

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/366166904>

Water Projects by Turkey and Iran: The Impacts on the Right of Iraq to Access Equitable Share of Water

Research · December 2022

CITATIONS

0

READS

18

3 authors, including:



Hiwa Rashid

University Of Garmian

8 PUBLICATIONS 0 CITATIONS

SEE PROFILE

Water Projects by Turkey and Iran: The Impacts on the Right of Iraq to Access Equitable Share of Water

By

Hiwa Rashid

Lecturer at School of law, Garmian University, Iraq

Email: hiwa.rashid@garmian.edu.krd

Asmar Abdul Rahim

*Senior lecturer at School of Law, College of Law, Government & International Studies,
Universiti Utara Malaysia, Malaysia*

Email: asmar@uum.edu.my

Haslinda Mohd Anuar

*Senior lecturer at School of Law, College of Law, Government & International Studies,
Universiti Utara Malaysia, Malaysia*

Email: haslinda@uum.edu.my

Abstract

The issue of the transboundary water projects has always caused tensions between two countries or more when an upstream water project poses risks to the population living in a downstream country. The Iraqi water resources for example have faced unprecedented pressure as a result of water projects conducted by Turkey and Iran on the Tigris and Euphrates Rivers. These projects have impacted the water quality and quantity of the Tigris, Euphrates and Shatt Al-Arab Rivers in Iraq and violated the rights of the Iraqis to access equitable share of water. Thus, the purpose of this paper is to analyse the legal responsibilities of upstream countries such as Turkey and Iran with regard to the effects of their water projects on the Iraqi water resources based on the international law perspective. The qualitative methods apply through content analysis and descriptive approach. This paper found that the development of current water projects by Turkey and Iran have caused a water shortage in the Iraqi water resources. The water projects carried out by Turkey and Iran have also violated the principle right to access equitable share of water according to customary international law, transboundary water treaties and other related international principles.

Keywords: Transboundary water; Southeastern Anatolia Project; Tropical Water Project; Tigris; Euphrates; international water law.

1.0 Introduction

Water is a substantial resource that plays a vital role in developing human civilization especially in the Middle East. For instance, Mesopotamia is a well-known civilization whose ancient water irrigation system is still evident and remains preserved till today. After the World War 1, a new geopolitical map appeared as a result of the collapse of the Ottoman Empire. Thus, the ownership of water resources became a fundamental concern for the interest of these new independent states in the region. Since then, construction of dams on the Tigris and Euphrates Rivers as transboundary waters become a critical issue for the socio-economic development of all riparian countries (Sitchinava 2021,69-79; Yousuf, Rapantova and Younis 2018, 1-19; Al-Ansari 2016,140-172).

Transboundary water refers to aquifers, lake and river basins which are normally shared between two or more countries to support the lives and livelihoods of the vast population in a certain area. Based on the United Nations (UN) report in 2020, there are 263 transboundary lakes and river basins that cover almost half of the earth's surface. Some 145 countries are within the territories of these basins, of which 30 lie entirely within them. There are approximately 300 transboundary aquifers helping to serve 2 billion people who depend on groundwater (UN Water 2020). The cost required to address the socio-economic and environmental challenges related to transboundary water (such as increasing water demand, security, regional peace and prosperity) have encouraged such countries to seriously consider securing access to equitable water sharing by having a strong transboundary water agreement (Zarei 2020, 81-94).

As of 12 July, 2021 Iraq's population stands at about 42,143,409 (Worldometer 2022). Iraq is located in the southwest of Asia and to the northeast of the Arab world. It lies between the latitudes 29 and 37 and the longitudes 38° and 48° (Figure 1) with a total area of 438317km² of which the water body area of the country is 950km² (Elaiwi, Hasan and Al-Hadithi 2020, 1-7). The middle and southern part of the country has a continental climate, varying from subtropical, arid and semi-arid, and shifts to the Mediterranean climate in the north and north-eastern mountain regions with an average annual rainfall of about 216mm. Iraq has a strategic geographic location as it has a 58km coastline to the north of the Arabian Gulf (Chabuk *et al.* 2020, 1-23). Historically, Iraq was the first and oldest country to use water from the Tigris and Euphrates Rivers and their tributaries. Other older civilizations which developed along the banks of these rivers include Babylonia and the Sumerian civilization. (Hussein 2017, 239-248).

