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Introduction

This climate change profile is designed to help integrate climate actions into development activities. It complements the publication 'Climate-smart = Future-Proof! – Guidelines for Integrating climate-smart actions into development policies and activities' and provides answers to some of the questions that are raised in the step-by-step approach in these guidelines.

The current and expected effects of climate change differ locally, nationally and regionally. The impacts of climate change effects on livelihoods, food and water security, ecosystems, infrastructure etc. differ per country and region as well as community and individual, with gender a particularly important vulnerability factor. This profile aims to give insight in the climate change effects and impacts in Iraq, with particular attention for food security and water. It also sheds light on the policies, priorities and commitments of the government in responding to climate change and important climate-relevant activities that are being implemented, including activities being internationally financed.

Summary

Lying in a water stressed region with little water resources of its own, Iraq is a nation that is experiencing significant and interconnected political, economic, environmental and security challenges^{1,2}. The effects of climate change - increasing temperature, reduced precipitation, increasing water scarcity and salinization, and increasing prevalence of sand and dust storms – will exacerbate these challenges and have serious implications for Iraq's future³. Central to these challenges is the decline of the Tigris and Euphrates rivers on which Iraq's water security and agriculture is dependent, both of which originate outside its borders in Turkey and over which Iraq has no authority or control. The adverse effects of climate change combined with the upstream infrastructure development of the Tigris and Euphrates will further undermine Iraq's agricultural sector, degrade its environment, increase desertification and fuel transboundary tensions and domestic instability.

¹ USAID (2017) Climate Change Risk in Iraq: Country Risk Profile. Available at <https://www.climate-links.org/resources/climate-change-risk-profile-iraq>

² M. El Raey (2014) Impact of Sea Level in the Arab Region http://www.arabclimateinitiative.org/Countries/egypt/ElRaey_Impact_of_Sea_Level_Rise_on_the_Arab_Region.pdf

³ Iraq's Initial National Communication to the UNFCCC (INC) (2017). Prepared by the Ministry of Health and Environment with the financial and technical support of UNDP, GEF, and UNEP. Available at http://unfccc.int/national_reports/non-annex_i_natcom/items/10124.php

Overall ranking

Iraq has an emissions ranking of 33 out of 220 countries and regions⁴ contributing about 0.63% of global GHG emission⁵. For climate vulnerability Iraq has a ranking of 130 out of 181 countries in the ND-Gain Index⁶ (ranking 1 being the least vulnerable). Iraq is the 83rd most vulnerable country and the 16th least ready country. *Vulnerability* measures the exposure, sensitivity, and ability to cope with climate related hazards by accounting for the overall status of food, water, environment, health, and infrastructure within a country. *Readiness* measures a country's ability to leverage investments and convert them to adaptation actions by looking at the country's economic, governance and social readiness. Globally, relative to other countries its current vulnerabilities are manageable but improvements in readiness will help it better adapt to future challenges.

Biophysical Vulnerability

Located in southwest Asia, Iraq is bordered on the east by Iran, on the north by Turkey, on the west by Syria and Jordan and on the south by Saudi Arabia and Kuwait (see [Map 1](#)). Topographically, Iraq is shaped like a basin containing the Mesopotamian plain of the Tigris and Euphrates rivers⁷ with four geographical regions⁸ (see [Map 2](#)):

- **The Mountainous region:** located in the northern and eastern part of Iraq, extended to the joint borders with Turkey, Iran and Syria in the north, east and west. This region occupies a little over 20% of the total area of Iraq.
- **The Undulating region:** A transition area between the lowlands in the south and the high mountains in the far north and northeast of Iraq. It occupies half of the mountainous region area and constitutes almost 10% of the area of Iraq.
- **The Desert plateau:** Located in the west of Iraq and occupies almost 40% of the area of Iraq.

⁴ Global Carbon Atlas (2016). Available at <http://www.globalcarbonatlas.org/en/CO2-emissions>

⁵ Climate Analysis Indicators Tool (CAIT) Version 2.0. (Washington, DC: World Resources Institute, 2014)". *World Resources Institute. This is higher than The Netherlands (0.41% of global emissions). Also presented in a table at https://en.wikipedia.org/wiki/List_of_countries_by_greenhouse_gas_emissions* In 2013 (the year of the emissions data) Iraq's population was 0.5% of the global population indicating that GHG emissions in Iraq approached a proportionate share of global emissions given the size of its population. Cited in USAID (2017) Greenhouse Gas Emissions Factsheet: Iraq available at <https://www.climate-links.org/resources/greenhouse-gas-emissions-factsheet-iraq>

⁶ GAIN index summarizes a country's vulnerability to climate change and other global challenges in combination with readiness to improve resilience. <http://gain.nd.edu/our-work/country-index/rankings/>
N.A. Al-Ansari (2013), Management of Water Resources in Iraq: Perspectives and Prognoses. Scientific Research, Vol.5 No.8, Article ID:35541, http://file.scirp.org/Html/6-8101946_35541.htm#txtF2

⁸ INC (2017).

- **Sedimentary plain:** The great Mesopotamian alluvial plains extending like a rectangle of 650 km length and 250 km width, between the town of Balad on the Tigris River and the city of Ramadi in the black hill area on Euphrates River from the north and including the marshlands and lakes to the west. This region occupies about 30% of Iraq.

Iraq has three major climate zones primarily delineated by rainfall (see [Maps 1 and 3](#))^{9 10}:

- **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.

Droughts, arid conditions and wind in combination with farming practices, poorly managed water resources and climate change (see below) contribute to the emergence of sand and dust storms (SDS) (see [Map 4](#)). Iraq is affected by the southern and southeasterly Sharqi, a dry, dusty wind with occasional gusts of eighty kilometers an hour, which occurs from April to early June and again from later September through November. This wind brings with it violent dust storms that may rise to heights of several thousand meters. From mid-June to mid-September the Shamal wind blows from the north and northwest. The very dry air permits intensive sun heating and aggravates desertification with high evaporation. It is particularly these two winds which generate severe dust-storms in the region. The result is that large parts of Iraq's fertile soil have already been 'blown away'^{11 12}.

