

CLIMATE VULNERABILITY ASSESSMENT KEY FINDINGS

DATA COLLECTION PERIOD: AUGUST – OCTOBER 2022

APRIL 2023

Climate change¹ and environmental degradation² have contributed to the displacement of at least 55,290 individuals in IOM assessed locations in central and southern Iraq between January 2016 and October 2022. This represents an estimated 13 per cent of the original population³ that used to reside in these locations. In other words, **one in ten people from these locations have been displaced in the past six years**. Given the uptick in environmental migration observed in 2022, this trend is expected to worsen, particularly in the absence of adequate mitigation and adaptation strategies.^{4,5}

To better understand the root causes of these movements, the International Organization for Migration's (IOM) Displacement Tracking Matrix (DTM) developed a tool to assess a location's vulnerability to climate-induced displacement. The tool measured four dimensions: 1) environmental events and water access, 2) services and infrastructure, 3) livelihoods and mitigation measures and 4) tension and conflict. This summary reports presents key findings across these dimensions.

This assessment examined conditions in locations which have already recorded climate-induced displacement as measured by IOM DTM's Climate Emergency Tracking tool.⁶ Data collection for this assessment took place from August to October 2022 across 9 governorates, 29 districts and 262 locations. IOM's Rapid Assessment and Response Teams collected these data through interviews with key informants (KIs) at the community level. KI findings from assessed locations were triangulated using Normalized Difference Vegetation Index (NDVI) anomaly data, which measure the 'greenness' of ground cover and are used as a proxy to indicate the density and health of vegetation. The NDVI anomaly data were extracted from the United States Geological Survey/National Aeronautics and Space Administration (NASA) Landsat remote sensing data and analysed in partnership with the World Food Programme's Vulnerability and Analysis Mapping team. The NDVI analysis will be included in the full-length version of this assessment.

CONTEXT

Pre-existing vulnerabilities

Environmental degradation and climate change impact different groups in different ways and to differing degrees. The families who likely face the greatest challenges are those who rely on land and water resources for income, struggle to access basic services and experience tensions over natural resources.⁷ Ineffective water management policies, broken or inefficient water infrastructure and damming or diversions by upstream governorates and countries also contribute to unequal access to available water resources.^{8,9,10} Together, these factors shape the ability of people to withstand the environmental challenges confronting them in central and southern Iraq, such as drought, sand/dust storms, increased water salinity and reduced water levels.

Impacts of climate change and environmental degradation

Negative environmental events can lead to lower crop and fishing yields and a reduced capacity to feed livestock. In response, some families have abandoned agricultural, livestock and fishing livelihoods altogether.¹¹ Additionally, land degradation and increasingly scarce water resources can contribute to tension in communities. This, in turn, makes cooperative approaches towards water management more challenging.^{12,13,14} Moreover, climate change and environmental degradation make locations less habitable by impeding the ability of households to meet their most essential needs. For example, water shortages impact individual health outcomes and community health risks such as infectious disease outbreaks. In the face of these stressors, some families send members of the household to different locations in search of a job, while others reduce their expenses or sell assets, land or livestock. If conditions persist, families may displace to other locations.

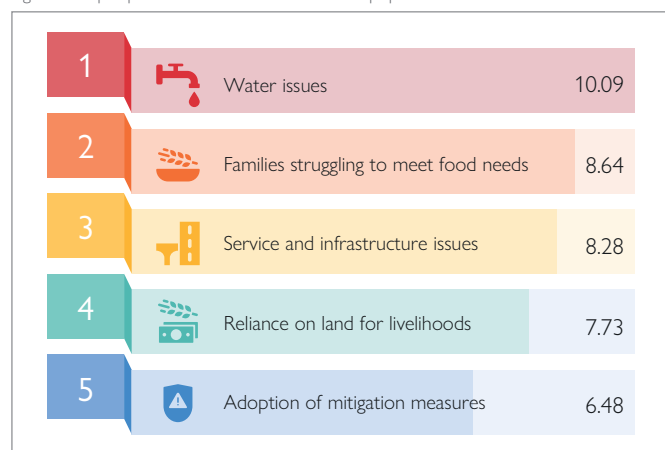
Given the resources required to move, however, **people who are displaced by environmental factors are not necessarily those most impacted or those with the greatest needs or vulnerability**. Families who remain behind may lack the means to relocate, forming a potential 'trapped population'.^{15,16,17}

OVERALL VULNERABILITY

The analysis for this section comes from a Random Forest classification algorithm. For a description of the model and methodology, please see the Methodological Note on page 3.

