The phenomenon of desertification and its effects on reducing agricultural areas in Babylon Governorate

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Abstract

Desertification is an environmental phenomenon and it is a clear reflection of the conditions of climate and irrigation drought and it is a widespread phenomenon in Babel Governorate and many governorates in Iraq and what contributes to the expansion of the desertification region is the scraping of orchards and trees inside cities which strip these cities of their greenness beauty and purity of their air which It exposes its environment to various risks not the least of which is the imbalance in the environment and the loss of productive lands, and this is very important in carrying large financial burdens represented by the costs of connecting electric energy services potable water and municipal services, with the accompanying provision of these services in light of the government deficit.

It from violating the laws but rather extends to the recovery of corruption and corrupt people in the process of seducing citizens as it turns into residential neighborhoods that cannot be legally connected to these services. There is no doubt that the phenomenon of desertification in the province of Babel exacerbated for several reasons the foremost of which was the decrease in water levels from neighboring countries that despite their economic relations are in their interest but they do not give Iraq its water share fairly as Iran worked to build dams on the rivers and tributaries linking the two countries and formed a decrease in the amount of water entering Iraq by (80%) in addition to the successive dry seasons for decades in addition to the decrease in the efficiency of the watering process due to the aging of water pumps and the failure to introduce technology in this process and these factors as a whole have increased the proportion of lands exposed to desertification to (74%) of the space group.

The total allocated to agriculture. The study in this research dealt with three topics included the first topic presented the research problem the research hypothesis the limits of the research area the goals of the research and some concepts about desertification and the second topic included natural factors that contribute to the spread of desertification and the third topic human factors and the agricultural situation in the province and methods of combating desertification Then proposals recommendations and sources. The research included a set of maps tables and pictures that illustrate some of the effects of desertification in the province.

Keywords: drought conditions desertification Kobel classification home balance the dynamics of human.

1. Introduction

The phenomenon of desertification is one of the important phenomena that must be studied and to know its negative effects on the environment in arid and semi-arid areas and try to avoid its great dangers to mineral installations transportation routes farms and Aden. Its risk increases with the decrease in rainfall levels in these areas the deterioration of vegetation cover the increase in areas affected by the salts and the emergence and widening of dunes which are the advanced face of desertification. The phenomenon of desertification is one of the distinct economic social and environmental problems that require the existence of a long-term strategy and plans to address it and limit its negative effects on the countries' reality. Many national and international projects have been established in the field of combating desertification in general and resisting sand encroachment in Babylon Governorate.

Babylon Governorate is one of the central governorates that suffers from the phenomenon of desertification and its expansion in most of its directions due to its geographical location in light of the desert climate and the amount of rain that ranges between (200-50) mm Buran high temperatures in the summer and heat waves that reach more than (52) M has affected the vegetation cover becoming poor and dead and does not contribute to protecting the soil from facing extreme climatic conditions.
conditions so it became fragile to be able to resist extreme climatic conditions and the vegetation cover became light to resist pressures on natural materials and one of the reasons that contributed to the spread of desertification in the governorate is The human factor and the unequal exploitation of the lands which helps to disturb the ecological balance of the soil.

2. **The research problem**

The research problem includes two questions:

a. Does the natural and human factors have an impact on the phenomenon of desertification and its spread in Babylon Governorate.

b. What are the effects of natural and human factors on the use of agricultural lands in Babylon Governorate.

3. **Research hypothesis**

The hypothesis of the study represents the development of solutions to the medal of the research problem which can be formulated on the following sea:

a. Human factors play a major role in the occurrence of the desertification problem which affects the effect of exacerbating this problem and increases its impact in conjunction with natural factors.

b. The problem of desertification is a clear negative impact on agricultural use through the significant decline of cultivated yards from arable lands and the decrease in production quantities of crops in the governorate.

4. **The objective of the study**

The study aims in this research to

a. Know the most important factors that contribute to the spread of the desertification phenomenon and the most important diagnosis Its causes for taking quick positions and decisions to reduce it.

b. Contributing to an infant climate study to improve the agricultural situation and protect it from the exacerbation of this phenomenon.

c. Raising the wheel of sustainable agricultural development in the governorate according to scientific foundations that contribute to eliminating cases of the spread of the phenomenon of sanitation.

5. **The spatial and temporal field of research**

Includes the spatial field of research in Babylon Governorate while the temporal field was for the year (2018). The astronomical and geographical location of Babylon Governorate: Babylon Governorate lies astronomically between latitude (32.7°) north and (33.8°) north and longitudes (43.42°) east and (45.50°) east, As for the geographical location it gave great importance, as it is located in the center of Iraq as it is bordered by the governorate of Baghdad on the north and Wa'asit from the east while it is bordered by the governorates of Karbala and Anbar on the west side, Najaf and Qadisiyah on the south side.

The governorate takes a shape close to the triangle with its base in the south then narrowing the area of the province in its northern part and its geographical area takes a longitudinal extension from the northwest towards the southeast Figure (1) and map (2). So it amounts to (5119) Km² and forms a designation to (1.2%) of the area of Iraq amounting to 435052 km², and it is divided from the administrative point of view into (4) districts which are the district of Hilla and it consists of two sub-districts with an area of (878) Km². Transformers and consists of three nuclei. The district has an area of 1667 Km² and the Hashemite district includes four areas and its area is (1646) Km² while the Musayyib district consists of three areas and its area is (928) Km² table (1). [1]
6. The first topic
6.1. The concept of desertification

It is the exposure of the land to degradation in arid and semi-arid areas and arid and semi-arid and semi-humid areas which leads to the loss of plant life and its biological diversity and this leads to the loss of meta-breeding The loss of the land’s ability to agricultural production and support animal and human life. [2]

Desertification: is a spatial extension of desert conditions in the direction of wet and semi-humid areas. [3]

6.2. Another definition of desertification

The phenomenon of desertification is the transformation of large areas of special and high production into areas poor in plant and animal life and this is due to either the brutal human interaction with it or the climate changes The state of weakness and weakness that the evidence complains of is either because of what a person does with it or because of the influence of other natural factors to which it is subjected in which human beings have no solution. And the part that complains and complains every day about this fat treatment of the land is “the soil”. The phenomenon of desertification is according to its most recent concept as mentioned in (1994) AD and the United Nations Convention to Combat Desertification as (land degradation in arid and semi-arid areas and dry and semi-arid humaneness )[4].

6.3. Causes of desertification

Several factors contribute to the occurrence of desertification including the following natural and human factors:

6.3.1. Natural factors

-Depletion of natural resources due to the retention facing the world in general including Iraq and Babylon Governorate in particular, droughts That strike the region in particular “the Middle East and in particular the Arab countries that affect green spaces and pastures.

-The lack of rain and its suppression leads to a scarcity of green areas and their transformation into desertified lands full of thorny plants.

-Dust storms and the increase in dunes encroachment that hit the squatters as a result of the negative effects that cause the Climate changes [5].

6.3.2. Human factors

Human factors include several things that have a direct role in the occurrence of desertification including:
- Excessive or inappropriate exploitation of lands leads to depletion of the soil.
- Removing the purposes that work to hold the soil together.
- Overgrazing leads to depriving the land of its weeds.
- Poor irrigation methods.
- Poverty and political instability harm agricultural lands.
- Unconscious agricultural treatments such as plowing the soil during times of inappropriate drought leading to disintegration of the surface layer of the soil and rendering it vulnerable to erosion.
- Wars the country went through and migration that forced residents to leave their lands Degrees of desertification.

6.4. The political conditions

These are the stages of the development of the desertification process which extends to the areas that are not decertified gradually the following degrees[6]:

a. Light or moderate desertification: - where the natural environment is characterized by a slight degradation of the biological capacity through which agricultural activities take place except through simple stripping of parts of the soil or simple armament And this is what some upper parts of the Mesopotamian alluvial Plain suffer from.

b. Medium desertification: It is characterized by the beginning of the real desertification process through the ruins of agricultural production in the region in a sense (10-50%). We gather simple sand as is the case in the east of the governorate.

c. Severe desertification: - It is noticed at this stage that the activity of air erosion increases in water erosion and is characterized by an increase in the natural vegetation cover and wild plants accompanied by a decrease in agricultural production in the region of more than 50% accompanied by a clear appearance of dunes Sandy as is the case in the central parts of the governorate.

d. Very severe desertification: - The prevalence of aerobic processes is characterized by erosion sedimentation and the emergence of large dunes and the high level of salinity in the soil which leads to a total decrease in the capacity For its productivity [7] and this stage represents the most dangerous stage and which is difficult to address and it is spread in most Arab lands of the governorate.

7. Methods of treating desertification:

7.1. Mechanical methods

by creating vertical barriers in the direction of the wind and from these methods:

a. Plant barriers there are many plants that have The ability to stabilize sands afforestation and the best stabilization work but it is necessary to choose the appropriate plant species in terms of length branching root strength and resistance to harsh environmental conditions.

b. Solid barriers: These are by using curtain barriers from walls or strong tree trunks that are intertwined with each other.

7.2. Chemical methods

Such as oil derivatives are in the form of a backlash that sticks to surface education but this method has dangers such as soil and water pollution and the impact on plants.

a. 1-Maintenance and protection of water resources: This is done well. Exploiting these resources rationalizing their use and using modern irrigation methods.

b. 2- Development of human capabilities: by using modern technology and training specialists on it especially concerning combating desertification such as remote sensing system aerial photography and determining the presence of groundwater in the ground.

c. 3- Spreading environmental awareness among citizens especially farmers livestock owners and herders.

d. 4-Providing the necessary protection for environmentally sensitive areas and concerning addressing desertification and concerning addressing the problem of desertification it is through intensive activities to preserve the soil mapping areas threatened by desertification the path of sand movement and developing immediate and plans to address them[8].
8. First Topic
8.1. Factors affecting the occurrence of desertification phenomenon in Babylon Governorate

8.1.1. Climate

Precursors climate is one of the natural factors affecting the overall multiple economic processes and activities foremost of which is agriculture which is the most important of those activities that are closely related to the climate. Every agricultural operation especially the irrigation of crops, cannot be achieved without determining the rates of water drainage. Water needs of crops [9] especially if we know that the climate of Babylon Governorate is characterized by thermal extremes if it falls within the desert climate region (BWH) according to the Quinn classification for climatic regions map(6) and this climate is characterized by high rates of solar radiation and a high daily heat range[10].

