MSc Program
Environmental Technology & International Affairs

When the Wells Run Dry: Understanding Drought Driven Migration in the Middle East through a Socio- Environmental Lens

A Master's Thesis submitted for the degree of
“Master of Science”

supervised by
Anke Schaffartzik, B.Sc, Mag. rer. soc. oec., PhD, B.A.

Andreea Mitu, BA

12215692

Vienna, 12.06.2025

Affidavit

I, **ANDREEA MITU, BA**, hereby declare

1. that I am the sole author of the present Master's Thesis, "WHEN THE WELLS RUN DRY: UNDERSTANDING DROUGHT DRIVEN MIGRATION IN THE MIDDLE EAST THROUGH A SOCIO- ENVIRONMENTAL LENS", 74 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
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Abstract

Drought is no longer a temporary climatic event but a slow onset disaster that is reshaping migration patterns across the Middle East. This thesis argues that prolonged water scarcity in the region exacerbates social vulnerabilities, compelling populations to migrate in search of more secure livelihoods. With hundreds of millions projected to face drought triggered displacement in the coming years, understanding the intersection between this slow onset disaster and resettlement is essential. Despite widespread acknowledgment of climate change as a migration driver, the specific links between drought and movement patterns in the Middle East remain underexplored. This paper addresses this gap by investigating the impact drought has on rural communities in Jordan and Iraq, disproportionately affecting agriculture dependent populations and vulnerable groups, driving rural to urban migration. The study seeks to contribute to the existing literature on drought induced migration by focusing on the relationship between prolonged drought conditions and internal migration patterns in the region. Yet, understanding these dynamics is challenged by the lack of comprehensive data on the topic and an accurate impact trajectory.

While European media often frames migration flows from the Middle East as a predominantly negative phenomenon impacting European countries, this paper shifts the focus to a regional analysis, emphasizing internal mobility dynamics within the Middle East. Few people migrate by choice; many migrate out of necessity. Centered around drought as a key driver of necessary environmental migration in the Middle East, this study aims to shed light on a largely overlooked aspect of climate induced movement in the region.

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Acronyms and Abbreviations

BCM - Billion Cubic Meters

CBM - Cubic Meters

ECJRC - European Commission Joint Research Centre

EM-DAT - The Emergency Events Database (The International Disaster Database)

EUMETSAT - European Organisation for the Exploitation of Meteorological Satellites

FAO - Food and Agriculture Organization of the United Nations

IDMC - The Internal Displacement Monitoring Centre

IDP - Internally Displaced People

IDPs - Internally Displaced Persons

IMERG - Integrated Multi-Satellite Retrievals for GPM

IOM - International Organization for Migration

IPCC - Intergovernmental Panel on Climate Change

IRC - International Rescue Committee

ISIL - Islamic State of Iraq and the Levant

KRI – Kurdistan Region of Iraq

MEMO - Middle East Monitor

MENA - Middle East and North Africa.

MODIS - Moderate Resolution Imaging Spectroradiometer

NASA - National Aeronautics and Space Administration

NDVI - Normalized Difference Vegetation Index

NGO - Non-Governmental Organization

NRC - Norwegian Refugee Council

PIN - People in Need

RICCAR - Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region

SPEI - Standardized Precipitation Evapotranspiration Index

SPI - Standard Precipitation Index

UN Habitat - United Nations Human Settlements Programme

UNCCD - United Nations Convention to Combat Desertification

UNDP - United Nations Development Programme

UNDRR - United Nations Office for Disaster Risk Reduction

UNEP - United Nations Environment Programme

UNESCWA - United Nations Economic and Social Commission for Western Asia

UNFCCC - United Nations Framework Convention on Climate Change

WRI - World Resource Institute

WWAP - UNESCO World Water Assessment Programme

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I. Introduction

Drought is a slow onset disaster that gradually destroys livelihoods by disrupting agricultural systems, and intensifying water scarcity, particularly impacting socially vulnerable people. In the Middle East, prolonged droughts have increasingly been recognized as an environmental stressor acting as a catalyst for internal displacement. This has been extensively studied in Syria, where prolonged drought is believed to have played a critical role in rural displacement prior to the 2011 conflict (Ghosh, 2021; UNDP, 2023; RICCAR, 2017). This thesis expands the scope to other countries where drought has been identified as a driver of migration, highlighting similar patterns in Jordan and Iraq, verifying that the case of Syria is not an isolated example. Despite global studies indicating that climate change has decreased agricultural productivity, significantly shaping migration in middle and lower income countries, the specific relationship between environmental change and mobility remains underexplored. While socioeconomic factors are more broadly discussed as influences on mobility patterns, environmental drivers also significantly shape migration decisions. The distinction between these factors is often unclear, making it difficult to isolate environmental causes as planetary boundaries continue to be crossed. Scientists confirmed that climate change is the primary cause of the unusually high temperatures recorded since 2020, which further increased evaporation of reduced rainfall, significantly raising the likelihood of extreme droughts (Carrington, 2023). This is illustrated through the prolonged drought in the Middle East between 1998 and 2012, which NASA researchers confirmed as the most severe drought in 900 years, with strong evidence linking it to human induced climate change (Hille, 2016). This is highly relevant to this research, as the drought particularly impacted rural communities reliant on agriculture and fishing, increasing internal migration in the region (Anderson, 2019), which is the central focus of this thesis. For a more focused analysis of the topic, two countries in the region will be explored: Jordan and Iraq, which have both experienced significant rural to urban migration due to worsening frequency and severity of droughts, underscoring unprecedented environmental stress. In Iraq, the pace of climate change has increased severe drought events in the Tigris-Euphrates basin from once every 250 years to nearly once a decade, triggering large scale displacement due to a spike in food prices and the drying up of

rivers and lakes (Carrington, 2023). Similarly, farmers are leaving rural areas in Jordan, searching for alternative incomes in urban areas (Anderson, 2019).

A striking and somewhat ominous entry point for this analysis is the warning Dorte Verner (World Bank) released in 2012 for the Middle East: "*Limited land and water resources will continue to fuel rural outmigration. Water scarcity, expected to impact 80-100 million people in the region by 2025, and land degradation will be intensified with the onset of climate change*". Thirteen years later, many signs point towards the fulfilment of Verner's prediction, as water scarcity remains one of the most pressing environmental challenges in the Middle East and North Africa (MENA) region. According to World Resource Institute (2019), recent data shows that around 83% of the area's population is exposed to extremely high water stress. Despite housing nearly 6% of the global population, MENA holds only 1% of the world's renewable freshwater resources (Belhaj, 2025). As a result, the region's per capita water availability falls significantly below the internationally recognized absolute scarcity threshold of 500 cubic meters per year (Belhaj, 2025). Jordan in particular faces severe shortages, with annual per capita water supplies dropping below 100 cubic meters per year (Belhaj, 2025). These conditions threaten agricultural sustainability and intensify the risk of displacement and migration due to water uncertainty (Belhaj, 2025). To contextualize the region's vulnerability to drought driven migration, the concept of a sacrifice zone is applied, which refers to geographic areas that are systematically marginalized and exposed to disproportionate environmental harm for the benefit of broader political or economic interests. From colonial partitioning to contemporary geopolitical interference, the Middle East has been systematically exploited for its resources, leaving populations to endure the compounded impacts of environmental degradation and economic instability. Therefore, framing the region as a sacrifice zone highlights how external powers have systematically disrupted its political and social balance, increasing its environmental vulnerability to various events, including droughts.

The hypothesis this study explores is that drought functions as a major, but often underrecognized, form of slow violence driving migration in the Middle East. Aiming to offer a nuanced perspective on the complex relationship between environmental factors and migration dynamics, this paper investigates how climatic stressors, exacerbated by demographic pressure and poor water management, create long term socio-environmental vulnerabilities that drive people to relocate. By applying an impact chain

framework, the interaction between the region's arid climate, rapid population growth, and limited water availability is examined. The present research focuses on the Middle East due to its low climate resilience and high water stress. While broader MENA dynamics are acknowledged, the analysis is grounded in Jordan and Iraq (including the Kurdistan Region of Iraq). Both countries are part of Al-Mashreq, a subregion of the Middle East that encompasses the eastern Arab world and is highly exposed to water scarcity and agricultural pressure. Furthermore, this study aims to insert rural vulnerability into drought assessment by applying a political ecology lens, which considers how power relations and historical inequalities shape environmental outcomes. It also draws on the concept of virtual water (the hidden water embedded in traded goods), to highlight the countries' dependency on food and product imports. Building on this conceptual foundation, the thesis examines three key sub-questions that collectively contribute to answering the overarching research inquiry:

In what ways does drought act as a significant push factor in migration patterns in the most affected and underresearched areas of Middle East, and how are these patterns influenced by socio-political and environmental factors?

1. How does water and food insecurity shape the relationship between drought, climate change, and migration in Jordan and Iraq?
2. Which communities in the region are most vulnerable to climate induced drought, and what conditions heighten their risk of displacement?
3. What are the lived experiences of drought affected farmers, and to what extent are their perspectives represented or overlooked in the general migration discourse?

While this study aims to provide a focused and timely contribution to the understanding of drought driven migration in the Middle East, several limitations should be acknowledged. These include the lack of long term migration data, as most existing research focuses on short term movements, overlooking deeper dynamics associated with slow onset climate change. Furthermore, a general data gap persists across the MENA region, where few countries provide reliable insights into the connection between drought and migration. Due to time constraints and limited technical resources, this work serves as an exploratory study that may be developed further through future, in depth research.

To guide this exploration, the thesis is structured as follows: Chapter I introduces the topic and research context. Chapter II begins with an overview of the scientific categorization of droughts, which complements the theoretical frameworks explored in this chapter, primarily focused on the political ecology lens, including Rob Nixon's concept of slow violence, the concept of virtual water, and the impact chain framework. Then, a critical examination of existing literature on drought related migration follows in Chapter III. The research methodology is demonstrated in Chapter IV, explaining the rationale behind the topic choice, and the use of satellite data and migration reports. Chapter V encompasses an overview of regional trends in drought and migration across the Middle East, with subsections exploring themes of water insecurity, population growth, rural to urban migration and transboundary water conflicts. Chapters VI and VII zoom in on Jordan and Iraq respectively, investigating impacts of drought severity and rural to urban migration at a national and subnational level in both countries. These case studies focus on personal accounts of drought affected farmers, emphasizing the slow violence drought exerts on local communities. Chapter VIII synthesizes the findings of Chapter V, VI and VII, connecting them into an integrative discussion. Lastly, Chapter IX provides the research conclusions, which Chapter X builds on to propose practical recommendations aligned with the thesis' main and sub-questions.

II. Theoretical Framework: Political Ecology and Related Concepts

Chapter II establishes political ecology as the main theoretical framework which this paper is based on, within which the concepts of slow violence and virtual water are integral. To highlight the impact of drought on several dimensions, its four scientific types are explained: meteorological, agricultural, hydrological, and socio economical droughts. Further concepts and definitions of key terms are included, such as vulnerability, exposure, adaptive capacity, which are highly relevant in identifying the people most impacted by this environmental phenomenon. Finally, the impact chain framework is used to bring the concepts together, highlighting how slow violence connects to virtual water by generating long term environmental degradation that disproportionately impacts marginalized communities.

2.1 Drought Definition and Types

Drought is a complex phenomenon with no universal definition applicable to all contexts (Bouhioui and Loudyi, 2025). Put simply, a drought event represents a shortage of water relative to normal conditions (West et al., 2019). However, various approaches can be used to define it. Droughts are one of the most impactful phenomena, reflecting water deficits caused by various factors such as insufficient precipitation, increased temperatures, and higher atmospheric water demand (UNDRR, n.d). Moreover, they cannot be stopped and are difficult to forecast (FAO, 2025). Unlike floods or other sudden natural hazards, droughts have a slow onset nature, and lack a clearly defined start and end, making it more difficult to detect and monitor. Nonetheless, "*droughts can be as deadly as other weather hazards, and they have affected more people than any other natural disasters in the last 40 years*" (IRC, 2023).

Within a political ecology lens, understanding the multidimensional nature of this slow onset phenomenon is essential. Considering several factors such as severity, frequency, duration, spatial extent, timing, and sectoral impacts (particularly on agriculture, water resources, and ecosystems), droughts are typically categorized in the following four types (Figure 1): **Meteorological drought**, defined as a deficiency of precipitation compared

to the long term average; **agricultural drought**, related to soil moisture deficits; **hydrological drought**, associated with decreased river flows and water bodies; **socio-economic drought**, where water shortages impact economic activities and societal needs (Bouhioui and Loudyi, 2025). While the four types are interconnected, their development and impacts are different. Meteorological drought begins with precipitation deficits and increased evaporation, which leads to soil water deficiency. This further triggers agricultural drought through the disruption of crops. If conditions worsen, reduced streamflow and groundwater recharge contribute to hydrological drought, which can provoke socioeconomic drought, directly impacting livelihoods. This classification uncovers the layered and cumulative impacts on water infrastructure and livelihoods, revealing how slow onset crises like agricultural drought threaten food and income sources over time, a key aspect of slow violence.

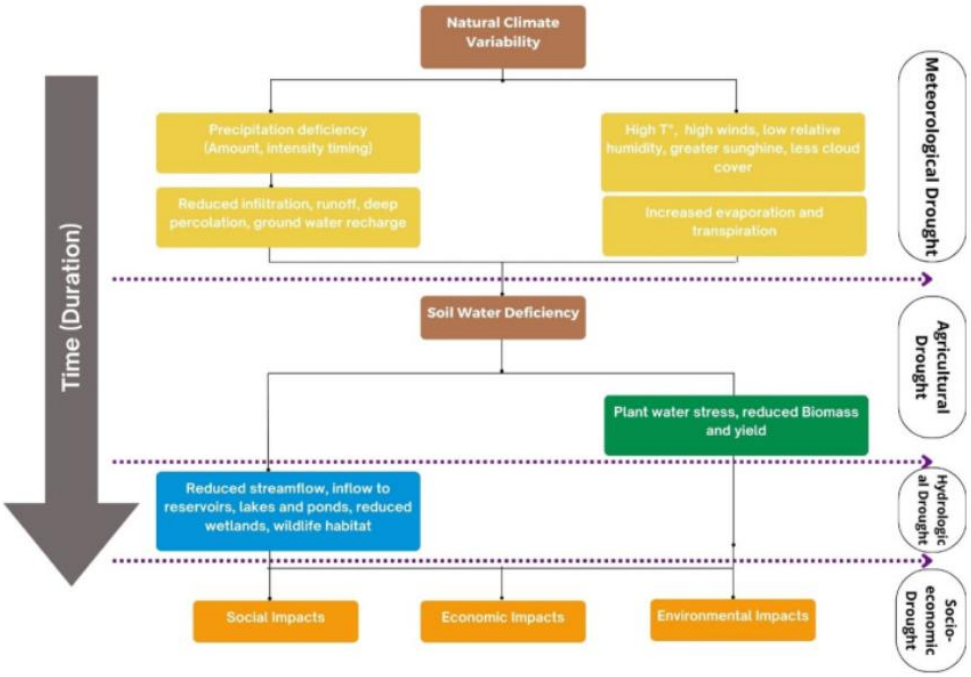

Figure 1: Types of Drought. Source: Bouhioui and Loudyi, 2025.

A variety of causes can be attributed to long periods of dryness, including natural agents such as weather patterns. More specifically, extensive research attributes change in ocean temperatures to be an important factor in drought occurrence, visible through climate phenomena such as El Niño (warmer than average ocean temperatures) and La Niña (cooler than average conditions) in the Pacific Ocean (IRC, 2023). Furthermore, the jet stream, characterized by strong winds flowing high in the atmosphere which move dry air from one part of the world to another, is also recognized as a drought contributing

factor (IRC, 2023). In addition to natural causes, drought occurrence and intensity is increasingly attributed to human activity crossing planetary boundaries, pushing ecosystems to their limits, visible through rising surface temperatures averaging 0.99 °C higher between 2001 and 2020 compared to 1850–1900 (IPCC, 2021). Activities like deforestation and intensive farming are known contributors to global warming, which makes extreme weather more likely by increasing evaporation, causing extremely dry periods (IRC, 2023). Consequently, drought monitoring and mitigation tools are of critical importance, and will be thoroughly explored in Chapter III. In summary, drought is a complex natural phenomenon with varying levels of intensity and duration. Severe drought episodes have drastic socio-economic and environmental impacts, including migration caused by decreased agricultural possibilities and natural resource degradation. The difficulty in assigning droughts a specific definition highlights the challenge faced when trying to quantify and analyze this phenomenon. What is clear, however, is the impacts droughts have on exposed populations and ecosystems, which will be extensively explored in the following chapters.