Over exploitation of lakes, rivers and aquifers can jeopardize these ecosystem services resulting in dire consequences to the reliability and sustainability of water supply. Hence, the transboundary water issue is fundamentally crucial for Iraq to guarantee its water right from the Tigris and Euphrates basins for the present and future Iraqi generations (UN 2013). The map of Iraq and its surrounding countries can be seen in Figure 1.



Figure 1: Iraq and its surrounding countries map (Source: Elaiwi, Hasan and Al-Hadithi 2020, 1-7)

By adopting the qualitative approach, content analysis, historical and descriptive methods, the analysis of this paper focuses on water projects established by both Turkey and Iran. This paper will examine whether these projects have breached and violated the rights of Iraq as a downstream country to share equitable water based on international water law as well as the negative impact on Iraq's water sharing.

2.0 The Background and Current Situation of Iraqi Water Resources

Iraq has different forms of surface water resources which consist of rivers and lakes. The Tigris and Euphrates Rivers with their tributaries are considered the main surface water resources that supply more than 98% of Iraq's water demand for various human purposes (Zarei 2020, 81-94). Iraq is currently facing a serious water shortage due to external factors such as climate change, water projects by neighboring countries, development of international water law, rapid population growth, urbanization, poor water management, internal political instability, lack of local water policies and insufficient legal framework (Zarei 2020, 81-94; Price 2018; Issa *et al.* 2014, 421-432). Reduced rainfall, snowfall and a noticeable decrease in water resources has affected the Iraqi economy particularly the agriculture sector (Elaiwi, Hasan and Al-Hadithi 2020, 1-7). UN water data in 2020 (UN 2020) reported that water resources in Iraq encountered seven challenges as follows: -

- *“The availability of water for agriculture, industry and household supplies is a major issue for Iraq. Upstream damming, pollution, climate change and inefficient usage impact the quality and quantity of the country's water.*
- *The Tigris and Euphrates rivers are Iraq's two major surface water sources; they may dry up by 2040 if current trends prevail.*
- *The amount of water available per person per year decreased from 5,900 cubic meters in 1977 to 2,400 cubic meters in 2009.*
- *20% of households in Iraq have unsafe drinking water source.*
- *65% of households use public networks as a main source of drinking water.*
- *92% of total freshwater is used for irrigation and food production.*
- *The Marshlands in the south of Iraq are the largest wetlands in Southwest Asia and are recognized as one of the world's most exceptional ecosystems, yet the percentage of dried marshlands is now 90%”.*

Over the past 30 years the hydrological situation of Iraq has undergone significant changes. The growing water demand and climate change causing the decrease of water precipitation are among the main factors leading to a considerable water shortage in the surface water levels. The levels of the Tigris and Euphrates Rivers as the main water sources for Iraq have dropped to less than a third of its natural levels (Al-Ansari *et al.* 2018, 95-121). The situation has become more critical when the water projects in the Tigris and Euphrates Basin have threaten Iraq's water rights. The catchment areas of the Tigris and Euphrates Basin are divided among Iraq, Turkey, Iran, Syria and Saudi Arabia (Al-Ansari 2016,140-172). The riparian countries have started to build huge dams over these rivers to secure the supply of water for multiple human purposes particularly in Turkey and Iran which has significantly decreased the flow of the Tigris and Euphrates into Iraq in the recent years (Issa *et al.* 2014, 421-432). For instance, after the construction of the Ilisu Dam on the Tigris, Iraq only obtains 9.7 km³ of water from the river which is a 47% decline, leading to the loss of use of 696,000 hectares of agricultural land. ((Yousuf, Rapantova and Younis 2018, 1-19; Al-Ansari 2016,140-172; (Al-Ansari 2013,667-684). The impact of water projects in Turkey and Iraq as riparian countries of these main water resources on Iraq is discussed below.

