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A forestation of desert Cities: A case study Al-Ramadi Cities

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ABSTRACT

Afforestation is one of the most important means to protect cities from climatic conditions. It is proper for cities like Ramadi (the study sample) to face extreme weather during summer. This study was conducted to rely on afforestation to improve Ramadi's climate and identifying plants species that are suitable for planting as well as clarify the way on how to implement afforestation projects inside and outside the city. The study found that the city suffers from high temperatures, low rainfall, relative humidity and blowing warm dry wind loaded with dust. This is a result of the lack of afforestation inside and outside the city, as well as the lack of experience in selecting and cultivating suitable vegetation for the climate and soils of the city, The results showed the great role of afforestation in certain environments in addition to identifying appropriate plant species for the climate and soils of Ramadi, the development of scientific steps to implement afforestation projects, plus a number of recommendations that would raise environmental, functional and engineering efficiency of afforestation planning.

Key words : *Afforestation, Criteria of Afforestation, Executing afforestation projects*

Introduction

Afforestation is one of the urban landscape components of contemporary Arabic cities, with special criteria and multiple functions. Afforestation gains a wide interest since early ages in ancient civilizations, plus the impact ofArabic art on planning afforestation inside cities (streets, Cantrell reservations, buildings' fronts) and outside them (protective green belt and green belts around public roads outside cities), as well as its impact on components of climate (solar radiation, temperatures, relative humidity, and wind speed) and other phenomena in the environment. It is impossible to ignore the importance of trees and shrubs in protecting humans from the direct sunrays in our hot, dry countries. They also enhance the atmosphere by water vapour that they produce, in addition to protecting cities from sandstorms and strong winds loaded with dust when planted as a green belt around the city. Or as a wind suppressor in the areas from which the wind blows (especially dust-laden), as well as their effect on the solid and gaseous components of the air. For the previously listed reasons, the research aims to:

1. Study the role of afforestation inside and outside cities.
2. Identify the plants species that are suitable for cultivation inside and outside the cities and their impact on the urban landscape of the city.
3. How to apply urban afforestation projects.

Concept and importance of afforestation

Afforestation is a modern term that man has de-

veloped in the agricultural sciences. The globe has been created with different geological and morphological features from one place to the other. There are large areas of land that are naturally green, on the other hand lot of areas that lack vegetation. here comes the roleof men to increase the number of trees and shrubs in those areas through afforestation to provide a healthy life for those living in these areas. Accordingly afforestation is defined as the increase in the green area and agricultural lands in the places s in which people living, where by men offer to plant large numbers of trees and small shrubs, within the agricultural plan, that suits the environmental conditions and the geographical location of that region (Vimal, 2020 and Abdulrazzaq *et al.*, 2020). There is a great importance of afforestation in human's life, represented by the following points:

1. Supporting food security, by providing fruits, nuts, and leaves for human consumption or fodder for animals. Wood can also be used for cooking, heating, and industry.
2. A large number of trees and shrubs in an area increases the photosynthesis process, during which plants obtain carbon dioxide and increase the amount of oxygen in the air, as a mature tree can absorb up to 150 kg of carbon dioxide annually. For example, an adult Pinus spp. can convert carbon dioxide that 40 people produce into oxygen within an hour. As a result, trees play an important role in mitigating the effects of climate change, and improve air quality in cities with high levels of pollution, making cities healthier places to live.
3. Large trees and shrubs are excellent filters for urban pollutants and fine particles, as they absorb gases such as carbon monoxide, nitrogen oxides, ozone, and sulphur oxides, plus filtering fine particles like dust, dirt or smoke from the air by trapping them on the leaves and bark.
4. Trees and shrubs help reduce carbon emissions by helping to conserve energy. For example, proper afforestation around buildings can reduce the need for air conditioning by 30%, thus reducing winter heating costs by 20-50%.
5. Plants, in general, have the ability of transpiration through which they produce water vapour, which helpsto clear the air from pollution and lowering temperatures during summer.
6. Afforestation in arid and semi-arid areas stabilizes the soil and reduces erosion, sand encroachment, and desertification, which may affect many areas around the world.
7. Mature trees and shrubs regulate water flow and play a major role in preventing floods and reducing the risk of natural disasters. A mature evergreen tree can intercept more than 15,000 litres of water annually.
8. The strategic distribution of trees and shrubs in cities can help cool the air between 2-8 ° C, thus reducing the "urban heat island effect" helping urban communities to adapt to climate change.
9. Trees and shrubs are natural windbreaks to protect from hot, dry, and fast winds loaded with dust and sand, especially in arid and semi-arid cities.
10. Research indicates that living near green areas can improve the physical and mental health of a person by boosting happiness and reducing depression, stress, as well as lowering high blood pressure, which in turn contributes to the well-being of urban societies.
11. Many trees and shrubs that are cultivated for afforestation purposes have medicinal properties, including Eucalyptus spp.
12. Planning an urban landscape with afforestation can increase property value, by up to 20%, as well as attract tourism and business.
13. Trees can be used as natural barriers within cities between properties replacing concrete barriers (Stefanie *et al*, 2013 and Dalia *et al*, 2020 and Benjamin, 2021).

Classification of urban afforestation

Town afforestation can be classified into the following:

First: Afforestation within cities. Including:

1. Afforestation of the streets (on the sidewalks).
2. Cantrell reservation afforestation.
3. Afforestation in front of houses.
4. Afforestation in front of shops (Al-Shammari, 2013).

Second: Afforestation outside cities. Including:

1. Protective green spaces around the city (green belt).
2. Green belts around public roads (outside cities) (Muhaisin,2011).

Field study

Study area: The city of Ramadi is in the eastern part of Anbar Governorate at the intersection of the Euphrates River with the Al Werrar Canal and a short distance from the lake of Habbaniyah to the

south of the city. Ramadi occupies an area of 5,764 hectares.It is 46 km from the eastern side of Fallujah and 110 km from Baghdad. As for the western side, it is 60 km away from the city of Hit, picture 1, and 450 km away from the Iraqi border. The city is distinguished by its important location on the international road linking Iraq, Jordan, and Syria. Itis considered one of the most important commercial stations between Baghdad and the Levant. The city is characterized by its dense population with a total of 475,540 people in 2007, in addition to that, the city is the administrative capital of Anbar Governorate and its centre for trade and services. The city is surrounded by several agricultural villages located along the banks of the Euphrates River. These villages depend mainly on the city of Ramadi to provide their needs in terms of health, administrative, educational, and commercial services (Preparing a strategy for developing the city of Ramadi and updating the basic design, 2010).

Topography: The city of Ramadi consists of a low-rise plateau that slopes down to the south towards the Euphrates River in the north, and by looking at photo 2, it appears that the heights are equal for the entire city, as the surface of the city is somewhat flat and free of terrain complications, which encouraged the expansion of the city and connect The residential neighbourhoods with each other, as well as the flow of traffic in them, which helped to encourage afforestation inside and outside the city. The elevation lines in the eastern part of Ramadi range from 46 to 51 m above sea level, while in its western part it was 65-94 m above sea level. In its western and south-easternparts, it is less than 46 m above sea level. Saying that the city's topography is flat and free of terrain complications, which helps in choosing the appropriate design for the city as well as the ease of future expansion (Al-Muhammadi, 2005 and Ahmed *et al.*, 2020).

