IRAQ Climate Fact Sheet

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I- GENERAL CLIMATE OVERVIEW

Iraq has three major climate zones primarily delineated by rainfall as seen in figure 1:

The Mediterranean climate: Rainfall in the mountains varies by location, ranging from 400 mm to more than 1,000 mm, falling mostly between November and March. It is characterized by cold winter and snow fall on the mountain tops. Summer is mild with the temperature not exceeding 35 °C in most areas.

Steppe climate: Semi-arid, it is the transitional climate between the mountainous area climate and the warm desert climate in the south. Bagdad, for example, is in the steppe and experiences average diurnal temperature ranging from 5°C to 18°C in the winter. In the summer, temperatures increase, rising from 26°C to 46°C daily. Annual rainfalls range between 200 and 400 mm with nearly all of it falling between November and April.

Warm Desert climate: Largely uninhabited with only negligible annual rainfall, the Iraqi desert is extremely hot and arid, with average diurnal temperatures ranging from 4°C to 17°C in the winter and rising to 25°C to 43°C in the summer months. Extreme temperatures ranging from -8°C in the winter to over 48°C in the summer can occur.

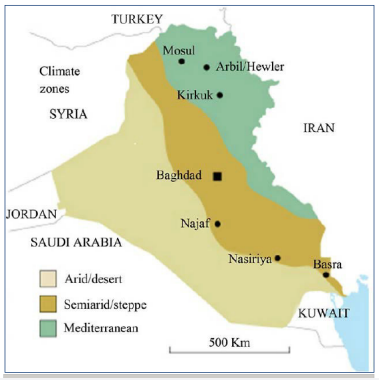


Figure 1: Iraq's Climate Zones (Ministry of Foreign Affairs of the Netherlands, 2018)

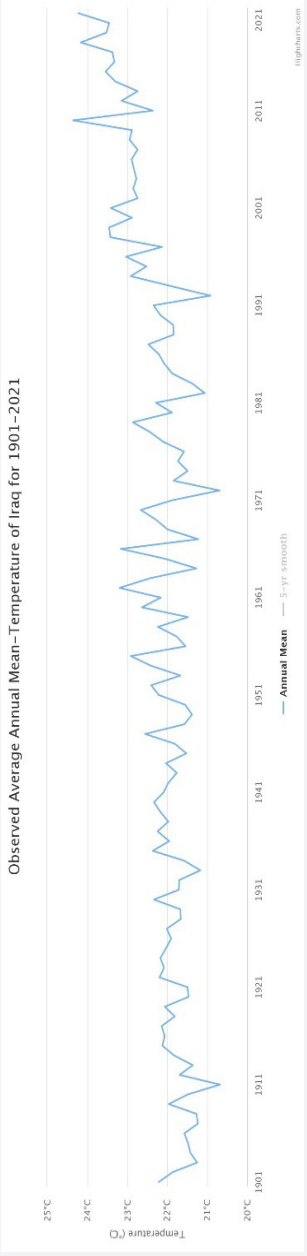


Figure 2: Observed Average Annual Mean Temperature (1901-2021) (WB CCKP, 2021)

II- CLIMATE CHANGE TRENDS

The ND-GAIN Country Index summarizes a country's vulnerability(1) to climate change and other global challenges in combination with its readiness(2) to improve resilience. Iraq's ND-GAIN Index rank is 120. It is the 84th most vulnerable country and the 155th most ready country. The high vulnerability score and low readiness score of Iraq places it in the upper-left quadrant of the ND-GAIN Matrix, which means it has both a great need for investment and innovations to improve readiness and a great urgency for action (University of Notre Dame, 2023).

1 Vulnerability measures a country's exposure, sensitivity, and ability to adapt to the negative impact of climate change. ND-GAIN measures the overall vulnerability by considering vulnerability in six life-supporting sectors – food, water, health, ecosystem service, human habitat, and infrastructure.

