Spatial distribution of green land use and its role in reducing temperatures in the Middle Euphrates region in Iraq as a walking area for visitors of Zeyart AL-Arbaeen

Ali Zouher Abdulwahab

Centre of Urban and Regional planning for postgraduate studies,
University of Baghdad, Baghdad, Iraq
ali.zouher1200b@iurp.uobaghdad.edu.iq

Kareem Hasan Alwan

Centre of Urban and Regional planning for postgraduate studies,
University of Baghdad, Baghdad, Iraq
kareem.h@iurp.uobaghdad.edu.iq

Abstract

The Middle Euphrates region is considered one of the agricultural areas in which farms abound and are distributed in places to the exclusion of others. In general, several factors affect the distribution of green areas, such as soil, climate, water sources, the availability of manpower for agricultural purposes, and markets consuming agricultural products, and for the purpose of understanding the spatial distribution of green areas in this region These factors were studied, and the researcher reached the area of green areas in the study area and its environmental impact in reducing the temperatures of the neighboring cities In addition to the itineraries that visitors to Imam Hussein take on foot (Zeyart AL-Arbaeen), by relying on modern satellite images, geographic information systems, and remote sensing techniques.

Keywords: Green areas; NDVI; Land Surface Temperature; Middle Euphrates region, Zeyart AL- Arbaeen.

1. Introduction

The Middle Euphrates region is an important region in the country as it has fertile soil through which the Euphrates River passes, as this river is an important water source for this region that meets the need for water in agriculture along with groundwater in the region, which made this region characterized by the presence of many farms And the orchards, which have an important role in enhancing the environment, preserving the ecological balance, providing the necessary food basket, and providing the necessary income for the farmers of this region.

These papers discuss the spatial distribution of these green spaces of various kinds within the Middle Euphrates region and their role in reducing temperatures.

In general, there is a group of geographical characteristics that affect the distribution of green and agricultural land uses, and they can be summarized as follows: (Abd et al., 2016, p. 247)

a. Natural characteristics: which include land surface (gradient), climate, soil, and water resources.

b. Human characteristics: which include the labor force in agriculture and their experience, in addition to the farmer's relationship with his land (the extent of his connection with it), as well as within the human characteristics are the irrigation methods and methods adopted for it, the drainage systems, agricultural mechanization and transportation methods for the purpose of marketing.

Green areas can be defined as lands planted with various types of plants, as they include squares planted with grass, farms, orchards, forests, public gardens, home gardens, and green belts for cities. (Kamouna et al., 2009, p. 9). The research was limited to farms and orchards due to the large study area.

Green areas today have become one of the basic requirements for the population, as they are no longer secondary as in the past, in addition to the need for them and the demand for them increases whenever the economic situation improves and the standard of living rises. Rather, their existence is of great importance indicating the progress of the region) Al-Kinani and Najm, 2017, p. 3(.The presence of agricultural green areas works to maintain the environmental balance and helps to face environmental risks (Laffta et al., 2021, p. 76).

The uses of green land, which include farms, have many benefits in the social, economic, aesthetic, recreational, and climatic fields, as they directly affect temperatures as their presence significantly reduces temperatures, so they help in facing the challenges of climate change (Abdulwahab et al., 2023, p. 1953).

2. study area:

The location of the study area, its water sources, and soil types will be identified, in addition to the climate in the Middle Euphrates region , the cities within it, and The main itineraries that visitors take, in order to finally identify the reality of the green areas in it.

2.1. Location:

The study area is located within the five governorates (Karbala - Babil - Najaf - Al-Qadisiyah - Al-Muthanna) with an area of (32674 km2), between latitudes (30°51'40") and (33°4'36") from the north, and between longitudes (43°10'47") and (45°50'1"), it is within the sedimentary plain (Al-Sami'e et al., 2023, p. 256) as in Map 1.

The province of Baghdad is located within the borders of the northern Middle Euphrates region, and the provinces of Wasit and Dhi Qar are in the eastern borders. As for the southern borders of the study area, the desert of Muthanna and Najaf extends to the borders of the Kingdom of Saudi Arabia. Views have differed in defining the borders of the region of the Middle Euphrates region. (Al-Jumaili, 2016, p. 248).