Climate: Ramadi is located between two latitudes (33.23° and 33.27° N) and longitudes (43.10° and 43.22° E) within the subtropical latitudes (Ammar *et al.*, 2016 and Dina, 2021).

The city of Ramadi and the surrounding areas have an arid climate. The temperatures for this region are very high, especially during the summer months that extend from May to October. The winter season extends from December to February. The average monthly temperature in summer reaches 45 degrees Celsius. In winter, the average monthly temperatures is (5°C), The reasons for this variation in temperature are, the fall of sun rays at a near right angle in summer and at an oblique angle in winter, the lack of clouds in winter and their absence in summer, the fact that the region is under the influence of the Mediterranean climate conditions, etc. This is followed by a decrease in temperatures in winter.In addition,environmental impacts that the

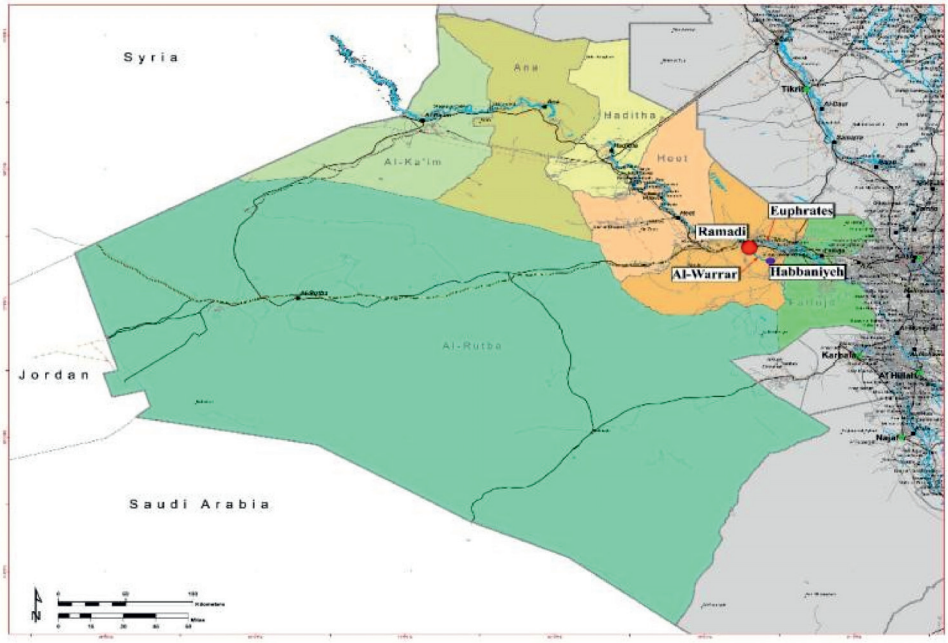

Photo 1. Ramadi site

region being exposed to dust and sand storms at different times of the year, the lack of rain in winter and lack thereof in summer, plus the significant decrease of water levels in the Euphrates river, the lack of afforestation and vegetation cover inside and outside the city.

The wind is one of the important environmental factors that affect the healthy growth and survival of plants in terms of its mechanical and physiological effect on the amount of water evaporated from the soil and plants, as the winds recorded their highest speed in August (7.7 m/s), while the lowest speed was recorded during October(2.9 m/s). The effect of wind speed is represented by its ability to carry large quantities of dust in the form of dust storms that block visibility, which increases the possibility of traffic accidents and obstructing traffic, especially in the summer season, as for the direction of the winds. The northwest winds are the predominant one in the region as they reach (35%) of the total blowing winds and are characterized by their dryness and low relative temperature due to their coming from low-temperature continental regions, followed by the westerly winds at a rate of (18%) and are characterized by their dryness and excitement of dust as a result of their passage to the plateau region Western Sahara (Al-Muhammadi, 2005 and Ammar, *et al.*, 2021). The rainfall in Ramadi is characterized by being low, seasonal, and fluctuating, and concentrated in the winter season, because the city is located between two rain lines (100-150 mm). This indicates that the city is in a region with low levels of rain, that varies from year to year (Al-Muhammadi, 2005).

Water bodies and the reality of afforestation: Ramadi is rich in its surface waters, which are represented by the Euphrates River, Al Warar Canal and Habbaniyah Lake, photo 3. The presence of such water sources explains the spread of afforestation and agricultural lands in the surrounding areas, Figure 4.

The lack of awareness and familiarity of suitable plants, criteria on how to control afforestation inside and outside the city, in addition to the lack of knowledge of afforestation steps and its implementation, caused the destruction of afforestation and the scarcity of agricultural areas in the city. The change of land use from agricultural to either residential or industrial, caused the lack of afforestation. This caused the green belt that surrounds the city to be destroyed and turning the land into anunfertile area, exposing the city to strong winds loaded with dust, high temperatures and air pollution (Jumaah *et al.*, 2021).

Based on the previous statement, appropriate plants must be determined in terms of their suitability to the climate, the environment of Ramadi city, achieving engineering, aesthetic, and preventive goals. Plants suitable for afforestation in the city of Ramadi shall be determined according to the following criteria:

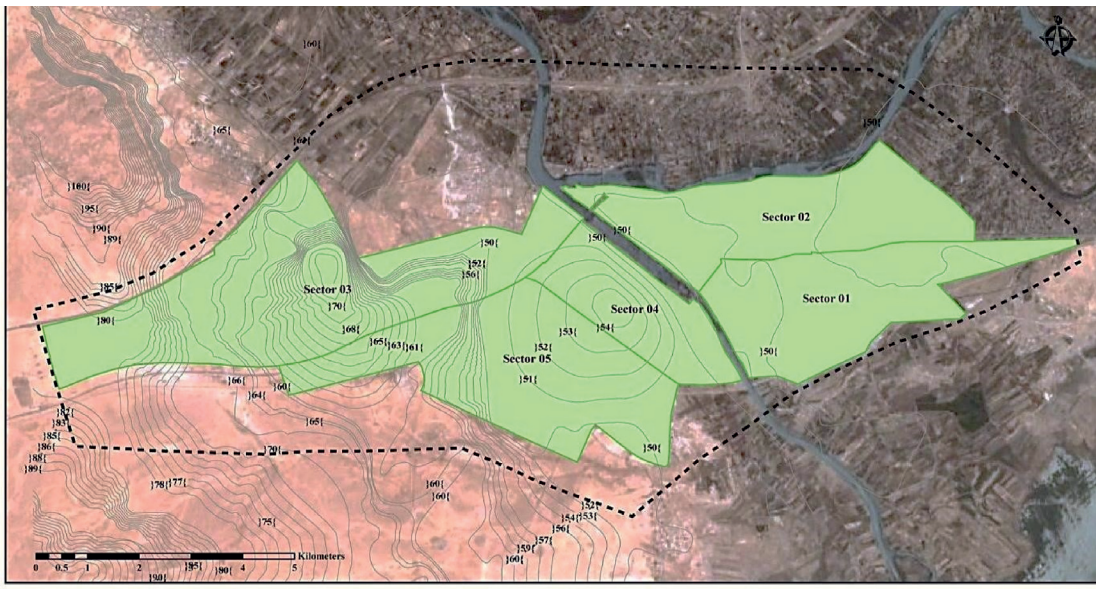

Photo 2. Topographic situation in Ramadi

First - Environmental criteria: The city of Ramadi is affected by multiple global, regional and local climatic factors, the most important of which are the expansion of inland deserts and the extension of sandy veins, and the rise in temperatures to more than 45 degrees Celsius in the summer, in addition to drought, thirst, lack of rainwater, springs and wells, and low humidity to a point Large, low soil fertility, high salt content and lack of organic matter, in addition to wind speed and the dust that it raises, causing sandstorms.