- The strongest predictor of the rate of depopulation (that is, the share of the original population displaced due to environmental factors) is the **presence of multiple water-related issues**, such as reduced rainfall, lower water allocation and broken or inefficient water infrastructure.¹⁸ As certain water-related problems are widespread, not all issues are associated with high rates of depopulation. In particular, a reduction in irrigation sources, a decrease in rainfall and a decline in water quality are common to nearly all locations, regardless of depopulation rate. On the other hand, the **cost of water trucking** and **damming or river diversions** are specific water issues associated with higher rates of depopulation.
- **Families struggling to meet their basic food needs** is the second strongest predictor of the depopulation rate. This suggests that those being displaced are in a particularly vulnerable economic position.
- The third strongest predictor of the depopulation rate is **difficult access to services or infrastructure**. This highlights the vulnerability of families residing in remote rural locations, where access to education, health care and markets may be more challenging.
- **Reliance on land for livelihoods** is the fourth strongest predictor of the depopulation rate. Changes in the environment have a greater impact on farmers, livestock herders and transhumant pastoralists, as they depend on favourable environmental conditions to make a living.
- The fifth strongest predictor of the depopulation rate is the **adoption of mitigation measures** by families. Reliance on mitigation measures indicates that families have been negatively impacted by changes in the environment and are taking steps to overcome these challenges. The most common mitigation measure, sending household members to another location to make money, points to the lack of alternative livelihood opportunities in the area but also enables families to raise money to remain or relocate. Other tactics, such as borrowing money, reducing meal size or taking children out of school, undermine the wellbeing and resilience of families. If the situation persists, families may be forced to leave the area.

Figure 1: Top 5 predictors of climate-induced depopulation*



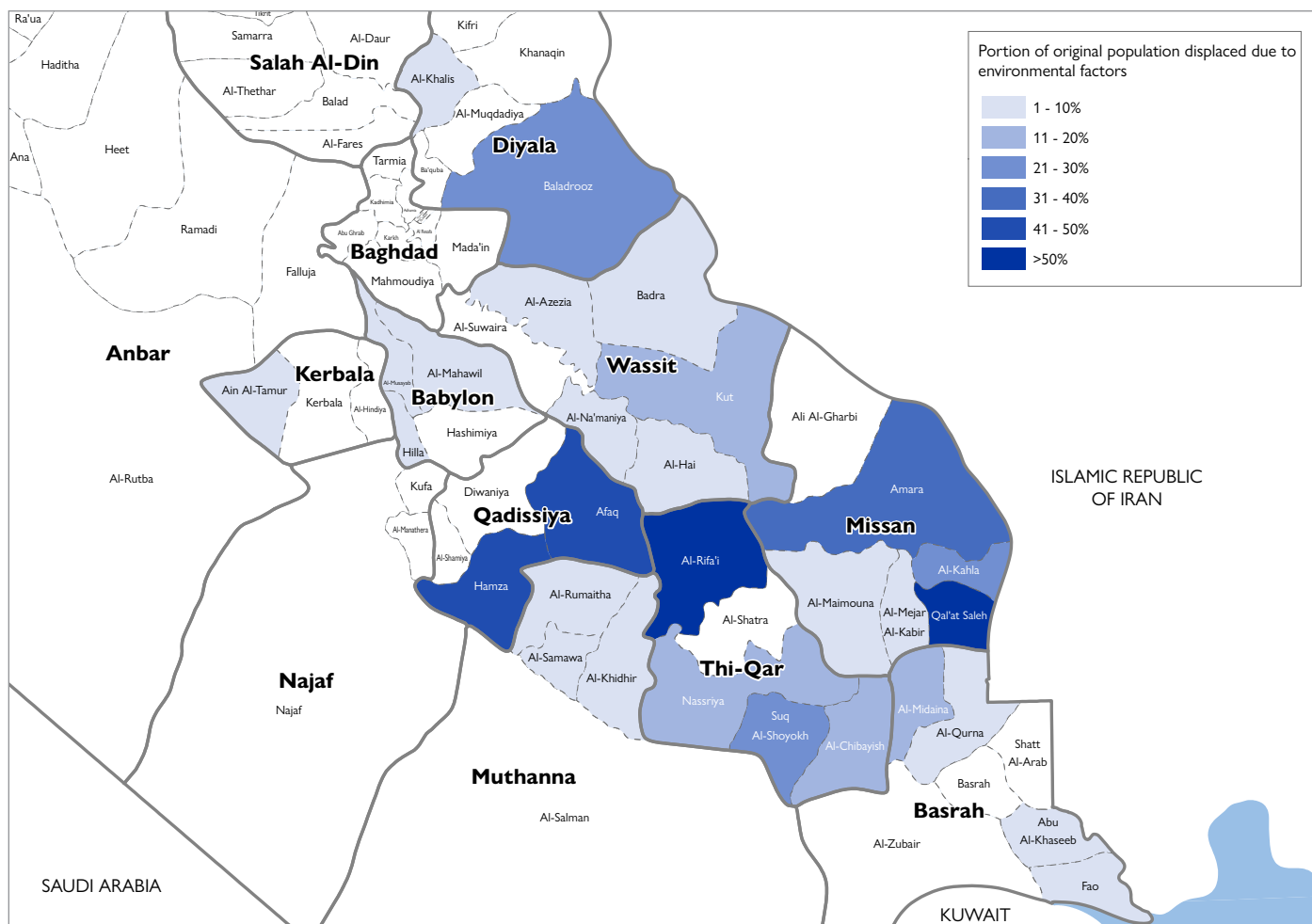
* Based on the mean decrease in Gini coefficient from Random Forest analysis

