

# USING OF AGRICULTURAL MECHANIZATION, FERTILIZERS AND IRRIGATION TECHNIQUES AND THEIR IMPACT ON THE LEVEL OF AGRICULTURAL PRODUCTION OF DESERT AREAS IN KARBALA GOVERNORATE

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## **Abstract**

This research deals with the impact of the use of agricultural mechanization, modern irrigation techniques, fertilizers and fertilization on the level of agricultural production of desert lands in the holy province of Karbala, using models of farms in the two divisions, the desert division and the Ain al-Tamr division, which are lands that are characterized by a desert climate, a comparison was made to measure the efficiency of the farms selected from the study area for the previous and subsequent years with the farms in the same area, however, there is a difference in the uses of agricultural mechanization, fertilizers, fertilization and modern irrigation techniques, as the study dealt with a number of farms of the desert division and farms from the Ain al-Tamr division to determine the level of development in the level of agricultural production before and after the use of modern agricultural mechanization, fertilizers and modern irrigation techniques in desert areas for a period of two years in a row (2019,2020), as the study area is Ain al-Tamr division, which takes an astronomical location between longitudes (043.15-043.45) east and latitudes (032.10-032.45) north with an area of 14230 dunums according to the statistics of the Karbala Agriculture Division for the year 2008, it is geographically bordered to the east by the Indian district and to the north, occupying a large part of Lake Al-Razzazah and the rest of its sides, bordered by the province of Anbar, as for the desert division, it is located astronomically between the longitudes (044.85-043.38) east it has an area of about .423 km<sup>2</sup> and is located within the western desert plateau with an area of 156223 acres according to the statistics of the Directorate of Agriculture for the year (2008), as for the area of the holy province of Karbala, it is about (52,941 km<sup>2</sup>). The main problem of the study is crystallized in showing the role of the use of mechanization and modern irrigation methods and fertilization in raising the level of agricultural production in the province of Karbala in the desert areas of those two divisions mentioned above, the research has adopted in its hypothesis, which he deduced from the current reality of Karbala province, where it reached advanced stages in achieving agricultural development, this came as a result of the agricultural projects that have been carried out recently in recent years in the desert areas of the province by relying on the use of mechanization instead of labor and the use of groundwater storage located in the western plateau area of Karbala province, this is done through the drilling of artesian wells and water technicians, as well as the development of many aspects that paved and facilitated the way for the development and upgrading of agricultural production in the study area, among these aspects, we mention the economic, climatic and environmental aspect by addressing desertification through the cultivation of the desert, which led to the

reclamation of the environment and raising the level of agricultural and economic production, the objective of the study is to analyze the reality of agriculture and develop solutions to meet the challenges in the cultivation of desert lands from Karbala province and to identify the most important obstacles and challenges facing agriculture in those areas and address them and to indicate and analyze the role and importance of using modern agricultural machinery and reduce manpower and save effort and expand the area exploited to improve the physical properties of desert soils and make them a giving soil using the optimal use of fertilization, in order to reach the objective of the study, it was adopted to measure the plant production efficiency of a number of farms through the data obtained from field visits to farms to the desert area available and at the level of the desert divisions and the Ain Al-Tamr division, which is the study area, after collecting and completing the information, it was classified and classified in tables and forms, many approaches were followed, including the analysis of those data and their presentation in order to reach and stand on the best expected results adopted by the study.

**Keywords:** Agricultural Mechanization, Fertilizers and Irrigation Techniques ,Karbala Governorate

### **Introduction**

Agricultural machinery, modern irrigation techniques and fertilizers are one of the scientific means adopted to solve agricultural problems, in addition, the use of irrigation techniques with the components of the agricultural technology package represented by fertilizers, improved seeds, mechanization and pesticides has contributed to doubling agricultural production.

The adoption of the use of machinery, modern irrigation techniques and fertilization is the most important and influential factor in increasing the level of agricultural production in the long term, this means that modern technological development requires more efforts, research, studies, training and extension for various fields of agricultural production (plant, animal and food processing), the most important problem facing agriculture today is the widening food gap between the local production of agricultural commodities and crops and the total demand, the reasons for this gap are attributed to the deterioration of productivity, the low efficiency of machinery, modern irrigation techniques, fertilization quantities and the deterioration of the natural resource base (drought, desertification, lack of rainfall) that caused the scarcity of water entering Iraq, as well as the water projects of neighboring countries represented by the construction of dams and reservoirs, they have greatly affected the water share of Iraq and thus reflected on the overall agricultural process in Iraq in general and in the province of Karbala in particular.

In this chapter, we will study the reality of using the three variables (agricultural machinery, modern irrigation techniques and fertilizers) in a number of farms located in the desert region, which included the desert and Ain al-Tamr divisions, this is through field visits to the farms of the desert region and to stand on the difference made by agriculture in those lands in terms of covering the desert and contributing to raising the level of local production of crops grown in the study area and because of the difficulty of reaching most of the farms of the study area and covering them completely due to the lack of rehabilitation of the main roads leading to it and the lack of secondary roads that intersperse with it, and that most farmers take random ways to reach their farms, satellite visuals were used and analyzed for the years (2002 and 2022) in order to show the difference in the cultivated areas in the aforementioned areas, see in image (24).