To clarify the climate effects in the governorate it is necessary to address the climate elements represented by Solar radiation heat rain relative humidity, evaporation and to the extent that highlights its relationship to the irrigation situation in the governorate and the effects it also reflects on the various activities that the population practices including the Iranian agricultural activity as well as its effect on the adequacy and compliance with the rates of expenditures of the Shatt al-Hilla and its Iranian system. The needs are based on the reality in which they appear and as follows:

8.1.2. Solar radiation

The intensity of solar radiation and the length of the enacted period on the surface of the earth varies according to the difference in the angle of incidence of the rays and the difference in the length of the day throughout the year due to the difference in the position of the earth in relation to the price during the annual Earth cycle around the sun, and in this of Cancer and the angle of incidence of the rays, which increases the intensity of heat acquired and reaching the surface of the earth [11] and it is clear from countries (1) that the average theoretical and actual hours of brightness increases in the province Babylon in the summer season starting from the month of March according to the apparent movement of the sun on the Astra line in this month, so the number of theoretical hours of brightness is (10.4) hours per day for the Hilla station on the same. As for the average number of hours of actual brightness before it, and for the same (8.7) hours on the day the sun passes into the course of Cancer in this month, this decrease in the number of hours of theoretical and actual brightness in the winter season is due to the presence of clouds and the apparent movement of the sun towards the southern hemisphere, which We conclude that Babylon Governorate receives large quantities of solar radiation especially in the summer compared to the winter season due to the perpendicularity of the sun's rays in this season which contributed to the increase in solar radiation in summer "which contributed to converting the visible short rays into long thermal rays for education as well as the high temperature. The surface, whether it is from breeding or from rocks, which contributes to the activity of mechanical erosion and has a in increasing the rate of evaporation in water surfaces and from the soil which leads to its drying as well as the emergence of compost as a result of water evaporation, which leads to the emergence of a salt layer on the soil surface [12].

Solar radiation is known as the radiant energy that the sun can handle in all directions and it is the source of heat on the surface of the earth [13]. It is also the basis for making the nutrients for plant life, as well as being the thermal energy used in the process of metamorphism.

The period of solar radiation differs in the hours of brightness between the months of the year and what reaches them theoretically and in practice. The actual brightness is the average number of hours of actual sunshine that are measured by the devices used to measure these such as (Pyranometer) and (Carnple - stoke) [14].

That knowing the actual hours of brightness has an impact on the drainage of Shatt al-Hilla and the Al-Hindiya River and their irrigation system as the irrigation water the amount of water required depends on the actual hours of brightness the incoming solar radiation and the associated calorific values and evaporation which varies between the seasons of the year and therefore cannot be the rates of water drainage provided by the Euphrates and the brightness hours also affect the water needs of crops and agricultural lands as well.

On its impact on the economic activities available in the governorate, the greater the number of hours of sunshine, the more water losses accompanied by the increase in dryland areas and the spread of desertification.

The actual periods of brightness vary between the months of the year as the average hours of actual brightness in the season of the year and starting from November reach (7) hours a day and these rates decrease until they reach (5.8) hours a day in January. The hot season of the year where the brightness hours increase, starting in April (8.4) hours a day and their highest rates are recorded during June and July (11.6) and (11.4 hours per day respectively). The increase in brightness hours is accompanied by the recording of high-temperature values and an increase in evaporation. Surface water soil and evaporation/transpiration from plants, thus increasing drylands and turning them into desertified lands which requires an
increase and provision of water in the rivers and streams from which agricultural lands irrigate them, facing the threat of desertification. Table (1)

Table 1. The monthly and annual average of actual hours of sunshine in Babylon Governorate for the year (2018).

| Month    | Actual brightness hours |
|----------|-------------------------|
| January  | 5.8                     |
| February | 7.06                    |
| March    | 7.7                     |
| April    | 8.4                     |
| May      | 9.6                     |
| June     | 11.6                    |
| July     | 11.4                    |
| August   | 11.2                    |
| September | 10.00                |
| October  | 8.05                    |
| November | 7                       |
| December | 6                       |
| Annual rates | 8.7                  |

[15] Source: Republic of Iraq, Ministry of Transport and Communications, Iraqi General Authority for Meteorology, Climate Section, unpublished data, 2018

8.1.3. Temperatures

Temperature is one of the most important elements of the climate as in addition to its effect on the life aspects above the earth's surface it affects other climate elements such as barometric pressure winds humidity solidarity and other elements of the climate as the heat is a product of solar radiation, which is the main source of it despite From the presence of other sources that increase the temperature in addition to that the variation that occurs in the other elements of the climate is only a reflection of the variation in the temperature values as they control the difference and discrepancy of the values of atmospheric pressure[16] which in turn affects the difference in the speed and direction of movement Wind and atmospheric depressions and temperature is one of the factors affecting the occurrence of desertification phenomenon in the governorate because of its effective role in drying up soil and increasing the wastage rates of surface water extracted in irrigation of lands and underground waters close to the surface of the earth that rise by capillary property and since the Babylon Governorate It is located in a dry desert climate characterized by high rates of temperature and its age in the summer month as shown in Table (2), as it recorded the highest rates of temperature in the months (May, June, July, August, September) when it reached ( 32.15, 33.35, 32.35 27.55, 29.3 m respectively, and the reason for the high rates of temperatures in the summer season is due to the length of the day and the clearness of the sky from the clouds and the angle of incidence of solar radiation is vertical and the province displays continental air masses while the winter temperatures are It is characterized by a gradual decrease from October to January as it recorded in the months (November ,December, January, February), and it was recorded (10.75, 8.55 11.5, 16.65), respectively, and this is due to the presence of clouds, the shortness of the day, the inclination of the angle of sunlight and the exposure of the governorate To the cold air masses and the increase in humidity, which reduces the sun's rays reaching the earth's surface.

Table 2. The average maximum and minimum temperatures, the monthly thermal range and the annual average (2018) for Hilla Station.

| Months | January | February | March | April | May | June | July | August | September | October | November | December | Annual average |
|--------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|-----------|-----------|----------------|
| Great  | 13.8    | 17.2     | 20.7  | 27.8  | 35  | 40.1 | 41.5 | 40.6   | 38.2      | 32      | 23.2      | 16.7      | 28.9          |
| Minor  | 3.3     | 4.3      | 10.1  | 13.7  | 20.1| 24.6 | 25.2 | 23.7   | 20.5      | 16.4    | 10.1      | 6.4       | 14.9          |
| Range  | 10.5    | 12.9     | 10.6  | 14.1  | 14.9| 15.5 | 16.3 | 16.9   | 17.7      | 15.4    | 13.1      | 10.3      | 14            |
| Average| 8.55    | 10.75    | 15.4  | 20.75 | 27.55| 32.35| 33.35| 32.15  | 29.35     | 24.2    | 16.65     | 11.5      | 21.9          |

[17] Source: Ministry of Transport and Communications, General Authority for Iraqi Meteorology and Seismic Monitoring, Climate Section, unpublished data for (2018).

8.1.4. Rainfall

The study of this climatic element aims to clarify the nature of its descent in terms of quantity and timing of descent in the governorate and its relationship to human activities and its impact on the deterioration of the evidence and the emergence of the problem of desertification, so care must be taken to study rain and its descent system because these characteristics are
useful in determining the actual value of rain, rain and Heat are two basic elements of climate that influence agricultural activity. Some researchers have adopted the borders of the rainy area mainly to know the dry areas and then to know the desertification, and the system of rains in the governorate is subject to the system of rain in Iraq so the rains come in the winter, autumn and spring seasons, mainly in the summer and they are non-existent due to the prevalence of high pressure prevailing in the Mediterranean in. This season, the rains in the governorate are characterized as sluggish and irregular in the times of their descent as they descend early in some years or late in the autumn season and this discrepancy reflected on the increase in desertification, because the rains wash the soil from salts and drain them into Drains or to lands of little decline and thus they work to dissolve the salts in the soil, but if the rains are little, they increase the salts in the soil by evaporation, which is a manifestation of desertification in the study area and it became clear from Table(3) that the rain falls in the governorate from October until the end of the month of May the beginning and end of the passage of the depressions over the governorate that arises over the Atlantic Ocean and the Mediterranean Sea, as the annual total of precipitation reached (107.7) mm in the governorate and that the amount of rain The fall during the month of October and the second amounted to (6.3, 18.7) mm respectively then the amount of rain began to increase during the month (December, second and February) with a total rate of 514 mm and by (47.7%) mm of the annual total rainfall due to the increased frequency of Depressions during this period did not start after that the amount of rain gradually decreased during the months of March, April of May (as the total rates in that period reached 31.3 mm or 29% of the total annual rainfall, and accordingly the lack of rain in the study area cannot be relied upon. In the establishment of agricultural activity as it is necessary to rely on irrigation water and the effect that this has on increasing soil salinity which is a manifestation of desertification in the governorate and due to the lack of rain in the summer with high temperatures which leads to the formation of environmental conditions It is appropriate to make the soil very dry and its ability to disintegrate with the increase in the number of salts due to the increase of the rate of evaporation and that these factors have an effective role in activating and increasing the decertified areas in Babylon Governorate.

| Months | January | February | March | April | May | June | July | August | September | October | November | December | Annual total |
|--------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|-------------|
|        | 16.3    | 14.6     | 13.4  | 11.5  | 6.4 | -    | -    | -      | -         | 6.3     | 18.7     | 20.5     | 107.7       |

[18]Source: Ministry of Transport and Communications, General Authority for Iraqi Meteorology and Seismic Monitoring, Climate Section, unpublished data.