As a result of studies and research conducted on the types of local and introduced plants to choose the ones that are compatible with the local environmental conditions and are able to withstand and adapt to the dry environment, it has been reached to determine the types and varieties of plants that are grown under the environmental conditions of the region and include local plants or plants that were introduced years ago. The city has many adaptations to the local environmental conditions in which it is grown, especially in terms of temperature

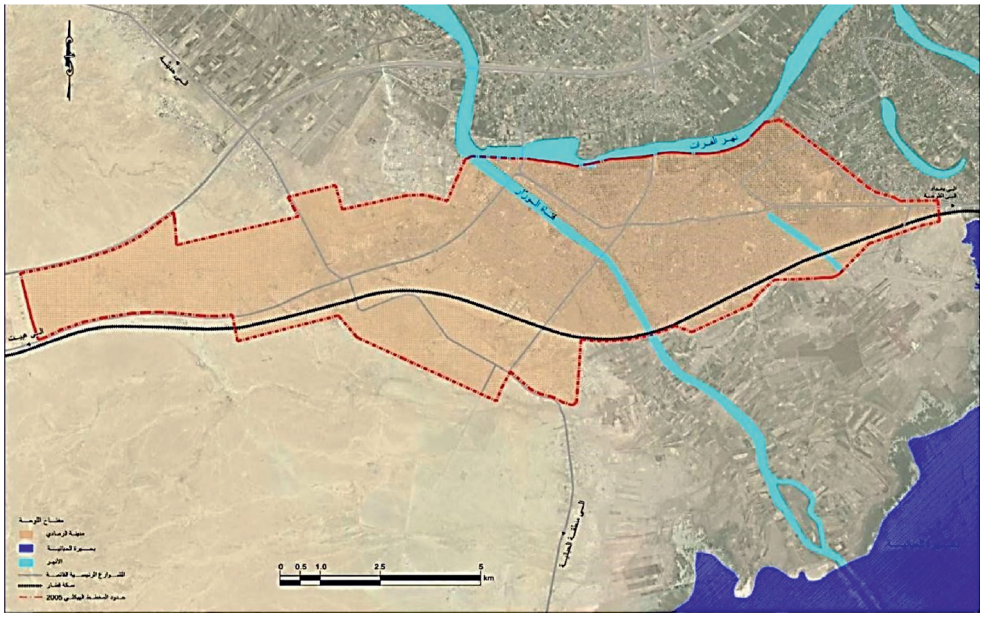

Photo 3. Bodies of water in the city of Ramadi

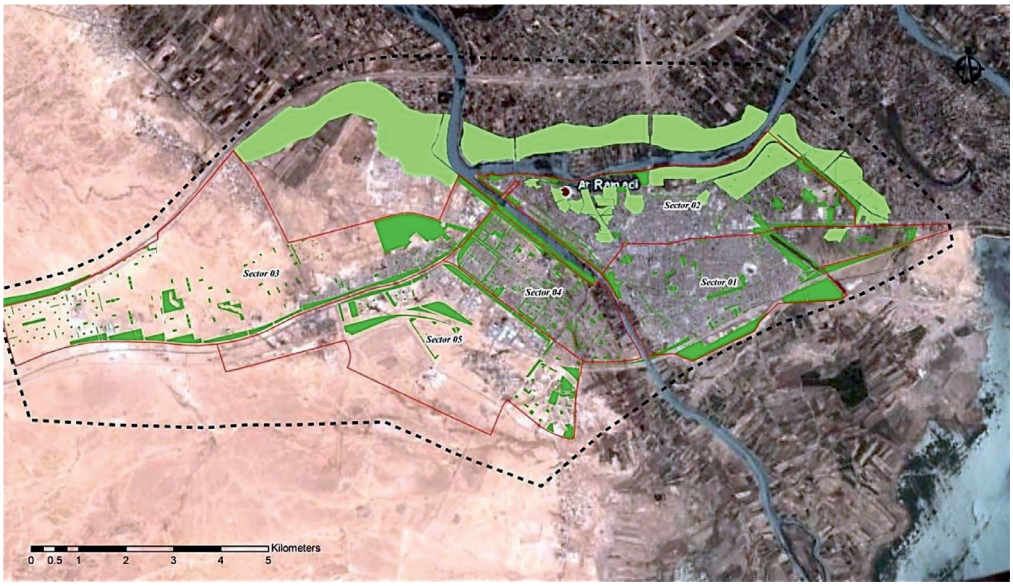

Photo 4. Explain afforestation and agricultural areas in the city of Ramadi

change and other climatic factors, which also achieve the purpose of its cultivation (for shade, cosmetic or other), and when choosing plants, they must have the following characteristics:

1. To be one of the species that have a high ability to withstand the local environmental conditions of the area in which it is grown in terms of high and low temperatures, drought, winds, salinity, etc.
2. To have a high resistance to infection by insect pests and pathogens or snake worms.
3. It should be fast and dense with abundant branching.
4. That it has a strong root system, in-depth and not spread horizontally, so that it does not hinder the growth of other plants and does not affect the neighbouring facilities.
5. That the nature of its growth, the shape of its crowns and its height be commensurate with the place in which it is grown and the purpose of its cultivation.
6. The plant seedlings should be of an appropriate size and age when planting to ensure their success and good condition in terms of vegetative and root growth and are safe from fractures and pest infestations.
7. It should be desirable, locally available, and in need of the least possible care and costs during the period of its cultivation and growth.
8. It can reproduce and has an ample production of seeds for future use in breeding and selection programs (Lionel *et al.,* 2013 and Georgia, 2013 and Ahmed *et al.,* 2020).