### **Research problem**

The research problem was represented by the following questions:

- 1- The impact of the uses of agricultural mechanization, fertilizers and modern irrigation techniques on the level of agricultural production of desert lands in the holy province of Karbala Have you contributed to the development and raising of agricultural production in desert areas?

**Research hypothesis**

It was found that there is a level of agricultural production in the desert lands in Karbala province before and after the use of mechanization, fertilizers and modern irrigation techniques.

**Research Rationale**

This research aims at the following

- 1- Studying and analyzing the reality of agriculture in Karbala and in desert areas in previous and subsequent years and making a comparison for three years 2019, 2020 and 2021
- 2- Knowing the extent of the impact of natural and human factors on desert farming in Karbala Governorate.

**Research Importance**

The importance of research is evident in the fact that it deals with an important and challenging issue with an economic and environmental dimension.

**Research Area limits**

The limits of the research area in the province of Karbala, the desert part of it, which includes the agricultural divisions (desert and Ain al-Tamr), that the area within the division of Ain al-Tamr, which takes an astronomical location between longitudes (543.15-543.45) east and two latitudes (532.10-532.45) north and an area of 14230 acres according to the statistics of the Karbala Agriculture Division for the year 2008, it is geographically bordered to the east by the Indian side and to the north, occupying a large part of Lake Al-Razzazah and the rest of its sides, bordered by the province of Anbar, as for the desert division, it is located between the longitudes (544.85-543.38) east it has an area of about 423 km 2 and is located within the western plateau

**Table(1)**

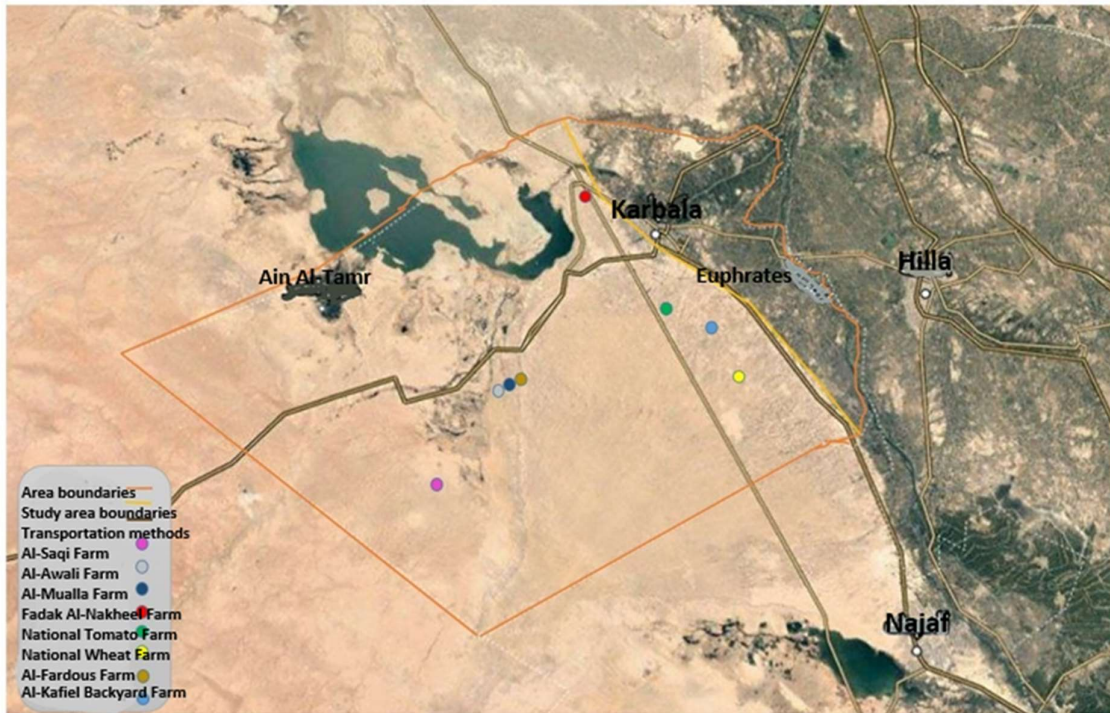
**Agricultural areas and production of a number of farms within the study area**

S.	The farm	Custom Farming	Area / Dunum
1	Fadak Al-Nakheel Farm	Palm	700
2	Al-Saqi Farm	Wheat, barley, palm	10,000
3	Al-Fardous Farm	Wheat, barley, industrial potatoes	1,180
4	Al-Awali Farm	Wheat- Barley- Potato	50,000
5	Al-Mualla Farm	Wheat – Barley	20,000
6	Al-Kafiel Backyard Farm	Wheat – Barley	480
7	National Wheat Farm	Wheat	400
8	National Tomato Farm	Tomato	10

Source: Field visits to a number of desert land farms on different dates.