Map (1) Location of the Middle Euphrates region in Iraq

Source: Researchers by GIS

2.2. water resources:

The most important source of water in the Middle Euphrates region is the Euphrates River and its branches. It enters the study area through the province of Babylon, then passes through the province of Karbala, then Najaf, then Al-Qadisiyah, then Al-Muthanna, as in Map (2) (Al-Khafaji et al., 2022, p. 3). It has a direct impact on the uses of green land in this region as well as all other urban activities.

Also, groundwater is considered the second source of water, especially in the western part of the study area. The main source of groundwater is rainwater if groundwater levels rise in the rainy season and decrease in Dry seasons, as well as the Euphrates River and its streams that also feed groundwater.
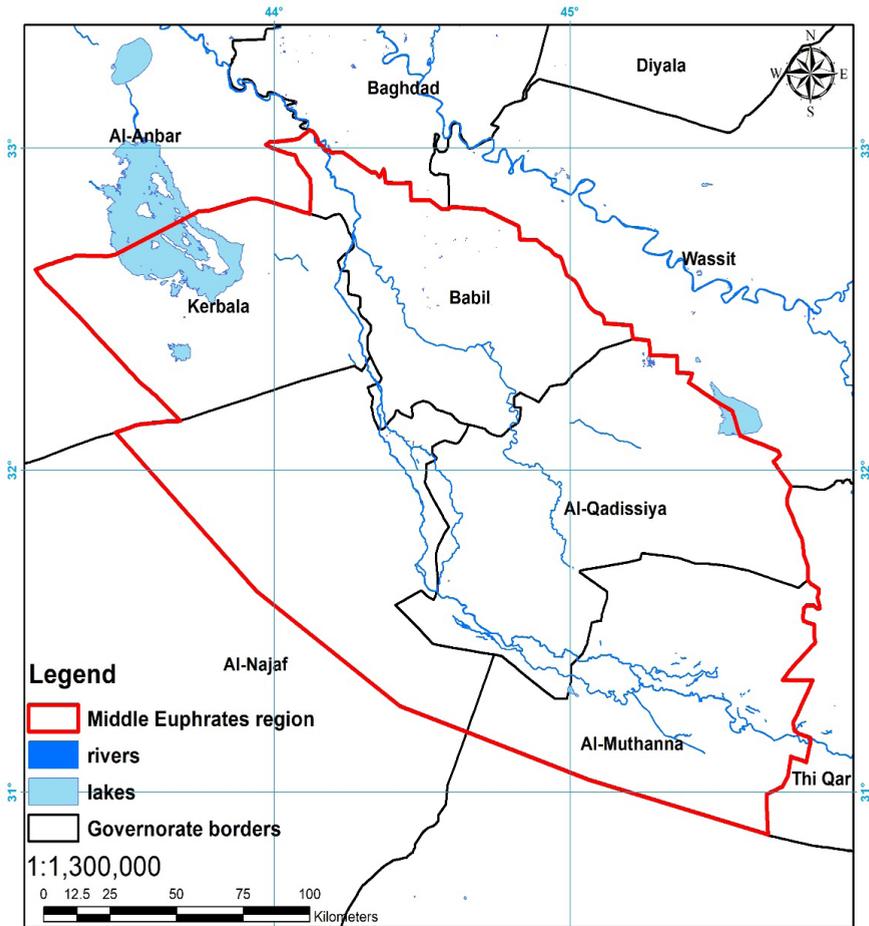

Map (2) The Euphrates River and its branches within the Middle Euphrates region

Source: Researchers by GIS

2.3. soil:

Agriculture depends largely on the availability of water and arable soil, as this is available in the study area, where a large proportion of arable land is available (Alowaid et al., 2021). Map (3) shows the soil types in the study area. The technological and scientific development that we are experiencing today has a clear impact on the agricultural fields, as it has become possible to reclaim soils that are not suitable for cultivation, to treat and improve the quality of the soil, as well as methods and means of delivering water to areas where it is not available (Hussein et al., 2021, p. 486). All this leads to an increase in the areas that can be cultivated. The options also vary in harmony with the characteristics of the soil, its type, and the locations of the land to be cultivated, as it is possible to grow crops that tolerate high salinity, as well as organic farming is one of the possible options (Shanishil et al., 2022, p. 352).