Rain is one of the important and influential climatic elements in the spread of desertification phenomenon, as its importance is evident in increasing the rates of surface runoff. The greater the amount of rain, the greater the amount of water drainage. Moreover, rain is an important and influential element in the establishment of agriculture as it contributes to providing crops with what they need Water and providing the soil with adequate moisture that helps keep it preserving plant life, and the importance of rain in agricultural activity is measured through its actual value for the plant, i.e. the amount of water that the plant can benefit from in completing its life cycle, and that the lack of rainfall in the governorate has directly led to the drying out of the soil And the increase in desertified areas [19]. As a result of the variation in the amount of rain falling above the surface of the earth, this has led to a variation in agricultural production because crops differ in their water rationing. Each crop has water metered dictated by the nature of the crop the nature of the soil and other climate elements [20].

8.1.5. Relative humidity

It represents the ratio between. The real vapor pressure to the common vapor pressure which is related to an inverse relationship to the temperature and a direct relationship with the rainfall that the highest value of relative humidity was during the winter season and in January and March in particular as it reached (72%) during December and within months Summer, June, July, and August, so the relative humidity was very low, as it reached (24.2%) during July and. Another definition of relative humidity: It is the annual relative between the amount of water vapor actually present in the air at a certain temperature and pressure and what it can carry at the same temperature and pressure to It reaches a state of saturation [21]. And the relative humidity is one of the important and influencing climatic factors in the rates of water discharges Its importance is through its positive relationship with the amount of rainfall which leads to a light of water needs, at when it appears to have a negative effect on the rates of drainage through its inverse relationship with the amount of evaporation and it also has a great effect on agricultural production as there is an inverse relationship between the amount of relative humidity and the processes of evaporation and opening so increasing the humidity in the air reduces the amount of water that can be evaporated. From the soil and eroding it from the plant and this reduces the water needs of the intakes while the decrease in its percentage in the atmosphere with the rise in temperature leads to the activation of the processes of evaporation and transpiration which leads to the possibility of plant tails and sometimes its wear due to the imbalance that occurs. The water inside it where the transpiration process exceeds the absorption process so the water requirements of the plant increase in a.
way that contributes to the increase in water losses[22], which is reflected in the low drainage rates of the irrigation water in Babylon Governorate. Table (4) data indicate that the annual rate of relative humidity in Babylon Governorate reaches (50.4%), and this rate increases during the cold season of the year due to low temperatures and rainfall, as it recorded its highest rate during December and January (73.8%). And 73.9% for each respectively, while the relative humidity decreases during the hot season of the year, as its lowest rates are recorded during June and 32.5% (32.8%), respectively, and this is due to the increase in temperatures and the absence of falling. The rains during this season as these characteristics lead to less moisture and higher evaporation rates, and this is accompanied by an increase in the water requirements of crops as a result of the decrease in the moisture content in the soil and their need to consume large quantities of water to complete the requirements of their growth stages during the period of cultivation.

Table 4. The monthly and annual rate of humidity The relative humidity in Babylon governorate for the period (2018).

| Month     | Relative humidity % |
|-----------|---------------------|
| January   | 73.9                |
| February  | 64.1                |
| March     | 54.2                |
| April     | 48.3                |
| May       | 37.3                |
| June      | 32.5                |
| July      | 32.8                |
| August    | 35.1                |
| September | 39.6                |
| October   | 49.5                |
| November  | 64.1                |
| December  | 73.8                |
| Annual rates | 50.4            |

[23]Source: Republic of Iraq, Ministry of Transport and Communications, Iraqi Meteorological Authority, Climate Section, unpublished data, 2018.

8.1.6. Evaporation

After evaporation from the climatic elements in the number of water discharges as it works to determine the amount of running water in the rivers but its effectiveness is related to a group of elements which are solar radiation temperatures popular humidity wind speed and air pressure so solar radiation is the main source of energy driving the process. Evaporation the greater the amount of solar radiation this is reflected in the increase in the evaporation process and concerning the temperature the relationship between it and evaporation is positive so evaporation increases with increasing temperatures and decreases with its decrease especially if the high temperature is associated with the blowing of hot dry winds and the relative humidity is inversely proportional to the rates. Evaporation When humidity rises in the air the rate of evaporation from water bodies decreases and vice versa, as for the winds, they are directly proportional to the rates of evaporation. If the wind is fast and dry, it leads to an increase in evaporation rates quickly because it displaces the layer saturated with moisture and replaces dry air in its place, which helps the activity of the evaporation process in contrast to the winds with light movement, it leads to lower evaporation rates.

Whereas the relationship between atmospheric pressure and evaporation is an inverse relationship, the decrease in atmospheric pressure leads to an increase in the speed of the evaporation process in a way that increases the speed of the release of water molecules towards the air and vice versa[24]. It is evident from the foregoing that the climatic elements are closely related to the evaporation process, which increases water losses in large quantities during the hot season of the year, which reflects a negative impact on the failure to meet the water needs of crops.

Table (5) indicates the high rates of evaporation during the hot season of the year, as they reach their highest rates in June and July (339.2) and (355.5) for each, respectively, while the rates of evaporation decrease in the cold season of the year, and their lowest rates are recorded in the two months. December and January (as it reached (57.1) and (51.8) mm each, respectively. The high rates of evaporation during the hot season of the year harm the rates of expenditures of Shatt Al-Hilla and its irrigation system, which requires determining the water shares according to the needs of agricultural lands and crops cultivated in the governorate.
Table 5. The monthly and annual rate of evaporation in Babylon Governorate for the period (2018)

| Month     | Evaporation (mm) |
|-----------|------------------|
| January   | 51.8             |
| February  | 77.6             |
| March     | 134.8            |
| April     | 189.0            |
| May       | 273.6            |
| June      | 339.2            |
| July      | 355.5            |
| August    | 322.7            |
| September | 248.8            |
| October   | 163.7            |
| November  | 85.4             |
| December  | 57.1             |
| Annual rates | 191.6         |

[25] Source: Republic of Iraq, Ministry of Transport and Communications, Iraqi Meteorological Authority, Climate Division, unpublished data, 2018.

And it is one of the important elements of the water balance, and the effectiveness of the rainfall depends only on the amount of year over year in the shaker and it depends on the temperature relative humidity and the amount of solar radiation that the data. The results obtained from evaporation is measured by the method of free surfaces in millimeters which shows the monthly rate of evaporation in Babylon Governorate that the highest rate was during July and was (3555) mm. As for the soil the rate of evaporation was during January when the climate is cold and moderate, and it reached (518) Mm, that evaporation has a direct relationship with temperature, as its value increases as the temperature increases. Ivanovo method was used to calculate the amount of evaporation For comparison with the results obtained by the method of the free surface, the equation depended on the relative humidity and temperature as two main factors in the equation for July. Explained in the equation below:

\[ * 0.0018 \times (100-A) \times (T + 25)^2 = E \]

whereas:

- E: Monthly rate of evaporation (mm)
- T: mean monthly temperature (°C)
- A: Average monthly relative humidity (%)

By applying the equation:

\[ 0.0018 \times (100-32.8) \times (33.35 + 25)^2 = 355.5 \times * \]

\[ 31.19 = 116.7 \text{ mm}. \]

8.1.7. Wind

It is a movement of Horizontal air within the atmosphere surrounding the globe, and it occurs due to the difference in atmospheric pressure resulting from the thermal differences between one region and another meaning that the winds head from high-pressure areas to low-pressure areas and a low wind speed characterizes Iraq throughout the year which causes the prevalence of high pressure similar to The tropical depression is winter and the thermocline in summer which does not help with rapid winds except for some cases in which air conditions and depressions occur especially the Mediterranean depressions which are accompanied by rapid winds. Another definition of the wind: is the horizontal movement of air parallel to the surface of the earth which works to converge the thermal differences And the atmospheric humidity and air pressure between different regions [27].

The influence of the winds varies in the quantities of German wealth according to its speed and direction and if the winds are dry and very fast they displace the layer saturated with water vapor in contact with the water surface and mix it With the upper air layers drier than the lower which helps to increase the amount of water evaporated from the water bodies while
during the stillness of the air a steam saturated layer leads to a decrease in the amount of water evaporated from the water bodies in addition to that the winds have a great impact on agricultural production as they affect the amount of relative humidity and helps to increase transpiration and increase the rate of evaporation which causes agricultural crops to lose large quantities of water and threaten them in their tails so the more dry the air the more the plant expels its water in the form of steam through its exposed surface air especially through the leaves and pores in the Its trunks, if this seas are carried away constantly by the air the honeydew evaporation from the plant will increase as well and this is the main effect of the winds on the plant. And under the winds, great damage to the crops as it causes them to lie especially when the land is newly leveled and the crops are of high altitudes such as yellow corn white and sunflower the effect of winds on crops becomes more pronounced when their speed increases (10%), and this leads to an increase in the speed of evaporation by a ratio between (1-3), which reflects its effect in the course of the harvest. German needs for crops [28].