Image (2)

Aerial view of the green cover (desert farms) in the study area in Ain Al-Tamr and the desert



Source: From the researcher's work based on the ARC GIS program

<https://www.arcgis.com>

Image (2)

Aerial view of the green cover (desert farms) in the study area in Ain Al-Tamr and the desert



Source: The researcher's work based on the ARC GIS program

<https://www.arcgis.com>



### 1- Analysis of satellite visuals:

The study of the agricultural reality of the desert region must be done accurately and according to a scientific perspective and with modern data and full coverage of the cultivated land in the desert areas, due to the wide area of the studied area and the difficulty of reaching all farms due to the deterioration of most of the transport routes leading to them, so eight separate farms were studied in the study area as a model, as well as the use of a satellite image set for the Holy Province of Karbala that varies chronologically (2002, 2022) based on the satellite (Landsat), in order to survey the variation of agricultural land areas for farms based on agricultural mechanization, fertilizers and modern irrigation techniques, to stand on the development of the level of agricultural production before and after the use of agricultural mechanization and modern irrigation techniques and fertilizers by comparing the expansion of areas exploited by agriculture in the desert lands of Karbala Governorate, and what was previously for the purpose of analyzing the results and measuring their regression (future forecasting), so the steps of studying and analyzing visuals will be explained, therefore, collecting information on desert land changes is essential to explain and analyze the best relationships and interactions between agricultural mechanization, fertilizers, modern irrigation techniques, fertilization and the level of agricultural production, remote sensing can be a source of data of great importance and help to study the change in cultivated areas in desert lands and to show spatial and temporal changes, building databases for these changes, which gives an effective effort to plan and study agricultural land in the study area through the integration of geographic information systems (GIS) and remote sensing techniques to provide in turn the possibility of broader understanding in providing data and great possibilities to display and determine the spatial dimensions of the phenomenon and benefit from modern technologies in the application of spatial analysis methods for remote sensing data, relying on the values of spectral reflections of satellite visuals to monitor changes in desert lands and thus their impact on the level of agricultural production through monitoring changes over multiple time stages .

The study was carried out using satellite images Table (30), which were taken for the study area in the month of (April), this month of the year was chosen in order to monitor the reflection of some farms whose crops such as potatoes and wheat are suitable in the study area where the crop is in the stage of full maturity or vegetative growth, which provides good data on vegetation cover in the study area, the vegetation of the plant appears clear and its degrees (dense and low density) therefore, the study area was visually monitored in April (2002, 2022) by the American satellite 7-Landsat and -9Landsat images (25) (26)

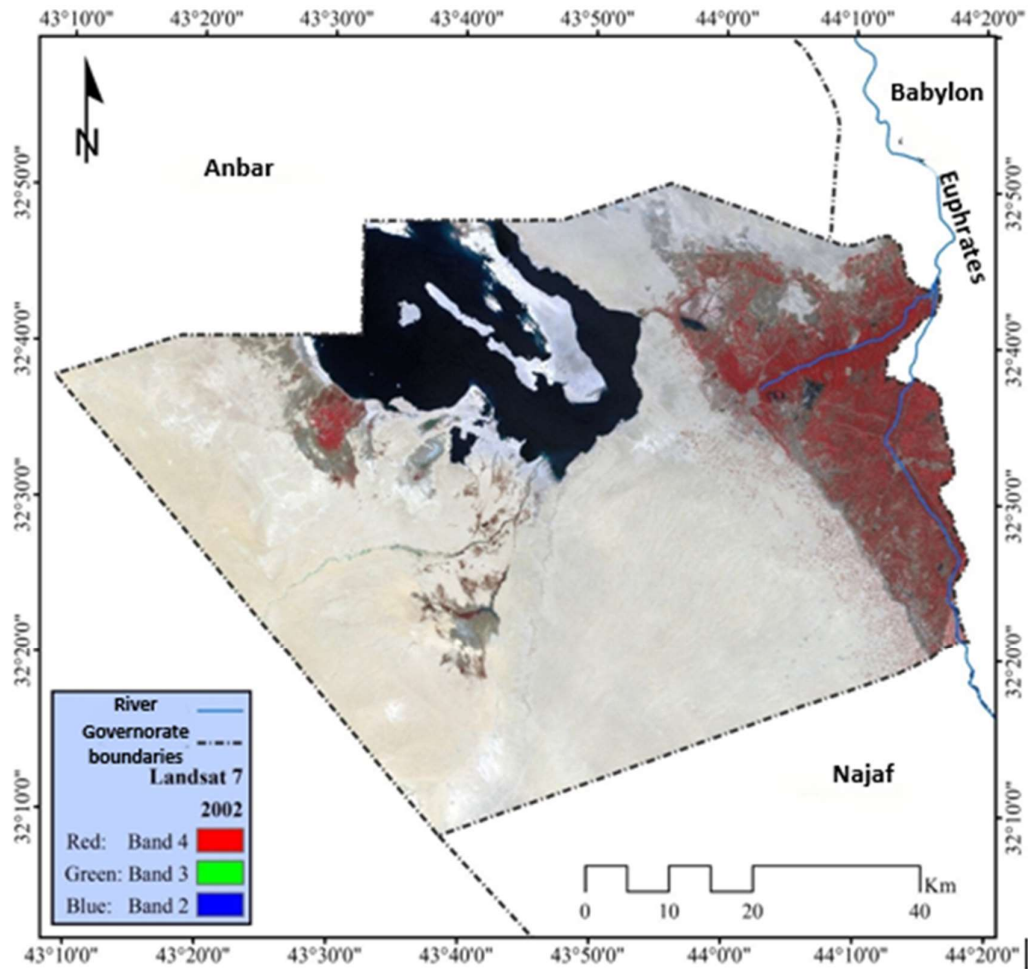
**Table (2)**

**Date of capture of satellite visualizations of the study area**

Satellite Type	Date Taken	Image path	Number of Photos
Landsat-7	2022-04-15	168/38	1
Landsat-7	2002-04-22	169/38	1
Landsat-9	2022-04-22	168/38	1
Landsat-9	2022-04-13	169/38	1
Landsat-9	2022-04-21	169/37	1