2.2 Political Ecology

Political ecology provides a critical framework for examining how environmental degradation and resource scarcity in the Middle East have transformed specific regions into sacrifice zones, where social vulnerabilities are intensified by political and environmental pressures. The fact that the climate crisis does not impact all communities equally, with low income and minority communities considerably more affected, has been a thoroughly examined and debated subject. However, various statistics support these findings, showing that "*Black people are exposed to 56% more pollution than they cause – while white people breathe 17% less pollution than they produce*" (The Climate Reality Project, n.d.). Similarly, people of color in poorer nations are more impacted by increasing temperatures and drought, as between 1998 and 2018, the world's least developed nations make up most of the severely affected countries by climate related extreme weather (The Climate Reality Project, n.d.). To encompass the described inequality, the term *sacrifice zone*, originating from livestock management, started to be used more widely (including in political ecology) after the 1970s (Juskus, 2023). A critical

concept in environmental literature, a sacrifice zone represents specific communities or a geographic area that has been permanently damaged by environmental factors or economic disinvestment, mostly found in low income and minority communities. This concept is central to this paper's exploration of drought impacted migration, as an analysis of the geographic region of the Middle East supports its position as a sacrifice zone. Historically, the Middle East has been an area both exploited and dismissed, colonized and divided by various powers to their own desire. In 1916, the borders of the Levant region in the Middle East were drawn by Britain and France, "*dividing the map of one of the most volatile regions in the world into states that cut through ethnic and religious communities*" (Al Jazeera, 2016). Since then, the region has been intermittently abandoned and exploited by external powers. Popular media coverage of the region highlights predominantly negative stereotypes that often distort the lived experiences of these communities. Little emphasis is placed on climate change consequences and national dynamics in the region. Therefore, the question raised is whether the Middle East is regarded as a region for which it is 'too late to be saved'.

Within sacrifice zones, the concept of trapped populations emerges, highlighting those who lack the resources to migrate despite severe environmental stress. While this thesis primarily focuses on migration patterns driven by drought, it is equally important to consider those who remain behind. According to the World Bank (2021), migration is too expensive for people in areas of extreme poverty, making it difficult for them to migrate, trapping them in these areas instead. This underscores the interconnectedness of trapped populations with key political ecology terms, such as **exposure** (the presence of people and infrastructure in risk prone areas), and **vulnerability**, (the inability to adapt or escape deteriorating conditions) (ECJRC and UNCCD, 2024). Additionally, drought hazard, sensitivity, and adaptive capacity are critical terms in assessing the broader implications of drought in vulnerable regions. **Drought hazard** refers to exposure, quantifying drought volume by focusing on surface water deficits as outlined in the World Drought Atlas (2024). Meanwhile, **drought sensitivity** underscores how certain livelihoods, particularly those reliant on natural resources are disproportionately affected due to their dependence on ecosystems and consistent water availability (ECJRC and UNCCD, 2024). **Adaptive capacity** examines the extent to which people can cope with or recover from drought impacts, dependent on factors such as household wealth, education, infrastructure access, and social protection systems. Closely linked with adaptive capacity, ***resilience*** to drought

is shaped by preexisting vulnerabilities such as poverty, unemployment, gender inequality, and lack of social protection. Although this thesis does not particularly focus on a gendered perspective into the impacts of drought, it is worth highlighting that climate hazards aggravate gender inequality, particularly increasing vulnerability of women and marginalized groups (ECJRC and UNCCD, 2024). In summary, water availability determines drought hazard, which only becomes a risk when exposed and vulnerable communities are impacted, while the consequences of drought risk are dependent on exposure levels (UNDP, 2023). Together, these concepts provide a comprehensive framework for understanding migration and immobility in drought affected regions on social, environmental and economic levels. Understanding these dimensions is essential for assessing both vulnerability and adaptive capacity of affected populations.

Two distinct perspectives can be applied through this theoretical lens. First, a grassroot perspective highlights rural areas as sacrifice zones within countries in the region. As increasingly more people dependent on agriculture move to urban centers, rural areas are being depopulated, isolating those left behind, who are unable or unwilling to relocate. This is an established emerging issue for policymakers on displacement and migration worldwide (IDMC, 2020). Deserted villages are considered insignificant and unworthy of investment, effectively becoming neglected. A second perspective offers a regional lens, framing the Middle East as a sacrifice zone where environmental degradation and social marginalization are systematically entrenched. Both perspectives have at their core the hypothesis that "*Migration is often expensive, and those most vulnerable to environmental change are usually poor*" (Black *et al.*, 2011), underlining that migration as adaptation strategy is not possible for everyone affected. Concurrently, a successful migration depends on several factors like age, gender, health attachment to a place and socio-economic status (ECJRC and UNCCD, 2024), highlighting risks like integration challenges in the new communities for migrants.

Slow Violence

The concept of slow violence embodies the unseen aspect of slow evolving environmental catastrophes and is especially productive in studying drought because of its slow onset nature and its impacts on several dimensions, as highlighted through its four different types, their interconnectedness and their specific temporality. The term was introduced

by Rob Nixon in *Slow Violence and the Environmentalism and of the Poor*, and defined as "*a violence that occurs gradually and out of sight, a violence of delayed destruction that is dispersed across time and space, an attritional violence that is typically not viewed as violence at all*" (ClimateLit, 2025). Regarding droughts, this definition can be applied as damage to one part of an ecosystem causes persistent disturbance in others, creating a chain reaction, as seen through the drought classification in Chapter 2.1. A key aspect of slow violence is that the connection between the initial impact and its widespread consequences is often subtle and difficult to trace, as the trigger often remains unknown. However, the impact is far reaching, having social, economic and environmental implications. Slow violence exacerbates the vulnerability of the poor and disempowered, highlighting the stark contrast between sudden events, like floods, and droughts, as well as the different levels of attention these phenomena receive. While sudden disasters are extensively covered in the media, and concrete numbers and consequences can be attributed to them, slow onset events are often ignored. Lacking the sensationalist aspect, the dramatic impact they have on people, and the environment is overlooked. This lack of attention increases exposure of poor, vulnerable groups to gradually evolving disasters such as droughts. This is also highlighted by Nixon, as his theory discloses that the poorest people suffer the most from environmental degradation (Harvard University Press, 2025).

Virtual Water

Virtual water is defined as the water used in the production process of an agricultural or industrial product (Hoekstra et al., 2011). For example, economists consider a product not only by its own weight and specifications, but also by the water needed to grow it (Pearce, 2006). It reflects how water scarce countries like Jordan and Iraq depend on external resources to sustain food systems and other water intensive products, transforming water from a local resource into a globally traded commodity. Under a political ecology framework, this highlights unequal global trade relations and reveals how adaptation to drought often relies on external dependencies. This dependency also reveals the region's vulnerability and the escalating impacts of climate change, as virtual water is a lifeline for countries in the region (Pearce, 2006). Jordan, one of the two countries this research focuses on, imports 80 to 90% of its water in the form of food (Pearce, 2006). The Middle East as a whole, is the first major region to have run out of water in the history of the

world, with the amount of imported water flowing into the area each year estimated to be larger than the water flowing down the Nile (Pearce, 2006). Because of this, the virtual water concept is used to illustrate how Jordan and Iraq's reliance on imported water intensive goods heightens their sensitivity to global supply chain disruptions, while also creating a complex web of social dependencies that exacerbate local vulnerabilities.

Favorable climatic conditions play a key role in the dynamic of virtual water, as considerably less water is required to produce a kilogram of grain in supporting conditions, compared to areas with high temperature and high evapotranspiration (Hoekstra et al., 2011). Therefore, the concept explains the position the Middle East holds as a region with a significant net virtual water import, as a strategic adaptation to their limited water availability (Hoekstra et al., 2011). It underlines that, in addition to external political interference, the predominantly arid climate contributes to the perspective of the Middle East as a sacrifice zone.

Impact Chain Framework

The impact chain framework underscores how environmental harm accumulates across different levels, offering a suitable tool to analyze how drought shifts from an environmental event to a trigger of migration. The cascading impacts of drought, exacerbated by climate change, are illustrated in the diagram below (Figure 2). Firstly, climatic factors such as reduced precipitation, higher temperatures, and increased evaporation, contribute to water shortages and decreased soil moisture, directly affecting environmental conditions (UNDP, 2023). This results in reduced water quality, declining soil health, and loss of biodiversity, which economically lead to significant production losses due to harvest deficits (UNDP, 2023). Ultimately, these chain effects increase food insecurity, poverty, and unemployment, exacerbating social inequality and deteriorating living conditions. Furthermore, heightened resource competition increases political unrest, which can ultimately threaten human security, as it contributes to internal displacement and possibly onset of conflict (UNDP, 2023). For this reason, the impact chain framework underscores how drought serves as a catalyst for broader social issues by intensifying vulnerabilities across multiple sectors. It is a widely recognized framework in climate and social sciences, and is highly relevant for the present study, as

it is used to illustrate the chain events triggered by drought in Jordan and Iraq.

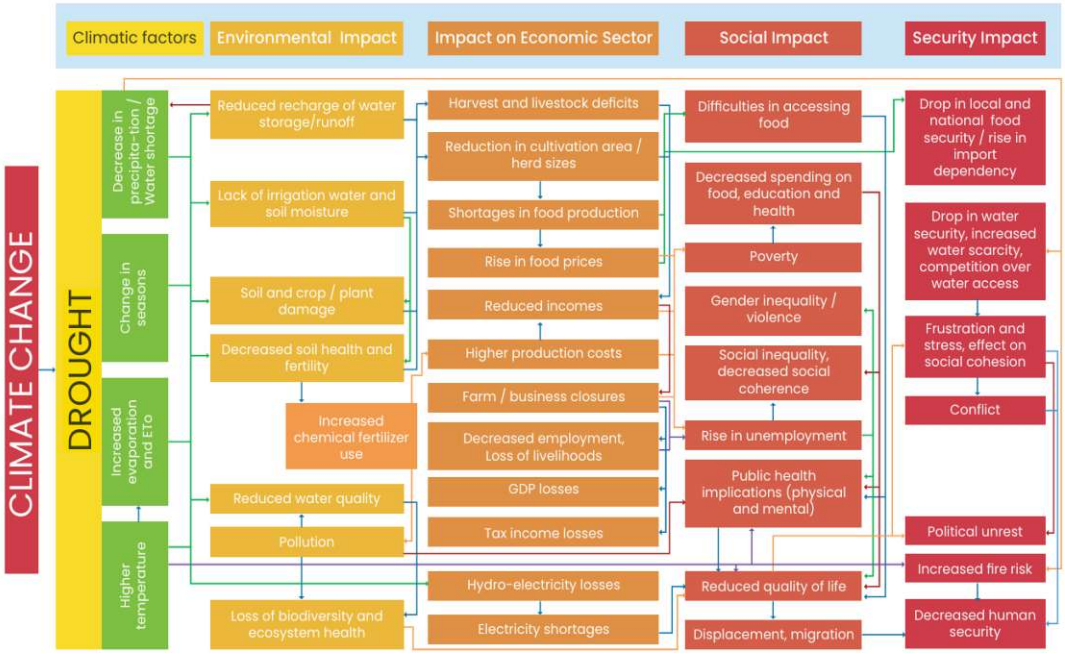

Figure 2: Impact chain of drought on the agricultural sector. Source: UNDP, 2023.

As a result, within the political ecology framework, the concepts of slow violence and virtual water are central to this research, offering an extremely fitting lens to assess displacement through environmental degradation. The concepts combine through the impact chain framework to map out the consequences drought has on migration in the Middle East. Particularly clear through Chapters VI and VII, the case studies on Jordan and Iraq reiterate the vulnerability of rural populations to drought, as migration is seen as an adaptive measure causing rural to urban migration due to agricultural deterioration. Moreover, they emphasize drought as an act of slow violence, unfolding gradually and invisibly, often overlooked as a natural hazard in comparison to impactful, sudden catastrophic events.

III. Methodology

This chapter outlines the research methods, including tools and materials, used in this study. It also provides a justification for the selection of the Middle East, specifically Jordan and Iraq, as primary focus areas, emphasizing their increased vulnerability to drought and severe water scarcity. This study employs a combination of satellite data, secondary datasets, and migration reports to analyze the relationship between drought and migration patterns. More specifically, this section discusses SPEI data to assess drought severity, while data from IOM, UNDP and UN Habitat provides insights into migration trends associated with environmental stress. Reports by the World Bank and IOM, focusing on precipitation, groundwater depletion, and population movements, correlate rainfall variability, drought intensity, and migration patterns, enabling the visual representation of migration hotspots and drought affected areas. This comprehensive approach underscores how prolonged drought conditions can act as a significant push factor for migration in the region.

3.1 Rationale for Regional Focus: Why the Middle East, Jordan, and Iraq?

The Middle East was selected as the focal region for this study due to its heightened exposure to both drought and migration, making it a critical area for examining the intersection of environmental stress and population displacement. The region stands out as the most water stressed region globally, with vast areas experiencing extremely high water stress, as indicated by the World Resources Institute (Kuzma et al., 2023). Within the region, two Al-Mashreq countries, Jordan and Iraq, were chosen as case studies given their recurrent inclusion among the most severely drought impacted countries. Both are categorized as experiencing extremely high water stress, using more than 80% of their available water (Kuzma et al., 2023). Moreover, hotspots of drought risk were identified in both countries, according to the spatial distribution of historical urban hydrological drought risk compiled by ECJRC and UNCCD (2024). Constructed based on measuring the severity of drought risk by combining drought hazard, exposure and vulnerability with adaptation cost, the map indicates that Jordan experiences medium drought related economic costs alongside a medium level of vulnerability, highlighting the importance of

policy interventions focused on improving water management and resilience (ECJRC and UNCCD, 2024). Iraq stands out in the region with both a high drought vulnerability index and significant economic costs associated with drought events (ECJRC and UNCCD, 2024). This shows that Iraq suffers from substantial losses when droughts occur, likely amplified by poor water infrastructure, as well as the country's dependence on agriculture and the Tigris-Euphrates River system. Therefore, Jordan and Iraq provide a complex case study for understanding how drought can potentially contribute to displacement and migration. Lastly, data on annual precipitation collected from the *3rd Arab State of the Water Report 2015: Annual Precipitation Volume Received by Arab Countries* also contributed to the choice rationale (Figure 3). The 2015 report reveals that the MENA region received a total of 1,585 billion cubic meters (BCM) annual precipitation per year, with Sudan receiving the most (394,76BCM), and Bahrain the least precipitation (0.04BCM). Focusing on Al-Mashreq countries, Iraq ranked 7th, receiving approximately 93.07BCM annual precipitation, placing it among the higher ranking countries in terms of rainfall volume. However, prolonged periods of drought alongside upstream damming and inefficient water management, situate Iraq amidst a complex water crisis (IOM, 2023). These contradictory perspectives motivated an in depth exploration of Iraq. Contrastingly, Jordan only received 6,99CBM annual precipitation in 2015, being classified as one of the most water scarce countries in the Middle East. Reduced precipitation poses serious challenges to long term water availability in Jordan, offering a complex case for drought impacted migration in the region.

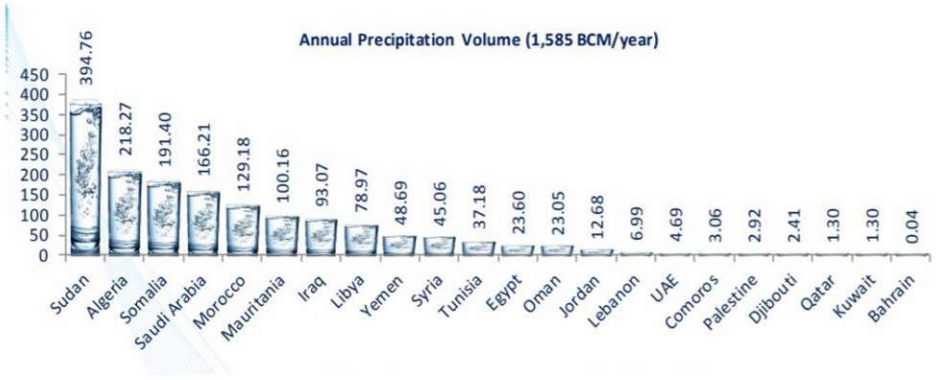

Figure 3: Annual Precipitation volume received by Arab countries in BCM/year. Source: Arab Water Council, 2021.

