University of Baghdad
College of Engineering
JE JOURNAL OF ENGINEERING

Journal of Engineering
journal homepage: www.jcoeng.edu.iq

Volume 30 Number 8 August 2024

Effect of Climate Change on Land Cover (Case study: Hilla District)

Zubaida Rifaat Talib*, **Suaad Jaber Laffta**

Center for Urban and Regional Planning for Post Graduate Studies, University of Baghdad, Baghdad, Iraq

ABSTRACT

Climate change poses a global challenge with profound repercussions on land cover, particularly affecting areas like Iraq due to decreased rainfall, rising temperatures, desertification, vegetation loss, and reduced river tiers attributable to weather change. This study investigates the impact of climate change on land cover in the Al-Hillah district of Babil province, Iraq, using remote sensing data and satellite imagery from Landsat 5 and 8 through the website of the US Geological Survey from 1995 to 2021. ArcMap 10.8 software program was employed to analyze and visualize these changes. The Al-Hillah district spans an area of 878 km^2, encompassing built-up areas, agriculture areas, desert land, wetlands, and river surface areas. The analysis involved Landsat satellite imagery for 1999, 2015, and 2021. The findings display that Hilla District has skilled the outcomes of climate change, primarily manifested in the expansion of desert areas. In 1999, barren land covered 93 km^2. It had increased to 183 square kilometers, resulting in rising temperatures and decreased rainfall about 2 degrees below the overall common. It has brought about a reduction in vegetation cover in an area of 196 square kilometers, compared to the year 1999 covered 45.6%.

Keywords: Land Use Land Cover (LULC), Climate change, Barren land.

1. INTRODUCTION

Global warming is one of the most pressing issues humanity has faced in the past years, and the result of human activities that release large amounts of greenhouse gasses (water vapor, carbon dioxide, methane, nitrous oxide, Ozone, and CFC) into the Earth's atmosphere and the use of fossil energy **(Ali and Najemaden, 2021)**, Based on that, climate change began, especially greenhouse problem gas emissions into the atmosphere **(Rashid et al., 2023)**, cause of great concern around the world in many aspects of the ecosystem in the world and investigate their effects **(Hasan and Abed, 2024)**, which is currently facing the world and Iraq in particular; one of its effects is the lack of green spaces, irregular water supply, and health **(Nations, 2015)**, Changing climate is having a significant impact on water resource

*Corresponding author
Peer review under the responsibility of University of Baghdad.
https://doi.org/10.31026/j.eng.2024.08.09

Article received: 27/09/2023
Article revised: 10/03/2024
Article accepted: 17/03/2024
Article published: 01/08/2024

estimates and quality and quantity in the future **(AL-Rikabi and Abed, 2021)**, these are the effects of drought, which is most closely related to desertification, as drought varies from region to region according to the extent of precipitation **(Moussa and Alwehab, 2022)** and that urban construction increase temperatures above the surrounding rural and suburban areas **(Badai, 2023)**. Climate change is one of the most formidable global challenges, with profound implications for the Earth's ecosystems. Among its myriad outcomes, climate change has a massive effect on land cover, encompassing each of the bodily and biological functions of the planet's surface **(Fick and Hijmans, 2017)**. Land cover alterations precipitated through converting climate styles have some distance-accomplishing ecological, socio-economic, and environmental repercussions. This advent explores the multifaceted effects of climate alternations on land cover, highlighting shifts in vegetation, land use, and land degradation, which affect ecosystems, biodiversity, agriculture, water assets, and human livelihoods **(Erb et al., 2018)**. The Babylon province suffers from an increase inside the urban place compared to the open and agricultural lands. This increases greenhouse gas emissions from burning fossil fuels used in electricity generation, production, transportation, industrialization, home heating, urban landfills, cement production, etc. **(Khalaf, 2018)**. Remote sensing and geographic information systems are among the most influential technologies in various scientific applications, providing valuable data sets and a comprehensive view of the Earth's surface.

Moreover, this system combines remote sensing data with the ability to process and analyze geospatial data in a data bank management system, which can update, store, process and modify this data **(Aparna et al., 2014)** to know the change in land cover area. Therefore, it can be used for evaluation **(Sholihah et al., 2016).** This work addresses some previous studies that dealt with the concept of land cover from different aspects, as follows: In general, Babylon is witnessing noticeable changes in temperature and climate, especially in recent years. For this reason, many researchers focused on desertification in this city **(Al-Shujairy et al., 2021)**. It aims to study the efficiency of drought monitoring indicators. Standardized Precipitation Index (SPI) and Normalized Difference Water Index (NDWI) for spatial description of drought conditions in Babil Governorate from 1980-2016. The results confirmed that using the NDWI and SPI supported meteorological indicators in detecting and monitoring the intensity and intensity of the drought impact. **(Shamki, 2018)** studied the environmental impact of climate drought in the Babylon region and ways to mitigate it. The region has a desert climate, so the study used the demarton index. This showed an average rainfall of 0.290. Then the changes in drought severity, the researchers used the Lange coefficient, which was 0.300. These changes were linked to shifts in the area of farmland and a notable increase in the slopes of the Hilla region, indicating a clear connection between these factors and climate conditions.