Source: USGS, Landsat7.9, Images (earth Explorer. USGS. Gov)

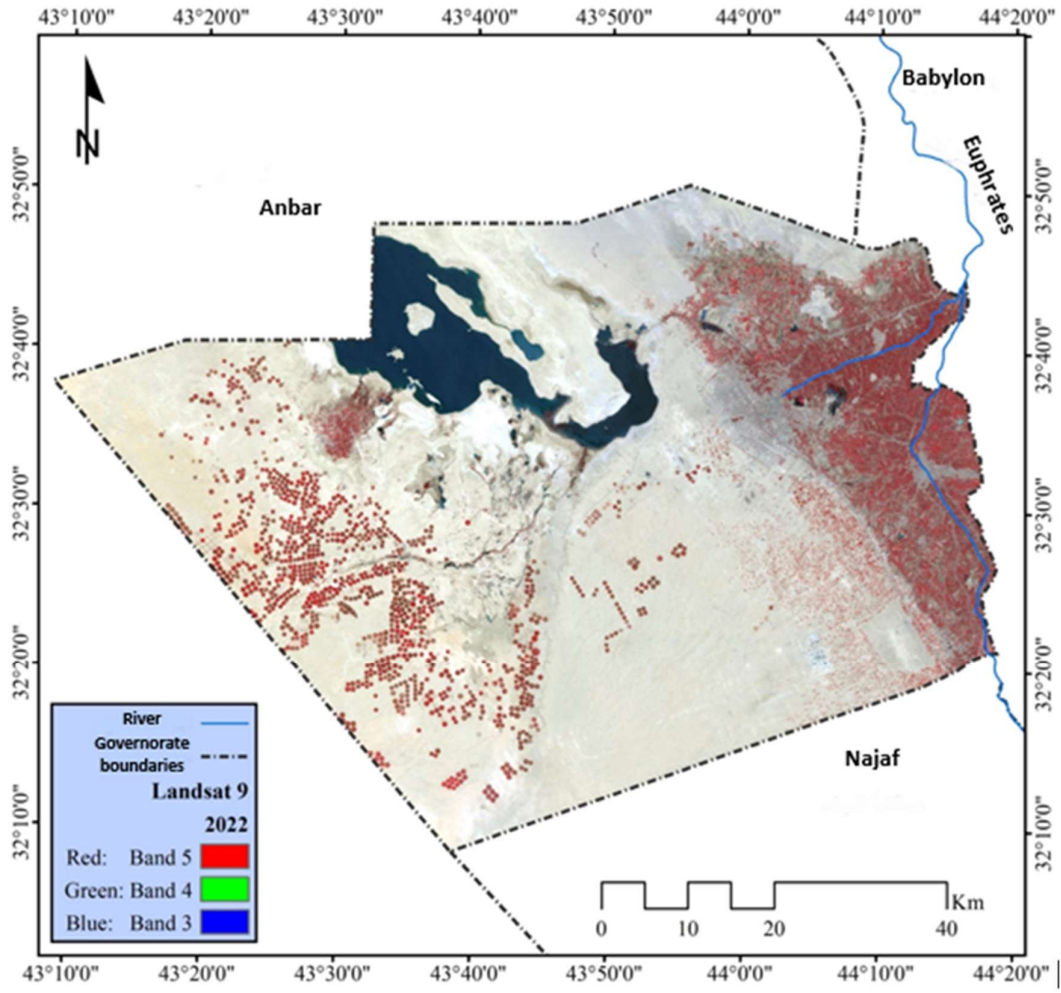
**Image (3)**  
**Raw visual of the holy province of Karbala in 2002**



Source: General Authority for Survey, Administrative Map of the Holy City of Karbala, scale 1:100,000