The lightest type of soil is sand soil, as this type of soil drains water quickly and the nutrients in it are low. It is noted in the study area that the area of this type of soil is small. Also, loam soil is one of the good types of soil for agriculture, whether it is clay or sandy, as it drains water well and achieves an appropriate balance for soil particles. It is clear in the study area that most of the soil is of this type.
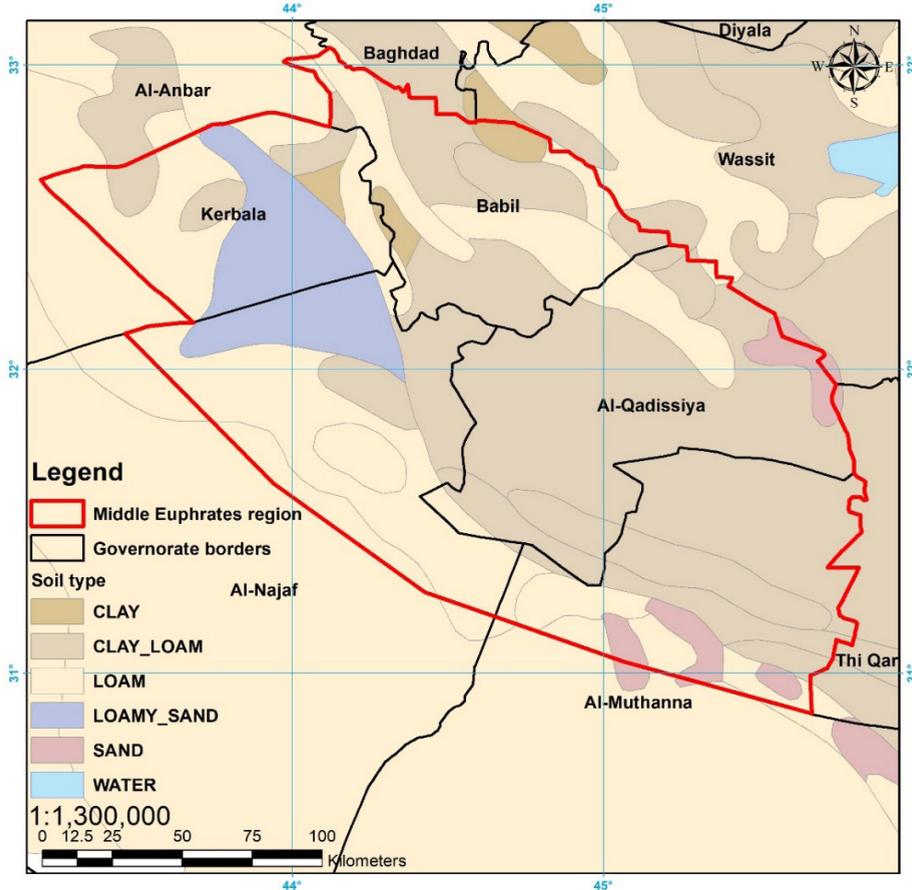
Map (3) Soil types

Source: Researchers by GIS

2.4. climate:

The climate has an effect on plants and crops. The effect may be direct or indirect, as the temperature has an effect on the spread of agricultural crops, affects the times of cultivation and maturity, and affects the process of photosynthesis, growth, food absorption, etc., that the solar radiation must meet the amount required for summer or

winter crops, as well About the importance of rainfall and its role in providing the quantities of water required for agriculture (Yousafani, 2021, p. 239).

The study area is located within what is known as the desert climate, which is semi-arid, where the predominant characteristic is high temperatures, which extend to more than 183 days, while its winter is short, not more than 90 days, and therefore there are no agricultural activities that do not depend on irrigation (Al-Jumaili, 2016, p. 248).

