgrounds and industrial lands.

B-Green spaces of public utility, such as amusement parks, orchards, sports fields, forests, beach gardens, and broad street gardens.

C-Green areas with special benefit such as plant and animal gardens, green strips as windbreaks and afforestation gardens in sanitary protection areas.

2. Classification of green spaces according to function, and it is divided into:

A-Productivity: such as agricultural fields, orchards and forests

B-Preventive: represented by afforestation of street sidewalks and pedestrian paths and others for protection around industrial zones.

C-Recreational: represented by afforestation of parks or public gardens and green playgrounds.

D-Aesthetic: Afforestation of middle areas and carports in the streets [10].

1.4. The role and impact of green spaces in cities with a hot and dry climate:

First: the environmental role

1-The role of green spaces and their impact on climatic elements

A- Solar radiation: Plants play a major role in regulating the value of solar radiation by blocking solar rays from horizontal and vertical surfaces by reversing part of them and absorbing another part depending on the size, density, type and area of coverage. As the intensity of radiation fluctuates due to the movement of leaves and the influence of the wind under the canopy of trees, and the intensity of lighting varies on the surface of the leaf due to the influence of the wind and the difference in the angle of incidence of the sun as well as the differences in days and seasons with the concomitant differences in weather, and when the crowns of trees are dense leaves, the radiation value The solar system decreases approximately 10% of the bright sunlight, and thus trees have an important role in blocking solar radiation, reducing its levels and providing shades, which creates an ideal environment suitable for human comfort [11]. Image (1).

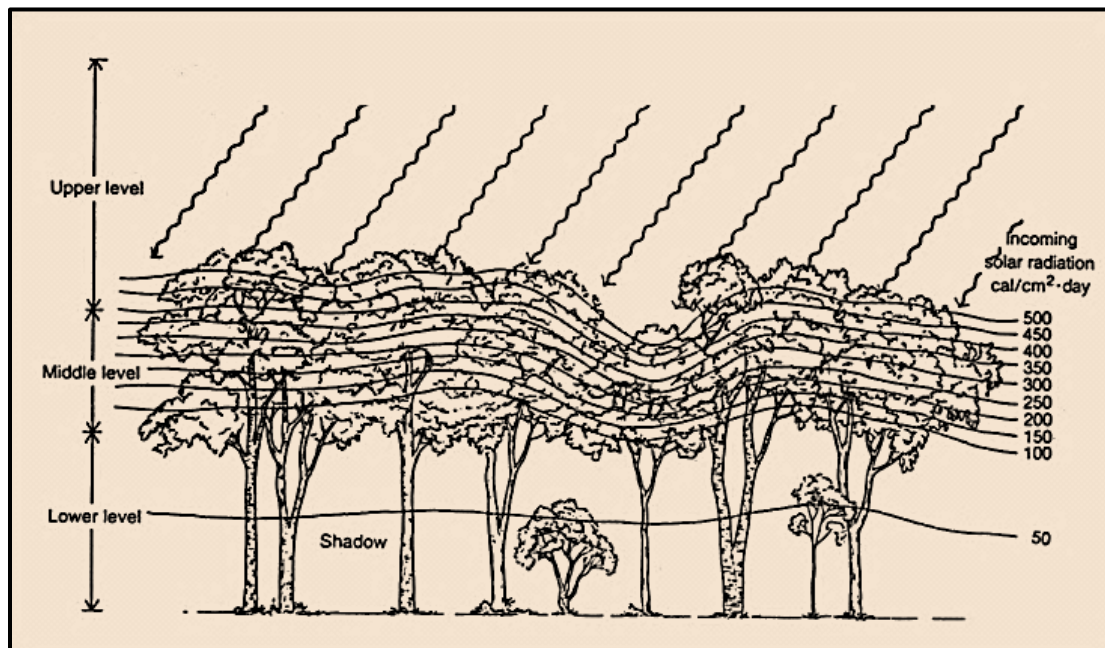


Image (1) The role of tree crowns in solar radiation levels

Due to the proximity of desert and semi-desert cities to the equator, the amount of solar radiation falling on them is high in the summer, so trees and shrubs must be planted in green spaces, taking into account that trees and shrubs differ in their ability to transmit light, some of which allow penetration in the amount of 10-40 % and sometimes up to 90% of the sun's rays, and it is necessary to know the size and height that the trees reach in order to plant them in the appropriate place in addition to being evergreen or deciduous [12].