Climate change effects on land cover are crucial for making informed decisions, this issue has many different aspects that need to be considered then by studying these complex effects, we can better prepare for the changes ahead and make choices that benefit the environment. **(Himanshu et al., 2015)**. It is essential to improve powerful techniques for each mitigation and adaptation **(IPCC, 2014).** These strategies forestation, innovative planning for land use, sustainable agricultural policy, and the creation of climate resilient infrastructure, to treatment the global posed through weather alternate and minimize its detrimental consequences on land cover, fostering international cooperation is vital, thereby safeguarding the ecosystems and human societies from the comprehensive influences of a climate change **(Reyers et al., 2015)**.

In precis, land cover changes can impact increased temperatures and be stricken by rainfall affected circumstances, the interactions are complex and can be stimulated through It plays an important position in the improvement of powerful techniques for each mitigation and adaptation **(IPCC, 2014)**. These results have extensive implications for ecosystems, agriculture, and water assets. Therefore, studying land cover change and knowing how affected is important to study climate science and environmental studies.

This research aims to determine the extent to which the land cover in Hilla district is affected by the phenomenon of climate change and to identify and analyse the reasons behind this impact on the environmental systems present in the district.

2. THE STUDY AREA

Babil governorate is located in southern Baghdad, about 100 km from the Baghdad center. Its area is about 5119 km^2, constituting 2% of the total area of Iraq. It is one of the provinces of the Middle Euphrates (Najaf, Karbala, Babel, Qadisiya, Wasit). It is located between latitudes 32.7 and 33.8 north and between longitudes 43.42 and 45.50 east **(Habitat, 2016)** as **Fig. 1** shows the boundaries and location of Babil province relative to Iraq.

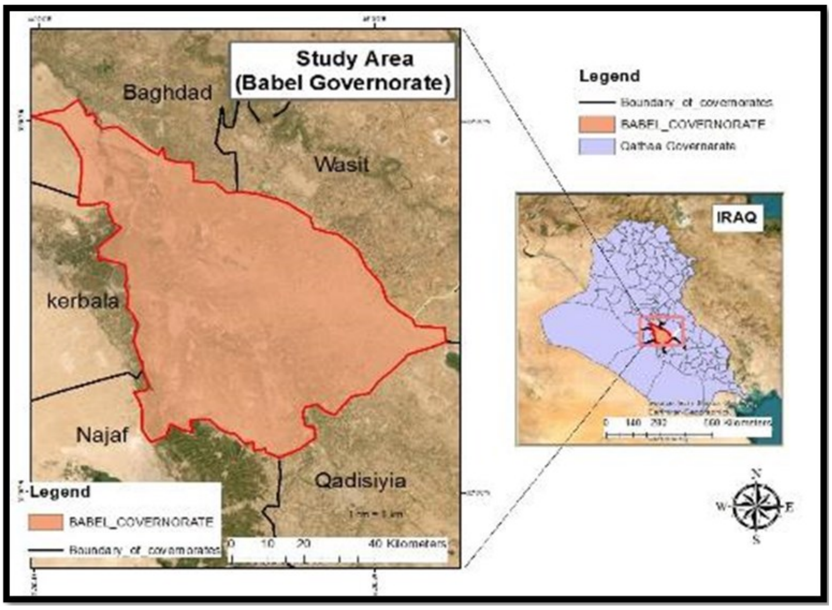

Figure1. Location of the study area Babylon province. (ArcMap 10.8)

The climate of Babil province is a hot desert, with a low rain rate between 50-200 mm. It is characterized by a very high temperature difference between day and night, summer and winter, ranging between 45-50 °C in the summer **(Al-Shabender et al., 2010)**. Because Hilla district is the center of the governorate and as a result of population concentration and urban expansion, it was chosen for study to determine the extent to which it is affected by the climate change phenomenon through land cover analysis.

3. METHODOLOGY

3.1 Data Collection

The data changed to obtaining satellite imagery from Landsat 5 and 8 through the website of the US Geological Survey **(USGS, 1973)**. These images have been applied to achieve the study goals during this period. Three distinctive time years, particularly 1999, 2010, and 2021, had been decided on for image acquisition. The digital satellite image projection used was WGS84 UTM_38N. These satellites were processed to estimate the land cover (LULC) **(Al-Shabender et al., 2012)** of Hilla district maps. In addition, temperature and precipitation data were computed using meteorological data **(Ministry of Transportation, 2023)**.

3.2 Land Cover Classification

Land cover classification is the systematic categorization of the surface of the Earth into distinct categories, taking into account factors such as physical materials, land use, vegetation, and other similar traits found within a specific geographical area **(Lillesand et al., 2015**; **Suharyanto et al., 2023)**. This classification is basic for remote sensing, geographic information systems (GIS), and environmental monitoring. **(Jensen and Everett, 1994).** As connected to development and urban planning, environmental planning, the management of natural resources and so on are all possible by understanding knowledge from LULC data **(Mahdi, 2022).** The steps involved in classifying land cover can be obtained. The supervised classification method was implemented in style with this category change, using the Maximum Likelihood Classification tool **(Lu and Weng, 2007)**. What separates each training sample's spectral response from the others is measured in both magnitude and direction, The digital satellite imagery from Landsat 5 and 8 was classified into verification layers within the study area to reveal the land cover patterns selected through various sources, including field surveys and satellite maps, to apply the guided classification process to the chosen land cover patterns **(Wang et al., 2013).**The land cover areas of Hilla district were calculated, and their ratio to the total area of the study area through the supervised classification method and for four indicators: vegetation cover, desert areas, built-up areas, surface area of rivers and wetlands, as accuracy in the samples was adopted through the use of more than 60 samples for each, in the classification of the indications depends on google earth engine and google earth pro and each classification has a band as shown in **Tables 1 and 2.** The Landsat 5 and 8 bands are presented **(Xiong et al., 2017).**