For its water supply, Iraq mainly depends on the Tigris and Euphrates Rivers (see [Map 6](#)), both of which originate from the same region in Turkey about 30 km from each other^{13 14}. The 1,800 km long Tigris River has four basin riparian countries: Iran, Iraq, Syria and Turkey. It originates in the Armenian Highlands in Turkey, flows south and merges with the Euphrates River in southern Iraq¹⁵. The rivers flow separately out of the mountains onto a wider, flat, and poorly drained plain, diverging hundreds of kilometers before joining together near Qarmat Ali about 160 km above the head of the Gulf, forming the Shatt al-Arab which drains towards the Gulf. Most of the water from these rivers comes from Turkey (71%) followed by Iran (6.9%) and Syria (4%). The remainder, only 8%, is from internal Iraqi sources. One of the critical issues for Iraq is that its water is affected by the decrease of rainfall and the building of dams and infrastructure outside its borders^{16 17}(see below).

Also providing an important supply of freshwater for domestic and irrigation are the Intermittent streams or *wadis*, some of which are also transboundary. The Wadi al Batin, for example, is a shared wadi with a length of 970 km crossing Iraq, Kuwait and extending south-westwards into Saudi Arabia, where it is referred to as Wadi ar Rimah. From a disaster risk perspective there is growing interest in the region for better management and control of wadi flows, as destructive overflows are common and cause major damage to dwellings and agriculture areas¹⁸.

Climate trends

Key climate changes since the 1950s include¹⁹:

- Increases in mean annual temperature at a rate of approximately 0.7°C per century.
- Variable changes in annual rainfall:
 - 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.

¹³ World Bank Climate Knowledge Portal: Iraq (2018). Available at http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCCode=IRQ&ThisTab=Adaptation

¹⁴ V.K. Sissakian, N. Al-Ansari, and S. Knutsson (2013). Sand and dust storm events in Iraq. *Natural Science*. 05. 1084-1094. 10.4236/ns.2013.510133. Available at https://www.researchgate.net/publication/276048930_Sand_and_dust_storm_events_in_Iraq

¹⁵ Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR) (2017). Available at <https://www.unescwa.org/publications/riccar-arab-climate-change-assessment-report>

¹⁶ Al-Ansari (2013); INC (2017);

¹⁷ The INC (2017) notes "there is a need to sign agreements with neighboring countries (Turkey, Syria and Iran) on joint water to determine the incoming water portion to Iraq; in quantity and quality, to be convenient with principles of sharing and equity, meet the current and future requirements and establish joint water projects".

¹⁸ RICCAR (2017)

¹⁹ USAID (2017); World Bank Climate Change Knowledge Portal (2018)

⁹ INC (2017)

¹⁰ USAID (2017).

¹¹ UN-Iraq (2011). JAPU (Joint Analysis and Policy Unit). Sand and Dust Storms Factsheet. Available at <https://reliefweb.int/report/iraq/sand-and-dust-storm-fact-sheet>

¹² USAID (2017), citing Al-Ansari (2013)

The overall decrease of rainfall in Iraq (ranging from 1.3 to 6.2 mm/yr), particularly during recent years, has resulted in the decline of the main rivers, decreased groundwater level, especially in desert areas, as well as a decrease in other water resources, such as springs and aquifers. The number of cool nights and days and diurnal temperatures are also significantly decreasing accompanied by a trend in increasing minimum and maximum temperatures²⁰.

There has been an increase in extreme events, especially the frequency of SDS occurrences. The maximum number of annual dust storms during 1951-1990 was about 24 days/year, whereas the number of annual dust storms during 2013 was estimated to be 300. One of the main reasons behind the development of sand and dust storms is the climatic changes within the region, especially the drastic decrease in the annual rate of rain fall, besides environmental changes, such as drying of the marshes, land degradation, and desertification. There are growing concerns that most of the agricultural land in Iraq will be converted to desert areas^{21 22}.

There has been a sharp increase in the dryness of the soil and depletion of below-ground water levels. A report indicated that the Euphrates and Tigris basins registered the second fastest rate of regional groundwater storage loss in the world (after India). As strong interlinkages exist between surface and groundwater in the Euphrates and Tigris river basins, groundwater depletion is also an issue of concern, especially in the context of climate change²³.

*Climate Change Projections*²⁴

Projected changes by 2050 include²⁵:

- Increase in mean annual temperature of 2°C;
- More frequent heat waves and fewer frost days;
- Overall decrease in mean annual average rainfall by 9 percent, with the greatest reduction during December, January, and February;
- Decrease in the maximum amount of rain that falls in any 5-day period, but overall increase in rainfall intensity (heavy precipitation events [HPE]);
- Decrease in run-off of 22 percent.

The anticipated impacts of these changes include²⁶:

- Longer and severe droughts;
- Increased flood occurrences (resulting from river fluctuations);
- Decreased agricultural production resulting from the increase in drought periods;
- Increased desertification as a result of the increase in sand and dust storms;
- Increased damage to infrastructure as a result of flooding and storms;

The anticipated loss of rates of surface water imports in Iraq to Tigris and Euphrates Rivers could decrease in 2025 to only 50-80% of the water imports of 2009²⁷. The decline in water levels will result in a decline in reservoirs, lakes and streams to a critical level, forcing a reliance on groundwater which in turn will result in the over-exploitation of many groundwater wells (many of which have high salinity and pollution). It has been suggested that the Tigris and Euphrates rivers will be completely dry by 2040 as a result of upstream development and climate change (see below)²⁸.

The Iraqi Marshlands, a nationally important and globally significant wetland with a unique ecosystem formed by the Euphrates and Tigris rivers joining and flowing through the marshes to the Gulf coast, is being affected by changes in climate patterns as well as human actions. Considered a strategic border area, the Marshlands were subjected to drying and damage to facilitate armies crossing the borders that resulted in environmental degradation and the loss of wildlife and biodiversity²⁹. The decrease in precipitation in the upper Euphrates and Tigris rivers will be amplified by the current and planned infrastructure of dams, diversions and oil related activities on the Euphrates and Tigris rivers that will restrict the amount of water entering the Marshes, as well as change the seasonal water flow pattern³⁰. Projections suggest that the Marshlands will be under increasing threat due to the rapid expansion of desertification, increased sand and dust storms (SDS), prolonged drought conditions and high temperatures (exceeding 50°C). The Marshlands will also experience increased salinity from the rise of sea levels through the Shatt al-Arab and into portions of the Hammar Marsh³¹ (see [Map 1](#)).

²⁰ RICCAR (2017).

²¹ UN-Iraq (2011)

²² Sissakian et al (2013)

²³ RICCAR (2017).