2.1 *Tigris River*

Tigris River rises at the southeast slope of Taurus Mountains in two sites, the western site is near Diar City at 1500m above sea level, with a discharge of $64\text{m}^3/\text{s}$, whereas the eastern site, named Butman Su, is located near Sinan City at 2700m above sea level with a discharge of $96.3\text{m}^3/\text{s}$. The River has a $235,000\text{km}^2$ drainage area which is shared among four countries which are Turkey (17%), Syria (2%), Iran (29%) and Iraq (52%). The length of the river is 1718km (Al-Ansari, Ali and Knutsson 2014,1066-1098), with tributaries such as the Karzan, which joins the river near Bishwi village and the Hazu tributary near Zeu village which is 240km to the north of the Turkish- Iraqi border and has a discharge of $59\text{m}^3/\text{s}$. The River is joined by Butan Su River, with a discharge of $20.3\text{m}^3/\text{s}$, to form a united Tigris River (Chabuk *et al.*2020, 1-23; Hussein and Mohamed 2021, 130-137; Al-Ansari, Ali and Knutsson 2014,1066-1098).

The River enters Iraq near Zakho City at 4km to the north of Fieshkhabor. The Khabur River is the first tributary with a length of 100km and a catchment area of 6268km^2 . The river goes on for about 188km towards the south until it reaches Mosul city. About 49km to the south of Mosul city, the Great Zab which is the largest tributary joins the River with its catchment area lying in Turkey, Iran and Iraq. Meanwhile, the Lesser Zab tributary which joins the River in Fatha has a catchment area of $22,250\text{km}^2$ of which 5975km^2 lies in Iran. Towards the south, the River reaches Baghdad and at 31km south to Baghdad, the Diyala tributary joins the River which has a $31,896\text{km}^2$ drainage basin, 20% of which is located in Iran and the balance in Iraq (Chabuk *et al.*2020, 1-23;Al-Ansari, Ali and Knutsson 2014,1066-1098; Issa *et al.* 2014, 421-432).

2.2 *Euphrates River*

The longest river in Western Asia is the Euphrates and a major part of it is located in Turkey. Its two main tributaries which forms the River are called the Murat-Sue and the Frat-Sue (or Karat-Sue) (Issa *et al.* 2014). The Euphrates rises in southern Turkey from the mountainous area and flows for about 1178km inside Turkey before reaching Syria where it goes on for 604km until it hits the Iraqi border. The length of the River in Iraq is 1160km (Al-Saadi and Sadkhan 2021,33-59). It runs from Turkey to its confluence with the Tigris in the south of Iraq for 2940km and the total drainage basin area of the River is estimated at $444,000\text{km}^2$, which lies in Turkey (28%), Syria (17%), Iraq (40%) and Saudi Arabia (15%) (Ansari, Ali and Knutsson 2014,1066-1098).

The Euphrates enters the Syrian border near Jarabulus and flows to Albukamal at the Syrian-Iraqi border. The catchment area of the river before reaching Iraq is about $201,000\text{km}^2$. In Syria, three tributaries join the Euphrates which are Sabur River, Balikh River and Khabur River. 14 dams have been constructed on the River in Syria such as Tabaka, Tersaah, Tishrine and Muhardah with different storage capacities.

The number of other small and medium size dams that have been developed on the river has reach 86 dams, the Babalhadied with a capacity of storage of $25 \times 106\text{m}^3$ is known as biggest dam, while the smallest dam has a $30,000\text{m}^3$ storage capacity (Ansari, Ali and Knutsson 2014,1066-1098).

2.3 *Shatt Al-Arab River (SAR)*

Shatt Al-Arab River (SAR) is located in the Basra governorate in southern Iraq, between $29^\circ 45' - 31^\circ 15' \text{ N}$ and $47^\circ 10' - 48^\circ 45' \text{ E}$. The Tigris and Euphrates confluence forms Shatt Al-Arab River in the town of Qurnah within 65km to the north of Basra. To join the Arabian Gulf from Qurna the SAR runs down 200km. The most important tributaries of SAR

comprise of the Tigris, Euphrates, Karkheh and Karun Rivers (Al-Asadi *et al.* 2020,1-15).

