



**T.C.**

**TOKAT GAZIOSMANPASHA UNIVERSITY**

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**M.SC RESEARCH**

**A GEOGRAPHICAL ANALYSIS OF POPULATION GROWTH AND  
DISTRIBUTION IN BARDARASH DISTRICT**

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Master thesis

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## SCIENTIFIC ETHICS PAGE

According to the thesis writing guide of Tokat Gaziosmanpaşa University Institute of Social Sciences, My Master's thesis named “**A GEOGRAPHICAL ANALYSIS OF POPULATION GROWTH AND DISTRIBUTION IN BARDARASH DISTRICT**” that I have prepared under the consultancy of “**Doç. Dr. Hüseyin Mertol**” is based on scientific ethical values and rules. I hereby declare that it is an appropriate, original work, and I will accept any legal sanctions if it is determined otherwise.



Signature

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## JURY ACCEPTANCE AND APPROVAL

The defense examination of the thesis study titled “**A Geographical Analysis Of Population Growth And Distribution In Bardarash District**” is prepared by Farhad Jalal NAJEM was held on 24/06/2024 it has been accepted by jury members as a Master’s Thesis at Tokat Gaziosmanpaşa University, Graduate Education Institute, Department of Geography.

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## CONFIRMATION

...../...../.....

Director of Graduate Education Institute

**ÖZET**  
**BARDARASH İLÇESİNDE NÜFUS ARTIŞI VE DAĞILIŞININ COĞRAFI**  
**ANALİZİ**

**Farhad Jalal Najem**

**Doç. Dr. Hüseyin Mertol**

**2024, xvi ve 124 sayfa**

Nüfus artışı ve dağılımı, bir bölgedeki veya ülkedeki bireylerin sayısını etkileyen doğum ve ölüm oranları, göç ve coğrafi faktörler gibi unsurlardan etkilenir. Irak'ın 1921'de kuruluşundan bu yana yedi nüfus sayımı yapılmış olup, en sonuncusu 1997 yılında gerçekleştirilmiştir. Nüfus artışı ve mekansal dağılım, sosyal, ekonomik ve çevresel boyutları anlamak için kritik öneme sahiptir. 2006 yılına kadar Bardarash, Akre ilçesinin bir alt ilçesiydi, ancak diğer ilçeler gibi ayrı bir ilçe haline gelmiştir. Bardarash doğum ve ölüm oranları ve göç gibi doğal faktörler nedeniyle nüfus dinamiklerinde önemli değişiklikler geçirmiştir. 1997 yılında, alt ilçenin nüfusu 47.564 iken, 2009 yılında ilçenin nüfusu 116.700'e ulaşmıştır. 2015 yılında, IŞİD nedeniyle yerinden edilmiş Iraklıları barındırmak için bir kamp kurulmuş ve yerinden edilen kişi sayısı 11.000'e çıkmıştır. Haziran 2021 itibarıyla, kampta kalan nüfus 3.541'e düşmüştür. Coğrafi konum, bölgenin incelenmesi için kritik öneme sahiptir ve nüfus dağılımı ve ekonomik faaliyetleri etkilemektedir. Bardarash ilçesi, 36.9.0 ile 36.42 kuzey enlemleri ve 43.24.0 ile 43.54.0 doğu boylamları arasında yer alan önemli bir bölge olan Duhok ilinde bulunmaktadır. Ticaret yolu ve tarım alanı boyunca yer alması, nüfus artışını çekmiştir. 1957'den 2006'ya kadar, Duhok ve çevresindeki alanlardaki nüfus büyüklüğü doğal olarak artmış, 1957'deki ilk resmi nüfus sayımı il genel nüfusunun %7.5'ini oluşturmuştur. 1987 sayımı, Bardarash'ın nüfusunun Duhok ilinin toplam nüfusunun %8.6'sı olduğunu göstermiştir. Ancak, 1991'de Baas hükümetine karşı yapılan Kürt ayaklanması sonrası ekonomik koşullar nedeniyle nüfus artışı yavaşlamış ve Bardarash'ın temsil oranı 2004'e kadar %8.8'de kalmıştır. 2004 ile 2009 yılları arasında Bardarash, yıllık %10.4'lük hızlı bir nüfus artışı yaşamış ve Duhok ilinin toplam nüfusunun %9.9'una ulaşmıştır. Bu değişim, Darato ve Rovia köylerinin alt ilçeler olarak yeniden sınıflandırılması ve Baas rejiminin çöküşü sonrası mülteci akını gibi idari reformlardan kaynaklanmıştır. Ancak, 2020'de, Bardarash'ın nüfusu, Duhok ilinin toplam nüfusuna kıyasla %9.5 azalmış ve yıllık nüfus artışı normal %2.9

oranına yavaşlamıştır. Bu değişiklikler, idari yönetim, sosyo-ekonomik ilerleme ve demografik dinamikler arasındaki bağlantıyı vurgulamaktadır. Kırsal nüfus 1987 ile 2009 yılları arasında önemli ölçüde azalmış, 2009’da, kentsel nüfus çalışma alanının toplam nüfusunun %33.4’ünü oluşturarak, önceki yıllara kıyasla yüksek bir oran sergilemiş ve yıllık %34.2’lik bir büyüme oranı göstermiştir. 2020’ye gelindiğinde kentsel nüfus %46.7’ye yükselirken, çalışma alanındaki kırsal nüfus, siyasi istikrarsızlık ve ekonomik zorluklara rağmen toplam ilçenin nüfusunun %53.3’ünü oluşturmuştur. özellikle Kalak alt ilçesindeki köylerde IŞİD’in gelişi bu düşüşü etkilemiştir. Çalışma alanındaki nüfus dağılımı ve modelleri, diğer bölgelerde olduğu gibi doğal ve insani faktörlerden etkilenmekte olup, etkilerin derecesi bölgelere ve ülkelere göre değişmektedir.

**Anahtar Kelimeler:** Nüfus artışı, Dağılım, Faktörler, Coğrafya.

**ABSTRACT**  
**A GEOGRAPHICAL ANALYSIS OF POPULATION GROWTH AND  
DISTRIBUTION IN BARDARASH DISTRICT**

**Farhad Jalal Najem**

**Doç. Dr. Hüseyin Mertol**

**2024, xvi and 124 pages**

Population growth and distribution are influenced by factors such as birth and death rates, migration, and geographical factors, which affect the number of individuals in a region or country. Since the establishment of Iraq in 1921, seven censuses have been conducted, with the most recent one in 1997. Population growth and spatial allocation are crucial for understanding social, economic, and environmental dimensions. Before 2006, it was a sub-district of Akre district, but Bardarash separated to become a district like other districts in Iraq. Bardarash has undergone significant changes in population dynamics due to natural factors such as birth rates, death rates, and migration patterns. In 1997, the population of the sub-district was 47,564, and by 2009, the district's population reached 116,700. In 2015, a camp was established to house internally displaced Iraqis due to ISIS, and the number of displaced persons increased to 11,000. As of June 2021, the remaining camp population was 3,541. The geographical location is critical for studying the area, affecting population distribution and economic activities. Bardarash district is located in Duhok Governorate, an important site, between latitudes 36.9.0 to 36.42 North and longitudes 43.24.0 to 43.54.0 East. Its location along a trade route and agricultural area has attracted population growth. From 1957 to 2006, the population size in Duhok and surrounding areas naturally increased, with the first official census in 1957 accounting for 7.5% of the total population of the governorate. The 1987 census showed that Bardarash's population was 8.6% of Duhok Governorate's total population. However, population growth slowed after the 1991 Kurdish uprising against the Ba'ath government due to economic conditions, and Bardarash's representation remained at 8.8% until 2004. From 2004 to 2009, Bardarash experienced rapid population growth of 10.4% annually, increasing its share to 9.9% of the total population of Duhok Governorate. This change was due to administrative reforms, such as the reclassification of the villages of Darato and Rovia as sub-districts, and the influx of refugees after the collapse of the Ba'ath

regime. However, in 2020, Bardarash's population decreased by 9.5% compared to the total population of Duhok Governorate, and the annual population growth slowed to a normal rate of 2.9%. These changes highlight the interconnection between administrative governance, socio-economic progress, and demographic dynamics. The rural population significantly decreased between 1987 and 2009. In 2009 the urban population constituted 33.4% of the total population of the study area, a high rate compared to previous years, with an annual growth rate of 34.2% due to political, economic, and service factors . By 2020 the urban population rose to 46.7% while the rural population of the study area constituted 53.3% of the total population of the district, despite political instability and economic challenges. with the arrival of ISIS affecting the decline, especially in the villages of Kalak sub-district. Population distribution and patterns in the study area are influenced by natural and human factors like other regions, with varying degrees of impact across areas and countries.

**Keywords:** Population growth, Distribution, Factors, Geography.

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## **DEDICATED TO**

Praise be to God, the Great, the Generous, He opens to whomever He wills of His servants with the truth, and He is the All-Knowing Fattah.

I dedicate this humble deed to those who are my pride and my treasure, to those who have supported me throughout life, and those to whom pleasing God is linked, to the candle of my way and the balm of my life, my Mother.

To my, wife, sisters, brothers.

To the soul of my late father, may God forgive him



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## ABBREVIATION

|        |                                                      |
|--------|------------------------------------------------------|
| BRHA   | Board of Relief and Humanitarian Affairs             |
| CSO    | Central Statistical Office                           |
| DEM    | Digital Elevation Model                              |
| FRDLC  | Federal Research Division Library of Congress        |
| GIS    | Geographic information system                        |
| GDP    | Gross Domestic Product                               |
| GNP    | Gross National Product                               |
| IPA    | Iraq Population Analysis                             |
| IDPs   | Internally Displaced Persons                         |
| ISIL   | the Islamic State of Iraq and the Levant             |
| KRI    | Kurdistan Region of Iraq                             |
| KRSO   | Kurdistan Regional Statistics Office                 |
| LDC    | Least Developed Countries                            |
| MDC    | Major Diagnostic Categories                          |
| MICS4  | Multiple Indicator Cluster Survey 4                  |
| PQLI   | Physical Quality of Life Index                       |
| IISPS  | Iraqi Institute of Statistics and Population Studies |
| UNHCR  | United Nations High Commissioner for Refugees        |
| UNICEF | United Nations Children's Fund                       |
| UASC   | Unaccompanied and Separated Children                 |
| WHO    | World Health Organization                            |

## INTRODUCTION

Since the establishment of the contemporary state of Iraq in 1921, a total of seven censuses have been undertaken within the nation, with the most recent one occurring in 1997. Notably, the 1997 census exhibited limitations as it did not encompass all governorates and specifically excluded the populations of Duhok, Erbil, and Sulaymaniyah, as reported by the Northern Region of Iraq in 2013. Subsequently, the eighth census, originally slated for 2007, was impeded by extraordinary circumstances arising in the aftermath of the regime's downfall, leading to its ultimate abandonment. Instead, a swift enumeration of the population, housing inventory, and economic establishments transpired at the conclusion of 2009. Additionally, the Northern Region of Iraq conducted the listing and numbering of addresses during the same period (IPA, 2012).

The examination of population expansion and spatial allocation constitutes integral facets within demographic investigations, exerting a significant influence on the configuration of the social, economic, and environmental dimensions of a given area (Haub, 2011). The complex interaction between population dynamics and diverse socio-economic elements holds far-reaching consequences for policymakers, urban planners, and researchers. A comprehensive comprehension of population growth, migration patterns, and spatial concentrations is imperative for the judicious allocation of resources, the advancement of infrastructure, and the crafting of sustainable policy frameworks (Weeks, 2015).

Population growth pertains to the rise in the count of individuals within a population over a specified duration. This fundamental demographic concept is shaped by various factors, encompassing birth rates, death rates, as well as immigration and emigration patterns. Comprehending population growth is imperative for evaluating the dynamics of a society and discerning its ramifications on diverse facets of life, encompassing social, economic, and environmental considerations (Weeks, 2015).

Bardarash constitutes a town and subdistrict located within the Nineveh Governorate, Iraq. While officially designated as part of the Akre District in the Nineveh Governorate by the Iraqi government, it is effectively administered by the Kurdistan Regional Government, being acknowledged as part of the Bardarash district within the Dohuk Governorate. The Kurdish designation of the town originates from the

combination of "ber" (meaning "stone" in Kurdish) and "reş" (signifying "black" in Kurdish), resulting in the translation "black stone." Conversely, the Arabic nomenclature, 'Ashā'ir al-Saba', translates to "seven clans," a reference to the presence of seven clans in Bardarash: Zangana, Darbazi, Bot, Razgary, Gezh, Chopani, and Rōžbayānī (Ali, 2018).

Over the course of time, there have been substantial alterations in global population trends, marked by changes in birth rates, mortality rates, and migration patterns. The examination of population growth entails the scrutiny of the augmentation in the number of individuals over a given period, while distribution concentrates on the spatial dispersion of these individuals across geographical areas. Complex dynamics in population change arise from factors including fertility rates, mortality rates, as well as patterns of immigration and emigration (Castles and Stephen, 2002).

In the year 1997, the Bardarash subdistrict encompassed 79 villages, housing a collective population of 47,564 individuals, as documented. A camp was instituted in Bardarash to accommodate Iraqis displaced by the Islamic State of Iraq and the Levant (ISIL), subsequently undergoing partial decommissioning in December 2017. In October 2019, the camp was reinstated to receive refugees, witnessing an influx of over 7,000 Kurds from northern Syria who had sought refuge following the 2019 after the Turkish army's intervention into northeastern Syria. This significant arrival transpired within a span of one week. By November, the population of the camp expanded to approximately 11,000 refugees, with women and children constituting around 75% of this demographic. Subsequently, the refugee count further increased to 14,031 by July 2020 (Marwan, 2020). As of June 2021, a total of 13,986 refugees departed from the camp upon acquiring residency permits in the Kurdistan Region, and another 1,488 individuals had repatriated to Syria. Consequently, the remaining population at the camp stood at 3,541 (Alix, 2019).

### **Significance of the Research**

This research provides recommendations based on a scientific analysis of population growth and distribution, aiding in the improvement of land use and guiding development in a balanced and sustainable manner. It contributes to the advancement of academic knowledge in the field of geography and population studies, encouraging further research and future studies in this area. The study offers a deep understanding of

the factors affecting population growth and distribution, such as economic, social, and environmental factors.

### **Research aims**

**Analysis of Population Growth:** Studying the population growth rates in the district over a certain period and comparing them with Duhok Governorate, identifying the factors affecting this growth such as migration, births, and deaths.

**Population Distribution:** Analyzing the geographical distribution and spatial patterns of the population in the district according to place of residence , and the reasons for population concentration in certain areas.

**Identification of Influencing Factors:** Studying the geographical, economic, and social factors that affect population distribution, such as the availability of natural resources, infrastructure, and economic opportunities.

**Study of Internal and External Migration:** Analyzing the impact of internal and external migration on population growth and distribution in the district.

**Impact of Political and Economic Conditions:** Studying the impact of political and economic conditions on population growth and distribution, such as the effect of conflicts or changes in economic policies.

**Geographical Analysis Using Geographic Information Systems (GIS):** Using geographic information systems to analyze spatial data and produce illustrative maps of population distribution and growth in the district.

### **The geographic location**

The geographic location is one of the most significant geographical factors for the study area, considering both natural and human elements. The location indicates a study of the region and its regional relations with neighboring areas. It encompasses two concepts: geographic and astronomical. Geographically, it encapsulates geographical phenomena, particularly climatic characteristics of the studied area. Astronomically, it involves pinpointing the study area through lines of longitude and latitude, thereby

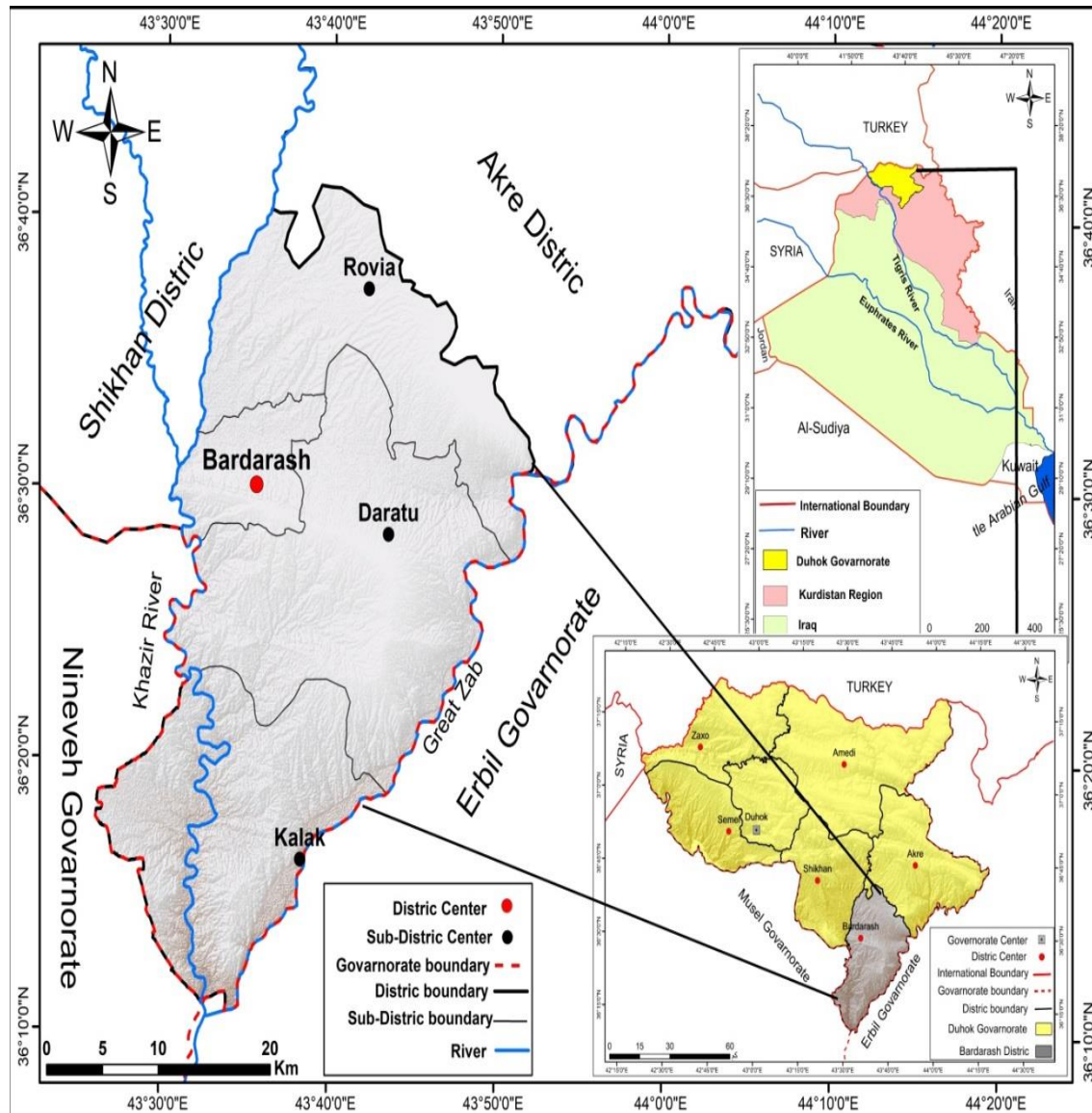
determining prevailing climatic features that influence population distribution and economic activities, especially agricultural endeavors.

The geographic location serves as a pivotal element in delineating the image and identity of the region, given its fundamental role influenced by astronomical positioning. In summary, the geographic location of the study area boasts the advantages of a vital location, contingent upon both natural and human geographical characteristics, irrespective of other variables and data.

In preceding years, the study area has played a prominent role in commercial stations due to its geographic location along a trade route between Turkey and northern parts of Iraq. Moreover, it serves as a link between Dohuk Governorate and Erbil Governorate. Its location falls within an agricultural region, which has encouraged population attraction, permanence, and development, in addition to conducive environmental elements fostering population stability. Bardarash District is one of the districts belonging to Dohuk Governorate in the Kurdistan Region of Iraq.

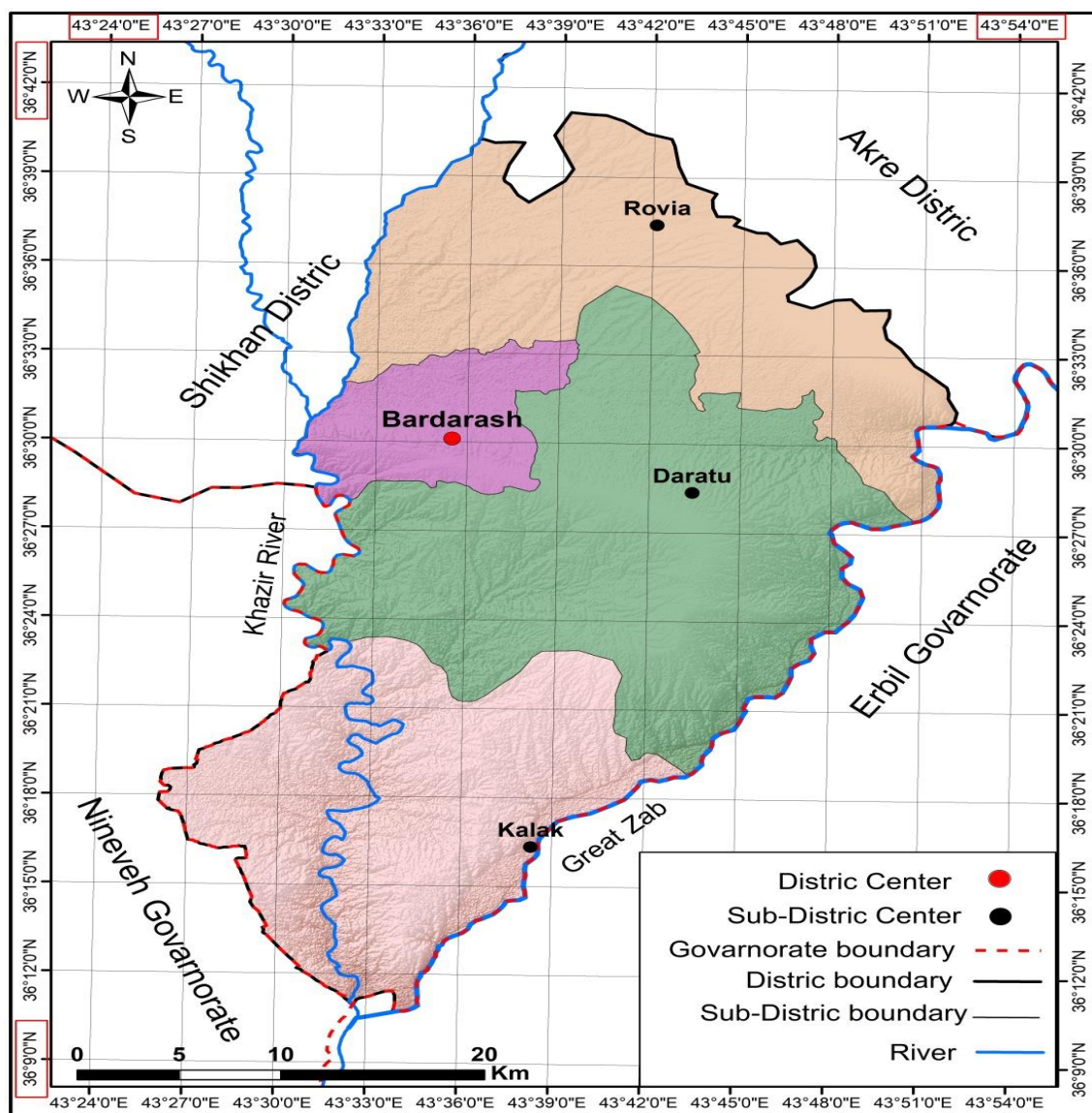
The Dohuk Governorate is situated in northern Iraq, bordered by Turkey to the north, Syria to the west, Erbil Governorate to the east, and Ninawa Governorate to the south, as illustrated in Map (1). Bardarash District occupies a significant position, located in the southwestern part of Dohuk Governorate. Astronomically, Bardarash District is positioned between the latitudes of 36.9.0 to 36.42 north and longitudes of 43.24.0 to 43.54.0 east, as depicted in Map (2).

**Map 1:** Position of the study area according to Duhok province, Kurdistan Region and Iraq.



**Source:** Researcher's work using Arc-GIS 10.8 based on the Kurdistan Regional Government Ministry of Planning Department (GIS).

**Map 2:** Astronomical and administrative position of the research area



**Source:** Researcher's work using Arc-GIS 10.8 based on the Kurdistan Regional Government Ministry of Planning Department (GIS).

## CHAPTER ONE

### 1. Literature Review

#### 1.1 Population size

Upon achieving independence in 1932, Iraq's departing British officials approximated the population to be around 3.5 million (FRDLC, 1988). The inaugural

census, conducted in 1947, revealed a population of roughly 4.8 million. Subsequently, the census in 1965 reported a total count slightly exceeding 8 million, with 902,000 residents in the Kurdistan Region of Iraq (KRI). During the most recent population census in 1987, the total Iraqi population was recorded at 16,335,000, with 2,015,466 residing in the Kurdistan Region of Iraq (KRI). Notably, the census conducted in 1997 excluded the populations of Duhok, Erbil, and Sulaymaniyah, with only estimations provided. At that time, the Kurdistan Region of Iraq (KRI) population was approximated at 2,861,701, contributing to the total Iraqi population of 22,046,244 million (FRDLC, 1988).

Subsequent to that period, the Central Statistical Office (CSO) and the Kurdistan Regional Statistics Office (KRSO) have regularly revised demographic statistics. For this report, the 2014 estimates have been employed, indicating a Kurdistan Region of Iraq (KRI) population of 5,122,747 individuals and an overarching Iraqi population of 36,004,552 individuals (FRDLC, 1988).

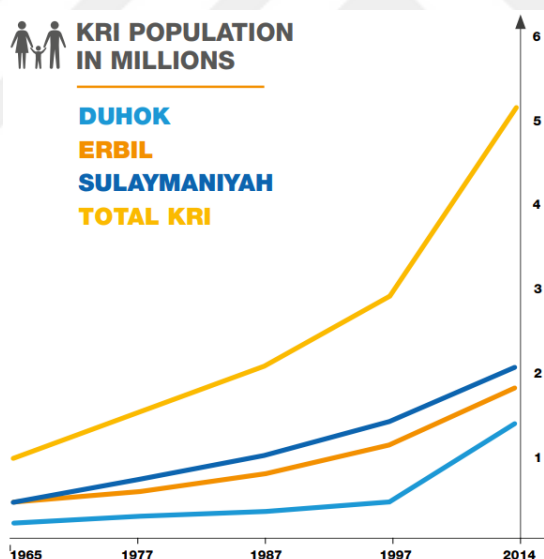


**Figure 1:** KRI POPULATION (1965-2014. CENSUS AND ESTIMATES) (FRDLC, 1988).

## 1.2 Urban and rural population

Historical data and projections suggest that the percentage of the urban population in all three governorates of the Kurdistan Region of Iraq (KRI) witnessed an increase of more than 24 percentage points from 1977 to 1987 in relation to the total population. Following this period, the urban population proportion in Duhok remained

constant at approximately 75%, while it experienced continuous growth in Erbil and Sulaymaniyah, reaching 84% and 85% respectively by the year 2014. Urbanization was stimulated not solely by economic variables such as urban economic development and increased wages but also by the contextual factors that the country encountered, encompassing the Iran-Iraq war (1980–1988), the Gulf War in 1991, the aftermath of the political system change in 2003, and the ensuing crisis. Specifically, the Erbil and Sulaymaniyah Governorates demonstrate notably elevated levels of urbanization, surpassing 80%. This is attributed to significant influxes of Iraqi migrants driven by economic motives or compelled displacement from other governorates to the capitals and mid-sized cities within these regions (IPSAR, 2012).

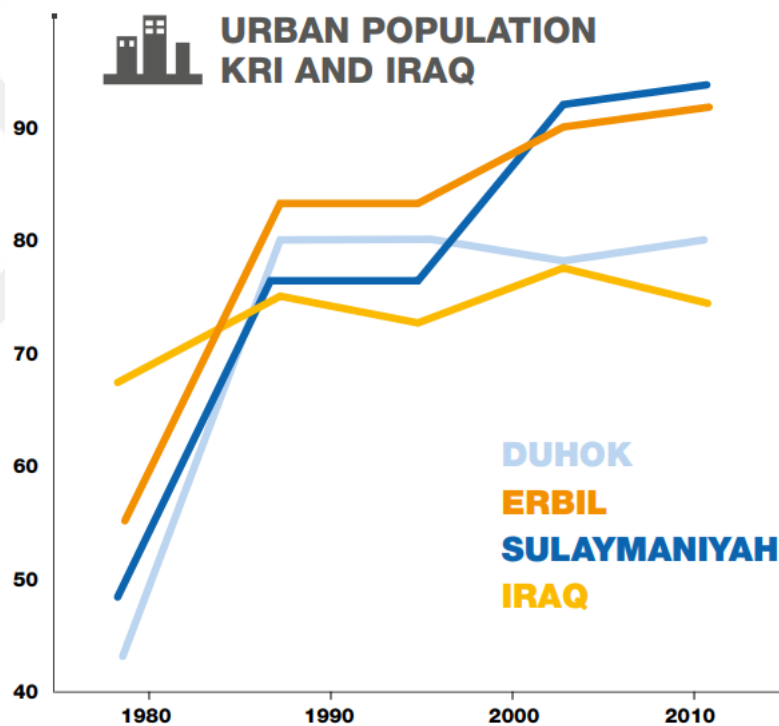


**Figure 2:** URBAN POPULATION. KRI AND IRAQ (1977-2014. CENSUS AND ESTIMATES) (IPSAR, 2012).

### 1.3 Population movement

As of October 25, 2019, a total of 11,292 refugees have traversed informal border crossings since October 14. Predominantly hailing from northern Syria, including Sare Kani village, Qamishly city, Hassaka governorate, Gre Spe village, Darbasiya village, Til Tamir village, Derike village, and Amoda village, these refugees

constitute the majority of arrivals. Currently, Bardarash camp accommodates a total of 10,699 refugees, while Domiz I camp hosts 180 refugees. The Board of Relief and Humanitarian Affairs (BRHA), in collaboration with UNHCR and various humanitarian organizations, has reached a consensus that commencing on October 26, newly arrived individuals will be housed in Gawilan Camp, situated 30 kilometers to the south of Bardarash camp. Recently erected tents have been set up, and the newly designated sector in Gawilan is capable of housing a maximum of 1,588 families. Established in September 2013, Gawilan camp presently shelters 8,115 Syrian refugees. Incoming individuals will have access to the existing services. In the event that Gawilan Camp attains full capacity, the overflow of new arrivals will be accommodated in Garmawa IDP Camp. Deliberations are presently in progress concerning the population of internally displaced persons (IDPs) currently residing in Garmawa camp (UNHCR, 2019).

Authorities in the Kurdistan Region of Iraq (KRI) have affirmed the continued operation of all informal entry points for Syrian refugees, including Al Walid. However, individuals utilizing these crossing points will now be directly transported to the Sahela transit site by Assayesh. Al Walid transit site will cease accommodating refugees overnight (UNHCR, 2019).

In partnership with the Board of Relief and Humanitarian Affairs (BRHA), UNICEF, The security of the region, and UNHCR has identified a new transit site adjacent to the Sahela crossing point. Situated before the primary security checkpoint, the new site, referred to as Sahela 2, facilitates more convenient access for humanitarian agencies. Given that Syrian refugees typically arrive during nighttime hours and will be transported from all five crossing points to Sahela, they will spend the night at the Sahela transit site. At this location, they undergo initial security screening before being subsequently transported to designated camps (UNHCR, 2019).

The UNHCR is presently in the process of erecting three supplementary Rubb halls in Sahela. This is in conjunction with the pre-existing Rubb hall, two prefabricated offices, and a covered hall, all of which are being established to cater to the substantial influx of individuals intending to stay overnight. Upon completion of the ongoing installations, the Sahela 1 and 2 transit sites will possess the capability to accommodate a maximum of 2,500 individuals nightly (UNHCR, 2019).

Ms. Jeanine Hennis-Plasschaert, the Special Representative of the United Nations Secretary-General for Iraq, conducted a visit to the Bardarash camp on the 23rd of October 2019. Throughout her visit, she engaged with recent arrivals and attentively addressed their expressed concerns. Ms. Hennis-Plasschaert expressed gratitude to the Governments of Iraq and the Kurdistan Region of Iraq for their facilitation of refugee relocation to Bardarash camp. She also commended the dedicated efforts of humanitarian response teams. The UNHCR has documented the registration of 2,199 Syrian refugees in Bardarash camp, with 434 individuals (23%) identified as reactivations. The matter of family separation has arisen, encompassing 187 households led by females and 69 cases of unaccompanied and separated children (UASC) recorded to date. The identification of UASC is conducted through registration processes and protective interviews, complemented by protection assessments within the camp. Ongoing efforts are being made to trace and reunite families. A notable portion of these children comprises adolescents who have undertaken their journey accompanied by neighbors or extended family members (UNHCR, 2019).