In addition, green spaces are of great importance in blocking and reducing strong light reflections from multiple sources such as walls, water bodies or glass facades. Therefore, when knowing the effects of strong sunlight and light reflections, it is necessary to lend great importance in the process of creating green spaces and how to organize and coordinate them to avoid some of these phenomena. Unhealthy [4].

B- Temperature: The effect of trees in lowering the air temperature occurs through increasing its relative humidity during the processes of evaporation and transpiration. These two processes consume thermal energy in the air to convert water into water vapour and thus lead to softening the air, and 60-70% of solar energy is consumed during the day. In the physiological processes inside plants, the effect begins to appear with the sunrise and the difference in temperature between shaded and non-shaded increases as the sun rises in the sky and the angle of incidence of solar rays increases, and this means that shading during the period of sunrise and sunset is effective for the purpose of protecting structural surfaces from direct solar radiation [13]. So trees and plants should be planted around buildings to greatly reduce the sun's impact on the temperature of exterior walls and reduce energy-related costs for heating and cooling purposes. By planting trees on the western side of a building, you can minimize the sun's impact on the wall's temperature. Planting trees on the western side of the building reduces the impact of direct sunlight and thus reduces the temperature of the wall. This means that heating and cooling the building will require less energy and reduce negative environmental impacts on cities' climate, as well as enhance the aesthetic and visual value of the building [4]. Planting trees around a building or business is not only a positive step towards reducing energy consumption, but it also has a fiscal benefit as well.

C- Relative humidity: Green spaces supply air with water vapour through transpiration, which increases the relative humidity in the air. Therefore, we note that the relative humidity between plants and under tree cover is higher than the relative humidity over the surface of dry soil. The difference

culminates in the summer and almost non-existent in the winter. The increase in relative humidity under trees varies with different types of trees and with different seasons and months [14]. By measuring the relative humidity, we find that it is relatively high in the middle of the night and reaches its highest level at three o'clock at night for all months of the year, then begins to decline from six in the morning until it reaches its lowest at twelve o'clock in the afternoon and its average percentage for all months of the year is 23%. Approximately, then it starts to rise again after twelve o'clock in the afternoon until it reaches its highest level at three o'clock in the middle of the night, reaching 57% for the whole year (on average) almost [4]. Image 2.

Temp. c°	Humid. %		Temp. c°	Humid. %
35.6	33		29,4	75
35.0	35		28.9	81
39.9	32		29.4	80
33.6	35		29.4	85
33.3	33		29.4	85
21.7	87		30.0	93
Day			Night	

Image (2) The effect of trees on air temperature and relative humidity during the night and day

The increase in relative humidity is necessary and has advantages and that green spaces have a big role in increasing this percentage, which sometimes reaches 18-20% compared to non-wooded areas, and research conducted in some European countries showed that green spaces have an important role in increasing the amount of rain by raising them to relative humidity. It reached 20-60 ml more than it is over non-wooded areas [14].

1.5. The intensity of evaporation is affected by several factors, including:

- The amount of incident solar radiation: It is one of the important and big factors affecting the values of evaporation. The longer the day increases, the solar radiation will increase, leading to higher temperatures, and its effect is reflected in the amount of water evaporated from the surface of the soil and plants.
- High temperature: leads to an increase in the evaporation process, especially if this rise is accompanied by dry air with rapid winds, and evaporation occurs at any temperature, no matter how low.
- Relative humidity: inversely proportional to evaporation as the evaporation rates of the air saturated with moisture decrease, and the opposite occurs in the case of a low level of humidity in the outside air.
- Wind: Its effect is more evident as its speed increases and its direction and movement are stable, as these cases lead to an increase in the amount of evaporation because it displaces moist air to replace it with dry air, and the air in contact with the soil and plants will be dry, which contributes to the increase of the evaporation process and its activity again. Especially if it coincides with hot and dry

winds. As for Transpiration, it is affected by the shape and size of the leaf, the size of the plant, the size of its pores, the type of soil, temperature, relative humidity, and wind speed, and the transpiration process is active during the day when the stomata of the leaves are open, and they fade or weaken at night, and transpiration is one of the important means by which large quantities of water vapour are released into the atmosphere, The amount of water that the plant loses through transpiration is estimated at 95% of the amount of water that enters the plant's body, while the remaining 5% is consumed by photosynthesis and cell building [7].