Table 1. Bands of Landsat 5 **(USGS, 1973)**

Landsat 5	Wavelength(μm)	Resolution (m)
Band1- Blue	0.45-0.52	30
Band 2 – Green	0.52-0.60	30
Band 3- Red	0.63-0.69	30
Band 4-Near Infrared (NIR)	0.76-0.90	30
Band5-Shortwave infrared	1.55- 1.75	30
Band6 - Thermal	10.40-12.50	30
Band7Mid-infrared	2.08-2.35	30

Table 2. Bands of Landsat 8 **(USGS, 1973)**

Landsat8	Wavelength (μm)	Resolution (m)
Band1- Costal aerosol	0.43-0.45	30
Band 2 – Blue	0.45-0.51	30
Band 3- Green	0.53-0.59	30
Band 4 – Red	0.64-0.67	30
Band 5- Near Infrared (NIR)	0.85-0.88	30
Band 6 – Shortwave infrared	1.57-1.65	30
Band7- SWIR	2.11-2.29	30

4. RESULTS AND DISCUSSION

4.1 First period(2005-1995)

Data was acquired from the meteorological station placed within the Hilla district. This statistic explains and sets up the connection among climatic elements, mainly temperature and rainfall. The findings illustrate a noteworthy correlation between those climatic factors and the volume of vegetation within. Fig. 2 shows the high temperature, and Fig. 3 shows the low rainfall in the case study. There may be a discernible increase coupled with a reduction in rainfall.

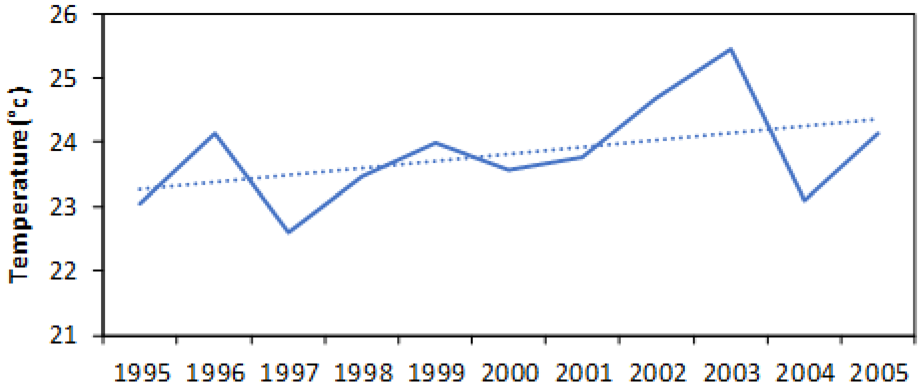

Figure 2. The temperature trend for the period 1995-2005

These increased temperature situations have consequently expanded barren land areas even as concurrently decreased the overall vegetation inside the district. Land cover was calculated using the Maximum likelihood class for 1999 and exported to a map in Fig. 4 illustrating the classification of Land cover in Hilla District using the ArcGIS 10.8 program. the vegetation area was 400 km^2 from the area of District 878 km^2 or 45.6%. Therefore, the barren land area was 93 km^2 or 10.6%, the built-up area was 369 km2 or 42%, and the surface area of wetlands and water bodies was 16 km^2 or 1.8%.