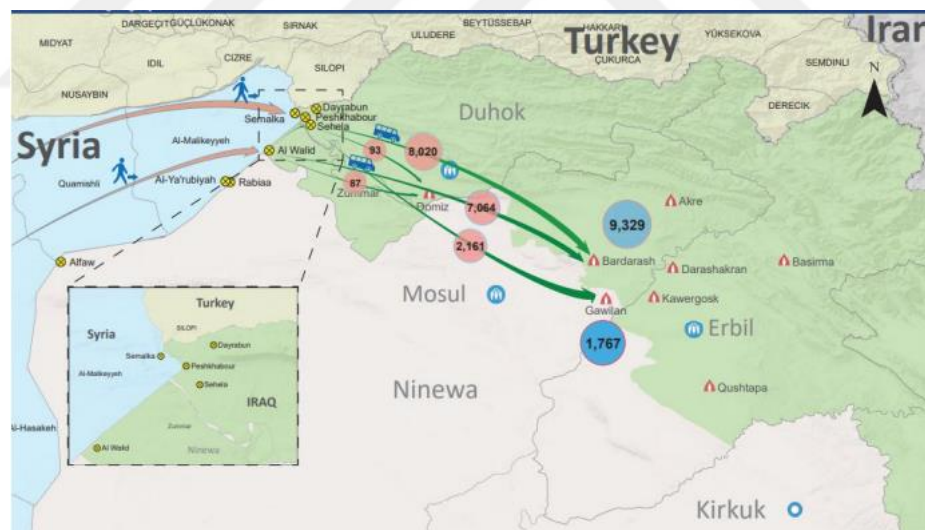


**Figure 3:** Population movement to Iraq (UNHCR, 2019).

#### 1.4 Theoretical Review of Population and Development

Population growth can be characterized as a rise in the demographic count of individuals residing within a nation, state, county, or municipality (Beaie and Acol, 2009). On a global scale, population expansion is attributed to a marked rise in fertility rates and concurrent declines in mortality rates, often correlated with the level of economic development. Numerous scholarly works indicate that the predominant

growth in population occurs in less developed nations, where the rate is often two to three times higher than that of highly developed countries (United Nations, 2011; Speidel et al., 2009). The principal factors mentioned include the fact that developed countries accrue greater advantages from advancements in modern medicine, and the global dissemination of knowledge regarding proper nutrition. This confluence has contributed to a reduction in mortality rates. Simultaneously, less developed nations have exhibited a significant population increase attributable to elevated fertility rates (Speidel et al., 2009). The rationale for this trend has been attributed to deeply ingrained cultural practices that place a substantial emphasis on the intrinsic value of children. Many individuals, both men and women, express a preference for having a larger number of children, driven by long-standing moral values (Speidel et al., 2009).

Conversely, development is frequently presumed to be oriented toward socio-economic, political, and scientific-technological dimensions. One could argue that the concept of development is inherently intricate (Oyeshola, 2007). The challenge associated with development lies not only in its definition but also in the complexity of its measurement (ibid). Typically, development is assessed using indicators such as Gross National Product per capita (GNP), Gross Domestic Product (GDP), or the Physical Quality of Life Index (PQLI). Nevertheless, none of these metrics appears to be an ideal measure of development unless they are integrated. Development emphasizes addressing human needs, the assembly of poverty profiles, and underscores that efforts in development should consider measuring the costs of adjustment not solely in terms of lost output, but also in terms of lost lives and diminished human potential (Porter and Faust, 2009).

Presently, the notion of development has adopted a new guise, characterized by the term "sustainable development." Indicators such as GDP and human development indices, which encompass factors like life expectancy, access to healthcare, clean water, and education, serve as metrics to gauge human development (Costanza et al., 2007). What, then, constitutes sustainable development? Various definitions exist, and it can be delineated in terms of indicators or the specific aspects it aims to measure. Some interpretations link sustainability to humanity's capacity to conserve existing natural resources, avoiding their overuse to prevent future depletion. Alternatively, others define it within the context of policy-making (Oyeshola, 2007). However, the definition

provided by the UN Commission on Economic Development in its 1987 Brundtland report appears to be widely accepted. According to the report titled "Our Common Future," sustainability is defined as meeting the needs of the present without jeopardizing the ability of future generations to fulfill their own objectives (United Nations, 1987). While certain writers have identified this definition as contentious, the prevailing consensus among the majority is that it adequately encompasses various dimensions of sustainability across a broad spectrum of applications (Dale, 2001).

A substantial body of literature, spanning numerous domains within the social sciences, elucidates facets of population growth and distribution. Notably, a protracted discourse has persisted among three distinct schools of thought concerning the origins of population growth (Lekganye, 2004). One perspective regards population growth as a crisis for humanity, affecting subsistence and living space. This viewpoint posits that elevated population growth is likely to intensify pressure on food, space, and various resources, along with impacting social and community relationships in terms of income distribution. Consequently, elevated population growth results in heightened economic challenges, malnutrition, and subsequently, an increased mortality rate. An alternative perspective posits that population growth contributes positively to economic development. This viewpoint is based on the belief that larger markets and a more specialized labor force, enabled by economies of scale, can enhance economic output. Additionally, the increased size of families or communities exerts pressure that, in turn, motivates individuals to exert more effort. This pressure is seen as a catalyst for fostering innovation and the adoption of improved methods and processes in both individual and communal endeavors. The third perspective asserts that population growth plays a pivotal role in numerous recent historical trends, including industrialization, urbanization, as well as technological and social innovation. From this standpoint, population growth in developing countries is seen as presenting both a challenge and an opportunity—a challenge to manage and an opportunity to harness and expand available resources (Rogers et al., 2012).

To elaborate on these conceptual frameworks, the discussion incorporates two theories: the Malthusian theory and the Boserupian theory of population growth. The proponents of the Malthusian theory, as articulated by Ehrlich et al. (1993), postulate that uncontrolled population expansion will inevitably result in a comprehensive

degradation of the natural environment, ultimately causing a cessation of population growth or, in extreme scenarios, the potential extinction of the human population. The Malthusian perspective is grounded in three key propositions. Firstly, it posits that population growth is contingent upon the availability of means of subsistence. Secondly, it asserts that population tends to increase when there is an adequate supply of subsistence. Thirdly, it contends that efforts to restrain population growth, without causing misery and vice, are inherently limited. Conversely, proponents of the Boserupian theory, articulated by Boserup (1965), contend that population growth and subsequent scarcity of natural resources act as catalysts for technological and environmental innovations. These innovations, in turn, lead to the conservation of natural resources and an augmentation of the material services provided by these resources, thereby facilitating the continued sustenance of the population. Regardless of the chosen theoretical framework, there seems to be a consensus that population growth and the natural environment exert reciprocal influences on each other (Dasgupta, 2000).

### **1.5 Inter-Relationship Between Population and Sustainable Development**

The correlation between population and sustainability is contingent on specific contexts and is influenced by a myriad of other factors encompassing economic, political, social, and cultural dimensions (Ericksen, 2008). Population constitutes a pivotal element in the multifaceted realm of sustainable development, spanning its economic, social, and environmental dimensions. Variables such as population growth and decline, urban or rural distribution, migration patterns, and demographic composition in terms of gender and age, among other factors, collectively exert influence on economic growth, labor markets, public health, environmental conditions, and the prospects for both present and future generations (Birdsall and Sinding, 2001). Achieving sustainable development and ensuring a harmonious equilibrium with population growth has emerged as an urgent objective confronting communities, business entities, governmental bodies, and the global community as a whole. The reluctance to address population growth does not stem from a scientific consensus suggesting its detriment to sustainable development. Scientific studies consistently underscore the significance of this variable. Instead, the hesitation arises from perceived cultural, ethical, and political challenges, rendering the topic seemingly impractical to broach (Mason, 2003). A paramount concern in contemporary times revolves around the

issue of population growth and its compatibility with sustainability, as gauged through sustainability indicators. This has sparked a widespread global discourse on the intricate interplay between population growth and the tenets of sustainable development. Nonetheless, the correlation between population growth and economic development is highly intricate, and the overall impact of demographic factors on sustained development can be inherently ambiguous at times.

Certain advocates argue that population growth has the potential to escalate the overexploitation of open-access environmental resources (Brander and Taylor, 1998). Alternatively, it may heighten the demand for environmental resources, including timber or non-timber forest products, as well as the appreciation of natural beauty as an amenity or for recreational purposes. This increased demand could lead to elevated prices for environmental goods, potentially creating incentives to preserve the stock of natural resource supplies to capture the flow of resource rent (Foster and Rosenzweig, 2003). Conversely, environmental degradation might intensify the demand for children to undertake tasks such as fetching water, collecting fuelwood, or managing livestock. Additionally, by exacerbating individual and public health challenges, leading to elevated child and adult mortality rates, there may be a heightened need for children to contribute economically to the household. The amalgamation of these dynamics aligns with a "vicious cycle" theory, reminiscent of modern Malthusianism. This theory posits a self-reinforcing downward spiral where population growth contributes to environmental depletion, which, in turn, stimulates further population growth, creating a cyclical pattern. In light of this perspective, it is evident that population growth is intricately and inherently connected to the principles of sustainable development. A decrease in population growth is perceived to enhance a country's potential for economic development. This, in turn, is thought to bolster a nation's capacity to elevate the well-being of its citizens (Herrmann, 2012). This assertion is grounded in the rationale that a decline in fertility leads to a reduction in the size and proportion of the younger age group, thereby diminishing the demands placed on government resources for education and health services.

### **1.6 Population geography theories**

Many scholars view population geography as a subdiscipline within human geography that investigates and analyzes the spatial distribution of human populations

(Clarke, 1965). Since Brunhes' inaugural discussion in 1910, the scholarly discourse in population geography has demonstrated diversity along three dimensions: the degree to which the examination of areal differentiation and geographic diversity of population could shed light on the unified and comprehensive nature of a place; the extent to which population served as the focal point of geographical considerations; and the methodology by which the field would engage in generating knowledge in collaboration with other academic specializations (Bailey, 2005).

#### **1.6.1 Population Distribution**

Geographical methodologies, including visualization, areal classification, and spatial decomposition, play a crucial role in clarifying the diverse characteristics of population and the complexities associated with its uneven growth. In the realm of demography, it is posited that factors such as fertility, mortality, and migration, as outlined by the balancing equation, along with age–sex composition derived from stable population theory, are pivotal in shaping and contributing to population diversity (Woods, 1982). Normative classifications utilized to explore aspects of diversity, including race, nationality, religion, education, occupation, family structure, urban–rural residence, development level, and customs (Trewartha, 1983), have increasingly gained significance as subjects of scrutiny. This trend is evident in related disciplines such as the geography of youth, geography of race, and children's geographies.

The utilization of visualizations to depict population diversity remains a catalyst for hypothesis testing. For instance, the creation of neighborhood maps illustrating the evolving distribution of minority groups has been coupled with research exploring patterns of segregation and the dynamics of population turnover. As fresh public and commercial challenges arise, and as Censuses and surveys contribute new data, the production of such population maps proliferates.

#### **1.6.2 Spatial Demography**

Clarke (1965) asserted that a distinct disciplinary division of labor facilitated interdisciplinary collaboration, emphasizing spatial aspects. Population geography, according to Clarke, sets itself apart from demography, characterized as the study of population as a singular subject. Operating within this framework, spatial demography delves into the geographic variances of population, migration, population systems, and the influence of modernization on population dynamics.

#### **1.6.2.1 Demography and Economics of Human Migration**

Of the three demographic components of change, migration occupies a central focus within population geography. Typically, migration flows are categorized based on factors such as motive (e.g., voluntary versus forced, economic versus environmental), distance moved (e.g., residential mobility versus international migration), and direction moved (e.g., new versus repeat or circular). Statistical analyses employ demographic rates, such as migration rate, and spatially referenced indicators, including in- and out-migration, net migration, migration efficiency, and migraproduction rate (Clark, 1986).

#### **1.6.3 Residential Mobility**

Residential mobility stands as a significant factor in the dynamics of local population growth and decline, carrying implications for the provision of services, such as schools and clinics, as well as contributing to neighborhood transformations, such as gentrification. The commonly observed exponential distribution of the distance covered in such relocations is cited to reinforce Ravenstein's assertion that the majority of moves are short-distance moves. This pattern continues to inspire gravity models in social physics to analyze migration flows. This prompted the utilization of gravity models, grounded in the social physics concept that the level of interaction is contingent upon the size of the places between which migrants move and their relative proximity. Furthermore, the frequently observed trend of residential mobility toward suburban areas, though not universally applicable, aligns with the social ecological principles espoused by sociologists associated with the Chicago school. Explanations that are less deterministic underscore the collaborative influence of housing and family factors. As Rossi and subsequently Lee observed, these factors unfold systematically throughout the life cycle. The significance and cost of information concerning opportunities and constraints have emerged as a crucial focus of research, accelerating the spatial utilization of microeconomic and push–pull frameworks. Influenced by Morrill's concepts regarding migration information fields and Wolpert's discourse on place utility, Brown and Moore recognize the dynamic trade-offs that individuals navigate concerning factors like employment accessibility, housing, schools, and amenities. These insights expand life cycle approaches by highlighting the strategies individuals employ to navigate risk and disappointment and to learn through experience (Vezzoli and Simona, 2017).

#### **1.6.4 Regional Migration**

Irregular and dynamic patterns in regional expansion, rural depopulation, urbanization, suburbanization, counterurbanization, nonmetropolitan growth, and the phenomenon of abandoned cities carry significant implications for economic and political frameworks. When examining the distribution and dynamics of both gross and net migration flows among regions, there has been an increase in the magnitude of gravity models to incorporate regional structures, recognizing the existence of competing destinations. Furthermore, on a national scale, innovative initiatives have been undertaken to employ entropy theory in comparative studies of migration. Research has progressed to enhance accounting frameworks and multiregional models, utilizing cohort-based methodologies built upon the framework of migration channels. This concept, originally employed by John Fraser Hart to clarify patterns of African-American urbanization within the United States, has become a focal reference in present-day analyses. The use of increasingly sophisticated evaluations of disaggregated life tables, transition probabilities, and estimates of fertility and mortality for significant subgroups provides crucial insights for local and regional governments. This encompasses, for example, comprehending the ramifications of aging scenarios on regional economies and housing demand (Czaika et al., 2015).

The growing interest in varied strategies for labor market policy has spurred investigations into the labor market dynamics of particular migrant cohorts, including unemployed individuals and family migrants. Sjaastad's influential human capital perspective on migration has showcased flexibility in explaining the heightened probability of migration among young individuals and specific unemployed demographics, attributed to an extended time horizon for realizing benefits. It also provided inspiration for investigating gender differences in migration returns (Mincer's family migration framework suggested the wife's sacrifice) and for comprehending the reasons why individuals in numerous developing regions migrated to locations characterized by high unemployment (the Harris–Todaro model of rural-to-urban migration underscored expected returns as opposed to actual wage disparities) (Czaika et al., 2015).

### **1.6.5 International and Circular Migration**

Long-distance human migration is intricately linked to variations in political cultures. For instance, countries like the US, Canada, and Australia define themselves as 'classic' immigration nations and engage in intense discussions regarding modes of migrant belonging, encompassing assimilation and multiculturalism, alongside influencing development outcomes. The narratives within the field regarding such migrations revolve around movements across formally acknowledged borders of nation-states, and these narratives have been categorized into distinct factions. Refugees, more broadly referred to as forced migrants, have been differentiated from economic migrants. Economic migrants, in turn, have been further subdivided based on skill level (skilled and unskilled) and legal status, including categories such as guest workers and individuals labeled as illegal, undocumented, or irregular migrants. Explanations extend to descriptions such as skilled migrants navigating between global cities and refugees being propelled akin to billiard balls, following the social physics logic of kinetic energy. International circulation implies a dedication to return migration and is associated with the demand for seasonal labor within livelihood systems that frequently precede borders imposed during colonial times. In these narratives, migrations are perceived as consequences of economic and political structures with a restricted influence on these systems. Current emphasis is placed on the growing phenomenon of international student migration and international return migration, particularly within the second generation (Arsenault, 2011).

### **1.6.6 Factors affecting Distribution of Population**

Population distribution refers to the spatial arrangement of population dispersal, the establishment of agglomerations, linear expansions of population, and similar phenomena. Across numerous nations, significant regional disparities exist in the geographic distribution of populations. Population densities vary across different global regions. The 2015 Revision of World Population Prospects represents the twenty-fourth iteration of the United Nations' estimations and forecasts for global population. These projections are compiled by the Population Division within the Department of Economic and Social Affairs of the United Nations (United Nations 2015).

As of mid-2015, the global population had reached 7.3 billion, indicating an increase of approximately one billion people over the preceding twelve years. The

distribution of the world's population is notably widespread across the seven continents. The majority of the global population, accounting for about 60%, resides in Asia (4.4 billion), followed by 16% in Africa (1.2 billion), 10% in Europe (738 million), 9% in Latin America and the Caribbean (634 million), and the remaining 5% split between Northern America (358 million) and Oceania (39 million). China (1.4 billion) and India (1.3 billion) stand as the world's most populous countries, collectively housing 19% and 18% of the global population, respectively. India's population is anticipated to experience sustained growth over the coming decades. Projections indicate an increase to 1.5 billion by 2030 and 1.7 billion by 2050. In contrast, China's population is expected to remain relatively stable and subsequently decline slightly. Consequently, it is forecasted that India's population will surpass that of China in the future.

The ten most populous nations globally are geographically dispersed across all continents: one in Africa (Nigeria), five in Asia (Bangladesh, China, India, Indonesia, and Pakistan), two in Latin America (Brazil and Mexico), one in North America (United States of America), and one in Europe (the Russian Federation). Notably, Nigeria, currently holding the seventh position in global population rankings, is experiencing the most rapid growth. At the current pace of growth, it is anticipated that Nigeria's population will exceed that of the United States by approximately 2050, making it the third most populous nation globally at that time. By 2050, six out of the ten most populous countries in the world are expected to have populations exceeding 300 million: China, India, Indonesia, Nigeria, Pakistan, and the United States of America. Approximately 50.4% of the global population is male, while 49.6% is female, according to estimates. The median age of the worldwide population, representing the point where half of the population is older and half is younger, stands at 29.6 years. Approximately one-quarter (26%) of the global population is under 15 years of age, 62% fall within the age range of 15-59 years, and 12% are aged 60 years or older (United Nations 2015).

Populations exhibit uneven distribution across the Earth's landmass, influenced by diverse physical environments in different locations. Consequently, it becomes imperative for demographers to comprehend the patterns and locations of population distribution. The current and anticipated spatial arrangements hold paramount importance in the field of demography. A demographer's task involves comprehending

specific patterns and influential factors affecting population density and overall population size. By leveraging this understanding, projections can be formulated regarding the potential growth or decline of the global population, along with its spatial distribution. Such projections enable leaders and policymakers to devise pertinent strategies and policies for environmental protection, sustainable development, and preparation for demographic shifts (United Nations 2015).

The determinants influencing the dispersion of population can be broadly categorized into the following principal groups:

- 1- Physical factors
- 2- Socio-economic factors
- 3- Demographic factors and Political factors



**Figure 4:** Types of factors affecting population distribution (United Nations 2015).

The physical elements primarily encompass climate, landforms, topography, soil quality, as well as the presence of energy and mineral resources. Additionally, accessibility factors, such as proximity to coastlines, availability of natural harbors, and navigability of rivers or canals, contribute to this category. Socioeconomic factors encompass cultural attributes, varieties of economic pursuits, technological applications (including agricultural methods), and social structures. Demographic factors involve alterations stemming from both natural population growth and migration. Elements such as political boundaries, political stability (or instability), disruptions, regulations on migration and trade, government policies, and transportation infrastructure are regarded as political considerations.

#### **1.6.6.1 Physical Factors affecting distribution of population**

Human decisions guide the shaping of space in alignment with cultural values, leading to diverse habitation patterns in response to environmental influences. Individuals establish a connection with the natural environment through settlements, which serve as tangible expressions of an envisioned ideal environment (Black et al., 2011).

##### **1. Climate:**

Climate stands as a paramount natural determinant, playing a pivotal role in shaping the regional flora and exerting a significant influence on agricultural practices. Additionally, climate dictates the types of fauna that are characteristic of a given region. Individuals actively pursue favorable climatic conditions when selecting settlement locations. Climatic belts represent the primary zones of human activity, as demonstrated by the global distribution of population, wherein the most densely populated countries are predominantly situated in tropical regions (Black et al., 2011).

A temperate and inviting climate holds a magnetic appeal for individuals. Such regions, characterized by favorable climates, create conducive environments for diverse fauna to flourish, contributing to the overall ecological balance of the area. The presence of agriculture and animal husbandry in these regions facilitates the sustenance of large populations through the production of food resources. Conversely, locations characterized by extreme climatic conditions typically exhibit sparse populations due to the challenges associated with sustaining human life in such environments. Countries situated in temperate regions, though cooler than tropical zones, experience higher population densities. Nevertheless, the polar zones, specifically the Arctic and Sub-Arctic regions, persist as the least populated areas due to their inhospitable climates. The exceedingly low temperatures in these areas create unfavorable conditions for human habitation, with limited vegetation. Harshly cold winters and extremely brief summers further compound the challenges of residing in such regions (Black et al., 2011).

##### **2. Topography or terrain:**

Regions that are navigable tend to be more densely populated than rugged terrains. Mountains, in particular, are less favored due to the scarcity of arable land. Moreover, the expenses associated with transportation, construction, and agriculture are

notably elevated in such areas. Overall, higher altitudes also pose physiological challenges to humans' adaptability. This phenomenon is attributed to diminished atmospheric pressure and reduced oxygen levels at higher altitudes. Consequently, elevated regions are not conducive to sustained population and growth. Conversely, low-lying plains and coastal areas are more favorable locations for human settlement. The Himalayas exhibit low population density, while the Ganges valley stands as one of the most densely populated regions globally. Coastal areas enjoy the strategic benefits of oceanic trade and transportation, resulting in a concentration of major cities predominantly situated in coastal regions.

### **3. Water:**

Water is indispensable for the sustenance of human life. The ancient civilizations of the world thrived in proximity to rivers and coastal regions, with the Nile, Amazon, and Ganges river systems providing the necessary support for prosperous civilizations along their banks. Sufficient rainfall is conducive to the flourishing of vegetation and agriculture, thereby influencing the suitability of a location for human habitation. Due to the scarcity of water, extensive desert regions remain uninhabited. Similarly, areas on the rain-shadow side of hills or mountains experience lower population density, while the leeward side, benefiting from adequate water resources, often supports higher population concentrations. Consequently, populations tend to concentrate in regions characterized by well-watered river valleys and coastal plains.

### **4. Natural disasters:**

The occurrence of natural disasters dissuades the concentration of populations. Frequent events such as storms, earthquakes, floods, and wildfires hinder the establishment of settlements, prompting people to migrate to safer locations. Numerous instances exist wherein natural disasters have led to the devastation of settlements. One such occurrence took place in 2011 when an earthquake measuring 8.0 magnitude struck the city of Bichuan in the Sichuan province of China. This seismic event resulted in the complete destruction of the city, with eighty percent of its buildings collapsing and a significant loss of lives. The city was not reconstructed and was instead left deserted to mitigate the potential loss of human life in the event of a recurrence of the disaster in the future. Comparable instances of this nature can be identified throughout history. On August 24, 79 AD, the eruption of the volcano Vesuvius occurred,

enveloping the adjacent town of Pompeii in ash and soil. This event effectively preserved the city in a state frozen since that ominous day, encapsulating everything from containers and furnishings to artworks and individuals. Pompeii, in conjunction with Herculaneum, was deserted and eventually faded into obscurity, with both their names and locations forgotten. Their rediscovery ensued through archaeological excavations conducted in the 18th century (Wears, 2013).

#### 1.6.6.2 Socio economic factors affecting population distribution

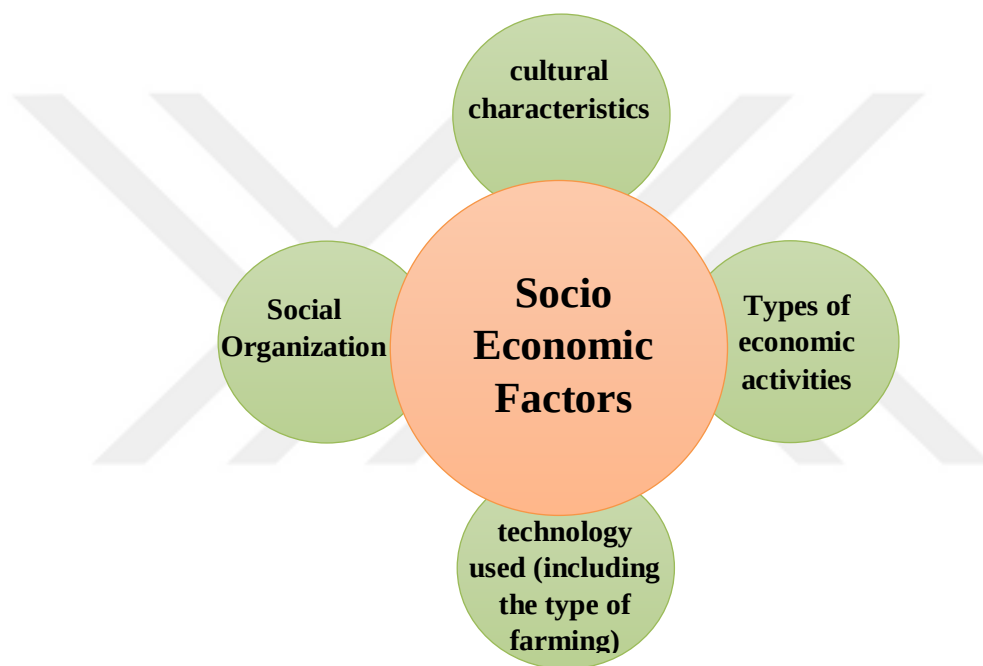


**Figure 5:** Socio Economic factors affecting population distribution (Raleigh, 2011).

The selection of a settlement location typically derives from natural processes. Nevertheless, over time, human intervention has enabled a degree of adjustment and control over these natural processes. Consequently, the determinants influencing the choice of settlement locations are no longer solely reliant on natural conditions. With the evolution of human society, social and economic considerations have taken precedence as needs have shifted (Raleigh, 2011).

#### 1. Economic activity:

Economic activity serves as a gauge for employment prospects. Individuals residing in rural areas predominantly rely on agriculture for their sustenance. In instances where the land proves insufficient to support the rural populace or when urban

areas offer more abundant opportunities, residents may opt to migrate to cities. The concentration of population in urban areas results from the array of economic activities and livelihood opportunities available in cities. Typically, urban settings offer employment opportunities for a broad spectrum of individuals, in contrast to rural areas where the range of options is comparatively limited (Raleigh, 2011).

Hence, the population density in towns and cities exhibits a tendency to surpass that in rural areas and is anticipated to further rise. Cities, inherently, offer a multitude of livelihood opportunities across both formal and informal sectors. Industries constitute a substantial employment sector and have consistently drawn inexpensive labor over numerous decades. This influx of labor often leads to the establishment of settlements, even in areas that would otherwise be considered uninhabitable. For instance, hydroelectric power stations located in sparsely populated regions attract migrants, contributing to a subsequent population increase in those areas. Likewise, the city of Dubai has witnessed significant population growth attributable to the burgeoning service and tourism sectors. A substantial migrant population has chosen to settle in Dubai, rendering it one of the world's fastest-growing cities primarily due to the expansion of tourism (Khaleej Times, 2017).

## **2. Social Organization:**

The social organization of communities in unexplored regions fosters the migration of individuals, prompting them to establish residences in novel lands. As a social being, it is imperative for humans to engage in communal formations, creating a familiar environment where they choose to reside. Individuals relocating from their places of origin often choose to establish settlements in regions or specific localities where the inhabitants share similar language, culture, food habits, and customs. It is not uncommon to observe cities featuring residential areas characterized by communal attributes (Raleigh, 2011).

### **1.6.6.3 Demographic factors of population distribution**



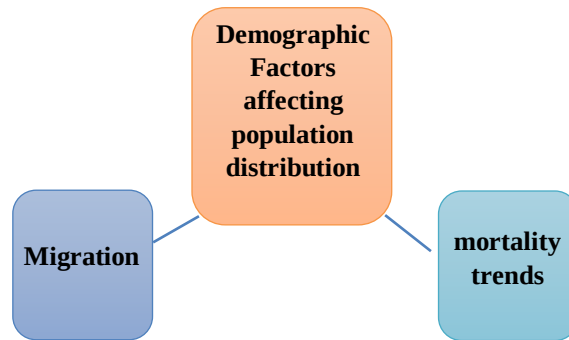


**Figure 6:** Demographic factors affecting population distribution (Hear et al., 2012).

Demographic factors encompass the attributes of a population that exert significant influence on patterns of population distribution and settlement. These factors comprise fertility and mortality trends, as well as migration. The interplay of fertility and mortality collectively shapes the natural increase within a region. Over the course of time, the disparate rates of growth arising from fertility and mortality dynamics contribute to alterations in population density and distribution (Hear et al., 2012).

### **1. Migration:**

Migration significantly shapes population distribution. Negative circumstances, referred to as push factors, in the place of origin often act as motivations for individuals to depart from their native locations to seek residence in new areas. Simultaneously, the allure of improved opportunities in distant lands serves as a positive factor that fosters migration. Individuals might opt to relocate due to factors such as limited land availability, a dearth of employment opportunities in their current place of residence, inadequate wages or salaries, and insufficient access to medical facilities and education. The anticipation of a higher standard of living frequently constitutes the primary motivator behind rural-to-urban migration. The migration process facilitates the redistribution of population; however, it concurrently exerts pressure on the destination, resulting in an elevation of population density in that specific location (Hear et al., 2012)

### **2 Natural increase:**

Natural increase represents the overall result of fertility and mortality dynamics within a given region. In regions with elevated fertility levels, the population tends to experience growth. Conversely, mortality serves as a stabilizing factor in such scenarios, mitigating the impact through deaths. Historically, epidemics and diseases

have exerted a substantial impact on mortality rates. In the past, a heightened prevalence of diseases led to increased mortality. To counteract these losses, a correspondingly high level of fertility was upheld. Due to advancements in medical science, numerous diseases became treatable, resulting in a substantial decline in the death rate. Consequently, the population experienced significant growth. However, this gave rise to challenges related to heightened population density and strain on finite resources. The introduction of contraceptives and the availability of various family planning options subsequently contributed to a decline in the birth rate (More and Shellman, 2004).

#### **1.6.6.4 Political factors influencing population distribution**

Population distribution is adversely impacted by warfare, political unrest, conflicts, and inadequate governance.

##### **1. War and political conflicts**

Warfare and political conflicts exact a significant human toll, leading to elevated mortality rates and compelling people to seek safety elsewhere. Peaks in mortality rates often coincide with dominant out-migration patterns. Meanwhile, safer locations undergo notable population growth due to the influx of migrants. Similar conditions prevail in regions adjacent to political boundaries of countries characterized by strained relations. Even in the absence of active conflict, the apprehension of potential hostilities compels individuals to relocate, rendering these areas among the least populated (Schmeidl, 2007).

##### **2. Political unrest and discrimination**

Political instability and discrimination have adverse effects on population growth. Confrontations between divergent political factions or individuals with varying religious beliefs have frequently led to a decline in population within the impacted region. Prior to establishing permanent residence in a new location, migrant populations seek areas that not only offer economic opportunities but also ensure a secure and healthful environment conducive to overall well-being. A region marked by political instability is incapable of furnishing these essential conditions, thereby discouraging not only incoming migrant populations but also compelling the existing residents to seek more peaceful locations for settlement. Discrimination encountered by migrants based on factors such as race, language, culinary practices, and culture serves as a deterrent to in-migration. This phenomenon has contributed to a reduction in population growth on

one hand and hindered the establishment of new settlements on the other (Schmeidl, 2007).

### **3: Policies:**

Initiatives promoting migration have frequently resulted in population growth within the destination region. International labor movements are observed where regulations governing cross-border migration are permissive. Migration plays a role in the redistribution of population. Policies advocating for decreased fertility rates, prohibition of infanticide, and similar measures also exert an impact on population growth in a given location. For instance, China's stringent enforcement of the one-child policy effectively curtailed fertility levels and population growth (Raleigh, 2011).

## Chapter two

### 2. Population growth in the study area

#### 2.1 Population size and growth

The phenomenon of population growth within a given geographic area serves as a multifaceted indicator, reflective of underlying dynamics pertaining to economic advancement, social organization, cultural attributes, and political ideologies (Faizal al-Iswi, 2001). A scholarly examination of population dynamics and its growth trajectory can be partitioned into distinct temporal epochs, notably demarcated by the pre- and post-2006 eras, where the former delineates the period antecedent to districtization, while the latter encompasses the subsequent phase extending from 2006 to 2020.