2 Readiness measures a country's ability to leverage investments and convert them to adaptation actions. ND-GAIN measures overall readiness by considering three components – economic readiness, governance readiness and social readiness.

From Past to Present:

The average annual mean temperature in Iraq for the year 1901 was 22.21 °C. This number increased to reach 24.22 °C in 2021 (+ 2.01 °C) (figure 2).

Variable changes in annual rainfall since the 1950s (Ministry of Foreign Affairs of the Netherlands, 2018):

-- In the northeast, annual rainfall has increased at a rate of 2.4 mm/ month per century.

-- In the southeast, annual rainfall has decreased at a rate of 0.88 mm/ month per century.

-- In the west, annual rainfall has decreased at a rate of 5.93 mm/month per century.

Projected:

- **Temperature:** While mean temperature for the reference period 1995-2014 was between 21.94 and 22.91 °C, it is expected to increase and reach 24.98 °C by mid-century under a high-emission scenario(3), and 28.96 °C by the end of the century under a high-emission scenario (figure 3, top). In addition, the number of hot days where the maximum temperature (Tmax) is greater than 35 °C is expected to rise from 148.48 days (2014 reference) to reach 165.15 days by mid-century and 194.16 days by end of century under a high-emission scenario (figure 3, bottom).

- **Precipitation:** While the average precipitation for the reference period 2014 was 115.71 mm, it is projected to increase by mid-century under a high-emissions scenario to reach 118.94 mm and by end of century under a high-emissions scenario to reach 125.91 mm (figure 4).

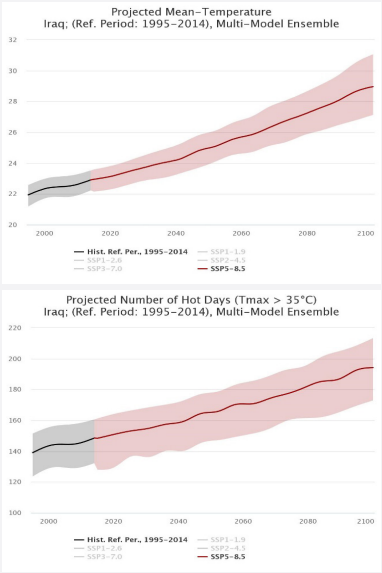


Figure 3: Projected Mean Temperature (top) and Projected Number of Hot Days [Tmax greater than 35 °C] (bottom) (WB CCKP, 2021)

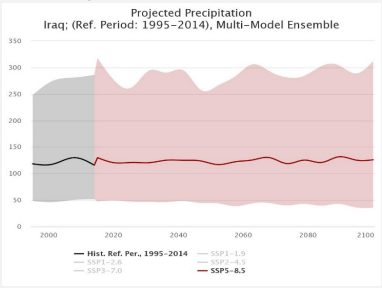
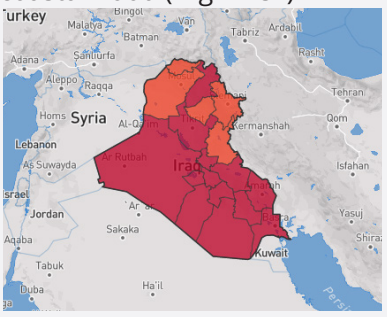


Figure 4: Projected Precipitation (WB CCKP, 2021)

coastal flood (High Risk)



urban flood (High Risk)

3 SSP5\RCP8.5-The highest baseline emissions scenario in which emissions continue to rise throughout the twenty-first century, depicting a world of rapid and unconstrained growth in economic output and energy use.

III- CLIMATE CHANGE IMPACTS

a- Natural Hazards

One of the main impacts of the change in temperature and rainfall patterns is the occurrence of natural hazards. Figure 5 summarizes the risk level of natural hazards in Iraq. It shows that the country has a high risk of river, urban, and coastal floods as well as landslides, extreme heat, water scarcity, and wildfire.