DISPLACEMENT DYNAMICS

- Nearly 62,000 families live in locations where climate-induced displacement is taking place. Around one in four households live in locations where at least 10 per cent of the original population has already left.
- The districts recording the highest levels of climate-induced displacement are:
 - Qal'at Saleh**, where **half of the population** in assessed locations has been displaced (1,728 families)
 - Al-Rifa'i**, where **three in five households** in assessed locations have been displaced (1,321 families)
 - Nassriya**, where **two in five households** in assessed locations have been displaced (1,257 families)
- Ten locations have been fully abandoned.** Most of these locations can be found in Thi-Qar Governorate, including five locations in Nassriya and three in Suq Al-Shoyokh.
- Climate-displacement is a more recent phenomenon in the governorates of

- Diyala, Babylon, Thi-Qar and Wassit. More than three-quarters of climate-induced displacement in these governorates took place in 2022. The primary drivers of displacement in these governorates in 2022 appear to be low rainfall and low water levels in the rivers and tributaries. Additional aggravating factors include low levels of groundwater, water salinization, disputes over water allocation and restrictions on the use of water.
- As of October 2022, 1,760 more families (10,560 individuals) were displaced by climate change and environmental degradation in 2022 compared to the whole of 2021, representing a 141 per cent increase. Once data for all of 2022 are available, the year-on-year increase is predicted to be even larger.

Map 1: Portion of original population displaced due to environmental factors



ENVIRONMENTAL EVENTS AND WATER ACCESS

- Nearly three quarters of locations experienced 6-8 types of extreme weather and slow-onset events. The most common events, reported in over 85 per cent of locations, include **droughts** and **sand/dust storms**. Additionally, most locations reported **increased water salinity**, **soil degradation** and **changing rainfall patterns**.
- Almost all locations reported a **decrease in irrigation water supply** in the past 12 months. KIs primarily attributed this reduction to **reduced rainfall**

patterns, as well as **reduced water quality**, making water sources unsuitable for irrigation. Additionally, at least half of locations pointed to the impact of **water allocation** and **damming/river diversions**, connected to a lack of international water sharing agreements and inequitable distribution within country.¹⁹ Furthermore, just over one third of locations cited ineffective water management, in the form of broken or inefficient water infrastructure, as a cause of this dwindling supply.

SERVICES AND INFRASTRUCTURE

- **Access to basic services is a challenge in most locations.**
- Across governorates, **Thi-Qar** reported the worst access to services, with nearly half of locations lacking access to all or nearly all services assessed. At the district level, **Al-Rifa'i** in Thi-Qar, **Baladrooz** in Diyala, **Amara** in Missan and **Al-Samawa** and **Al-Rumaitha** in Muthanna reported the highest shares of locations lacking access to all or nearly all services.
- The service most difficult to access was **water**. In just under two thirds of locations, less than 75 per cent of households had enough water for drinking or domestic purposes.
- Despite the challenges faced by these communities, only 5 per cent of locations reported receiving aid or assistance²⁰ from the government, humanitarian organizations, local charities, relatives and friends or other sources.

LIVELIHOODS

- Nearly all locations indicated **loss of crop production, livestock deaths or reduced fishing yields** as a result of environment factors. A similar share **struggled to feed livestock**. KIs also noted **large-scale abandonment of agricultural, livestock and fishing activities**. In 71 per cent of locations, over half of households no longer practice these trades.
- Changes to the environment are also causing households to adopt mitigation measures, as cited by KIs in 75 per cent of locations. Among those locations, nearly all reported sending households members to another location to make money.