##### 2.1.1 Population size and growth during (1957-2006).

The evolution of population size in Duhok and its surrounding study area from 1957 to 2006 is delineated in Table 1. Notably, the inaugural official census in Iraq, undertaken in 1957, marked a pivotal juncture despite logistical limitations. During this period, the population of the study area constituted 7.5% of the total population of Duhok province. Subsequent census endeavors were beset by political disruptions, with the 1967 census was brought forward to 1965 due to internal conflict in Iraq , rendering comprehensive coverage challenging. Despite the passage of two decades since the first census, the proportion of the study area's population within Duhok province increased marginally to 8.4% by the year 1977.

**Table 1:** Population growth of Bardarash region and their growth rate compared to Duhok province during (1957-2020).

| Year | Bardarash       |                     |             |                                                       | Duhok province  |                     |             |
|------|-----------------|---------------------|-------------|-------------------------------------------------------|-----------------|---------------------|-------------|
|      | Population size | Total increase rate | Growth rate | The population of the area compared to Duhok province | Population size | Total increase rate | growth rate |
| 1957 | 16141           | -                   |             | 7.5                                                   | 215022          | -                   | -           |
| 1977 | 28237           | 74.9                | 3.7         | 8.4                                                   | 334872          | 55.7                | 2.8         |
| 1987 | 38216           | 35.3                | 3.5         | 8.6                                                   | 440840          | 31.6                | 3.2         |
| 1996 | 58698           | 53.6                | 5.95        | 8.4                                                   | 694390          | 57.5                | 6.4         |
| 2004 | 76732           | 30.7                | 3.85        | 8.8                                                   | 870074          | 25.3                | 3.16        |
| 2009 | 116700          | 52                  | 10.4        | 9.9                                                   | 1171228         | 34.6                | 6.9         |
| 2020 | 153616          | 31.6                | 2.9         | 9.5                                                   | 1637981         | 39.8                | 3.6         |

**Source** / From the researcher's work based on Appendix No. 1

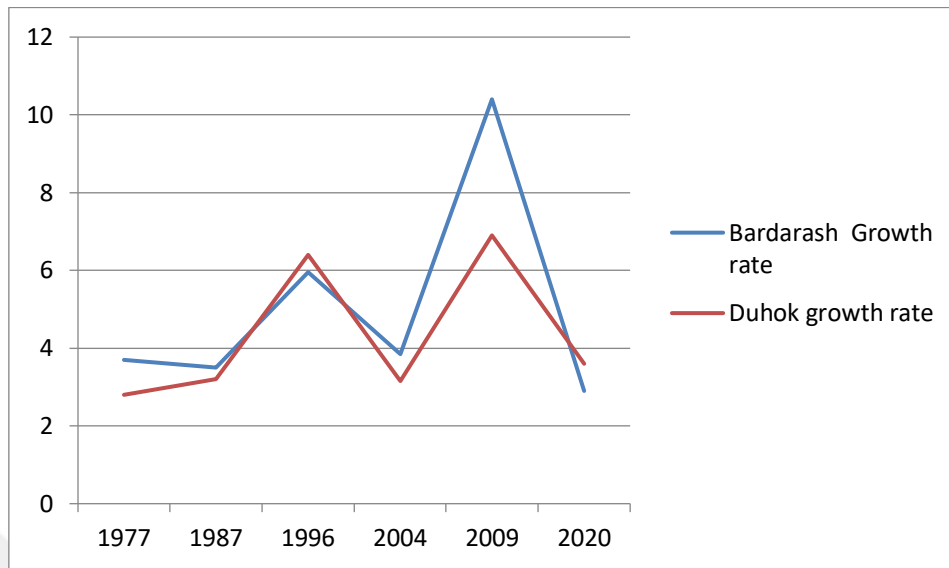


**Figure 7:** Population growth of Bardarash region and their growth rate compared to Duhok province during (1977-2020).

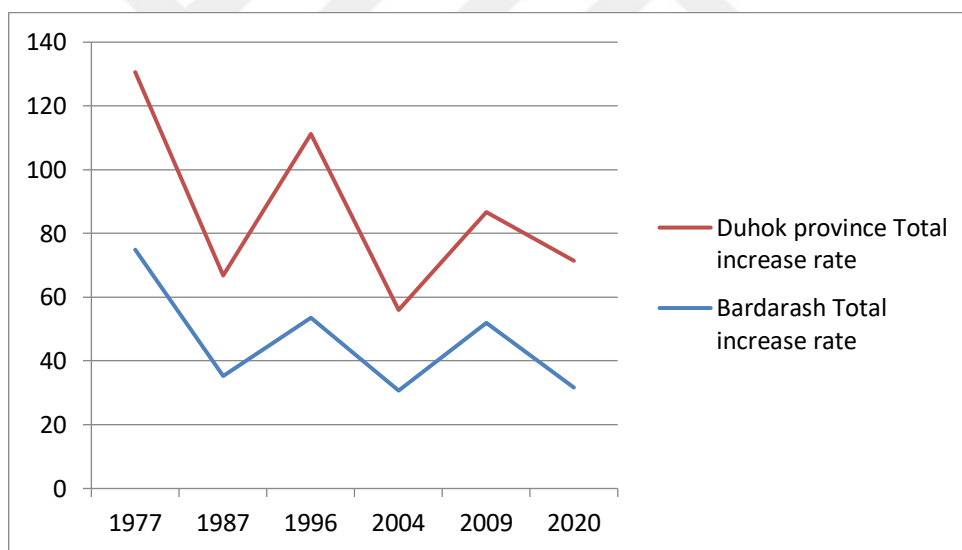


**Figure 8:** Total increase rate of bardarash region and compare to duhok province (1977-2020).

In 1987, a census was successfully conducted, revealing that the population of the study area accounted for 8.6% of the total population of Duhok province. However, the tumultuous aftermath of the 1991 uprising against the Ba'ath government and subsequent administrative transitions impeded census operations in certain provinces, including Erbil, Duhok, and Sulaimani, during the 1997 enumeration. Consequently, the population growth in the study area did not significantly outpace that of Duhok province as evidenced by the data available. Notably, an educational census conducted in 1996

for administrative units within Duhok province reaffirmed the study area's population representation at 8.4% of the province's total populace.

According to data sourced from the Duhok Statistical Directorate, the population of Bardarash constituted 8.8% of the total population of Duhok province in the year 2004.

Total increase rate =  $(p_1 - p_0) \div p_0 \times 100$

P1=Population in the new census

P0=Population at previous census

$$r = \left( \frac{\sqrt[t]{p_1}}{p_0} - 1 \right) \times 100$$

R= population growth rate

T= number of years between the two censuses

In 1987, Bardarash experienced a notable population increase of 74.9%, outpacing the growth rate of Duhok province, which stood at 55.7%. This indicates a relatively rapid population expansion within Bardarash during this period.

By 1996, while Bardarash still maintained a substantial growth rate of 5.9%, there was a slight deceleration compared to the previous decade. Meanwhile, Duhok province also experienced growth, albeit at a slightly slower pace with a population increase rate of 31.6%.

The year 2004 witnessed a resurgence in population growth for both Study area and Duhok province. Bardarash exhibited a growth rate of 3.8%, surpassing that of Duhok province, which registered a growth rate of 3.1%.

### **2.1.2 Population size and growth between 2006-2020**

In accordance with the data presented in Table 1, a discernible shift in the demographic landscape of Bardarash is observable in the year 2009, delineated by a notable increase wherein it constituted 9.9% of the aggregate population of Duhok province. This observed deviation is subject to multifaceted determinants, encompassing various factors including, In 2009, there was a moderation in the growth rates for both areas. Bardarash experienced a growth rate of 10.4%, while Duhok province saw a growth rate of 6.9%. Despite the decline in growth rates, both areas continued to exhibit population expansion.

By 2020, there was another notable increase in population growth for Bardarash, with a growth rate of 2.9%. Duhok province also experienced growth, albeit at a slower rate of 3.6%. This indicates continued demographic expansion within Bardarash, albeit at varying rates over the years, alongside growth within Duhok province as a whole.

The transition of administrative jurisdiction from a sub-district to a district status represents a pivotal administrative reform with far-reaching implications. Such a shift inherently signifies an enhancement in the governance structure of the area, often catalyzing developmental strides across economic and societal realms. This administrative evolution typically fosters an environment conducive to economic prosperity and cultural advancement, consequently stimulating population growth within the redefined district boundaries. This phenomenon underscores the interconnectedness between administrative governance, socio-economic progress, and demographic dynamics, whereby administrative reforms serve as catalysts for regional development and population expansion.

The delineation of Daratu and Ruviya villages as sub-districts follows the reclassification of Bardarash from a sub-district to a district. This administrative restructuring ensued in response to burgeoning population figures within the aforementioned villages. The transition to sub-district status was catalyzed by several factors, notably the establishment of governmental facilities within district centers and the concomitant proliferation of employment opportunities. Contrary to expectations, this shift did not precipitate a reduction in outbound migration from the sub-districts; rather, it stimulated an influx of individuals, thereby exerting a palpable impact on population dynamics and accelerating the rate of demographic expansion within these locales.

The aftermath of the Ba'ath regime's collapse in 2003 initially heralded a period of relative tranquility in regions formerly under its sway. However, this stability underwent a marked shift around 2005-2006, characterized by a surge in terrorist activities, including incidents of kidnapping and intimidation, notably targeting Kurdish communities. Faced with escalating threats to their safety and well-being, a considerable portion of the Kurdish populace residing in these areas sought refuge in more secure urban centers. Bardarash emerged as a primary destination for this

displaced population, witnessing a substantial influx of refugees seeking sanctuary from the prevailing insecurity.

In the year 2020, the demographic composition of the specified locale exhibited a notable disparity, with its population registering a discernible decrease of 9.5% relative to the aggregate populace of Duhok province.

## **2.2 Elements of natural population growth**

Natural increase is considered one of the most important factors affecting population growth, often referred to as natural population change or natural population movement. Therefore, natural increase is considered a key element in determining population growth in any region. This increase will affect all other demographic changes, not just population size (Kamran Tahir, 2014).

Natural increase is the difference between birth and death rates. Birth rates vary with changes in biological conditions that are related to gender and vary from nation to nation. Birth rates vary with social factors such as early marriage, polygamy, and religious factors and the economy play a good role in changing the birth rate. However, mortality increases in poor environments and decreases significantly in rich areas (Fouad al-Saqar, p. 289). We can discuss each of the genres of population growth separately.

### **2.2.1 Birth**

Births constitute a fundamental driver of population growth, exerting a substantial influence on demographic trends due to the inherent correlation between the number of births and population expansion. As emphasized (Shaswar Mohammed, 2013), disparities in birth rates serve as primary determinants of divergent rates of population growth observed across regions. However, it is crucial to acknowledge the limitations inherent in the assessment of birth data within the study area, as underscored (Jaza Tawfiq, 1999). The irregularity and deficiencies characterizing birth data in the study area, mirroring challenges prevalent across Duhok province, are attributable to multifarious factors. These factors encompass administrative inefficiencies, incomplete reporting mechanisms, and discrepancies in data collection methodologies. Consequently, while births remain pivotal in shaping population dynamics, the interpretation of birth data necessitates a nuanced

understanding of the inherent limitations and challenges impeding its accuracy and comprehensiveness.

1. Lack of a strict law that forces citizens to register births early.
2. Early deaths of children are not recorded.
3. Rural residents are less aware of the scientific importance of birth registration, so they pay less attention to birth registration.

Given the irregularity and limitations inherent in the available birth data, researchers may resort to employing the general birth rate equation to estimate population dynamics:

Total birth rate = number of births in a year ÷ population in half of the same year × 1000

**Table 2:** Births in Bardarsh district during (2012-2022).

| Year | Population in the middle of the year | Birth | Birth rate per thousand |
|------|--------------------------------------|-------|-------------------------|
| 2012 | 129023                               | 1849  | 14.3                    |
| 2013 | 133212                               | 1885  | 14.1                    |
| 2014 | 137470                               | 1903  | 14.8                    |
| 2015 | 141798                               | 2052  | 14.5                    |
| 2016 | 146190                               | 2035  | 13.9                    |
| 2017 | 150640                               | 2040  | 13.5                    |
| 2018 | 145267                               | 2090  | 14.4                    |
| 2019 | 149391                               | 2011  | 13.5                    |
| 2020 | 153616                               | 2193  | 14.3                    |
| 2021 | 157840                               | 1970  | 12.5                    |
| 2022 | 162180                               | 1952  | 12                      |

Source: Ministry of Health of the Iraqi Kurdistan Regional Government, Bardarash District Health Directorate, Registration Department, Unpublished Information.

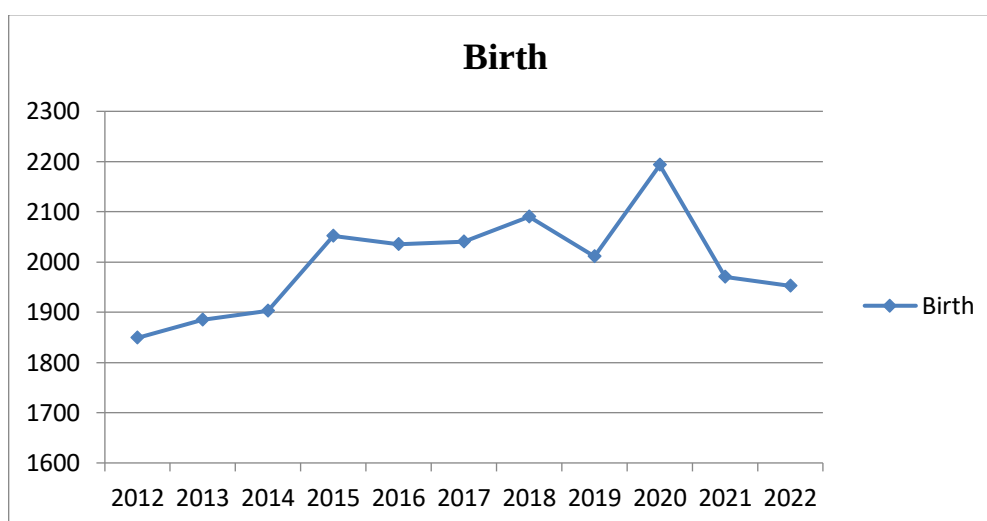


**Figure 9:** Births in Bardarsh district during (2012-2022).

### **2.2.1.1 Several factors affecting birth rate.**

#### **2.2.1.1.1 Early marriage**

Early marriage in Iraq is considered one of the factors contributing to high population growth rates. Marrying girls at a young age leads to an increase in the number of births, as young brides have a longer reproductive period compared to women who marry at an older age. This situation promotes rapid population growth and increases pressure on the country's economic and social resources(IISPS,2022).

In most of the Arab countries today, a reduction in child marriage rates is witnessed compared to what it was like in the past. Yet, Iraq, in particular, is showing a considerable regression in this area. A UNICEF multiple indicator cluster survey (MICS4), conducted on areas and regions in Iraq in 2011, reported the age group between 15 and 19 years to make up 39.6% of the entire population, the highest proportion among age groups, suggesting that Iraq is mostly a young community where a high percentage of married individuals are from within this age group, 45.1% to be precise. This high percentage highlights the widespread of the phenomenon of forced marriage of minors, who constitute a high proportion of the population. Additionally, a survey conducted by the Iraqi Ministry of Planning's Central Bureau of Statistics in cooperation with the Central Bureau of Statistics of Kurdistan and the ministries of health and women on ' knowledge, attitudes and aspirations of adolescent girls ', showed that the estimated number of girls in Iraq within the age group of 10-14 years was 1.9 million girls. According to these estimates, these girls represent

approximately 6% of the total population. According to the results of this survey, the girls in this age group are distributed by 65.4% in cities and 34.6% in rural areas.

**Table 3:** shows the age distribution by categories and regions in 2011.

|            |       | Region           |      |                   |      |       |       |
|------------|-------|------------------|------|-------------------|------|-------|-------|
|            |       | Kurdistan region | %    | South/centre Iraq | %    | Total | %     |
| <b>Age</b> | 15-19 | 2755             | 22.3 | 9618              | 77.7 | 12373 | 39.6  |
|            | 20-24 | 2643             | 26.3 | 7404              | 73.7 | 10047 | 32.15 |
|            | 25-29 | 2345             | 26.5 | 6481              | 73.5 | 8826  | 28.24 |

It is noted in Table 3 that the proportion of young ages, 15-19 years, represents the highest proportion of age groups in the country; making Iraq a young community. This category constitutes 39.6% of the population, which is the same age group teenage marriage girls belong to.

**Table 4:** Age and number of married female in bardarash district (2019-2021)

| <b>Year</b><br><b>Age</b> | Marriage numbers |      |      | Total ration of marriage (%) |      |      |
|---------------------------|------------------|------|------|------------------------------|------|------|
|                           | 2019             | 2020 | 2021 | 2019                         | 2020 | 2021 |
| 16- 20                    | 444              | 448  | 531  | 42.3                         | 34.6 | 33.9 |
| 21 - 25                   | 408              | 590  | 741  | 38.9                         | 45.6 | 47.2 |
| 26 - 30                   | 145              | 192  | 218  | 13.8                         | 14.9 | 13.9 |
| 31 - 35                   | 36               | 43   | 45   | 3.5                          | 3.3  | 2.8  |
| 36 -40                    | 10               | 10   | 20   | 0.9                          | 0.8  | 1.3  |
| 41 -45                    | 4                | 7    | 6    | 0.4                          | 0.5  | 0.4  |
| 46 - more                 | 2                | 4    | 8    | 0.2                          | 0.3  | 0.5  |
| Total                     | 1049             | 1294 | 1569 | 100                          | 100  | 100  |

Source / Ministry of Justice, Bardarash Justice Personal Status, Personal Status Pen Department, Information about age and number of female marriages in Bardarash district (2021,2020,2019), (unpublished)

This factor plays a significant role in the high birth rate, and early marriage is one of the most prominent characteristics of the population in the study area. The typical age of marriage for Kurdish individuals ranges between 14 and 17 years(Khalil

ismail,1995). In Bardarash, the phenomenon of marriage begins at an early age, specifically between 16 and 20 years. Approximately 80.8% of girls marry between the ages of 16 and 25 as we can see in Table(4). While early marriage is more common in rural areas—where rural residents make up 53% of the total population in the study area—this phenomenon is also noticeable in urban areas. This is because most urban inhabitants are originally from rural areas and have recently moved to the cities, bringing this tradition with them.

#### **2.2.1.1.2 Fertility rate**

Fertility has strongly declined over the last three decades but a high fertility level persists in a part of the developing World. Disparities are therefore very pronounced. The causes of disparities and changes are diverse and complex. They are all linked to the development process. Recent availability of data for more than one hundred countries show that cross-country differences affect fertility rates significantly and this differences tend to diminish as countries become more developed (PRB, 1999).

The fertility rate among the Less Developed Countries (LDC's) is at least triple as high as among the More Developed Countries (MDC's). There are few variations between the MDC's, and total fertility rate implying from 1.2 to 3.7 live births per women. On the other hand, women in LDC's are expected to have from 3.5 to 6.9 children (PRB, 1999). Total fertility rates are comparative heterogeneity. This probably is a result of the beginning of local fertility declines in some LDC's as a new trend.

According to Weeks (1994), high fertility in LDC's is explained by some theorists as a response to the pressures to have children created in high mortality societies by the need to replace members. Other pressures for children may be translated into a desire for children as security, labor, and desire for sons. In other LDC's, high fertility persists because so many people seem activity to desired large families.

Theories of low fertility in MDC's emphasize the role of wealth and economic development in lowering levels of fertility. Low fertility is typically explained as one strategy by which people seek to find wealth and prestige. In low fertility societies, higher strata's couples calculate more costs than benefits in having large families and thus decide to have fewer children than do as people in the lower strata's.

The fertility rate, often measured as the number of live births per woman of childbearing age (usually between 15 and 49 years old) in a given population, is a key determinant of birth rates. Several factors influence fertility rates, including:

- **Access to family planning:** Availability of and access to contraception and family planning services can impact fertility rates by enabling individuals to make informed decisions about family size and spacing of pregnancies.
- **Socioeconomic factors:** Socioeconomic status, education level, and employment opportunities can influence fertility rates. Higher levels of education and greater economic empowerment among women tend to be associated with lower fertility rates.
- **Cultural and societal norms:** Cultural attitudes toward childbearing, gender roles, and family structures can shape fertility preferences and behaviors, thereby impacting fertility rates.
- **Government policies:** Government policies related to family planning, maternal and child health, and support for working parents can also influence fertility rates by affecting individuals' access to resources and support systems.

#### 2.2.1.1.3 Religion factors

The intricate interplay between religion and birth rates manifests through a multifaceted array of influences, encompassing cultural mores, socio-economic dynamics, educational accessibility, and healthcare provisions, among other determinants. A comprehensive examination illuminates the nuanced mechanisms through which religion exerts its impact on demographic trends (Lesthaeghe, 2010).

- **Religious Beliefs and Fertility Ideals:** Many religions have teachings or cultural norms that encourage larger families or place a strong emphasis on procreation. For example, in some branches of Christianity and Islam, there is an emphasis on the importance of having children and raising them within the faith.
- **Religious Practices and Family Structure:** Religious communities may have specific practices or norms that encourage early marriage and childbearing. Religious factors also affect divorce rates. Because Islam hates divorce, as the Prophet (pbuh) says: (أبغض الحلال عند الله الطلاق) That is, the worst thing that is lawful in the sight of Allah is divorce which can contribute to higher fertility

rates(Ahmad Najmeldin,1982.p70). The divorce rate in this area is low as shown in Table (5) .

**Table 5:** Marriage and divorce in Bardarash court during (2018–2023).

| Year | Marriage |      | Divorce | Total of Marriage and divorce |        |     |
|------|----------|------|---------|-------------------------------|--------|-----|
|      | Number   | %    | Number  | %                             | Number | %   |
| 2018 | 1127     | 92.6 | 90      | 7.4                           | 1217   | 100 |
| 2019 | 1049     | 91   | 104     | 9                             | 1153   | 100 |
| 2020 | 1294     | 92.7 | 102     | 7.3                           | 1396   | 100 |
| 2021 | 1569     | 93.1 | 116     | 6.9                           | 1685   | 100 |
| 2022 | 1445     | 92.5 | 117     | 7.5                           | 1562   | 100 |
| 2023 | 1385     | 91.4 | 131     | 8.6                           | 1516   | 100 |

Source / Ministry of Justice, Bardarash Justice Personal Status, Personal Status Pen Department,2024.

- **Access to Contraception and Family Planning:** Religious beliefs can also influence attitudes towards contraception and family planning. Some religious groups may discourage the use of contraceptives or limit access to family planning services, leading to higher fertility rates among their followers.
- **Education and Empowerment of Women:** Certain religious beliefs and practices may discourage the education and empowerment of women, which can in turn affect birth rates. Lower levels of education among women are associated with higher fertility rates, as educated women tend to have fewer children and have them later in life.
- **Economic Factors and Social Support:** Religious communities may provide social support networks and assistance to families, which can influence fertility decisions. In some cases, religious organizations may provide financial assistance or social services to support larger families, which can contribute to higher fertility rates.

### 2.2.2 Death

Population growth is one of the topics included in population studies, as all population societies are characterized by a dynamic nature due to the numerical increase or decrease in the population, and this increase and decrease is represented by the vital

activities of the population, which are births that represent the positive factor towards increasing the size of the population, while deaths represent the negative factor towards decreasing the size of the population, as well as the migration factor, are among the factors that play an important role in the increase and decrease in the size of the population. It varies from one place to another and from one period to another according to the economic, political, and social conditions of the country in which the population lives and according to the population policy as well. Negative for population growth, as well as health and living conditions (WHO, 2018).

The death rate, or mortality rate, is influenced by various factors, including socio-economic conditions, access to healthcare, lifestyle choices, environmental factors, and more (Landrigan et al., 2018).

Several factors that affect death rate and difference in insufficient data

- **Access to Healthcare:** Access to healthcare services, including preventive care, treatment for illnesses, and emergency services, significantly impacts mortality rates. Regions with limited access to healthcare tend to have higher mortality rates due to untreated illnesses and lack of medical intervention.
- **Disease Prevalence and Control:** The prevalence and control of infectious diseases, chronic conditions, and other health issues play a crucial role in mortality rates. Effective disease prevention measures, vaccination programs, and healthcare infrastructure can lower mortality rates by reducing the impact of diseases.
- **Socio-Economic Status:** Socio-economic factors such as income, education, and employment status are closely linked to mortality rates. Higher socio-economic status is associated with better access to healthcare, healthier lifestyles, and improved living conditions, resulting in lower mortality rates.
- **Lifestyle Choices:** Lifestyle factors such as diet, physical activity, smoking, and alcohol consumption significantly impact mortality rates. Unhealthy lifestyle choices increase the risk of chronic diseases such as heart disease, cancer, and respiratory illnesses, leading to higher mortality rates (Landrigan et al., 2018).
- **Environmental Factors** Religious communities may provide social support networks and assistance to families, which can influence fertility decisions. In

some cases, religious organizations may provide financial assistance or social services to support larger families.

Total mortality rate = number of registered deaths ÷ population in half of the year×1000

**Table 6:** Deaths in Bardarsh district during (2012-2022)

| Year | Population in the middle of the year | Number of Deaths | Death rate per thousand |
|------|--------------------------------------|------------------|-------------------------|
| 2012 | 129023                               | 264              | 2                       |
| 2013 | 133212                               | 268              | 2                       |
| 2014 | 137470                               | 288              | 2.1                     |
| 2015 | 141798                               | 313              | 2.2                     |
| 2016 | 146190                               | 286              | 1.95                    |
| 2017 | 150640                               | 261              | 1.75                    |
| 2018 | 145267                               | 280              | 1.9                     |
| 2019 | 149391                               | 292              | 1.95                    |
| 2020 | 153616                               | 409              | 2.7                     |
| 2021 | 157840                               | 402              | 2.5                     |
| 2022 | 162180                               | 388              | 2.4                     |

Source/ Ibid.,Table 2

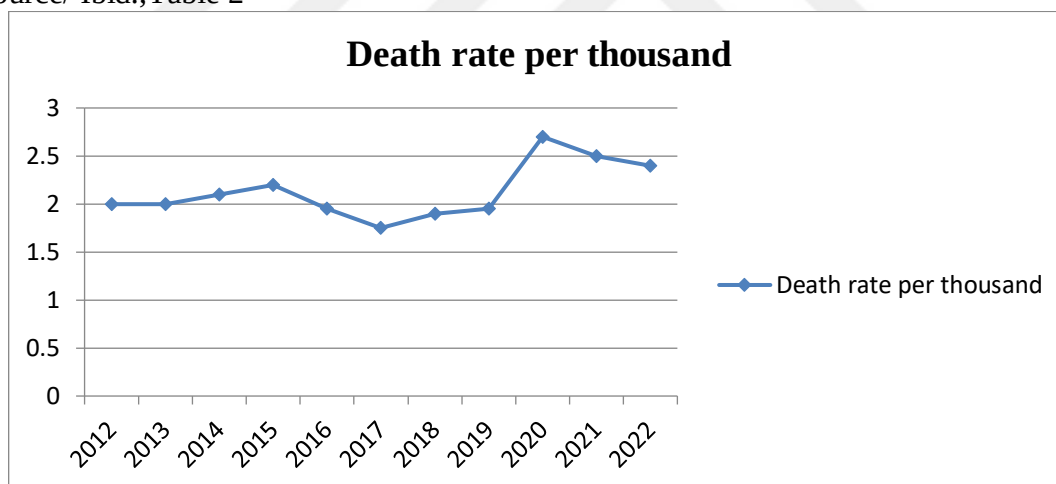


**Figure 10:** Deaths in Bardarsh district during (2012-2022).

Bardarash district, situated in the northern Iraq, presents an intriguing case for the examination of demographic dynamics and mortality trends. Over the past decade, the district has undergone substantial socioeconomic changes, impacting population dynamics and health outcomes. Understanding the interplay between population growth and mortality rates is crucial for formulating effective public health policies and interventions. Thus, this study aims to analyze population trends and mortality rates in

Bardarash district from 2012 to 2022, offering valuable insights into the demographic landscape of the region.

### **2.2.3 Migration**

Migration plays a pivotal role in the dynamics of population growth, exerting notable influences on demographic and economic attributes, alongside shaping the composition and size of populations (Fathi Abu Ayanna, 2005). Essentially, it entails a decrease in population at the origin of migration and a corresponding increase at the destination. However, a universally accepted definition of migration remains elusive among researchers. Generally, it is construed as the relocation of individuals or groups from one geographical location to another with the intent of altering their habitual residence.

The United Nations provides a comprehensive definition of migration as "a form of movement from one place to another for the purpose of changing permanent residence" (Kamran Tahir, 2012).

#### **2.2.3.1 Internal migration**

IDPs, involving the movement of population from one region to another within a country, is distinct from foreign migration due to the absence of physical barriers such as international borders, facilitating easier mobility. This ease of movement is notably underscored by the absence of infrastructure like roads between internal locations. Moreover, it is evident that individuals exhibit a higher degree of psychological readiness towards internal migration compared to external migration (Abbas Fazel, 1980).

There are several factors that affect internal migration such as (Abbas Fazil, 1980, p. 177).

**A. Geographical factors:** The physical landscape, climate conditions, and geographic features of a region can significantly impact internal migration patterns. For instance, individuals may be inclined to move to areas with more favorable climates, natural resources, or geographic amenities such as proximity to coastlines or mountain ranges.

**B. Economic reasons:** Economic opportunities and disparities between regions play a crucial role in driving internal migration. People may move in search of better employment prospects, higher wages, lower cost of living, or access to industries that

align with their skills and qualifications. Economic downturns or regional economic booms can also prompt significant migration flows.

**C. Demographic factors:** Demographic characteristics of a region, including population density, age distribution, family structure, and cultural diversity, can influence internal migration patterns. For example, younger populations may migrate to urban centers for educational and career opportunities, while older individuals may relocate to areas with better healthcare or retirement amenities.

**D. Political reasons:** Political instability, government policies, and governance structures can impact internal migration dynamics. Factors such as civil unrest, conflicts, government interventions, and regional autonomy movements may lead individuals or communities to migrate within the country in search of safety, security, or political freedom.

We can divide this migration into two parts

**A. Incoming migration:** After the fall of the Ba'ath regime and the arrival of refugees, after the arrival of ISIS and the arrival of IDPs, After the fall of the Ba'ath regime in Iraq, the country faced significant challenges, including the arrival of refugees fleeing violence and instability. Subsequently, with the emergence of ISIS (Islamic State of Iraq and Syria), the situation escalated further, leading to additional waves of IDPs seeking safety from the conflict and persecution perpetrated by the extremist group. These events significantly affected the social, political, and humanitarian landscape of Iraq and neighboring countries, exacerbating existing tensions and crises.

**Table 7:** Number and rate of migration to Bardarash district from (2006 to 2020).

| Year             | 2006-2014 |        |      | 2014-2020 |        |      |
|------------------|-----------|--------|------|-----------|--------|------|
|                  | Family    | Person | %    | Family    | Person | %    |
| <b>Bardarash</b> | 2287      | 10855  | 34.7 | 1050      | 5421   | 13.6 |
| <b>Darato</b>    | 293       | 1482   | 4.5  | 119       | 634    | 1.8  |
| <b>Ruvia</b>     | 697       | 3398   | 9.6  | 649       | 3926   | 9    |
| <b>Kalak</b>     | 1109      | 4756   | 12.8 | 731       | 3501   | 10   |
| <b>Total</b>     | 4386      | 20491  | 15   | 2549      | 13482  | 8.7  |

Source/ Kurdistan Regional Government, Ministry of Interior, District and Sub-district Administration (Darato, Ruvia, Kalak), unpublished information.

The presented data delineates the migration patterns of families and individuals emanating from distinct regions throughout the stipulated temporal interval. Noteworthy within this dataset is the preeminence of Bardarash, which emerged as the principal locus of migration, constituting 34.7% of the aggregate migrants, both in terms of familial units and individual constituents. Cumulatively, across all delineated regions, the migration statistics encapsulate 4386 families and 20491 individuals traversing geographical boundaries. Consequently, the computed average migration rate stands at 15% over the specified timeframe.

The tabulated data furnishes a comprehensive delineation of migration trends across four discrete regions spanning two distinct temporal epochs: 2006-2014 and 2014-2020. Each row corresponds to a specific region, while the columns encapsulate the enumeration of migrating families, the aggregate count of individuals partaking in migration, and the proportional representation of migrants from each region vis-à-vis the total migration within each temporal phase. A comparative analysis of the data from the two delineated time periods facilitates the discernment of evolving migration dynamics. For instance:

- Bardarash had a higher percentage of total migration in the first time period (34.7%) compared to the second time period (13.6%), indicating a potential decrease in migration from Bardarash.
- Darato had a slight decrease in both the number of families and individuals migrating, resulting in a lower percentage of total migration in the second time period.
- Ruvia and Kalak also show fluctuations in migration patterns between the two time periods.