Temperature rates in the study area begin to rise gradually with the beginning of January in the winter season, and so on until July and August in the summer season, when the temperature reaches its peak, and then it gradually decreases again until October. Therefore, the climate of the Middle Euphrates region highlights the summer and winter seasons. In their presence, the emergence of the spring and autumn seasons decreases, as the month of October is often transitional between summer and winter, while the month of April is transitional from winter to summer. In general, temperatures often do not exceed the rates needed by agricultural crops, and do not fall below zero degrees Celsius, so that the growth of some agricultural crops is affected. As a result, the study area enjoys a long growing season for plants that allows the cultivation of different crops (Al-Jubouri, 2016, p. 250).

The hours of sunshine in the central Euphrates region range between 10.2 hours per day during January in the winter and 14.1 hours per day during the summer month of July. The study area is dominated by a lack of clouds and a relatively clear sky, that is, the sun's rays are mostly not

obscured, except for a few ineffective days, which helps in the cultivation of multiple crops (Al-Jubouri, 2016, p. 246).

The amounts of precipitation falling in the middle Euphrates region in winter, despite its relative scarcity, positively contribute to the irrigation of various agricultural crops, which contributes to enhancing other water sources. Humidity rates are relatively high in winter, and this benefits the soil and plants. The prevailing winds in the middle Euphrates region are northwest, followed by North wind (Al-Jubouri, 2016, p. 269).

2.5. Cities of the Middle Euphrates Region:

The Middle Euphrates Region includes 41 Iraqi cities of various administrative levels within the five governorates within which the region is located and distributed throughout the area of the region) Iraqi Central Statistical Organization, 2023(as in Map (4).
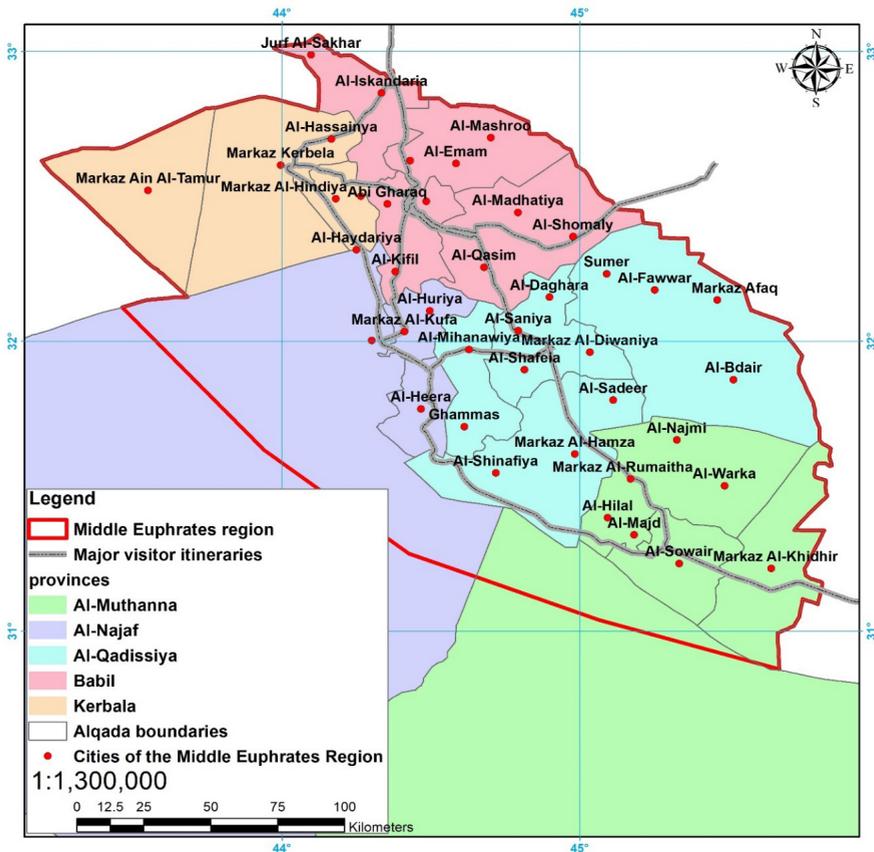
Map (4) Cities of the Middle Euphrates Region