The Tigris, Euphrates and Karkheh Rivers have 192km² lengthen with 80,800km² drainage area. It is about 300m wide near Qurnah and the width increases downstream to 700m near Basra city and to about 850m near its mouth in the gulf area. The Karun and Karkheh Rivers contribute about 24.5 and 5.8 billion cubic meters (BCM) annually, respectively. This makes up about 41% of the water of Shatt Al-Arab River. Its annual discharge at Fao City reaches $35.2 \times 10^9 \text{ m}^3$ (Al-Ansari 2016,140-172). The River forms the boundary between Iraq and Iran before discharging into the Persian Gulf and is therefore strategically significant for both Iraq and Iran as can be seen in their continuous conflicts over the River, for instance during the Iraq-Iran war in 1980-1988 (ECC- Platform Library 2020). Shatt Al-Arab River is considered as the main source for different water usages such as domestic, industrial and agricultural activities in the Basra Governorate (Al-Ansari *et al.* 2021, 161-199).

The residence of Basra suffers from poor water quality as a result of the decrease in water flow which is largely controlled by the water projects in the upstream countries. It is very costly to have access to clean water through the used water treatment and desalination processes. Since the 1990s, the federal government has failed to develop a public water infrastructure to allow public access to drinking water. As a result, the people at large are forced to buy drinking water from private sellers since the water provided by the domestic tap is unsafe for drinking ((Mason 2022, 52-61). In 2018, the governorate faced an unprecedented water pollution catastrophe which caused 118,000 people to be hospitalized in a day. (H R W 2019).

Iraq has also used the River as a navigational channel for transporting vessels into Basra's ports through the Arabian Gulf. The destruction and losses of the biological diversity of the River due to bombing boats along the River, uncontrolled urbanization, oil projects, huge number of vehicles in the river area together with some natural factors are expected to aggravate the deterioration of the river quality (Al-Asadi *et al.* 2020,1-15). The River is polluted with some heavy metals such as Cr, Cu, Ni, Mn and Fe in amounts higher than the United States Environmental Protection Agency (USEPA) guideline and is encountering noticeable contamination, particularly in the more populated and industrialized area (Allafta and Opp 2020, 1-16). The current intensive water project developments by Turkey and Iran on these water resources have expedited the water crisis in Iraq.

3.0 water project developments in turkey and iran

This study will discuss the water projects developed on the Tigris and Euphrates Rivers by both Turkey and Iran as upstream countries.

3.1 TURKEY

Turkey's intensive development of water projects such as construction of dams for irrigation, hydropower on the Tigris and Euphrates have significantly affected the Iraqi surface water. This is because about 80% of the water supply of the Euphrates and Tigris comes from Turkey (Al-Ansari *et al.* 2021, 161-199). The Southeastern Anatolia Project (*Güneydoğu Anadolu Projesi*) (GAP) is a comprehensive water management project in the southern part of Turkey set by "the Regional Development Administration" (RDA). This project was carried out between 1975–2017 with a cost of \$32 billion (Yousuf, Rapantova and Younis 2018, 1-19).

The GAP is considered as one of the largest regional development projects ever constructed in the Middle East (Bilgen 2018,1-20). This project comprises of 22 dams (14 of them are constructed on the Euphrates while 8 are on the Tigris), 19 hydraulic power plants

and irrigation investments which cover 1.8 million hectares of land in the Euphrates-Tigris Basin (GAP 2021) to irrigate 17,000 km² of land. The targeted volume of water to be captured is 100 km³ which is triple the capacity of all the Iraqi and Syrian reservoirs (Al-Ansari 2013,667-684). This project was specifically intended to develop the southeastern areas that cover nine provinces which is approximately 10.7% of Turkey in terms of both geographical and population (GAP 2021). Due to its huge size and scale, GAP is considered as the largest river basin development project over the globe for the purpose of irrigation and hydropower to Turkey and it has adversely affected the supply water, energy and food security in downstream countries such as Iraq (Amin 2022,7-16).

GAP is able to irrigate 1.82 million hectares of land in the Euphrates and Tigris basin, which is require about 29 km³ of water for irrigation, while the reservoirs of the project have the capacity to store 100 km³ of water. However, it is predicted that GAP will allow Turkey to have control over 80% of water from the Euphrates. This will have an effect on the total volume of water received by Iraq from the Euphrates. For instance, in 1990 Iraq received 29 km³ of water from the Euphrates but the volume declined drastically to 4 km³ in 2013. In addition, according to the spokesperson of the Iraqi Ministry for water resources, in August 2021 the water levels of both the Tigris and Euphrates have declined by more than 50% percent (Travers 2022; Dilan, 2021; Al-Ansari 2013,667-684).