We must mention the large settlements for displaced people in the region, which is it the **Bardarash camp**

Situated in Northern Iraq between Mosul and Erbil, the Bardarash Camp commenced operations in January 2015. At the time of our mission, it provided shelter for 9,000 individuals. Seeking refuge from the neighboring conflict, the majority of this population hails from the Shabak community, an ethnic minority in the Nineveh province frequently targeted and persecuted by Daesh. In a brief timeframe, 3,000 tents were erected on concrete foundations, complete with adjacent toilet facilities. In May

2015, the Crisis and Support Centre at the French Foreign Office (MAE) enlisted the participation of its private-sector collaborators in an initiative aimed at enhancing conditions within this Internally Displaced Persons' (IDP) camp. In alignment with the partnership accord formalized with the MAE on August 27th, 2014, the Foundation deployed a Veoliaforce volunteer to the site for active involvement in the needs assessment. David Poinard, the leader of the Technical Engineering department at Eau du Grand Lyon, journeyed to Bardarash in June. His task involves evaluating the potable water conditions, encompassing the entire process from borehole production to the distribution network leading to the terminal outlets. Consequently, he has conducted assessments on the four boreholes and the eight storage facilities, while also evaluating the water quality and the distribution network responsible for delivering water to the three taps allocated to each of the 3,000 tents (UNHCR, 2019). But the population of Bardarash camp was not calculated with the population of the area and its growth.

Delegate migration coefficient =  $I \div P \times 100$

I Number of incoming immigrants

P Population at the middle of the period in a given area

## **B: Departure migration**

Indeed, the term "migration patterns" encompasses the movement of individuals or families from one geographical area to another, whether it be within the same country or across national borders. These movements may occur due to various reasons such as economic opportunities, seeking refuge from conflict or persecution, pursuit of education, marriage, or simply for a change in lifestyle. Moreover, migration patterns are not static; they evolve over time due to changing socio-economic, political, and environmental factors. For instance, economic downturns in certain regions may lead to an outflow of residents seeking better job prospects elsewhere, while political instability or natural disasters may prompt large-scale displacement of populations.

During the period spanning from 2006 to 2014, the Bardarash district witnessed a noteworthy demographic phenomenon characterized by an approximate exodus of 4176 individuals. However, it is pertinent to acknowledge the inherent limitation in accessing comprehensive and precise statistical data specific to the district, thereby

constraining a thorough analytical examination of this migratory trend within the district's boundaries. Primarily, the majority of these migrants opted to relocate to prominent urban centers, notably Erbil and Duhok. It is imperative to underscore the influential role assumed by educational and sociocultural determinants in precipitating and perpetuating this migration surge. From 2014 to 2020, the number of people who left Bardarsh district is approximately (7250) people (Department of Immigration and Displacement, Dohuk Governorate).

### **2.2.3.2: International Migration**

Migration has major impacts on both the people and the places of the migrants' origin and destination. When supported by appropriate policies, migration can contribute to inclusive and sustainable development in both origin and destination countries, while also benefitting migrants and their families. The linkages between migration and development, including the opportunities and challenges that migration brings, are well established and duly acknowledged in a series of landmark agreements adopted by the United Nations Member States, including, the 2030 Agenda for Sustainable Development and, most recently, the Global Compact for Safe, Orderly and Regular Migration (Tabor et al., 2015). The Gawilan transit center commenced operations in August 2013, initially providing accommodation for a limited number of Syrian families. Following this, additional families were transferred to Gawilan from the Bardarsh youth center and Bardarsh Stadium, which served as the initial reception sites for Syrian refugees upon their entry into Iraq. The population experienced a gradual increase, culminating in the accommodation of up to 550 families by November 2013. Due to numerous families settling in undeveloped areas lacking essential facilities, UNHCR collaborated with the Duhok Governorate to undertake the construction of the Gawilan camp. By mid-2014, all families were transferred from the nearby transit site to the newly established camp. The residents exclusively consist of Syrian refugees, with 70% originating from Hassaka Governorate, 15% from Kobane, 3% from Damascus, and 12% from diverse areas (UNHCR, 2019).

The territorial advances of Daesh (Islamic State) in Iraq, commencing in June 2014, have resulted in significant population displacements. Consequently, the autonomous Kurdistan Region is contending with an influx of refugees escaping

conflict zones. Following an initial mission with the French Red Cross in the summer of 2014, the Veolia Foundation is currently engaged in a subsequent assignment initiated by the French Foreign Office. This assignment involves evaluating the conditions at the Bardarash Camp. In August, a volunteer from the Foundation was dispatched to the location. Upon approaching from Erbil, one is confronted with a striking scene: 3,000 tents positioned on concrete foundations, enclosed by barbed wire, and safeguarded by armed security personnel (UNHCR, 2019). For information the population of Gawilan camp was not calculated with the population of the area and its growth

## **2.3 Population growth trends in the study area**

### **2.3.1 Population growth according to the administrative units of Bardarsh district**

District Center:

The area formerly known as "Al-ashayir Al sabha" became the center of a sub-district in 1898, belonging to the Aqrah District of the Mosul Province. It later became the center of a district in 2006, belonging to the Duhok Province. The population of the sub-district was 16,141 people in 1957, with the rural population being larger than the urban population during those periods, which will be discussed later. From 1996 to 2009, the area recorded high rates of change and growth due to the general security conditions and the concentration of services in the city center. In 2009, the population of the district center was approximately 26,570 people, and in 2020 it reached 312,919 people, with a total increase of 27.8% and an annual growth rate of 3.3%, See Table(8).

Daratu Sub-District:

Daratoos was a village belonging to the Bardarash sub-district and became a sub-district center in 2006, with its center in the village of Daratoo, approximately 12 km from the district center. In 2009, the population of the sub-district was about 28,832 people, and in 2014 it increased to 32,796 people, with a total change rate of 13.6% and an annual growth rate of 2.7%. The growth rate decreased to 1.08% in 2020 due to migration from rural areas to larger urban areas.

. Rovia Sub-District:

Rovia was a village belonging to the Bardarash sub-district and became a sub-district center in 2006, with its center in the village of Rovia, approximately 17 km from the district center. In 2009, the population of the sub-district was about 29,993 people, and in 2014 it increased to 35,272 people, with a total change rate of 17.8% and an

annual growth rate of 3.5%. The growth rate increased to 4% in 2020, with a total change rate of 24.3%.

**Table 8:** Population growth according to administrative units of Bardarsh district (2009-2020)

| <b>Region \ Year</b> | <b>2009</b> | <b>2014</b> | <b>2020</b> |
|----------------------|-------------|-------------|-------------|
| The district center  | 26570       | 31219       | 39902       |
| The ratio of change% |             | 17.5        | 27.8        |
| growth rate%         |             | 3.5         | 4.6         |
| Daratu Sub-District  | 28832       | 32796       | 34931       |
| The ratio of change% |             | 13.6        | 6.5         |
| Growth rate%         |             | 2.7         | 1.08        |
| Roviya Sub-District  | 29943       | 35272       | 43850       |
| The ratio of change% |             | 17.8        | 24.3        |
| Growth rate%         |             | 3.5         | 4           |
| Kalak Sub-district   | 31355       | 36935       | 34933       |
| The ratio of change% |             | 17.8        | -5.4        |
| Growth rate%         |             | 3.5         | -0.9        |
| Total                | 116700      | 136222      | 153616      |
| The ratio of change% |             | 16.7        | 12.8        |
| Growth rate%         |             | 3.3         | 2.1         |

**Source /** From the researcher's work based on Appendix No.5

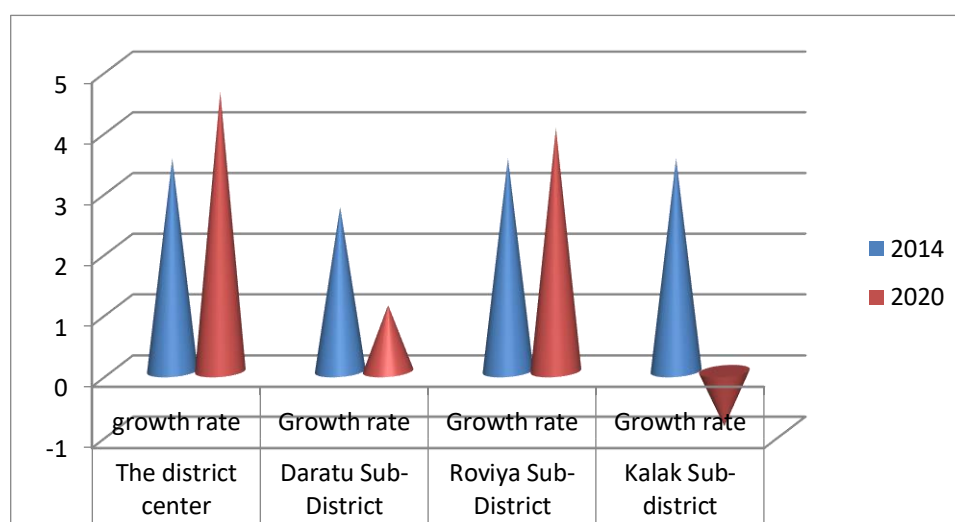


**Figure 11:** Growth rate according to administrative units of Bardarsh district (2014-2020).

Kalak Sub-District:

The Kelek sub-district belonged to the Hamdaniya District in the Nineveh Province. After the uprising in 1991, its administrative unit was changed to the Aqrah

District. After Bardarash became an area, the Kalak area was administratively linked to the Bardarash area. It is approximately 35 km from the district center. In 2009, the population of the sub-district was about 31,355 people, and in 2014 it increased to 36,935 people, with a total change rate of 17.8% and an annual growth rate of 3.5%. The growth rate decreased to -0.9% in 2020, with a total change rate of -5.4% due to unstable conditions in the region, especially in rural areas, and migration to more stable urban areas as previously mentioned.

### **2.3.2 The population growth of Bardarash compared to the districts of Duhok province**

The Bardarash District ranks third in terms of population growth after the Sheikhan and Semel Districts, with an annual increase of 5,135 people and a growth rate of 6.3% (Table 9). In the Sheikhan District, the annual increase is 7,278 people with a growth rate of 10.5%, while in the Semel District, the annual increase is 8,213 people with a growth rate of 8%. The lowest growth rate was recorded in the Amedi District at 4%, which is attributed to its geographically complex and rugged terrain. Most of its land is steep and unsuitable for human activities, with more than half of its area having a slope greater than 15 degrees, making it unsuitable for human or agricultural use. The flat land, with a slope value of zero, constitutes only 0.07% of the total area (Nashwan Shukri et al, 2013).

**Table 9:** Population growth in districts of Duhok province (2006-2020).

| <b>Districts</b> | <b>The Total Population Increase</b> | <b>The annual absolute increase</b> | <b>The overall rate of change</b> | <b>Ratio of Annual change</b> | <b>Population growth rate</b> |
|------------------|--------------------------------------|-------------------------------------|-----------------------------------|-------------------------------|-------------------------------|
| <b>Duhok</b>     | 158119                               | 11294                               | 57.3                              | 5.2                           | 4                             |
| <b>Zakho</b>     | 126714                               | 9051                                | 65                                | 4.6                           | 4.7                           |
| <b>Akre</b>      | 88380                                | 6312                                | 73.2                              | 5.2                           | 5.2                           |
| <b>Amedi</b>     | 49320                                | 3522                                | 58.2                              | 4.1                           | 4.1                           |
| <b>Semel</b>     | 114991                               | 8213                                | 113                               | 8                             | 8                             |
| <b>Sheikhan</b>  | 101894                               | 7278                                | 148.9                             | 10.7                          | 10.5                          |
| <b>Bardarash</b> | 71895                                | 5135                                | 88                                | 6.2                           | 6.3                           |
| <b>Total</b>     | 711313                               | 50805                               | 76.8                              | 5.5                           | 5.48                          |

**Source /** From the researcher's work based on Appendix No.3

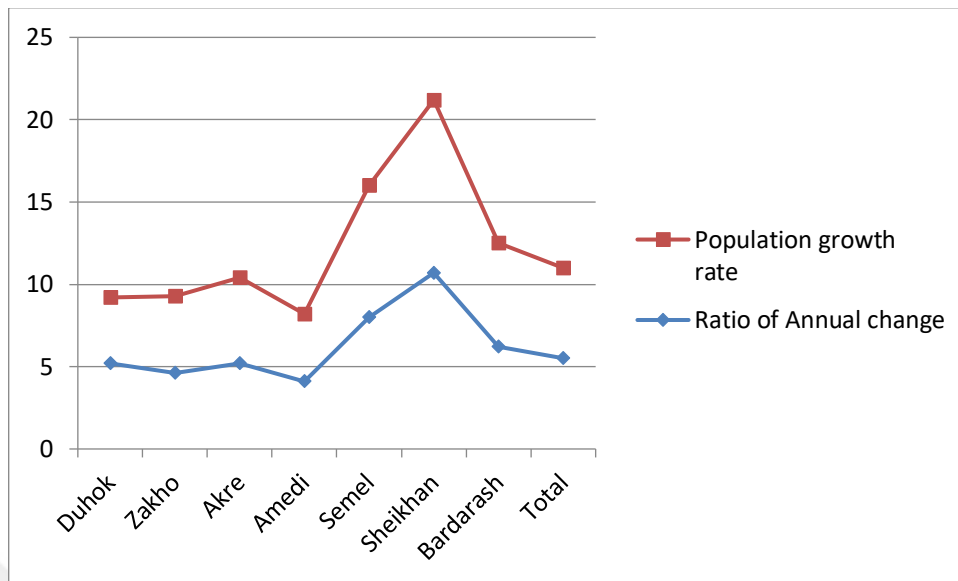


**Figure 12:** Ratio of Annual change and Population growth rate in districts of Duhok province (2006-2020).

Sheikhan emerges as the district manifesting the most pronounced overall rate of change and population growth rate within the examined dataset. This observation suggests a notable surge in demographic expansion within its geographic confines. Conversely, Semel delineates a strikingly high overall rate of change and growth rate, indicative of considerable population augmentation within its jurisdictional bounds. Amedi and Zakho, by contrast, present relatively subdued overall rates of change and growth rates vis-à-vis their counterparts. Such disparities imply variances in the pace and extent of demographic transformations across distinct regions.

The dataset underlines substantial population growth trends across the array of districts under scrutiny, thereby illuminating areas characterized by rapid demographic proliferation. This empirical insight underscores the imperative for attentive consideration in regional planning endeavors and judicious resource allocation initiatives. By furnishing pertinent statistical inputs, these findings facilitate the formulation of informed decision-making frameworks tailored to accommodate the evolving dynamics of regional population shifts efficaciously.

**Table 10:** Percentage of population change and growth in the districts of Duhok Governorate (2006-2020).

| Year | Duhok District | Absolut population increase | Total rate of change | Population growth rate | Semel District | Absolut population increase | Total rate of change | Population growth rate |
|------|----------------|-----------------------------|----------------------|------------------------|----------------|-----------------------------|----------------------|------------------------|
| 2006 | 275845         | -                           | -                    | -                      | 101757         | -                           | -                    | -                      |
| 2009 | 308302         | 32457                       | 11.7                 | 3.9                    | 153985         | 52228                       | 51.3                 | 17.1                   |
| 2014 | 363172         | 54870                       | 17.8                 | 3.5                    | 181390         | 27405                       | 17.8                 | 3.6                    |
| 2020 | 433964         | 70522                       | 28.5                 | 3.2                    | 216748         | 35358                       | 19.5                 | 3.3                    |
| Year | Zakho District | Absolut population increase | Total rate of change | Population growth rate | Amedi District | Absolut population increase | Total rate of change | Population growth rate |
| 2006 | 192665         | -                           | -                    | -                      | 84625          | -                           | -                    | -                      |
| 2009 | 226897         | 34232                       | 17.6                 | 5.9                    | 95159          | 10534                       | 12.4                 | 4.1                    |
| 2014 | 267279         | 40382                       | 17.7                 | 3.5                    | 112095         | 16936                       | 17.8                 | 3.5                    |
| 2020 | 319379         | 52100                       | 19.4                 | 3.2                    | 133945         | 21850                       | 19.5                 | 3.2                    |

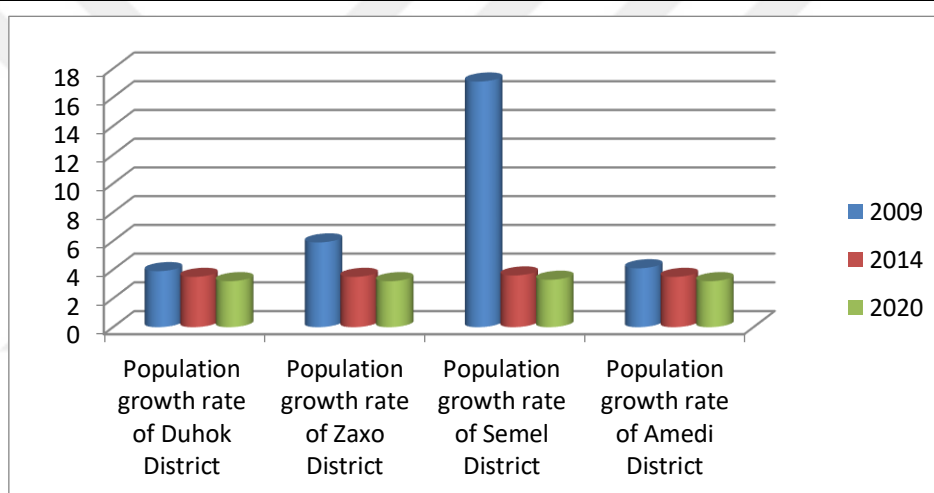


**Figure 13:** Population growth rate in 2009, 2014 and 2020.

Both Duhok and Semel districts have demonstrated noteworthy shifts in population dynamics over the observed periods. Duhok District consistently exhibited more substantial absolute population increases compared to Semel District, indicating a pattern of greater demographic growth within its boundaries. Notably, Duhok District experienced an escalating trend in total rates of change from 2009 to 2020, suggesting a sustained acceleration in population expansion. In contrast, Semel District's total rate of change exhibited fluctuations over the same period, with an initial surge in 2009 followed by subsequent stabilization in subsequent years.

Despite Semel District's notable initial surge in total rate of change in 2009, the subsequent years saw a gradual stabilization of this metric. Such dynamics underscore the intricate and evolving nature of population trends within these respective regions.

These insights are of paramount importance for policymakers and stakeholders, as they provide a nuanced understanding of regional demographic shifts. Moreover, they serve as critical inputs for the formulation of targeted policy interventions and resource allocation strategies aimed at effectively addressing the evolving needs of the population within Duhok and Semel districts.

Both the Zakho and Amedi districts exhibited significant absolute population increases over the observed periods, with Zakho District consistently demonstrating larger increments compared to Amedi District. This observation suggests varying degrees of demographic expansion within these regions. Furthermore, the total rate of change remained relatively stable over time for both districts, albeit with minor fluctuations observed in the growth rates. Despite variations in the magnitude of population growth, both districts maintained comparable growth rates throughout the observed years, indicating a degree of consistency in demographic trends.

The presented data underscores the dynamic nature of population dynamics within the Zakho and Amedi districts over the examined timeframe. Such insights are integral for policymakers and stakeholders as they offer a comprehensive understanding of regional demographic shifts. Furthermore, they serve as crucial inputs for informing targeted policy interventions and resource allocation strategies aimed at effectively addressing the evolving needs of the population within these districts. By recognizing and responding to these demographic dynamics, policymakers can better tailor their initiatives to meet the evolving demands and challenges faced by the communities in Zakho and Amedi districts.

| <b>Year</b> | <b>Akre District</b>    | <b>Absolut population increase</b> | <b>Total rate of change</b> | <b>Population growth rate</b> | <b>Bardarash District</b> | <b>Absolut population increase</b> | <b>Total rate of change</b> | <b>Population growth rate</b> |
|-------------|-------------------------|------------------------------------|-----------------------------|-------------------------------|---------------------------|------------------------------------|-----------------------------|-------------------------------|
| <b>2006</b> | 120669                  | -                                  | -                           | -                             | 81721                     | -                                  | -                           | -                             |
| <b>2009</b> | 148515                  | 27846                              | 23                          | 7.7                           | 116700                    | 34979                              | 42.8                        | 14.2                          |
| <b>2014</b> | 174947                  | 26432                              | 17.8                        | 3.5                           | 136222                    | 19522                              | 16.7                        | 3.3                           |
| <b>2020</b> | 209049                  | 34102                              | 19.5                        | 3.2                           | 153616                    | 17394                              | 12.7                        | 2.1                           |
| <b>Year</b> | <b>Shekhan District</b> | <b>Absolut population increase</b> | <b>Total rate of change</b> | <b>Population growth rate</b> | <b>Total</b>              | <b>Absolut population increase</b> | <b>Total rate of change</b> | <b>Population growth rate</b> |
| <b>2006</b> | 69368                   | -                                  | -                           | -                             | 926650                    | -                                  | -                           | -                             |
| <b>2009</b> | 121670                  | 52302                              | 75.4                        | 25.1                          | 1171228                   | 244578                             | 26.4                        | 8.8                           |
| <b>2014</b> | 143324                  | 21654                              | 17.8                        | 3.5                           | 1378429                   | 207201                             | 17.6                        | 3.5                           |
| <b>2020</b> | 171262                  | 27938                              | 19.5                        | 3.3                           | 1637963                   | 259534                             | 18.8                        | 3.1                           |

**Source** / From the researcher's work based on Appendix No.3

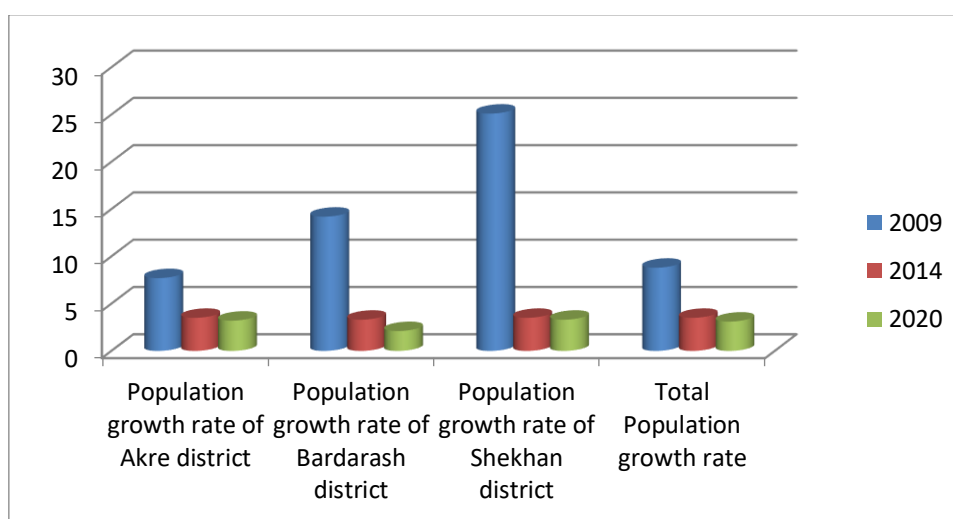


**Figure 14:** Population growth rate in (2009, 2014 and 2020).

Both the Akre and Bardarash districts have exhibited substantial absolute population increases over the observed periods, with Bardarash District demonstrating notably larger increments in comparison to Akre District. This observation suggests varying degrees of demographic growth between the two regions. Notably, Bardarash District displayed a remarkable total rate of change in 2009, followed by a gradual decline in subsequent years, whereas Akre District maintained a relatively consistent total rate of change throughout the examined timeframe.

Despite disparities in absolute population increases and total rates of change, both districts have demonstrated comparable population growth rates over the observed years, albeit with a discernible declining trend observed in Bardarash District. This consistency in population growth rates underscores the resilience of demographic trends within the Akre and Bardarash districts, despite fluctuations in other metrics.

The provided data underscores the nuanced nature of population dynamics within these districts over the examined timeframe. Such insights hold significant value for policymakers and stakeholders, furnishing indispensable information for informed decision-making processes pertinent to regional planning, resource allocation, and policy formulation. By elucidating the evolving demographic landscape, this data aids in devising strategies aimed at addressing the evolving needs of the population within the Akre and Bardarash districts effectively.

## **Chapter Three**

### **3. Distribution and spatial patterns of population in the study area**

#### **3.1 Volumetric and relative distribution of the population**

The size distribution of population can be defined as the arrangement or classification of settlements according to their population weight, which varies from one administrative unit to another (Mohammed, 2005). This classification depends on the number of population, and it is this number that creates variations in the concentration or dispersion of the population, where the reciprocal relationship between humans and. The area of land on which he lives, and the economic potential it possesses that help secure the needs of the population, and at the same time it is possible to identify the sizes of large, medium and small human settlements, as well as the level of civilizational and civil development that the population has reached in those centers (Jassim, 2008).

Bardarash district in the year (1977-2020) has seen several demographic and administrative changes, which affected the occurrence of many differences in the size of human settlements, in order to be more familiar with the size of human settlements can be divided into:

- A. Distribution of urban settlements (according to size).
- B. Distribution of rural settlements (according to average village size).
- C. Distribution of rural settlements (according to size)

##### **3.1.1 Distribution of urban settlements (according to size)**

The urban settlements in the study area have undergone significant changes in their sizes over the years of the study. However, what is interesting is that these changes were not uniform but varied from one settlement to another, as demonstrated in Table (11) and Figure (15) and Table Number (12) for the urban growth rate.

Bardarash city took the lead in urban population size in (2020), where approximately (21.8%) of the district's total population is concentrated, while this percentage represented about (4.9%) of the total population of Aqrah during the period of (1987). Because Bardarash, before becoming a district, was a sub-district of Aqrah, it

separated in 2006 and was recognized as an independent district under Duhok Province. Then the percentage declined to about (4.6%) of the region's total population during the year (1996), and in (2009), the percentage increased to (18.8%) of the district's total population, as a result of administrative and demographic changes that occurred in the study area on one hand, and on the other hand, the instability in Mosul city, the security situation in Mosul was another reason. The urban growth rate between (1996-2009) increased significantly by more than (17%).

The Township of Kalak: Ranked second in terms of district centers. In (2020), it accounted for nearly (14.4%) of the total district's population, while in (2009), it accounted for (9.6%) more. However, its population density increased in proportion to the urbanization of the district, while the annual growth rate of the urban population in this Sub-district increased by (8.9%) from (2009-2020), It is worth noting that the Residential complex of Bshiryan was counted with this township.

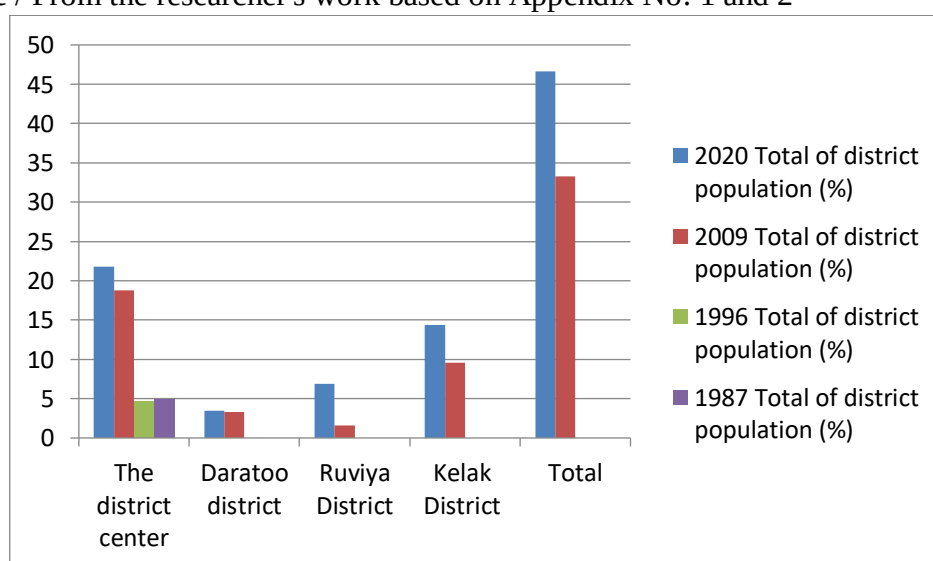
The Township of Rovia: Ranked third in terms of district centers. In (2020), it accounted for nearly (6.9%) of the total district's population, while in (2009), it accounted for (1.6%) more. However, this change is mainly due to several factors that contributed to the emergence of a new urban center and the relocation of the majority towards the urban centers such as (Zakho - Duhok and Akre - Mosul), and the urban growth rate in this area significantly increased by more than (40%) from (2009-2020).

The Township of Darto: Ranked fourth in terms of district centers, and in (2020), it accounted for nearly (3.5%) of the total district's population, while in (2009), it was (3.3%). However, at this point, a change occurred due to the expansion of this settlement towards the outskirts of Darto town with the emergence of other urban centers, and the urban growth rate in terms of urbanization in the year (2009-2020) was (3.7%).

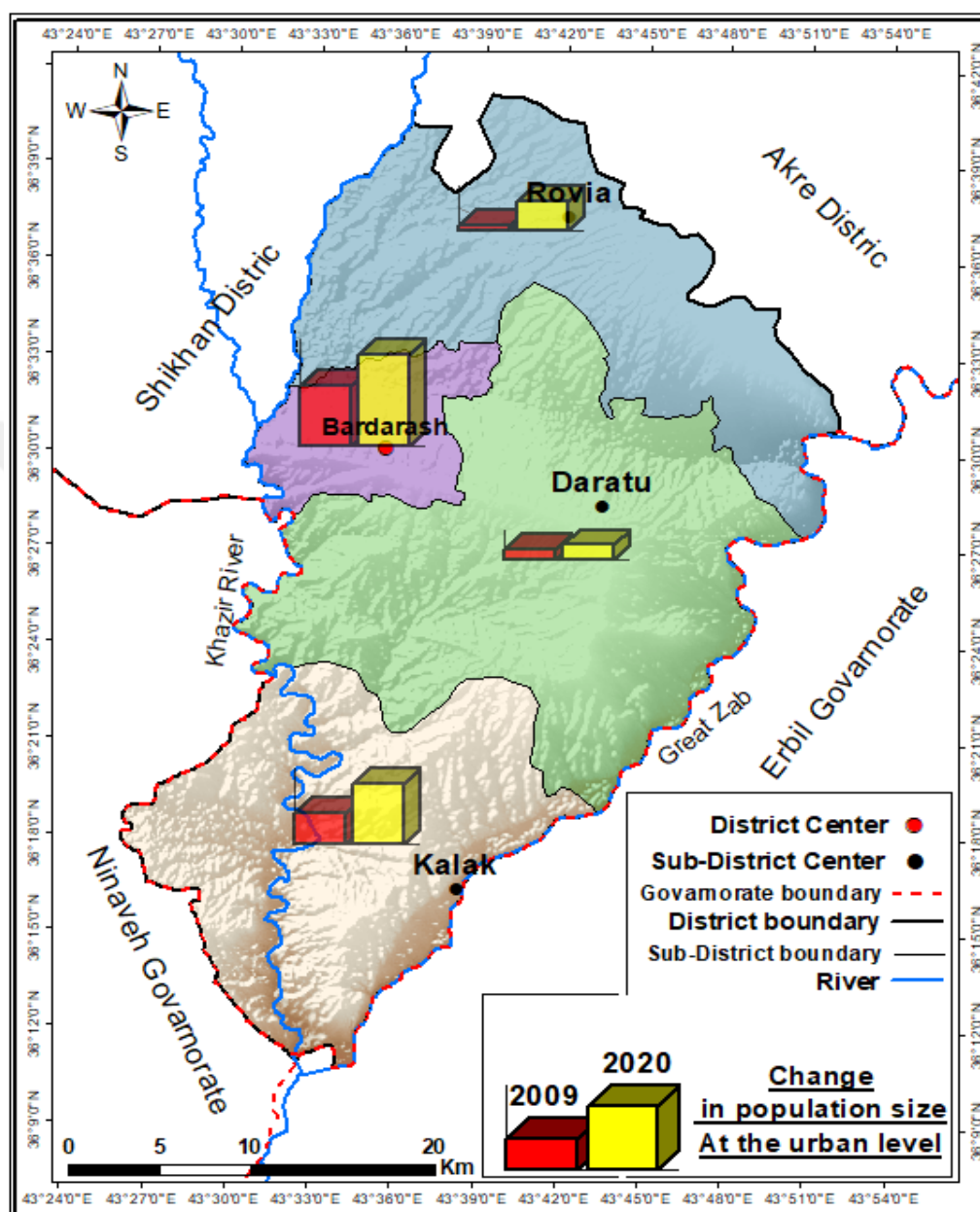
**Table 11:** Size and population of urban settlements in Bardarsh district (1987-2020)

| Year | Administrative unit                              | The district center | Daratoo district | Ruviya District | Kalak District | Total |
|------|--------------------------------------------------|---------------------|------------------|-----------------|----------------|-------|
| 1987 | The urban population / person                    | 4573                | -                | -               | -              | 4573  |
|      | Of the total population of the district (%)      | 4.9                 | -                | -               | -              | -     |
|      | Of the total urban population of The district(%) | 21.3                | -                | -               | -              | -     |
| 1996 | The urban population / person                    | 6827                | -                | -               | -              | 6827  |
|      | Of the total population of the district (%)      | 4.6                 | -                | -               | -              | -     |
|      | Of the total urban population of The district(%) | 20.2                | -                | -               | -              | -     |
| 2009 | The urban population / person                    | 22010               | 3851             | 1948            | 11198          | 39007 |
|      | Of the total population of the district (%)      | 18.8                | 3.3              | 1.6             | 9.6            | 33.3  |
|      | Of the total urban population of The district(%) | 56.4                | 9.9              | 5               | 28.7           | 100   |
| 2020 | The urban population / person                    | 33483               | 5421             | 10605           | 22181          | 71690 |
|      | Of the total population of the district (%)      | 21.8                | 3.5              | 6.9             | 14.4           | 46.6  |
|      | Of the total urban population of The district(%) | 46.7                | 7.6              | 14.8            | 30.9           | 100   |

**Source** / From the researcher's work based on Appendix No. 1 and 2

**Figure 15:** Urban population according to administrative units of Bardarash district.

**Map 3:** Urban population according to administrative units of Bardarash district in 2009-2020.



**Source** / From the researcher's work based on Table(11)

**Table 12:** Annual growth rate of urban population by administrative unit (1987-2020%).

| Administrative units | 1987-1996 | 1996-2009 | 2009-2020 |
|----------------------|-----------|-----------|-----------|
| The Center District  | 5.4       | 17.1      | 4.7       |
| Daratu District      | -         | 5.2       | 3.7       |
| Roviya District      | -         | 5.8       | 40.4      |
| Kalak District       | -         | 6.5       | 8.9       |

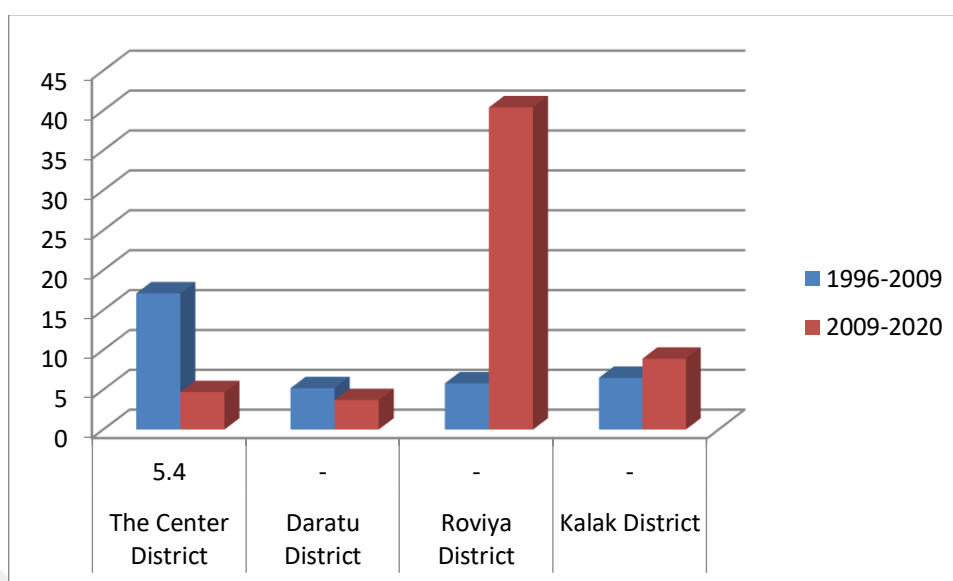


**Figure 16:** Annual growth rate of urban population by administrative unit (1987-2020%).

Here we can say that despite the changes that have occurred in the size of the population of the urban settlements of the district, but the ranking of their size has changed to some extent. Therefore, the urban settlements of Bardarash district according to their size in 2020 can be classified into three different groups as follows:

#### **First/ Large-sized residences**

The district center of Bardarash is located in the middle of the district and the population this year was about (33483) people and (46.7%) of the urban population of the district. Thus, it is considered to be the largest urban settlement in the district and has received the first rank throughout the years of research.