Source: Researchers by GIS

2.6. Visitor itineraries:

The Arbaeen pilgrimage is one of the largest religious gatherings in the world, during which visitors go to the shrine of Imam Hussein, peace be upon him, in the holy city of Karbala, which is considered one of the most important Iraqi cities, The beginning of this event will be with the beginning of the second month in the Islamic Hijri

calendar and will continue until the 20th day of the same month. Most of the visitors are Iraqis, including quite a few foreigners from different countries. In 2019, approximately 21 million visitors participated in this ritual, Visitors start walking from the various Iraqi governorates passing through the Middle Euphrates region towards the holy city of Karbala (Soltani et al., 2021, p. 1), as in Map (5) which shows the Itineraries of visitors within the study area, as confirmed by (Lami et al., 2019, p. 3) and (Sadiq et al., 2016, p. 105).

Map (5) Itineraries of visitors through cities in the Middle Euphrates region

Source: Researchers by GIS

Therefore, it is necessary to work to reduce temperatures as much as possible in their itineraries, especially with the climate changes and high temperatures in recent years.

2.7. Green land uses:

The researcher determined the areas for green land uses in the Middle Euphrates region, based on geographic information systems programs and on Landsat 9 satellite images, which were taken in the fourth month of 2023, and through the Normalized Difference Vegetation Index (NDVI), which adopts the following equation: (Yasin et al., 2022, p. 5)

$$NDVI = (NIR - RED) / (NIR + RED)$$

NDVI : Normalized Difference Vegetation Index

NIR : mean light reflected in the near-infrared spectrum

RED : mean light reflected in the red range of the spectrum

Normalized Difference Vegetation Index "is equal to the difference in the intensities of reflected light in the red and infrared range divided by the sum of these intensities" As in Figure (1).
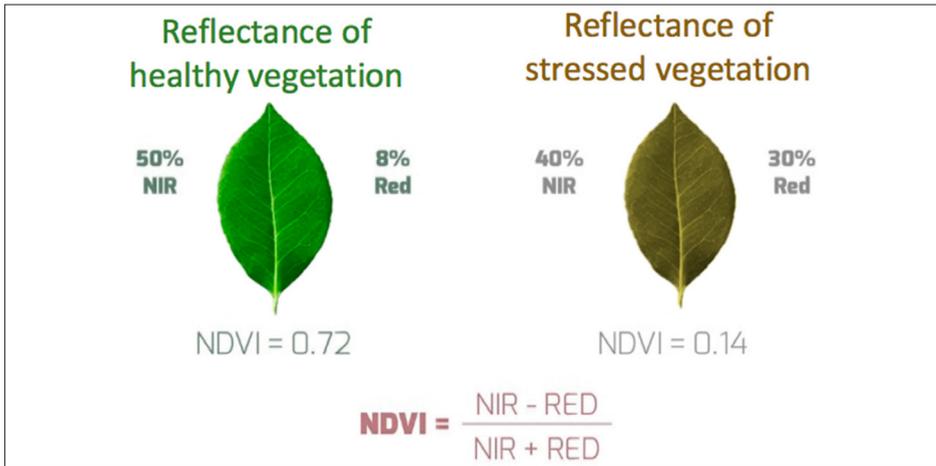
Figure (1) The difference between a healthy and an stressed plant for (NDVI)

Source: (Loures et al., 2020, p. 2)

NDVI values are between (-1) and (1), negative values indicate clouds, snow and water, negative values close to zero indicate rock and bare soil, small positive values (0.1 or less) indicate free land areas that consist of rock Or sand, medium values (0.2) to (0.3) refer to small shrubs and grassy plantations, large values (0.6) to (0.8) refer to farms, orchards and forests (Zhao et al., 2023, p. 4).