The following is a description of the types of plants that are tolerant to different climatic factors:

1. High temperature tolerant plants: *Phoenix dactylifera, Tamarix* spp., *Delonix regia, Acacia* spp., *Cupressus* spp., Casuarina spp., *Schinus molle, Albizzia lebbek, Hyphaene the visbaica, Nerium oleander*, *Dodoneacosa, Bogainvea* spp. spp., *Agave* spp., *Ziziphus spina-christi, Eucalyptus* spp., *Azadirachta indica, Parkinsonia aculeate*, *Washingtunia filifera, Olea europaea, Populs* spp., *Creatonia siliqua, Melia azedarach.*
2. Low-temperature tolerant plants: *Tamarix* spp., *Araucaria* spp., *Nerium oleander*, *Cupressus* spp., *Pinus* spp., *Schinus molle*, Rosa spp., *Eucalyptus* spp., *Olea europaea, Thuja orientalis, Quercus rubra, Parkinsonia aculeate, Acacia ehrenbergiana, Acacia tortilis, Acacia farnesina, Ailanthus altissima, Elaegnus angusti folus, Grevillea robustu*
3. Smoke and dust resistant plants: *Tamarix* spp., *Nerium oleander, Melia azedarach, Hibiscus* spp., *Ficus spp., Ailanthus altissima*, *Populs* spp., *Eucalyptus* spp., *Phoenix* spp
4. Drought and thirst tolerant plants: *Tamarix* spp., *Ipomea palmate, Parkinsonia* spp. , *Begonia* spp., *Tecoma* spp., *Opuntia* spp., *Thevetia* spp., *Nerium oleander, Ficus Pesudo-sycomorus*, *Ricinus communis, Cupressus* spp., *Acacia* spp., *Schinus molle, Albizia Lebbek, Casuarina* spp., *Punica granatum, Casuarina* spp., *Punica granatum, agnus-castus, Pithecellobium dulce, Ziziphus* spp., *Phoenix dactylifera, Washingtunia filifera, Azadirachta indica, Lantana camara, Eucalyptus* spp., *Olea europaea, Elaegnus angustifolus, Prosopis* spp., *Pinus* spp., *Yucca* spp.
5. Weather- and wind-tolerant plants: *Tamarix* spp., *Araucaria* spp., *Acacia* spp., *Nerium oleander, Punica* spp., *Cupressus* spp., *Prosopis* spp., *Casuarina sp*p., *Pheonix dactylifera, Calatropis procera, Vitex agnus – custus, Ziziphus* spp., *Eucalyptus* spp., *Azadirachta indica, Hyphaena thebaica.*
6. Marine wind-tolerant and salinity-tolerant plants near seacoasts: *Tamarix* spp., *Dodonea* spp., *Eucalyptus* spp., *Myoporum serratum, Tecoma* spp., *Ficus* spp., *Acacia* spp., *Salicornia begolovi, Jacaranda* spp., *Phoenix* spp., *Washingtonia filifera.*

Soil has a great influence on the success of plant growth, as the lands differ according to the percentage of the composition of their grains, which are sand, silt, and clay. Light lands contain a high percentage of sand and poor in nutrients and do not retain water or nutrients for a long time, while heavy lands contain a large percentage of clay grains. It maintains an adequate amount of moisture, and the soil is called alkaline when it is rich in carbonate and sodium bicarbonate. As for the calcareous soil contains a large percentage of calcium carbonate, or the soil is saline if it contains more calcium chlorides and sulphate and the sodium is less than 15% of the total exchangeable bases. Depending on the shape of the spread of the root system of plants, we can mention two types of lands, which are shallow lands with a little depth due to the presence of subsurface layers of rocks. Such lands are suitable for plants with roots spread horizontally and gravel lands and suitable for plants whose roots can spread and infiltrate between rocks and stones (Xiaobin and Chen, 2020 and Srikant *et al.,* 2020 and Saad *et al.,* 2020 and Long *et al.,* 2021). The following

is a description of the types of plants that are tolerant of different terrestrial environmental factors:

1. Plants suitable for cultivation in light sandy soils: *Myrtus communis, Araucaria* spp., *Quince* spp., *Begonia* spp., *Tamarix* spp., *Olea* spp., *Cestrum elegans, Schinus molle, Jacaranda* spp., *Melaleuca* spp., *Jasminum* spp. , *Grevillea robusta, Dalbergia sisso, Acacia farnesiana, Prosopis* spp., *Vitis vinifera, Plumbago auriculata, Thevetia* spp., *Tecoma* spp., *Prunus amygdalus, Bogainvillea* spp., *Ceratonia silaiqui, Lantana* spp. .
2. Plants suitable for cultivation in heavy soils: *Tipuana tipu, Bombax* spp., *Delonix regia, Araucaria* spp., *Adhatoda* spp., *Bauhinia* spp., *Enterolobium saman, Ipomea palmata, Caesalpinia pulcherrima, Morus* spp., *Thuja orientalis, Washingtunia filifera. , Cocos* spp., *Cupressus* spp., *Citrus* spp., *Mangifera indica, Punica* spp., *Jasminum* spp., *Euphorbia pulcherrima, Duranta repens, Pithecellobium dulce, Acacia Arabica, Cycas revolute, Musa* spp., *Melaleuca* spp., *Schinus molle, Hibiscus* spp., *Ficus* spp., *Rosa* spp., *Moringa Arabica, Plumeria* spp. .
3. Plants tolerant to alkaline soils: *Tamarix* spp., *Melia azedarach, Acacia* spp., *Parkinsonia* spp., *Bauhini* spp., *Jasminum* spp., *Ficus* spp., *Nerium oleander, Callistemon v 2014-02is, Populs* spp., *Punica* spp., *Albizzia lebbek., Psidium guajava, Casuarina* spp., *Washingtunia filifera, Melaleuca* spp., *Phoenix* spp.
4. Plants tolerant to calcareous soils: *Psidium guajava, Callistemon vimatelyis, Albizia Lebbek, Olea europaea, Opuntia ficus - indica.*
5. Salt tolerant plants: *Tamarix* spp., *Tamarix amplexicaulis, Parkinsonia* spp., *Calatropis procera, Ricinus cammunis, Dalbergia sisso, Ziziphus spina-christ, Ficus* spp., *Acacia Prospp., Psidium guajava, Oleander Nerium* spp., *Eucalus guajava, Oleander Nerium* spp., *Eucalus guajava, Oleander Nerium* spp. spp., *Casuarina* spp., *Myoporum serratum, Salicornia begolovii, Avicennia marina, Rhizophora mucronata.*
6. Plants suitable for cultivation in shallow land: *Albizia Lebbek, Cupressus* spp., *Acacia farnesiana, Schinus terebithifolius, Acacia* spp., *Olea europea, Melaleuca* spp., *Eucalyptus* spp., *Populus alba, Ficus carica*.
7. Plants suitable for cultivation in gravel lands: *Parkinsonia* spp., *Tamarix* spp., *Populs* spp., *Pinus* spp., *Cupressus* spp., *Morus rubra, Ceratonia siliqua, Casuarina* spp.

Second - Coordination and aesthetic standards: Trees and other plants form the basic element for the beauty of cities and the coordination of sites, public gardens and parks, where trees add the element of nature and beauty to public facilities and facilities and break their intensity and hardness.

The following are the coordination and aesthetic criteria of the different plant groups:

1. Plants should be used in afforestation and garden design as plant groups, especially in modern style designs in many forms, and in interior arrangements.
2. Plants should be used as pictorial models that have distinctive characteristics or as attracting elements in their natural form and for the colours of their leaves, stems or flowers, or the shape of their crowns and branches, or their ability to be cut and shaped into regular shapes.
3. The plants should give the place a natural element, break the sharpness of the geometric lines, and give a natural picture of the design.
4. To allow plants to give the required colours in coordination.
5. To work to hide defects or unwanted scenes and draw attention to the beautiful scenery. It is also considered one of the living, moving and changing elements that add life to the place and keep boredom away with changing colours and leaves throughout the seasons of the year.
6. Plants also achieve the factor of unity, as they can link and unify the elements that make up the landscape in city planning. Trees in streets, parks and public parks can be a green network that connects and absorbs the bifurcated monuments in the city, even if it does not appear clearly from the ground level, but it is visible when looking from a high place or a tower of high towers. There should be good knowledge and know-how in how to distribute and coordinate the selected plants and link them to the design, and the symmetry of plants with each other should give the required balance, beauty and compatibility (Anne *et al.,* 2019 and Ali and Maryam, 2020).