#### **Second/ Medium-sized residence**

The town of Kalak falls into this group and the population of Kalak this year was about (22181) people, which accounts for about (30.9%) of the total urban population of the district. During the years of research, it followed Bardarash in terms of population.

#### **Third/ Small-size residence**

Ruviya township had a population of about (10605) people which accounts for about (14.8%) of the total urban population of the district. Daratu town is located in this group and the population was about (5421) in 2020, which accounts for about (7.6%) of the urban population of the district, so it is considered the smallest town in the district.

It is worth mentioning that most researchers specializing in urban geography have tried to find the relationship between the size of the city and the ranking it occupies in a particular region or country, as this type of organization or division depends on geographical, economic and cultural conditions (Sabri, 2002).

As a result of several specialized studies in this field, researchers have developed a number of laws that are used to find the ranking of cities, the most important and famous of which (the law of ranking - size) developed by (George Zipf). The third city is equal to 1/3 and the fourth is 1/4 of the first city (Abdulrazaq, 1977).

While trying to implement the above standards for the study area, we notice differences in the population size of urban towns of Bardarash district and looking at Table (13), it appears that the population size of the second town in 2009 accounted for half of the first city In 2020, the population of the second city will be much more than half the size of the first city by 66.2% , as pointed out by Zipf.

**Table 13:** Ranking of urban centers of Bardarash district according to the first city (2009-2020).

| The ranking     | 2009 | 2020 |
|-----------------|------|------|
| The first city  | 100  | 100  |
| The second city | 50.8 | 66.2 |
| The third city  | 8.8  | 31.7 |
| The fourth city | 17.5 | 16.2 |

The third city in 2009 accounted for about 8.8% of the population of the first city, while this figure will rise to 31.7% in 2020, but the fourth city is close in the same year This difference in the size of the population of the urban settlements of the district is related to the difference in the annual growth of the settlements on the one hand and on the other hand There is a criterion used in Iraq to determine urban centers, which is the principle of (performance). Obviously, this criterion does not take into account the size of the population.

### **3.1.2 Distribution of rural settlements (according to average village size).**

The total sizes of villages are one of the measures by which the total sizes of rural settlements for each administrative unit can be identified, as the presence of differences in natural and human factors leads to the emergence of a feature of variation in their totals, and the presence of appropriate conditions for practicing agricultural activity on a large scale may be a factor. To attract residents to it, and then the density

and size of the settlements becomes large and numerous, compared to other region (Jassim, 2008,p,118).

The density and size of settlements have significantly increased compared to other areas. Notably, the rural centers in Bardarash have experienced minimal changes in their sizes during the study period. Table (14) indicates that the number of rural settlements was approximately 105 in 2009, decreasing to 99 by 2020 due to administrative changes in some villages. The average size of rural settlements in the study area was 740 people per village in 2009, rising to 827 people per village in 2020. This corresponds to an annual increase rate of 16.4 people per village, as shown in Table (14).

**Table 14:** Number, proportion and average size of rural population in Bardarash region (1996-2020).

| Year | Administrative unit               | The Sub-district center | Daratoo Sub-district | Ruviya Sub-district | Kelak Sub-district | Total |
|------|-----------------------------------|-------------------------|----------------------|---------------------|--------------------|-------|
| 1996 | Number of villages                | 78                      | -                    | -                   | -                  | 78    |
|      | %                                 | 22.6                    | -                    | -                   | -                  | -     |
|      | Population/persons                | 51871                   | -                    | -                   | -                  | 51871 |
|      | %                                 | 45.7                    |                      |                     |                    |       |
|      | Average Population Person/Village | 665                     |                      |                     |                    | 665   |
| 2009 | Number of villages                | 7                       | 28                   | 43                  | 27                 | 105   |
|      | %                                 | 6.7                     | 26.7                 | 40.9                | 25.7               | 100   |
|      | Population/persons                | 4560                    | 24981                | 27995               | 20157              | 77693 |
|      | %                                 | 6.4                     | 30.9                 | 36.6                | 26.1               | 100   |
|      | Average Population Person/Village | 651.4                   | 892.2                | 651                 | 746.5              | 739.9 |
| 2020 | Number of villages                | 7                       | 28                   | 47                  | 17                 | 99    |
|      | %                                 | 7                       | 28.3                 | 47.5                | 17.2               | 100   |
|      | Population/persons                | 6419                    | 29510                | 33245               | 12752              | 81926 |
|      | %                                 | 7.8                     | 36                   | 40.6                | 15.6               | 100   |
|      | Average Population Person/Village | 917                     | 1050                 | 707.3               | 750                | 827.5 |

**Source /** From the researcher's work based on Appendix No. 1 and 2

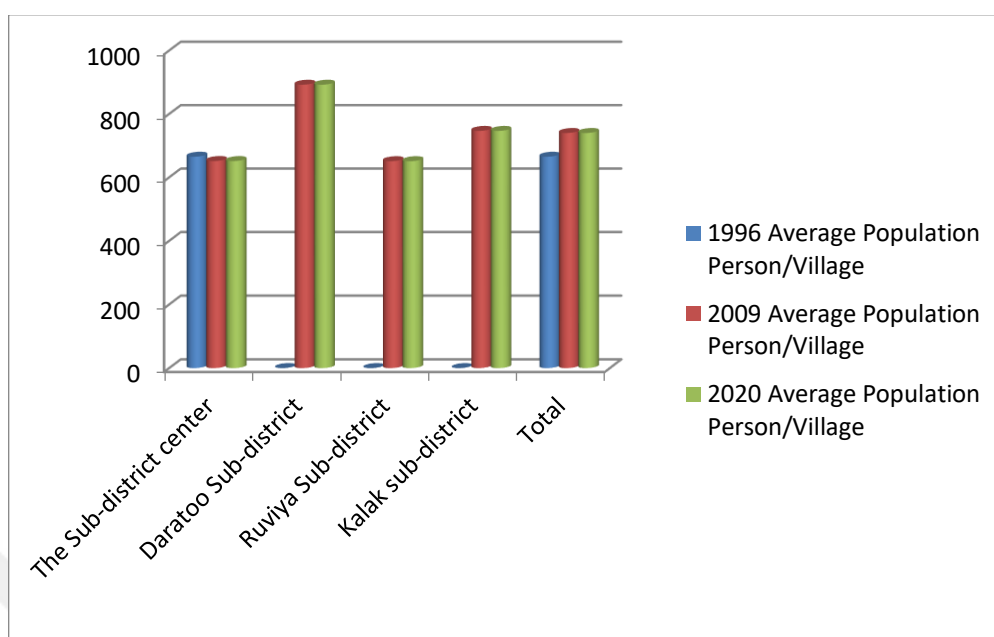


**Figure 17:** Average Population Person/Village of bardarash region.

Table (14) shows that these settlements are not evenly distributed across all administrative units within the Bardarash district. Instead, there are significant disparities in the number of these centers.

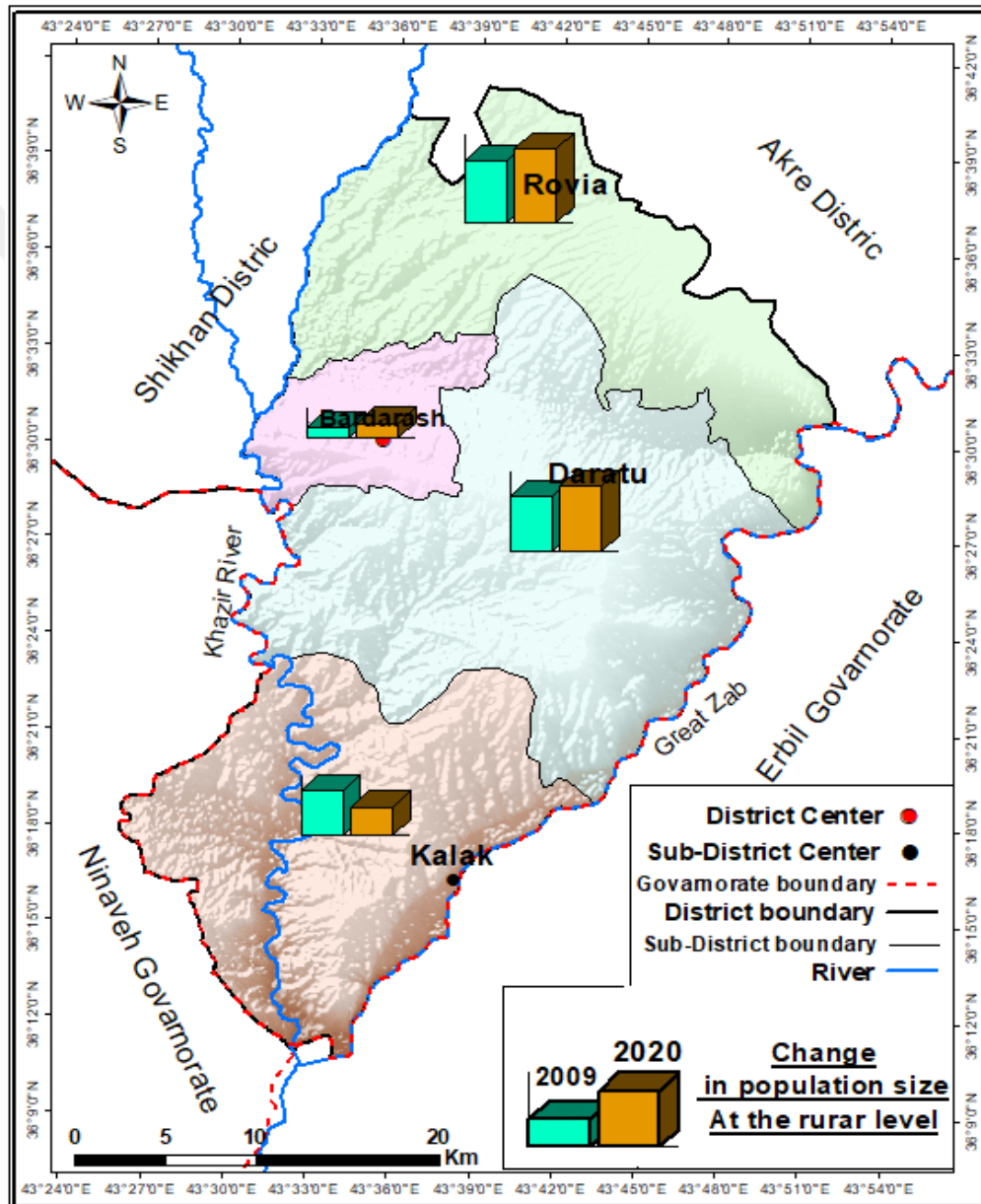
In 2020, the central district of Bardarash consisted of seven villages. The average size of the villages during this period was about 917 people per village. Previously, they accounted for about (6.4%) of the total number of villagers in the district, thus the average size of the village this year (651) people per village.

In 2009, Daratu sub-district consisted of 28 villages and the average size of villages in this sub-district was 892 people per village, which accounts for about 30.9% of the total rural population of the district. In 2020, the average size of the villages did not change, but the average size of the villages changed to 1050 people per village, accounting for about 36% of the total population of the district.

In 2009, Ruviya sub-district consisted of 43 villages and the average village size in this sub-district was 651 people per village, which accounts for about 36.6% of the total rural population of the district. In 2020, the average size of villages in this district has decreased to 707 people per village, due to the recognition of several settlements as villages, and the migration of people from villages to cities has reduced the average size of villages in this sub-district. They account for more than 40% of the total rural population of the district.

In 2009, Kalak sub-district consisted of 27 villages and the average village size in this sub-district was 746 people per village, which accounts for about 26.1% of the total rural population of the district . In 2020 it decreased to 17 villages due to the arrival of ISIS and the administrative reasons mentioned earlier. The average size of the villages this year is 750 people per village.

**Map 4:** Population size at the village level (2009-2020)



**Source /** From the researcher's work based on Table(14)

**Table 15:** Average annual change of village size at the level of administrative units of Bardarash district

| Administrative units    | 1996-2009 | 2009-2020 |
|-------------------------|-----------|-----------|
| The Center Sub-District | -1.04     | 24.1      |
| Daratu Sub-District     | -         | 14.3      |
| Ruviya Sub-District     | -         | 5.1       |
| Kalak Sub-district      | -         | 34.6      |
| district                | -         | 16.4      |

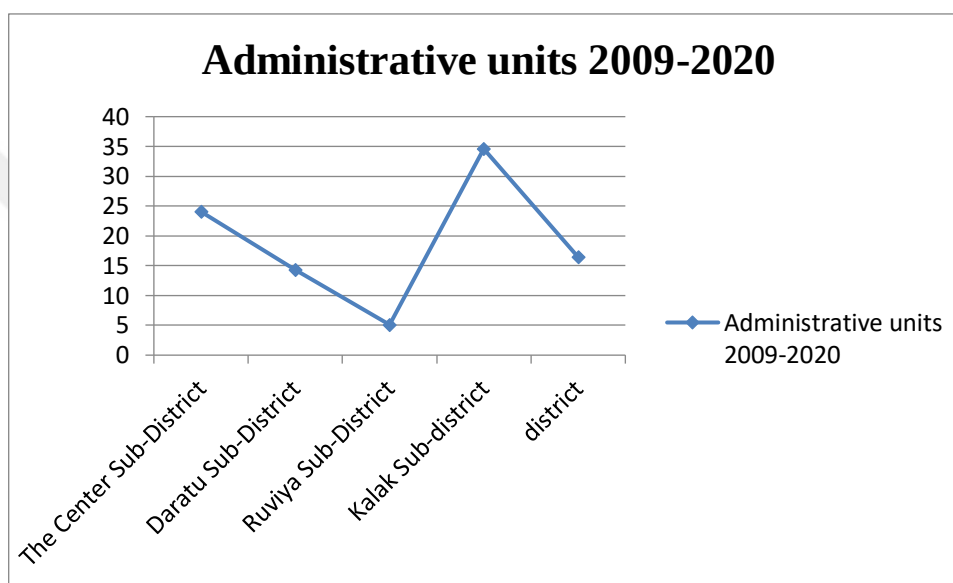


**Figure 18:** Average annual change of village size at the level of administrative units of Bardarash district from 2009-2020.

### 3.1.3 Distribution of rural settlements (according to size)

This type of distribution means classifying rural centers or organizing them into specific size categories, and this classification will be based on the number of residents. It is known that the last element varies from one village to another, and within the same administrative unit. This variation is important in selecting some villages. In order to develop its reality, or to establish some service projects in it to serve itself and to serve the neighboring village centers, and in order to raise its administrative level depending on the presence of a number of diverse criteria, including the number of population (Ahmad, 2008,p,143).

**Table 16:** The Volume Distribution of Rural Settlements in the Bardarash District  
(2010-2020)

| Size category  | 2010                   |                | 2020                   |                |
|----------------|------------------------|----------------|------------------------|----------------|
|                | (%) Number of villages | (%) Population | (%) Number of villages | (%) Population |
| Less than 400  | 33.4                   | 8.7            | 36                     | 6.7            |
| at 400-799     | 34.3                   | 27.3           | 29                     | 21.4           |
| at 800-1199    | 13.3                   | 18             | 10                     | 12.5           |
| More than 1200 | 19                     | 46             | 24                     | 59.4           |
| Total          | 100                    | 100            | 100                    | 100            |

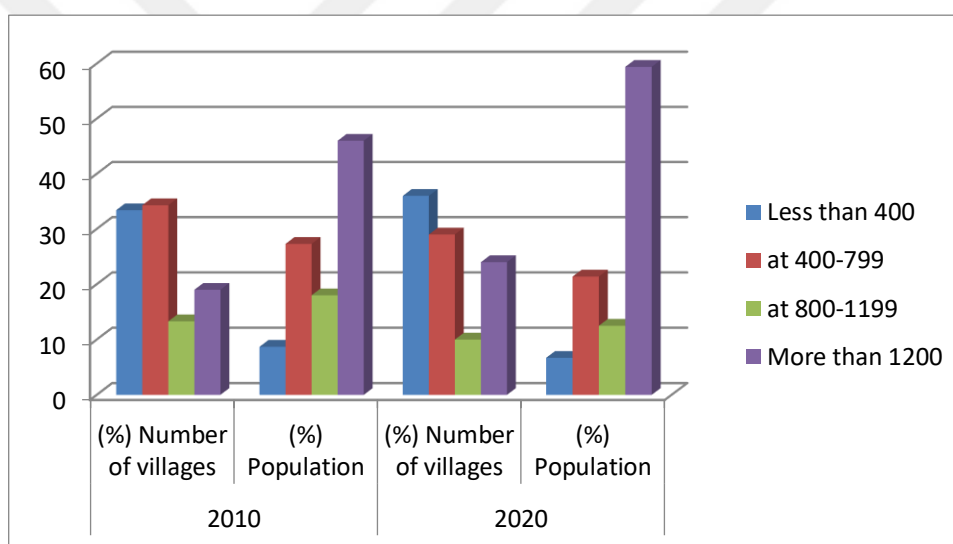


**Figure 19:** The Volume Distribution of Rural Settlements in the Bardarash District  
(2010-2020)

- 1- The category of rural settlements with less than 400 inhabitants occupied a large percentage in the Kalak district during the year (2020), amounting to about ( 47%) of the total villages, with a population of about (7.8%). on the other hand, this category was a close percentage during the same period in the Rovia district, where it reached about (42.5%) of the total rural settlements and (7.1%) of the total rural population, the lowest percentage of the said category appeared in the daratu) district and amounted to about (25% and 5.3 the reason for this is due to the fact that the vast majority of the population of darattu district lives in large villages.





- 3- The rural settlements classified under the category (800 - 1,200 inhabitants), it came within the districts (center and Daratu) with the highest percentage, reaching the limits of (14.3% and 14.2%), respectively, and with a population of (16.7% and 13.7%) of the total population of rural settlements, within this category that year (2020), then the district of Kalak came in third place after these two areas in terms of its representation of the said category, it amounted to about (11.8%) of the total villages, and (16%) of the total population in the same period, as for the area (Rovia) came in last place, where it occupied a small percentage of this category compared to the rest of the categories in the same area, where it amounted to (6.4%) and the percentage of the population did not exceed (9.4%), and it is worth noting that this category has witnessed many differences during Years of study are between the administrative units of the study area.
- 4- The largest percentage of the category of large-sized rural settlements with (1200 residents) and more appeared within the daratu area, which occupied the lead with a percentage exceeding (32.2%) of the total villages, and with a population reaching more than (63.5%), in (2020), while the two areas (Kalak and Rovia) were close in the large category, reaching about (23.5% and 21.3%) of the total villages, respectively, with a population estimated at (60.7% and 57.9% of the total population in the same year, as for the district (center) came in last place, where it occupied a small percentage of this category, reaching (14.3%) and with a population percentage not exceeding (45.5%).

**Table 17:** Volumetric distribution of rural settlements by administrative units In the bardarsh district (2010-2020).

| Size category           | 2010               |      |            |      | 2020               |      |            |      |
|-------------------------|--------------------|------|------------|------|--------------------|------|------------|------|
|                         | Number of Villages | %    | Population | %    | Number of Villages | %    | Population | %    |
| The Center Sub-District |                    |      |            |      |                    |      |            |      |
| Less than 400           | 2                  | 28.5 | 380        | 7.8  | 2                  | 28.5 | 540        | 8.4  |
| at 400-799              | 3                  | 42.9 | 1577       | 32   | 3                  | 42.9 | 1893       | 29.5 |
| at 800-1199             | 1                  | 14.3 | 935        | 19   | 1                  | 14.3 | 1075       | 16.7 |
| More than 1200          | 1                  | 14.3 | 2025       | 41.2 | 1                  | 14.3 | 2911       | 45.4 |
| Total                   | 7                  | 100  | 4917       | 100  | 7                  | 100  | 6419       | 100  |
| Daratu Sub-District     |                    |      |            |      |                    |      |            |      |
| Less than 400           | 7                  | 25   | 1658       | 6.7  | 6                  | 21.4 | 1571       | 5.3  |
| at 400-799              | 11                 | 39.3 | 6679       | 26.9 | 9                  | 32.2 | 5158       | 17.5 |
| at 800-1199             | 4                  | 14.3 | 4448       | 17.9 | 4                  | 14.2 | 4047       | 13.7 |
| More than 1200          | 6                  | 21.4 | 12034      | 48.5 | 9                  | 32.2 | 18734      | 63.5 |
| Total                   | 28                 | 100  | 24819      | 100  | 28                 | 100  | 29510      | 100  |
| Ruyiya Sub-District     |                    |      |            |      |                    |      |            |      |
| Less than 400           | 17                 | 39.5 | 2751       | 9.7  | 20                 | 42.5 | 2360       | 7.1  |
| at 400-799              | 14                 | 32.6 | 8131       | 28.8 | 14                 | 29.8 | 8505       | 25.6 |
| at 800-1199             | 4                  | 9.3  | 3908       | 13.9 | 3                  | 6.4  | 3122       | 9.4  |
| More than 1200          | 8                  | 18.6 | 13443      | 47.6 | 10                 | 21.3 | 19258      | 57.9 |
| Total                   | 43                 | 100  | 28233      | 100  | 47                 | 100  | 33245      | 100  |
| Kalak Sub-District      |                    |      |            |      |                    |      |            |      |
| Less than 400           | 9                  | 33.4 | 2014       | 10   | 8                  | 47   | 992        | 7.8  |
| at 400-799              | 8                  | 29.6 | 4888       | 24.2 | 3                  | 17.7 | 1986       | 15.5 |
| at 800-1199             | 5                  | 18.5 | 4841       | 24   | 2                  | 11.8 | 2033       | 16   |
| More than 1200          | 5                  | 18.5 | 8431       | 41.8 | 4                  | 23.5 | 7741       | 60.7 |
| Total                   | 27                 | 100  | 20174      | 100  | 17                 | 100  | 12752      | 100  |

**Source** / From the researcher's work based on Appendix No. 6

### **3.2 Environmental distribution of the population**

This type of population division according to urban and rural areas is of great importance in population studies because it reveals the types of relationships that exist between humans and the earth, in addition to the facts related to the nature of population gathering patterns Shape of settlements and their distribution (Hiwa Sadq, 2005).

One of the important distributions in population studies is the division of the population into urban and rural, but one of the aspects that is still controversial among scholars and researchers is how to differentiate or distinguish between urban and rural residents and what criterion can be taken to achieve this.

This topic has been addressed by quite a few researchers in the fields of sociology, human geography, urban geography or planning, and others, and many attempts have appeared to find special criteria for determining what is urban and what is rural. Some researchers have taken the size of settlements as a criterion, others have taken the criterion of population density, and some have taken the characteristics of the local area (Abdali et al.,1986).

Different opinions of researchers on the one hand and differences between countries on the other hand, has led to the use of different criteria to distinguish between villages and cities. Some countries use demographic criteria, while others use morphological or historical criteria. However, in some places more than one criterion is used to distinguish between cities and villages, which is called the criterion (mixed) and this type is the most appropriate to distinguish between cities and villages (Khalil Ismail, 1999). In Iraq, the working criterion is the principle of separating cities and villages, so that cities are places with municipal councils, but places without municipal councils are considered villages (Abbas Fadhel, 1980).

Cities differ in their foundation from the village unit in terms of the function it performs. They are sometimes no larger in area than the village, but they differ fundamentally in that most of their people have given up agriculture, which is no longer their main occupation, and have turned their economic activity towards trade or industry (Abbas fadhel ,2004).

The most prominent attempts in this regard were made by researchers ( Taylor and Janes) they put forward several points to differentiate between what is rural and what is urban, the most important of which is ( Abd ali et al.,1986).

- 1- In terms of crafts, most of the rural population works primarily in agriculture, while urban residents depend on crafts other than agriculture.
- 2- In terms of population density, the density in urban areas is greater compared to rural areas.
- 3- In terms of Ecology, rural areas are dominated by the natural environment, where man is in direct contact with the natural environment, while in urban areas the population is in contact with the environment created by man from buildings, factories and other productive and service institutions .
- 4- Social differences are significant in urban areas and to a small extent in the countryside .
- 5- Social relations in urban areas are characterized by being broad and extended, while in rural areas they are characterized by being simple relationships.

Here, based on the principle used in Iraq, we try to investigate the environmental distribution of the population of the study area in order to show all the changes and relationships that have occurred in the urban and rural population of the area.

### **3.2.1 Environmental distribution at the level of the study area**

#### **A. Urban population**

In 2020, the residents of Bardarash district accounted for more than 46% of the total population of the district, as shown in Table 8, which is a high rate compared to other years of the study period. In 1957, they accounted for 3.4% of the total population, but in 1977 the figure decreased slightly to more than 5.5%, which is an annual growth rate of 9% It has almost doubled in previous years, accounting for 12% of the total population, but the annual growth rate of urban population during this period is 19.7% Cities as a result of political, economic and service factors.

**Table 18:** Number and environmental distribution of population in Bardarash region during (1957-2020)

| year | Number of urban population | Urbanization % | Number of rural population | Ruralisation % |
|------|----------------------------|----------------|----------------------------|----------------|
| 1957 | 550                        | 3.4            | 15591                      | 96.6           |
| 1977 | 1539                       | 5.5            | 26698                      | 94.5           |
| 1987 | 4573                       | 12             | 33643                      | 88             |
| 2009 | 39007                      | 33.4           | 77693                      | 66.6           |
| 2020 | 71690                      | 46.7           | 81926                      | 53.3           |

**Source** / From the researcher's work based on Appendix No.3

**Table 19:** Environmental change rate of population in Bardarash region during (1957-2020)

| Period    | Urbanization % | Ruralisation % |
|-----------|----------------|----------------|
| 1957-1977 | 9              | 3.5            |
| 1977-1987 | 19.7           | 2.6            |
| 1987-2009 | 34.2           | 5.9            |
| 2009-2020 | 7.6            | 0.5            |

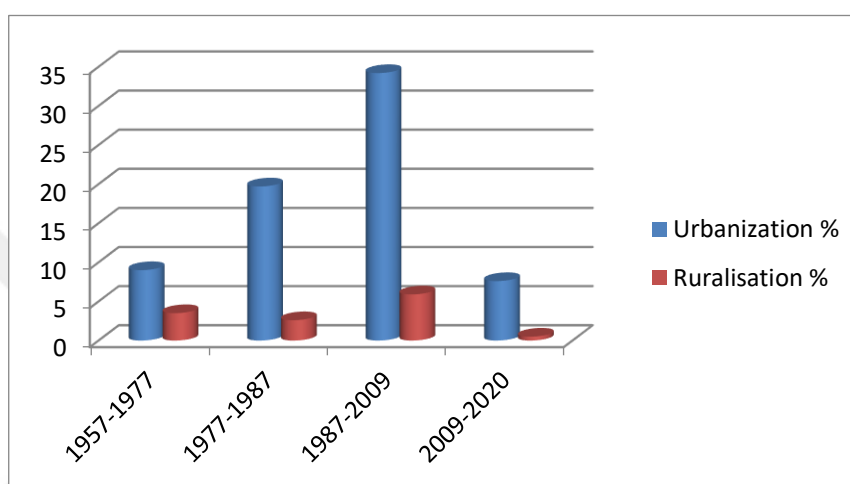


**Figure 20:** Environmental change rate of population in Bardarash region during (1957-2020).

However, in 2009, as shown by the results of the process of (enclosure and census) the urban population increased in an attractive and unnatural manner and accounted for about (33.4%) of the total population of the district This is a huge change in the environmental distribution of the population of the district, as a result of several reasons, the most important of which are:

- 1- After the administrative changes that occurred in 2006 when Bardarash district was issued an administrative order to become a district, Kalak Sub-district was added to Bardarash district, which was previously part of Akri district.
- 2- Establishment of two new Sub-districts (Daratu-Ruviya) which were previously two large villages and their center was Daratu village and Ruviya village.
- 3- Influx of Kurdish refugees from Mosul to the district center and surrounding areas . After the liberation of Iraq and the emergence of terrorist activities in late 2005 to 2009 in Nineveh province against non-Arab communities, especially the Kurdish community.

## **B. Rural population**

In 2020, the villagers of Bardarsh district accounted for about (53.3%) of the total population. (See Table 20) 96% and 94% of the population of the region, but the growth rate during this period was about 0.5% (see Table 19). This can be attributed to several factors, including the use or emergence of various tools such as mechanized equipment in agricultural fields, the instability of the security situation, the deterioration of economic conditions, and the lack of job opportunities in villages. All these factors have strongly contributed to the increased migration of residents to cities and towns. However, in 1987, according to the general census results, the proportion of rural residents decreased slightly to 88% of the total population. In 2009, the proportion of rural residents decreased significantly compared to the proportion of urban residents, about 66% of the total population of Bardarash district, which is due to several reasons, including the recognition of several villages as sub-district centers Normalization of the political situation in the region and increased job opportunities in the city centers. During the period (1988-2009), the annual growth rate of the rural population was 5.9%, but the annual growth rate of the rural population between 2009 and 2020 dropped significantly to about 0.5%, due to other reasons As mentioned above, the arrival of ISIS in 2014 had an impact on the decline in the number of villagers, especially in Kalak sub-district.

### **3.2.1.1 Environmental distribution at the level of administrative units of the study area**

The environmental distribution of the population has changed not only at the district level, but also at the sub-district level specially kalak and after that ruviya sub-district.