It was found that the area of green land uses in the Middle Euphrates region is approximately (991 km2), which represents 30.33% of the total area of the study area, and it is distributed within the region as in Map (6).
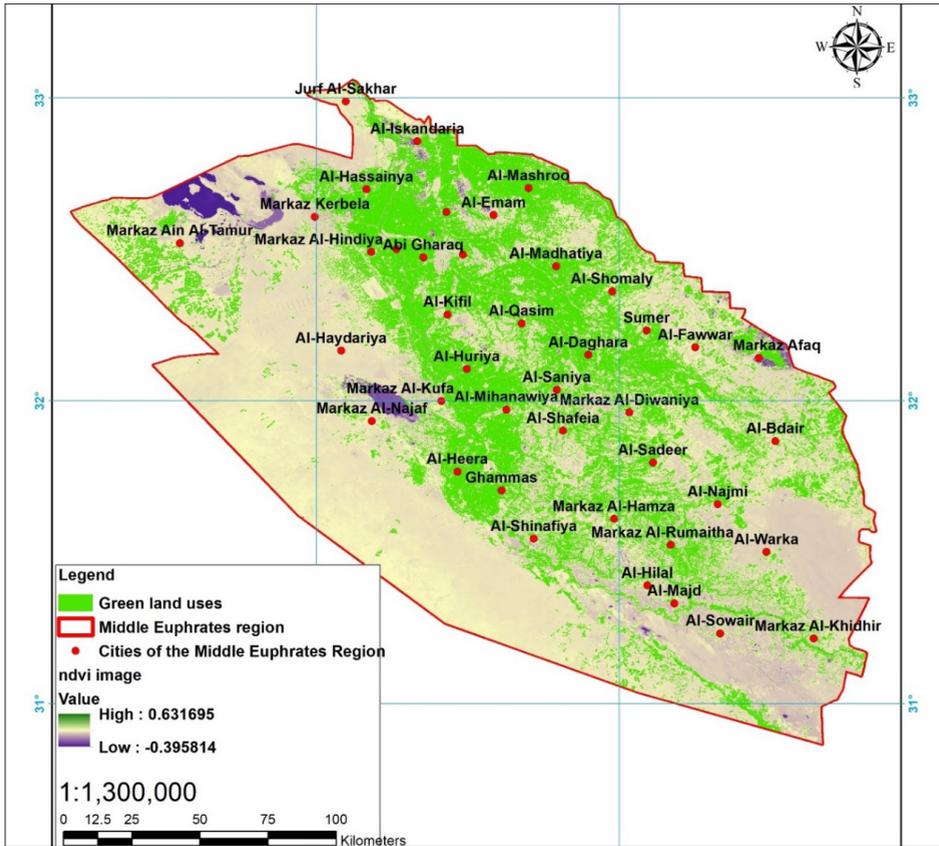
Map (6) Green land uses according to NVDI

Source: Researchers by GIS

By conducting a comparison between the types of soil, the presence of surface water sources, and the distribution of green land uses, as in Map (7), it is clear that the green land uses are concentrated near and along the Euphrates River within the middle Euphrates region, and within the area of land with clay loam soil mainly.

It also seems clear that there are few farms in the southwestern parts of the region towards the western desert of the country near

the center of Ain al-Tamr and in the south of the cities of As-Sawir and Al-Majd, where the official and governmental agencies in Iraq have begun to invest in these areas with agricultural projects for environmental and economic purposes.