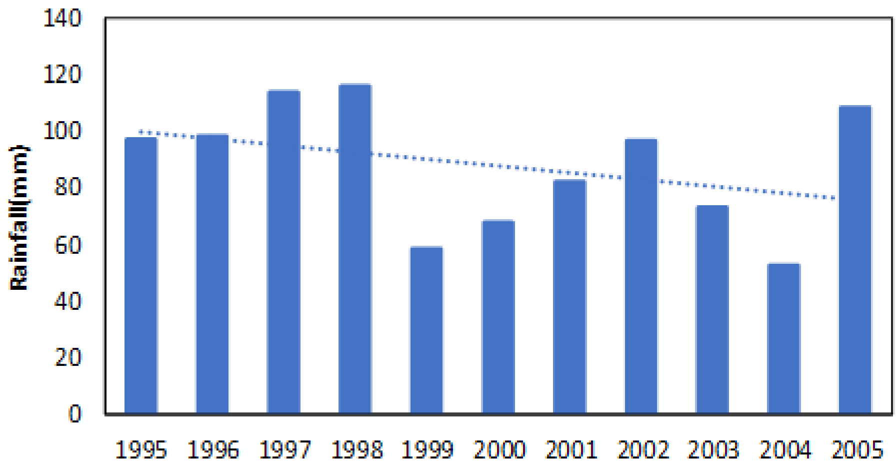

Figure 3. The Rainfall trend for the period 1995-2005

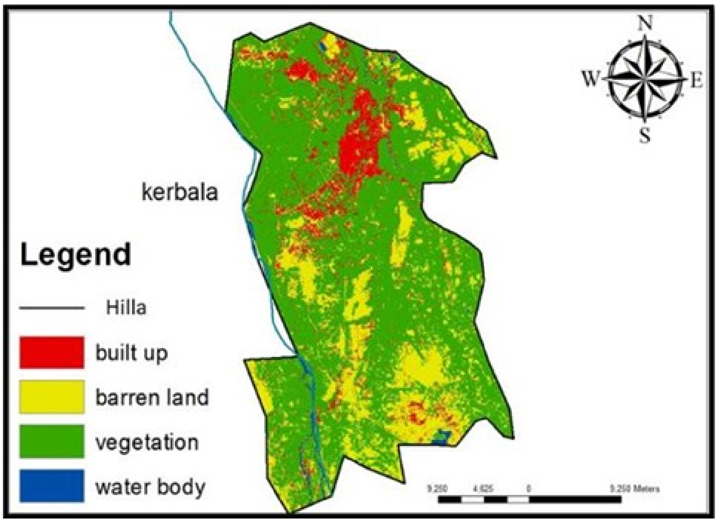

Figure 4. The Land Cover of Hilla District for the year 1999 **(Arc map 10.8)**

Table 3. Area and Percentage of the LULC for the study area in 1999

Classification	Area(km^2)	Percentage %
Vegetation	400	45.6
Built-up	369	42
Barren land	93	10.6
Waterbody	16	1.8

4.2 Second Period (2006-2015)

Data for 2006–2015 were collected from the climatic station in Hilla District of the Department of Meteorology and clarified the relationship between the climatic factors, temperature, and rainfall. The relationship with the vegetation cover area showed a general rise in temperature with a decrease in the amount of rain, as shown in **Figs. 5 and 6**. The high degree of temperatures increases the area of barren lands in the region due to soil erosion, scraping of agricultural lands, and overgrazing.
Land cover was calculated using Maximum likelihood classification for 2010 and exported to a map in **Fig. 7** using ArcGIS 10.8 software. The vegetation cover area was 286 km^2 from District 878 km^2 or 31%. Therefore, the barren land area was 130 km^2 or 14.8%, the built-up area was 470 km^2 or 53.5%, and the surface area of wetlands and water bodies was 10 km^2 or 1.13%.