²⁴ Reference period used is 1986-2005 in the projection presented in the World Bank Climate Change Knowledge Portal and cited by USAID and RICCAR. http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=IRQ&ThisTab=ClimateFuture

²⁵ USAID (2017); World Bank (2018); RICCAR (2017).

²⁶ USAID (2017); World Bank (2018); RICCAR (2017).

²⁷ INC (2017).

²⁸ Al-Ansari(2013).

²⁹ INC (2017)

³⁰ RICCAR (2017)

³¹ M. El Raey (2014)

Long-term projections (2100)

The moderate model³² reported in the CORDEX RICCAR Initiative³³ analysis (based on a broad range of global and regional climate and impact models) suggests a change in mean temperature for the Tigris headwaters with an overall increase of 1.8°C and 2.2°C at end-century (other analysis suggest an increase of up to 2°C by 2050, see above). Annual projected patterns of precipitation are variable for the Tigris headwaters with increases of 4% at mid-century and 1% at end-century. At the seasonal level, both the Tigris and Euphrates headwaters show a decrease of precipitation during winter and an increase during summer. Changes in mean temperature of the Euphrates headwaters follow the same trends as the Tigris headwaters in terms of increases towards end-century, with projected increases of 1.9°C at mid-century and of 2.3°C at end-century.

Socio-economic Vulnerability

GDP (PPP) per capita (2017) ³⁴ :	USD 17,349
Population (July 2018) ³⁵ :	39,339,753
Projected population (2050) ³⁶ :	81,490,000
Population density per km ² (2016) ³⁷ :	86
Human Development Index (2016) ³⁸ :	121 out of 188 countries
Corruption Perceptions Index (2017) ³⁹ :	169 out of 180 countries

Gender Inequality Index (GII) (2016) ⁴⁰ :	123 out of 188 countries
Fragile State Index (2017) ⁴¹ :	10 of 178 countries
Adult literacy (2018) ⁴² :	78.5%
Internally Displaced Persons (IDP) (Feb. 2018) ⁴³	2.42 million

Iraq is a 'middle income, resource rich, yet fragile and conflict-riven' country⁴⁴, predominately urban with only about 31% of the population residing in the rural areas. Baghdad, for example, has a population of an estimated 7.2 million and is the second largest Arab city⁴⁵. Iraq's widespread insecurity since 2014 has resulted in the deterioration of the standard of living with a noticeable share of the population falling into poverty or extremely vulnerable to falling into poverty. In 2014 poverty, as estimated by the Iraqi government, reached 22.5 percent (nationwide)⁴⁶ with higher rates in the rural areas (30.9%)⁴⁷. Over 2 million (some estimates suggest up to 4 million) Iraqis have been displaced, primarily by military operations, many of whom are still living in camps and not able to return to their homes. In addition, it is estimate that over 280,000 Iraqi refugees are living in countries in the region⁴⁸.

Iraq's economy is dominated by oil, which contributes about 60% to the GDP⁴⁹. The proven oil reserves of Iraq constitute the third largest reserve of conventional oil in the world (after Saudi Arabia and Iran); it is the tenth country in the world in terms of natural gas reserves⁵⁰. There has been a neglect of the industrial and agricultural sectors and weak private sector investment, in part due to the wars and political instability⁵¹.

The decline of the agricultural sector is evident in the reduction of agriculture's overall contribution to the GDP, largely a result of the lack of investment in the agriculture for decades. However, although the agricultural sector

³² RCP 4.5. The RCPs are consistent with a wide range of possible changes in future anthropogenic (i.e., human) greenhouse gas (GHG) emissions, and aim to represent their atmospheric concentrations. RCP 2.6 assumes that global annual GHG emissions (measured in CO₂-equivalents) peak between 2010-2020, with emissions declining substantially thereafter. Emissions in RCP 4.5 peak around 2040, then decline. In RCP 6, emissions peak around 2080, then decline. In RCP 8.5, emissions continue to rise throughout the 21st century. The moderate (RCP 4.5) projections are used in the Profile, reflecting that a peaking of emissions is now considered likely around 2040 (after 2030). Global emissions would need to peak in 2020 to meet the two-degree global temperature target. See <http://www.wri.org/blog/2017/11/turning-point-which-countries-ghg-emissions-have-peaked-which-will-future>

³³ CORDEX is a consortium of leading climate modelers, the Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR). The RICCAR report (2017) is available at <https://www.unescwa.org/publications/riccar-arab-climate-change-assessment-report>

³⁴ World Bank Data – GDP per capita, PPP. <http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD>

³⁵ World Population Review, Iraq. UN population estimate for mid-year 2018. <http://worldpopulationreview.com/countries/benin-population/>

³⁶ UNDESA (2017): *World Population Prospects: The 2017 Revision, Key Findings and Advance Tables*. Working Paper No. ESA/P/WP/248. https://esa.un.org/unpd/wpp/Publications/Files/WPP2017_KeyFindings.pdf

³⁷ World Bank Data (2018) – Population density, <https://data.worldbank.org/indicator/EN.POP.DNST>

³⁸ UNDP (2017) Human Development Report 2016: Human Development for Everyone. Table 1. <http://hdr.undp.org/en/content/human-development-index-hdi>

³⁹ Transparency International (2018) Corruption Perceptions Index 2017. https://www.transparency.org/news/feature/corruption_perceptions_index_2017

⁴⁰ UNDP (2017) Human Development Report 2016. Table 5. <http://hdr.undp.org/en/content/human-development-index-hdi>

⁴¹ Fragile State Index (Fund for Peace) (2017). <http://fundforpeace.org/fsi/>

⁴² UNICEF (2018) data refers to 2013 or earlier. https://www.unicef.org/infobycountry/iraq_statistics.html

⁴³ UNHCR (Feb 2018) Iraq Situation Update. Iraqi refugees hosted in the region are estimated at 280,04. Available at <http://reporting.unhcr.org/sites/default/files/UNHCR%20Iraq%20Flash%20Update%20-%2026FEB18.pdf>

⁴⁴ World Bank (2017). Iraq: Systematic Country Diagnostic. Report #122333-IQ. Available at <http://documents.worldbank.org/curated/en/54281148727729890/pdf/IRAQ-SCD-FINAL-cleared-02132017.pdf>

⁴⁵ World Population Review (2018). Available at <http://worldpopulationreview.com/countries/iraq-population/cities/>

⁴⁶ World Bank (2018) Country Overview. Available at <http://www.worldbank.org/en/country/iraq/overview>

⁴⁷ World Bank (2017). Iraq Systematic Country Diagnostic.