As a result, the usage of land for agricultural purpose in Syria and Iraq decreased from 650,000 hectares to 240,000 hectares (Tosun 2019; Bilgen 2018,1-20; Al-Ansari 2013,667-684). Approximately 8.2 million people live in the Euphrates Basin in Iraq and out of its agricultural land of 20000 km² only 7500 km² can be utilized due to the water shortage in Iraq from the Euphrates water share (Al-Saadi and Sadkhan 2021,33-59).

Apart from GAP, the Ilisu Dam is also considered one of the largest dams on the Tigris. This Dam is located at 65km² upstream from the Turkey-Syria border and has a storage capacity of 10.4 billion m³ with a surface area of 313km². This Dam is used to generate electricity and began operating officially in the summer of 2019 until now. The Cizre Dam was built for agricultural purposes on Tigris River at 45km downstream of Ilisu and about 20km upstream of the Iraq-Turkey border. From the aforementioned water projects, Turkey controls 60% of the headwaters of Tigris River and 95% of the headwaters of Euphrates River (Amin 2022,7-16; GAP 2021) Under international water laws, these water projects in Turkey are not permitted to cause transboundary harm to Iraq.

3.2 **IRAN**

Recently, Iran initiated a huge water project called the Tropical Water Project (TWP) which comprises of 14 dams and 150 km long diversion tunnels on the Sirwan and the Zmkan Rivers to transport water to the rural areas in the south of the country (Table 3).

It was planned that the TWP project was to be constructed in two stages; while the first stage has already been completed, the second stage is still ongoing (Sarhat 2022,273-287; Faraj and Zaidan 2020, 1-6). The objective of the TWP is to expand the agricultural land area by converting the area from a land cultivated by rain to irrigated land and to provide potable water for human and industrial purposes. (Sarhat 2022,273-287). The overall capacity of all the planned dams is about 1.9 billion m³ of which 1.806 billion m³ is to be stored in dams built on Sirwan River (also called Diyala River) and its tributaries while the balance is to be stored by the dams built on Zmkan River (Sala and Laffert 2021; Faraj and Zaidan 2020, 1-6).

Table 3: The TWP Dams built across Sirwan and Zmkan Rivers and their tributaries (Source: Farag, D., M. & Zaidan, K. 2020)

Dam	Completion Date	Dam height (m)	Storage capacity (Million m ³)	Catchment area (Km ²)	Longitude and Latitude
Azadi	2012	64	70.47	722	34°32'55.6"N 46°21'12.3"E
Gawshan	2004	123	550	1,245	34°57'49.0"N 46°59'38.5"E
Daryan	2018	146	316.3	3,135.85	35°09'08.3"N 46°18'25.3"E
Soleyman-Shah	2006	36	50	859.53	34°53'32.4"N 47°31'51.6"E
Zmkan	2017	65	23	367	34°19'10.7"N 46°22'04.0"E
Azgala	2018	65	30	----	34°47'30.1"N 45°50'57.2"E
Wahdat (Qeshlq)	1979	89	215	1,077.7	35°25'34.4"N 46°59'34.1"E
Garan	2013	62	110	307.07	35°36'03.6"N 46°19'10.1"E
Hirwa	2018	45	12	261.6	35°07'19.8"N 46°14'43.3"E
Java	2013	86	172	1,751.7	35°04'09.0"N 46°50'01.2"E
Azad	2014	125	300	984.5	35°20'08.6"N 46°32'58.5"E
Ziviyeh	2013	54	17	83.6	34°55'38" N 46°42'36.9" E
Amir-abad	2019	30	6	35	35°04'05.7"N 47°15'37.1"E
Ramshat	2019	35	6	36.3	35°04'58.1"N 47°11'51.4"E
Darbandikhan before TWP	1957	128	3,000	16,685	35°06'47.2"N 45°42'24.6"E
Darbandikhan after TWP	1957	128	3,000	3,837	35°06'47.2"N 45°42'24.6"E