3.2 Remote Sensing for Drought Monitoring

In regions characterized by severe water scarcity, such as the Middle East, effective drought monitoring is essential to mitigate adverse effects. This section outlines the application of remote sensing techniques used in this study to assess drought severity in Jordan and Iraq. Key indicators in monitoring environmental variables are identified in the theoretical chapter as rainfall levels, soil moisture content, land surface temperature, and vegetation health. While such data was solely collected by early drought monitoring systems through in situ measurements, these have been replaced by remote sensing systems (Ghasemfir et. al, 2023). Since the NASA Landsat series launch in 1972, meteorological and environmental satellites have played a critical role in collecting drought related data, allowing long term observation of variables over large temporal and spatial scales, particularly relevant in data poor regions like the Middle East (Ghasemfir et. al., 2023). Using a combination of passive microwave, infrared, and optical sensors, satellites can detect precipitation deficits, monitor surface temperatures, and assess vegetation conditions, providing datasets on drought development, and enabling early warning systems to mitigate impacts on agriculture and water resources (EUMETSAT, n.d.). The most relevant dataset from satellite data used in this research is the Standardized Precipitation and Evaporation Index (SPEI). The SPEI is a widely recognized tool for assessing drought conditions, relying on a simple water balance derived from precipitation and temperature data (Tirivarombo et al., 2018). SPEI values provide a comprehensive framework for interpreting climatic conditions: a value of 0 indicates normal conditions, while positive values denote wetter conditions, ranging from 0 to +1 for moderate wetness, +1 to +2 for very wet conditions, and values exceeding +2 for extreme wetness (Bouhioui and Loudyi, 2025). Conversely, negative values represent drier conditions, with 0 to -1 indicating moderate dryness, -1 to -2 signifying severe drought, and values below -2 categorized as extreme drought (Bouhioui and Loudyi, 2025). This structure enables a nuanced understanding of drought intensity, facilitating comparative analysis across time and space.

The relevance and accuracy of satellite data for drought monitoring has been highlighted by Ghasemifar, Sonboli, and Hedayatizade (2023) in a study which validates the reliability of this data particularly in regions with sparse meteorological stations. Their research also identifies a seasonal pattern of agricultural vulnerability, as intensification

of drought conditions across several countries in the Middle East were observed during summer months June -August (Ghasemifar et. al., 2023). The authors also emphasize the significant role of large scale atmospheric dynamics in regional drought occurrences, underscoring the need for integrated climate and migration policies that consider both local and regional climatic factors (Ghasemifar et. al., 2023). These findings offer an answer to sub-question 2 in Introduction, as they highlight the vulnerability of rural communities to the intensification of droughts during critical agricultural periods, leading to crop failure and a loss of income. Further satellite data used for this research was extracted from the Copernicus Global Drought Observatory, which includes information on monthly precipitation and NASA Worldview, which offers information on drought hazard frequency and distribution, as well as land temperature changes.

3.3 Migration Reports

To effectively examine the link between drought and migration in the Middle East, the following section integrates migration reports on drought driven displacement in the region, collected from various sources. Migration statistics were taken from various IOM reports on climate induced displacement in the MENA region. Data on rural to urban migration in Jordan was extracted from the *Urban Planning & Infrastructure in Migration Contexts: Mafraq Spatial Profile, Jordan* by UN Habitat, published in 2024. Data on coping strategies and drought affected populations in Iraq were drawn from the 2023 *People in Need* report, providing concrete case study evidence from Salah Al-Din and Ninewa Governorates to analyze how drought intensifies migration pressures and compels residents to adopt adaptive strategies. Information on drought induced displacement in Iraq was sourced from reports by the Norwegian Refugee Council (2021) and the International Organization for Migration (2022). Data on global drought induced displacement were drawn from reports by the IRC and IOM, which provided baseline statistics to contextualize the study's focus on internal migration in the Middle East. These reports provided baseline data on migration patterns and demographic characteristics of affected populations.

The World Drought Atlas (2024) was extensively used, providing valuable insight into drought impacted migration dynamic in Jordan and Iraq. The report identified countries

which present discrepancies between reported drought driven displacement between 2017 and 2023, and data on the respective mobility patterns. For example, no data has been reported on people affected by drought or displacements triggered by drought in this period in Jordan, which is noteworthy given its known status as a water scarce country highly vulnerable to drought. This suggests a potential underreporting or lack of systematic monitoring of drought impacts and related displacement in Jordan. The World Drought Atlas indicates Iraq is among the countries that have reported people affected by drought during the respective period, however displacement data specifically linked to drought is lacking. This further supports a discrepancy in comprehensive tracking of drought driven displacement or a gap in data collection and reporting. This is particularly relevant given the known vulnerability of both countries to drought and water scarcity in the context of agricultural livelihoods and internal migration.

IV. Literature Review

This chapter provides a comprehensive review of existing literature on the relationship between drought and migration patterns in the MENA region. It examines the attention the topic has received over time, empirical studies, and methodological approaches that explore how climate induced droughts drive human mobility across the Middle East. Despite drought driven migration impacting people across the globe since the last century, the topic has been understudied and underexplored until recently. While the first publications on the subject appeared around the late 1980s, it was not until after the 2015 migration crisis in Europe that interest in the topic peaked. This supports the slow violence and impact chain approach discussed in the previous chapter, as it took decades for the subject to gain momentum, while consequences of droughts unfolded silently over decades. Moreover, communities most impacted by droughts were not the ones given a voice and tools to narrate the impacts until they caused disruptions in other parts of the system. Understanding the nexus between these topics is crucial for informing policy and adaptive strategies in drought prone regions such as the Middle East. By synthesizing findings from previous research, this chapter identifies key themes, emerging migration trends and research gaps relevant to understanding the social impacts of drought.

4.1 Water Insecurity

Water scarcity is a recurring and central theme in drought related literature. Worldwide, it is defined as having less than 1,000m³ of available water per person per year, with the threshold for absolute water scarcity of 500m³ per person per year (UNESCWA, 2015). Research consistently highlights the critical role of water scarcity in understanding the impacts of drought across various sectors, highlighting agricultural damage, pressure on ecosystems and increasing resource competition in socio-economic settings. It is important to differentiate between water stress and water scarcity, as the first focuses on the ratio of water demand to renewable supply, measuring the competition over local water resources, and the latter regards insufficient natural water resources, and can occur in areas where there is adequate water infrastructure (Kuzma et al., 2023). Globally, more than 50% of the world's population lives under highly water stressed conditions for at

least one month of the year, and the percentage is estimated to keep growing (Kuzma et al., 2023). According to Kuzma et al. (2023), a country is considered under 'extreme water stress' when it uses over 80% of its water resources, and under 'high water stress' at a 40% withdrawal rate. This framework implies that the smaller the buffer between supply and demand, the more vulnerable a population is to sudden water shortages. While this offers a useful quantification of water risk, it overlooks socio-political and infrastructural factors that also influence a community's resilience, potentially oversimplifying the complexity of water vulnerability.

While this approach is widely accepted in assessing water stress, it is critiqued for overlooking factors like water quality and access to infrastructure. The World Bank asserts in the two volume report *Ebb and Flow,* published in 2021, that it is necessary to note that outdated or nonexistent water infrastructure as well as water pollution play a key role in exacerbated water stress. Based on an extensive dataset covering nearly half a billion people from 189 population censuses across 64 countries between 1960 and 2015, the reports integrate an environmental and policy dimension on the topic, highlighting the interconnectedness between natural resources, politics and community. Most importantly, the report links water stress and drought to migration, which lacks in the supply and demand approach previously discussed. *Ebb and Flow* provides an essential empirical foundation for understanding migration patterns related to water issues (World Bank, 2021). By examining how deficiencies in water infrastructure and inadequate access to clean water sources compel communities to relocate in search of better living conditions, the report upholds the concept of water stress acting as a significant push factor for migration, especially in regions prone to drought (World Bank, 2021).

Water scarcity can exacerbate existing political tensions and contribute to instability in vulnerable regions; an intricate link increasingly explored in relevant literature. Several cases around the globe demonstrate drought driven displacement is an important contributing factor to political instability. The most widely recognized case is the Civil War in Syria, where multi dimensional drought triggered internal displacement, fueling a devastating conflict which caused refugees to flee the country in 2016 (Ghosh, 2021). The UNDP (2023) reinforces this impact chain, emphasizing the connection between increased migration and political instability in Syria, as drought aggravated resource competition in overpopulated, urban areas. A third source, RICCAR (2017), further

substantiates this connection by linking prolonged drought between 2006 and 2010 to agricultural collapse and internal displacement in Syria. The country represents a key case where environmental and political factors converge, amplifying the potential for drought to drive migration and social unrest. It also illustrates the impact chain framework, demonstrating how drought deepens social vulnerability by increasing resource competition, potentially escalating into broader security challenges. However, various sources argue an inverse relationship, with conflicts often intensifying droughts through the targeting and destruction of water infrastructure (World Bank, 2021). The World Bank Group report titled *Water in the Shadow of Conflict* (2021), mentions there have been at least 180 instances where water infrastructures were targeted since 2011, including in Gaza, Yemen, Syria and Libya, leaving hundreds of thousands of people without access to water (World Bank, 2021). Additionally, the report states that a pattern of cooperation rather than dispute can be noticed due to drought. However, this may be the case in other regions, but it does not stand true in the Middle East, where water disputes are predominant, a topic briefly discussed in Chapter 5.2.

4.2 Migration as Adaptation Strategy

Statistics suggest that drought related displacement is projected to affect 700 million globally by 2030 (IRC, 2023), with outmigration from drought impacted areas as a common adaptation measure to drought risk management (UNCCD, 2024). In Iraq particularly, extensive evidence of drought induced migration can be found. A 2021 survey by the Norwegian Refugee Council (NRC) across several areas revealed that 7% of 2,800 households reported forced migration of at least one family member due to water scarcity and its socioeconomic effects and emphasized that young people are particularly vulnerable to this dynamic. Similarly, the IOM (2022) reported 1,818 people being displaced by drought in December 2021, accounting for 303 families. This is part of a surge in displacement rates in late 2021 due to severe drought conditions caused by low precipitation and reduced vegetation. While seasonal displacement is common in certain regions of Iraq, this increasing displacement trend highlights the vulnerability of rural populations which are unable to sustain livestock due to fodder shortages, being forced to migrate to urban centers such as Erbil and Mosul (IOM, 2022).

De Coning et. al., (2022) underscore the complexity of migration patterns, as movements are not always linear from point A to B but can involve multiple, interconnected displacements, with some individuals experiencing secondary or cyclical migration, further complicating their adaptation process. In Iraq, internally displaced persons (IDPs) and returnees are particularly vulnerable to heightened food insecurity, including along the Tigris Euphrates River system (de Coning et al., 2022). Ninewa governorate was particularly impacted by the 2021 drought, as the host of the largest number of IDPs and returnees in Iraq (de Coning et al., 2022). Repeated displacements, as can be seen in the case of IDPs, provide a mobile perspective on trapped populations. Although these people are not physically trapped in a certain place, they can be viewed as trapped in a cyclical migration loop. Furthermore, the political ecology framework applies to them, as returnees and IDPs are one of the most vulnerable groups of society, suffering the impacts of drought more severely than others. Black et. al. (2011) emphasize that the poorest people are the least mobile and the most at risk of being trapped and recognize the critical need of functional early warning systems to minimize their vulnerability to extreme events. WWAP further supports this by linking trapped populations to inequality in access to water, as safe water is available for wealthier nations at a low price, while the poor bear the burden of paying disproportionately more for unreliable and lower quality services (WWAP, 2019).

The paper *Region on the Move: Regional Mobility Report for the Middle East and North Africa 2021–2022* by IOM (2023) explores drought driven migration in Iraq by introducing a tool to gauge the vulnerability of various locations to disaster displacement, assessing four key dimensions: environmental events and water access, access to basic services, livelihoods and mitigation measures, and tension and conflict. IOM states that many of the surveyed areas face multiple environmental hazards, including droughts, sandstorms, and water scarcity, affecting over 85% of locations. Access to sufficient water remained limited for two thirds of households, with specific governorates like Thi-Qar suffering from severe service access issues, with nearly half of the assessed locations lacking access to most basic services (IOM, 2023). People in Need also carried out a study investigating drought impacted migration in Iraq in 2023, titled *'A Gender and Inclusive Climate-Migration Study in Hatra - Ninewa Governorate- Iraq',* focusing on specific locations in the Salah Al-Din Governorate in central Iraq, where climate change related migration had been reported. People in Need reiterate the impact drought has on

agricultural productivity and livestock, disclosing various coping strategies farmers adopted such as borrowing money from relatives to meet basic needs or sustain agricultural activities and reducing the area under cultivation to minimize input costs and manage water scarcity (PIN, 2023). Over half of the respondents noted reliance on humanitarian assistance from NGOs as a crucial form of support during climate emergencies, with other coping strategies being selling livestock or household assets (30%) or seeking daily wage labor opportunities in nearby towns (PIN, 2023).

Black, Bennet, and Beddington (2011) critique the lack of recognition of migration as a form of resilience and adaptation to climate change, a perspective this thesis adopts and seeks to amplify. The authors assert that the UNFCCC must urgently acknowledge the connections between environmental change and migration, emphasizing that migration should not only be viewed as a consequence of climate stress but also as a viable adaptation strategy. They argue that existing research in climate adaptation and environmental science fails to adequately address the role of migration, and advocate for more empirical studies to assess how migration shapes vulnerability and resilience.

4.3 Food insecurity

Climate change poses a profound threat to the Middle East, with climate related hazards causing food insecurity in 23 countries in 2017 (FAO, 2019), with drought as the most common contributor, affecting over 39 million people (EUMETSAT, n.d). Voiland (2024) reports that 2024 witnessed unprecedented global temperatures, recording January to May as the warmest period in its 175 year temperature dataset. Ghasemfir et al. (2023) emphasize the intensifying impact of climate change on droughts, projecting a temperature increase of 0.8°C to 3.3°C in the Middle East by 2079, exacerbated by decreased precipitation, which might extend drought duration by 2 to 4.2 months per degree of temperature rise. This underscores the vulnerability of the Middle East to intensifying impacts of climate change, particularly to food insecurity caused by declining and unreliable agricultural production. In severe cases, and more specifically in vulnerable areas ruled by poverty, this can lead to famine, reiterating food and water scarcity as drivers of displacement (IRC, 2023). These climatic shifts not only threaten agricultural productivity but also have profound socio-economic implications, as

evidenced by the 2023 People in Need report, which outlines how agricultural communities in Iraq have adopted various coping strategies in response to prolonged droughts. Further sources link drought to food insecurity, including the FAO (2025): "*Agriculture is the first and most affected sector by drought, absorbing up to 80% of all direct impacts, with multiple effects on agricultural production, food security and rural livelihoods."* Kuzma et. al. (2023) emphasize that global food security is at risk, with 60% of the world's irrigated agriculture facing extremely high water stress, particularly sugarcane, wheat, rice and maize. Jordan and Iraq are both countries directly dependent on agriculture for livelihood, as will be shown in Chapters VI and VII.

Regarding Jordan, the UNDP provides valuable insights into the intersection of climate change and social vulnerability in the context of drought in the 2023 report *'Climate Change and Social Vulnerability: Using Multi-Sectoral Indicators to Assess Compound Drought Risk and Social Vulnerability in Jordan'.* The UNDP argues that drought disproportionately affects vulnerable populations in agriculturally dependent areas like Deir El Kahf, reinforcing the UNCCD Drought Initiative's assertion that the most vulnerable bear the greatest burden. Utilizing a GIS-based spatial analysis with 31 indicators, the report highlights regional disparities in drought hazard levels across Mafraq, Zarqa, and Amman, linking persistent drought to social instability and migration dynamics (UNDP, 2023). By highlighting the multi dimensional impacts of drought, the findings underscore how climate induced environmental stress intensifies social vulnerability, serving as a critical framework for understanding the dynamics of migration in water scarce areas like Mafraq.

4.4 Gaps in the Field

While the existing literature provides valuable insight into drought and water related vulnerabilities, substantial gaps remain unaddressed. The UNCCD argues that the media generally links drought to migration from the Global South to the Global North, despite this not being supported by data: "*On the contrary, data shows that the vast majority of human movement due to drought is domestic."* (UNCCD, 2024). This emphasizes a gap in coverage of migration from an environmental perspective, instead of the predominant political one. Moreover, the Arab Water Council asserts that diverse community voices, particularly from vulnerable and marginalized groups, have not been included in climate

change research and policymaking in the Arab region, a point that has been insufficiently acknowledged (Arab Water Council, 2021). This is the main gap addressed in this thesis, as sub-question 3 in the Introduction stimulates discussion on drought driven migration on a more personal level, encouraging fresh research on the topic focused on national and sub national impacts.