Center Sub-district:- As noted in Table No. (20) We can see that in the center district ‘there has been no change in the population ‘as in 2009-2020 ‘the proportion of urban dwellers (82.8% and 83.9%) is the total population of the center ‘and the villagers of The Center district account for 17.2% and 16.1% of the total population.

Daratu Sub-district:- Daratu sub-district like the center sub-district has very little environmental change in the population as it is obvious in (2009 - 2020) the proportion of urban residents (13.4% and 15.5%) of the total population of the sub-district approximately (86.6% and 84.5%).

**Table 20:** Environmental distribution at the level of administrative units of Bardarash district (2009-2020).

| Administrative Unit     | 2009       |                  |            |                  | 2020       |                  |            |                  |
|-------------------------|------------|------------------|------------|------------------|------------|------------------|------------|------------------|
|                         | Population | Urban residents% | Population | Rural residents% | Population | Urban residents% | Population | Rural residents% |
| The sub-district center | 22010      | 82.8             | 4560       | 17.2             | 33483      | 83.9             | 6419       | 16.1             |
| Daratu sub-district     | 3851       | 13.4             | 24981      | 86.6             | 5421       | 15.5             | 29510      | 84.5             |
| Ruviya sub-district     | 1948       | 6.5              | 27995      | 93.5             | 10605      | 24.2             | 33245      | 75.8             |
| Kalak sub-district      | 11198      | 35.7             | 20157      | 64.3             | 22181      | 63.5             | 12752      | 36.5             |

Source / From the researcher's work based on Appendix No.

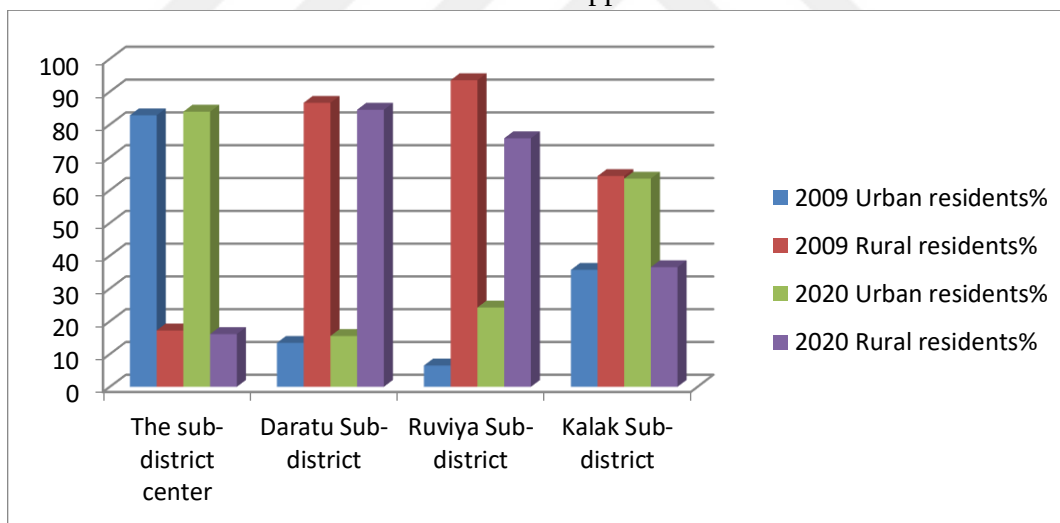
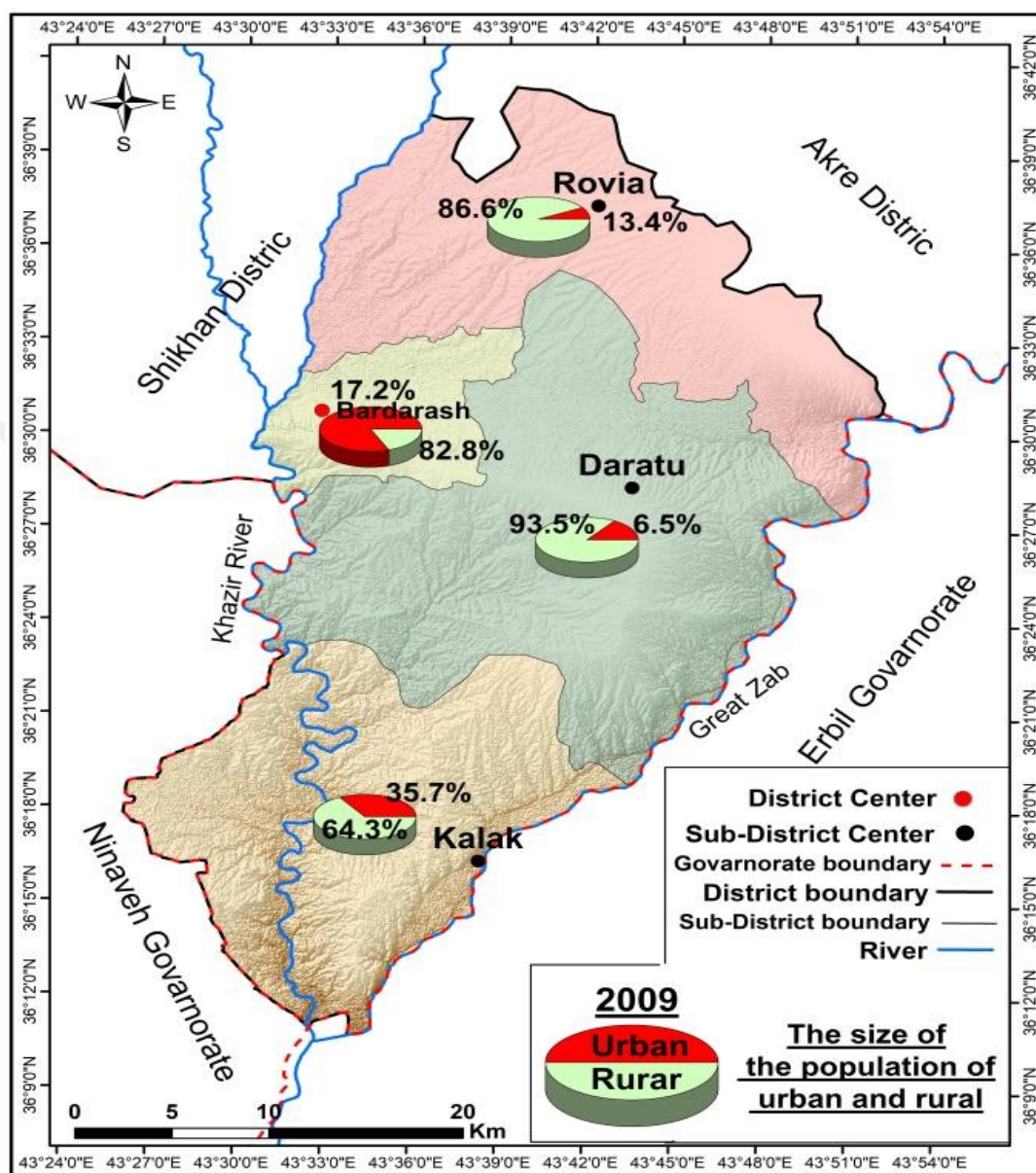


**Figure 21:** Urban and Rural residents from 2009 and 2020.

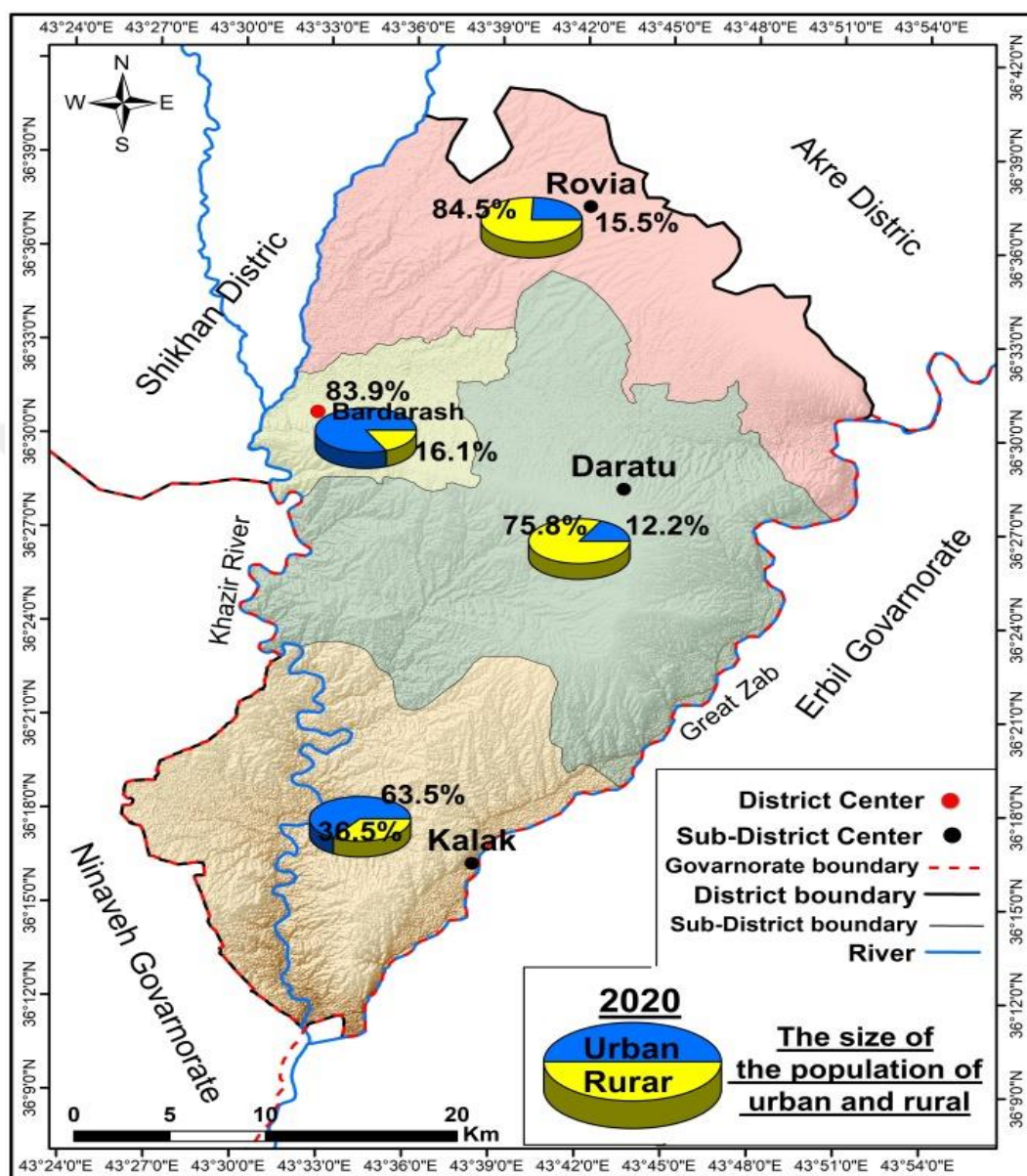
**Map 7:** Environmental distribution at the level of administrative units of Bardarash district 2009.



**Source /** From the researcher's work based on Table No.20

Ruvia sub-district:- As shown in the table above, during (2009-2020) the urban population increased from (6.5%) to (24.2%) of the total population of the sub-district. It has decreased to 75.8% of the total population of the sub-district. The change in this proportion of urban population in this sub-district is due to several reasons, including the strategic geographical location of the sub-district center in terms of trade, ie located on the road (Erbil-Duhok) and located on the road (Akri-Mosul)

**Map 8:** Environmental distribution at the level of administrative units of Bardarash district 2020.



**Source** / From the researcher's work based on Table No.20

**Kalak sub-district:-** During the year (2009-2020) the urban population increased from (35.7%) to (63.5%) of the total population of the sub-district. 36.5% of the total population of the sub-district, ie rural residents have decreased significantly, while urban residents have increased significantly at the expense of rural residents. Several villages belonging to Kalak sub-district, another reason was that after the year (2018) about (6) villages were added to the district (Hamdania) in terms of administration, so we did not get the necessary information about these villages.

### **3.3 Population density**

Population density is another form of population distribution and varies from one region to another as a result of several different factors, including the pattern of population spread and the area occupied by a dwelling (Wasn Hamza, 2008).

Population density, in the general sense, is the geographical concentration of population and is expressed through the relationship between two unequal elements: population (a variable element) and land area (a constant element) (Mansour al-Rawri, 1989).

Discussing population size without referring to location does not give a clear picture of population distribution and can not compare population distribution between regions, so researchers consider (density) as the main criterion for population distribution because in density population is associated with location. It is about finding the relationship between population and place (An'am Samir, 2002).

Therefore, population density is of great importance in population research, because population geography focuses on knowing the number of population in a given area (Fathi Mohammed Abu Ayana, 1996). In other words, population density is the number of people per square kilometer or square mile (Chenar Mohsen, 2014).

The population density index is calculated by dividing the population number by the area, but this resulting figure is very misleading because not all residents occupy the area, and there are areas that are uninhabitable such as mountains, valleys, deserts, etc., and there is no population in large areas such as rivers and lakes (Dea Awad Kathem, 2010).

Therefore, researchers use several types of density equations such as: (general density), (physiological density), (agricultural density), (economic density) (Shaswar Mahmoud, 2013), but here we use one type is (general density).

#### **3.3.1 General density**

General density is often referred to as arithmetic density or absolute density and is considered the most common and simplest density measure used by experts and researchers (Kamran Tahir, 2013).

And the relationship between population size and unit area measured on the basis of density means is between high concentration (POPULATED-OVER) and low population (POPULATED - UNDER). The larger the area, the more it indicates the

overall density It is superficial and inaccurate, and the opposite appears when the area is small which means the overall density is more accurate (Shayma akram al jbury,p,52).

The results are obtained by dividing the total population by the total area of the area (Mansour Mohammed Al-Kikha, 2003).

$$\text{General Density} = \frac{\text{Total population}}{\text{The total area of the area}}$$

We try to discuss the overall population density over two levels in the study area as follows:

#### A. At the district level

Examining Table 21, it becomes evident that the overall population density in Bardarash District has experienced fluctuations during the study period. Bardarash is slightly less dense compared to Duhok Governorate due to its large area and relatively small population. In 2009, Bardarash accounted for approximately 10.4% of the area and 9.9% of the population of Duhok Governorate, while in 2020, it represented 9.3% of the total population of the governorate.

**Table 21:** General population density in Bardarash region and Duhok province (1957-2020)

| year | General population density persons/km2 |                |
|------|----------------------------------------|----------------|
|      | Bardarash District                     | Duhok Province |
| 1977 | 34                                     | 51.4           |
| 1987 | 46                                     | 72             |
| 1996 | 70.7                                   | 64.8           |
| 2009 | 101.8                                  | 106.4          |
| 2020 | 134                                    | 148.7          |

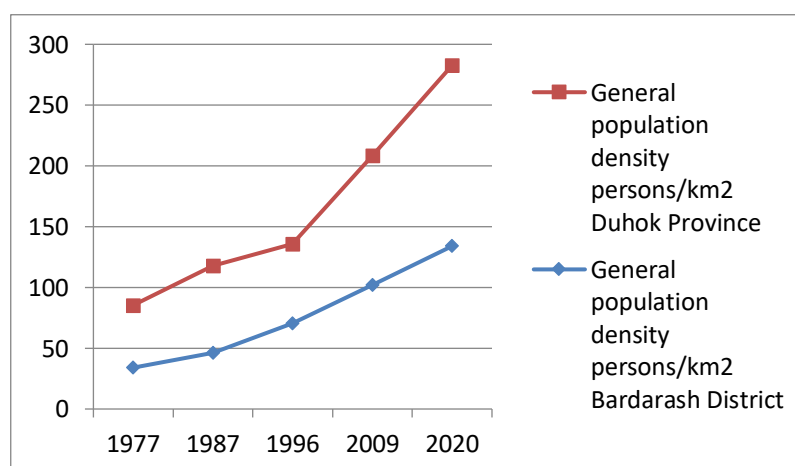


**Figure 22:** General population density in Bardarash region and Duhok province (1957-2020)

Table 21 indicates that the overall population density in Bardarash District was between 34 and 46 persons per square kilometer during 1977-1987. This density increased to 101 persons per square kilometer in 2009 and is projected to rise to 134 persons per square kilometer by 2020, reflecting an annual growth rate of 2.8%. Table 22 further clarifies that the district's area has remained constant over this period, with changes solely in the population numbers. In contrast, the overall population density in Duhok Governorate was 148.7 persons per square kilometer in 2020, with an annual population density growth rate of 3.6% from 2009 to 2020.

**Table 22:** Growth rate and density change in Bardarash district and Duhok province (1977-2020).

| period    | Bardarash District % | Duhok Province % |
|-----------|----------------------|------------------|
| 1977-1987 | 3.5                  | 3.1              |
| 1987-1996 | 5.9                  | 6.4              |
| 1996-2009 | 7.6                  | 5.2              |
| 2009-2020 | 2.8                  | 3.6              |

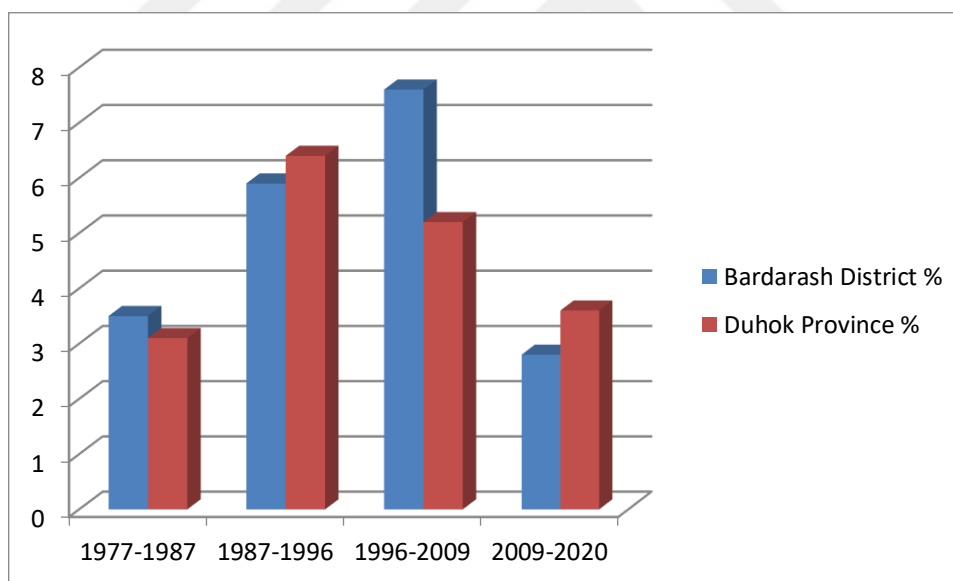


**Figure 23:** Growth rate and density change in Bardarash district and Duhok province (1977-2020)

## B. At the administrative unit level

The general population density does not only change from time to time at the district level, but also at the level of administrative units from time to time differences in the rates are observed Let's do the overall population density:

**1- Center sub-district:** In 2009, the total population density in Center sub-district was more than (323 people/km<sup>2</sup>), which is the highest density at the level of administrative units, due to the fact that Center sub-district has an area of (82.1 km<sup>2</sup>). It is very low compare to other sub-districts, as shown in Table (23).

In 2020, the total population density of this sub-district increased to more than (486 people / km<sup>2</sup>), which is due to several reasons including population growth and high annual growth rate (4.6%) as shown in Table (8). The unchanged or stable area of the sub-district also contributed to the increase in population density.

**Table 23:** Total population density in administrative units of Bardarash district during (2009-2020)

| Administrative Unit | Total population density (persons/km <sup>2</sup> ) |       |
|---------------------|-----------------------------------------------------|-------|
|                     | 2009                                                | 2020  |
| The Center          | 323.6                                               | 486   |
| Daratu              | 63.8                                                | 77.3  |
| Ruviya              | 100.9                                               | 147.8 |
| Kalak               | 98.1                                                | 110.5 |

Source / From the researcher's work based on Appendix No 5 and 7

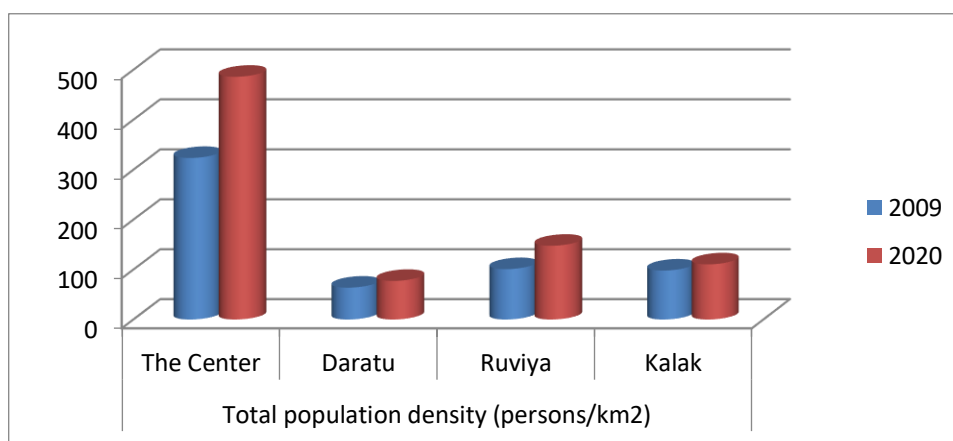
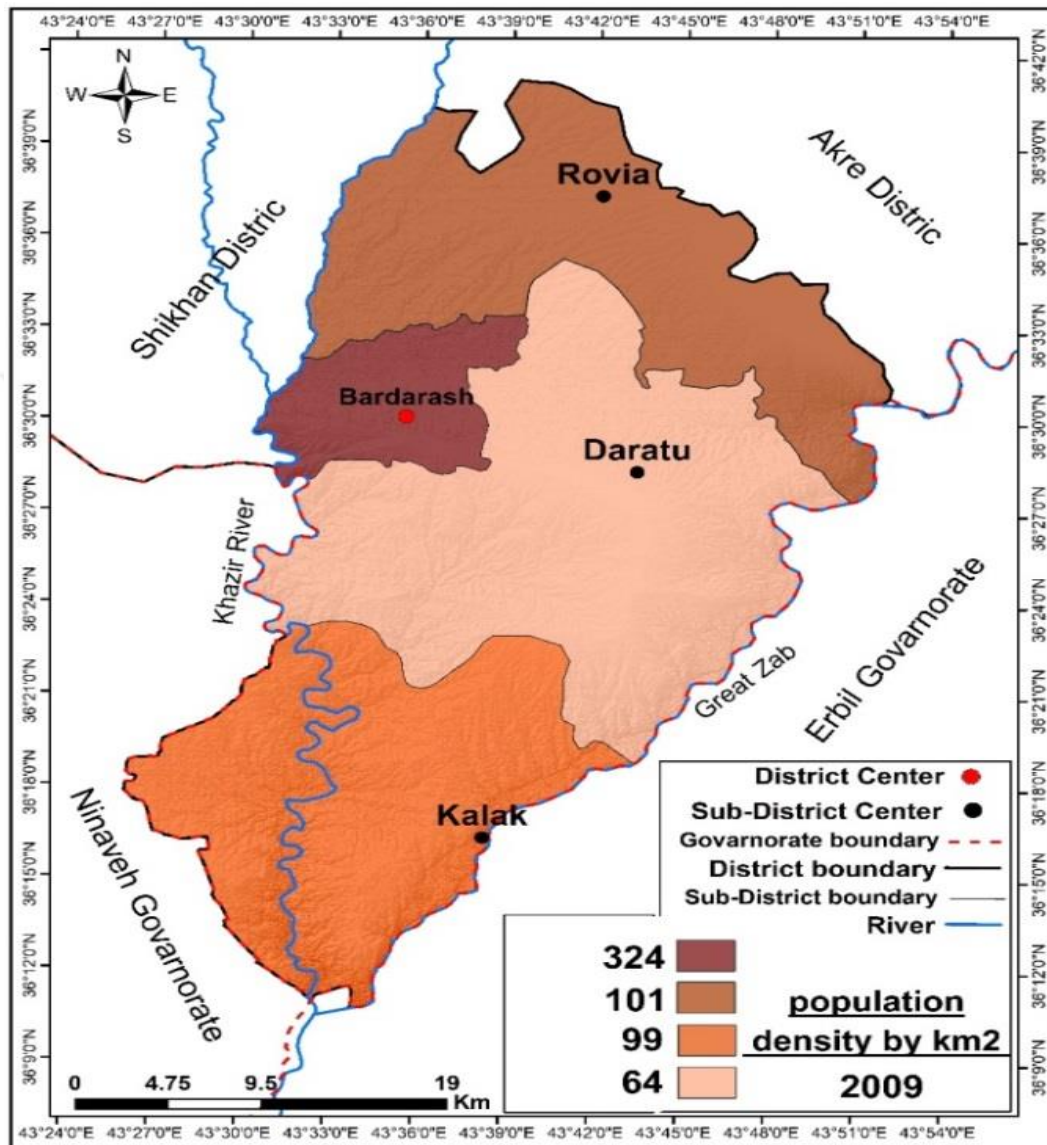


**Figure 24:** Total population density in administrative units of Bardarash district during (2009-2020).

**Map 9:** Total population density in administrative units of Bardarash district during 2009

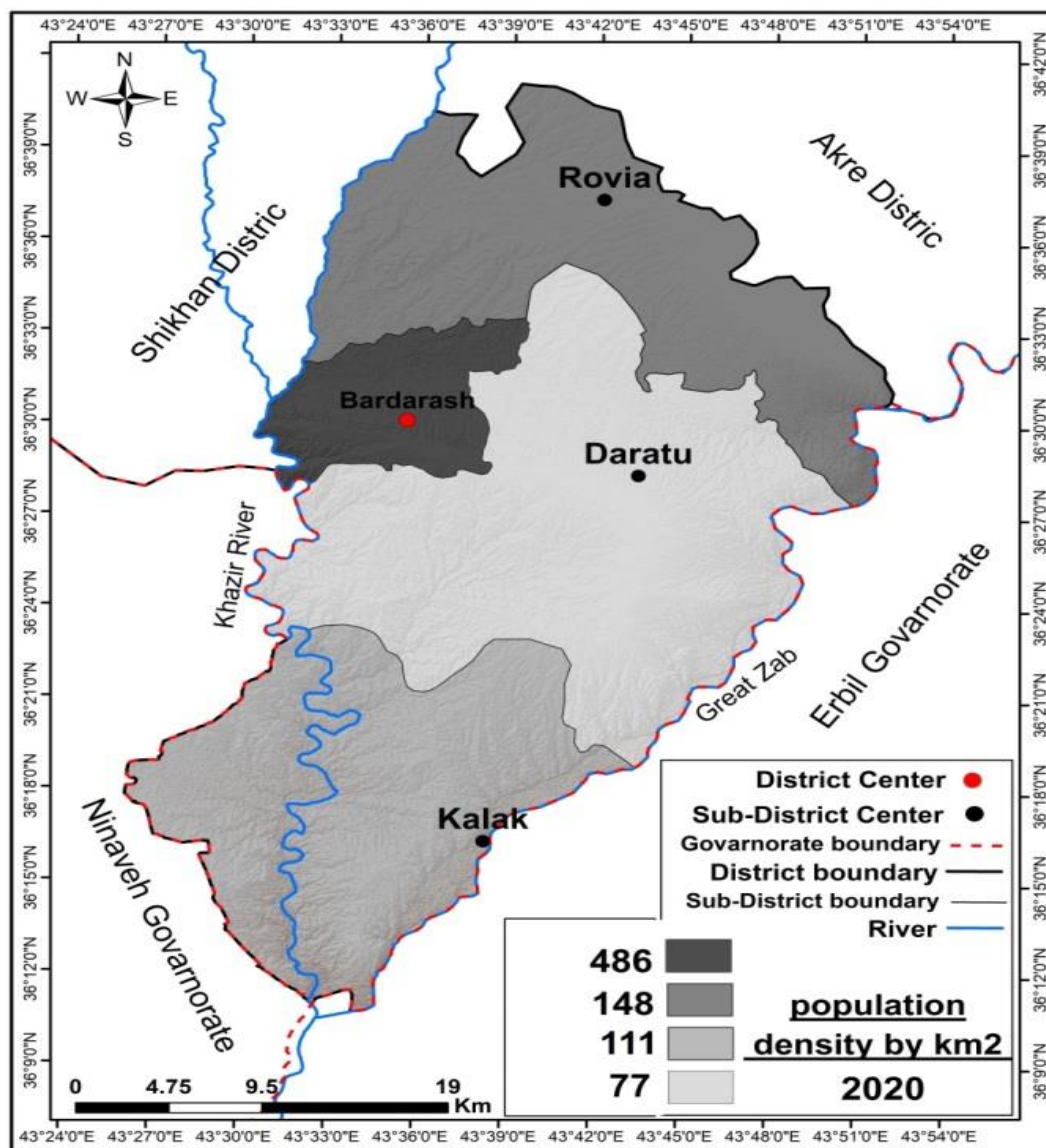


**Source /** From the researcher's work based on Table 23

## 2- Daratu sub-district

Population density is a key demographic indicator that measures the number of people living per unit area, typically per square kilometer (km<sup>2</sup>). It is a crucial metric for understanding how densely populated an area is, which has significant implications for urban planning, resource allocation, infrastructure development, and environmental management. In 2009, Daratu sub-district had a population density of 63.8 persons per

Map 10: Total population density in administrative units of Bardarash district during 2020.



**Source** / From the researcher's work based on Table 23

square kilometer. This figure reflects the number of individuals residing within a given area, providing insights into the distribution of the population at that time. A population density of 63.8 indicates a moderately populated region, suggesting a balance between available land and the number of inhabitants.

By 2020, the population density in Daratu had increased to 77.3 persons per square kilometer. This rise represents a natural demographic shift, highlighting changes in population growth and spatial distribution within the sub-district. The increase in density can be attributed to various factors including natural population growth (births

minus deaths), migration patterns, and possibly urbanization or changes in land use. The increase from 63.8 to 77.3 persons per square kilometer over the eleven-year period represents a growth rate of approximately 1.9%.

### **3- Ruviya sub-district**

The Ruviya sub-district has experienced a significant increase in population density over the period from 2009 to 2020. Population density, typically measured as the number of persons per square kilometer (person/km<sup>2</sup>), is a key demographic indicator that reflects the concentration of people within a given area.

In 2009, the population density in the Ruviya sub-district was 100.9 persons per square kilometer. By 2020, this figure had risen to 147.8 persons per square kilometer. This represents an increase of approximately 46.5%, indicating a substantial growth in the population relative to the area size over the eleven-year period.

Such an increase in population density can be attributed to several potential factors. These might include natural population growth due to higher birth rates compared to death rates, migration patterns where more people are moving into the sub-district than leaving it, or a combination of both. Additionally, economic, social, and infrastructural developments within the sub-district could have made it a more attractive place for people to live, thereby contributing to the population increase.

The rise in population density has important implications for urban planning, resource allocation, and service provision within the sub-district. Higher population densities can lead to increased demand for housing, healthcare, education, transportation, and other public services. Therefore, understanding and planning for such demographic changes is crucial for sustainable development and ensuring a high quality of life for the residents of Ruviya.

### **4- kalak sub-district**

The General population density in Kalak sub-district in 2009, like Ruviya and Daratu sub-districts, was very normal, approximately (98.1/person km<sup>2</sup>). The reason is that the political situation was relatively calm, and the location of the area is an agricultural area like other sub-districts, so the population growth grew very normally by (3.3). However, in 2020, the total population density has changed significantly, despite the decline in annual population growth rate to 2.2, but the total density reached

110.5/person km<sup>2</sup>, This is for several reasons, including the displacement of residents of several villages we mentioned previously as.

### **3.4 Patterns of distribution**

Obviously, the population is not evenly distributed around the world, but high population density in one region or low population and low density in another region, reflecting a number of different factors (natural and human).

When spatial differences in the distribution of a phenomenon appear from one place to another in terms of (size, importance, nature of spatial relationship, characteristics) of the phenomenon, then patterns appear (Mohsen al-Mudhaffar, 2005).

Pattern is a term often used in scientific research to refer to division. For researchers and geographers, pattern is the way in which species or phenomena on Earth are organized (Khalil Ismail, 1982).

Knowing the distribution of the population is a gateway to the degree of relationship between people and the place where they live and the economic capacity of the region to provide the needs of its people (Hiwa Sadq, 2005).

In previous years, ie before 1996, the rural population of Bardarash region relied more on the water of the springs, which has caused the distribution of the population to take the form of (spread), that is, most villages are built around the springs appear in many parts of the region. However, after 1996, the public drinking water network was established in most of the villages by QANDIL. Therefore, most of the villages relied on wells. Topography also played an important role in the adoption of this method. Distribution is due to the flatness and width of the land. This is due to the direct observation of the researcher to visit many villages in the study area in (2020) (52.8), However, based on the practice of dispersion in the study area, there are differences in the distribution of the population from one part of the district to another.