The main climate-related natural hazards that have occurred from 1900 till 2023 in Iraq are seen in table 1:

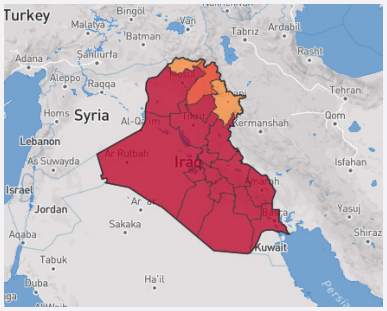
Table 1: Climate-related Natural Hazards (from 1900 till 2023) (EM-DAT, 2023)

Disaster Type	Occurrence (1900-2023)
Flood	(of which 7 recorded flash floods, 4 recorded riverine floods) 17
Drought	3
Storm	1
	Total deaths: 161 **Total damages ('000 US$): 758 811**

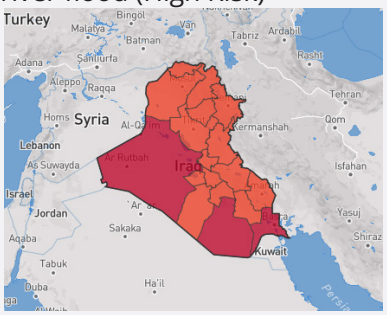
Specific recent examples of such hazards include the December 2021 flash floods that were caused by the heavy rainfalls that hit the country's northern Kurdish region. The heavy rains overnight caused a flash flood in Erbil, the region's capital, and Kirkuk Governorate, located in Northern Iraq. The incident caused widespread damage to houses, infrastructure, and vehicles, and 14 people were reported dead by the floods with more than 7,000 affected people. The heavy rains came at a time when Iraq was suffering from severe droughts (ReliefWeb, 2021). In addition, Iraq is subject to sandstorms, one of which happened in May 2022, leaving 5 000 people needing treatment, with 2 000 of the "suffocation" cases reported in the province of Baghdad (BBC, 2022).

b- Water

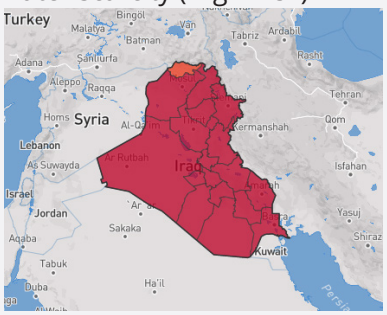
The Euphrates and Tigris River basins which form the major water resources for Iraq are faced with increasing challenges in terms of climate change, demographic pressures, upstream hydro-infrastructure developments, water-quality concerns, and recent conflicts which will



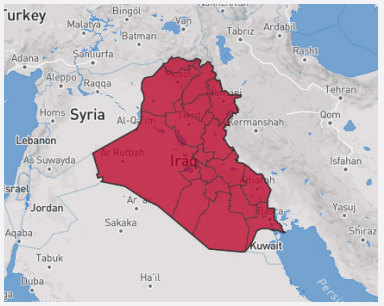
river flood (High Risk)



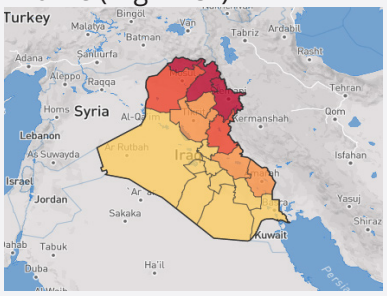
water scarcity (High Risk)



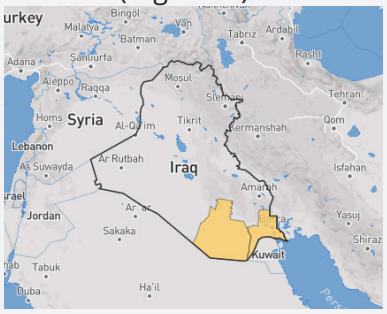
extreme heat (High Risk)



wildfire (High Risk)



landslide (High Risk)



cyclone (Very Low)