TENSION AND CONFLICT

- Around one in five locations reported tension or open conflict between groups, particularly between members of the *same* tribe or ethno-religious group sharing the same livelihoods. **Natural resources were a driver of tension or conflict in only seven districts, especially Nassriya, Kut and Suq Al-Shoyokh districts.**
- **Tensions or conflict over natural resources primarily revolves around water, grazing land, livestock and arable land.** Triggers for tension or conflict often involved disagreements over water sharing, especially the perception that farmers were exceeding their water quota.²¹
- Disputes over natural resources led to the displacement of households in seven districts, especially Al-Khalis and Kut districts.
- In locations reporting tension or conflict over natural resources, **around one third of locations said such tensions have increased in the past year.**

RECOMMENDATIONS

- Water-related issues are the top driver of climate-induced displacement in Iraq. Addressing these challenges will involve **greater cooperation on the distribution of water resources between Iraq and neighbouring countries**, the development of **more equitable water management policies** within Iraq, **improvement of existing water infrastructure** and **acquisition of climate-smart infrastructure** and **awareness-raising campaigns** around water conservation.²²
- Additionally, communities in central and southern Iraq require greater support to **diversify livelihood options** and **expand the provision of basic services**.
- As tensions and conflict over natural resources tend to revolve around water, support should be provided to communities to develop **monitoring systems related to water scarcity** and **platforms for dialogue and mediation**. Further research and analysis should be conducted to understand the relationship between environmental stress and tensions or conflict in Iraq.
- Many locations are experiencing wide-ranging challenges across the domains considered. However, 10 districts have shown particularly high levels of vulnerability including:
 - **Qadissiya governorate:** Afaq and Hamza districts
 - **Missan governorate:** Al-Maimouna, Al-Mejar Al-Kabir, Amara, Qal'at Saleh and Al-Kahla
 - **Thi-Qar governorate:** Al-Rifa'i, Nassriya and Suq Al-Shoyokh districts
- Policies related to disaster risk reduction, climate change and development should take into account the vulnerability and needs of those who have displaced and may displace in the future.^{23, 24}
- Further data collection and research aimed at assessing and monitoring the impact of climate change and environmental degradation on living conditions are needed. While this assessment collected data at the location level, more granular assessments disaggregated by sex and age could shed light on the different consequences faced by different groups. Moreover, monitoring activities should integrate the perspectives of impacted families with remote sensing and satellite data on key environmental indicators.²⁵ Given the potential for greater climate-induced displacement in the future, researchers and programmatic actors should further develop early warning or predictive models which could signal shifting trends in the short- to long-term, building on existing examples.^{26,27} Finally, local authorities and the central government should be provided with technical assistance on data collection and analysis to build their capacity to assess and monitor the consequences of climate change and environmental degradation based on their data.

RANDOM FOREST METHODOLOGICAL NOTE

To understand the leading drivers of climate-induced displacement, a Random Forest classification algorithm was used. Random Forest is based on the Decision Tree model, a type of machine learning algorithm which ranks different predictors based on their level of association with the dependent variable and sorts observations into groups based on shared traits. Decision Tree analysis can be used to classify locations based on the most relevant independent variables and predict which category locations might fall into based on those characteristics. Random Forest builds a set of uncorrelated Decision Trees (a forest) and ranks the predictors used in each tree based on the mean decrease in the Gini coefficient. This approach addresses issues of multicollinearity and overfitting in prediction associated with a single Decision Tree.

The dependent variable for the Decision Trees composing the Random Forest was 'rate of depopulation' (that is, the share of the original population displaced), grouped as follows: 'low' depopulation (0-10%), 'medium' depopulation (11-30%) and 'high' depopulation (31-100%). In total, 28 independent variables were tested through the Random Forest analysis.

Although the Random Forest addresses issues of multicollinearity in terms of prediction, more caution is needed with respect to the score of factors. If two or more variables are correlated and one is selected for the model, the other variables will most likely not be selected. This is because the correlated variable(s) do not offer additional explanatory power for the model. As a result, the importance of the two or more correlated variables is weakened.

A complete description of the model development and methodology can be found in the full-length Climate Vulnerability Assessment.