Despite the negative impact of the wind on agricultural production, there are positive aspects to it as it transfers water vapor and falls in the form of rain from which plants take the water they need and the wind works to raise the humidity level in the atmosphere of the areas near Water bodies, which helps reduce the thermal contrast ratio[29]. As for Babylon Governorate, being part of the sedimentary plain, the prevailing winds are northwesterly, north, and westerly (75%), and this is due to the emergence of these reverse westerly winds coming from the Atlantic Ocean due to the advance of the pressure zone The high Azurite from the latitude (25-40) to the south and the prevalence of low pressure over the Mediterranean region and the breakfast of Levant Iraq and the Arabian Gulf so these winds continue to advance from west to east across the mountains of the Levant and continue to advance towards Iraq to enter Iraq which is west and then becomes north. Due to the direction of the mountains from the northwest to the southeast, these winds often lead to rain in the northern parts of Iraq due to their passage by teams covered by water, and upon their arrival to the south and its confluence with the winds the south-eastern winds cause rain in the middle and south, resulting from the confluence of two air masses, one of the cold and the other warm, and despite the prevalence of the northwest winds in the governorate some winds come to the south-eastern winds, and these winds are known as the anal winds, where the percentage of these winds is (25%) When it blows it causes dust and brings large amounts of dust, and it is often swift. Table (6) shows that the annual rate of wind speed in Babylon Governorate reached (1.7) m /, and the wind speed increases during the hot months of the year as it reaches its maximum. During the months of June and July (2.3) and (2.6 m) each respectively and this wind speed is accompanied by an increase in the amount of evaporation and evaporation / transpiration which leads to an increase in the percentage of hydro pneumatics and water consumption of agricultural crops in a manner that leads to a decrease in water that requires the necessity of providing it to meet the water needs For the various economic uses available including agricultural uses in the governorate while in the cold season of the year the wind speed rates decrease until it reaches during the months (October and November) to (1.0) Marga for each of them respectively and this low wind speed during the cold season makes the process of evaporation and evaporation / evaporation less which reduces the percentage of water losses that the irrigation system is exposed to in Babylon Governorate compared to the hot season of the year.

Table 6. The monthly and annual average of the prevailing wind speed in Babylon Governorate for the period (2018).

| Month     | Wind speed M/sec |
|-----------|------------------|
| January   | 1.3              |
| February  | 1.8              |
| March     | 2.1              |
| April     | 1.9              |
| May       | 2.0              |
| June      | 2.3              |
| July      | 2.6              |
| August    | 1.9              |
| September | 1.4              |
| October   | 1.0              |
| November  | 1.0              |
| December  | 1.2              |
| Annual rates | 1.7          |

[30] Source: Republic of Iraq, Ministry of Transport and Communications, Iraqi Meteorological Authority, Climate Division, unpublished data 2018.

8.1.8. Wind Speed:

Babylon Governorate is located on the edges of the high-pressure area in Central Asia, and for this reason, about (75%) the age of the direction of the wind blowing is in the northwest direction and the rest. As for the westerly or south-eastern
direction, the wind speed ranges between (2.7-5.9) from us, it may have the highest value in the summer and reach (5.9) m/ta, which are dry winds that contribute to the erosion of the region and play a major role in the encroachment of dunes table (7). As for the winter season, the speed is a ton and reaches (2.7) Second, and it is clear from a table (7) that the prevailing winds in the governorate for most days of the year are in northwesterly winds, as their frequency is (31.6%) of the rate of blowing winds, and the reason for the prevalence of these winds is due to the presence of a high-pressure area over the mountainous lands. Turkish counterbalanced by low pressure centered in the Arab Gulf region, and These winds are characterized by their low temperature and lack of humidity during their blows in the winter season accompanied by the clarity of the sky, but in the summer they work to moderate degrees the temperature at night and its high during the day then followed by the Arab and northern winds and a percentage (11.6% 11.7%) respectively as these winds suffer from subsidence processes to the pelvic region so their temperature may rise and their humidity decreases and become very dry winds and therefore these winds contribute effectively in increasing desertification because it works to reduce breeding and increase evaporation rates, which increases the quantities of salts in the soil as well as increase the effectiveness of the capillary property by increasing the need for crops for water to compensate for the shortfall in the amount of lost water.

Table 7. the heliographic ratios of wind directions in Al-Hilla Station (2018)

| Western  | Northwestern | North | Northeastern | Eastern | Southeastern | South | Southeastern | Dormancy |
|----------|--------------|-------|--------------|---------|--------------|-------|--------------|----------|
| 7.11     | 6.31         | 6.11  | 1.6          | 2.7     | 3.3          | 1.4   | 2.4          | 1.20     |

[31] Source: Ministry of Transport and Communications, General Authority for Meteorology and Seismic Monitoring, Climate Division, unpublished data, for 2018.

8.2. Secondly The surface

The surface factor is one of the factors affecting the occurrence of the desertification phenomenon as it leads to an increase or decrease in the velocity of water flow on the surface of the earth and the surface coefficient is related to the soil factor the breeding section and its ability to drain excess water depends on the degree of surface slope. When the slope of the surface is severe the soil cannot accumulate at an appropriate thickness which in turn reduces the growth of plants on it, especially trees [32] and the speed of running water over the steep surface is strong, which leads to a decrease in the percentage of water seeping into the soil and a decrease in the rate of evaporation but if the surface is moderate or its slope is little then this leads to making the village suitable for irrigation and drainage operation and also helps to increase the percentage of water penetrating the soil. Therefore torrents are one of the most important sections of the surface suitable for agriculture: the level of the surface in it helps from the forces of irrigation and drainage in regions where rain is not sufficient to meet the needs of crops. It also helps to establish transport routes and railway lines that are relied upon in marketing agricultural villas. Besides, the accumulation of soil in the plains Hand of thickness, viability, and absorption of the population[33].

As for Babylon Governorate, it is part of the alluvial plain in Iraq, and it has flatlands that slowly warn towards the southeast as the line of equal elevation (44) m above sea level passes in the northernmost parts, while the line of equal elevation passes (20) M above sea level in its southern sections map (2), and according to the astronomy, the general gradient of the governorate’s land does not exceed (1 / 0.00011) from the northwest to the southeast [34]. And the slope of the governorate is a secondary slope from the northwestern sides towards the eastern and southeastern sides, as the line of equal elevation (32) m above sea level passes in two parts in the northwest at a time when the declining elevation line (24) m above sea level in its eastern sections passes, as well as the line of equal elevation (22) passes. In its southeastern sections this variation in elevation has a clear effect on the length of the network of rivers and irrigation streams that followed these slopes [35] and consequently it has an effect on the phenomenon of sanitation.

Despite these races, the surface of the governorate is not without the presence of slight local topography that does not increase the rate of the height between some of them on the two headquarters for each (100) meters extension, and among the most prominent of these differences in height is what is found between the areas close to the streams of the rivers and the areas far from them. (Map (5), and its height usually ranges between (2-3) m above the level of river basins [36].
Figure 2. In Babylon Governorate Lines of equal elevation (contour). Source: 1-General Directorate of Survey, Babylon Governorate topographic map, standard 1:000005, 1985. 2- Abdu Al-Ilah Razouqi Karbal, Agriculture and future of vegetables in Al-Hillah District, Unpublished MA Thesis, Collage of Literature, University of Baghdad, 1967, p. 84.

Figure 3. Source: 1- Abd al-Ilah Rufi Brail. Growing vegetables and their future in the al-Hillah district, an unpublished master's thesis from the College of Arts, University of Baghdad, 19 p. 2- Ali Karim Muhder, the simplest Libyan potential for producing cereal crops in Babylon Governorate using geographical information systems (GIS) an unpublished master's thesis at the Faculty of Arts, University of Baghdad 2007.

8.3. Water resources

Water resources are the most important ingredient of life on the surface of the earth. Water is after the friendly resource, without which there would be no life on the surface of the earth. The Almighty said:
The water resources in Babylon Governorate have three sources: rain, surface water, and groundwater. The climatic characteristics of Babylon Governorate represented by the desert climate according to the Queen classification (BWH), make agriculture dependent on permanent irrigation on surface water resources represented by a group of rivers and streams that run on the territory of the governorate that branches out from the Euphrates River and its branches, which are the Shatt al-Hillah and the Al-Hindiya River and their branches.

Figure 4. The water resources in Babylon province, Source: The Ministry of Water Resources in the province of Gil, the Directorate of Water Resources, a map of irrigation projects in the province.

8.4. The soil:

Soil is usually defined as the fragile layer that gives the rocks of the earth's crust at a height ranging from a few centimeters to several meters and it is the most important natural element in which the food substance is available which is the basis of plant life and the twin of the continuation of this [37]. And the soil represents the variable natural element as it subjected to change more than other natural phenomena, it is possible to change some of its properties by using some compounds or adding some organic materials, or providing a special service to the soil that gives it a new characteristic that differs from what it was before that process was carried out and as a result, the soil has attracted the attention of the farmer since ancient times and his control over it Control of some other natural phenomena has been controlled [38].

The soils of Babylon Governorate, of which the study area is part, is characterized by being part of the sedimentary stream soils in Iraq that is, you see them from the sedimentary soils type ((Alluvial Soils), which were formed as a result of sediments brought by the water of the Euphrates River. And the sediments dissolved by irrigation water, [39] To these sediments and German sediments were added sediments brought by the wind from areas outside the sedimentary plain or from other sedimentary areas in the form of the Hawa docks. Therefore, this soil is of the type of transported soils, as it does not originate on the original rocks, which in turn cover the basic characteristics of the soil above it, but rather it is soil transported from rocks far from the soil itself, and the characteristics of this soil do not resemble the characteristics of the rocks of the area above it and it consists of a mixture The rocky fragments are varied and many, and this applies to the soils of the entire governorate. The terrain is of low elevation and it is deep where its depth exceeds several meters and the underground water level is high during the period of high water levels in the Euphrates River and has a high degree of fertility compared to the fertility that can be observed in soils that are exposed to the desert climate. Besides, this soil contains Large quantities of lime ranging between (20-30%) also contain in most of its sections a large percentage of the mountain, and the problem of alopecia appears in this soil as a result of constant dressing, which led to an increase in the percentage of salts in it, especially sodium and chloride salts [40].