⁴⁸ UNHCR (2018).

⁴⁹ World Bank Climate Change Knowledge Portal (2018)

⁵⁰ INC (2017).

⁵¹ INC (2017)

currently contributes only about 5% to the national GDP⁵², it is an important source of livelihood for 25% of the Iraqi population. Agriculture is primarily by small-scale farms that are rain-fed in the north and irrigated in other regions, e.g. the Tigris - Euphrates Basin⁵³. Women are a growing share of agricultural labor; according to FAO the estimated percentage of women in the agriculture increased from more than 50% in 2000 to about 60% in 2012, making women the main agricultural labor force in Iraq. The increasing incidence of drought and water scarcity places an increased burden on women both for food production and in fetching water for basic household needs⁵⁴.

Cultivation of field crops, particularly wheat and barley in winter and maize and rice in summer, constitutes the greater part of irrigated agriculture, in addition to other field crops, winter vegetables, fodder, permanent garden such as palm and various fruits. For rain-fed agriculture crops are wheat and barley; wheat in the areas with relatively higher rainfall areas and both crops in lower rainfall areas⁵⁵ (see [Map 5](#)).

Irrigated agriculture consumes more than 80% of total water resources of Tigris and Euphrates Rivers and their tributaries. Large areas of agricultural land suffer from salinity and water logging, particularly in central and southern Iraq where salinity is considered the biggest problem facing irrigated agriculture in Iraq. It has largely exacerbated over the past years because of aging irrigation infrastructure and failure of the government to complete many projects, especially land reclamation projects⁵⁶. In response to the decline of rains and rivers, farmers wealthy enough to afford the high cost of fuel and pumps have turned to wells, but increasing costs and salinization raise sustainability concerns.

Small farmers and livestock producers are facing daunting climate-related challenges, including decreased rainfall and run-off and increased temperatures, which are contributing to widespread desertification⁵⁷. Drought is expected to significantly limit future livestock production, which is already experiencing feed shortages. More climate related disasters can be anticipated, such as the extreme droughts of 2007–2009, which damaged almost 40% of the cropland, with higher intensity in the northern governorates and reaching over 50% in Ninawa and Erbil governorates. Staple crops such as dates, rice and grain, could not be grown

because the Euphrates River was flowing well below its usual level⁵⁸. Anticipated flooding, such as the 2013 flood in southeastern and eastern Iraq, will damage large areas of cropland. Sand and dust storms are likely to threaten cropland and agricultural productivity. A major consequence of the diminished freshwater flow from the Tigris and Euphrates into the Persian Gulf is saltwater intrusion upriver and salinization of groundwater.

Crucial to Iraq's agricultural production is access to water. In addition to changes in climate patterns, as noted above, the critically important Euphrates and Tigris river basins are faced with increasing challenges in terms of demographic pressures, upstream hydro-infrastructure developments, water-quality concerns and recent (and on-going) conflicts which will deeply affect future water availability in the basins still further⁵⁹. A vital concern to Iraq is the control that Turkey can exert over the water of the Tigris and Euphrates Rivers on which it is dependent for much of its water supply⁶⁰. The upstream development due to construction of dams, reservoirs and irrigation projects, as well as the increased usage of water in both Turkey and Syria is decreasing the amount and increase the salinity of the water available for Iraq⁶¹ (see [Map 6](#)). It is anticipated that there will also be a knock-on effect from the impact of climate change in Turkey, Syria and Iran that will further reduce the quantity (and quality) of water entering Iraq.

This will cause⁶²:

- Diminishing water for agriculture;
- Land degradation due to expected high salinity; Further drying of the Basra marshes (marshlands) causing more ecological damage;
- Further deterioration of the already bad water quality of the Euphrates;
- Less hydropower generation;
- Rising risk of regional conflict;
- Demographical implications where farmers and fishermen will leave their homes;
- Lower groundwater levels.

A highly sensitive issue is the dependence of Iraq on the rainfall and snow fall, as well as other climatic factors, outside its borders and the water policies and development projects of its neighboring countries that impact on its

⁵² World Bank Climate Change Knowledge Portal (2018); USAID (2017).

⁵³ INC (2017)

⁵⁴ FAO (2012). Investment Centre. Agriculture sector note. Iraq Country Highlights. Available at <http://www.fao.org/docrep/017/i2877e/i2877e.pdf>

⁵⁵ INC (2017)

⁵⁶ INC (2017)

⁵⁷ USAID (2017)

⁵⁸ RICCAR (2017)

⁵⁹ RICCAR (2017).

⁶⁰ Al-Ansari (2013)

⁶¹ INC (2017)

⁶² Al-Ansari (2013)

access to water⁶³. As the amount water diminishes due to climate change, the control of the Tigris and Euphrates has the potential to become a conflict ‘flashpoint’ in the region if their flow, amount and access continue to benefit upstream users to the detriment of Iraq⁶⁴. There are currently no transboundary riparian agreements in place for the sharing of the rivers. The on-going Syrian conflict, the transnational conflict with ISIS, and tensions with Turkey over water infrastructure development hinders the establishment of enforceable international riparian agreements⁶⁵. A precedent for using ‘water as a weapon’ has already occurred in Iraq when ISIS in 2014 seized control and threatened to sabotage the Mosul dam on the Tigris River in Northern Iraq, an action that could have killed thousands and flooded Baghdad⁶⁶.

National Government Strategies and Policies

In 2003, the Ministry of Environment (MoE) was established in Iraq to implement state policy that protects and improves the quality of the environment. Sitting within the Ministry of Health and Environment, the MoE also serves as a participant in international environmental agreements. Iraq became a member of the United Nations Framework Convention to Combat Desertification (UNCCD) in 2009. Iraq ratified the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol in 2009 as a Non-Annex I country, and the MoE worked with UNDP, Global Environment Facility (GEF), and UN Environment Programme (UNEP) in the preparation and submission of its Initial National Communications (INC) to the UNFCCC. Iraq signed the Paris agreement on climate change in December 2016 but has yet to ratify the agreement.

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 programs⁶⁷. The MoE has reported that a national strategy for adaptation of impacts of climate change will be developed, noting that the water resources sector will be one of the most vital sectors included in the strategy. The preparation process will include working with regional countries to adopt a regional program to combat drought, dust storms and desertification.