#### **3.4.1 The method of spread**

, The value of the sparse or dispersed population distribution equation for this method ranges between (30-100) degrees, which indicates the wide distribution of the population. According to Table 13, this method was observed at the level of the study area, and the population distribution is clear in the northern parts of the country, especially in the Rufya sub-district, so that the population dispersion equation for the region reached (35.6) degrees. The observation of this pattern in this area is due to

several reasons, including the location of the area and the nature of the terrain of the area, which is a plain area and most of its lands are agricultural and more, as well as government policy and follow the decision not to build housing units.

**Table 24: Distribution of the rural population in the Bardarash region and its administrative units using the dispersion equation \*in 2020.**

| Administrative Unit | Number of rural settlements | Rural population/person | Total population/persons | Dispersion equation |
|---------------------|-----------------------------|-------------------------|--------------------------|---------------------|
| The Center          | 7                           | 6419                    | 39902                    | 1.1                 |
| Daratu              | 28                          | 29510                   | 34931                    | 23.6                |
| Ruviya              | 47                          | 33245                   | 43850                    | 35.6                |
| Kalak               | 17                          | 12752                   | 34933                    | 6.2                 |
| Total sub-district  | 99                          | 81926                   | 153616                   | 52.8                |

**Source** / From the researcher's work based on Appendix No.6

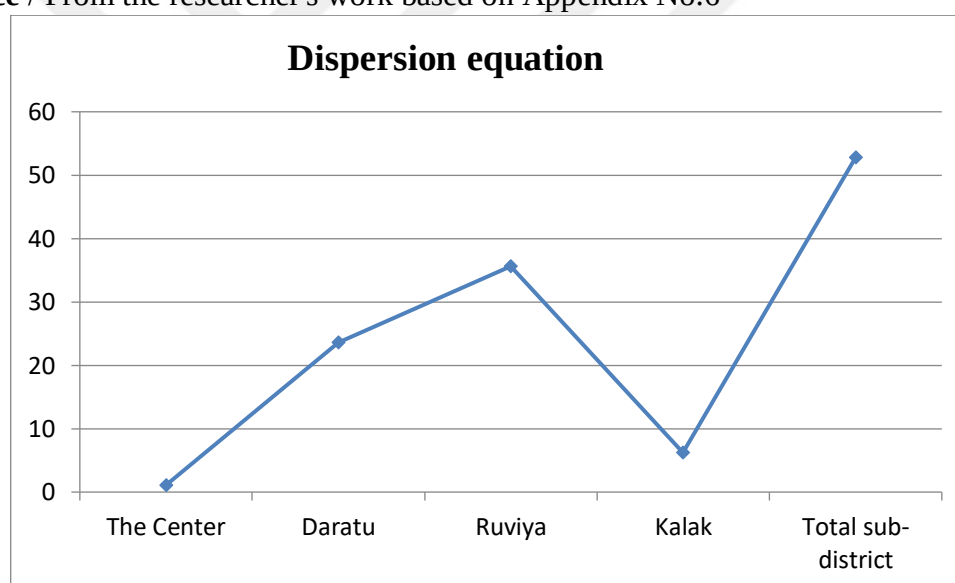


**Figure 25:** Dispersion equation in 2020.

\*The larger the dispersion equation, the more dispersed the result, but the lower the result of the equation shows the pattern of distribution of the population assembly.

$$C = \frac{E \times N}{T}$$

C = dispersion equation

N = Number of rural settlements

E = Rural Population

T = total population in an administrative unit

**Source:** John I.clark, population geography,optcit, p63.

### **3.4.2 The method of assembly**

The empirical determination of the dispersion equation within this method reveals an angle measurement of less than (30) degrees, denoting a clustered distribution pattern of the population within the designated areas, as detailed in Table (14) with a range of (23.6-1.1) degrees. This observation serves as empirical evidence elucidating the population distribution dynamics across the examined districts. Particularly, it underscores that the Kalak and Center sub-districts, despite their comparatively smaller territorial expanse in relation to the Ruviya sub-district, harbor a notable density of village settlements, which tend to be spatially proximate to one another.

The prevalence of assembly patterns is notably pronounced within the northern sectors of the center sub-district and the western precincts of the Daratu sub-district, primarily attributable to the geographic placement of settlements within the plains and along the principal thoroughfare connecting Daratu and Bardarash to Duhok. Concurrently, this spatial configuration has engendered the uptake of assembly methodologies within the environs of Mosul.

### **3.4.3 Linear method**

This divisional trend is notably discernible within the intermediary zones of the Ruviya and Kalak sub-districts, where a considerable proportion of settlements have embraced this methodological approach. This propensity is chiefly attributed to the traversing of the principal thoroughfares, notably the Bardarash-Akre and Bardarash-Erbil routes, thereby delineating a distinct spatial separation. Additionally, a noteworthy segment of rural settlements situated within the Daratu sub-district, particularly those positioned in the western and eastern vicinities of the sub-district center, have similarly adopted this methodological framework, owing to their strategic positioning along aforementioned road networks.

## **Chapter Four**

### **4. Factors affecting the geographical distribution of the population of Bardarash district**

The spatial distribution of the population in any region is a reflection of the result of the interaction between natural and human geographical factors. These factors, through their interaction, shape the picture of this distribution and do not operate independently but in an intertwined manner, with the degree of influence varying from one factor to another (Abbas Fadhil, 1983). We can say that the population distribution of any area is the outcome of the interaction between humans on one side and environmental and human variables on the other (Abdullah Al-Tarzi, 1990). There are a number of interconnected and complex natural and cultural factors that influence the variation in population distribution, whether dispersed or concentrated, in any region. The relative importance of these factors varies from one region to another and within a single country. Hence, the geographer finds themselves tasked with analyzing the spatial variation in population density and distribution (Laith Nawar, 2022) in light of these influences. The factors affecting population distribution can be classified as follows:

#### **4.1 Natural Factor**

Natural factors have a clear impact on the pattern and density of population distribution on one hand, and on what this distribution and density might look like in the future on the other. Natural factors control the pattern of population distribution and its variation from one place to another, ranking first in terms of their influence (Mansour Al-Rawi, 1989).

Despite the scientific progress witnessed globally in various fields, control over natural factors remains limited and cannot be fully adapted to human desires except on a limited scale and in specific elements. Natural conditions are relatively stable, which means that controlling them requires constant means to reduce the impact of natural phenomena. Human control over these conditions depends on the level of their education and their ability to subject these conditions to their will (Nouri Khalil, Ibrahim Abdul Jabbar, p. 42).

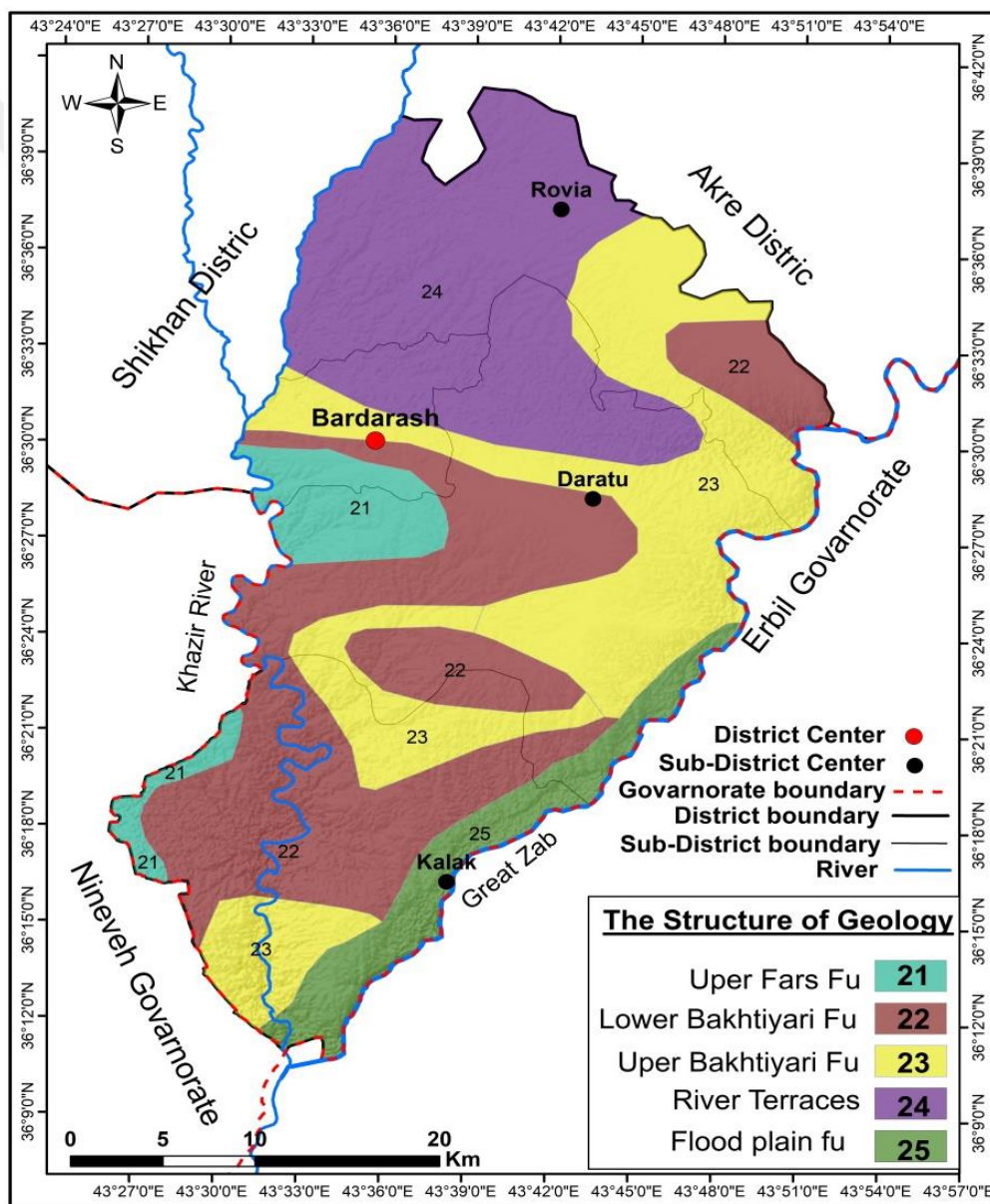
#### 4.1.1 Geological Structure

It does not have a direct role in influencing population attraction, but its role can be understood indirectly through its control over the topographical construction of the region, such as high mountains or flat lands between mountain ranges. Additionally, it plays a role in the formation of mountain passes (areas of geological weakness) and controls sources of well and spring water, natural resources, and the occurrence of a region on a seismic line. The "study area" according to the structural map of Iraq falls within the unstable shelf area: the high fold belt (Sulaymaniyah-Zakho) (Chenar Mohsen, 2014). The geological structure of the study area is divided into five main types according to the map.

- **Upper Fars Fu:** It consists of red and gray shale rocks interspersed with layers of siltstone and sandstone, dating back to the Upper Miocene (Zirak Azizkhan, Ahmed, 1998, p. 38). It is most commonly found in plains and river basins. This composition is generally found in two locations in the northwest of the Bardarash district, specifically in the central and southern parts of the study area, along the Khazir River. This composition occupies a small area within the region (6.1%).
- **Lower Bakhtiyari Fu:** This structure dates back to the Early Pleistocene period and contains a mixture of moisture and large rocks, so that the deeper you go into the soil, the smaller the size of the rocks and the amount of moisture increases (Bassem Qasim, 2022). This structure extends mostly in the southern parts of the study area along the western part to the middle of the area and also in the northeastern part is much less visible, covering more than (359 km<sup>2</sup>) or about (31%) of the total area.
- **Upper Bakhtiyari Fu:** This structure dates back to the Late Pleistocene period, mostly consists of mudstone and sand, sometimes containing fine stones in the form of gravel (Assu) and in some other places only gravel appears (Mosadeq Tovi, 2017). This structure appears in the Middle Eastern parts of the study area in general and extends to the northern parts, ie on the banks of the Great River (Geat Zab), with an area of more than (349 km<sup>2</sup>) or about (30%) of the total area.

- **River Terraces:** These are represented by fluvial deposits and slope deposits, which are recent deposits formed during the Quaternary period (Pleistocene). They consist of gravel, limestone, and sandstone (Chenar Mohsen, 2014). This structure is located in the far northern and northwestern parts of the study area, along the banks of the Khazir River, covering an area exceeding 288 km<sup>2</sup>, which is approximately 25% of the total area of the district.

**Map 10:** Geological structure map of Bardarash district



**Source:** Researcher's work using Arc-GIS 10.8 based on the geological structure map of the Kurdistan Region.

- **Flood Plain Fu:** It consists of heterogeneous materials including boulders, gravel, sand, silt, and clay mixed with rock fragments. These are derived from Eocene limestone rocks formed by water during the rainy periods of the Holocene (Samah Saber, 2018). This structure is clearly visible in the southeastern part of the study area and extends to the northern part parallel to the Great Zab River, representing a small area of the study region (6.9% of the total area of the district).

#### 4.1.2 Topography

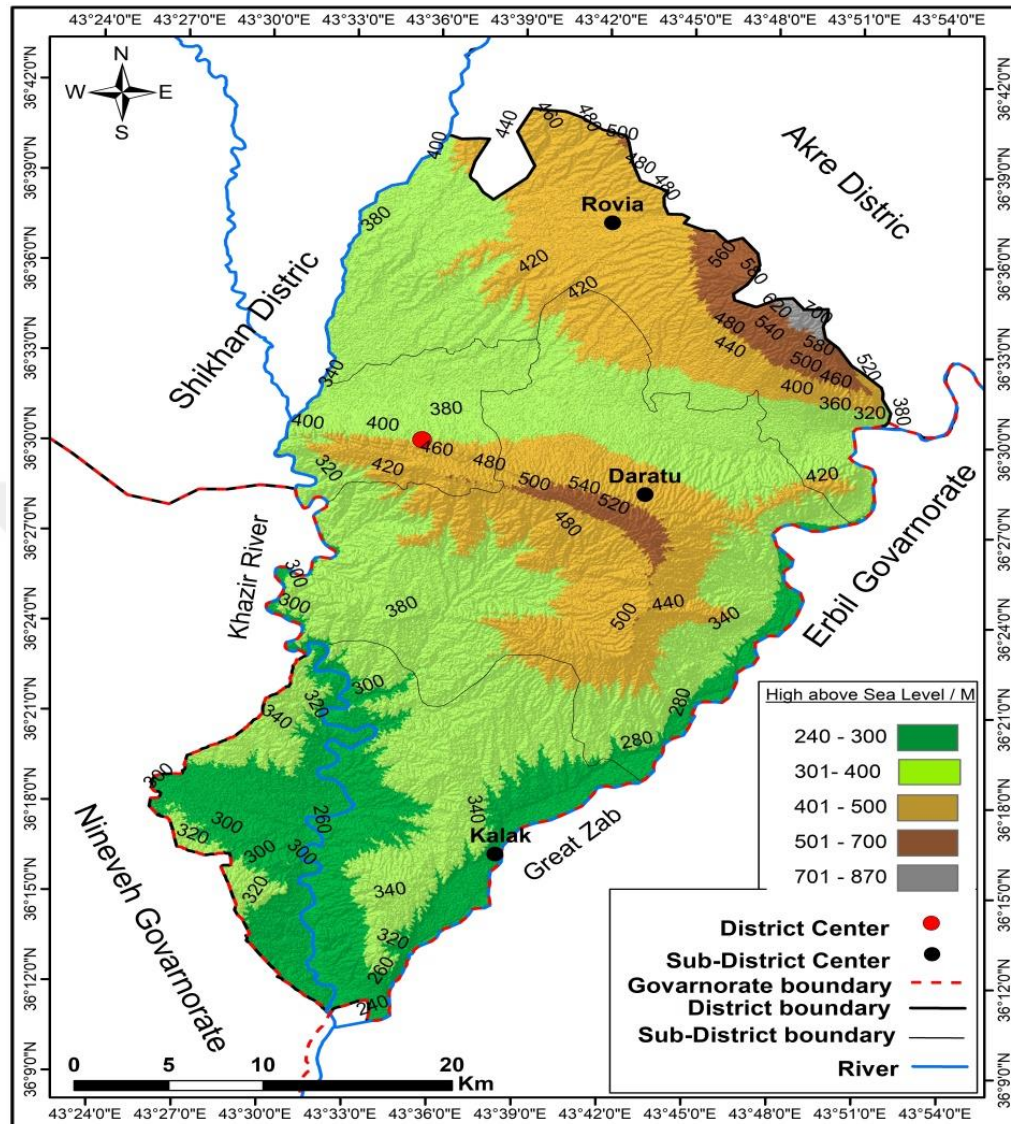
Surface features play an active role in the distribution and density of the population by influencing economic life and all aspects of human life in general. People prefer one environment over another due to their mental and environmental capabilities, which enable them to exploit and live in these environments (Abdul Fattah Hazin, 2004). In his comprehensive analysis of the vertical distribution of the population, researcher Staszewski showed that the number of people and their densities diminish with increasing altitude above sea level. This phenomenon reflects the growing difficulties in exploiting high-altitude geographical environments and adapting to them (Taha Hamadi, 1988).

Since ancient times, most people have chosen flat areas for their residence and activities, resorting to high-altitude areas only in cases of insecurity. However, this phenomenon has disappeared in the present age, and people now choose their living areas for various purposes, including economic factors. Plains are more stable than mountains due to the ease of transportation and the possibility of carrying out agricultural and other activities. This phenomenon reflects the increasing difficulties in exploiting high-altitude environments, which limit arable land. Rugged areas also contribute to the fragmentation and dispersion of agricultural land, making it difficult to operate agricultural machinery and equipment, thus rendering agricultural work in these areas challenging (Yusuf Ali, 2013).

There is a significant difference in the level and direction of the surface of the study area, so that the height of the surface decreases from the northern parts to the southern parts of the area, reaching 780 meters above sea level in the northern part. In the southern part, the altitude decreases to 240 meters above sea level, as shown in map 1. The surface of the earth can be generally divided into two areas.

- **Plains:** Plains are defined as extensive areas of relatively flat land on the Earth's surface, featuring low slopes and minimal topographical variation. In densely populated plain areas, the construction of roads and railways is considered a form of economic investment due to the high number of travelers and transported goods, and the significant amount of capital that can be invested. Consequently, the density of transportation means increases, as does the volume of transported goods. These areas become more connected to the outside world and are better able to specialize in production (Fuad Al-Saqqar, Mohammed Rashid, 1980). The area of the plain in the study area is more than (775 km<sup>2</sup>) or (67.8%) of the area of the district. These plains range from 380 m to 240 m above sea level. The high plains are located in the northwest and central part of the study area, but the low plains are divided into the southwest part. The southeastern part extends along the Great Zab to the central and eastern parts of the district.
- **Hills:** Hills are semi-pyramidal or dome-shaped lands that appear elevated compared to the surrounding surface (according to studies by Professor Jeky). Professor Van Beer explained that the elevation of hills ranges from 200 to 2000 feet above the surrounding surface, with the slope of their sides exceeding five degrees. About one third or (32.2%) of the study area, that is, in some places is useful for agriculture, especially for (barley and wheat). As can be seen, the high islands are located in the northeastern and central part of the study area, as well as the low islands surround the high islands, the area of the islands is about (371 km<sup>2</sup>).

**Map 11:** Topographic map of the study area



**Source:** Research work based on: Kurdistan Regional Government, Ministry of Planning, Regional Statistical Board, Department of (GIS), sample data of the study area, (DEM), through the use of Geographical Information System program Arc GIS – ArcMap.

#### 4.1.3 Climate

It is another important natural factor that affects the distribution of population, because it is closely related to human life and environment. The impact of this factor on the population is twofold. It affects the population by affecting the soil, natural vegetation and agricultural practices (Kamran Tahir, 2013).

Climate is considered one of the most important natural factors influencing the geographical distribution of the population and their spatial movements, whether between districts or provinces. One of the strongest pieces of evidence proving the

significance of climate's impact on population distribution is that in many areas on the Earth's surface, population density does not exceed more than one person per square kilometer due to extreme dryness or severe cold (Doha Mahmoud, 2021). Based on the above, we will examine the climate characteristics in the study area through the presentation and analysis of these characteristics and their various elements (temperature and rainfall).

- **Temperature:** Temperature is one of the main climatic elements that significantly affects human activities, particularly agriculture, as each crop has a minimum and maximum temperature threshold. If temperatures fall below or rise above these thresholds, it can cause substantial damage to production (Zeina, 2006). Additionally, temperature affects human life, as the human body has the ability to regulate its temperature, maintaining a constant internal temperature of 37°C despite significant external fluctuations (Taha Hamadi, 1988). From Table 1, we observe that temperatures are high in the summer and tend to be dry and cold in the winter. Temperatures begin to rise starting from April, with an average temperature of 17°C, and continue to increase until reaching their peak in July and August

**Table 25:** Monthly and annual temperatures rate in Bardarsh district for (2010-2022)

| Months      | Maximum | Minimum | Monthly rate |
|-------------|---------|---------|--------------|
| January     | 10.6    | 1.8     | 6.2          |
| February    | 12.7    | 3.1     | 7.9          |
| March       | 17.1    | 6.5     | 11.8         |
| April       | 23.7    | 10.3    | 17           |
| May         | 29.9    | 15.7    | 22.8         |
| June        | 37.5    | 23.1    | 30.3         |
| July        | 41      | 25      | 33           |
| August      | 41      | 25.7    | 33.3         |
| September   | 35.7    | 21.2    | 28.4         |
| October     | 27.4    | 15.9    | 21.6         |
| November    | 19.6    | 8       | 13.8         |
| December    | 11.5    | 2.9     | 7.2          |
| Annual rate | 25.6    | 13.3    | 19.4         |

**Source:** Kurdistan Regional Government of Iraq, Ministry of Agriculture and Irrigation, General Directorate of Agriculture, Duhok, Agricultural Services Department, Meteorology Division, Bardarash Station, unpublished data.

- **Rainfall:** Rain is one of the climatic elements that affects population distribution and is characterized by its scarcity and seasonality, falling during the winter and spring seasons (Noaman Al-Shuatha, 1986). Undoubtedly, rain is the most important type of precipitation in terms of its impact on plant life and the extent of human exploitation of the land. The pattern and amount of rainfall, along with the temperature regime, largely determine the suitability of the land for agriculture or grazing, as well as the type of natural vegetation, whether trees or grasses. Additionally, the actual value of rainfall controls the type of crop produced (Munir Ismail - Amjad, 2011).

**Table 26:** Rainfall Amounts (mm) in Bardarash District (2006-2023)

| N  | Year      | Rainfall / mm |
|----|-----------|---------------|
| 1  | 2006-2007 | 443.6         |
| 2  | 2007-2008 | 185.8         |
| 3  | 2008-2009 | 236.8         |
| 4  | 2009-2010 | 424.9         |
| 5  | 2010-2011 | 477.5         |
| 6  | 2011-2012 | 275.3         |
| 7  | 2012-2013 | 545.7         |
| 8  | 2013-2014 | 310.2         |
| 9  | 2014-2015 | 458.3         |
| 10 | 2015-2016 | 474.6         |
| 11 | 2016-2017 | 322.6         |
| 12 | 2017-2018 | 420.8         |
| 13 | 2018-2019 | 1016.2        |
| 14 | 2019-2020 | 570.7         |
| 15 | 2020-2021 | 216.2         |
| 16 | 2021-2022 | 283.3         |
| 17 | 2022-2023 | 331           |

Source/ Ibid., Table No.25

#### 4.1.4 Soil

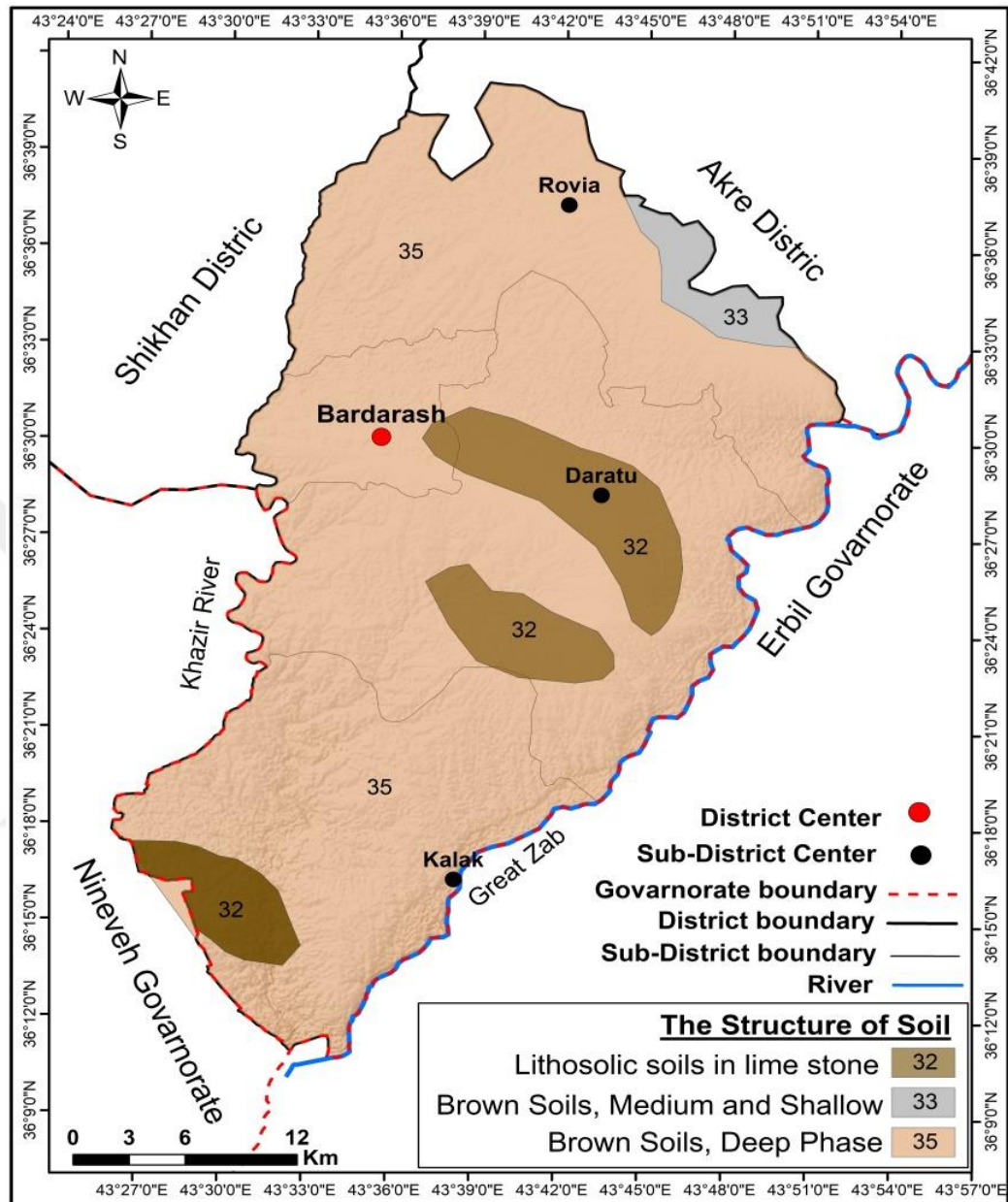
Soil is one of the main natural elements for humans in terms of their activity and sustainability, as it is a source of livelihood and habitation. Soil is the fragile layer that covers the rocks of the Earth's crust, ranging from a few centimeters to several meters in thickness. It is a complex mixture of mineral and organic resources, water, and air, in which plants anchor their roots and draw the essential elements for their survival, growth, and production (Ali Salem, 2012).

Despite the difficulty in identifying the relationship between soil nature and the distribution and density of the population through the spread and geographical

distribution of human settlements, its impact cannot be underestimated. If other natural factors are equal in any study area, the soil will show its effect on the distribution of human settlements and population density (Khalil Ismail, 1981). There is a correlation between soil quality and population distribution: areas with fertile alluvial plains have higher population densities, while areas with less fertile laterite soils, especially in regions with agricultural activity, have lower population densities (Abdul Ali Al-Khafaf, Abdul Makhor, 1986). In the study area, and through Map No. (2), we can identify the types of soil as follows:

- **Lithosolic soils in lime stone:** This soil is primarily composed of rocky materials and rock debris resulting from the weathering of parent rocks. When this soil forms in limestone areas, it exhibits unique characteristics that reflect the nature of the underlying rock. Lithosolic soils in limestone areas are characterized by being shallow and rocky with good drainage but poor in nutrients. They require precise agricultural management and appropriate amendments to improve their fertility and ability to support plant growth. These soils are prone to erosion due to rainfall, especially on slopes, leading to shallow soils covered with stones and rocks, most of which are composed of limestone or gypsum rocks (Shaker Khusbak, 1973). This soil covers the hilly and elevated areas of the Bardarash district, accounting for 12.6% of the study area. This type of soil is found in the central and southernmost parts of the district.
- **Brown Soils, Medium and Shallow:** Brown soil is a type of soil distinguished by several characteristics that make it different from other soils. It is often fertile and contains 1-2% organic matter and essential nutrients for the growth of plants and shrubs (Shaker Khusbak, 1973). This soil typically does not exceed a depth of 30-50 cm and may have less water retention capacity compared to deeper soils. This type of soil is found in the northeastern part of the study area and covers the hilly and elevated regions. The area covered by this soil is approximately 2.6% of the total area.

**Map 12:** Soil types in the study area



**Source:** Researcher's work using Arc GIS 10.8 based on soil composition map Buring map of Kurdistan Region.

- **Brown Soils, Deep Phase:** This type of soil is characterized by several unique properties that make it important in the fields of agriculture, construction, and ecology. It is an essential part of the ecosystem and has a significant impact on human activities such as farming and building. Understanding the characteristics of this soil helps in more effective land management and achieving sustainable development. This soil contains organic matter ranging from 1-4% and less than 9% calcareous materials. Its surface soil is dark brown and fragile, but its color

changes to light brown at a depth of 30-50 cm (Samir Sabah, 2010). The impact of this type of soil on population distribution is not only directly visible, but also indirectly affects the concentration of population in areas with good soil type and useful for agriculture (Kamran Tahir, 2013). Regarding the study area, most of the area is covered with this type of soil, but we can say (925 km<sup>2</sup>), or more than (84%) of the area of the district.

#### **4.1.5 Surface Water Resources**

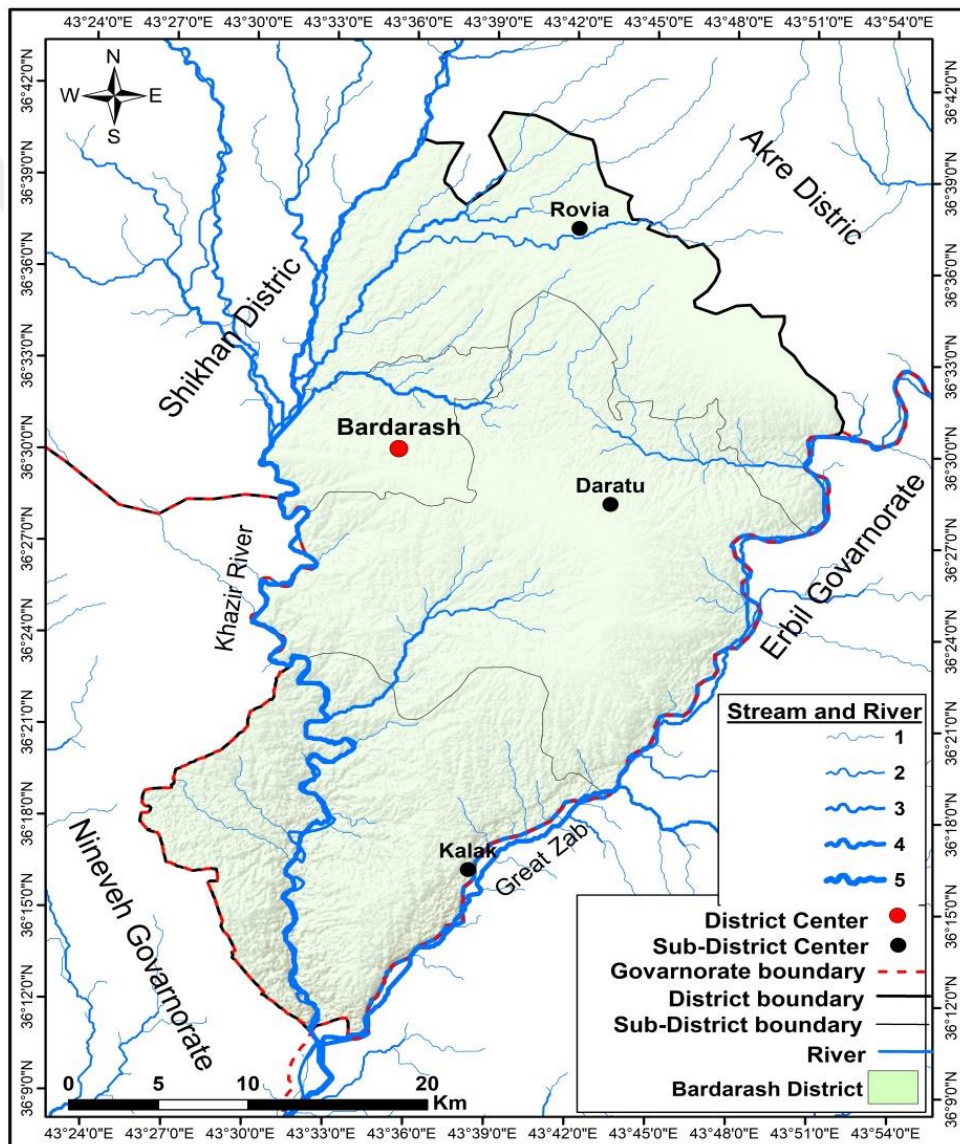
Water resources are among the most important factors affecting the distribution and density of populations in any area on Earth. These natural resources, created by God since time immemorial, are undeniably significant, as highlighted in the Holy Qur'an: (وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيٍّ) "And We made from water every living thing" (Qur'an, Surah Al-Anbiya, Ayah 30). Historically, this vital element has played a major role in the settlement and development of populations and has been a cause of human migrations from one place to another. It can be said that this resource is one of the most crucial factors that greatly influences the pattern of population distribution. Areas rich in water are densely populated and teeming with various forms of life, whereas the opposite is true for water-scarce regions (Azad Al-Naqshbandi, Jirjis, 1990). Water is used in various activities and domestic, economic (industrial), and agricultural applications, in addition to municipal uses. Hence, the significant role of water resources and their impact on the overall life of the population is evident (Hussein Ali, 1999). By surface water, we mean streams, rivers, seas, and lakes, whether seasonal or permanent (Pishtivan Shafiq, 2012).