The lack of rain depends on the nature of the natural plant and thus the quality of the soil poor in organic matter and this is due to the lack of vegetation cover due to climate conditions lack rain high temperatures evaporation and human activity that works on soil degradation and as a result of a poor irrigation system in the area irrigated with water for the longest period possible unlike desert soils Whose sensitivity and purity is high and consequently the leakage of water in it and the failure of the plant to benefit from it. The increase in salt in the soil due to the capillary property and the high temperatures, leaving the salts on the soil, and thus the decrease in the yield of durum, led to not cultivating large areas and lands that have become unfit for agriculture.
In light of the foregoing, the soils of Babylon Governorate were classified by soil experts according to the latest classification throughout Iraq, which is the All-Iraq Soil Classification (1994), which was based on the soil classification for the year (1975) based on its productive capacity and this type of classification suits all crops. There is no single type of agricultural crop. This system includes eight varieties according to the decrease in the productive capacity of each of these varieties, as well as the multiplicity of factors specific to them, namely:

A- Land suitable for agriculture and includes the following:

1- Land of the first class: very good lands for agriculture
2- Class II lands: good lands for agriculture
3- Lands of the third class: medium-inventory lands for agriculture
4- Fourth-grade lands: lands with a limited amount of cultivation.

B- non-arable lands:

1- Lands of the fifth class: excellent for grazing.
2- Sixth-grade lands: good for grazing.
3- Lands of the seventh class: medium quality for grazing.
4- The lands of the eighth class: not suitable for agriculture and grazing, and could be used for recreation. [41]

depending on the previous classification. The lands of Babylon Governorate were divided into seven classes at present and into three classes in the future taking into consideration the specific factors which are the proportion of soft soil and its poor drainage that is not integrated with Soil salinity and when you classify soils in Babylon Governorate, the classification is as follows:

8.4.1. Rearing the shoulders of rivers:

This soil extends on both sides of the Shatt al-Hilla for a large distance, reaching the city of Al-Hilla, Map (5). It was formed as a result of the sedimentation of the Shatt al-Hillah of large-sized particles in the areas close to it and extending on its sides. For the rest of the regions of the Qaisi Plain as its height ranges from (2-3) meters above the level of low lands [42].

![Figure 5. Soil classification in Babylon province. Source: Seher Abd Al- Hadi Hussien Al-Shariefy, The educational composition of the inhabitants of Babylon, Unpublished MA Thesis, Faculty of Education, University of Babylon, 2009, p.54.](image-url)
This relative elevation results in good characteristics of the soil, represented in the good surface drainage of water due to the degree of slope of its large surface about a month or towards areas of river basins, in addition to that, the level of the underground water in it is home for the same reason and the degree of salinity of this groundwater. Athena is due to the continuous supply of water from the neighboring river. As for the inner Tariqa, it is the other that distinguishes this terrier in that it is good drainage resulting from the roughness of the soil texture of the shoulders of rivers. It is composed of mixed clay silt [43]. It is also considered to be of moderate velocity. Based on these features river shoulders soils are considered from soils in which the forgetting of organic matter rises and which are protected by palm trees to prevent their temperature from rising too much in the summer which impedes the oxidation of organic materials in them and fulfills their vital activity inside the soil and this type of soil can be considered the best types of soils. Suitable for agricultural investment in the governorate, where the cultivation of various crops is widespread.

8.4.2. River basin soil

This soil is capped in areas far from the courses of the main rivers and is characterized by occupying levels below (2-3) m below the level of rearing high shoulders and it was formed from the accumulation of fine sediments that were transported by floodwaters away from the river courses. It is left from clay or a silty clay mixture, which gave it a coherent grain and poor drainage, as the percentage of clay in it ranges between (50-70%) as well as containing a high percentage of lime, as well as a decrease in the features of these soils and surrounding them with higher areas. The level of the underground water in it and this forgetfulness increases whenever we go to the south as for the internal drainage is poor and accordingly, the percentage of salts has increased but it varies from one region to the other [44]. Hillah and Hindia and is suitable in most of its sections for the cultivation of crops especially barley due to its tolerance of salt and resistance to harsh climatic conditions [45].

8.4.3. Soil of river basins buried in silts

This soil is found within the areas of the river basins and it is not possible to distinguish between it and the soil of river basins because most of its surface is given by irrigation sediments as a result of practicing irrigation agriculture for a long period on it and given the length of this period surface irrigation sediments give it a range of thickness ranging from one meter to several meters and this soil is found in the eastern and northeastern part of the governorate. Babil is also located in the southern part of it which is located between the two main branches of the Euphrates (Shatti al-Hillah and al-Hindiya and they are extended to Qadisiyah Governorate [46]. This soil is characterized by its being of a strange clay texture or a mixture of silty clay and the depth of the underground water ranges between (1.52/0.51) m, but it rises during periods of practicing irrigation operations which leads to making it characterized by poor drainage and high salt content. This soil is suitable for agricultural production especially To cultivate field crops that are suitable for climatic conditions to cultivate them, but their suitability is low for growing vegetables and fruits, and their potential may increase in the future after they are removed from the salts [47].

8.4.4. Basin depressions soil

It is the soil which is the breeding whose composition is due to natural factors and appears especially in the northern part of the governorate, where it is surrounded by the high shoulders of rivers, the banks of irrigation channels, and the upper parts of the soils of the ponds buried with silts, and their level is lower than the level of the latter by about (1.0 - 1.0) m [48], and this soil is composed of cohesive clay tissue so it has a very weak internal drainage due to the consistency of its richness and the high level of the high internal water in it. Therefore most of its sides have become alkaline salty and unfit for agriculture any kind of crops except for Some natural plants that are suitable for grazing animals.

8.4.5. Soil of the marshes and swamps buried in the western region

This type of soil is found in the southern parts of the governorate around the northern edges of Hor Ibn Najm, to occupy a place in the middle of the Euphrates, Shatti al-Hilla, and al-Hindiya branches. The high level of the underground water in it, and it has a coherent clay texture, except for the areas adjacent to the irrigation channels[49], where its texture increases roughness and becomes composed of a silty clay mixture or a mixture of silty. And most of its parts are surrounded by Christ, who makes it untreated soil Suitable for cultivation except its northern parts with a relatively high level where it is exploited to cultivate crops of salt-resistant animal fodder [50].

8.4.6. The sand dune terrain

The dunes are spread in the southeastern part of Babylon Governorate, where it consists of sediments of clay silt and sand carried by the wind. Stream areas that are not cultivated or from materials transported from ancient river beds that were filled with sediments and dune soil is characterized by being sandy Mixed muddy and its temperature ranges between (5-5.6) m per day[51], and based on the dedication criteria it has fast evaporation and has a rough texture so that the quantities of added
water cannot be controlled, which made it unfit for agriculture and agricultural production and has a great impact on the spread of the phenomenon of desertification in the governorate.

8.4.7. geese desert soil

This soil prevails in Al-Musayyib district in two regions, one of which is located in the northeast of the district and the other in its northwest. This soil is considered to be organic black and its salinity is not high, as it is less than (4) mm / Cellulose, and the wind and water transported it to its current sites and its litter is characterized by being weak with high sensitivity and low groundwater level in it and it is made of sandy soil with a rough texture, and its atoms are a mixture of quartz and gypsum[52]. It is clear from the foregoing that the soils of Babylon Governorate are clear, and they include the study area of sedimentary soils transported by flood and irrigation waters in addition to what was carried by the winds to the area as it is an important factor in the development of agriculture but despite the similarity of its general characteristics, the study proved that there are differences between their types and this has a great impact on the rates of discharges and levels of the Shatt al-Hillaah and the streams branching from it and this, in turn, affects the nature of agricultural activity in the governorate.

9. The second topic

Human factors and their impact on the occurrence of desertification phenomenon in Babylon Governorate.

9.1. Human factors

The human factor was and still is the main role in the destruction of vegetation cover and soil degradation and leaving it barren exposed to various environmental factors which led to its erosion, activating various erosion factors and the spread of desertification.

9.1.1. Misuse of the land

The human factor has its effect on the spread of desertification by not using the land correctly and scientifically. Excessive irrigation is one of the wrong methods used in agriculture as irrigated agriculture is spread throughout the governorate, and the soil spreading with water and following traditional and irregular fashion methods. And with the absence of an effective drainage system the groundwater level increased, which led to an increase in the salinity of the soil at the surface which reduced its productivity and then left it and consequently desertification. It was found that the salinity is related to the texture of the soil and the topography so the salinity of the soil is really low compared to the thin soil and that its salinity Soil reflects the salinity of groundwater in terms of density and chemical composition knowing that the quality of salinity varies from one region to another and it has been shown that the presence of highly saline groundwater close to the surface poses a real threat to the intensive irrigated agriculture without a suitable drainage system in addition to the deterioration of the cover Vegetation increased with the increase in agricultural investment. Agriculture requires the first removal of natural plants or greening the soil by using mechanisms and often leaving the land without cultivation for a long period due to insufficient Airport or surface resources as a result of drought or the land may leave fallow after harvesting until appropriate weather conditions are available or follow another behavior which is moving to new lands for cultivation after the decline in the productivity of the land as a result of the increase in salts and the rise in the groundwater level [53], and as is the case in most of the lands in the governorate, as these lands are left as pastures for livestock and animals that destroy some of the halophytic plants that may grow in them, and leave the land barren without protection, which helped in the occurrence of desertification.

9.1.2. Population growth

Population growth is one of the most important reasons that called for attention to the problem Global, is a problem of desertification population growth is one of the most important human factors affecting the emergence of the problem of desertification [54]. The increase in population numbers in developing countries, including arid and semi-arid countries with rapid swat which leads to pressure on various natural resources as well as similar to the phenomenon of burial and global warming. On the globe in the mid-seventies, the rate of population growth exceeded 2% per year in about four-fifths of the countries of dry and semi-dry lands [55], and it is one of the causes of the deterioration of vegetation cover. For urban growth on the trends of the city’s expansion housing and urbanism, which always tries to exploit the lands adjacent to the city (due to the availability of services and others). These lands are often agricultural and thus convert them into residential lands and push agriculture and lands that are not already suitable.