The MoE, as the national liaison actor, in cooperation with the Ministry of Water Resources, the Ministry of Agriculture and other relevant ministries and departments has also taken several actions to protect Iraq’s environment, especially its water resources, including⁶⁸:

- in collaboration with UNDP and UNESCO, a comprehensive study regarding the integrated framework for drought risk management.
- forming a committee with the assistance of international experts from UNEP, UNDP, UNESCO and FAO to study the phenomenon of repeated soil and dust storms (SDS).
- in cooperation with UNEP training Iraqi cadres in desertification issues and the requirements of UNCCD, including reporting and preparation of strategies, programs, national legislations and projects to mitigate desertification.

Intended Nationally Determined Contributions (INDC)^{69 70}

Iraq submitted its INDC (only in Arabic) to the UNFCCC in November 2015. Iraq has set targets to reduce greenhouse gas (GHG) emissions by 90 million metric tons of CO₂ equivalent/14% below business-as-usual (BAU) emissions between 2020 and 2035: 13% are conditional on receiving international support and 1% is unconditional (financed from Iraq’s own resources).

The INDC does not include a total cost estimate for the mitigation and adaptation actions, but for several specific adaptation actions cost estimates are provided.

⁶³ The Güneydöğü Anadolu Projesi (GAP) in Turkey is a long-term project that include 22 massive dams and 19 hydropower plants across the Tigris-Euphrates River Basin and will ultimately utilize 10% of Turkish lands. See S. W. Al-Muqdadı, M. F. Omer, R. Abo, and A. Naghshineh (2016) Dispute over Water Resource Management—Iraq and Turkey . Available at <https://pdfs.semanticscholar.org/7015/779747f0d04593daf864a7e7a4509ed36ceo.pdf>

⁶⁴ T. Sternberg, Water Towers: Security Risks in a Changing Climate (2017) in *Epicenters of Climate and Security: The New Geostrategic Landscape of the Anthropocene*, edited by C. E. Werrell and F. Femia. https://climateandsecurity.files.wordpress.com/2017/06/2_water-towers.pdf

⁶⁵ A-Muqdadı et al (2016); USAID (2017).

⁶⁶ M.D. King and J. Burnell, Weaponization of Water in a Changing Climate (2017) in *Epicenters of Climate and Security: The New Geostrategic Landscape of the Anthropocene*, edited by C. E. Werrell and F. Femia. https://climateandsecurity.files.wordpress.com/2017/06/8_water-weaponization.pdf

⁶⁷ Available at [https://wedocs.unep.org/bitstream/handle/20.500.11822/8726/-The%20National%20Environmental%20Strategy%20and%20Action%20Plan%20%20\(2013%20%E2%80%93202017\)%20for%20Iraq-2013National_Environmental_Strategy.pdf?sequence=4&isAllowed=y](https://wedocs.unep.org/bitstream/handle/20.500.11822/8726/-The%20National%20Environmental%20Strategy%20and%20Action%20Plan%20%20(2013%20%E2%80%93202017)%20for%20Iraq-2013National_Environmental_Strategy.pdf?sequence=4&isAllowed=y)

⁶⁸ INC (2017)

⁶⁹ <http://www4.unfccc.int/Submissions/INDC/Published%20Documents/Iraq/1/INDC-Iraq.pdf>

⁷⁰ World Bank Group (2016) available at http://spappssecext.worldbank.org/sites/indc/PDF_Library/IQ.pdf

Mitigation (no cost estimates provided)

Sector	Target	Actions	
		Conditional	Unconditional
Supply-efficiency Grid/Energy Loss Reduction		Reduce transmission and distribution losses	
Gas		Upgrade refineries; LPG fuel for vehicles	
Supply side efficiency power generation			Efficiency improvement in thermal power
Renewable energy: Hydro	3.3% increase in hydro-electric power plants installed capacity (dam)	3.3% increase in hydro-electric power plants installed capacity (dam)	
Waste-to-energy		Use plasma-technology for waste-to-energy	
Recycling, reuse, reduce			Recycling law
Public Transport		Rail, modal shift to mass transport	
Aviation		Aviation efficiency	
Rail		Rail	
Vehicle Fleet		Standard for imported vehicles	Vehicle inspection
Fertilizer		Natural fertilizer	
Sustainable Land Management		Sustainable Land Management	
Conservation			Forest Protection
Buildings		PV build in buildings, smart meters in buildings, low emission building materials	Efficient lighting, insulation, building design

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Adaptation

Sector	Target	Actions (All conditional)	Cost estimate
Water; Water Management	6.4 billion m ³ per day by 2035 water provided	Mosul dam, flood control system, water treatment	USD 11000.00 million
Wastewater Management	21 billion m ³ per year by 2035 wastewater treatment	Wastewater treatment plants	USD 80000.00 million
Water Conservation and Reuse	Increase of reuse of water in industries by 25% by 2035 Reuse drainage water of 3.5 billion m ³ per year by 2035	Water use efficiency in distribution network and water consumption meters; Water monitoring, reuse of drainage water in green belts against desertification	No cost estimate provided.
Agriculture:Irrigation		<ul style="list-style-type: none"> Irrigation methods Irrigation efficiency, drought resistant crops, digging water wells 	USD 45000.00 million
Agriculture: Climate Smart Agriculture		<ul style="list-style-type: none"> Agriculture management; early warning system Cattle herding, reducing pesticides, resistant plants, R&D on climate impacts 	No cost estimate provided.
LULUCF/Forestry; Sustainable Land Management	17% areas protected by 2035	Wetlands, protection of natural vegetation cover, buffer zones around protected areas	No cost estimate provided.

Sector	Target	Actions (All conditional)	Cost estimate
Health: Health Services and Assessment		Enhancing health services	No cost estimate provided.
Health: Disease Surveillance and Control		Provision of potable water, monitoring of infectious diseases	No cost estimate provided.
Tourism		Conditional <ul style="list-style-type: none"> Shift of tourism to areas not affected by sea level rise. 	No cost estimate provided.

Climate Finance and Climate Change Projects

Humanitarian aid and support for social and economic services have been the priorities for international funding for Iraq. However, technical and financial support was provided by UNDP, GEF and UNEP for the preparation of Iraq's Initial National Communication to the UNFCCC and its Intended Nationally Determined Contribution (INDC).