A second significant gap in the study of drought induced displacement lies in the lack of systematic data collection and monitoring in many countries in the Middle East. The main challenge is attributing migration to a slow onset process without a clearly defined start or end, resulting in the underreporting of drought driven migration in the region, despite increasing environmental stress. Since the IDMC started gathering drought related data in 2017, 5.4 million displacements caused by drought were recorded from 259 events in 21 countries (UNCCD, 2024). However, this figure is likely a significant underestimate, as EM-DAT International Disaster Database records droughts occurring in 67 countries over the same period (UNCCD, 2024). Moreover, only 20% of countries which reported having populations impacted by drought in 2020, also offered numbers on the topic, and among 65 countries with data on people affected by drought between 2008 and 2020, only 13 report data on internal displacement caused by drought (Figure 3) (UNCCD, 2023). Significant gaps are visible in Figure 3 in the Middle East, with limited information available on drought driven displacement despite the region's vulnerability to water scarcity. The IDMC highlights in its report *Drought Displacement Modelling (2023)*, that limitations in current methodologies are the predominant reliance on census and survey data, while time series and mobility specific datasets are neglected. The report emphasizes the challenge of identifying migration patterns and motivations, as the focus remains on recognizing migration destinations. This occurs because existing models mostly ignore agricultural and environmental pathways to drought displacement, focusing primarily on climate and demographic data (IDMC, 2022). This gap is recognized as a limitation in the Introduction, as insufficient data on migration dynamics in drought prone areas in the Middle East constraints research to areas where information is available. Although this gap will not be addressed in this thesis, it is important for it to be acknowledged as it underlines the need for improved data coverage.

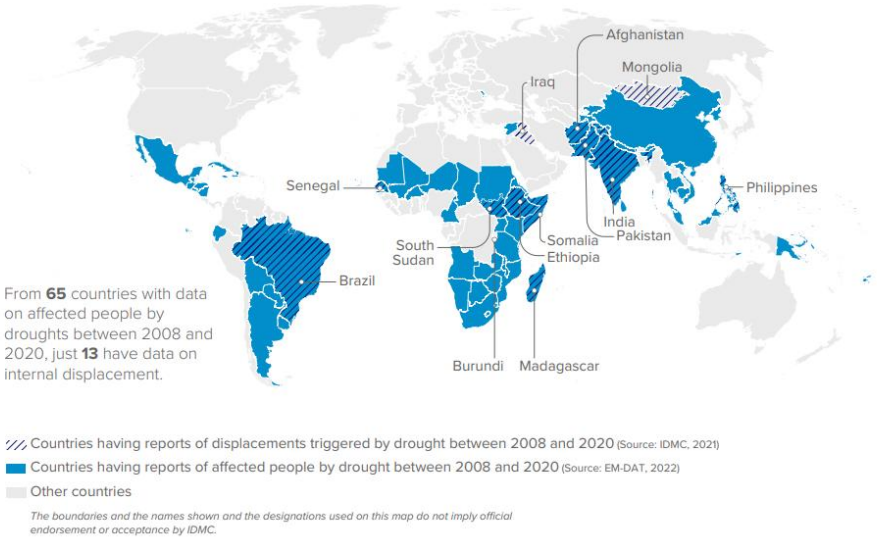

Figure 3: Countries reporting drought affected populations. Source: IDMC, 2022.

Thirdly, the lack of early warning systems is predominantly mentioned in relevant literature as the most important gap in effective drought monitoring in the region. This aggravates climate change impacts by delaying growing seasons, causing more frequent and severe droughts, and increasing temperatures. PIN (2023) reports that farmers rely on informal networks, such as verbal communication or social media for weather predictions, in the absence of early warning systems. Information shared by the Department of Agriculture in drought prone areas often does not reach local communities, highlighting a gap in knowledge sharing between authorities and farmers (PIN, 2023). As a result, the lack of local institutional support determines many farmers to abandon farming activities during droughts, highlighting the absence of effective adaptive measures (PIN, 2023). Hatem et. al. (2024) reiterate that systemic gaps in drought monitoring and the absence of effective early warning systems are likely to amplify rural vulnerabilities and accelerate migration trends if left unaddressed. This gap will be discussed in the case studies on Jordan and Iraq.

V. Central Themes in Drought Induced Migration in the Middle East

The following chapter dives into central themes in drought and migration in the Middle East, providing a compelling overview on the relation between the two. The main argument of this chapter is that decreased precipitation and increasing temperatures causing a significant decline in agricultural viability, forcing farmers to migrate to urban centers in search of alternative incomes. Therefore, rural to urban migration, in addition to population growth, increases competition over resources, exacerbating drought impacts, and, in extreme cases, contributing to political instability. By delving into this impact chain, this chapter underlines how rural to urban migration becomes an adaptation strategy to drought; while emphasizing the role urbanization plays in straining limited available resources and urban infrastructures. By examining the intersection of climate change and population dynamics in the Middle East, ways in which drought acts as a significant push factor in migration patterns are illustrated, answering the thesis' overarching research question.

5.1 Decreased Rainfall and Agricultural Decline in the Middle East

Firstly, chapter 5.1 examines precipitation patterns across Jordan and Iraq through SPEI analysis, illustrating the direct impact drought has on agricultural decline. With 80% of the agricultural land in the region dependent on rainfall (UNDP, 2023), the increased vulnerability of rural populations to decreased precipitation is highlighted. Given that the MENA region only receives 1.5% of global precipitation, despite it covering a vast land surface, it is evident that decreasing rainfall patterns exert hydrological pressure on the region's water scarcity, particularly undermining agricultural productivity. Out of the 59 million hectares of total rainfed agricultural land across MENA, Iraq encompasses the second largest rainfed agricultural area (above 7 million ha), and Jordan covers 506,000 hectares of farmland, occupying a mid range position in cultivated land area (UNDP, 2023). This dependence underscores the impact of decreased rainfall on agricultural yields, which threatens food security. An overall decrease in rainfall and reduced stream flows, contributing to declines in agricultural production and food security has been

observed in the long term assessments by the Arab Geographical Information Room on precipitation patterns across the region between 1971–1980 and 2011–2019 (Fig. 4) (UNDP, 2023).

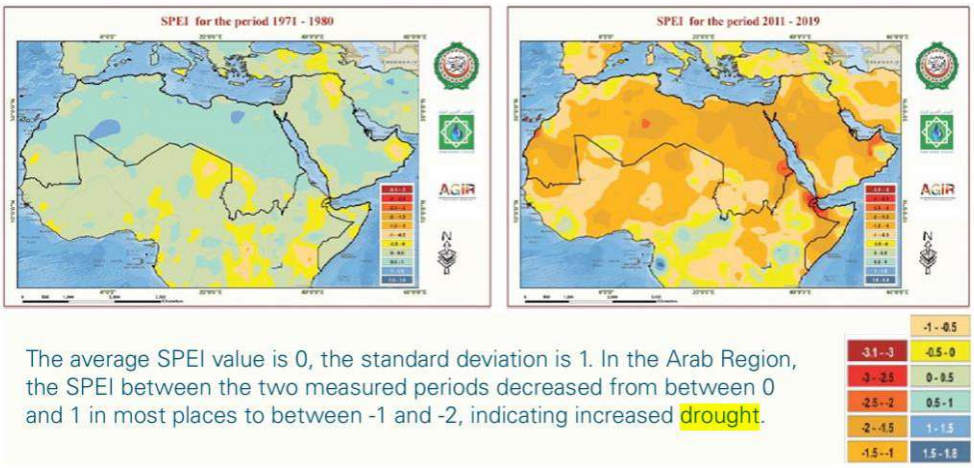

Figure 4: SPEI for the Arab Region for periods 1971-1980 (left) and 2011-2019 (right). Source: Arab Water Council, 2015.

The two SPEI maps illustrate a shift towards increased drought conditions across MENA. While the first map reflects relatively stable precipitation and evapotranspiration patterns, the second shows a significant decrease in SPEI values, underscoring escalating aridity and a worsening trend in drought frequency and severity. As a result, drier conditions lead to crop failures and agricultural difficulties, damaging income streams of farmers dependent on rainfed agriculture in Iraq and Jordan. A more detailed examination of Figure 4 reveals a decline in SPEI values in central and southern Iraq, corresponding with the country's primary agricultural regions, particularly the Mesopotamian plain between the Tigris and Euphrates Rivers. Reduced rainfall and heightened evapotranspiration in this vital food production area in Iraq aggravate droughts, threatening food security. Similarly, Figure 4 reveals that moderate to severe drought (−1 to −2) is experienced in the Jordan Valley, the country's key agricultural region, producing over 60% of the country's crops, particularly fruits, vegetables, and citrus (Mauvais, 2021). The findings are supported by a second analytical tool, the SPEI Global Drought Monitor (Figure 5), which underscores that rainfall reduction in Iraq and Jordan is significant, particularly corresponding to agricultural areas. While Figure 4 provides a historical and comparative perspective on drought conditions, Figure 5 provides a current image on drought severity, based on a 48 month timescale. The Global Drought Monitor snapshot highlights severe and prolonged drought conditions across MENA, with values falling below -2.33 in large

areas in Iraq and Jordan. Northern and central areas in Iraq show intense drought conditions, align with areas critical for agriculture, while central parts around Baghdad show average SPEI values. Jordan shows more uniform values, with most of the country under red and dark red zones (SPEI values of -2.33 to -1.5), indicating severe to extreme drought, which exacerbates the country's limited water resources. Further interpretation of the SPEI map shows that the situation is particularly critical in areas around Amman and southern regions. For both countries, the SPEI values indicate a long term drought trend which increases environmental pressures on rural livelihoods and agricultural productivity.

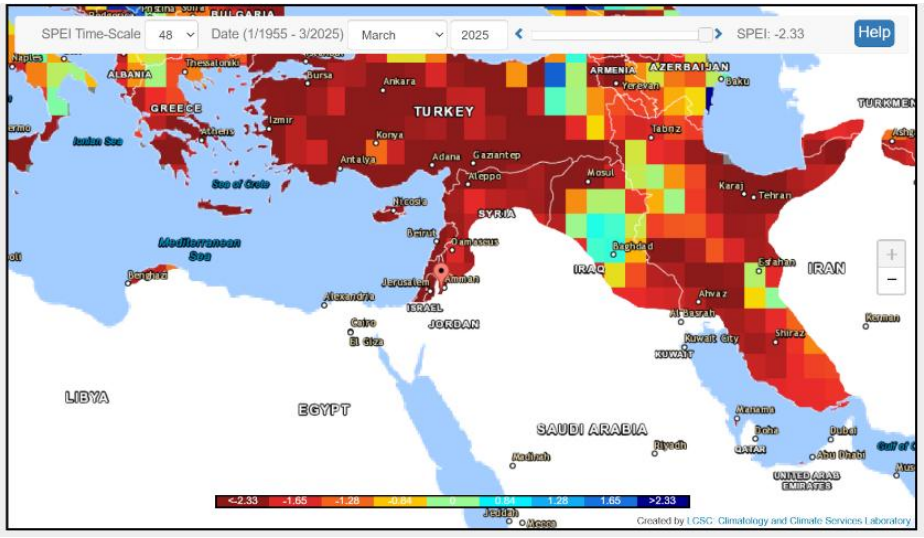

Figure 5: 48 month SPEI timescale. Source: Global Drought Monitor.

The importance of decreased rainfall in key agricultural zones in Jordan and Iraq lies in its contribution to drought and land degradation. Between 2000 and 2012, 143,16 ha of arable land were lost in the MENA region, with drought alone affecting 54.86 million hectares (UNDP, 2023). This loss diminished seasonal returns and degraded land quality, which had further implications for migration and conflict escalation, illustrating how climate change induced decreases in precipitation contribute to more frequent and intense droughts, ultimately threatening food security through the collapse of rural farming systems. Aa a result, as agricultural livelihoods become unsustainable, rural populations are likely to seek alternative opportunities in urban areas, driving rural to urban migration (UNDP, 2023). By demonstrating how declining agricultural viability drives rural to urban migration, this analysis contributes to answering Sub-question 1, showing how food insecurity shapes the relationship between drought, climate change, and migration in Jordan and Iraq. Sub-question 2 is also addressed as the vulnerability of agricultural

communities to drought is highlighted, with decreased precipitation as a condition heightening their displacement risk. In addition to decreased rainfall, the projected increase in temperatures across the Middle East mentioned in Chapter 4.3, further strains agricultural systems. When combined with growing demographic pressure and reduced per capita resource availability, this warming trend contributes to loss of rural livelihoods, strengthening migration pressures toward urban centers, indirectly supporting the main research question by illustrating how environmental degradation acts as a significant push factor in rural to urban migration.

5.2 Urbanization and Population Growth as Strains on Resource Availability, Political Instability

Diving into population dynamics, the following section focuses on two main topics: population growth and rural to urban migration. While Chapter 5.1 focused on how decreased rainfall undermines agricultural production and drives rural to urban migration, this chapter offers a complementary perspective by examining how urbanization and population growth reduce per capita resource availability. This lens highlights how demographic pressures aggravate environmental stress, contributing to broader patterns of water and food insecurity, a perspective which addresses Sub-question 1 by showing how drought interacts with population density and urban expansion to shape migration dynamics in Jordan and Iraq. This exploration emphasizes that rural migration as an adaptive strategy to diversify income sources, is often overlooked despite its significant implications for food security and agriculture.

The MENA population has doubled since the early 1990s (UNESCWA, 2025), with an increase of by 2.24% and 1.6% in Jordan and Iraq respectively (Macrotrends, 2024; World Bank, 2024). As population growth often results in increased water demand (Kuzma et. al., 2023), limited water resources are strained by this increase. Moreover, in marginalized communities, especially in the Global South, resource availability decreases as population increases, reducing the available amount of water per capita. Therefore, the argument can be made that population growth, just as decreased rainfall, is a key contributor to drought impacts in the region. This perspective is particularly relevant in the context of urban to

rural migration, as this dynamic intensifies social inequality in urban areas by straining already limited resources.

While the steady movement of people from rural areas to urban centers has long been a key migration trend in the Middle East and North Africa (FAO, 2019), the region has experienced one of the most significant urban transitions globally, with 61% of its population now living in urban areas (UNESCWA, 2025). Temporary migration is a popular trend identified in internal migration dynamics, with seasonal rural urban migration as a common adaptation strategy in response to agricultural failure (FAO, 2019). This emphasizes the complex dynamics of drought induced migration. While increased rural to urban migration boosts a country's economy and increases individual financial support, it decreases agricultural labor and expertise in rural areas (FAO, 2019). In urban centers, it can lead to housing shortages and increased pressures on urban infrastructure. This highlights the importance of considering climate impacts not only in areas of origin but also in urban centers receiving large numbers of migrants, contributing to the dual impact of drought induced migration: not only are rural areas suffering from environmental degradation and livelihood loss, but urban centers are also facing increased pressure as they absorb displaced populations. This demonstrates a weakness of migration as an adaptive strategy to drought impacts in rural areas, as the livelihood of migrants could potentially not improve by moving to urban centers. Rural to urban migration has led to significant urbanization in the Middle East over the past decades.

In addition to exacerbating water and food scarcity, decreasing rainfall, agricultural decline, rapid population growth, and accelerating urbanization converge to create pressures undermining political stability in MENA. These stressors can contribute to local or cross border tensions in under resourced regions, as competition over scarce resources increases, as seen in Iran, where years of mismanaged water resources and excessive agricultural water use have already triggered protests (Kuzma et al., 2023). Jordan and Iraq are both vulnerable to reduced river flow due to water conflicts with neighboring countries. Jordan struggles with neighboring Israel in control over the Jordan River (Mauvais, 2021), while tensions between Iraq and upstream Turkey pose challenges in administrating the Euphrates -Tigris water system shared.

This interplay addresses the main research question by showing how decreased rainfall and increased temperatures, combined with agricultural decline, urban pressure, and demographic growth, creates structural stress. This stress challenges governance, triggers displacement, and contributes to political instability, especially in underresearched areas like Iraq and Jordan. The mention of resource competition and unrest shows how environmental factors translate into migration push factors shaped by socio-political conditions. It also addresses Sub-question 2 as the argument shows that communities in rural, agriculturally dependent, and resource scarce regions are most vulnerable. Conditions like poor infrastructure, rapid urbanization, and weak institutional response heighten this vulnerability by increasing their risk of displacement and exposure to water conflict. This highlights the slow violence with which drought acts, emphasizing the interconnectedness of drought, migration, and political instability, highlighting how environmental stress gradually undermines stability in the region, potentially contributing to conflict. The MENA region faces multifaceted challenges, confronting political and economic issues, while also struggling with severe water scarcity that exacerbates social vulnerabilities and heightens migration pressures. Stemming from this, the Middle East was one of the global hotspots for water related tension between 2020 and 2023 (UNCCD, 2024). Jordan and Iraq are included in the World Drought Atlas map showing tensions, demonstrations and disputes where water issues acted as trigger (UNCCD, 2024). Jordan Valley is a water conflict hotspots in Jordan, while flow reduction in the Euphrates and Tigris River contribute to water conflicts in Iraq, topics which will be discussed in Chapter VI and VII respectively.