D- Wind: Green spaces have a clear effect on the intensity and speed of the wind, and this effect varies according to the type, age, height and method of planting plants (protective belts, windbreaks, rows of trees and shrubs in the streets, green oases or any other form of green space), as well as The vegetation density of trees and shrubs reduces wind speed by 75-85% [15]. Image 3.

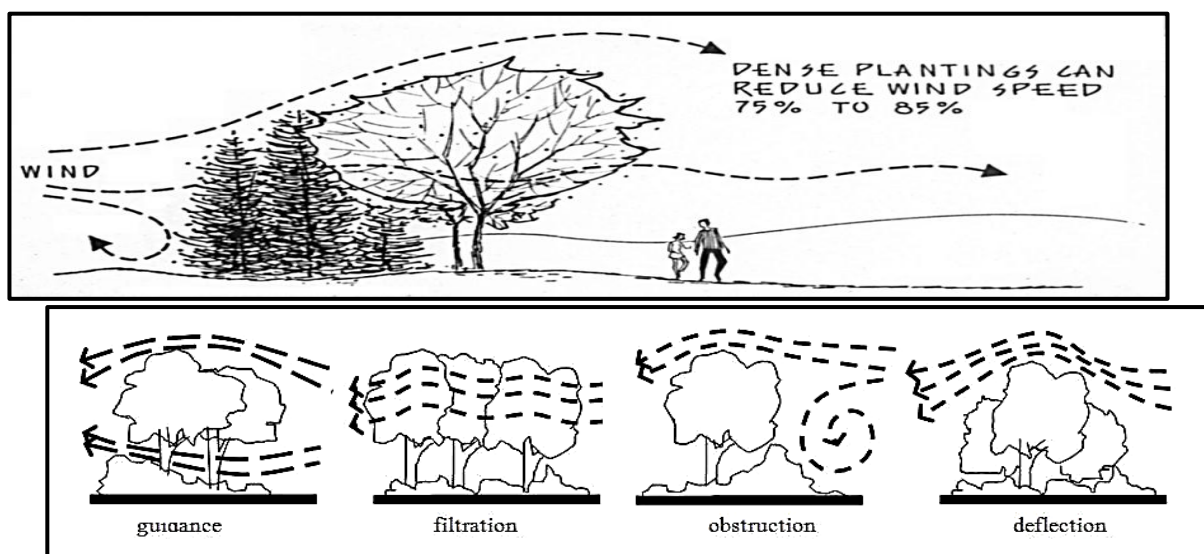


Image (3) The role of trees and shrubs in reducing wind speed

The effect of green spaces is highly visible on wind movement and direction, especially for microclimate local climates. Its effect in hot dry areas is to reduce the movement of strong hot and dry winds, often loaded with dust and other solid particles. Therefore, the entire city or some of its important parts and main roads must be protected by surrounding it with protective belts, which can protect it to some extent from the intensity of the winds and their various spatial damage [16].

The fast winds during their blowing on the protective belts or windbreaks gradually slow down until it ceases, and the completely protected distance after the bumper can be estimated according to the following equation:

$$D = 356 H / V$$

D = distance (meters) totally protected by windbreak.

H = bumper height (m)

V = local wind velocity (m / s).

For example: when the windbreak height is 1 meter and the local wind speed is 1 meter / second, the protected distance is 356 meters [17]. The role of windbreaks and green belts for cities with a hot and dry climate is shown by reducing wind speed and limiting its harmful effect, protecting soil from erosion and stabilizing sand dunes, reducing evaporation and transpiration, protecting crops and improving the surrounding environment that leads to increased production, protection of livestock and increased production Animal, softening the atmosphere by adjusting the temperature and humidity and reducing the speed of strong winds, making use of the timber of trees and shrubs in many industries,

reducing the heat exchange with the outside environment and thus maintaining a more moderate atmosphere in the wooded green spaces in a scientific way in terms of the distribution of trees and the density of their leaves. The wind movement helps to mix the components of the air continuously when the balance of its main components is disturbed, such as consumption of carbon dioxide or oxygen disposal by plants, and what happens inside cities and around industrial complexes that generate large quantities of toxic gases around them. These components [4].