In 2017 Iraq (with UNDP) received approval for Readiness and Preparatory Support by the Green Climate Fund⁷¹. Iraq has also submitted a proposal (with IFAD as the implementing entity) to the Adaptation Fund for Building Resilience of the Agricultural Sector to Climate Change (BRAC)⁷².

See Table 1 below for international and multilateral climate change projects.

Table 1: Recent and current international and multilateral Climate Change Projects⁷³

Name of Project	Fund	Amount of Funding Approved (USD millions)	Disbursed (USD millions)	Dates
Catalysing the use of solar photovoltaic energy	UNDP/GEF	2.4	n/a.	2014-2018
Readiness and Preparatory Project	GCF	.67		2017-2019
Iraq Crisis Response and Resilience Programme	UNDP and partners agencies	58.7		2014-2018
Developing Disaster Risk Management Capacities	UNDP	6.5	1.6	2013-2016
Support Development of First National Communication to UNFCCC	UNDP	1.0	1.0	2013-2015

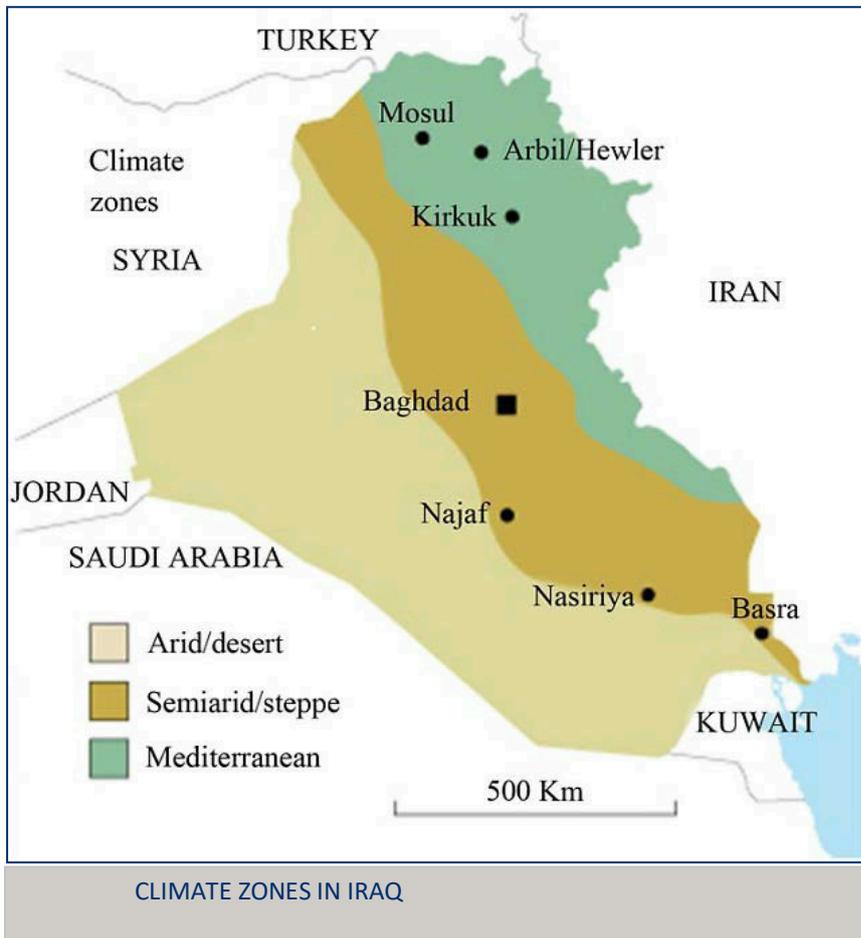
⁷¹ https://www.greenclimate.fund/documents/20182/953917/GCF_B.19_15_Rev.01_-_Readiness_and_Preparatory_Support_Programme_progress_report.pdf/8d883d85-6fe6-4fa6-86e1-61c0cf-8013d6?version=1.0

⁷² <https://www.adaptation-fund.org/project/building-resilience-agriculture-sector-climate-change-iraq-brac-2/>

⁷³ Climate Fund Update available at <https://climatefundsupdate.org/>; GEF project information available at <https://www.thegef.org/country/iraq>