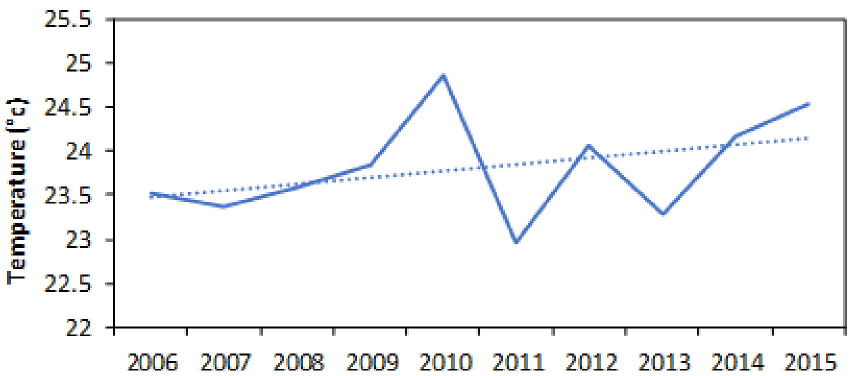

Figure 5. The temperature trend for the period 2006-2015

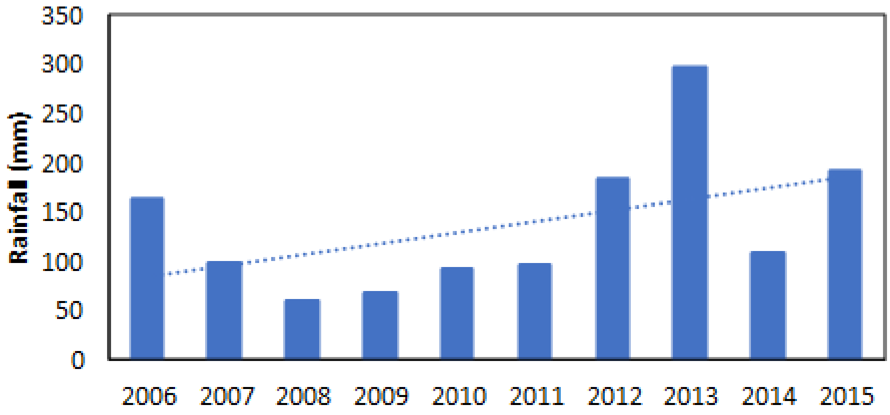

Figure 6. The Rainfall trend for the period 2006-2015

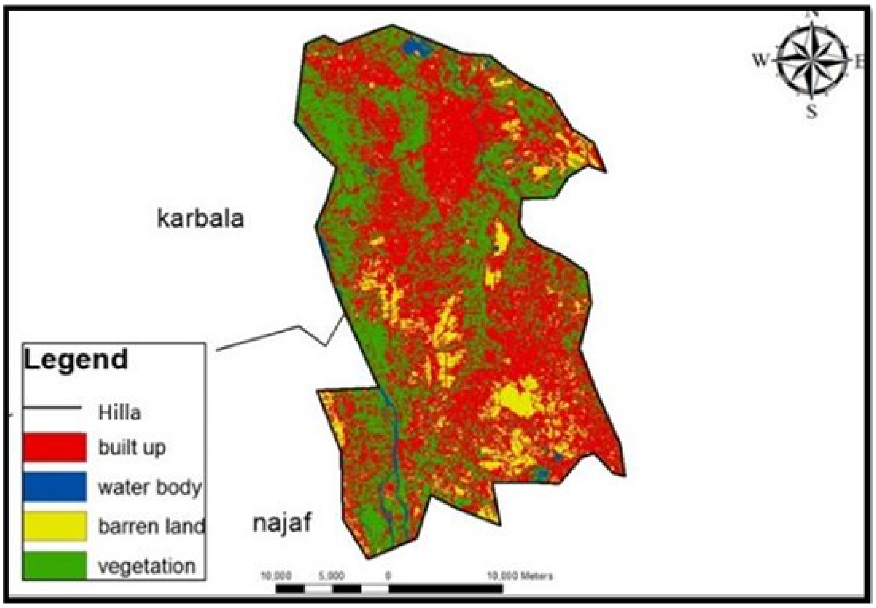

Figure 7. The Land Cover of Hilla District for the year of 2010 **(Arc map 10.8)**

Table 4. Area and Percentage of the LULC for the study area in 2010

Classification	Area (km^2)	Percentage %
Vegetation	286	31
Built-up	470	53.5
Barren land	130	14.8
Waterbody	10	1.13

4.3 Third Period (2016-2021)

Data for 2016-2021 was collected from the climatic station located in Hilla District, Department of Meteorology. The data was used to clarify and indicate the relationship between the climatic elements: temperature and rainfall. The relationship with the vegetation cover area showed a general rise in temperature with a decrease in the amount of rainfall, as shown in **Figs. 8 and 9** illustrated the contributed degree of temperatures to decreased vegetation cover area in the district.

Land cover was calculated using Maximum likelihood classification for 2021 and exported to a map in **Fig.10** showing the classification of Land cover using ArcGIS 10.8 software. the vegetation cover area was 196 km^2 from the area of District 878 km^2 or 22%. Therefore, the barren land area was 183 km^2 or 21%, the built-up area was 490 km^2 or 56%, and the surface area of wetlands and water bodies was 7 km^2 or 1.02%. The relationship between land cover, temperature, and rainfall is complex and can vary depending on several factors, including local climate, geography, and land management practices. However, some general cause-and-effect relationships can be identified:

Firstly, land cover change and increased temperature are closely linked. When natural land cover, such as forests or grasslands, is replaced by areas or agriculture (deforestation), it often decreases the land's reflectivity (albedo). This means that urban surfaces like concrete and asphalt absorb radiation, leading to higher temperatures, especially noticeable in cities due to the urban heat island effect. Additionally, changes in land cover can have an impact on microclimates. For example, removing vegetation reduces the cooling effect of evapotranspiration. The process through which water evaporates from plants and soil. Consequently, this can cause temperatures to rise in the areas.

Secondly, land cover change also influences rainfall patterns. Deforestation and loss of vegetation significantly reduce the release of moisture into the atmosphere via transpiration and evaporation (evapotranspiration). As a result, cloud formation is hindered, potentially leading to decreased rainfall in cases. Furthermore, alterations in land cover can disrupt wind patterns. This disruption has implications for rainfall distribution as well. Urban areas with buildings obstruct wind flow. It may affect how rainfall is distributed downwind.