9.1.3. Overgrazing
Unjust grazing means the disinvestment of pastures. By loading them with numbers of animals that are inconsistent with the nutritional energy of the pastures and not taking into account the types of plants in the pastures and their suitability for the animals that roam those pastures, and this unorganized grazing had the main role in destroying the vegetation due to the exposure of the soil and its exposure to the factors of erosion, so the man did not take into account the energy. The pastures, or their ability to withstand grazing, did not take into account the distribution of animals or the followers of good pastoral cycles, in addition to intensive and continuous grazing on plants, which led to the deterioration of plants and their disappearance in many areas[56]. Table (8).

Table 8. Administrative units in Babylon Province and its area/km².

| Administrative unit | Aspects   | Area Km² | Population number | Population ratio% |
|---------------------|-----------|----------|-------------------|-------------------|
| Hillah center       |           | 161      | 548396            | 28.6%             |
| Al-kefal            |           | 526      | 138679            | 7%                |
| Abo Karak           |           | 191      | 107351            | 6%                |
| Mahawil center      |           | 608      | 115886            | 6%                |
| Al-Mashru            |           | 834      | 125720            | 6.5%              |
| Al-Imam             |           | 225      | 36397             | 2%                |
| Al-niel             |           | 455      | 58227             | 3%                |
| Hashimia center     |           | 18       | 35242             | 2%                |
| Al-kasim            |           | 225      | 161307            | 8%                |
| Al-medhatia         |           | 528      | 137698            | 7%                |
| Al-shomaly          |           | 498      | 88636             | 5%                |
| Al-talha            |           | 253      | 39568             | 2%                |
| Musayyib center     |           | 20       | 52904             | 3%                |
| Al-hindiyah         |           | 257      | 117999            | 6%                |
| JurfAl-Saghar       |           | 283      | 48014             | 2.5%              |
| Al-Iskandaria       |           | 388      | 161123            | 8.4%              |
| JurfAl-Iskandaria   |           | 928      | 381040            | 19.9%             |
| The total area and population Province | | 5119 | 1921006 | 100% |

[57] source: the Planning Commission, the German Central Bureau of Statistics and Cooperation in the Babylon Governorate, unpublished data for the year 2017.

9.1.4. Geographical analysis of the governorate’s site

The governorate’s site has great importance in establishing agriculture as the governorate forms a market from which the governorates that are located close to it are supplied especially Baghdad, Karbala, and Najaf. These governorates are markets for the governorate’s products. Good transport routes linking Babylon with its important markets perform a basic and general activity if the agricultural area is not expanded from through raising the efficiency of the rivers network and irrigation streams of the Euphrates River and its branches, which is the main source for providing the water needs a lot of agricultural lands and for the various economic activities available in the governorate. It is noticed that the areas of the shoulders of rivers are higher in the northern parts of the governorate than in the southern parts of it where it reaches. Its height in the northern sections is about (8) meters above the level of the national lands far from the river, while the difference between these two rainfalls reaches (2) meters in the southern regions. The clarity of the river shoulders areas in the northern and central sections of the governorate is more than it is in the southern parts. Due to the decrease in the quantities of materials carried by the water of rivers in their lower warriors, as these shoulders were formed as a result of the accumulation of monthly sediments on them in times of flood, and this area is apparent a natural occurrence in the cemetery plains, because oppression depletes most of the quantities of alluvial materials and the largest of its particles in the areas close to it, while the areas far from the river have only quantities. Fewer than those materials, whose atoms are soft can remain stuck in floodwaters for a long time due to their lack of relative weight.
The steepness of the shoulders of rivers and the roughness of the texture of their soils consisting of mixed materials, their height and the low level of underground water in them helped determine the nature of agriculture prevailing there, as it is characterized by the cultivation of vegetables, fruits and fodder crops.

Due to the nature of the surface of the shoulders of the rivers as areas that are relatively high from the level of the river’s water, the farms located within them were distinguished by the rule of medium irrigation method in which pumps are used to raise the quantities of water needed for agricultural lands represented in such a range. and in addition to the high shoulders area of rivers, there is the area of the river basins plains. The rivers represent the subtle surface areas in Babylon Governorate which occupies most of the governorate’s area. This area was formed from the sediments brought by the water of rivers and their branches to the governorate especially in the flood season, and it is characterized as being high near the shoulders of rivers and it is composed of sandy clay deposits as well as atoms that are seen the largest size is because it was the first to be dispensed of suspended materials due to its proximity to the river, and the plains far from the shoulders of the rivers are characterized as low and their level may be less than two or three meters from the plains near the shoulders of the rivers, and they have fine, muddy and thin atoms of permeability and drainage. Because it was erected later after the large humpbacks, and the excess water drains into it in the flood season. the areas of the river basins are generally distributed To the east of Shatt al-Hilla and in the area between the two coasts of Hilla and al-Hindiya, and some relatively low-lying areas resemble small basins, as is the case in the area confined between the Musayyib project in the north and the tables of Babylon and the Neill to the south, and the area between the Alexandria stream north of the Al-Musayyib stream. In the south, as well as several depressions that lie between the two coasts of Hilla and Al-Hindiya [58]. The waters of the marshes and swamps covered some of these depressions in the recent past, and the control of floodwaters in the Euphrates and Shatt al-Hindiya and the tightening of control over the waters that flowed in the Shatt al-Hilla resulted in the drying up of the great ones, if not nearly all of them are like Hor Al-Shouk, which was located southwest of the city of Hilla for a distance of 15 km.

As well as Horlb-Najm, which is located in the far south of the governorate between the two coasts of Hilla and Al Hindi, and he has benefited from it at present to drain irrigation water above the need of agricultural lands. As the lowest rise in the province. Although the precious characteristic of the surface of these basins is low, it is not completely devoid of some relatively high phenomena, as high longitudinal hills extend over them, the height of which does not exceed the level of the bottoms of the neighboring basins by 6.5%. These longitudinal ridges extend for a distance that may reach more than (5-8). (Km, these hills are known locally as Al-Arar and Mrez达尔-er Arakoub) and they were formed as a result of the continuous cleaning process of the dressing tables that raise and collect sediments on the sides of those streams, and this certainly has its risks in preventing adequate water drainage rates from reaching the areas of Astana, especially in The hot summer, as well as strings of dunes spread over the river basins in the area to the southeast of the governorate.

Which extend until entering the boundaries of Wa’asit Governorate, where the height of a single dune ranges between (6-9) m above the level of the neighboring national lands. And the dune has a crescent shape that follows the movement of the prevailing northwestern winds that wish its edges towards the southeast.

And its shape changes when the southeast winds blow in the governorate in addition to the presence of some heights that are in the form of small hills located in the northwestern part of the governorate known as (Dahr al-Majasa) It is visible from the level of the surrounding lands by about 6-9 meters from which it appears in the area to the north of the Alexandria stream, which are ancient heights dating back to the Miocene era.

It is clear from the above that the surface of the governorate is characterized by its simplicity and its lack of slope but despite this simplicity, Its surface is not without the presence of some elevations represented by the presence of two areas of varying height the first was represented by the natural shoulder area of rivers which is characterized by good drainage and good soil, and the second region was represented by the region of low river basins, which represent the low surface areas characterized by poor and lack of natural drainage. In addition to the high level of underground water and low soil fertility, the effect of this was evident on the directions of extension of the network of rivers and irrigation streams that followed these slopes and To practice fun irrigation methods and thus on the rates of discharges and levels which greatly affects the German needs for the various economic activities available in the study area, especially the agricultural activity in terms of providing water requirements for agricultural lands and cultivated crops.

10. Topic Three
10.1. **First:- Agricultural lands in Babylon Governorate (types of lands according to irrigation methods in Babylon governorate)**

10.1.1. **Dirt lands**

a. (guaranteed rain) more than (400) mm / year.

b. Humanity guaranteed from rain (400-350) mm / year.

c. not guaranteed Rainfall is less than (350) mm / year.
10.1.2. The lands irrigated from rivers

The cultivated lands in Babylon Governorate have reached (7728441) dunums of the total arable land. And the total Arab lands for the year 2018 reached (1018638) the total number of deadlands for the year 2018 dunums.

10.1.3. Dry areas

It is areas that suffer from a lack of rainfall where agriculture faces increased evaporation, transpiration over the amount of rain falling in them. The productivity of these areas will be very tasteful from year to year so that the production in them is easy to drop to the failure to harvest at all, and for this, they are the regions. The risky and uncertain production in the production and the climatic conditions in it, the lack of rain and its home distribution in the characteristic character and the climate in it is very dry", which leaves its effect in years with medium rain [59], and in another equation which is the equation (De Matron to extract the evidence of =drought that Annual rainfall (mm)/the average annual temperature (C) + 10, if the value is less than (5) then the climate is dry from 5 -10 semi-arid, from 10 to 20 relatively humid and from 30 to 20 humid climate. [60]:

\[
\text{Drought context for a specific month} = \frac{\text{Rainfall for that month (mm)}}{\text{Average temperature for the same month (° C) +10}} \times 12
\]

(1976) : de Marathon based his classification on the value of the drought coefficient (1) and as in the equation Below:

\[
I = \frac{P}{T+10}
\]

Where:

I: Drought coefficient without units.

P: Annual rate of rainfall (mm).

T: the average monthly temperature (°c). By applying the equation in the governorate by relying on Table (2) and Table (3), it was found that the lands of the Governorate suffer from drought in many months of the year.