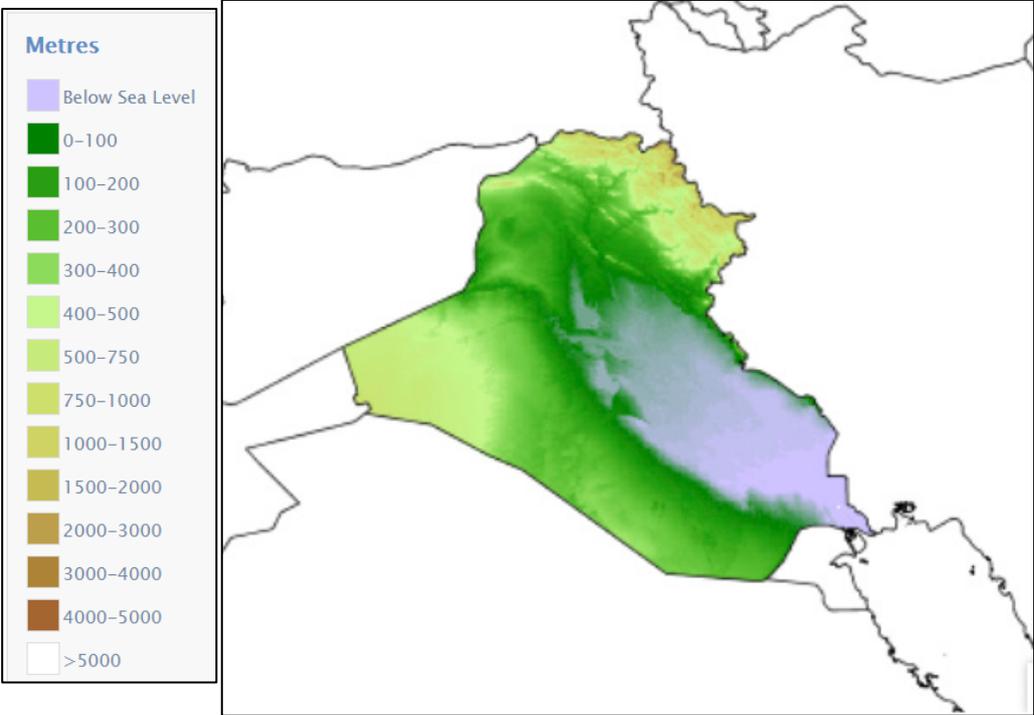
Maps

Map 1 Climate Zones in Iraq



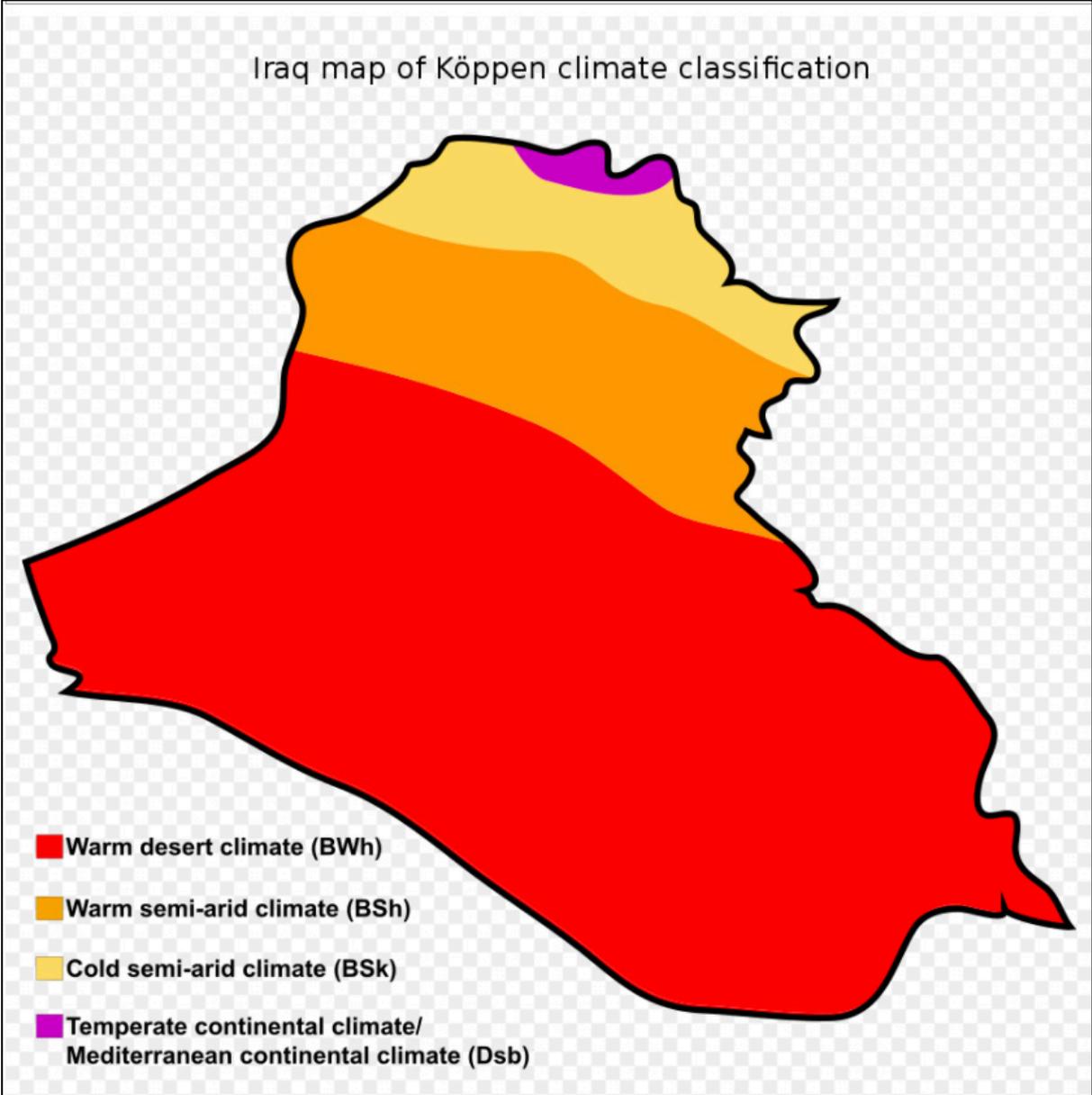
Source: USAID (2017) *Climate Change Risk in Iraq: Country Risk Profile*. Available at <https://www.climatelinks.org/resources/climate-change-risk-profile-iraq>

Map 2 Elevation



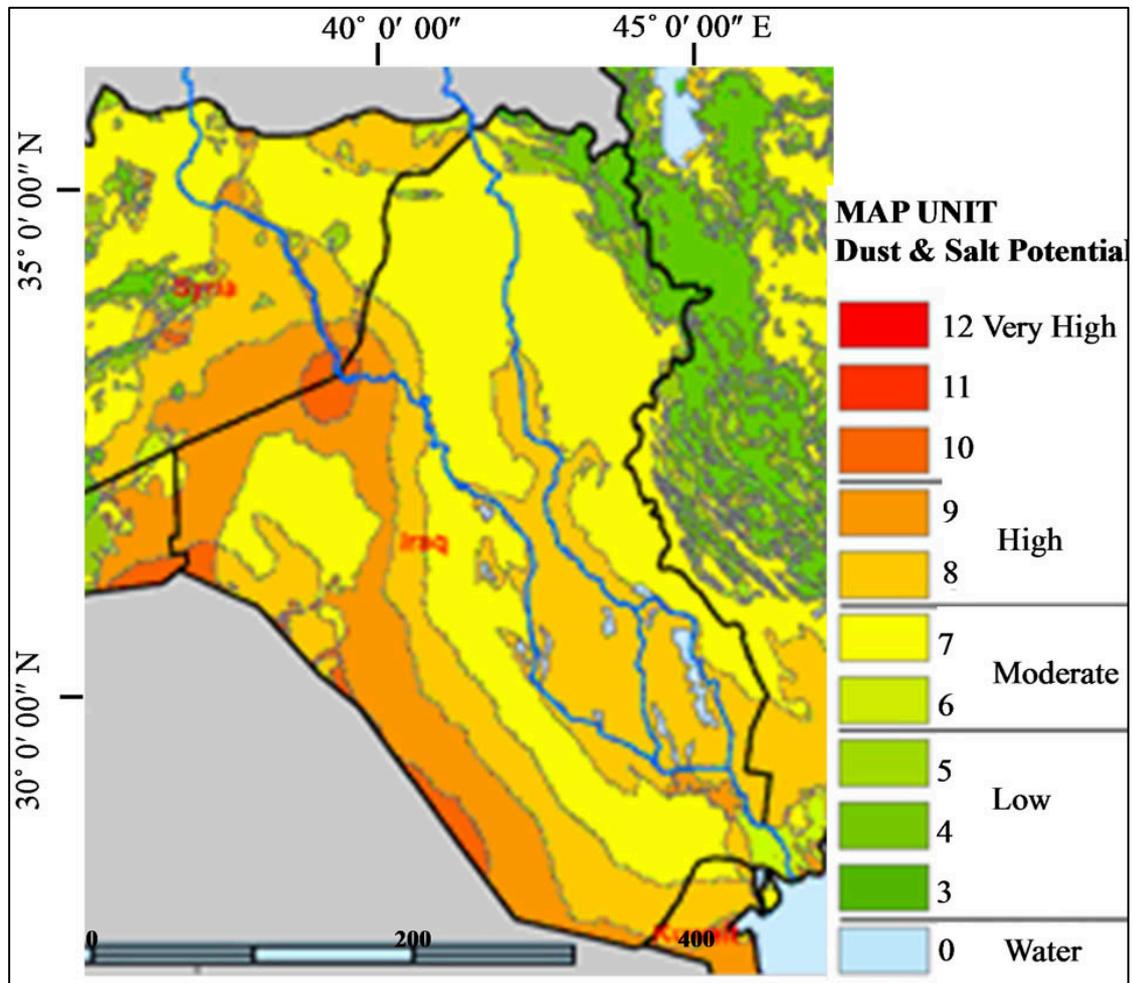
Source: FAO (2018)
<http://www.fao.org/countryprofiles/maps/map/en/?iso3=IRQ&mapID=603>