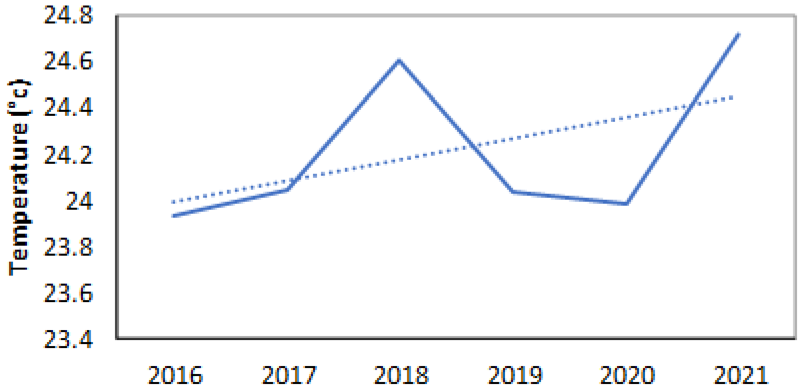

Figure 8. The temperature trend for the period 2016-2021

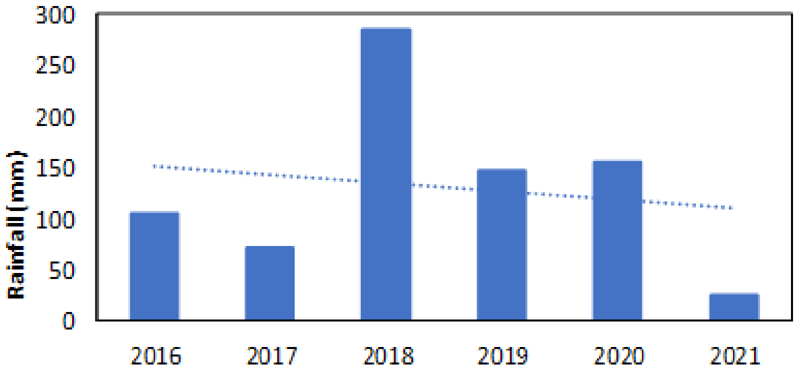

Figure 9. The Rainfall trend for the period 2016-2021

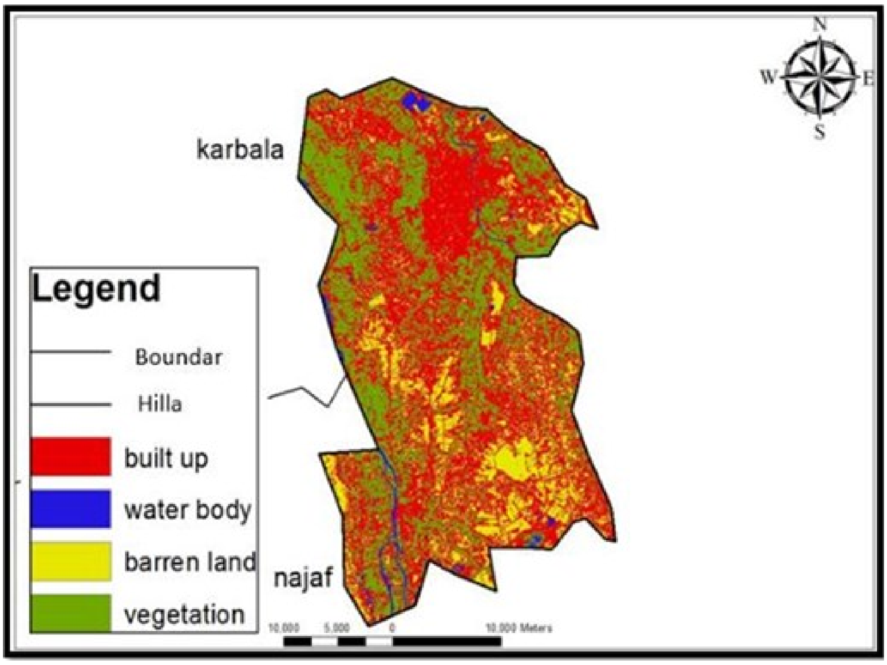

Figure 10. The Land Cover of Hilla District for the year 2021 **(Arc map 10.8)**

Table 5. Area and Percentage of the LULC for the study area in 2021

Classification	Area (km^2)	Percentage %
Vegetation	196	22
Built-up	490	56
Barren land	183	21
Waterbody	7	1.02

5. CONCLUSIONS

After analyzing the Land Cover (LULC) of Hilla District using remote sensing techniques for 1995, 2015, and 2021, the result concludes. The study area suffered from a decreased area of vegetation during the period from 1999 to 2021, as noticed whenever in 2021, vegetation area of 196 km^2 of 22%, an area of built-up of 490 km^2 of 56%, and an area of Barren land is 183 km^2. In 2015, the area of vegetation was about 286 km^2, and the area of Barren Land was 130 km^2 by 14.8%. As for the area of built-up area, it increased to 470 km^2. Then, in 2021, there was an increase in the area of Barren land in an area of 183 km^2, and the area of Bult-up increased to 490 km^2, and the area of vegetation was 196 km^2 by 22%. This change in land cover spaces is because increased human pressure on the land area through increased built-up area can lead to the destruction of agricultural areas and degradation of the landscape. Furthermore, increased water use for agricultural, industrial and personal purposes can reduce the water sources available to plants and exacerbate the problem of drought. Then, the vegetation cover and increasing its area play a significant role in lowering temperatures, and some plants also contribute to absorbing greenhouse gases. Additionally, Changes in rainfall patterns and rising temperatures play an important role in the depletion of vegetation cover and increasing the area of barren lands. The increase in temperatures and the disruption of rainfall can lead to the expansion of deserts and the emergence of barren lands.

Acknowledgements

This work was supported by the (Center of Urban and Regional planning for postgraduate, University of Baghdad), by the Project name (effect of Climate Change on Land Cover Case Study: Hilla District).

Credit Authorship Contribution Statement

Zubaida Rifaat: Writing, Dr. Suaad Jaber: review & editing, Writing – original draft, Validation, Software, Methodology.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES

Ali, S. H., and Najemaden, M. A. 2021. Spatial analysis of the CO emission from Nineveh Governorate using remote sensing techniques and GIS. *Iraqi Journal of Science,* pp.4503-4517. https://doi.org/10.24996/ijs.2021.62.11(SI).30

AL-Khateeb, S.T. and Sinjari, A.M., 2023. Design, Construction, and control tracking of solar thermal concentrator by using PLC in Erbil. *Journal of Engineering*, *29*(3), pp.40-62. https://doi.org/10.31026/j.eng.2023.03.04.

Al-Ansari, N., 2013. Management of water resources in Iraq: perspectives and prognoses. *Engineering*, *5*(6), pp.667-684. https://doi.org/10.4236/eng.2013.58080

Al-Rikabi, W.J. and Abed, B.S., 2021. Improvement of the hydrodynamic behavior and water quality assessment of Al-Chibayish Marshes, Iraq. *Journal of Engineering*, *27*(12), pp.50-68. https://doi.org/10.31026/j.eng.2021.12.05.