Third - Engineering standards: Plants can be used as an architectural factor in afforestation, designing and coordinating sites, and the criteria for the architectural use of trees and shrubs can be concentrated in the following:

1. Cultivation of a group of hedge plants close to

each other to form plant fences that fulfill the purpose of building fences to isolate or to define and divide certain areas or separate parts from each other or to block unwanted views.

2. Defining paths and paths in the garden by planting hedges on their sides to direct movement in a specific direction.
3. To work on completing parts or spaces in units of houses to achieve interconnectedness or form a frame to highlight a specific model or building.
4. To achieve a cover for building defects or make an imaginary modification to their shapes and heights.
5. To help resist the factors of erosion, as light soils can be affected by wind or water, and that the force of influence by weather factors depends on the area of the exposed part, the strength of the winds, the abundance of rain, the nature of the land, the amount of its slope and the amount of vegetation it covers, and that afforestation is the ideal solution to the problem of erosion because Covering the ground with vegetation works to protect the soil from various erosion factors.
6. To help resist air pollution in the streets. This is achieved by planting trees and shrubs that reduce air pollution, especially in the section designated for pedestrian traffic.
7. To reduce the intensity of noise and reduce glare, as the use of plant fences from trees reduces glare and dazzles the eyes with intense light, as well as reducing the intensity of annoying noise resulting from traffic, cars and other noise causes (Clemens and Hans, 2018 and Jitendra *et al.,* 2021).

Controls afforestation cities: The afforestation process very important as an element of being a significant impact in the urban tissue of the city and in the climate and in the components of the mental state, controls include landscaping inside and outside the cities include:

First -Afforestation within cities

1- Streets (both sides of the street on the sidewalks): Due to increasing traffic problems and high pollution significantly and the fact that plants play a major role in this ease the damage it's best street plants cultivation taking into account the relationship between the form and nature of the growth of plants and their location in the overall coordination of the city, providing hand environmental suitable for the movement of people and reduce extreme weather conditions and enhance the urban landscape of the street and thus the city in general. As well as reduce the output noise of cars and their impact on pedestrians, plants and help to give a sense of security for pedestrians. It is also possible to take advantage of the distance between the trees in the development of billboards and signage (Jian and Qiang, 2021). Of the general controls that should be taken into consideration when choosing plants public streets (on the sidewalks) as follows:

A. Must be borne by the trees and shrubs selected ill-treatment of pedestrians, especially children, and that the plants are planted in the streets of the species that bear the environmental area and resistance to diseases and insect pests and environmental conditions. Pollution factors, as well as lack of the need for continuous maintenance.
B. Avoid planting fruit trees and shrubs on the sidewalks because of the loss of fruits and dangerous traffic due to tampering with children, knowing that the primary goal of planting trees in the streets is the aesthetic side, coordination and environmental.
C. The distance between each tree should not be less than 5-8 m in streets inside cities or villages and 10-12 m in highways and ring roads, but in the case of planting Phoenix dactyliffera, the distance is 5-8 m.
D. Streets are planted inside and outside cities according to what specialists see and each case separately, and it is better that the width of the sidewalk is not less than 3 meters, and choose trees and shrubs that can provide shade and have moderate heights, especially in areas with high winds and streets where cars are abundant to avoid Fallen such as Albizzia lebbek and Jacaranda mimosifolia.
E. That the nature of plant growth and its size are compatible with the ratio of the size and nature of the street and with the conditions of the site in which it is grown and the surrounding facilities that are fixed, so that the branches of trees and shrubs are not subject to entanglement with wires, and in the case of the many wires of the streets we choose trees and shrubs that can be trimmed and formed easily, as well as the relationship of trees and then from buildings.

F. When a short street or the average length of the preferred cultivation and one type of trees or shrubs, for ease of maintenance operations and to highlight the coordination value, and in the condition of the streets long can be more than one type of cultivation, taking into account proportionality between them in terms of height, colour, shape and environmental needs.
G. Planted large trees in the pits with dimensions of 1.5×1.5×1.5 m^3 (taking into account the soil and location) and at distances from each other 5-8 m depending on the type and nature of growth, may need trees at the beginning of life to a pillar or iron mesh for straightening her leg and protection .
H. Determining the size of the tree basin on the sidewalks and the necessity to allocate a sufficient distance for pedestrian traffic, so that the width of the sidewalk is sufficient for planting trees and shrubs and pedestrian traffic, taking into consideration the nature of plant growth and its branching in the future.
I. The trees and shrubs planted on both sides of the road are of limited green growth, so that their branches do not extend to neighboring buildings or impede the movement of pedestrians such as ornamental palms, and it is preferable to plant small flowering trees or shrubs of limited growth such as Bauhinia spp. or Tecoma spp. In the pedestrian sidewalks on the streets.
J. Must be a pedestrian crossing areas 60 meters at least planted basins of trees, 40 meters in cultivated basins with shrubs, and 20 meters from the cultivated basins of herbal plants flowering, so that the driver of the car stop at the pedestrian path, and that does not impede the movement.
K. Is not less than the pavement width 3 m, to be enough to put plants and easy pedestrian movement (Al-Moussawi, 2011 and Al-Shammari, 2013 and Jian and Qiang, 2021).

2. Medians: The median islands is one way important to beautify the streets and so planted with trees, shrubs, and depending on these display islands, the were dilated can be planted with trees and shrubs with shade and beauty with refined well, albeit narrow, prefer cultivated type of plant hedges and flowering configurable, either If large-wide and the lengths of the islands can be planted with two types of trees with water needs converged to facilitate maintenance, preferably trees are flowering to give beauty to the streets. Of the general controls that must be taken into account when selecting and planting trees medians following:

A. It is preferable that the trees planted, especially in the middle of the islands, have high stems and that their branches are high in a way that does not hinder the movement of pedestrians or cars, so that the length of the stem is not less than 3-4 m, and that the size of the trees is proportional to the width of the central islands.
B. Not planting large trees at crossroads or at the head of islands in the streets so as not to obstruct the path of vision for drivers, noting that a distance of at least 5-8 m around road junctions is left without planting large trees or plants, and it can be planted with grassy plants of low height and flat. Green.
C. prefer planting medians to separate directions to reduce the cars resulting from the use of high light.
D. Taking into account the distribution of laboratories and places designated for placing advertisement and commercial billboards from the central islands to avoid overlapping between them.
E. Making edges connected to the islands to define the planted plants inside, leaving a distance of not less than 1 meter in width of the side berth.
F. Take into account not planting trees near the vents and allow the rotation to the opposite direction shaped (U-TURN) Central islands and sufficient planting hedges up no more than 50 cm and so the ways that are created and are re-examine the former ways created and remove the trees barrier to see.
G. advertising and commercial paintings at a distance of not less than 20 m from the end of the slot's islands intermediate and special U-turn back roads that are optimized are placed are transported billboards to see the barrier methods currently existing previously created.
H. It is preferable to plant date palms in the middle islands if the width of the islands is not less than 4 m, as they are distinguished from other trees in that they give shade without crowding out the elements of other plant formations and after their growth does not obstruct the vision. It is worth mentioning here

the cultivation of species of poor crop or male as the target of palm cultivation is not the fruit, but in terms of aesthetic, environmental and coordination of the sites that is cultivated by (Jun *et al.*, 2018 and Elearon *et al.*, 2021 and Benjamin, 2021).