Figure 5: Climate-Related Natural Hazards Risk Level (ThinkHazard, 2020

deeply affect future water availability in these basins. A critical concern to Iraq is the control that Turkey can exercise over the water of the Tigris and Euphrates Rivers on which it is dependent for much of its water supply. The upstream development due to construction of dams, reservoirs, and irrigation projects, as well as the increased use of water in both Turkey and Syria is decreasing the amount and increasing the salinity of the water available for Iraq. It is also anticipated that there will also be a negative impact caused by climate change in Turkey, Syria and Iran that will further reduce the quantity and quality of water entering Iraq (Ministry of Foreign Affairs of the Netherlands, 2018). Figure 6 shows the projected annual Standardized Precipitation Evapotranspiration Index (SPEI)(4) in Iraq. The projected maximum annual SPEI drought index under a high-emissions scenario will score a value of -2.49 by 2050 and will reach -3.15 by the end of the century, implying an increasing high pressure on the already scarce water resources. A consequence of water scarcity could be a decline in agricultural productivity especially for crops that need irrigation. Other consequences include inadequate sanitation which can lead to deadly diarrheal diseases and other water-borne illnesses (WWF, 2023).

Degrading water quantity and quality are drivers for water shortage-induced displacement of populations which remains high in the case of Iraq. For instance, in July 2019, 21 314 internally displaced persons (IDPs) were identified. These were mainly coming from the central and southern parts of the country due to the lack of water associated with high salinity content and waterborne disease outbreaks in both urban and rural communities, with approximately 5 300 families displaced from the southern governorates of Missan, Muthanna, Thi-Qar and Basra, and 1 700 from the central governorates of Qadissiya, Wassit, Najaf, Babylon and Kerbala (IOM, 2020).

c- Agriculture

The agricultural sector in Iraq contributes to only 5% of the GDP however it is a source of livelihood for 25% of the population. Agriculture is primarily by small-scale farms that are rain-fed in the north and irrigated in other regions. Irrigated agriculture consumes more than 80% of total water resources of Tigris and Euphrates Rivers and their tributaries (Ministry of Foreign Affairs of the Netherlands, 2018).

Food security is an ongoing concern in Iraq, where it is estimated that approximately 1.77 million are susceptible to it. Agricultural productivity is limited in the country, with farmers lacking the supplies and resources they need. In addition, as seen in figure 7, the main crop growth duration has been decreasing over time due to climate change which will reduce

4 An index which represents the measure of the given water deficit in a specific location, accounting for contributions of temperature-dependent evapotranspiration and providing insight into increasing or decreasing pressure on water resources. Negative values for SPEI represent dry conditions, with values below −2 indicating severe drought conditions, likewise positive values indicate increased wet conditions.

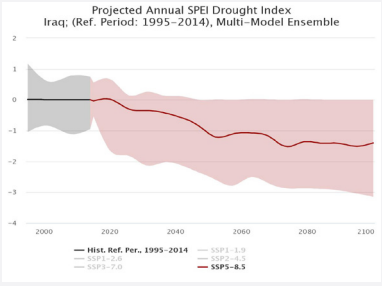


Figure 6: Projected Annual SPEI Drought Index (WB CCKP, 2021)

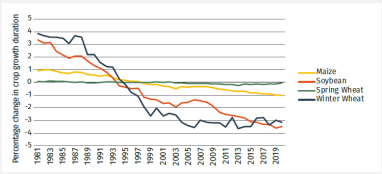


Figure 7: Percentage Change in Crop Growth Duration (1981–2019) (WHO, 2021)

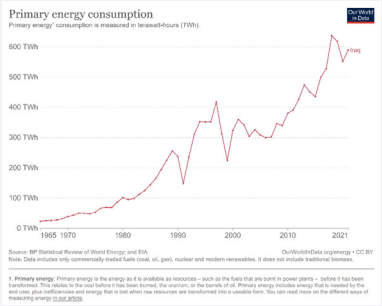


Figure 8: Primary Energy Consumption (TWh) (Ritchie et al., 2022)