Al-Shabender., Sabah M., Wali., Majeed K., Noori., Hassan A., 2012. Structure Plan for Babylon Governorate, General Directorate of Urban Planning, Baghdad.

Al-Shabender., Sabah. M., Wali., Majeed. K., Noori., Hassan. A., 2010. Structure Plan for Babylon Governorate, General Directorate of Urban Planning, Baghdad

Al-Shujairy, Q.A., Al-Hedny, S. and Al-Barakat, H., 2021, April. Evaluation of dryness conditions in Babylon governorate using the Standardized Precipitation Index (SPI) and the Normalized Difference Water Index (NDWI). In *IOP conference series: earth and environmental science* (Vol. 722, No. 1, p. 012032). Https://doi.org/10.1088/1755-1315/722/1/012032.

Ali, Z.R. and Muhaimeed, A.S., 2016. The study of temporal changes on land cover/land use prevailing in Baghdad governorate using RS & GIS. *The Iraqi Journal of Agricultural Sciences*, *47*(3), pp.846-855. https://doi.org/10.36103/ijas.v47i3.576

Aparna, N., Ramani, A.V. and Nagaraja, R., 2014. Risk management support through India Remote Sensing Satellites. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *40*, pp.1-6. https://doi.org/10.5194/isprsarchives-XL-8-1-2014

Badai, A., 2023. Independent Thermal network through thermal synergy between four architectural units. *Journal of Engineering*, *29*(7), pp.1-17. https://doi.org/10.31026/j.eng.2023.07.01

Di Gregorio, A., 2005. Land cover classification system: classification concepts and user manual: LCCS (Vol. 2). *Food & Agriculture Org.*

Ebrahimi, M., Matkan, A.A. and Darvishzadeh, R., 2010. *Remote sensing for drought assessment in arid regions (a case study of central part of Iran," shirkooh-yazd")*.

Erb, K.H., Kastner, T., Plutzar, C., Bais, A.L.S., Carvalhais, N., Fetzel, T., Gingrich, S., Haberl, H., Lauk, C., Niedertscheider, M. and Pongratz, J., 2018. Unexpectedly large impact of forest management and grazing on global vegetation biomass. *Nature*, *553*(7686), pp. 73-76. https://doi.org/10.1038/nature25138.

Faqe Ibrahim, G.R., 2017. Urban land use land cover changes and their effect on land surface temperature: Case study using Dohuk City in the Kurdistan Region of Iraq. *Climate*, *5*(1), P. 13. https://doi.org/10.3390/cli5010013

Fick, S.E. and Hijmans, R.J., 2017. WorldClim 2: new 1-km spatial resolution climate surfaces for global land areas. *International Journal of Climatology*, *37*(12), pp. 4302-4315. https://doi.org/10.1002/joc.5086

Habitat, U., 2016. Urban Crises Charter. Global Alliance for Urban Crises

Himanshu, S.K., Singh, G. and Kharola, N., 2015. Monitoring of drought using satellite data. International Research Journal of Earth Sciences, 3(1), pp. 66-72.

Hasan, B.F. and Abed, B.S., 2024. Assessment of climate change impact on water productivity and yield of wheat cultivated using developed seasonal schedule irrigation in Euphrates basin. In AIP Conference Proceedings (Vol. 2864, No. 1). https://doi.org/10.1063/5.0186954

IPCC, "Annex II: Glossary," In Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, pp. 113-130.

Jensen, M.E., Bourgeron, P., Everett, R.L. and Leader, A.T., 1994. Volume II: ecosystem management: principles and applications. *Gen. Tech. Rep. PNW-GTR-318. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station*. https://doi.org/10.2737/PNW-GTR-318.

Khalaf, Alaa Ghadhban,2018. Spatial analysis of desertification phenomenon in Karbala area by using geographic information system, *M.Sc. thesis*, *Building and construction engineering department, University of Technology.*

Lillesand, T., Kiefer, R.W. and Chipman, J., 2015. Remote sensing and image interpretation. *John Wiley & Sons*. https://doi.org/10.4236/ojg.2018.82011.

Lu D., Weng Q. A., 2007. A survey of image classification methods and techniques for improving classification performance. *International Journal of Remote Sensing.* 28(5), pp. 823-870. https://doi.org/10.1080/01431160600746456

Marx, W., Haunschild, R., Thor, A. and Bornmann, L., 2017. Which early works are cited most frequently in climate change research literature? A bibliometric approach based on reference publication year spectroscopy. *Scientometrics*, *110*, pp. 335-353. https://doi.org/10.1007/s11192-016-2177-x

Mahdi, A.S., 2022. The land use and land cover classification on the urban area. *Iraqi Journal of Science*, pp. 4609-4619. https://doi.org/10.24996/ijs.2022.63.10.42

Ministry of Transportation, Iraqi Meteorological Organization and Seismology, Climate Center and Research Science, 2023. data of climate, unpublished data, Baghdad.

Moussa, Y.K. and Alwehab, A.A., 2022. The urban expansion impact on climate change for the city of Baghdad. *Iraqi Journal of Science*, pp.5072-5085. https://doi.org/10.24996/ijs.2022.63.11.41

Murshed, M. and Saadat, S.Y., 2018. Effects of urbanization on climate change: evidence from Bangladesh. *Journal of Natural Sciences Research*, *8*, pp.1-8.