And the definition of drought: is that the quantities of rain are less than their general average for a long or short period, which leads to a lack of running water in rivers and a decrease in the groundwater level in the ground [61] The phenomenon of drought is one of the frequent phenomena that occurs in arid, semi-arid and semi-humid areas, and its danger lies if it lasts for several years continuous which leads to a decrease in the amount of water in the rivers and a decrease in the level of groundwater as well as the scarcity of natural plants, and thus the occurrence of desertification phenomenon in the governorate Picture (1).

![Picture 1. manifestations of desertification in a number of areas in Babylon Governorate. Photo taken on (10-12)](10.1.4. Aridity)

A natural phenomenon that is distinguished by being permanent in a region, and the amount of precipitation in it is small but it ensures the continuation of life in a fragile inter-balance that facilitates its collapse[62].
3-2-1-5 Water deficit: it is an artificial condition that may occur in any region of the world when the demand for water becomes more than available water resources [63]. That these sources are linked to tension on the natural and agricultural environment, especially in the dry and semi-border areas, and above all, Babylon Governorate. Note the figure below:

10.2. Second: The nature of the agricultural situation in the governorate:

Babylon Governorate is considered one of the agricultural governorates in Iraq, because the governorate is rich in tables fully reclaimed irrigation projects, partially reclaimed irrigation projects, and a large network of channels and homes helped the emergence of agriculture and increase agricultural production in it but the spread of desertification reduced a lot of arable areas and turn them into barren, barren lands the total area of Babylon Governorate is (2197922) permanent and the rate of arable areas is (407524) dunums and constitutes a percentage (62.7%) of the total area. As for the rate of non-arable areas, it is (117212) dunums, and it constitutes (29.3%) of the total square, while the total area amounted to (524736) dunums, and it constituted (26%). Through Table (9), we note the cultivated lands in the governorate.

Table 9: the type of crop and the areas of agricultural lands cultivated in Babylon Governorate for the year (2018).

| Crop type         | Cultivated area (dunums) | Products/Tons | Damaged |
|-------------------|--------------------------|---------------|---------|
| Rice(amber)       | 85                       | 115           | 25      |
| Barley            | 1200                     | 13197         | 1303    |
| Palm groves       | 63350                    | 40879         | 12341   |
| Mash              | 250                      | 765           | 123     |
| White corn        | 250                      | 876           | 187     |
| Yellow corn       | 7000                     | 5554          | 124     |
| Jet               | 2000                     | 344           | 134     |
| Vegetables        | 3983                     | 15676         | 4391    |
| Fruits            | 65204                    | 12576         | 3245    |
| Sesame            | 30                       | 18            | 12      |
| Watermelon        | 400                      | 4565          | 567     |
| Water cucumber    | 90                       | 8945          | 8734    |
| Tomatoes          | 200                      | 7695          | 2063    |
| Beans             | 150                      | 1234          | 7062    |

[64]Source: Directorate of Agriculture in Babylon Governorate, Agricultural Statistics Division, unattended data for 2018.

10.2.1. Cultivated lands In the province, it includes

10.2.2. Land cultivated with field crops and divided into

10.2.2.1. Lands cultivated with winter field crops, wheat and barley

The wheat crop is one of the most important winter field crops prevalent cultivated in the governorate, as it occupies the largest agricultural areas in it, as the average of the area planted with this crop reached (167585), while the yards cultivated with this crop have varied in recent years due to the fluctuation of rain and drought that afflicted many agricultural lands in the governorate. After the area cultivated with the wheat crop was (21693) dunums in 2008, it decreased to (19876) dunums in 2018, due to the change in the political and economic conditions of the country during that period as well as the decrease in the volume of water shares entering the governorate together a negative impact on agricultural production. And the high prices of agricultural products and the spread of desertification. As for the barley crop, as it comes after the wheat crop in terms of the area cultivated with winter field crops in Babylon Governorate, but it comes after the wheat and yellow corn
crops in terms of the area planted with winter and summer field crops in them amounted to (42421) dunums. Production and its decline due to the occurrence of desertification phenomenon.

10.2.2.2. The lands cultivated with summer field crops, yellow corn, rice, sesame, cotton, melon flower, millet.

The yellow maize crop is among the most important summer field crops prevalent cultivated in the governorate, as it comes first in relation to these crops due to the availability of suitable conditions for its cultivation, which is good soil and water availability, but it comes after the wheat crop in terms of the area cultivated with winter and summer field crops (as it becomes clear) From table (8), the average area cultivated with the yellow corn crop reached (11732), and the areas cultivated with this crop have varied in recent years, as these areas range between (59132) dunums in 2008, which is the lowest area recorded during the mentioned period, and soft (53320) In 2018. The rice crop comes after the yellow maize crop in terms of the area cultivated with summer field crops in the governorate as the average area planted with this crop reached (8769) dunums. As for the sesame crop, it comes after the rice crop in terms of the area cultivated with summer field crops in the governorate. The average area cultivated with this crop reached (4877), after the sesame crop, in terms of the cultivated area, which amounted to (2937) dunums, and for sunflower it comes after the cotton crop in terms of the area cultivated with summer field crops in the portfolio, as the average area cultivated with this crop reached (2160) dunums, and the millet crop came in the last visible in terms of the area cultivated with summer field crops, as the average area cultivated in it reached (2441) dunums.

10.2.2.3. The lands cultivated with leguminous crops are divided into

a. The lands planted with the winter leguminous crops and the most important of these crops are cultivated in the governorate in Legumes, as the average area cultivated in it was (23434) dunums.

b. The lands cultivated with summer leguminous crops. Cowpea, livestock: The cowpea crop comes first Whereas the area cultivated with summer leguminous crops in the governorate, the average area planted with this crop reached (4211) dunums. As for the harvest of the hay, it comes after the cowpea in terms of the area cultivated with the summer leguminous crops prevalent in the governorate, where the average area cultivated with this crop reached (2287 dunums).

10.2.3. The lands cultivated with fodder crops including

Jet, white corn, fodder mixtures, the Jet crops come first in terms of the area planted with the supporting fodder crops cultivated in the governorate, as the average area planted for this crop reached (43765) dunums, and as for the clover crops come after the jet harvest from Whereas, the cultivated area, which amounted to 14452 (2009), decreased to (13243) in 2018. The fodder mixtures come after the alfalfa crop in terms of the area planted with forage crops, as the average area planted with these crops was (970) dunums for the period (2009), which decreased in 2018 to (776) dunums and as for white corn, it comes last in terms of area, which amounted to (550) below them for the period (2018).

10.2.4. Lands cultivated with vegetables

Vegetable cultivation occupies an important place in agricultural production in Babylon Governorate in terms of its high nutritional value as an essential component of the daily human diet. And vegetables are classified into two types:

a. summer vegetable crops: they come first in relation to the vegetable crops cultivated in the governorate that the average cultivated area reached (29,371) dunums of duration (2009), and the areas cultivated with these crops have varied in recent years at the time when the cultivated area (30824) countries in 2012 decreased to (27712) dunums in 2018, after which pictures (2).

b. Winter mowing crops: The second type of mowing crops that are predominantly cultivated in the governorate, comes after the summer vegetable crops in terms of The area cultivated with vegetable crops, as the average area cultivated there was (16878) dunums for the period (2009).
10.2.5. Lands cultivated with orchards

Horticultural plants have been known since ancient times in Mesopotamia. Iraqis were known to cultivate date palms, olives, grapes and other fruit trees. They also found in the Hammurabi Sharia some laws and regulations for cultivating orchards, especially palm groves, so it became clear that the Iraqi is one of the countries known since ancient times. In the cultivation of fruit trees especially palm cultivation. As for Babylon Governorate it is considered among the most important governorates of Iraq in the cultivation of fruit trees especially palm trees, as it occupies an advanced position in the number of palm trees and its production. Its number reached about (1281982) palm trees in 2007, of which there are (381998). A palm tree in the district of Hillah, which is thus ranked first in the number of palm trees. The number of date palms increased to (2063096) date palms in 2010, of which there are (677458) date palm trees in the Al-Musayyib district that have been erased? Thus, the first place in the number of palm trees for the aforementioned year, but their production decreased to (615,641 tons in 2018), and their production reached (578802) tons and a percentage (152%) of Iraq's production and that the decrease in their production is due to the drought that afflicted many of the lands of the province, which contributed to the occurrence of The phenomenon of desertification and the lack of numbers of date palms in the governorate Table (10) . As for other fruit trees they take the same geographical distribution as palm trees and the governorate owns large numbers of fruit trees, and the number reached (411,757) trees in 2008 and reached (543,326) trees in (2018). Picture (3).

| Type       | 2008 Products/Tons | 2018 Products/Tons |
|------------|--------------------|--------------------|
| Ascetical  | 60532              | 55792              |
| Hystawy    | 9486               | 10152              |
| Sayer      | 40                 | 24                 |
| Khedrawi   | 421                | 328                |
| Sweeti     | 85                 | 59                 |
| Derry      | 45                 | 23                 |
| Other kind | 1744               | 1052               |
| Total      | 72353              | 67430              |

[65]Source: Directorate of Agriculture in Babylon Governorate, Agricultural Statistics Division, non-pictorial data for the year 2018.
10.2.6. lands planted with forests