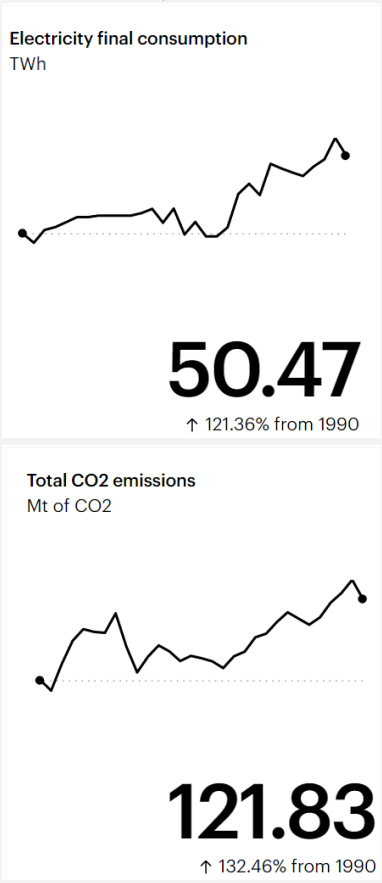


Figure 9: Electricity Final Consumption (top) and Total CO2 Emissions (bottom) (IEA, 2022)

yields consequently.

Conflict and lack of income have resulted in the internal displacement of around 1.44 million people, which has put further burdens on the agricultural sector and increased pressures on hosting communities. Climate change is likely to exacerbate these existing challenges, with crop productivity threatened by weather extremes, rising temperatures and changing precipitation patterns (WHO, 2021). It is essential to mention here that Iraq imports almost 50% of its total food supply to meet local demand, and as Russia and Ukraine are both large producers of wheat and sunflower oil, the price of these products has reached alarming values in the country due to the recent Russia-Ukraine conflict (The New Arab, 2022).

d- Energy

Figure 8 reveals a big increase in primary energy consumption from 1965 (23 TWh) to 2021 (590 TWh) in Iraq, which includes total energy combining electricity, transport, and heat. This augmenting trend is projected to continue over time.

Focusing on electricity consumption only, figure 9 (top) shows that it increased from 1990 (22.80 TWh) to 2020 (50.47 TWh). This rise in consumption consequently increased the total CO2 emissions from the energy sector by 132.46% from 1990 to 2020 (figure 9, bottom). It is projected that electricity consumption will keep on increasing especially with the expected increase in the warm spell duration index(5) until the end of the century under a high emission scenario (figure 10).

Renewable Energy: Despite Iraq's minimal use of renewable energy, the country has high potential in renewable sources. However, no private company to date has invested in renewable energy in the country. Iraq benefits from more than 3,000 hours of solar radiance per year, and the hourly solar intensity varies between 416 W/m2 in January and 833 W/m2 in June. Although the overall regulatory framework is insufficient, the Ministry of Industry of Iraq has developed a directive to increase the use of solar energy. Hydropower is currently the renewable energy source with the highest share in renewable electricity generation in Iraq. Over 90% of the country's renewable power comes from hydropower. However, the sector has faced several difficulties due to conflicts and climate challenges to which hydropower generation is highly vulnerable. Despite the limited water resources, the plan is to increase hydropower to 14 TWh by 2035 (Ersoy & Pfaff, 2021).