3-In front of the houses: controls to consider when selecting and planting trees in front of the houses include:

A. That the basin agriculture site on the right side of the pavement near the wall of the house, the left side of the pavement and leaves (near the street) pedestrian.
B. Have a low level of the basin below the level of the floor of the yard so that flowed into the pond as well as Seoul's house wash water-free soap and disinfectants.
C. Can be aspects of the basin of the concrete pouring depth of 40 cm and a thickness of 10 cm.
D. The distance between the tree and the other is sufficient 5-8 m so that the shadows do not interfere with each other.
E. If the yard wide recommends planting palm trees and fruitful citrus, grapes and other fruit trees.
F. Cultivation of short-height tree groups in all corners of the house, to play the role of linking the house and the garden.
G. Shrubs are planted standing, not branching, between flat areas and between windows and doors of the house and the garden.
H. It connects these shrubs with the tree groups in the corners of the house with a cut plant curtain, 1-1.5 m high, or with a natural curtain to connect all the units in the formation together and give the required cohesion and unity, but it must be taken into account that the corners of the tree groups fence are curved angles in order to fulfill their function in breaking the sharpness of straight lines.
I. You do not plant any trees or shrubs in front of the doors and windows so as not to block the sun's rays or landscapes.
J. Reduce the cultivation of flowering herbivores around the homes of their need for a large effort to serve and so as not to draw attention from home.
K. Covering the building with climbers, and in some cases, this is considered a very important factor to complement the final image of beautifying the building. Climbers have many benefits in coordination, but in this case the main purpose of their cultivation is to gain nature and link the building to the garden.
L. Can some deciduous trees grow leaves to provide shade in summer and light and sun in winter, but planting trees sustained the evergreen province prefer the cleanliness of the street in front of the house.
M. Not to grow any plants that need special care.
N. Repair of engineering defects of the buildings for a modification of an imaginary landscape in terms of height and size, so planting specific types of high trees and the existing growth.
O. It is preferable to plant palm trees in front of buildings, especially official or eastern buildings.
P. Not to grow any plants with thorns or visible roots or with secretions or toxic, irritating or allergenic products (Vicchiato and Tempesta, 2013 and Richieri *et al.*, 2018).

4. In front of the shops: it should be maintained trees and shrubs next to the shops and to the continuity of the beauty of the city, as it is in addition to the benefits of trees and shrubs aesthetic and coordinating with many health and environmental benefits, which requires us to attention and continued to work for the protection and propagation are soothing atmosphere and regulate the temperature and increase moisture in dry places and reduce the proportion of pollution in the environment. The general controls that must be taken into account when selecting and planting trees and shrubs in front of the shops include:

A. Avoid high-rise planting trees so as not to obscure the vision of shops advertising boards.
B. Prefer planting shrubs limited height and a few side forests.
C. The multiplication of the cultivation of perennial herbaceous plants so beautiful and earn docks occupy a large portion of the sidewalk while avoiding the entire sidewalk filled pools of agriculture, which hinders the progress of pedestrians.
D. The cultivation of plants that do not need to trim continuous operations and where there is no thorns do not even have a reason to be removed in the future.
E. Trying to grow flowering shrubs or flowers that give a year-round and be beautiful and smell of flowers to attract the pioneers of the

shops and their owners.

F. Avoid planting trees Deciduous to keep clean the sidewalk and the street from the leaves and fruits falling in front of the shops.
G. The distribution of trees, shrubs, and paintings of propaganda and commercial on sidewalks to avoid overlap between them (Nano, 2020).

Second: Afforestation outside cities: It includes

1. Green spaces with protective capacity (Green Belt): The main objectives of the establishment of the green belt around the cities is to adjust the sizing of urban growth sizes are not allowed to overcome, to prevent the integration of urban areas with each other, provide recreational spaces for urban residents, to maintain the distinctive characteristics of cities. (Santosh and Tripathi, 2008). In addition, the uses of the green belt outside cities are complementary to its uses inside them in terms of providing more quality health conditions by improving some climatic characteristics for the better, such as wind repelling, absorbing part of the excess carbon dioxide or volatile solid components in the air and influencing temperature, humidity and solar rays as well. On its aesthetic value and cultural influences by increasing information about plant life and related sciences, the green belt is usually linked to the main roads and it can be a link between countries, regions, parks, or a protective belt to isolate urban areas in the city from sources of pollution, in addition to being Wind source (Danica *et al.,* 2020). The green belt is often in the form of belts or patches and protective around the city connected to the protective belts inside and in some areas isolated it takes more space in order to have influence more effective and specifications task bear the severe winds and deepen its roots and has the ability to absorb and reduce dust mite's volatile in private air in the city's climate and its relationship to stop desert encroachment on large residential complexes or small (Benjamin, 2021).

2. Green belts around public roads (outside cities): The roads around the city lack trees and shrubs to perform some functions such as windbreaks, mitigate the atmosphere, break the intensity of sunlight and reduce the effects of strong lighting emitted by car lights at night from the opposite side, and the most important of all is to provide The appropriate atmosphere with landscapes on both sides of the road that helps motorists during their long journeys to achieve psychological stability and calm nerves and endure more hardships than roads surrounded by barren areas emit signs of fatigue and this depends on the method of afforestation followed, so the focus on afforestation is to reduce the severity of highways Motorists and passengers must provide beautiful views (Huapu, 2020).

The plants used in the afforestation of roads are

1. The permanent trees and shrubs typically evergreen and deciduous can be cultivated by less in certain areas or facades of the street South Interfaces so as to avoid gathering fallen leaves on the road or when the area is in a situation where do without the need for a shadow or what shape it.
2. The roads usually consist of two lanes separated by strips of carrots or land that can be used to cultivate various types of plants suitable for carrots moderation.
3. The method of planting trees and shrubs be aesthetic first and then functional and are grown as follows:

A. They are grown in the form of rows on either side of the road and where some of the views which states that this type of agriculture, which is something wrong to the effect that this method is no longer aesthetically high value, as the monotony of the cultivation of plants in the form of straight with trunks lines the crowns and similar heights may lead to the boredom that produces car drivers during the long driving.
B. Method that simulates nature and provides some of the beautiful scenery around the road and breaks the simple phase and the monotony of the dull and provides an atmosphere in which many beautiful effects and serial sudden changes the numerous elements of excitement that affect their responses to increase awareness and attention to the car drivers and a long hour (Dalia *et al.,* 2020 and Ziyu *et al.,* 2021).