1.6. The role of green spaces and their impact on environmental pollution and solid air components

a. Environmental pollution: outdoor air consists of 21% oxygen, 0.03-0.04% carbon dioxide, 78% nitrogen, 1% ineffective gases, and between 5-25g of water vapour per 1 m³ of air. As for the corrupt air, it contains the same gases but in different proportions as well as other gases released by the body (especially ammonia) and about 45 g / m³ water vapours [18].

The increasing concentration of pollutants in urban air is attributed to smoke, gases, pollutants, and materials released by factories, cars, and various activities in the city.

The spread of pollutants in the city has a great impact on its climate and human health and comfort [19]. Green spaces play an important role in removing gaseous pollutants. Plants work to purify the air, reduce air pollution, and improve the environment. Pollution is considered one of the serious problems that humans face in all parts of the world, as pollution has begun to increase since the beginning of the industrial revolution in the world, especially in Europe. Pollution has included water, air and soil after the spread of large factories and the use of various means of transportation with internal combustion, as well as human encroachment and overrun Vast lands covered with vegetation. Plants play an important role in purifying the air from pollutants, toxic gases and unpleasant smell, and this purification is done through:

- Absorbing a large part of these pollutants either directly from the outer surfaces of the leaves or after dissolving them in rainwater through the openings of respiratory stomata and then entering them into photosynthesis and converting them into energy and oxygen or converting them into storage inside the plant in the gaps, thus preventing their access to soil and microorganism.
- Blocking unpleasant smell and replacing them with other stronger and more beautiful aromatic smells coming out of leaves and flowers with the addition of oxygen, which increases the purity and freshness of the air [13].

The percentage of acceptable air pollution for a person should not exceed one part of polluted air for every 3000 parts of fresh air almost, but in many highways and major cities the pollution percentage increases and reaches 3: 3000, so planting plants on roadside and in the middle islands of the streets, it helps reduce air pollution [16].

The role of plants in their description is highlighted as a basic factor for absorbing the large increase of some gases such as carbon dioxide through the process of photosynthesis, as it has been scientifically proven that the process of photosynthesis in plants increases directly with the increase in the percentage of carbon dioxide in the atmosphere, and it has been found that an area of 1 m² of the surface of the leaves represents 1.5 grams of carbon dioxide, and that an area of 25 square meters of leaves secretes a sufficient amount of oxygen for one person to breathe for the same period of time, and this is during the hours of the day and the process of photosynthesis and the production of oxygen, and since the person breathes at night and in the winter periods (times when no process occurs Photosynthesis), so an individual requires 150 square meters of leaf area to meet his oxygen needs, and one large tree is found to be sufficient for 5 people to breathe [12]. And one hectare of forests can absorb approximately 100 medium-sized cars, and this depends on the type of forest, the type of trees, the composition and components of the forest, the tree growth. Soil type [19]. Cars represent the main source of air pollution inside cities, as 2/3 carbon monoxide and 1/2 the amount of hydrocarbons and nitrous oxides that pollute the air comes from cars, and these gases may be accompanied by some highly toxic compounds and lead particles, as the combustion of gasoline represents (To which some lead compounds are added to improve its qualities as a fuel) is the main source of lead in the airspace, and this source alone represents about 94% of the percentage of lead emitted to the air [20]. Studies

have shown that the green spaces surrounding the factories have a great impact on reducing the gaseous pollutants. It was found that 500 square meters of green space can reduce the concentration of nitrogenous oxides by 67%, while the green belts that are 500 meters wide can reduce the percentage of sulfur dioxide by 70% [21]. A belt of trees with a width of 30 m can reduce the concentration of CO present in the air by 60%, and environmental studies indicated that an area of 1 km² of trees absorbs 12-120 kg of CO daily, Table 1. also, gardens, parks and street trees have a great role in reducing the concentration of many toxic gas pollutants such as CO, NO₂, SO₂ and smoke [13]. Table 2.