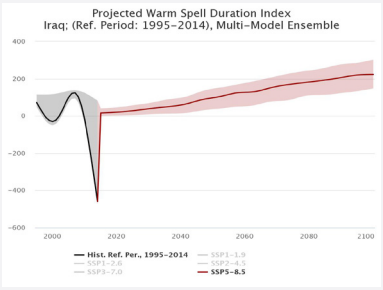


Figure-10: Projected Warm Spell Duration Index (WB CCKP, 2021)

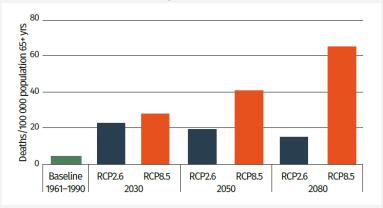


Figure 11: Heat-Related Death in Elderly People (65+ years) (WHO, 2021)

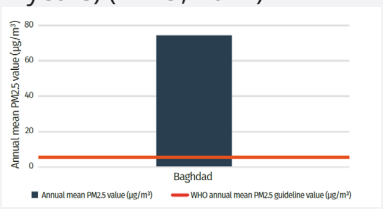


Figure 12: Annual Mean PM2.5 in Baghdad Compared with the WHO Guideline Value (WHO, 2021)

5 An index that depicts periods characterised by several days of very warm temperatures compared to local or regional averages.

e- Health

The health risks of heat stress include heat-related illnesses such as dehydration, rash, cramps, heatstroke, heat exhaustion and death. According to figure 11, baseline (1961–1990) heat-related deaths among the elderly (65+ years) in Iraq are around 4 deaths per 100 000 population. Under a high emissions scenario, heat-related deaths among the elderly (65+ years) are projected to rise to about 64 per 100 000 by 2080. A rapid reduction in emissions (RCP2.6) could significantly reduce deaths among the elderly in 2080 to around 14 per 100 000 population.

On the other hand, climate change increases the intensity and frequency of extreme weather events including drought and floods. Rising sea levels can lead to storm surges, coastal erosion, saltwater intrusion of groundwater aquifers and ecosystem disruption. These events can lead to population displacement and affect water and sanitation infrastructure and services. They can also contaminate water with faecal bacteria (E. coli, salmonella) from run-off or sewer overflow leading to Cholera. In fact, on 19 June 2022, Iraq's health authorities announced a Cholera outbreak after at least 13 cases were confirmed across the country, with thousands of hospital admissions for acute diarrhea reported. Ten of the confirmed cases were in the northern city of Sulaymaniyah, while two more cases were confirmed in the southern province of Al Muthanna, and the other in Kirkuk, north of Baghdad. As of 7 August 2022, Iraq reported 783 confirmed cases of cholera, with four associated deaths. The most affected governorates are Kirkuk (450 cases and 3 deaths), Baghdad-Rasafa (193 cases and 1 death) and Thi Qar (52 cases) (ReliefWeb, 2022).

Figure 12 shows that the capital Baghdad had annual mean PM2.5 levels above the WHO guideline value of 5 µg/m3. Ambient air pollution can have direct and sometimes severe consequences for health. Fine particles, which penetrate deep into the respiratory tract, subsequently increase mortality from respiratory infections, lung cancer and cardiovascular disease. Sand and dust storms have severe impacts on human health, by increasing particulate matter and carrying harmful substances and pathogens, all of which contribute to air pollution and associated respiratory problems. In fact, 12 575 deaths from ambient air pollution in Iraq were recorded in 2016 (WHO, 2021).

IV- CLIMATE CHANGE RESPONSE: NATIONAL AND INTERATIONAL

➔ **National laws and policies include:**

Iraqi Law of Protection and Improvement of the Environment, No. 27 of 2009: This Law aims to improve and to protect the environment

by handling the damages, protecting the public health and the natural resources. The Law establishes a Council for the protection and improvement of the environment referring to the Ministry of Environment and cooperating with other Ministries. It also defines its duties and responsibilities. Smaller Councils will be established in the different provinces of the country. The Law sets forth provisions for the protection of the environment. The regions responsible for environmental pollution must use clean technologies and set up a suitable environmental policy. The use of sensors for pollution monitoring and control is recommended as well as the renewable energy technologies. An environmental impact assessment shall be done for any new project held in the country. The Law concerns also the protection of water from pollution. It regulates the discharge of effluents whether they are of domestic, industrial, or agricultural origin. This Law covers the following subjects as well: regulation of air pollution and noise reduction; earth protection; biodiversity protection; management of hazardous waste; protection of the environment from pollution resulting from exploration and extraction of oil wealth and natural gas; establishment of an environmental protection fund; rewards; compensation for damages; and penal provisions. The Law repeals the Law No. 3 of 1997 on the protection and improvement of the environment (ILO, 2014).