Where it overcame the limitations in these sites such as soil type and the lack of nearby surface water sources by using scientific means and methods in agriculture and relying on groundwater, and as a result it contributed to stabilizing the soil, enhancing the environment, and employing manpower, in addition to many other benefits of these projects in these areas.
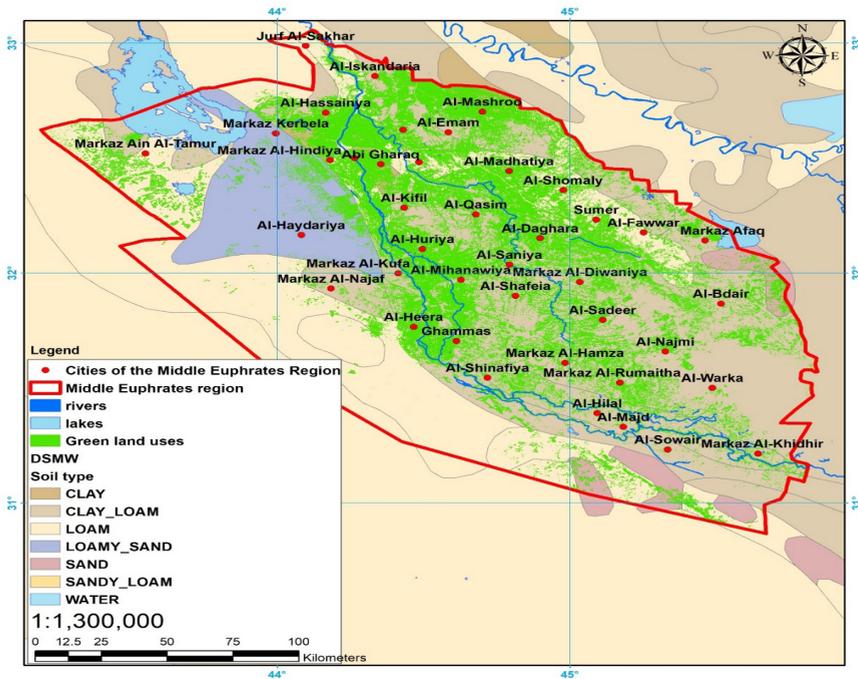

Map (7) Comparison of soil types, presence of surface water sources, and distribution of green land uses

Source: Researchers by GIS

2.8. Land Surface Temperature:

For the purpose of identifying the effect of green areas on reducing temperatures within the study area, the researcher made a map of the Earth's surface temperatures based on satellite images of the Landsat 8 satellite that were taken in the eighth month of 2022, that is, at the height of the summer season.

Where after downloading these satellite images, several operations are carried out on them, starting with converting their numerical values into spectral radiation, then the satellite temperature is extracted from the spectral radiation, after which the vegetation cover is extracted to determine the emission from the surface of the earth, and this is a series of operations to finally reach the temperature of the surface of the earth Which is extracted in Kelvin and then converted to the Celsius unit (Fayshal et al., 2023, pp. 5–6), Where the researcher applied these steps based on geographic information systems (Arc map), as the results were as shown in Map (8).
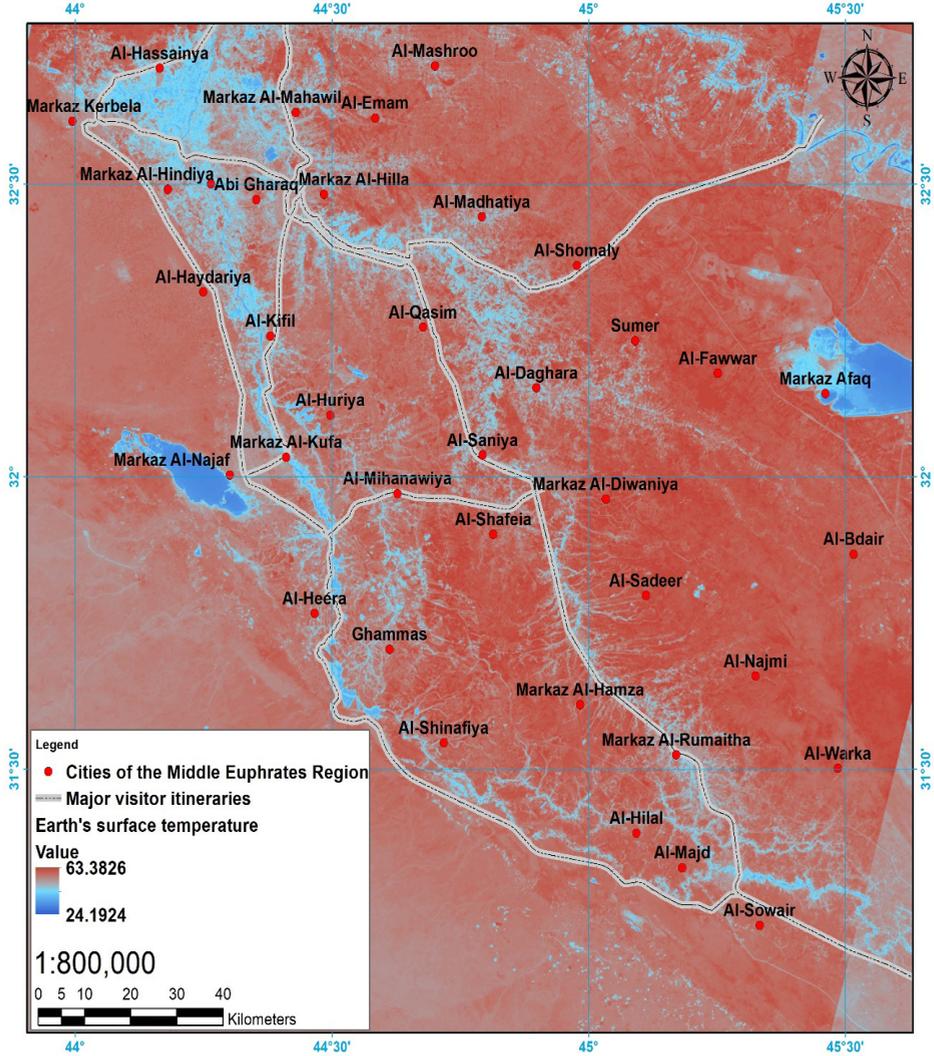
Map (8) Land Surface Temperature