2. USGS, Landsat 9-8-7 Images (earth Explorer. USGS. Gov)

**Image (4)**  
**Raw visual of the Holy Province of Karbala year (2022)**



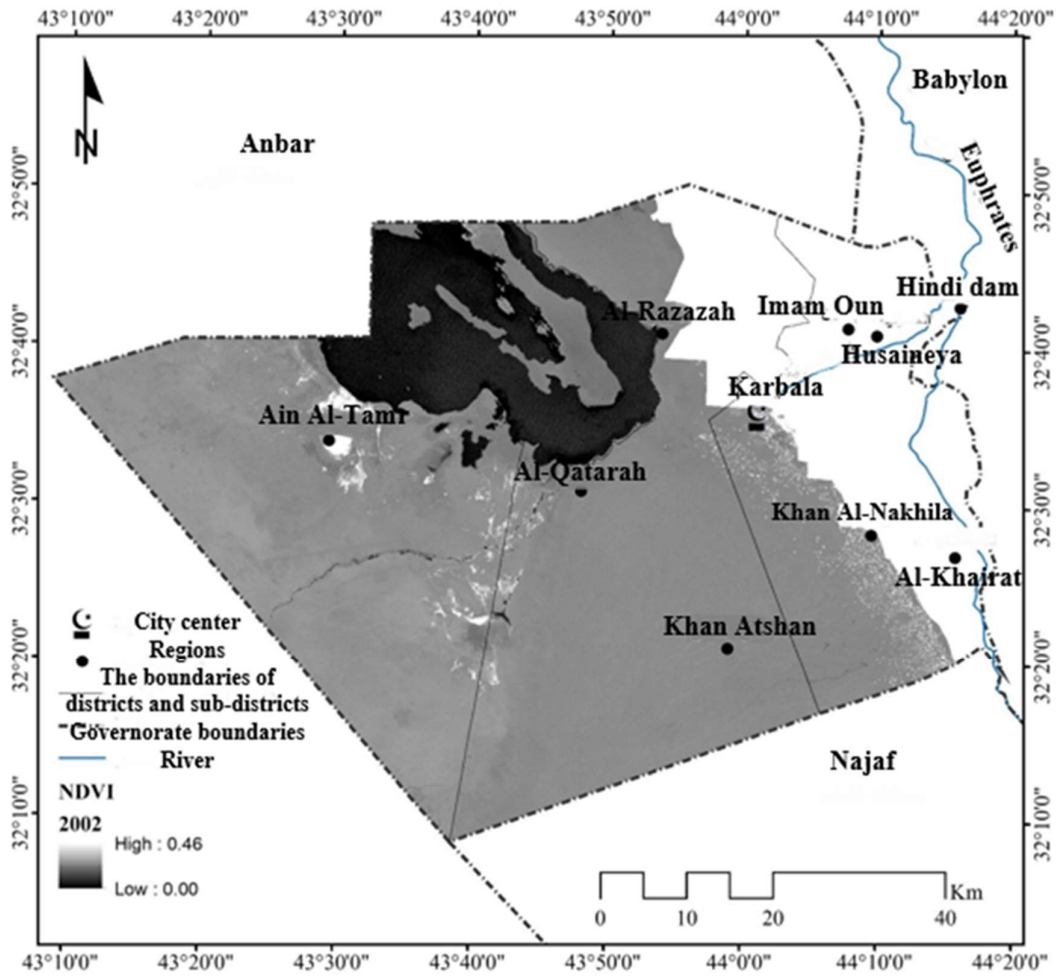
Source: General Authority for Survey, Administrative Map of the Holy City of Karbala, scale 1:100,000

2. USGS, Landsat 9-8-7 Images (earth Explorer. USGS. Gov)

The satellite visual has gone through several processing processes until it reached the current form, including the process of parallelism and correction, the term digital visual processing is broad and includes many complex calculations that are employed in the form of programs used by those working in the field, the main idea of digital visual processing is to introduce the visual into the computer as a band by band, element by element, until it is stored in the form of a matrix, then the statistical equations are applied to represent the types of processing required on the satellite visual as shown in Fig. (5, 6)

Image (5)

Satellite visual processing of the study area for the year 2002

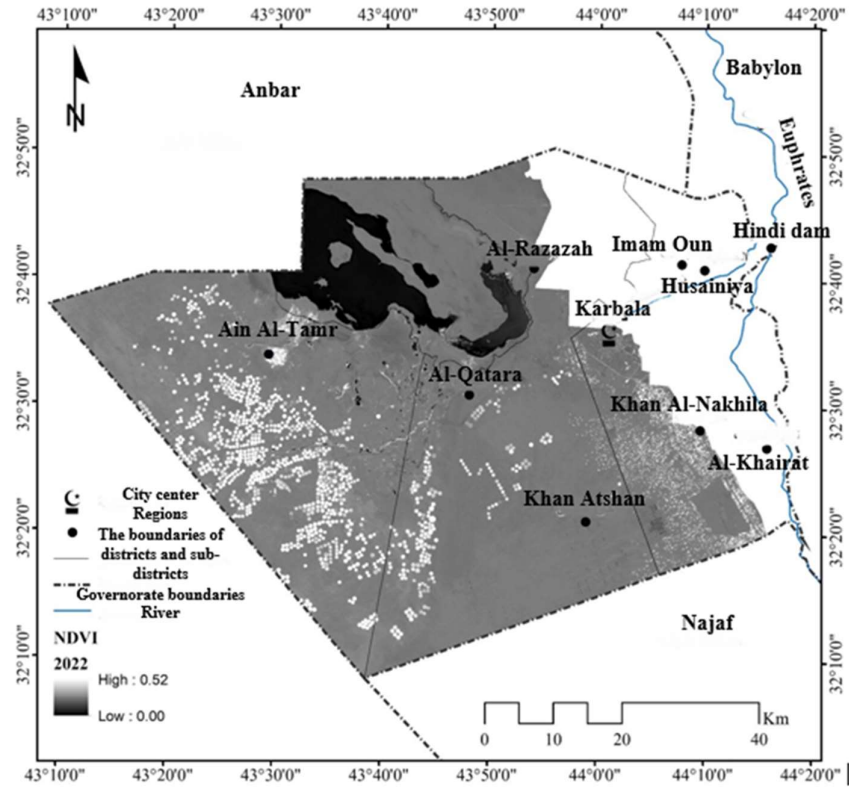


Source: Visual Map 9

Image (6)