The National Environmental Strategy and Action Plan for Iraq (NESAP) (2013-2017) includes the identification of problems, causes and potential solutions to combat desertification, land degradation, drought as well as national action programs (Ministry of Foreign Affairs of the Netherlands, 2018).

➔ **The different international documents submitted as part of the UNFCCC are seen in table 2:**

Table 2: Timeline of UNFCCC Document Submission (ClimateWatch, 2022)

Date	Document Submitted
2015	INDC
2017	First National Communication
2021	*First NDC

Iraq aspires to implement its nationally determined contributions for the period from 2021 to 2030 to achieve an expected reduction between 1% - 2% of its total emissions according to the national inventories of greenhouse gases through the national effort, and 15% when international financial and technical support is available and security and peace are achieved according to the paths and directions that have been identified in this document, in a manner that guarantees the realization of common benefits to enable its fragile sectors to adapt to the harmful effects of climate change, and after its people enjoy the provision of electric energy for 24 hours a day, like the people of the world.

V- REFERENCES

BBC. (2022). Iraq dust storm leaves 5,000 people needing treatment. Retrieved from https://www.bbc.com/news/world-middle-east-61335124

ClimateWatch. (2022). Retrieved from https://www.climatewatchdata.org/countries/IRQ?end_year=2019&start_year=1990

EM-DAT. (2023). Retrieved from https://public.emdat.be/

Ersoy, S. R. & Pfaff, J. T. (2021). Sustainable Transformation of Iraq's Energy System. Retrieved from https://epub.wupperinst.org/frontdoor/deliver/index/docId/7891/file/7891_Iraq.pdf

IEA. (2022). Retrieved from https://www.iea.org/countries/iraq

ILO. (2014). Retrieved from https://www.ilo.org/dyn/natlex/natlex4.detail?p_lang=en&p_isn=89060

IOM. (2020). Retrieved from https://iraqrecovery.iom.int/iraqwatercrisis/#:~:text=In%20July%202019%2C%20the%20International,urban%20and%20rural%20communities%2C%20with

Ministry of Foreign Affairs of the Netherlands. (2018). Retrieved from https://www.government.nl/documents/publications/2019/02/05/climate-change-profiles

ReliefWeb. (2021). Retrieved from https://reliefweb.int/disaster/fl-2021-000208-irq

ReliefWeb. (2022). Retrieved from https://reliefweb.int/disaster/ot-2022-000241-irq

Ritchie, H., Roser, M., and Rosado, P. (2022). Energy. Retrieved from https://ourworldindata.org/energy

The Arab News. (2022). The Iraq Report: Ukraine turmoil triggers food crisis in Iraq. Retrieved from https://www.newarab.com/analysis/iraq-report-ukraine-turmoil-triggers-food-crisis

ThinkHazard. (2020). Retrieved from https://thinkhazard.org/en/report/118-iraq

University of Notre Dame. (2023). Retrieved from https://gain.nd.edu/our-work/country-index/rankings/

WHO. (2021). Retrieved from https://www.who.int/publications/i/item/WHO-HEP-ECH-CCH-21.01.10

World Bank Climate Change Knowledge Portal (WB CCKP). (2021). Retrieved from https://climateknowledgeportal.worldbank.org/country/iraq

WWF. (2023). Water scarcity. Retrieved from https://www.worldwildlife.org/threats/water-scarcity#:~:text=When%20waters%20run%20dry%2C%20people,and%20other%20water%2Dborne%20illnesses