In the study area, this resource has played a significant role in the distribution of population, so that the population density or size of settlements near the surface water source is somewhat larger than that of settlements far from this source, Looking at the map number (3) the most important groundwater resources in the region are:

- Great zab: The Great Zab River is one of the most important and largest tributaries of the Tigris River within Iraq (Samir Sabah, 2010). It forms the northeastern, eastern, and southeastern borders of the Bardarash district. This river enters the study area from the village of Chama, located in the far northeast of the study area, and continues flowing southward until reaching the village of Zangel, part of the Kalak sub-district. The Great Zab River forms approximately

45 km of the administrative borders of Bardarash district, separating it from the Shaklawa district to the northeast, and from the Khabat district in Erbil province to the east and southeast, serving as a natural boundary. Several large villages and densely populated settlements are located on or near this river, including Chama, Beninan, Bashiryan, and Zangel. Additionally, the center of the Kalak sub-district is also situated on this river.

**Map 13:** Surface water resources in the study area



**Source:** Researcher's work Implementing flowdirection operations using Arc GIS 10.8 based on DEM 12.5M

- **The Khazir River:** Located to the west of the Bardarash district, it forms the northwestern and western borders of Bardarash until it reaches the village of

Qasrok, part of the Kalak sub-district. This river enters the study area from the village of Kharaba Saadoun, located in the far northwest of the study area, serving as the boundary between the Shaikhan district of Dohuk province and the study area. The river is approximately 5 km from the center of Bardarash city. It is one of the tributaries of the Great Zab River, merging with it in the Khabat district, specifically at the village of Matarad Saralou, and is about 4 km from the village of Gazakan, which is within the study area. The Khazir River originates from two areas, starting with two branches: one branch originates from the Dinarte sub-district of the Akre district, and the other from the Jamanki sub-district of the Amedi district. These two branches merge at the village of Bakerman in the Akre district (Samir, 2010). The river is fed by several tributaries, some of which are within the study area and others outside its administrative boundaries, as shown in map number (4).

## **4.2 Human Factors**

Human factors play a significant and active role in determining how populations are distributed. Humans, with their various skills and diverse capabilities, are able to exploit natural environmental conditions in ways that align with their ambitions and desires. Therefore, they are considered the primary influencers in the spatial distribution of populations (Louay, 2021). Some of the most important human considerations that determine the nature of the geographical distribution of populations are as follows:

### **4.2.1 Economic factor**

#### **4.2.1.1 Agriculture**

Economic factors play an important role in the distribution of populations, as humans need to engage in activities that align with their capabilities to sustain life (Maki, 1974). Agriculture has historically played a significant role, particularly in earlier periods, in the distribution of populations, being considered a key attractor of people (Ali Atiya, 2013). It remains one of the primary occupations globally, closely linked to population distribution. It is well known that humans in primitive societies relied on what nature provided in terms of food, shelter, and clothing (Fathi Abu Ayana, 2000).

The area suitable for agriculture in the study region is estimated to be 370,000 dunams, which is equivalent to 925 km<sup>2</sup>, representing 80.7% of the total area of the

district, which is estimated to be 1,146 km<sup>2</sup>. Due to the availability of favorable climatic conditions in addition to this land, various crops are cultivated, including winter and summer crops, with wheat, rice, and potatoes being the most important. However, the number of people practicing agriculture has declined in recent times. This is attributed to the lack of an agricultural policy in the region, the abundance of agricultural machinery and equipment, which reduces the need for manual labor, and the shift of the population to other non-agricultural professions such as trade, government jobs, and services.

#### **4.2.1.2 Transportation**

Transportation routes play a crucial role in the distribution of populations due to their functional relationship in serving the inhabitants. Therefore, transportation routes are considered a product of economic activity or derived from it, as they connect different areas within a single region and with adjacent regions (Mohammed Khamees, 1988). Population distribution in many places owes to the road network in the region. The population in areas traversed by the main road, called 'magistral' in Latin, is higher compared to other areas, due to the emergence of settlements along the roads (Abdullahghafur, 2012).

There is no diversity of transportation in the study area, as it is limited to land transportation by car, which has led to the spread of a network of main and secondary roads.

##### **Main roads:**

- Bardarash - Baadre - Duhok 85 km
- Bardarash-Ruviya-Akri 38km
- Bardrash - Ruviya - Erbil 75 km
- Bardardarash-Kalak 35km
- Bardarsh – Mosul 38 km
- Secondary roads
- Bardarash – Daratu 12 km
- Qaranaz – Banenan – Kalak 50km

#### **4.2.2 Political factors**

Political factors played a role in the distribution of population and its density was clearly different from one area to another in the study area Kalak district, as well as

the displacement of a large number of villagers. Also, a large part of the population of Nineveh province, especially the community (Kurdish and Shabak) moved to the urban settlements of Bardarash district, which caused differences in the distribution of population density from one area to another.



## **Discussion and Conclusion**

Population growth refers to the increase in a population over time, influenced by factors like birth rates, mortality rates, immigration, and emigration. Population distribution, on the other hand, outlines the spatial distribution of individuals within a specific region, influenced by geographical attributes, climate, resource availability, economic prospects, and sociocultural dynamics. Both population growth and distribution are important considerations in fields such as urban planning, resource management, economics, and public health, as they impact issues ranging from infrastructure development to environmental sustainability and social dynamics.

Geographic location is a crucial factor in a study area, encompassing both natural and human elements. It encapsulates climatic characteristics and influences population distribution and economic activities. Geographical positioning influences the region's image and identity, influencing its image and identity. Its importance is influenced by astronomical positioning. The Dohuk Governorate, located in northern Iraq, is bordered by Turkey, Syria, Erbil, and Ninawa. The Bardarash District, situated in the southwestern part of the governorate, is strategically located between latitudes 36.9.0 to 36.42 north and longitudes 43.24.0 to 43.54.0 east.

Since 1921, Iraq has conducted seven demographic surveys, culminating in the most recent iteration in 1997. Notwithstanding, the 1997 census was beset by constraints, notably the exclusion of specific administrative regions. The subsequent census endeavor, the eighth in sequence, was preempted by the dissolution of the incumbent regime, prompting instead a hasty enumeration endeavor in 2009 encompassing population dynamics, housing inventory, and economic entities. The dynamics of population expansion and spatial distribution are of paramount significance to stakeholders such as policymakers, urban strategists, and scholars, given their profound implications for societal, economic, and environmental domains.

Iraq's population has fluctuated since gaining independence in 1932, with estimates ranging from 3.5 million to over 8 million. The Kurdistan Region of Iraq (KRI) has a population of 2,015,466. The most recent census recorded a total population of 16,335,000, with 2,861,701 in the KRI. The 2014 estimates show a KRI population of 5,122,747 and an overall Iraqi population of 36,004,552.

According to Table 1, population growth in Duhok and its surrounding areas from 1957 to 2006 is shown. The first official census conducted in 1957 represented 7.5% of the total population of the governorate. Political unrest delayed the 1967 census, but by 1977, it had risen to 8.4%.

In 1987, a census showed that the population of Bardarash constituted 8.6% of the total population of Duhok Governorate. However, the 1991 uprising and administrative changes affected the census processes, resulting in the population growth of Bardarash not significantly surpassing that of Duhok Governorate. In 1996, Bardarash's population represented 8.4% of the total population of the governorate.

In 1987, Bardarash experienced a rapid population growth of 3.5%, surpassing Duhok's 3.2%. By 1996, the annual growth rate reached 5.95%, while Duhok saw 6.4%. In 2004, the annual growth rate in Bardarash rose to 3.8%, exceeding Duhok's 3.1%. By 2009, the growth rates peaked at 10.4% and 6.9% respectively. By 2020, the annual population growth rate slowed to 2.9%, while Duhok's rate was 3.6%. Both regions continued to experience demographic expansion. In 2009, the population of Bardarash increased to 9.9% of the total population of Duhok Governorate. This change was due to administrative reforms, such as the transition from sub-district to district status, which improved governance and stimulated economic growth, followed by the designation of Darato and Rovia villages as sub-districts.

The collapse of the Ba'ath regime in 2003 led to an increase in terrorist activities, particularly those targeting Kurdish communities. Bardarash became a haven for these displaced persons, resulting in a significant influx of internally displaced persons. In 2020, the population of Bardarash decreased by 9.5% compared to the total population of Duhok Governorate. These factors highlight the interconnection between administrative governance, socio-economic progress, and demographic dynamics.

The study reveals a significant increase in marriage trends among married females in Bardarash from 2019 to 2021, with early marriages primarily affecting the age group of 16-20. The demographic of females aged 21-25 also saw a surge in engagements. However, older age groups, particularly those aged 31 and above, showed relatively stable marriage rates. This suggests a need for further research into the factors influencing early marriages, as well as the societal implications of these trends. The

study also highlights the importance of understanding the complex dynamics of marriage in Bardarash.

Village size is a measure of rural settlement size, influenced by natural and human factors. Appropriate conditions for large-scale agricultural activities can attract residents, leading to larger and more numerous settlements compared to other regions.

In 2020, rural settlements with less than 400 inhabitants occupied a significant percentage in the Kalak district, accounting for 47.7% of total villages and 7.8% of the population. This percentage was similar in Rovia, reaching 42.5% of total villages and 7.1% of the total rural population. The lowest percentage was found in Daratu, with 25.3% and 5.3% of the population. The center and Daratu ranked first in terms of rural settlements of the same size (400-800 inhabitants), with 42.9% and 32.2% respectively. The rural population accounted for 29.5% and 17.5% of the total category. The Kalak district had a low percentage of this middle category, with 17.7% and 15.5% of residents. The largest percentage of large-sized rural settlements with 1200 residents and more appeared in Daratu, with a population exceeding 32.2% of the total villages. The Kalak and Rovia districts were close in the large category, with 60.7% and 57.9% of the total population.

In 2020, Bardarash district residents accounted for over 46% of the total population, a high rate compared to previous years. Despite a slight decrease in 1977, urban population growth reached 19.7% due to political, economic, and service factors.

In 2020, Bardarash district's villagers made up 53.3% of the total population, despite political instability, poor economic conditions, and lack of job opportunities. The growth rate was 3.5%, largely due to agricultural land. However, in 1987, rural residents decreased slightly to 88%. Between 2009 and 2020, the rural population's annual growth rate dropped to 0.5%, largely due to factors like the arrival of ISIS in 2014.

Population density is a form of population distribution that varies across regions due to factors like population spread and dwelling area. It is the geographical concentration of population, expressed as the relationship between population and land area. Density is crucial in population research as it helps determine the number of people in a given area. However, the population density index can be misleading due to

uninhabitable areas and large areas. Researchers use various density equations, including general density, to calculate population density.

General density, also known as arithmetic or absolute density, is a common and simple density measure used by experts and researchers. It measures the relationship between population size and unit area, with larger areas indicating higher density and smaller areas indicating more accurate results.

Population distribution in regions is influenced by natural and human geographical factors, which are intertwined and vary in influence. Natural and cultural factors influence population distribution, with their importance varying across regions and countries. Geographers analyze spatial variation in population density and distribution based on these influences, which can be classified into several categories.

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Division, Bardarash Station

**Appendix 1:** Population of Duhok Province by District (1975-2020)

| Year | Duho<br>k     | Zakho  | Amedi  | Akre   | Semel  | Shekha<br>n | Bardaras<br>h | Total   |
|------|---------------|--------|--------|--------|--------|-------------|---------------|---------|
| 1957 | 37813         | 45665  | 56340  | 46390  | -      | 28814       | -             | 215022  |
| 1965 | 37158         | 33049  | 35730  | 39897  | -      | -           | -             | 145834  |
| 1977 | 98242         | 59564  | 69118  | 70915  | -      | 37033       | -             | 334872  |
| 1987 | 132163        | 83917  | 27813  | 92977  | 49411  | 54559       |               | 440840  |
| 1996 | 211815        | 136602 | 80078  | 147240 | 70719  | 47936       | -             | 694390  |
| 2004 | 259004        | 180902 | 79458  | 190033 | 95544  | 65133       |               | 870074  |
| 2009 | 308302        | 226897 | 95159  | 148515 | 153985 | 121670      | 116700        | 1171228 |
| 2020 | <b>433964</b> | 319397 | 133945 | 209049 | 216748 | 171262      | 153616        | 1637981 |

**Source:** Researcher's work based on

- 1- The Republic of Iraq, Ministry of Interior, Directorate of General Civil Status, Statistical Collection of the 1957 Census, Mosul and Erbil Provinces, Al-Rashad Printing Press, Baghdad
- 2- The Republic of Iraq, Ministry of Planning, Central Statistical Organization, Department of Population and Labor Force Statistics, Results of the 1965 General Population Census, Central Statistical Organization Press, Baghdad, 1974
- 3- The Republic of Iraq, Ministry of Planning, Central Statistical Organization, Results of the 1977 General Population Census for Duhok Governorate, 1978

- 4- The Republic of Iraq, Ministry of Planning, Central Statistical Organization, Directorate of Population Statistics, Results of the 1987 General Population Census for Duhok Governorate, 1988
- 5- Kurdistan Regional Government of Iraq, Ministry of Planning, High Commission for Statistics, Directorate of Statistics of Duhok, Population Department, Unpublished Data for the Years 1996-2004
- 6- Kurdistan Regional Government, Ministry of Planning, Statistics Department, Directorate of Statistics of Duhok, Results of the 2009 Survey and Enumeration
- 7- Kurdistan Regional Government, Ministry of Planning, Statistics Department, Directorate of Statistics of Duhok, Results of the 2020 Projections
- 8- Kurdistan Regional Government, Ministry of Interior, Directorate of the Sub-districts (Dartu, Rovya, Kalak), Published Information

**Appendix 2:** Population of Akre and Bardarash districts according to administrative units (1957-2020)

| Year | Center of akre district | Dinarta | Bjil  | Grasin | Sub-district of bardarash | Center of bardarash district | Dartu | Ruviya | Kalak | Total  |
|------|-------------------------|---------|-------|--------|---------------------------|------------------------------|-------|--------|-------|--------|
| 1957 | 6041                    | 9743    | 14465 | -      | 16141                     | -                            | -     | -      | -     | 46390  |
| 1965 |                         |         |       |        |                           | -                            | -     | -      | -     | 39897  |
| 1977 | 10209                   | 9664    | 5625  | 17180  | 28237                     | -                            | -     | -      | -     | 70915  |
| 1987 | 54761                   | -       | -     | -      | 38216                     | -                            | -     | -      | -     | 92977  |
| 1996 | 28219                   | 20314   | 11286 | 28723  | 58698                     | -                            | -     | -      | -     | 147240 |
| 2004 | 37703                   | 21474   | 15400 | 38724  | 68119                     | -                            | -     | -      | 8613  | 190033 |
| 2009 | -                       | -       | -     | -      | -                         | 26570                        | 28832 | 29943  | 31355 | 116700 |
| 2020 | -                       | -       | -     | -      | -                         | 39902                        | 34931 | 43850  | 34933 | 153616 |

**Source:** Same references in appendix No(1).

**Appendix 3: Population of Duhok Province (Urban-Rural) by Districts (1957-2020)**

| <b>Districts</b> | <b>Environment</b> | <b>1957</b> | <b>1965</b> | <b>1977</b> | <b>1987</b> | <b>1996</b> | <b>2004</b> | <b>2009</b> | <b>2020</b> |
|------------------|--------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>Duhok</b>     | Urban Residents    | 9624        | 20505       | 46346       | 117315      | 173742      | 237608      | 293885      | 413670      |
|                  | Rural residents    | 28189       | 16653       | 51896       | 14848       | 38073       | 10350       | 14417       | 20293       |
| <b>Zakho</b>     | Urban Residents    | 9506        | 15949       | 31498       | 69777       | 103352      | 163693      | 203660      | 286670      |
|                  | Rural residents    | 36159       | 17100       | 28066       | 14140       | 33250       | 15894       | 23237       | 32708       |
| <b>Amedi</b>     | Urban Residents    | 5019        | 4232        | 10558       | 12926       | 21452       | 51918       | 64267       | 90462       |
|                  | Rural residents    | 51321       | 31498       | 58560       | 14887       | 58626       | 27546       | 30892       | 43483       |
| <b>Akre</b>      | Urban Residents    | 7413        | 11065       | 10918       | 21397       | 33664       | 59679       | 66710       | 93901       |
|                  | Rural residents    | 38977       | 28832       | 59997       | 71580       | 113576      | 130398      | 81805       | 115148      |
| <b>Semel</b>     | Urban Residents    | -           | -           | -           | 18692       | 20817       | 69333       | 118233      | 166424      |
|                  | Rural residents    | -           | -           | -           | 30719       | 49902       | 26211       | 35752       | 50324       |
| <b>Shekhan</b>   | Urban Residents    | 8367        | -           | 5961        | 9327        | 6802        | 47251       | 74151       | 104374      |
|                  | Rural residents    | 34791       | -           | 31072       | 45232       | 41134       | 18050       | 47519       | 66887       |
| <b>Bardarash</b> | Urban Residents    | -           | -           | -           | -           | -           | -           | 39007       | 65271       |
|                  | Rural residents    | -           | -           | -           | -           | -           | -           | 77693       | 88345       |
| <b>Total</b>     | Urban Residents    | 39929       | 51751       | 105281      | 249434      | 359829      | 629482      | 859913      | 1220772     |
|                  | Rural residents    | 189437      | 94083       | 229590      | 191406      | 334561      | 228449      | 311315      | 417188      |

**Source:** Same references in appendix No(1).

**Appendix 4:** Population of Bardarash district (urban-rural) according to administrative units (2009-2020).

| <b>Administrative units</b> | <b>Environment</b> | <b>2009</b> | <b>2020</b> |
|-----------------------------|--------------------|-------------|-------------|
| <b>The center district</b>  | Urban Residents    | 22010       | 33483       |
|                             | Rural residents    | 4560        | 6419        |
| <b>Daratu</b>               | Urban Residents    | 3851        | 5421        |
|                             | Rural residents    | 24981       | 29510       |
| <b>Ruviya</b>               | Urban Residents    | 1948        | 10605       |
|                             | Rural residents    | 27995       | 33245       |
| <b>Kalak</b>                | Urban Residents    | 11198       | 22181       |
|                             | Rural residents    | 20157       | 12752       |
| <b>Total</b>                | Urban Residents    | 39007       | 71690       |
|                             | Rural residents    | 77693       | 81926       |

**Source:** Researcher's work based on

- 1- Kurdistan Regional Government, Ministry of Planning, Statistical Board, Duhok Statistical Directorate, Results of Enclosure and Numbering (Inventory and numbering (2009).
- 2- Kurdistan Regional Government, Ministry of Planning, Statistics Department, Directorate of Statistics of Duhok, Results of the 2020 Projections
- 3- Kurdistan Regional Government, Ministry of Interior, Directorate of the Sub-districts (Daratu, Rovya, Kalak), Published Information
- 4- Ministry of Interior of the Kurdistan Regional Government, Directorate of the Rovya Sub-district, Published Information

**Appendix 5:** Total population of Bardarash district by administrative units (2009-2020)

| <b>Administrative units</b> | <b>2009</b> | <b>2014</b> | <b>2020</b> |
|-----------------------------|-------------|-------------|-------------|
| <b>The center district</b>  | 26570       | 31219       | 39902       |
| <b>Daratu</b>               | 28832       | 32796       | 34931       |
| <b>Ruviya</b>               | 29943       | 35272       | 43850       |
| <b>Kalak</b>                | 31355       | 36935       | 34933       |
| <b>Total</b>                | 116700      | 136222      | 153616      |

**Source:** Same references in appendix No(4).

**Appendix 6: Villages belonging to the center district**

|              | <b>Village name</b> | <b>Population (2010)</b> | <b>Population (2020)</b> |
|--------------|---------------------|--------------------------|--------------------------|
| <b>1</b>     | Amian               | 467                      | 680                      |
| <b>2</b>     | Amianok             | 140                      | 220                      |
| <b>3</b>     | Zawi Rash           | 423                      | 663                      |
| <b>4</b>     | Zamzamok            | 935                      | 1075                     |
| <b>5</b>     | Shewara             | 240                      | 320                      |
| <b>6</b>     | Kanilan             | 2025                     | 2911                     |
| <b>7</b>     | Mamozin             | 687                      | 550                      |
| <b>Total</b> |                     | <b>4917</b>              | <b>6419</b>              |

**Villages belonging to Daratu Sub-district.**

| <b>N</b> | <b>Village name</b> | <b>Population (2010)</b> | <b>Population (2020)</b> |
|----------|---------------------|--------------------------|--------------------------|
| 1        | Ziazark             | 786                      | 1158                     |
| 2        | Baninan             | 2965                     | 3730                     |
| 3        | Bahrawa mazn        | 736                      | 809                      |
| 4        | Biyok               | 488                      | 550                      |
| 5        | Trbasi              | 488                      | 522                      |
| 6        | Kharok              | 747                      | 799                      |
| 7        | Dahlari             | 768                      | 931                      |
| 8        | Drin bot            | 598                      | 650                      |
| 9        | Dosra               | 1178                     | 1475                     |
| 10       | Dogndan gawra       | 1180                     | 1320                     |
| 11       | Dogndan Bchok       | 562                      | 460                      |
| 12       | Zantanan            | 2299                     | 2680                     |
| 13       | Shamsakhr           | 471                      | 660                      |
| 14       | Shikhalk            | 280                      | 458                      |
| 15       | Talok               | 1027                     | 1149                     |

|              |                |       |       |
|--------------|----------------|-------|-------|
| 16           | Trbdaw nwe     | 525   | 583   |
| 17           | Trdasan        | 2366  | 2864  |
| 18           | Tortaza        | 339   | 310   |
| 19           | Tomzard        | 1063  | 1484  |
| 20           | Toraz          | 288   | 345   |
| 21           | Kawnabak       | 1672  | 2375  |
| 22           | Morilan        | 1262  | 1530  |
| 23           | Hanjirok kazan | 310   | 380   |
| 24           | Bahrawa bzik   | 69    | 86    |
| 25           | Khandk         | 198   | 230   |
| 26           | Khraba yasin   | 174   | 220   |
| 27           | Trbdo kon      | 1470  | 1276  |
| 28           | Hnjirok nwe    | 510   | 476   |
| <b>Total</b> |                | 24819 | 29510 |

**Villages belonging to Ruviya Sub-district.**

| <b>N</b> | <b>Village name</b> | <b>Population (2010)</b> | <b>Population (2020)</b> |
|----------|---------------------|--------------------------|--------------------------|
| 1        | Palasan             | 1366                     | 1446                     |
| 2        | Khamis kazk         | 111                      | 100                      |
| 3        | Hasania             | 886                      | 1250                     |
| 4        | Jojar mazn          | 1398                     | 1961                     |
| 5        | Jojar bzok          | 943                      | 1150                     |
| 6        | Janta               | 6                        | 9                        |
| 7        | Drbisan mazn        | 751                      | 742                      |
| 8        | Sirbob              | 89                       | 15                       |
| 9        | Dostak              | 492                      | 450                      |
| 10       | Tobzawa Bchok       | 254                      | 172                      |
| 11       | Bardasor            | 908                      | 1305                     |
| 12       | Bamarze             | 333                      | 231                      |
| 13       | Ekmala              | 469                      | 450                      |
| 14       | Ismawa              | 2388                     | 3450                     |
| 15       | Omarsinan           | 1826                     | 603                      |

|       |                     |       |       |
|-------|---------------------|-------|-------|
| 16    | Al lahi             | 38    | 41    |
| 17    | Sirzawsh            | 1441  | 2100  |
| 18    | Zama                | 2001  | 2789  |
| 19    | Nazrawa             | 666   | 745   |
| 20    | Kani nasbahan bchok | 210   | 166   |
| 21    | Kani nasbahan mazn  | 1171  | 1305  |
| 22    | Qaranaz             | 583   | 950   |
| 23    | Ali shana           | 304   | 128   |
| 24    | Trita               | 604   | 776   |
| 25    | Drbesan bchok       | 278   | 170   |
| 26    | Tartajo             | 717   | 635   |
| 27    | Hzar jot            | 1319  | 1502  |
| 28    | Shekhanok           | 681   | 1022  |
| 29    | Setrdk              | 361   | 673   |
| 30    | Zilka Abdulaziz     | 474   | 561   |
| 31    | Dinaran             | 682   | 450   |
| 32    | Dolijan mazn        | 1704  | 2150  |
| 33    | Dolijan Tarq        | 19    | 20    |
| 34    | Dolijan Salh        | 23    | 14    |
| 35    | Garbawil bchok      | 252   | 285   |
| 36    | Tobzawa mazn        | 570   | 729   |
| 37    | Dolijan kto         | 171   | 204   |
| 38    | Khraba wash         | 441   | 231   |
| 39    | Bardaziw            | 76    | 95    |
| 40    | Trbawil gawra       | 206   | 219   |
| 41    | Mkxim Hsnia         | 554   | 673   |
| 42    | Khraba saadon       | 447   | 581   |
| 43    | Kandala sor         | 20    | 43    |
| 44    | Ashti               | -     | 38    |
| 45    | Hzar jot masihi     | -     | 123   |
| 46    | Yakmala nwe         | -     | 437   |
| 47    | Pirbob nwe          | -     | 56    |
| Total |                     | 28233 | 33245 |

**Villages belonging to Kalak Sub-district.**

| <b>N</b> | <b>Village name</b> | <b>Population (2010)</b> | <b>Population (2020)</b> |
|----------|---------------------|--------------------------|--------------------------|
| 1        | Naz qala bzok       | 273                      | 166                      |
| 2        | Naz qala Tawra      | 94                       | 66                       |
| 3        | Bahra Sherkan       | 1137                     | 085                      |
| 4        | Badana bzok         | 205                      | -                        |
| 5        | Badana tawra        | 862                      | -                        |
| 6        | Tarjla              | 1306                     | -                        |
| 7        | Trkomas             | 947                      | 1462                     |
| 8        | Tl aswad aliawa     | 430                      | -                        |
| 9        | Hasan shami         | 2647                     | -                        |
| 10       | Zantal              | 1237                     | 1465                     |
| 11       | Zahra khaton        | 685                      | -                        |
| 12       | Sevdinan            | 343                      | 380                      |
| 13       | Shekha mirzori      | 997                      | -                        |
| 14       | Shekha mirzeri      | 371                      | -                        |
| 15       | Zama kor            | 693                      | 115                      |
| 16       | Tazakan             | 1240                     | 1525                     |
| 17       | Tawilan azad        | 99                       | 25                       |
| 18       | Qasrok              | 898                      | 1180                     |
| 19       | Kazra sor           | 386                      | 853                      |
| 20       | Kalabor             | 527                      | 754                      |
| 21       | Mantoba             | 778                      | 45                       |
| 22       | Tl aswad tawra      | 697                      | -                        |
| 23       | Khazre nwe          | 149                      | 30                       |
| 24       | Tawilan botan       | 431                      | 652                      |
| 25       | Nazmia              | 94                       | 165                      |
| 26       | Tolaban             | 2001                     | 3289                     |
| 27       | Tl aswad Kzka       | 647                      | -                        |
| Total    |                     | 20174                    | 12752                    |

**Source:** Researcher's work based on

- 1- Kurdistan Regional Government, Ministry of Planning, Statistics Department, Directorate of Statistics of Duhok, Results of the 2009 Census and Enumeration.
- 2- Kurdistan Regional Government, Ministry of Planning, Statistics Department, Directorate of Statistics of Duhok, Results of the Forecasting for the Year 2020
- 3- Kurdistan Regional Government, Ministry of Interior, Directorate of Sub-districts (Daratu, Rovya, Kalak), Published Information.

**Appendix 7:** Area of administrative units of Bardarash region (km<sup>2</sup>) in years (1957-2020)

|                         | 1996  | 2004  | 2009   | 2020   |
|-------------------------|-------|-------|--------|--------|
| The center sub-district | 830.6 | 830.6 | 82.1   | 82.1   |
| Daratu                  | -     | -     | 451.8  | 451.8  |
| Ruviya                  | -     | -     | 296.7  | 296.7  |
| Kalak                   | -     | -     | 316    | 316    |
| Total                   | 830.6 | 830.6 | 1146.6 | 1146.6 |

**Source:** Researcher's work based on

- 1- The Republic of Iraq, Ministry of Planning, Central Statistical Organization, Annual Statistical Report 1990, Table (1/5), Pages 7-8, 20.
- 2- The Republic of Iraq, Ministry of Planning and Development Cooperation, Central Statistical Organization and Information Technology, Annual General Statistical Report, 2005-2006, Table (1/5), Pages 14-20, 15.
- 3- Government of the Kurdistan Region of Iraq, Ministry of Planning, High Commission for Statistics, Directorate of Statistics of Duhok, GIS Department, Map of Duhok Province, 2010.
- 4- Government of Kurdistan Region, Ministry of Agriculture and Water Resources, Directorate of Agricultural Land Affairs. Conversion of area measurement to (km<sup>2</sup>) by converting square meters to hectares. Considering that one hectare equals 10,000 square meters, the conversion factor for each (km<sup>2</sup>) is equivalent to 400 hectares.

**Appendix 8:** Area of districts (km2) in Duhok province (1957-2020)

| Year<br>District | 1957  | 1965 | 1977 | 1987 | 1996  | 2004  | 2009    | 2020    |
|------------------|-------|------|------|------|-------|-------|---------|---------|
| Duhok            | 1449  | 1922 | 1449 | 981  | 1045  | 1045  | 1015.5  | 1015.5  |
| Zakho            | 2135  | 2085 | 2085 | 1034 | 1378  | 1378  | 1451    | 1451    |
| Amedi            | 3097  | 2974 | 2974 | 2707 | 2716  | 2716  | 2773.9  | 2773.9  |
| Akre             | 2840  | 2773 | -    | -    | 2829  | 2829  | 1832.1  | 1832.1  |
| Semel            | -     | -    | -    | 1398 | 1414  | 1414  | 1376.1  | 1376.1  |
| Shekhan          | 2047  | -    | -    | -    | 1333  | 1333  | 1414.2  | 1414.2  |
| Bardarash        | -     | -    | -    | -    | -     | -     | 1146.6  | 1146.6  |
| Total            | 11568 | 9754 | 6508 | 6120 | 10715 | 10715 | 11009.4 | 11009.4 |

**Source:** Researcher's work based on

- 1- The Republic of Iraq, Ministry of Interior, Directorate of General Civil Status, Statistical Collection of the 1957 Census, Mosul and Erbil Provinces, Al-Rashad Printing Press, Baghdad
- 2- The Republic of Iraq, Ministry of Planning, Central Statistical Organization, Department of Population and Labor Force Statistics, Results of the 1965 General Population Census, Central Statistical Organization Press, Baghdad, 1974
- 3- The Republic of Iraq, Ministry of Planning, Central Statistical Organization, Results of the 1977 General Population Census for Duhok Governorate, 1978
- 4- The Republic of Iraq, Ministry of Planning, Central Statistical Organization, Directorate of Population Statistics, Results of the 1987 General Population Census for Duhok Governorate, 1988
- 5- Kurdistan Regional Government of Iraq, Ministry of Planning, High Commission for Statistics, Directorate of Statistics of Duhok, Population Department, Unpublished Data for the Years 1996-2004
- 6- Kurdistan Regional Government, Ministry of Planning, Statistics Department, Directorate of Statistics of Duhok, Results of the 2009 Survey and Enumeration
- 7- Researcher's work using Arc-GIS 10.8 based on the Kurdistan Regional Government Ministry of Planning Department (GIS), 2024.3.

## BACKGROUND

|                       |                                                                                                                                                                                                                                                          |
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