Satellite visual processing of the study area for the year 2022



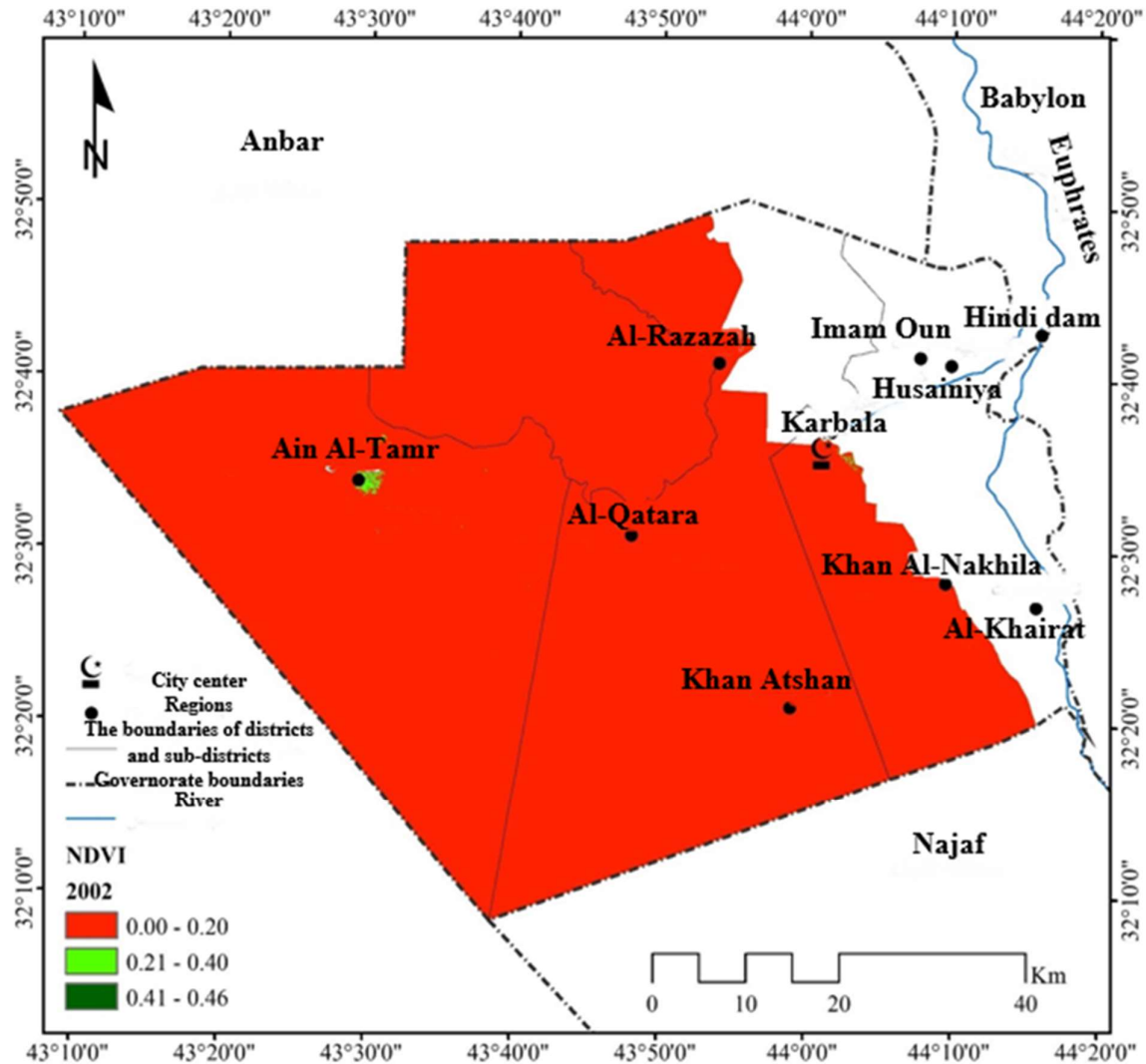


Source: Visual Map 10

After conducting the necessary processing on satellite visualizations using (NDVI 5.3 and ArcGIS 10.6), the following areas of green areas in the study area for the years (2002-2022) were obtained as shown in the maps (13.14) below:

Map (6)

Cultivated areas according to the levels of vegetation index (NDVI) in the study area for the year (2002)