Nations, U., 2015. Transforming our world: The 2030 agenda for sustainable development. New York: United Nations, Department of Economic and Social Affairs, 1, P.41.

Rashid, M.R., 2023. Climate Change: causes, impacts, and strategies for a sustainable future. https://doi.org/10.20944/preprints202312.1729.v1

Reyers, B., Nel, J.L., O'Farrell, P.J., Sitas, N. and Nel, D.C., 2015. Navigating complexity through knowledge coproduction: Mainstreaming ecosystem services into disaster risk reduction. *Proceedings of the National Academy of Sciences*, *112*(24), pp. 7362-7368. https://doi.org/10.1073/pnas.1414374112

Shamki, A. I. 2018. The environmental impact of the drought phenomenon in Babil Governorate and the potential for reducing it. *Basic Education College Magazine for Educational and Humanities Sciences*, (38), pp. 1040-1057.

Sholihah, R.I., Trisasongko, B.H., Shiddiq, D., La Ode, S.I., Kusdaryanto, S. and Panuju, D.R., 2016. Identification of agricultural drought extent based on vegetation health indices of landsat data: case of Subang and Karawang, Indonesia. *Procedia Environmental Sciences*, *33*, pp. 14-20. https://doi.org/10.1016/j.proenv.2016.03.051

Shaw, R., 2023. Integrated and inclusive natural hazards risk reduction & management: training of trainers. *UNESCO Publishing*.

Suharyanto, A., Maulana, A., Suprayogo, D., Devia, Y.P. and Kurniawan, S., 2023. Land surface temperature changes caused by land cover/land use properties and their impact on rainfall characteristics. *Global Journal of Environmental Science and Management*, *9*(3), pp. 353-372. https://doi.org/10.22034/gjesm.2023.03.01

United States, Geological Survey, 1973, Science for a changing world.

Wang, P., Zhang, L., Yang, W., Liu, D., and Zhang, Y. 2013. Land cover classification using time series of Landsat TM/ETM+ imagery, *Journal of Remote Sensing*, Vol.6, pp. 550-558.

Xiong, J., Thenkabail, P.S., Gumma, M.K., Teluguntla, P., Poehnelt, J., Congalton, R.G., Yadav, K. and Thau, D., 2017. Automated cropland mapping of continental Africa using Google Earth Engine cloud computing. *ISPRS Journal of Photogrammetry and Remote Sensing*, *126*, pp. 225-244 https://doi.org/10.1016/j.isprsjprs.2017.01.019

Yamanoshita, M., 2019. IPCC special report on climate change and land. *Institute for Global Environmental Strategies*.

تأثير التغير المناخي على الغطاء الارضي (منطقة الدراسة: قضاء الحلة)

زبيدة رفعت طالب*، سعاد جابر لفتة

مركز التخطيط الحضري والاقليمي للدراسات العليا, جامعة بغداد, بغداد، العراق

الخلاصة

ظاهرة التغير المناخي تمثل تحديًا عالميًا له آثار عميقة على الغطاء الأرضي , حيث يواجه العراق في هذه الفترة ، نتيجة لقلة سقوط الامطار وإرتفاع درجات الحرارة والتصحر وإنحسار الغطاء النباتي وإنخفاض في منسوب الانهر نتيجة لظاهرة التغير المناخي, فتأثر بها خصوصا منطقة الفرات الاوسط كونها إقليم يغلب عليها الطابع الزراعي, في هذا البحث تم دراسة تأثير تغير المناخ على الغطاء الأرضي في قضاء الحلة في محافظة بابل، العراق بإستخدام بيانات الاستشعار عن بعد وصور الأقمار الصناعية من Landsat 5 و Landsat 8 من خلال الموقع الإلكتروني لهيئة المسح الجيولوجي الأمريكية للأعوام من 1995 إلى 2021. وتم استخدام برنامج ArcMap 10.8 لتحليل هذه التغييرات وتصورها، حيث تبلغ مساحة قضاء الحلة (٨٧٨ كم2) ، إذ تم مراقبة التغيير في مساحة الغطاء الارضي من خلال المناطق المبنية والغطاء النباتي والاراضي الصحراوية والمساحة السطحية للاراضي الرطبة والأنهر لمنطقة الدراسة ، إذ تم إستخدام المرئيات الفضائية للقمر لاندسات للسنوات (1999–2015–2021) ، تبين إن قضاء الحلة تأثرت بظاهرة التغير المناخي نتيجة إزدياد الاراضي الصحراوية حيث كانت في سنة ١٩٩٩ قد بلغت 93 كم2 أما في سنة ٢٠٢١ قد زادت وبلغت183 كم2 ونتيجة لإرتفاع درجات الحرارة وإنخفاض كميات الامطار بمعدل 2 عن المعدل العام قد أدى الى إنحسار الغطاء النباتي في سنة ٢٠٢١ وقد بلغت 196كم2 بعد أن كانت مساحته تغطي بنسبة 45.6% من مساحة القضاء.

الكلمات المفتاحية: الغطاء الارضي، التغير المناخي، الاراضي الصحراوية.