Table (1) shows the role of trees in reducing the level of air pollution

Number of tree lines planted	Density factor		Reducing the level of air pollution with polluting gases (CO ₂ , CO)	
	Winter	summer	Winter	summer
One line of trees	0.11	0.22	3-0	10-7
Two lines of trees	0.15	0.37	5-3	20-10
Two lines of trees with two lines of bushes	0.18	0.58	7-5	40-30
Three lines of trees with three lines of bushes	0.20	0.68	12-10	50-40
Four lines of trees with two lines of bushes	0.23	0.75	15-10	60-50

Table (2) Quantities of pollutants absorbed by the leaves of *Albizzia Lebbek* (mg / hour)

Types and quantities of pollutants				
NO _x	O ₃	SO ₂	CO ₂	Suspended particles
1000.13×10 ³	2696.01×10 ⁴	1785.84×10 ⁴	1130.58×10 ³	1087.10×10 ³

b- Solid air components: Green spaces filter and filter the atmospheric air and clean it in the surrounding environment, as heavy particles settle from the air and settle on the roofs of trees, and the adult plant is more effective in the process of collecting these minutes [22].

The solid components of the air may be dust, sand, or smoke particles, and the minutes that are with a diameter of 75 microns settle to the bottom, but the minutes smaller than 50 microns remain volatile in the air for a period of up to several weeks, and these minutes have negative effects on human health that vary according to the type of these minutes [18].

The more humid air is less able to carry dust particles (its capacity is much less than the hot dry air to carry dust particles because it is saturated with water vapour, so it increases the chances of air purification and the gathering of dust particles in green areas) and thus is purer [19].

Plants in nature play this effective role, as they work to remove many particles of solid pollutants suspended in the air (dirt, dust, sand, ash, smoke, lead, copper, pollen) by depositing them on the surfaces of the different parts of the plant, the leaves and capillaries present the branches, stems, hollows and crevices in the core of the stems and twigs trap these pollutants and deposit them, and then get rid of them through rain into the soil [12]. Green spaces are the lungs of the city as they clean and purify the city air by depositing particles suspended in it on the surface of the soil or sticking a portion of them to the surface of the leaves, and this process depends on the density of vegetation and some morphological characteristics of the leaves that grow and wrinkle and the hairs abound in them, studies have proven That pine forests are deposited annually 30-35 tons of suspended matter in the air per hectare, and that an area of one hectare of beech trees can remove and deposit 4 tons of dust in the air per year, and it has also been found that planting a green belt of plants 180 m in width can It reduces the percentage of dust particles in the air by 75%, and studies have shown that the percentage of pollen scattered in the air, especially in the spring, can be reduced by 80% by the presence of a

dense forest of conical trees, and it has also been evident that the concentration of smoke in Hyde Park is low. (With an area of 2.59 km²) in London with 28% of its concentration in the neighbouring areas [21, 23]. Second: the aesthetic role: The aesthetic role of green spaces is one of the main functions in coordinating and designing gardens, as plants are used in modern designs, especially in architectural design and in interior arrangements. For cutting and shaping into regular shapes, the presence of plants gives the element of nature to the place and breaks the sharpness of the geometric lines and gives a natural picture of the design.

Plants are used to give the required colours in the coordination and design of green spaces, they work to highlight other elements in green spaces, they work to hide defects or unwanted views, draw attention to the beautiful views, and they are one of the living, moving and changing elements that add life to the place and keep boredom away. With the change of colours and leaves throughout the seasons of the year.

When creating green spaces, the designer must have a good knowledge and know-how in how to distribute and coordinate the selected plants and link them to the design of green spaces, and that the harmony of plants with each other gives the required balance, beauty and compatibility [24, 25].

Third: the constructive role: Plants have an important role in designing green spaces, and this role is highlighted through the formation of plant fences that can perform the purpose of building fences to block the unwanted views by planting a group of fences close to each other or in groups that may be in different vegetative heights and densities. It can also be used to define and divide large green spaces into smaller areas and isolate their parts from each other, or isolate places for seating and rest, as well as identifying traffic lanes and roads in a specific direction. Defining and beautifying the paths of the wide entrances to the garden and dividing them by planting groups of trees, flowerbeds and individual models have their own distinctive characteristics. Plants are also used to supplement and form certain parts or to fill in the spaces between green spaces and buildings. It is also used to give a feeling of the apparent breadth, and it can be used by planting it in short groups to form a frame to define and highlight a constructive structure of special importance or a frame surrounding the building to introduce the element of nature and break the sharpness of straight geometric lines. In addition to being used to cover defects in buildings and to give a feeling of height and height to low buildings or to give an imaginary shortening of tall buildings [26].