Forests are considered one of the most important natural resources on the surface of the globe, but they are distinguished by their differences in terms of their source, some of them are natural, some of them are artificial, and natural forests grow as for the fall of seeds from the mother trees and the differences that develop from the mangroves of the cut trees on the surface of the forest floor, as for the forest Synthetic is the work of man, such as spreading seeds or planting seedlings in areas designated for this purpose, and soils and climate play a major role in creating and reproducing forests, as these natural factors determine the type of forests and trees that can grow in an area, as well as determine the speed of their growth. The climate, site factors, and manifestations of desertification play a major role in reducing forest areas in the governorate. These factors cannot be easily changed, but all we can do is adapt to them by choosing the appropriate species. Here forests differ from agriculture, as the latter can affect the quality of the soil to an extent. What is through cultivation or fertilization, as well as influencing the climate through cultivation in greenhouses or greenhouses. It must be mentioned that forest sites are usually far from cities and transportation routes, but many of them are located in rugged and difficult-to-reach areas, which increases the costs of wood and so The untapped and untapped forests are considered to have an economic value equal to zero. Image (3) and (4). Babylon Governorate has many forests in it, which are concentrated in the district of Mahawil, and these goals are:

a. Al-Mashru forests: The forests of the project are the oldest forests in the district of Mahawil, as it was established in 1956 and its total area is (2,347) dunums. (A dunum), al-Kharbana first forest with an area of (80) dunums, al-Kharbana second forest with an area of (45) dunums, the Imam forest with an area of (390) dunums, al-Akir forest and its area (60) dunums, al-Rasheed forest with an area of (400) dunums, Hassan Najjar forest with an area of (825) dunums, the Al-Bakr and Al-Hilali Forest with an area of (265) dunums, and finally the Basateen Hamid strip with an area of (180) dunums.

b. Forest al-Nasr / 3) Bida al-Nasiriya: (It is the second forest established in the district of Mahawil, where It was established in 1973 and its area reached (433) dunums, and this area is divided into a lubricated area estimated at (100) dunums, and the number of trees per dunam is about (150) trees and a white area is estimated at (333) dunums.

c. Khanfara Forest (10 / Khanfara: It is the third forest that was established in the governorate, where it was established on 7/7/1979, with an area of (1180) dunums. Likewise, this area is divided into wooded area (790) dunums and a white area estimated at (390) dunums.

d. Al-Marawiya Forest (6 / Al-Marawiya): It is considered the other forest that was established on 7/7/1979, with an area of (465) dunums, and it is divided into a wooded area (123) dunums and a white area (342) dunums.

e. Abu Sudira Forest (13 / Abu Sudira: It is considered the last forest in the governorate where it was established on 07/16/1979. Its total area is (291) dunums, and it is divided into wooded area (141) dunums, and a white area estimated at (150) A picture (4) and a picture (5) dunums.

![Picture 4](image)

Picture 4. The effect of desertification manifestations on natural intentions in Babylon Governorate.

Photo taken on (12-11-2019).

10.2.7. Livestock

Babylon Governorate is one of the governorates in which livestock of various kinds are available, where there are sheep and the number was (34156) and the number of owners reached (3454) and the number of cows reached (24532) and the number of owners reached (6785) and the number of buffaloes (10543) The number of owners reached (3459) and the number of poultry reached (813994) and the number of owners reached (657) owners. The increase in areas in which the phenomenon of desertification has led to a decrease in the livestock in the governorate. Table (11).
Table 11. Types of animals and their numbers in Babylon Governorate for the year 2018.

| Type of Animals | Number | Her Owners |
|-----------------|--------|------------|
| Sheep           | 34156  | 3454       |
| Cows            | 24532  | 6785       |
| Buffalo         | 10543  | 3459       |
| Poultry         | 813994 | 657        |

[66] Source: Directorate of Agriculture in Babylon Governorate, Department of Livestock, unpublished data for the year 2018.

10.3. Lands not suitable for agriculture, including

a. Lands designated for the poultry fields.

b. Lands designated for fish lakes.

c. Public utilities include housing, mosques, cemeteries, recreational places, homes, playgrounds.

10.3.1. Land designated for poultry fields

Babylon Governorate owns large numbers of poultry fields, as the average for the period is (771) (2013) right, as its geographical distribution varies between districts and sub-districts. The governorate, and that the number of these fields reached (696) right in 2018, and the statistics show the distribution of these fields, where the district of Mahawil occupies the first place in the number of fields, as its number reached (320) fields, while the district of Hilla comes second in the number of fields, where their number reaches To (135) right, please Al-Hashimiyeh district in the third rank with (125) parties and Al-Musayyib district came last in the number of fields as it reached (116) fields, and that the high temperatures in the summer month have a significant impact on the decrease in productivity in the governorate Table (12).

Table 12. The number of poultry fields in Babylon Governorate by district for the year 2018.

| Enumerate | District     | Field numbers |
|-----------|--------------|---------------|
| 1         | Hillah       | 135           |
| 2         | Mahawil      | 320           |
| 3         | Al-Hashimiyeh| 125           |
| 4         | Al-Musayyib  | 116           |
| 5         | Total        | 696           |

[67] Source: Babylon Agriculture Directorate, Livestock Division, Poultry Division, unpublished data, 2018.

10.3.2. The lands designated for fish lakes

Babylon governorate owns about (145) fish lakes, the total area of which reaches about (31025) dunums and a water area of up to (8282) dunums, in addition to (8) Companies in the governorate have an area of (7,081) dunums and a water area of (5352) dunums. It is evident from table (13) that there is a discrepancy in the fish lakes within the districts and sub-districts of the governorate where the Mahawil district occupies the first place in the lakes with its number reaching (78) fish lakes and the al-Musayyib district comes second in terms of the number of lakes which amount to (44) lake, while the Hilla district comes in the third rank and with (15) lake, and the Hashemite district comes fourth in terms of the lakes, which amount to (8) fish lakes with an area of (507) dunums, and a financial area of (429) dunums. The areas that were designated for fish lakes, but the lack of water availability and other human factors led to this.

Table 13. Number of fish lakes and their area in Babylon Governorate by districts for the year 2009.

| Enumerate | District     | Lakes number | Total area/ dunums | Water space |
|-----------|--------------|--------------|--------------------|-------------|
| 1         | Hillah       | 15           | 22545              | 1561        |
| 2         | Mahawil      | 78           | 1551               | 1262        |
| 3         | Al-Hashimiyeh| 8            | 507                | 429         |
| 4         | Al-Musayyib  | 44           | 6422               | 5030        |
| 5         | Total        | 145          | 31025              | 8282        |

[68] Source: Babylon Agriculture Directorate, Livestock Division, Fish Division, unpublished data, for the year 2018.

And in Table (14), in which the total areas of agricultural lands are shown in terms of arable and unfit areas, and the percentage of each side of the governorate. In Babylon Governorate for the year (2018).
Table 14. The total areas of agricultural land in Babylon Governorate for the year (2018).

| Agriculture division | Arable area/ Dunums | Invalid area/ Dunums | Total area/ Dunums | The ratio of the total agriculture area/ Province area |
|----------------------|---------------------|----------------------|--------------------|-----------------------------------------------|
| The center           | 34873               | 44585                | 79458              | 4%                                            |
| Abo karak            | 51916               | 8100                 | 60016              | 3%                                            |
| Al kefal             | 109740              | 68940                | 178680             | 9%                                            |
| Total District       | 196529              | 121625               | 318154             | 16%                                           |
| Al Mahawil           | 62572               | 22825                | 85397              | 4%                                            |
| Al Imam              | 78609               | 118250               | 96859              | 5%                                            |
| Al Neil              | 64000               | 10000                | 74000              | 4%                                            |
| Al Mashrue           | 175262              | 4000                 | 179262             | 9%                                            |
| Total District       | 380443              | 55075                | 435500             | 22%                                           |
| Al Musayib           | 40392               | 6000                 | 46392              | 2%                                            |
| Al Sada              | 61000               | 14340                | 75340              | 4%                                            |
| Al Iskandaria        | 63826               | 27928                | 91754              | 5%                                            |
| Jurf Al Saghar       | 109750              | 75230                | 184980             | 9%                                            |
| Total District       | 274968              | 123498               | 398366             | 20%                                           |
| Al Hashimiyah        | 49590               | 10691                | 60281              | 3%                                            |
| Al Medhatia          | 156905              | 3000                 | 159905             | 8%                                            |
| Al Kasim             | 54189               | 22000                | 76189              | 4%                                            |
| Al Tulia             | 64475               | 55771                | 120246             | 6%                                            |
| Al Shumaly           | 82365               | 25750                | 108115             | 5%                                            |
| Total District       | 407524              | 117212               | 524736             | 26%                                           |

[69] Source: Based on: Directorate of Agriculture in Babylon People's Governorate, Land, Unpublished data for 2018.

11. Suggestions and recommendations

1. Improving the country's capabilities in terms of methods of meteorology, weather and water sciences in terms of forecasting a future drought.
2. Programs to strengthen the country's preparedness to confront and manage the country's vulnerability to drought.
3. Establishing food security systems, including storage and marketing.
4. Finding alternative livelihood projects, which may provide landowners with available means for their sources of income in the event that their lands become dry.
5. Sustainable irrigation programs for crops and livestock together.
6. Programs for sustainable management of natural resources.
7. Programs to teach appropriate methods of agriculture.
8. Development of various energy sources and their proper utilization.
9. Strengthening the capabilities of scientific research and training in the country in the fields of desertification and drought.
10. Training programs to conserve natural resources and the sustainable use of them.
11. Providing appropriate training and technology to exploit alternative energy sources, especially renewable sources, with the aim of reducing the use of wood as a source of fuel.
12. Full cooperation between governmental institutions, agricultural groups, and the General Union of Peasant Cooperative Societies in the field of informational and guidance awareness to enlighten farmers and farmers about the type of diseases and methods of combating them.
13. Follow-up the effectiveness of agricultural initiatives and follow-up of the loans granted to farmers by the Agricultural Bank and its branches to prevent their use in carving the purposes assigned to them and activate the role of monitoring agencies. Especially the offices of the inspectors general.
14. Developing a realistic strategy in order to expand afforestation in desert areas, especially on the outskirts of cities, to face dust storms and honey sand movement barriers.
15. Stopping the process of running orchards and wooded areas inside cities and not converting them into residential areas behind which are left behind by what politicians support the law in order to explicitly violate the laws.
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