Source: Researchers by GIS

Where it is clear that the temperature of the earth's surface decreases in the areas that contain green areas, as the temperature of the earth's surface in the center of the city of Hilla, for example, was 38 degrees Celsius, while the temperature in its surroundings between it and the city of Abi Gharaq was 32 degrees Celsius, at the same time it was The surface temperature of the earth in the city of Karbala is 40 degrees Celsius, and the difference between the temperatures of the two cities of Hilla and Karbala is due to the northwesterly winds and the fact that the city of Karbala is bordered by the desert and open lands from the northwest, the surface temperature of the earth is higher than that of the city of Hilla, which is located within the surrounding agricultural areas It is located in all directions, and therefore the winds, before reaching the city of Hilla, pass through the green and agricultural areas, so they work to cool them down, which in turn reduces the temperature of the city.

All of this is reflected in the itineraries of visitors, and therefore the itineraries near which the green areas are located have lower temperatures compared to the itineraries that are far from the green areas. For example, the temperature in the visitors' itineraries that connects Markaz Al-Diwaniyah with Markaz Al-Hilla, specifically in the city of Al-Qasim, reached 40 degrees Celsius. While the temperature dropped on the same track before entering the city of Hilla, specifically in the agricultural area on the outskirts of the city, to 34 degrees Celsius. Therefore, the difference between the two points in the same itinerary in temperature was 6 degrees Celsius, and this difference is due to the presence of green areas.

Conclusions:

1. The abundance of water within the study area, where the Euphrates River with its branches provides an important source of water, reinforced by the presence of groundwater.

2. The soil in the study area is suitable for cultivation, whether it is clay or sandy.

3. The climate within the study area promotes agriculture and helps grow a variety of crops.

4. The study area includes many cities (41) in addition to some villages that provide labor (farmers), and the cities represent the market that consumes agricultural products.

5. Green areas represent 30.33% of the study area with an area of 991 square kilometers

6. Adopting modern technologies in agriculture and irrigation enables us to cultivate land that is not suitable in one way or another for cultivation, whether the soil is not suitable, whether due to the distance of water sources or others.

7. The difference in earth surface temperatures between green and uncultivated areas reaches 10 degrees Celsius

8. Cultivated green areas that are in the path of the winds before entering the cities cool the winds and thus reduce the temperatures in the cities.

9. Itineraries of visitors when entering agricultural areas where temperatures drop and become more comfortable.

Recommendations:

1. Supporting agriculture and farmers because of its economic, environmental and recreational benefits

2. Work to establish green belts, especially for the cities bordering the Western Desert

3. Supporting agricultural projects in the Western Desert

4. Selecting the types of plants and crops according to scientific studies before giving official approvals

5. Cultivating types of plants of high economic value that can have a suitable environment

6. Work on afforestation of visitors' Itineraries because of its environmental benefits and because it reduces temperatures and provides appropriate shade in addition to other benefits

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