This chapter identified contributing factors to drought, as well as a rural to urban migration pattern triggered by drought. Rural to urban migration is seen as a dynamic that could solve the limited solutions rural population in countries like Jordan and Iraq face in dealing with once agricultural land becoming a wasteland. These challenges also underscore the urgent need for integrated water management and regional cooperation to prevent deepening rural distress and resulting migration flows. The last part of the chapter highlighted how the intricate relationship between population growth, rural to urban migration and drought can lead to political unrest and conflict. This reinforced the impact chain framework approach in drought induced migration, with significant consequences on freshwater availability, food security, rural livelihoods, and ecosystem stability (RICCAR, 2017).

VI. Intersecting Crises: Drought, Water Scarcity, and Migration in Jordan

Chapter VI delves into the complex case study Jordan comprises on drought and migration, diving into the national and sub national perspectives on the relation between the two. As the vast majority of agricultural land in Jordan has been abandoned and turned into a deserted landscape (Pernot, 2024), Jordan serves as a persuasive case study of this thesis' hypothesis that drought functions as a major, but often underrecognized, form of slow violence driving migration in the Middle East. This case study combines a general exploration of trends such as population growth, decreased precipitation and increased temperatures, with a specific examination on how these factors result in agricultural decline, triggering rural to urban migration from Deir El Kahf, a rural area in Jordan, dependent on agriculture. Although not thoroughly explored, the possible impact of drought in political instability is briefly discussed. This chapter addresses the main research question, as well as the 3 sub-questions of this thesis, as it is focused on compiling an account of rural voices directly impacted by drought, while highlighting rural to urban migration as an identified migration route in Jordan. This approach addresses the research gap identified in Chapter IV, Section 4.4, specifically the lack of coverage of localized drought impacts in underresearched, vulnerable areas.

6.1 Central Themes in Jordan

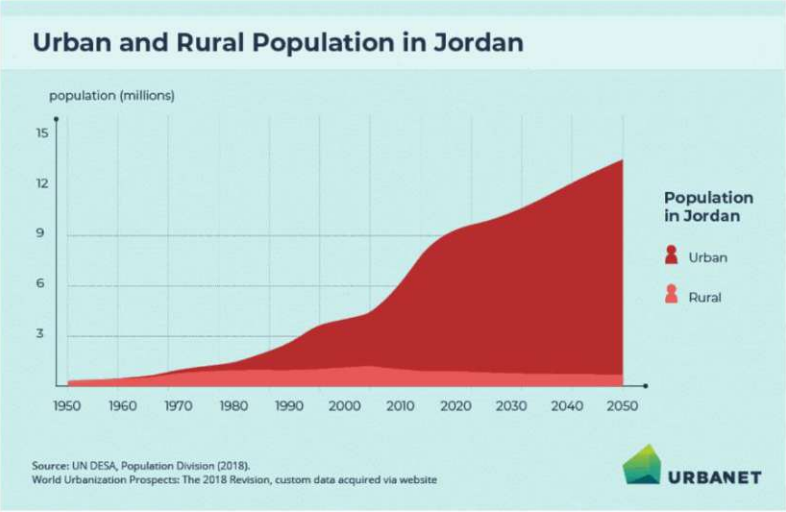

Figure 6: Urban and Rural Population in Jordan. Source: Urbanet, n.d.

Firstly, population growth and urbanization trends in Jordan are examined, as both were identified as exacerbating drought factors in Chapter V. Over the past two decades, Jordan's population doubled from 5 million to 11 million people, including an intake of Syrian refugees estimated around 1.3 million people (World Bank, 2024). Concurrently, Jordan's built up area doubled to 1 500 km² between 2004 and 2015, expanding by about 15 km² per year (UN Habitat, 2024). Despite covering just 3.8% of Jordan's land, urban areas are home to over 91% of the population, an imbalance particularly visible in Amman, which accommodates a quarter of the country's residents (UN Habitat, 2024). These urbanization trends severely strain existing infrastructures and available resources, and encroach on agricultural land, further pressuring ecosystems already impacted by overgrazing and inefficient agricultural and water practices, which have resulted in the degradation of 41% of Jordan's land (UN Habitat, 2024). Thus, the link between population growth, urbanization and land degradation is formed. As cities absorb the pressures of both rapid growth and displacement, the result is a heightened vulnerability to poverty, deteriorating infrastructure, and overstretched public services. Environmental constraints such as land degradation and water scarcity have reduced its capacity for agricultural self sufficiency, resulting in Jordan's high dependency on food imports. Prolonged drought periods over decades have caused significant decrease in wheat production (World Bank, 2020), leading to an increasing dependence on external sources. For comparison, Jordan was importing 90% of its grain in 2024, while in the 1960s it was producing 70% of its barley and wheat requirements itself (Pernot, 2024). In rural areas, arid conditions, water scarcity, and frequent droughts severely limit agricultural production and income opportunities. This sharp decline in self sufficiency reflects the long term impact of drought and growing environmental and socio-political constraints in the country. While food imports are now essential, agricultural productivity remains vital for rural livelihoods and local resilience in Jordan, playing a critical role during crises and a strategic buffer in times of external disruption.

Jordan's already scarce resources are being pushed to the limit by the combined pressures of various factors. As the fifth most water scarce country globally, Jordan faces an acute resource crisis, with only 100 cubic meters of water available per person in 2021, far below the absolute scarcity threshold of 500 cubic meters (Hagood, 2020). This is aggravated by climate change, which brings rising temperatures, erratic rainfall, and prolonged droughts (UN Habitat, 2024). These climatic shifts are reducing water

availability, exacerbating heatwaves and extending dry periods, threatening agricultural productivity and the country's overall resilience and adaptive capacity to drought. Jordan is heavily reliant on limited and unevenly distributed precipitation, a vulnerability amplified by climate change, as annual rainfall has already declined by 5–20%, and is projected to decline further by the end of the century (UN Habitat, 2024). As precipitation has been identified as a major factor contributing to drought in Chapter V, a data analysis of monthly precipitation from April 2010 to April 2025 from the Copernicus Global Drought Observatory is a relevant tool for visualizing the increasing unpredictability of rainfall. By comparing observed precipitation (blue bars) against the long term average (1981-2010) indicated by the orange line, a recurring seasonal pattern of precipitation highs and lows is identified, but with notable fluctuations (Figure 7). While certain years, such as 2018 and 2020, exhibit higher precipitation, recent years show lower and more irregular rainfall patterns, suggesting increasing variability and potential drought conditions. The observed decrease in rainfall and increased unpredictability are significant contributors to heightened impacts drought has on water availability in Jordan, supporting the slow onset aspect of the slow violence theory.

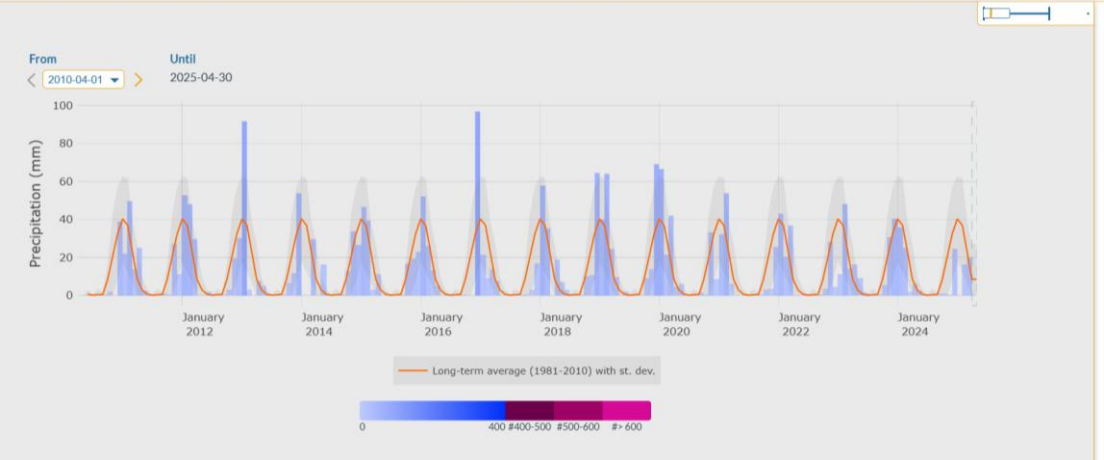

Figure 7: Monthly Precipitation Jordan. Source: Copernicus Emergency Management Service, 2025.

The SPEI, as an index that integrates both precipitation and potential evapotranspiration, also indicates a pronounced decline in moisture levels from 1950 to 2023. The SPEI time series for coordinates [31.75, 35.75] in Madaba (Figure 8), an area close to Amman, shows fluctuations between wetter and drier periods between the 1950s and the late 1990s. However, persistent negative SPEI values indicate increasing dry conditions from 2000 onwards. This highlights a significant intensification of drought risk in the region, suggesting escalating water scarcity and potential stress on agricultural resources. The

severe and frequent droughts experienced by Jordan over the past decades are closely linked to rising water and food insecurity (UN Habitat, 2024). This link explains how climate induced stress contributes to migration patterns and affects the most vulnerable communities, directly addressing Sub-questions 1 and 2.

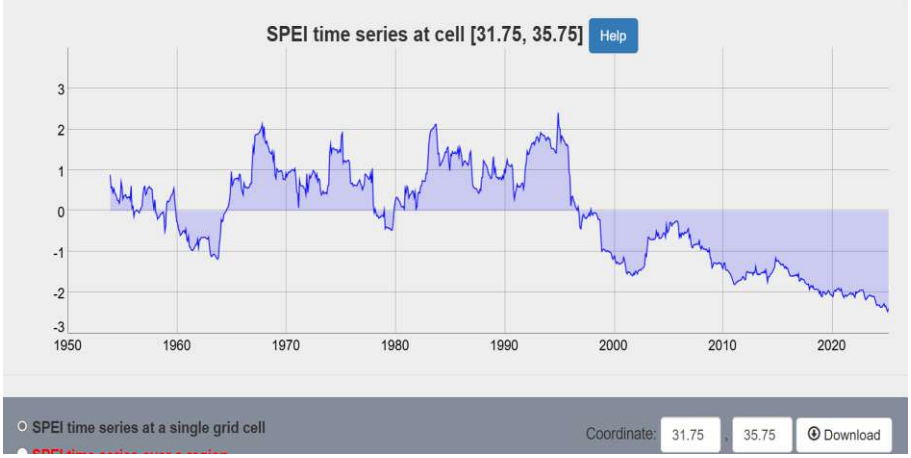

Figure 8: SPEI Time Series at [31.75, 35.75]. Source: Copernicus Emergency Management Service, 2024.

In addition to precipitation, transboundary water conflicts play an aggravating role in drought intensity in Jordan. The country faces significant challenges as the Dead Sea is shrinking at a fast pace, losing approximately one meter of water annually (Mauvais, 2021). This crisis has been exacerbated by upstream diversions, particularly by Israel's control of river flows, which have significantly reduced the discharge of Jordan River, accelerating the depletion of the Dead Sea (Mauvais, 2021). This rapid decline threatens both water and food security, as the pressure on already strained resources will intensify as water becomes even scarcer.

Water conflicts and reduced precipitation also accelerate groundwater depletion, an often an invisible factor which contributes to the slow unfolding impact of droughts, as it plays a critical role in shaping water insecurity in drought prone regions like Jordan. As drought conditions worsen, communities turn to aquifers, depleting the available water and causing a loss of rural livelihoods. The scarce water resources in Jordan have been exploited by political elites adjusting water to their own agricultural interests for decades (UN Habitat, 2024). Concretely, a groundwater strategy adopted in 1997 failed due to elite control which through poor enforcement and infrastructure inefficiencies resulted in the loss of over 45% of water resources (UN Habitat, 2024). In the present, at a national level, the highest groundwater depletion volumes can be found in Zarqa Basin and Azraq

Basin, while Hammad and Sirhan Basins show no depletion (Figure 9) (UNDP, 2023). Table 3 highlights the vulnerability of several groundwater basins in Jordan, with the Yarmouk basin classified as extremely vulnerable, and the Mujib basin highly vulnerable. The Northwest governates are identified as areas with high drought vulnerability and low adaptive capacity, particularly in rural, agricultural areas like Irbid, Jerash, and Ajloun, as these regions depend heavily on rainfed agriculture and show poor resilience to drought (UNDP, 2023). The contrast between some areas losing large amounts of groundwater, and others showing no depletion, highlights the uneven levels of climate vulnerability across Jordan. These variations are essential for understanding where drought related migration pressures are the highest, underscoring the need for localized analysis when assessing vulnerability and displacement risk. These differences help answer Sub-question 1, by showing how water scarcity and drought can push people to migrate, especially in areas with less water. They also address Sub-question 2, by pointing to which communities are most at risk of being displaced and why.

GROUNDWATER BASIN NAME	SAFE YIELD	ABSTRACTION	DEPLETION STATUS AS PER MWI	BALANCE (CALCULATED AS DEPLETION PROXY)
Amman - Zarqa	87.5	165	-77.5	-77.5
Araba North	3.5	6.6	-3.1	-3.1
Araba South	5.5	10.9	-5.4	-5.4
Azraq	24	69.7	-45.7	-45.7
Dead Sea	57	83.8	-26.8	-26.8
Disi	125	141.56	-16.6	-16.56
Hammad	8	1.6	None	6.4
Jafr	27	35.5	-8.5	-8.5
Jordan Side Valley	15	45.6	-30.6	-30.6
Jordan Valley	21	27	-6	-6
Sirhan	5	4	None	1
Yarmouk	40	54.5	-14.5	-14.5

Figure 9: Groundwater Basins Depletion Jordan. Source: UNDP, 2023.

This escalating scarcity forms a key pathway linking climate induced drought to migration, particularly for already vulnerable populations with limited adaptive capacity. The convergence of these environmental and demographic trends signals a pressing need for integrated climate adaptation and resource management strategies.

6.2 Mafraq Governorate and Community Voices on Drought in Deir El Kahf

The following section explores rural to urban migration in Jordan, directly investigating the premise of this paper that drought acts as a push factor for migration in an act of slow violence. As discussed in Chapter 6.1, the severity of drought impacts reveals a gradual and often invisible form of harm, which aligns with the slow violence concept, describing the delayed and dispersed damage inflicted by environmental degradation. Therefore, the assumption that rural populations in Jordan increasingly move toward urban areas in search of more secure livelihood, as an outcome based on the environmental vulnerabilities identified, is explored. The Mafraq Governate is particularly relevant to the topic of drought induced migration, as it has been identified as a drought hotspot, where climate change and extreme weather conditions have driven people into urban areas (UN Habitat, 2024). The rural to urban migration is also visible through the fact that in less than four decades, the urban area of Mafraq tripled, growing from 14.7 km^2 in 2005 to 42.7 km^2 in 2023, while also making residents heavily reliant on groundwater sources (UN Habitat, 2024).

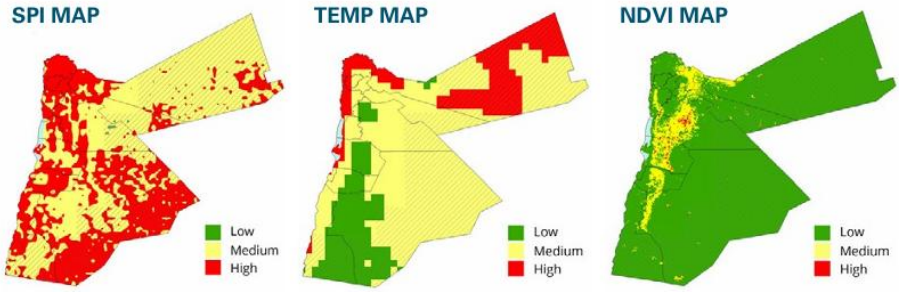

Figure 10: Layers for overall drought hazard calculation. Source: UN Habitat, 2024.

Figure 10 illustrates social vulnerability and drought risk across Jordan by combining maps on low rainfall, high temperatures, and limited vegetation. The drought hazard assessment maps highlight Mafraq Governorate as one of the regions most exposed and vulnerable to drought in Jordan. Mafraq stands out for experiencing both high levels of drought exposure and significant sensitivity, making it particularly susceptible to the impacts of prolonged dry periods. Unlike regions such as Amman, which may face some exposure but remain less sensitive due to stronger infrastructure and adaptive capacity, Mafraq's environmental and socio-economic conditions contribute to its pronounced

vulnerability (UNDP, 2023). Concurrently, the temperature map identifies Mafraq as an area of medium to high temperature risk, suggesting elevated temperatures that can intensify evaporation and exacerbate water scarcity. Furthermore, the NDVI map shows Mafraq as a low vegetation area, indicating sparse vegetative cover and reduced agricultural productivity. Vulnerabilities of Mafraq are identified as limited infrastructure, unemployment and poverty, exacerbated by the Governorate hosting the world's largest Syrian refugee camp (UN Habitat, 2024).