This method of afforestation intermittent requires scientific and practical experience and needs to be much wider area around the roads for the purpose of acting freely design plant aggregates in the form of a beautiful coordinator of the plant in terms of height and beauty emulator for the nature of the sequence shows that these plant aggregates are designed and implemented nature regardless of proximity or dimension of the main axes, and interfer-

ence with each other trees and shrubs individually or in the form of different groups or elevations on the contrary, interspersed with tracts of empty land or covered lawns take a recipe or dense natural light forest.

4. The bends in the roads must be clear and exclude them snap elements and beauty in order not to draw the attention of the driver significantly. If that happens there is a sudden natural or artificial element on both sides of the road is mainly present in this case must take care of them in particular to show the aesthetic features through the design and coordination around them are consistent with the shape or model.
5. At this intersection of roads centres should pay attention to the lack of planting trees and high shrubs so as not to obscure places of vision and leads to increase the number of accidents.
6. Points of convergence road entrances major cities must be visible and planted shrubs trees instead of the traffic signals should be kept close to the edges of roads and the cultivation of plants affect view it (Dariusz *et al.,* 2019 and Ziyu *et al.,* 2021)

Executing afforestation projects: The following procedures must be followed when implementing urban afforestation projects:

First - matching schemes: Must initially preview agriculture site and matching schemes prepared for projects and landscaping with the real dimensions of nature to make sure they could be implemented and to propose amendments required them.

Second - Identification of agriculture sites: After the completion of the matching schemes for agriculture are identified places or agriculture sites inside and outside the cities, usually selected plants to be site cultivated either by placing wooden or iron pegs or put different suppositories colours or put the dust of white or placing stones or any other material available to the municipality. Third-determine planting dates: Must be the process of agriculture is generally appropriate in terms of weather conditions deadlines and should not be agriculture when severe winds or heavy rainfall, for palm prefers cultivation in the spring where the weather is suitable and fall and be a success rate of agriculture in which high (Sudipto, 2017).

Fourth: drilling processing of agriculture

1. Drilling and remove dust are drilling sites cultivation of plants according to plans prepared for that, and before the drilling process must determine the quality and nature of the soil to be excavated is it rocky or rocky and determining ground water level and analysis to find out what it contains of useful materials and materials harmful to plants cultivated, and then the drilling process and remove dust by workers or by dedicated agricultural machinery start.
2. Determination of drilling depths and measurements: The digging depths are determined according to the type and size of plants and the nature of the soil or according to the instructions of the supervising engineer. The drilling must be of a suitable depth and width. Usually, the size of the palm pits is 2×2×2 m, and the size of the tree pits is 1.5×1.5×1.5 m. The size of the digging of shrubs, climbs and hedges is 0.5×0.5×0.5 m. As for preparing the land for the cultivation of the green flat (the grass), the land is plowed, the earthen blocks are broken, the stones and impurities are removed, and the surface layer must be suitable for cultivation to a depth of 50 cm and is made up of clay, sand and organic decomposing sterile fertilizer, and then the land is irrigated. When it begins to dry and hoe well and remove all growing weeds. Then the necessary settlement processes work by immersing the soil with water well and leaving it for a period of time to give the soil the possibility of subsidence to the natural level, and the soil is well settled, and more soil is added in the event of a decline in the soil level.
3. Regularity in the drill must be given regular drilling depth and width and from all sides and a flat floor and the walls are straight, and may not be edited in the specified elevations without the approval of the supervising engineer
4. The nature of the excavations: the depth of drilling or decrease according to what he sees as the supervising engineer, for example, possible drilling to depths identified in the drawings can be increased, but the supervisor engineer may notice the hole in the rock layer site you need to drill further increase in the depth asks drilling, or vice versa in some cases not possible to complete the drilling depths identified in the drawings as the supervisor engineer noted that the size of the hole and the nature of the soil suitable for planting (Jim & Ng,2018 and Jim,2021).

Fifth - Agricultural soil processing: The processing of agricultural soils for afforestation projects ac-

cording to the following:

1. Determine the quality of the soil: the soil is considered an essential and important element in the success of the cultivation of plants and so direct plant growth impact. It is essential to good agricultural soil rich provide nutrients to ensure cultivated plant growth in which well. Therefore, it must study the properties of the soil and the level of surface water in the planned planting sites are required in good agricultural soil should be the following: the degree of PH=7, EC=2500 Maikaromoz/cm specifications at a temperature of 25°, chlorides less than 200 ppm, calcium carbonate less than 5% of the dry weight of soil.

2. Determine the quality of the mixture and add upgraders: must be free of stones agricultural and plant roots and soil impurities, preferably contain ingredients and improvers organic fertilizers and the following proportions:

- 30% sweet sand free of salts and weeds and construction materials from waste materials and other building
- 50% sandy soil (70% sand +15% Green +15% clay)
- 10% peat moss
- 10% organic fertilizer and sterile Degradable

3. Backfilling: the pits prepared for planting are filled with the previous mixture by 60% of the size of the pit, and then the soil mixture is moistened with water in preparation for planting (Jim & Ng,2018).

Sixth - Implementation of irrigation systems: Due to the needs of cultivated plants to provide water for irrigation on an on-going basis, so must implement appropriate irrigation systems so as to achieve the following objectives:

1. Give plants water needs regularly and accurately with the control given amount.
2. Reducing the costs of irrigation and maintenance of crops by dispensing with water transport vehicles that cost a lot in addition to being impractical. Each type of plant has a preferred method of irrigation, and the following is a description of the most important types of plants and preferred irrigation methods:

- Palm trees planted in a single method of drip irrigation or watering every single tree separately.
- Shrubs and hedges: drip irrigation method.
- Green spaces: a way of irrigation sprinkler.
- Green lawns, trees and shrubs within the enclosed space: spray irrigation method (Christopher, 2019).

Seventh- the transfer of plants to agriculture site: should all plants be transferred to agriculture from certified local sources site and in the absence of desired plants locally are imported plants and the remaining period in the nursery before planting at least two months to adapt them and compatibility with environmental conditions, and must are available in the following specifications plants:

1. Palms: Preparing the planting site with palm trees, 1-1.5 m in length and 6 cm in diameter from the centre of the palm.
2. The minimum height of trees processed 1 m from the surface of the earth to the top of the tree diameter and no less than 3 cm leg and be planted inside bucket or bags size commensurate with the size of the tree.
3. Processing bushes height of at least 0.5-1m from the surface of the soil in the pot.
4. Herbal processing plants flowering annuals winter or summer or sustainable, to be cultivated on time for each of them according to the seasons.
5. The processing of seeds used in the cultivation of green bodies of a mixture of varieties or class vetiver Bermuda or any other brand proved to be successful in the area to be cultivated.

And taken into account when the process of plants transferred to the agriculture site include

A. Compilation of small pots planted with plants in special boxes suitable for transport and put them in a manner and arranged in a box properly and in a manner not to put seedlings on top of each other until the plants are not exposed to fall or damage during the course of the vehicle.
B. The stem is attached to the vehicle for large seedlings whose height exceeds 2 m, in order to ensure the stability of the stem and roots in the soil and not to break them, resulting in the death of the seedling.
C. Should not carry the plant (Seedling) of the leg, and the load from the bottom by carrying pots so as not exposed roots to pieces and death.
D. Coverage of the vehicle carrying the lid box plants suitable until the plants are not affected by air heat during the walk.