Map 3 Köppen classification



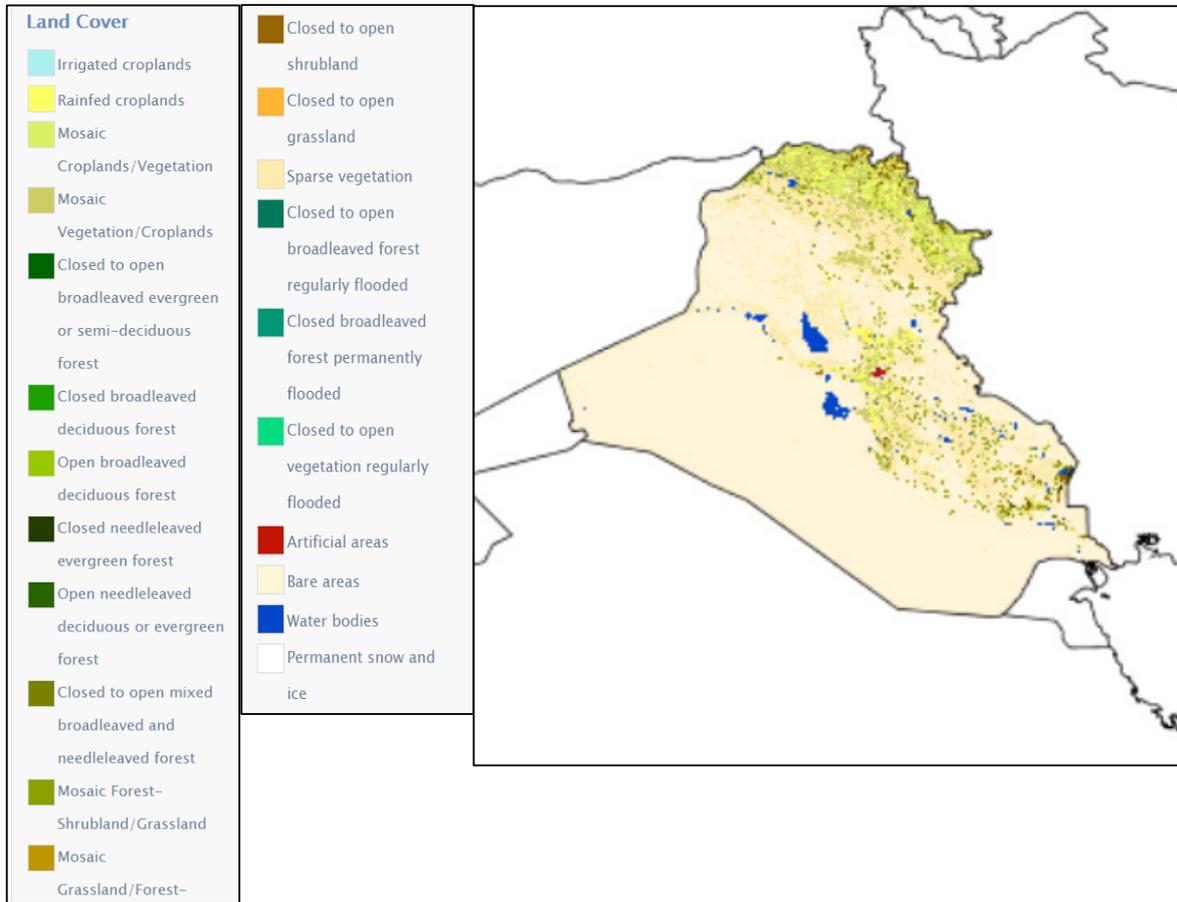
Source: Ali Zifan
<https://creativecommons.org/licenses/by-sa/4.0/>, via Wikimedia Commons

Map 4 Potential of Sand and Dust Storms (SDS)



Source: V.K. Sissakian, N. Al-Ansari, and S.Knutsson (2013). Sand and dust storm events in Iraq. *Natural Science*. 05. 1084-1094. 10.4236/ns.2013.510133. Available at https://www.researchgate.net/publication/276048930_Sand_and_dust_storm_events_in_Iraq

Map 5 Land cover



Source: FAO (2018) available at <http://www.fao.org/countryprofiles/maps/en/?iso3=IRQ> citing University of Maryland and the World Land Cover dataset from the USGS EROS Data Centres Global Land Characteristics Database. <https://lta.cr.usgs.gov/GLCC>

Map 6 Dams in the Tigris-Euphrates River Basins



Source: N.A. Al-Ansari (2013), Management of Water Resources in Iraq: Perspectives and Prognoses. Scientific Research, Vol.5 No.8, Article ID:35541, http://file.scirp.org/Html/6-8101946_35541.htm#txtF2