Fourth: The economic role: Rationalization of energy allocated to cooling buildings by reducing the thermal loads imposed on them: Cities are considered a factor affecting the quality, quantity of heat loads, acquired and stored, and the subsequent night radiation and heat exchange with the ocean. The environment depends on the temperature of the building, Plants can be grown around buildings, thus greatly reducing the building's heating and cooling costs, which in turn reduces the amount of energy consumed. Plants also work to balance the strength of hot and cold air waves and provide a barrier between the walls of the building and its external surroundings, as well as their direct effect in repelling solar radiation, and they also protect the building from the negative effects of weather, thus. Green spaces surrounding buildings are an effective way to protect them from the elements of climate and reduce heating and cooling costs [16].

Shading the streets with plants leads to covering a large part of the street and blocking direct solar radiation from falling onto the street, which helps prevent the earth from gaining solar heat, as the plants absorb part of the solar radiation falling on it to carry out the vital processes inside as well as reverse the other part and return it to the upper layers of the atmosphere, then the creation of green spaces, planting plants, and the creation of sidewalks suitable for tall trees that cover the streets will reduce the heat load imposed on the urban environment with its various horizontal and vertical surfaces, and increasing the relative humidity in the atmosphere at certain rates plays a role in reducing the energy expenditure of the building, This can be achieved by creating green spaces that have a major role in reducing the temperature of the outside air surrounding the building and thus reducing the cost of cooling for the internal spaces, providing a feeling of comfort outside and inside the building [23].

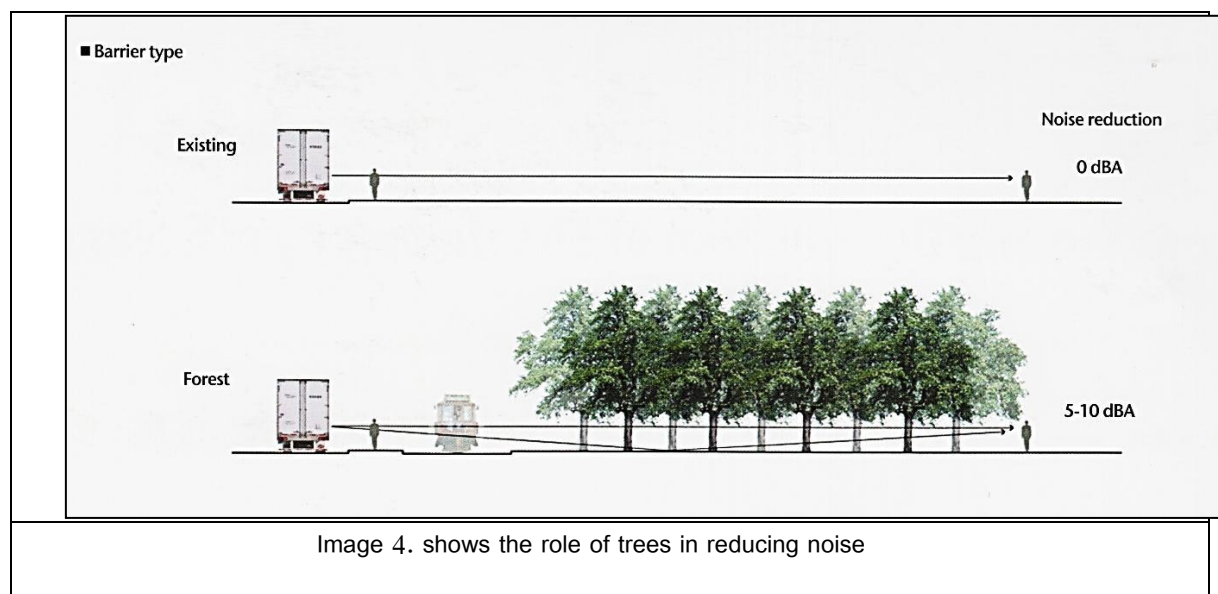
1. Raising the value of urban land: Green spaces increase the value of urban land as it adds to the urban landscape in terms of aesthetics and health.
2. Raising the rates of commercial transactions: The green spaces raise the rates of commercial transactions for the commercial stores, as they have achieved a suitable environment for the shopping movement of the citizen and tourists at the same time.
3. Financial returns from the operations of investing in plant parts: The parts of plants cultivated in green areas, such as leaves, stems and seeds, are invested in various economic and commercial operations, such as the manufacture of paper, fertilizers, medicines, and others [27].