E. Do not throw the plants from the top box mounted to the ground when the discharge process (Luckea and Beechamb, 2019 and Stefanie *et al.*, 2021).

Eighth - Save seedlings in agriculture sites: You must create a protected place or nursery land site and an area suitable for the number of seedlings that will be supplied, so that it is equipped with all the equipment necessary for keeping tools and the survival of seedlings in good condition until the date of planting and adapted on site conditions that take into account the following:

1. Protect the seedlings from the sun, wind, and do all the necessary steps to adapt the plants of the new site, with the continuation of the process of irrigation plants.
2. Distribution of plants appropriately in the nursery and arrange a certain proportion to the farming operation table location.
3. Do not move plants from the nursery to the planting sites only after the completion of the drilling processing necessary for the cultivation of plants
4. When exposed plants damaged during the period of survival in the nursery should be replaced with the same type and specifications (Tobias *et al.*, 2021).

Ninth - agriculture in specific locations: plants are grown in specific locations in the following form:

1. Take out the plant from the bag or from a potted planted in it with its roots surrounded by soil mass conjoined.
2. Planting the seedling into the hole so that the roots do not appear above the soil surface level.
3. Fill the hole completely with a mixture of agricultural soil and prove well the soil around the roots.
4. Irrigation of the plant, seedling, or shoot immediately after planting it

Tenth - Support and backing: support and backing processes that go together are on the trees, but the way is different and the method according to the age of the tree and the size and purpose of breeding as follows: using wood beams lengths and thickness suitable for the installation of plants and help them to vertical growth, with the length and size of the seedling, and replaced whenever the need arises and prove plants supports deep down does not exceed one third of the ground level of the one hand, fences are reinforced and climbers commensurate with the desired shape and purpose of cultivation, the use of appropriate materials linked to plants that do not hinder the growth of plants (Ayat *et al.*, 2021).

Eleventh - Install plants: use installation wires when a large-sized plant growing, palm and some other plants, made up installation wires of three wires iron galvanized soft and flexible diameter of 2-4 mm and be resistant friction between the wire and the leg covered with a layer of rubber and must be wires suitable for installation lengths to install large plants and prove at the bottom of the wire cover is made of the same material to control the tensile process and jaw wires.

Twelve - iron cages: iron cages are placed on the newly cultivated plants when needed so as to protect them from strong winds, currents and pedestrians' bulk and animals.

Thirteen - replace weak or dead plants: after agriculture is replaced by weak or dead plants or plants Dwarf types and sizes identical to the cultivated plants previously rapidly, where weather conditions permit and agriculture so as not to become a big difference between the sizes of plants (Ayat *et al.*, 2021 and Tobias *et al.*, 2021).

The implementation of afforestation projects outside the cities should be the following, as well as the procedures that have been mentioned previously to follow the procedure as follows:

Preferably be a group of trees and shrubs planted around the city width not less than 20 m (when the distance between the seedlings planted 2.5-3 m and is the last row consisting of bushes and low ace or medium height and distributed in the left part and right AS high altitude and after coming medium trees rise In the middle of the group's tall trees and planted 5 shows this method of planting the group, the distance separating the rows from each other by 40 m, In desert cities (such as the study area), the dimensions between the afforestation groups (the green belt) are reduced, so that they consist of a group of 4-6 rows and the distance between one group to another ranges from 1030 m, and in this case the number of rows of trees and shrubs in each group. The method of linking trees and myrtle trees and the width and breadth of the spaces between them depends on the characteristics of the soil and the climate in the belt area in which these groups are planted. The dimensions of the four-row groups shall be 10-20 m (Na *et al.*, 2019 and Benjamin, 2021).

As for the cultivation of the green belt windbreaks around with the hot dry climate the city must

Fig. 5. Illustrates how to implement the afforestation outside of the city (Green Belt)

follow the basic principles in the organization of plants, as follows:

1. The extent of the protected area from the wind behind the trees and shrubs used windbreaks is measured is determined by the height of trees and shrubs, the larger the higher will be greater protection as the light wind in this case is longer.
2. The scope of protection for the opposite side of the wind behind the bumper extends almost 30 times for the height of the belt and the direction of the wind 10 times the maximum height.
3. Maximum protection from the wind can be achieved when the width of a bumper wind ranges 11-12 twice the height of trees and shrubs.
4. Permeability or density barrier affect the scope of the protected area. Although the dense barriers greatly reduce wind speed and have impact for a short distance directly behind the barrier and then regenerate the wind speed again, so Plants as window barriers to wind pass part of a lower speed and the failure of air which cushion It reduces wind violence and extends the scope of protection.
5. In the locations where the conflict and the conflict between the winter wind blocking and encourage the breeze in the summer to approximate the direction of both or oppose them entirely, any green belt to block the wind in winter will have a similar effect in summer Therefore, In these cases, it is necessary to determine the type of afforestation in relation to the outcome of the temporal effect of the region, as the hot and disturbing time period reaches desert and semi-desert areas for more than eight months per year, which results in commitment to the specificity and quality of these buffer zones. (Muhaisin, 2011 and Maria *et al.*, 2020)

Conclusion

1. Lack of rightplanning in general and the lack of awareness of how afforestation inside and outside the city is important, led to depriving the city of the benefits of reforestation and its importance to the city and its inhabitants.
2. Green spaces inthe streets, medians and front of houses and shops are important environmental and aesthetic variables in the city.
3. The transmittance of trees to infrared rays is three times that of the visible light, this feature makes them a good mean to shad streets as it prevents 90% of the sunrays from reaching the shaded area.
4. Trees and shrubs vary in the efficiency of their use to prevent darkening depending on their shape, nature, and location.
5. The shadingefficiency of trees and shrubs is different depending on street orientation. For example, streets with (East-West) direction has the best shading efficiency and then the rest of the directions with (north-south) having the minimum efficiency.
6. The direct impact of afforestation in the atmosphere through what is caused by evaporation processes and shads provided,the reduction of wind speed plus filtering air from dust, emotions, and other suspensions.
7. Increasing vegetation among buildings help saving cost and energy in addition to reducing the negative impact of urban lifestyle on the environment.Plus the visual relief that green areas provide to the eyes of the road users.

Recommendations

1. Introducing this study to relevant authorities to benefit from its results for planning and de-

signing afforestation of public urban streets inside and outside the city.

2. Dividing the afforestation project into stages that depend on several substantive organizational processes; legislation, planning, survey work, design, implementation, maintenance, and administration.
3. Remove any vision obstaclesuch as trees and road or advertising signs at intersections and near traffic lights replacing them with grass and short bushes.
4. Ensure the appropriate plant species is chosen to be cultivated,that suits local environmental conditions.
5. Increase the number of maintenance workers in municipalities to ensure the sustainability of afforestation in the city.
6. Considering that the design of the streets and sidewalks is an integrated project thattogether creates the best urban environment.
7. Remove unauthorized residential and industrial constrictions that exceed on lands appointed for green areas.
8. When developing any urban projects, planners and designers need to ensure that the local environment is as close as possible to provide thermal comfort to humans in urban spaces.

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