Within the Mafraq governorate, drought hazard is particularly pronounced in the village of Deir El Kahf, as the SPI map reflects significant precipitation deficits and sustained dry conditions, with direct implications for livelihoods reliant on agriculture and water resources (UNDP, 2023). Deir El Kahf is located in the Province of Northern Badia, in the Mafraq governorate, around 80 km to the east of the city of Mafraq. Northern Badia occupies a total area of 71,474 km² and the sub district of Deir El Kahf occupies an area of 646 km2. Deir El Kahf has a population density of 54.2 people per km², significantly higher than the 15.2 people per km² in Mafraq, and Jordan's density, indicating a more concentrated population in a relatively small area (City Facts, n.d). This higher density suggests increased pressure on local resources, particularly in the context of drought and water scarcity, exacerbating existing vulnerabilities. The livelihood structure of the governorate is mostly based on rainfed agriculture and livestock (UN Habitat, 2024). Therefore, drought, water scarcity, and shifting rainfall patterns are damaging agricultural livelihoods by reducing livestock and crop production, while increasing fodder and animal product prices (UNDP, 2023).

Drought severity in Deir El Kahf is clear from climate data such as SPEI trends, drought hazard frequency and distribution and land surface temperature. The same patterns as in the SPEI time series in Madaba, explored in Chapter 6.1 on Figure 8, can be observed in the SPEI time series for Deir El Kahf, illustrating a long term trend toward increasing drought conditions from 1950 to 2023. While the information on drought hazard frequency and distribution across Jordan offered by NASA Worldview satellite is limited to the period 1980 – 2000 period, it is relevant to the slow unfolding of slow violence, as it shows that even three decades ago, Deir El Kahf indicated a high frequency of drought events. This emphasizes its vulnerability to water scarcity and agricultural stress over a long period of time, as the information collected by other sources, like UNDP and UN Habitat, are from year 2023 and 2024. The land surface temperature map of Deir El Kahf

(Figure 11), is characterized by a uniform and widespread orange coloration, indicating elevated temperatures that extend beyond Deir El Kahf to the surrounding areas. This consistent intensity suggests a prolonged and extensive period of high temperatures, likely accelerating evaporation rates, depleting soil moisture, and increasing water stress for both agricultural and residential areas. For a community already vulnerable to water scarcity like Deir El Kahf, such elevated temperatures allude to significant crop impacts.

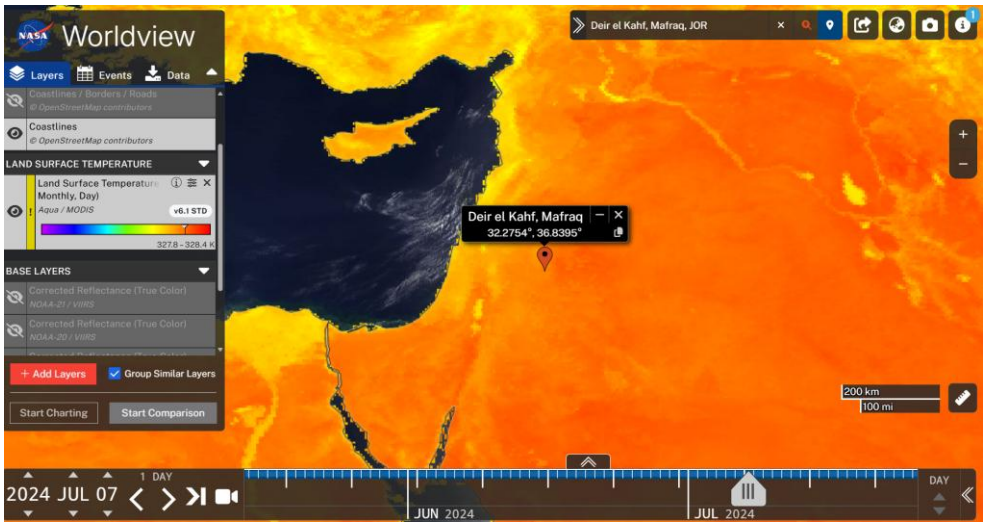

Figure 11: Land Surface Temperature Deir Al Kahf. Source: NASA Worldview.

To relate satellite data to lived experiences of climate change impacts, the following section explores the relation between drought and migration through testimonials from farmers in Deir El Kahf, who have directly experienced or witnessed this connection. Due to the impossibility of conducting field research, these testimonials are extracted from existing interviews documented in the secondary source *Climate Change and Social Vulnerability, Part 1* by UNDP (2023), which encompasses a drought risk assessment in agricultural and agropastoral sectors in Jordan. These first hand accounts provide answers to this thesis' Sub-question 3, as they offer insight into the lived experiences of drought affected populations, and which voices are represented or overlooked in broader migration narratives. An interesting correlation between the interviews and the findings of this thesis is the role of precipitation, identified in Chapter V as a key factor exacerbating drought. This is supported by farmers' testimonials, as many describe their dependence on rainfall for agriculture and explain how reduced precipitation has negatively impacted their livelihoods and production capacity. This is concretely illustrated through the personal experiences shared by residents of Deir El Kahf. This

study case addresses Sub-question 3 by including the lived experiences of affected farmers into the broader regional dialogue on drought impacts and social vulnerability.

Farmers who run smaller farming businesses combining crop and livestock production with gardening describe their livelihood as follows:

- *"We raise goats. We have a property that **depends on rainfall**. No irrigation is available for planting. We plant about 100 Dunum of wheat and barley."* (UNDP, 2023).
- *"We carry out home gardening and grow olive trees. We produce for household use only, the whole family works in the garden. We plant irrigated plants but the olive trees **depend on rain.**"* (UNDP, 2023).
- *"My father has livestock and **we plant according to rain**. We have 30-40 Dunum of land that we cultivate in size in Al-Rafa'iya. We bring in Jordanian and non-Jordanian workers, only men. Women help by taking care of livestock only. I have 30-40 sheep."* (UNDP, 2023).

For context, land area in Jordan is commonly measured in dunums, with one dunum equivalent to 1,000 square meters, or 0.1 hectares. Other interviewed farmers who run larger farm operations oriented towards exporting crops, express the following:

- *"We have 300 Dunum of our own property. We plant several times, **rainfed field crops**. Part of the land is pastures and part is for agriculture. We are used to working on the farm, sometimes we rent workers. We **depend on rain**."* (UNDP, 2023).
- *"I plant trees on 90% of the land. I will stop planting vegetables next year due to the **lack of rain** and the high cost. I rent 350 dunums and employ 70-80 workers from June until October. The family works on the land especially during the school holiday period. The ones who work are males only. Of the workers, 3/4 are female and the rest are males. They are Jordanians. We export 80% of our products abroad."* (UNDP, 2023).
- *"Our land is 4,000 Dunum in size, we have no water on it. We are 7 brothers, working on the land. **We depend on rain**. My brothers have some sheep and goats."* (UNDP, 2023).

These farmers' testimonies provide direct, real life insights to Sub-questions 1 and 2 of this research. Firstly, the farmers reveal how water and food insecurity shape the relationship between drought, climate change and migration in Jordan by repeatedly mentioning their dependence on rainfall for crop survival and the timing of plantation. This shows how drought directly threatens their ability to grow crops and raise livestock, with some farmers revealing that they plan to stop planting vegetables or reduce production because of high costs and low rainfall, revealing how drought leads to economic strain and could push them to abandon farming or seek other livelihoods. Secondly, their words disclose which communities in the region are most vulnerable to climate induced drought, and what conditions heighten their risk of displacement, as these farmers live in rural, drought prone areas and depend entirely on rainfall for survival, making them highly vulnerable. Many farmers work without irrigation and have no access to stable water sources, while large families depend on small plots of land. This makes them more likely to suffer from drought impacts and potentially move to urban areas in search of stability.

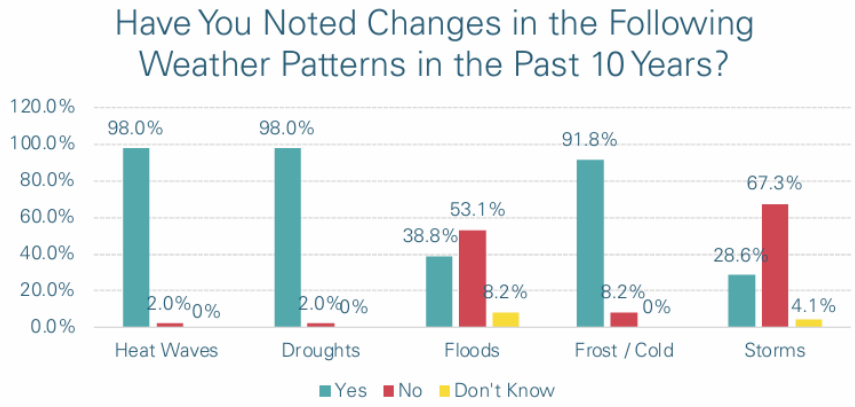

Figure 12: Weather Patterns Change. Source: UNDP, 2023.

Almost 50% of farmers stated that weather changes (such as temperature and precipitation changes in patterns and strength), have very much affected their livelihoods, while another 18.4% say they were affected to some extent (UNDP, 2023). These farmers' responses reflect the intrinsic connection of their livelihoods with weather patterns, while highlighting the significant impact of climate related changes on daily life in vulnerable communities. Furthermore, survey data on changes in weather patterns in Deir El Kahf shows that 98% of respondents observed increases in droughts and heatwaves over the past decade (Figure 12), confirming that drought has had a noticeable impact on their lives. This illustrates how environmental change drives water and food insecurity, a topic

explored by Sub-question 1. Direct impacts of drought reported by local farmers are reduced crop, livestock productivity and increased production costs, leading to abandonment of farming by some households (UNDP, 2023). Moreover, Figure 12 emphasizes that drought is not only a measurable environmental trend but also a lived experience, a perception critical in understanding how drought functions as a push factor: when rural communities recognize that water availability is declining and weather patterns are worsening, they are more likely to consider migration as a survival strategy.

Moving on to the way residents of Deir El Kahf respond to these changes in weather patterns and drought impacts, farmers mention migration as an adaptive strategy (UNDP, 2023). Both migration to cities and migration outside Jordan are mentioned, with a shift toward short term urban migration noticed, as community members are seeking alternative income in national and international urban centers. Overall, 34.7% of interviewed residents stated that many people had migrated away from Deir El Kahf due to climate change and drought, while 46.9% stated that some people had migrated for this reason. The primary drivers of out migration were identified as loss of agricultural livelihoods, reduced incomes and lack of jobs, while some interviewees mentioned migration in search of better pastures (UNDP, 2023). Drought impacted migration is clear from the farmers' responses below:

- *"Agriculture is in decline. We produce for household consumption. The seasons are going from bad to worse.* ***The rains are late*** *and things get worse. Our source of income has decreased, so* ***some people have left****."*
- *"We are taking up loans, reducing the number of livestock and the extent of farming.* ***Some people migrated to the city****."*
- *"****Migration to the cities and outside the country has increased****."*
- *"The income was affected and became less. I took many loans. People* ***work outside agriculture*** *to make a living* ***and migrate****."*
- *"****Climate change*** *has* ***made people leave agriculture*** *and* ***move to cities*** *looking for employment."*
- *"****Migration of*** *people began* ***with seasonal migration****, they return after the end of the season. Some have migrated to the area of the Deir for grazing."*

In addition to coping strategies, farmers in Deir El Kahf expressed frustration over the lack of government support in addressing drought impacts such as poverty and unemployment. Survey data on the perceived existence of support systems in the village shows that 61.2% of respondents report having no social support systems in times of hardship, while only 10.2% say they do. The identified needs of the community are improved water infrastructure, creation of jobs and social protection, which emphasizes the impact drought has on aggravating poverty and social inequality *(*UNDP, 2023*)*. This is highly relevant to Sub-question 2, as the lack of state support increases the vulnerability of drought affected communities and heightens their risk of displacement.

Therefore, the analysis of drought impacts in Deir El Kahf revealed loss of livelihoods and displacement dynamics, providing concrete evidence of how water and food insecurity shape migration patterns in Jordan, directly addressing Sub-question 1. By compiling data from SPEI, drought hazard maps, and secondary sources on localized impacts, a strong link between drought and migration is confirmed at a sub national level. Illustrating how the collapse of agricultural livelihoods forces rural populations to abandon their land, farmers reveal the disconnect between vulnerability assessments on a national level and the lived experiences of affected communities. The concepts of slow violence and the impact chain framework are emphasized, as environmental degradation erodes the viability of agricultural livelihoods over time, ultimately triggering migration towards urban centres. This case not only sheds light on which communities are most vulnerable to climate induced drought and why (Sub-question 2), but also exposes how their experiences remain underrepresented in broader migration discourse (Sub-question 3). While Jordan exemplifies the structural fragility of a water scarce society, the following section turns to Iraq, where similar environmental stressors intersect with upstream water control and unfavourable climate to create a complex and multi layered drought migration nexus.

VII. Drought Impacted Migration in Rural Areas of Iraq: Climate Change and the Erosion of Place Based Identities

A further case study of drought driven migration is explored in the current chapter on Iraq, where several reports on migration due to drought have been reported, as established in this paper's literature review. The chapter is structured in two sections, with the first offering an overview on climate change, drought and migration impacts on a national level, while the second zooms in on several rural clusters of drought driven displacement in the country. Delving into migration trends, drought impacts and their effects on vulnerable communities, this section highlights how worsening drought conditions have influenced patterns of displacement, reshaped rural livelihoods, and contributed to broader social transformations across Iraq through acts of slow violence.

7.1 Overview: Climate Risks, Decreased Precipitation and Migration

Iraq is ranked fifth most vulnerable country to climate change by UNEP, experiencing extreme temperatures, worsening droughts, erratic rainfall, and reduced food availability (IOM, 2022). Climate change impacts are aggravated by transboundary water conflicts and weak natural resource management, having damaging effects on farmers' ability to sustain agricultural livelihoods. Iraqis have also been facing increasingly frequent dust events caused by droughts and land overuse, particularly dangerous for people suffering from asthma or respiratory disease (NASA Earth Observatory, 2022). These changes in climate have severely affected livelihoods across Iraq, causing great losses in crop harvest, livestock, and fishing yields (IOM, 2023). The key factors causing environmental displacement in Iraq are identified as water related issues, particularly decreased rainfall and inefficient water infrastructure, while localized conflicts over natural resources like water and crop land, reported in seven districts in Iraq, led to household displacement (IOM, 2023).

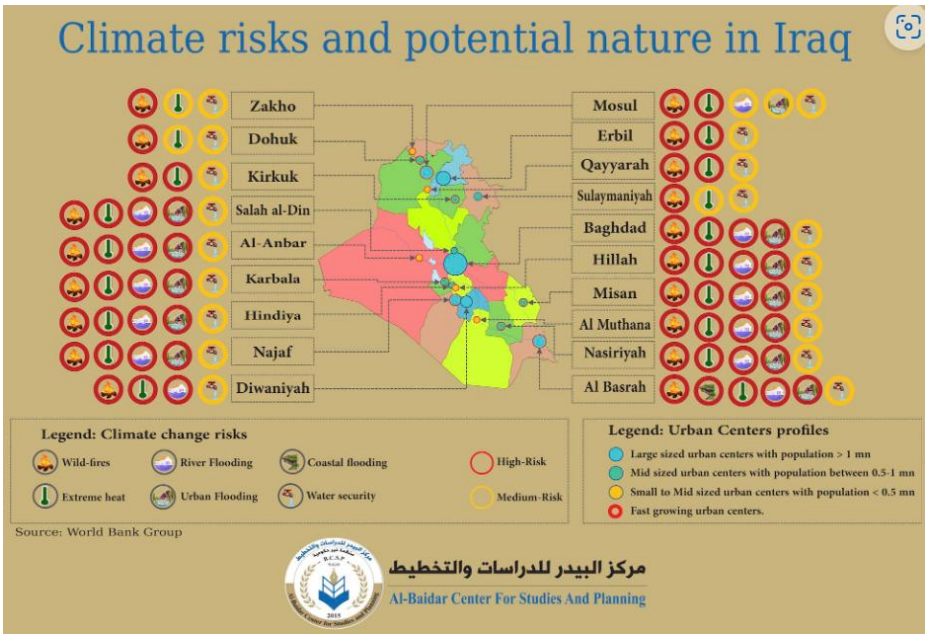

Figure 13: Climate Risks in Iraq. Source: Al- Baidar Center for Studies and Planning, 2023.