Source: 1. Image (3) 2. Using NDVI 5.3

**Table (3)**

**Vegetation cover levels for the two agricultural divisions (desert and Ain al-Tamr) in 2002**

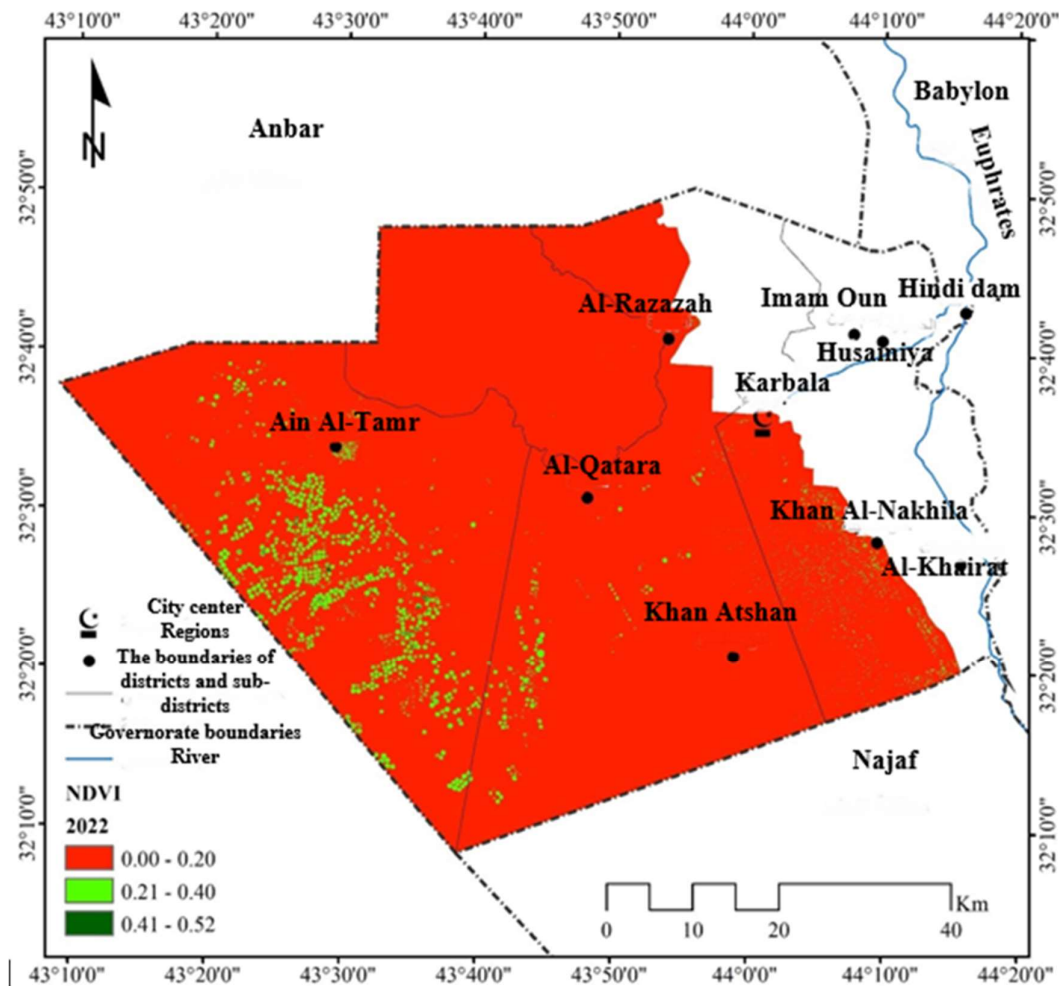
NDVI Plant Guide Categories	Area (km <sup>2</sup> )	
	Ain al-Tamr	Desert
0-0.2	1985	1571
0.21-0.4	0.99	8.89
0.41 and above	0	0.24
Total	1986	1580

Source: Map (1), using ArcGIS 10.6

The cultivated areas for the year (2002) (1985.78) km<sup>2</sup> for the Ain Al-Tamr, and (1579.80) km<sup>2</sup>, (this area represents all vegetative levels except the vegetative level 0-0.2 which indicates that the vegetation cover is very weak or non-existent and the highest vegetation ratio of vegetation cover for the vegetative level (0.21,0.4) is (0.99) km<sup>2</sup> for the Ain Al-Tamr, it is the level that represents the degree of low-density vegetation, while the desert area has reached the vegetative level of (0.21-0.4) (8.89) km<sup>2</sup>, through field visits to some farms in the study area, it was found

that most of the farms in the desert areas use modern and economical irrigation methods, which were primarily the method of sprinkler irrigation, this is because most of the land in the study area was used to grow winter field crops (wheat and barley), as for palm and tomato plantations, drip irrigation method is used.

**Map (2)**  
**Cultivated areas according to the levels of the Vegetation Cover Index (NDVI) in the study area for the year (2022)**



Source: 1. Image (3) 2. Using NDVI 5.3

**Table (4)**  
**Vegetation levels in the study area for the year 2022**

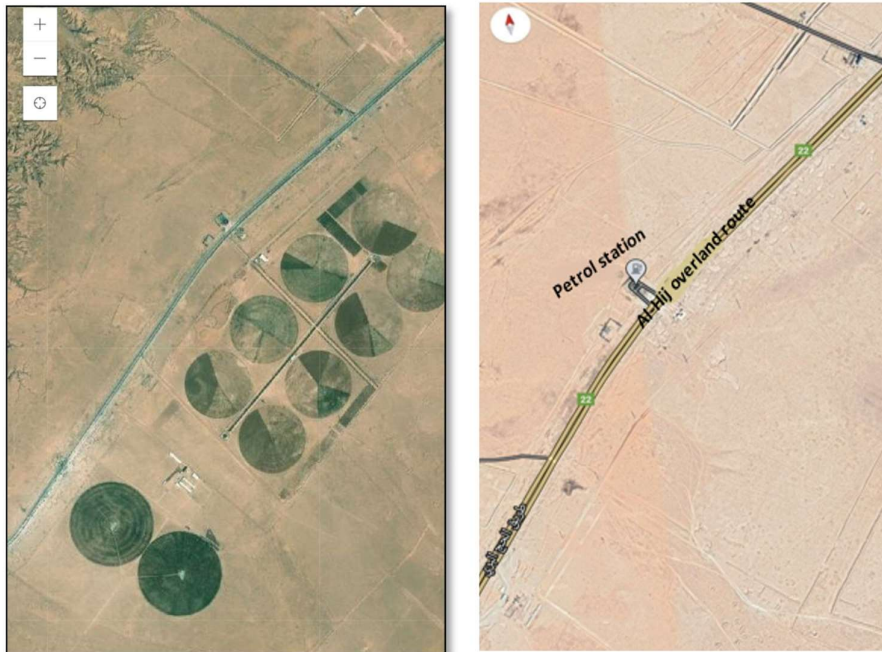
NDVI Plant Guide Categories	Area (km <sup>2</sup> )	
	Ain al-Tamr	Desert
0-0.2	1956.01	1460.21
0.21-0.4	29.73	117.64
0.41 and above	0.04	1.95
Total	1985.78	1579.80