ENDNOTES

- 1 The United Nations Framework Convention on Climate Change defines climate change as 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to other natural climate variability that has been observed over comparable time periods.' IOM, *Migration, Environment and Climate Change: Evidence for Policy Glossary* (Geneva, 2014).
- 2 The United Nations Office for Disaster Risk Reduction (UNDRR) defines environmental degradation as '[t]he reduction of the capacity of the environment to meet social and ecological objectives and needs. [...] Degradation of the environment can alter the frequency and intensity of natural hazards and increase the vulnerability of communities. The types of human-induced degradation are varied and include land misuse, soil erosion and loss, desertification, wildland fires, loss of biodiversity, deforestation, mangrove destruction, land, water and air pollution, climate change, sea level rise and ozone depletion.' IOM, *Migration, Environment and Climate Change: Evidence for Policy Glossary* (Geneva, 2014).
- 3 The original population refers to both IDPs who have displaced from assessed locations as well as the population who continue to reside there.
- 4 IOM Iraq, *Migration, Environment and Climate Change in Iraq* (Baghdad, 2022).
- 5 Lisa Binder, Barbora Šedová, Lukas Rüttinger, Julia Tomalka & Stephanie Gleixner, *Climate Risk Profile: Iraq. Potsdam Institute for Climate Impact Research & adelphi* (Potsdam, 2022).
- 6 DTM used its Climate Emergency Tracking tool to determine which locations have already recorded climate-induced displacement. All of IOM DTM's Climate Emergency Tracking reports can be found [here](#).
- 7 Roger Guiu, *When Canals Run Dry: Displacement Triggered by Water Stress in the South of Iraq*, *Internal Displacement Monitoring Centre, Social Inquiry & Norwegian Refugee Council* (Geneva, 2020).
- 8 Action Contre la Faim & REACH, *Climate Motivated Displacement: Baseline* (Erbil, 2022).
- 9 Roger Guiu, *When Canals Run Dry: Displacement Triggered by Water Stress in the South of Iraq*, *Internal Displacement Monitoring Centre, Social Inquiry & Norwegian Refugee Council* (Geneva, 2020).
- 10 World Food Programme & Social Inquiry, *Prospects for Resilience Amid Fragility: Conflict Analysis of Al-Qurna and Al-Dair Districts in Basra Governorate* (Baghdad, 2022).
- 11 IOM Iraq, *Migration, Environment and Climate Change in Iraq* (Baghdad, 2022).
- 12 Ibid.
- 13 World Food Programme & Social Inquiry, *Prospects for Resilience Amid Fragility: Conflict Analysis of Al-Qurna and Al-Dair Districts in Basra Governorate* (Baghdad, 2022).
- 14 World Food Programme & Social Inquiry, *Improving Prospects for Peace and Stability in Vulnerable Communities in Southern Iraq. Thi-Qar Governorate Conflict Analysis* (Baghdad, 2022).
- 15 IOM Iraq, *Migration, Environment and Climate Change in Iraq* (Baghdad, 2022).
- 16 IOM, *Intersessional Workshop on Climate Change, Environmental Degradation and Migration: Background Paper, International Dialogue on Migration* (Geneva, 2011).
- 17 IOM defines trapped populations as '[p]opulations who do not migrate, yet are situated in areas under threat, [...] at risk of becoming 'trapped' or having to stay behind, where they will be more vulnerable to environmental shocks and impoverishment.' It notes that trapped populations may be 'poorer households who may not have the resources to move and whose livelihoods are affected.' IOM, *Migration, Environment and Climate Change: Evidence for Policy Glossary* (Geneva, 2014).
- 18 Water-related issues include: 1) a reduction in irrigation water supply, 2) damming or river diversions, 3) reduced rainfall patterns, 4) broken or inefficient water infrastructure, 5) reduced water allocation, 6) reduced water quality (e.g. salinity or pollution), 7) population growth/intensive agriculture and 8) rising costs of water trucking.
- 19 Nussaibah Younis, *Early warning: How Iraq can adapt to climate change*, *European Council on Foreign Relations* (Berlin, 2022).
- 20 If KIs responded affirmatively that households in the locations had received any aid or assistance, they were asked the source of this aid (e.g. government assistance, humanitarian organizations, charity from the local community, relatives and friends or other). They were then asked what form of assistance had been received. Options included: housing reconstruction; temporary shelter; agricultural input subsidies; subsidized water supply; cash assistance/social safety net; in-kind food aid; psycho-social care; water, sanitation and hygiene assistance; education assistance; agricultural assistance or other.
- 21 This information was collected as part of a follow-up for qualitative information with the Rapid Area Response Teams.
- 22 IOM Iraq, *Migration, Environment and Climate Change in Iraq* (Baghdad, 2022).
- 23 Ibid.
- 24 IOM, *People on the Move in a Changing Climate – Linking Policy, Evidence and Action* (Geneva, 2022).
- 25 IOM Iraq, *Migration, Environment and Climate Change in Iraq* (Baghdad, 2022).
- 26 Ibid.
- 27 IOM Somalia, *Somalia – Drought Related Displacement Analysis (December 2021)*, (Mogadishu, 2022).

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