Figure 13 illustrates the distribution of climate risks across Iraq, with drought, extreme heat, and water scarcity emerging as the most pressing threats. Southern governorates such as Basra and Missan, as well as central and northern areas like Salah Al-Din and Kirkuk, are shown to be particularly vulnerable. These regions face overlapping environmental pressures that heighten the risk of livelihood disruption and displacement, especially in rural areas where agriculture remains a key source of income. This directly supports Sub-question 1 and 2, as it highlights how water and food insecurity, driven by drought and climate stress, shape vulnerability and influence migration patterns. Salah Al-Din will be examined in more detail as a case study to provide insight into how these risks unfold at the rural community level.

Next, precipitation and temperature trends are analyzed, as factors directly relating to water insecurity caused by drought. As Thi-Qar is one of the drought affected governorates explored in Chapter 7.2, monthly precipitation at its location is analyzed (Figure 14). Monthly precipitation trends between April 2010 to April 2025, compared to the long term average between 1981-2010, reveal periods of drought as precipitation falls consistently below the average, particularly between 2018 and 2022, with notable spikes in 2014 and early 2022. The gray shaded area indicates standard deviation, emphasizing increasing variability in rainfall patterns, suggesting a trend toward more erratic precipitation cycles in the past two decades. Similar patterns of decreased rainfall and

significant fluctuations are identified in monthly precipitation trends for Salah Al-Din, another governorate where drought driven migration is explored in the following section.

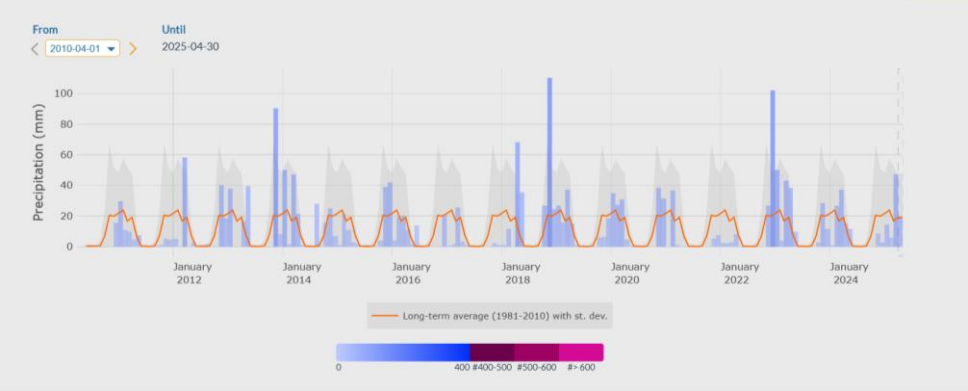

Figure 14: Thi-Qar Monthly Precipitation 2010 -2024. Source: Copernicus Global Drought Observatory, 2025.

Furthermore, Figure 15 visually confirms Iraq's extreme exposure to heat stress by showing data extracted from July 2024 on land surface temperatures across the country averaged over a three month period. According to the temperature bar on the left, the satellite data from NASA Worldview shows widespread temperatures likely exceeding 45–50°C across Iraq, confirming a trend of intense heat during summer months, vital for agricultural production (a trend mentioned in Chapter 3.2 as identified by Ghasemfir et. al, 2023). This reinforces the country's exposure to extreme temperatures as an environmental pressure driving water and food insecurity and supports the vulnerability of agriculture dependent communities to drought impacts, addressing Sub-questions 1 and 2 of this research.

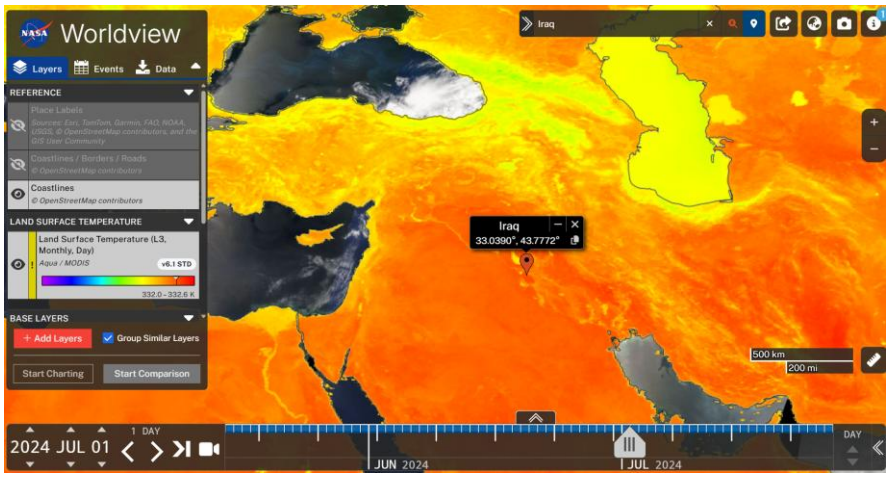

Figure 15: Three Month Average Daytime Land Surface Temperature (MODIS L3). Source: NASA Worldview, 2024.

Complementary to satellite data, migration reports offer valuable insights on the exposure and vulnerability of communities to droughts. Various drought driven displacement across the country has been reported over the past three decades, as Iraq has been experiencing frequent and severe meteorological droughts. Seven distinct drought periods were identified between 2000 and 2022, with the latter year experiencing the most severe period of dryness (Hatem et al., 2024). A clear link between the reported dry periods and displacement can be drawn through an analysis of migration reports by IOM during the same time frame. More specifically, 20,000 rural inhabitants were forced to leave their agricultural communities in 2012 because of severe drought (IOM, 2020). Another case of drought impacted displacement was documented in 2019, when around 5,922 residents from the governorates of Karbala, Qadissiya, Najaf, and Wassit were forced to relocate to urban areas as a result of water scarcity, high salinity, and pollution (IOM, 2022). This second case further illustrates how drought related water insecurity increases migration risks, as nearly 6,000 residents from four predominantly rural and agricultural governorates were forced to relocate to urban centers. This reiterates the rural to urban migration trend triggered by environmental degradation and declining agricultural viability, previously identified in Jordan.

The increasing drought driven displacement trend peaked in 2021, with the arrival of the worst drought Iraq had experienced in four decades, increasing disaster displacement in the country six times compared to 2020. A minimum of 55,290 individuals were reportedly displaced in central and southern Iraq due to the climate crisis between January 2016 and October 2022 (IOM, 2023). Due to limited monitoring, a research gap identified in Chapter II, the real displacement numbers are probably higher than reported. These concrete examples which also provide numbers of affected individuals highlight that the persistence and severity of drought conditions have had critical implications for rural livelihoods in Iraq, undermining agriculture, water security, and economic stability (Hatem et al., 2024). These cases also show a clear causal relationship between severe drought and displacement, providing real world examples of how slow onset environmental degradation triggers migration. By highlighting that water insecurity shapes migration patterns, Sub-question 1 is addresses. Moreover, the displacement of large rural groups of people reiterates the vulnerability of rural communities to climate induced drought, also identified in Jordan in Chapter VI. This example highlights the

limited water infrastructure as a factor amplifying the displacement risk of affected communities.

Similar to Jordan, Iraq is also heavily reliant on food imports, highlighting the dependency on virtual water of both countries. Therefore, crop failure across the country due to the severe 2021 drought disrupted local food supply, enabling an increase in imported food prices. Droughts in northern Iraq and the Kurdistan Region of Iraq, known as cereal surplus areas, resulted in 70% lower wheat harvest compared to 2020, while in KRI wheat production was approximated at 50% lower than in 2020 (de Coning et al., 2022). The widespread crop failure in Iraq disrupted local food supply, creating condition that push agricultural dependent communities to migrate away from rural areas. The severe 2021 drought in Iraq, which led to significant crop losses and food price increases, illustrates how climate induced food insecurity disrupts livelihoods and increases migration pressure, supporting Sub-questions 1 and 2 by showing how drought triggers economic and social instability in various regions.

Lastly, drought intensifies the impacts of transboundary water conflicts in Iraq, particularly over the Tigris and Euphrates River system shared with Turkey, Syria and Iran. The two rivers are Iraq's main water sources and have long been an origin of political tension between the neighboring states. While upstream dam construction has significantly decreased water availability in the country, prolonged droughts have further exacerbated water intake from the rivers at an unparalleled rate (Nath, 2025). The conflict over the Tigris-Euphrates River system poses a significant threat to communities, as its reduced flow, when combined with prolonged drought, can lead to displacement. This was evident in October 2022, when the displacement of an estimated 3,000 families across eight Iraqi governorates occurred, owed to the combined impact of a prolonged and severe period of drought and falling river levels caused by upstream neighbors disrupting the water flow (MEMO, 2022). This example highlights a migration caused by the accumulated impact of water scarcity, rather than resulting from sudden disasters, illustrating the concept of slow violence that unfolds over time. A further example of drought and water conflict is visible in the Diyala governorate, which was affected more severely by drought waves because of Iran cutting tributaries flowing into the Tigris, causing a decline of over 90% in the water level of the Diyala River (MEMO, 2022). Both examples illustrate the impact chain dynamic, where upstream damming reduces river flow and leads to a series of worsening conditions: decreased water availability, declining

agricultural productivity, loss of income, and forced mobility. This chain of events reinforces how environmental degradation, though gradual, can become a decisive factor in migration decisions. The examples also emphasize the vulnerability of populations dependent on natural resources, addressing Sub-question 2.

7.2 Vulnerable Communities: Thi Qar and Salah Al Din

The following section focuses on illustrating the powerful local impacts of droughts. Similarly to the case study on Deir El Kahf, this section collects testimonials from people displaced by drought in the Thi- Qar governorate in Iraq. Additionally, the chapter analyses findings of *People in Need'*s report on Salah Al- Din, providing further answers for this paper's research questions. Emphasizing the political ecology theoretical framing, this chapter highlights the vulnerability to drought induced migration of already displaced people in Iraq, as Internally Displaced People (IDP) more likely to be affected by temperature and precipitation changes (REACH Initiative, 2021). This is particularly visible in areas previously under ISIL occupation, such as Hawija, where droughts already contributed to climate induced displacement, with one in four returnee families reporting that a household member was forced to migrate due to worsening conditions (IOM, 2022). In western Ninewa, around 1,800 recently returned IDPs were redisplaced because of drought related crop failure, as the severe 2021 drought devastated agricultural land, leaving returnee families without viable livelihoods and no choice but to migrate once again (Hasan, 2022). These cases highlight the fragility of these communities, demonstrating how environmental degradation and inadequate recovery sabotage return processes and deepen displacement cycles in agricultural dependent areas (IOM, 2022). These cycles emphasize the political ecology aspect of drought impacted migration, demonstrating that groups which are already most vulnerable from a socio-economic perspective, like IDPs and returnees, suffer from drought impacts the most.

Thi-Qar, briefly mentioned in the literature review chapter as particularly lacking access to basic services, has been identified as the most affected governorate by the 2021 severe drought in Iraq (IOM, 2022). Various reports by IOM and IDMC include testimonials from farmers who migrated from Thi-Qar due to drought related challenges. To provide a more personal and grounded understanding of climate induced displacement, three of

these testimonials will be examined. The first two are extracted from the article *Navigating Rivers and New Cities: Migration and Water Scarcity,* written by Deepika Nath for IOM in March 2025. The third testimonial is extracted from IDMC's paper *When Canals Run Dry: Displacement triggered by water stress in the south of Iraq*, published in February 2020. These narratives will be unpacked to illustrate how environmental stressors contribute to migration decisions, focusing on how they contribute to answering the main research question *In what ways does drought act as a significant push factor in migration patterns in the most affected and underresearched areas of Middle East, and how are these patterns influenced by socio-political and environmental factors?* and the 3 sub-questions.

Figure 16: Sukaina. Source: IOM 2025

Sukaina moved to Markaz Al-Basra neighborhood in Basra city in 2020, along with several families who were affected by water scarcity in the village of Nahr Al-Azz, in the Qurna district, Basra (IOM, 2025). The 73 year old woman from Thi-Qar recalls the abundance and simplicity of her life in the village, before the onset of severe drought. Alongside other women from her community, she reflects on times when rain was so frequent it became an inconvenience. "*Decades ago, during the rainy season, it would pour continuously for four-five days straight. We were annoyed with the rains because it forced us to stay indoors*", she says (IOM, 2025).

Sukaina's words provide answers to the main research question, as they reflect the slow violence of climate change, through the gradual loss of consistent rainfall, which led to a loss of agricultural viability. Moreover, Sukaina's story emphasizes the personal impact of drought impacted migration, the loss of the deep emotional, cultural, and social connection people have to the places they live in, as places that once provided for its residents also forced them to migrate. Her nostalgia for the past highlights how drought becomes a push factor, forcing people to leave their homes, illustrating the link between water insecurity and displacement, showing how the absence of rain, once taken for granted, now contributes to climate induced migration. Her testimony contributes to

understanding how the lived experiences of drought affected individuals are expressed (Sub-question 3). It gives voice to a group (elderly women in rural Iraq) that is often underrepresented in migration discourse.

Figure 17: Basim. Source: IOM 2025

Basim still lives in Thi-Qar, but he is being pushed to the edge of relocation due to drought related challenges, including the deterioration of farmland. Basim fondly recalls his former life in the marshlands, where he would wake up before dawn and spend his mornings fishing and hunting, and his afternoons playing football. He expresses that he once felt financially secure and deeply rooted in his village, never imagining he would have to leave. However, growing water scarcity and the lack of future opportunities for his children now force him to reconsider the sustainability of life in Thi-Qar (IOM, 2025). Basim's perspective underscores the temporal dimension of slow violence, as he already believes that his children have no future in Thi-Qar. His story illustrates how the impacts of climate change are not immediate, but gradual, destroying livelihoods over time. His account further illustrates the erosion of place-based identity in the context of migration, also discussed in Sukaina's case, as he emphasizes that leaving his village was once unthinkable but now feels inevitable. Basim's deep attachment to his village and traditional lifestyle shows how displacement threatens not only physical survival but also emotional and cultural belonging. Such experiences also highlight the impact chain framework, where water scarcity leads to livelihood loss, creating uncertainty about both present and future.

This testimony addresses the main research question, as well as sub-question 1 and 2, as Basim's reflection shows how a once stable rural life is being steadily eroded, contributing to the slow and cumulative displacement this research seeks to understand. Moreover, it reflects how declining water availability undermines traditional livelihoods in agricultural and fishing dependent communities. He represents rural populations whose

lives are tightly connected to natural resources and his family's vulnerability is heightened not just by environmental degradation, but also by the lack of alternative livelihoods, demonstrating the socio-economic conditions that intensify displacement risk.

Figure 18: Basim. Source: IDMC, 2020.

Lastly, Basim's story from IDMC (2020) offers a powerful example of drought impacted displacement. Living on the edge of the Iraqi marshes in rural Thi-Qar, Basim recently left his home with his family in search of work in Basra. They abandoned their crops, watermelons and sunflowers, knowing they would not survive the drought. His neighbor, the last remaining resident in the village, pointed to a dried out canal filled with stagnant water, remarking that even the animals refused to drink it. Though saddened by their departure, Basim knows it was the right thing to leave Thi-Qar (IDMC 2020).

Basim's story provides a similar lens through which to understand the cascading effects of environmental degradation, particularly within the framework of involuntary migration shaped by a lack of viable alternatives. However, Basim's decision appears more pragmatic than nostalgic, driven by crop failure and the collapse of basic environmental conditions. This highlights the harsh reality of environmental degradation to the point of unlivable conditions, in contrast to the other accounts that focus on nostalgic memories of a better past. The observation that even animals refuse to drink from the dried out, stagnant canal underscores the severity of the situation and the urgency behind Basim's decision to leave. His narrative normalizes migration as rational response to irreversible environmental damage, reinforcing the slow violence perspective. It also ties into Sub-question 2, revealing how rural communities become most vulnerable when they are left with no adaptive options, and Sub-question 1, by showing how water insecurity directly undermines agricultural livelihoods, forcing relocation.

Additional testimonials illustrating drought impacted migration are identified in Missan, Al Hadam, where water scarcity impacted the area's main sources of livelihood

opportunities, agriculture and farming, causing displacement in all thirteen villages of the community (IOM, 2023). A young farmer named Mohsin shared that it hasn't rained properly in Missan for at least two years, and there was no rainfall at all last winter. Similar to interviewed farmers in Deir El Kahf, the young farmer shares he has witnessed noticeable changes in weather patterns, local climate, soil conditions, and water availability over the past few years, making it increasingly difficult for him to continue the farming practices that have sustained his community for generations. Nearby areas have also seen farmers leaving in search of better opportunities. Despite these challenges, Mohsin continues to hope for rain in order to preserve the area's 5,000 year old agricultural tradition (IOM, 2023). His testimony reflects how water scarcity drives both livelihood loss and migration decisions, directly answering Sub-question 1 on the relationship between water and food insecurity, drought, and displacement.