Source: Map(2), using ArcGIS 10.6

As for the satellite visual analysis of the study area for the year 2022 to reveal the increase in cultivated areas in the Karbala desert, which is due to the establishment of large-scale farms, especially Al-Abbasid and Husseiniya holy shrines, the cultivated land area for the year (2022) reached (1985.78) km<sup>2</sup> for the Ain Al-Tamr division (this area represents all vegetative levels except for the vegetative level (0-0.2), which indicates that the vegetation cover is very weak or non-existent, and it is mostly the spread of some desert natural plants), the highest area was for the vegetative level (0.21-0.4), which amounted to (29.73) km<sup>2</sup>, as for the desert division, in the year (2022) it reached (1579.80) km<sup>2</sup> (this area represents all vegetative levels except the vegetative level (0-0.2) which indicates that it is a very weak or non-existent vegetation cover or that it is the spread of some natural plants in the region), the highest area was for the vegetative level (0.21-0.4), which amounted to (117.64) km<sup>2</sup>, while the level (0.4 or more) amounted to (1.95) km<sup>2</sup>, by comparing the cultivated area with all levels in the study area between the years (2002 and 2022), we find that the vegetative area has increased significantly in the year 2022), by observing the satellite visuals, we find that the desert division and the Ain Al-Tamr division have appeared in the farms very clearly and in the form of circles, This is due to the use of farms for pivot irrigation with a sprinkler, but in 2002 we do not notice the existence of any of these farms, this indicates that agricultural investment is increasing in 2022 in desert areas at the level of the two divisions (desert and Ain al-Tamr), depending on modern irrigation techniques such as pivot sprinkler irrigation and the emergence of farms in circles, as well as drip irrigation techniques used in palm and tomato plantations, as well as the development of the use of agricultural mechanization and fertilizers, images are noted (29).

### Image

**A farm within the desert division before the establishment of the farm and after its establishment in the desert lands of the holy province of Karbala**



Source: 1- Arc map2009 arc GIS 2022 - 2,  
<https://www.arcgis.com>



## **Conclusions**

1. The study area is characterized by breadth and leveling, which encouraged its exploitation for agricultural production, especially field crops and dates. Human factors also appear that contributed to the Shiites of farmers and investors to exploit desert lands, represented by government facilities such as loans, marketing policy and others.
2. Through satellite visuals and aerial photographs, the difference in the breadth of cultivated areas is shown, its areas in the study area have multiplied significantly by comparing the years (2002-2022), we find that the desert area has increased green spaces due to agricultural investment and the adoption of modern irrigation methods such as mechanization, irrigation methods and fertilization.
3. The study area faces some obstacles represented by natural and human geographical factors as well as an obstacle in the way of the expansion of agricultural production in the study area, including high temperatures, increased evaporation and solar radiation, which directed investors and farmers to exploit most of the desert lands in the cultivation of winter crops, this is in addition to the climatic characteristics of solar radiation, heat and wind, which greatly help in the use of clean energy, the rains, even if they decreased, also contributed to fertilizing the fields because of the nitrogen they contain, which is one of the main fertilizers used for crops grown in the study area. etc, as well as the human factors represented by the poor transport methods and the difficulty of accessing and serving cultivated desert lands.

## **Recommendations**

1. Work to follow modern irrigation methods such as sprinkler irrigation and drip irrigation because these methods are one of the advanced economic methods that helped reduce water losses during the process of watering crops.
2. The use of organic fertilizers and pesticides in an appropriate amount to maintain the quality of the soil and the quality of the crop from pollution and diseases that afflict it.
3. Providing agricultural equipment and supplies to farmers who invest in desert lands in order to support the process of combating desertification, increasing the level of agricultural production and long-term environmental improvement.
4. The application of modern technologies within the resources available in the study area, such as the use of solar energy that was applied in the model farms of the Abbasid and Husseiniya holy shrines, which contributed to solving the problem of power outages in desert areas, it also has a role in preserving the environment because of the results it reflects on free solar radiation clean energy.
5. Expanding the cultivation of strategic crops such as wheat and palm tree cultivation, pomegranates, olives and citrus fruits can also be cultivated in those desert areas, because these crops have a high ability to tolerate salt concentrations in the soil, it is also possible to introduce new varieties for agricultural crops invested in those lands, as well as contribute to supporting local markets and increasing farm income.

## **References**

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- 3- Source: General Authority for Survey, Administrative Map of the Holy City of Karbala,

scale 1:100,000

4- USGS ,Landsat 9-8-7 Images (earth Explorer . USGS . gov)