Fifth: the social role

1. Achieving social interaction: This is done by increasing the opportunities for meeting, exchanging views and ideas, acquaintance and forming new friendships and relationships between visitors to green spaces.
2. Achieving visual comfort: by reducing unwanted visual effects, increasing natural colours, reducing sun glare and so on.
3. Achieving auditory comfort and reducing noise: Cultivation of plants in and around cities and on both sides of roads reduces the sounds emanating from the activities of the daily activities of humans and cars, as the crowns of plants absorb approximately one-fourth of the strength of the sounds and reflect the rest [27]. Table 3 shows the noise levels in decibels and their effect on the human sense of hearing, while image 4 shows the role of trees in reducing noise.

Table (3) Shows noise levels in decibels

Noise level (dB)	The influence
65	Limit psychological comfort, and after that manifestations of stress and fatigue begin
90	Exposure to this level for several years affects hearing loss and impaired hearing
100	Exposure to this level affects the damage to the hearing organs
130	It causes a pronounced sense of pain
140	Loss of eardrums and permanent loss of hearing.
or more	



4. Achieving thermal comfort: The environmental conditions surrounding a person directly affect the person's health and his ability to work. The physical and mental activities of a person are at their best within a certain range of environmental conditions, and their efficiency in performing these activities outside this range decreases in addition to the potential for disease and stress. The human body, according to its organic system, expends energy in order to adapt to the surrounding environmental conditions, and when the energy expenditure is at its minimum, the surrounding conditions are considered within the limits of thermal comfort [7].

Thermal comfort is defined as the condition of the central nervous system that leads to a person feeling satisfied with the environment around him, and some researchers [9] prefer to define it as a condition in which a person does not feel cold or hot, or harassment as a result of a defect in a thermal environment. Climate factors are one of the main influences on human comfort, directly through their effect on the level of physiological comfort, and indirectly the effect on psychological comfort. A person needs to maintain a constant temperature for body tissues of 37°C, and a change in this temperature by a few degrees represents a threat to his health, even his life. While the skin temperature is 34°C, determining the comfort conditions in any area requires a full knowledge of the climatic elements directly related to human comfort such as solar radiation, temperature, air humidity, wind speed, and the effect of each of them on the thermal balance of the human body, as the person feels comfortable when they occur. The data of the elements referred to within the comfort zone, which means that it is the area in which the body's thermal balance mechanism is at its lowest state of activity, and it represents the climatic conditions in which a person feels thermal comfort. The human being is considered the most efficient measure in determining thermal comfort, but it is difficult to obtain full acceptance of the members of a group who live in a certain thermal climate due to their different thermal desires. The human response to climatic conditions depends on physiological influences, including age, gender, human colour, and the body's health status as well as the body's ability to adapt to temperatures. Within his living region [28].

Thermal comfort occurs when the body loses an amount of heat equal to that generated by its vital activities in order to maintain a constant temperature for its body, which is called thermal balance, and the heat generated in the human body is emitted to the surrounding environment in ways that are (evaporation from the skin and respiratory system, delivery and carrying to the air) Ocean, radiation to and from adjacent surfaces). The amount of heat exchange in any of these methods depends on the thermal variables of the surrounding environment (air temperature, air humidity, air velocity, average radiant temperature, level of human activity, type of clothing and its susceptibility to thermal insulation) [29].

5- Providing a healthy environment: Seeing green spaces reduces blood pressure, in addition to the health benefits linked to the biological benefits represented by reducing pollution levels, regulating temperature and supplementing its urban surroundings with quantities of oxygen.

6. Achieving a safe environment: by creating vertical or horizontal plant barriers to protect from dangerous or polluted places, or to protect humans and direct their movement on the streets inside and outside cities.

1.7. Urban green space standards

1. Planning standards for green spaces: The planning standards for green spaces depend on the local conditions of each city, neighbourhood or residential group. However, there are basic considerations in planning and designing green spaces that must be taken into account:

A- That the areas designated for green areas be commensurate with the size of the population they serve.

B - The location of the green zone is appropriate according to the purpose of use.

C- Taking into account the benefit from the topography of the land and preserving the nature of the public site.

D - taking into account the provision of recreational elements in parks and public parks [27].

2. Quantitative criteria for green spaces: The conditions that determine the amount of green spaces in cities vary greatly from one location to another, whether natural conditions such as availability of rain, surface or ground water, the nature of the soil and climate, or the urban, social and economic conditions of urban residents [14].

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