Drought driven migration has been further documented by the NGO People in Need (PIN) in Salah Al-Din, a governorate bordering the Kurdistan Region of Iraq. Predominantly desert and semi desert land along the Tigris River, the region suffers from ongoing environmental degradation due to drought and desertification, placing significant strain on rural livelihoods (PIN, 2023). Interviews conducted by PIN reveal that between 20–50% of farmers now view migration as a long term response to worsening environmental conditions and the impacts of climate change. In Tikrit alone, 70% of farmers have already relocated to urban areas, having abandoned agricultural lands that are no longer profitable (PIN, 2023). While 60–80% of respondents expressed a desire to remain in their communities and saw migration only as a last resort, around 30% regarded it as a necessary long term solution. These findings align closely with the impact chain framework, demonstrating how drought and degraded land leads to livelihood loss and

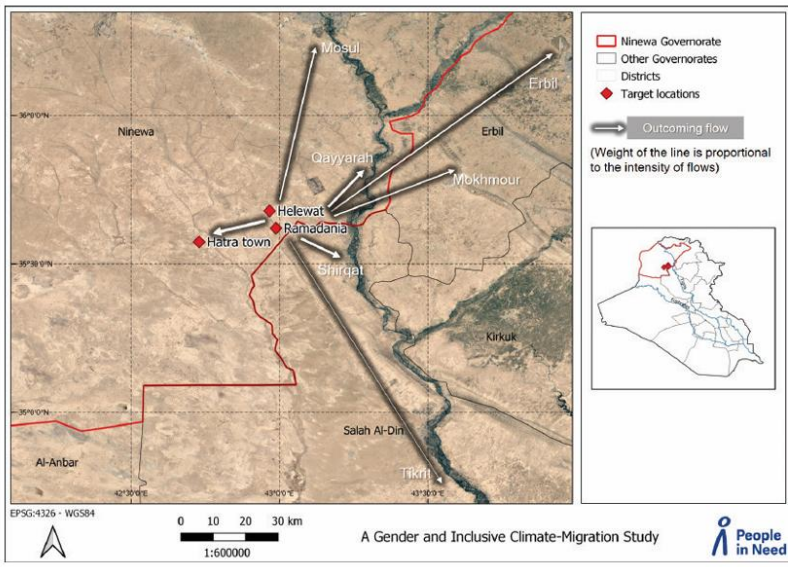

Figure 19: Migration patterns in Iraq. Source: PIN, 2023.

displacement. PIN also identifies clear rual to urban migration patterns in Ninewa governorate, particularly from farmlands in Hatra, Helewat, and Ramadania, toward urban centers such as Mosul, Erbil, Qayyarah, Mokhmour, and Shirqat, indicating significant outmigration from these rural areas to urban areas (Figure 19). Migration triggers are identified as lack of rain, sandstorms and desertification in search of alternative sources of income (PIN, 2023). Governmental authorities recognize that two out of three main displacements in Salah Al-Din are connected to the absence of rain and severe droughts (PIN, 2023). These findings offer critical insight into how prolonged drought, coupled with desertification and diminishing agricultural viability, acts as a persistent stressor gradually undermining rural life. They illustrate how displacement in Iraq is the result of long term environmental degradation that decreases the livelihood security of rural communities, capturing the essence of slow violence. The migration patterns from farming villages to urban centers underscore the rural to urban dynamics of climate induced displacement, providing a clear response to Sub-question 1 by highlighting how water and food insecurity shape migration decisions. At the same time, the vulnerability of farming populations speaks directly to Sub-question 2, pointing to farmers as among the most at risk groups with few sustainable alternatives. Together, these insights reveal migration not only as a coping mechanism but increasingly as an adaptive strategy.

VIII. Discussion

Building on the material covered on drought and migration in MENA (Chapter V) and the two case studies on Jordan (VI) and Iraq (VII), Chapter VIII presents a nuanced discussion of the findings to answer the overarching research question on ways in which drought act as a significant push factor in migration patterns in the most affected and underresearched areas of the Middle East, and how socio-political factors influence these patterns. This chapter focuses on connecting Chapters V, VI and VII, discussing how the main themes are weaved throughout them. It also discussed similarities and differences between drought impacted migration in rural areas in Jordan and Iraq. The relation between drought and migration has been explored both broadly, on a regional level, and in detail, at a sub national level, in Jordan and Iraq. The findings of this exploration emphasize that the link between the two factors occurs on various dimensions: environmental, social, economic and political. While Chapter V built up the argument that drought causes agricultural decline, this was used in Chapters VI and VII to illustrate how this causal relation leads to people migrating away from regions where their livelihoods depend on agriculture, as droughts lead to livelihood loss. This provides an extensive answer to the overarching research question on ways in which drought act as a significant push factor in migration patterns in the most affected and underresearched areas of Middle East, and how are these patterns influenced by socio-political and environmental factors, by providing insight into the three sub-questions.

In response to Sub-question 1, *How does water and food insecurity shape the relationship between drought, climate change, and migration in Jordan and Iraq?*, this research found that human induced climate change has led to decreased precipitation and rising temperatures, two key drivers of drought. These climatic shifts contribute significantly to water and food scarcity, which in turn act as major push factors in migration from rural areas in both Jordan and Iraq. For Sub-question 2, which asks *Which communities in the region are most vulnerable to climate induced drought, and what conditions heighten their risk of displacement?*, the findings indicate that drought has the most severe impact on agricultural areas and on communities dependent on natural resources, with rural farming communities among the most affected in both Jordan and Iraq. Their risk of displacement is increased by factors such as reliance on rain fed agriculture, already precarious socio-economic conditions and inadequate state support. Within the broader

group of drought exposed farmers, a particularly vulnerable subgroup consisting of IDPs and returnees is identified, as seen in the case study on Iraq. These individuals have already experienced displacement and returned to drought prone areas, a cycle which highlights their repeated exposure to climate risks, which significantly heightens their vulnerability to further displacement. In connection with the final sub-question, *What are the lived experiences of drought affected farmers, and to what extent are their perspectives represented or overlooked in the general migration discourse?*, this research found that the personal accounts of farmers are complementary to observed satellite datasets, as both sources note decreased precipitations in areas where droughts led to migration. Moreover, lived experiences included an emotional perspective to drought induced migration by highlighting the place-based identity most interviews farmers lose when forced to migrate from their homes. It was found that their perspective is heavily overlooked in migration discourse, as voices of farmers, older people, young people forced to find an income through seasonal migration, and returnees remain largely absent from media narratives and public policies. Despite being among the most affected by climate induced displacement, their experiences are rarely acknowledged outside specialised reports produced by organisations such as IOM and NGOs. It can be concluded that this lack of visibility further enhances their vulnerability, as it limits awareness, resource mobilisation, and policy responses tailored to their specific needs. These answers also encompass the impact chain framework which illustrates how decreased rainfall causes agricultural decline, which together with population growth increases resource competition. The slow violence concept showed that in both Jordan and Iraq, compounding factors acting over decades led to droughts too severe to withstand, forcing people to migrate away to urban cities in search of different income sources. The virtual water, although not explored in depth, played a useful role in answering Sub-question 2, as it highlighted Jordan and Iraq's vulnerability to drought at a national level, as countries dependent on water imports due to their own limited water availability. All this information confirms that drought acts a push factor in migration patterns mainly through creating a rural to urban migration pattern, as demonstrated in Jordan and Iraq. Chapter 5.2 showed that socio-political factors significantly shape migration patterns, identifying areas dependent on natural resources, such as Deir Al-Kahf, Thi-Qar and Salah Al-Din as sacrifice zones left to depopulate through state neglection and lack of investment. Transboundary water conflicts, briefly examined in Chapter 5.2, also account for political factors causing forced migration. Therefore, socio-

political factors influence drought induced migration through weak political structure, diminished political interest and widespread poverty.

Migration patterns identified in this research in Jordan and Iraq reveal more similarities than differences. Firstly, rural to urban migration as an adaptive strategy to drought is predominant in both countries. In Jordan, the Mafraq Governorate serves as a focal point for drought induced migration, with residents in rural areas like Deir El Kahf moving to urban centers in search of stable livelihoods. Likewise, migration in Iraq is also concentrated in rural areas, particularly in Salah Al-Din and Thi-Qar, where severe drought has driven thousands to seek alternative income in urban centers, as shown in Chapter VII. Secondly, in both case studies, farmers' voices emphasized how drought induced migration occurs over decades, through gradual signs like weather pattern changes and decreased water availability, and only after a long period of time trigger the migration decision, underscoring the slow violence with which drought acts. Thirdly, decreased rainfall and increased temperatures have been identified as key contributors to drought. Further similarities include both countries presenting hotspots in transboundary water conflicts. However, Jordan proves a more stable internal dynamic, with IDPs mainly coming from outside the country, particularly Syria. In Iraq, the large number of IDPs have been displaced inside the country during the war on ISIL. While both countries have been experiencing heightened drought risk, Iraq shows more severe impacts through multiple recorded displacement episodes, while Jordan's migration patterns are less pronounced in terms of volume but are significant in regions with concentrated agricultural activity, such as Deir El-Kahf. While the exact figures differ across sources, it is essential to recognize the broader patterns and implications of the data, as overall, both Jordan and Iraq illustrate how prolonged drought conditions disrupt agricultural livelihoods, deplete water resources, and trigger rural to urban migration. The severity and scale of these impacts differ due to particularities in amplified water conflicts and effectiveness of climate adaptation frameworks.

These insights are completed by the compilation of farmers' voices in Deir El Kahf, Thi-Qar and Missan, which highlight the severity of drought on a personal level, a perspective left unaddressed by global media which portrays migration generally from the Global South to the Global North, overlooking national patterns, as mentioned in Chapter 4.4. Chapters 6.2 and 7.2 placed the spotlight on impacted people to share their stories, highlighting the personal aspect of drought impacted migration, particularly place based

identity and the difficulty in deciding to migrate away from agricultural lands which once provided income and a good life for farmers.

To conclude this discussion, while the materials analysed are not exhaustive, they offer valuable insight into how drought has critically affected the agricultural sector in both Jordan and Iraq. Recurrent droughts have led to significant declines in wheat production and severe crop losses, particularly impacting rural livelihoods and driving migration toward urban areas. Groundwater depletion emerges as a shared and pressing concern in both countries. In Jordan, overexploited aquifers, inefficient water infrastructure, and the effects of upstream damming have all reduced water availability. In Iraq, similar upstream diversions and persistent droughts have caused dramatic declines in river levels, forcing people to abandon agricultural lands. The case studies also revealed diverse migration patterns, including seasonal, semi permanent, and youth employment driven movement. While both countries experience migration linked to drought, the dynamics differ. In Jordan, access to health and education services appears to interact with drought impacts to facilitate migration decisions. In contrast, in Iraq, drought alone acts as a primary push factor, particularly in rural areas with limited state support. These findings are directly relevant to the research questions guiding this study, proving how environmental stress intersects with socio-political and infrastructural vulnerabilities to shape migration.

IX. Recommendations

In light of the findings presented across this thesis, the following recommendations are proposed to address the complex relationship between drought and displacement in Jordan, Iraq, and the broader Middle East. These recommendations are directed at national governments, local authorities, international organizations, civil society actors, research institutions, and the media. Their collective involvement is essential to create more inclusive and sustainable responses to climate induced migration. The aim is to inform targeted and evidence based policy responses that acknowledge both the environmental and socio-environmental drivers of drought induced migration. Each recommendation aligns with the research's core findings and reflects the urgent need to mitigate future displacement, increase resilience, and ensure that vulnerable voices are heard in decision making processes.

1. Invest in targeted monitoring systems for drought driven displacement across Jordan, Iraq, and the wider Middle East to establish a more accurate evidence base for addressing the issue.
2. Monitor the full trajectory of drought induced migration by capturing complex movement patterns beyond simple origin to destination flows.
3. Document lived experiences of drought displaced communities by investing in systematic interviews and storytelling initiatives, particularly in underrepresented regions like Deir El Kahf, Thi-Qar, and Missan.
4. Engage national and regional media outlets to document and share the stories of drought affected communities, raising public awareness and shaping narratives that reflect the human impact of environmental displacement.
5. Promote research partnerships between local universities, NGOs, and international organizations to fill critical data gaps on drought impacts and migration trends in underreported regions of the Middle East.
6. Require the systematic inclusion of social vulnerability assessments in national drought and migration strategies, with attention to marginalised groups such as IDPs, returnees, and low income farming families.
7. Identify and provide direct, long term support to the most vulnerable communities, including IDPs and returnees, through capacity building,

infrastructure investment, and access to basic services to reduce future displacement risks.

8. Develop and enforce locally tailored climate adaptation measures and sustainable water governance policies as integrated components of national and regional strategies, with a focus on drought resilient agriculture, efficient water use, and reducing displacement risks.
9. Establish comprehensive systems to monitor, restore, and build resilience of agriculturally viable land affected by drought.
10. Establish localized early warning systems and drought forecasting tools in rural areas, especially in drought hotspots, to help farmers anticipate environmental stress and reduce forced migration.
11. Fund rural revitalization initiatives that provide sustainable livelihoods beyond agriculture, to reduce dependence on rainfed farming and mitigate outmigration pressures.
12. Improve water infrastructure in Jordan and Iraq by addressing aquifer overextraction, leakage, and inefficiency, particularly in vulnerable governorates, to support long term water availability for rural communities.

X. Conclusion

This thesis has demonstrated that drought acts as a significant push factor in shaping migration patterns in the Middle East, focusing on Jordan and Iraq as impacted but underresearched countries. By analysing regional data and two detailed case studies, the research confirmed that prolonged drought, driven by climate change induced declines in precipitation and rising temperatures and population growth, leads to agricultural collapse and ultimately triggers rural to urban migration.

The research effectively addressed the three sub-questions guiding this thesis:

1. Water and food insecurity were shown to be key drivers linking drought and migration, as declining harvests and reduced access to drinking water made agricultural livelihoods unsustainable.

2. The most vulnerable communities were identified as rural farmers, particularly those in Deir El Kahf, Thi-Qar, and Missan. Their risk of displacement was worsened by poverty, reliance on rainfed agriculture, weak state support, and in Iraq's case, repeated displacement cycles among IDPs and returnees.

3. Lived experiences collected from farmers highlighted the emotional aspect of migration, in addition to the social and economic burden. The loss of place-based identity revealed that these voices are consistently overlooked in mainstream discourse, appearing mainly in specialised reports by organisations like IOM and NRC.

The analysis confirmed a consistent rural to urban migration flow but also emphasized the complexity of these patterns, as migration is not a simple A to B trajectory, but a nuanced, multi layered process, involving seasonal, temporary, and circular movements, with many returning when conditions allowed, reflecting ongoing ties to land and livelihood. The intricate dynamics of population shifts showed an increased abandonment of rural areas also strains urban resources, amplifying structural vulnerabilities to water scarcity in urban contexts. Socio-political factors were also found to shape these migration patterns, exemplified through areas such as Deir El Kahf, Salah Al-Din, and Thi-Qar being regarded as sacrifice zones due to prolonged state neglect. In both countries, lack of governance interest, inadequate infrastructure, and transboundary water conflicts aggravated environmental pressures, leaving rural communities with few

adaptation options. In Iraq, the situation was aggravated by internal displacement linked to conflict and drought, while in Jordan, Syrian refugee flows further complicated local migration dynamics. The concept of slow violence was critical to understanding how droughts occur gradually but relentlessly, leading to displacement over decades. Despite these long term impacts, the lack of early warning systems, data, and coping mechanisms in rural areas leaves affected communities without adequate support. By unpacking these complexities, this research highlighted the critical need for improved data collection and monitoring systems specifically tailored to drought induced displacement. It further emphasized the importance of including directly affected people in dialogue on specific adaptation strategies to mitigate the intensifying impacts of drought. Further research in this domain is essential to enhance understanding of this relation.

In conclusion, this thesis offers a comprehensive, multi level examination of how drought drives migration in the Middle East. It uncovers the structural vulnerabilities that intensify displacement and reveal that the migration response is not a simple movement, but a complex, adaptive strategy shaped by environmental, social, and political forces. The findings emphasise the urgent need for targeted climate adaptation, resilience building in rural communities in Jordan, Iraq, and the broader Middle East region.

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