The Nowsud tunnel is another Iranian water project considered to be one of the largest water tunnels in the world (Sarhat 2022,273-287). It is 48.7km in length with a width of 6.125m, and in some places it can reach to 9m wide. This tunnel has a maximum capacity of 70 m³/s to bring approximately 1.0-1.6 billion m³ of water annually from the Sirwan and Zmkan Rivers to Kermanshah and Elam governorates for agricultural and industrial development Sarhat 2022,273-287; Faraj and Zaidan 2020, 1-6; Elaiwi, Hasan and Al-Hadithi 2020, 1-7).

The Darbandikhan Dam is an embankment dam that was initiated in 1956 and completed in the summer of 1961 on the Sirwan/Diyala River for a different socio-economic purpose. It is located 65 km to the southeast of Sulaymaniyah City and 230km to the northeast of Baghdad. The Dam is 128 m high and has a crest length of 445 m and a crest width of 17 m with an elevation at 495m (Yousif *et al.* 2019, 295-308). Based on a recent study TWP poses risks for the Darbandikhan Dam which is expected to lose a considerable amount of water mainly as a result of both water diversion from its original basin to the Nowsud Tunnel, which is more than a billion cubic meter and the construction of dams in Iran (Faraj and Zaidan 2020, 1-6). Based on the data from GIS, approximately 77% of the natural catchment area of the Darbandikhan Dam will be lost when the TWP project is completed and in full operation (Faraj and Zaidan 2020, 1-6). It is also expected that TWP dams will cause a decline in the amount of water in Sirwan/Diyala Rivers by more than 70% because it is estimated that TWP will

withdraw more than three billion m³ of water from the Sirwan River Basin (Sarhat 2022,273-287).

The Sirwan and Little Zab Rivers rise in the northwestern of the Zagros Mountains, then flow into the KRI. At a town named El Zab in the Kirkuk Governorate, Little Zab River meets the Tigris, while the Sirwan runs south through Iraq's Diyala Governorate before reaching Tigris to the south of Baghdad. Both rivers are a lifeline for about two million people for socio-economic purposes in both the Sulaymaniyah and Diyala Governorates (Corona 2020). In 2020 the Iranian government decreased the flow of the Sirwan and Little Zab Rivers, both of which flow across the Iran-Iraq border in the KRI, threatening inter alia water shortage, reduction of agricultural production and environmental degradation in the region particularly in Garmian, Diyala areas (Sarhat 2022,273-287; Corona 2020; Elaiwi et al., 2020).

Throughout the last three decades Iran has built about 600 dams, which have caused a threat to the Iraqi water resources as a result of severance or diversion of the river water into Iraq. (Sirwan, D., 2022). The Daryan Dam for example is located at the Kermanshah Governorate of the Iranian Kurdistan which is about 28.5km from the Iraqi border. This dam is intended to generate hydroelectricity and to irrigate southwestern Iran and is expected to yield 230 megawatts. Iran has also built dams on other seasonal rivers close to the Iraqi border which have reduced the water flow into Iraqi land. The dams built on the Karkheh and Karun Rivers are meant to collect water and lead it into Iran (Elaiwi, Hasan and Al-Hadithi 2020, 1-7; Corona, 2020).

Despite the problems caused by the Iranian water projects to the Iraqi water share, there is still no water treaty between Iraq and Iran in place for equal water sharing benefits (Chomani and Bijmens 2016, 1-18; UN-ESCWA and BGR 2013). Development of water projects in Iran should take into account its consequences to the downstream Iraqi water resources based on international water law and principles because such development has exacerbated the existing environmental catastrophe in Iraq.

4.0 impact of intensive water projects in turkey and iran on iraq as a downstream country

The United Nations Environment Programme (UNEP) has predicted that the availability of water in Iraq will be reduced by about 20% by 2025. This will pose a risk for the socio-economic stability of the country. Based on the report of UN, dams built in the neighbouring Turkey and Iran have critically decreased the overall volume of the Tigris and Euphrates up to 60 percent. (Travers 2022). It is clear that urbanization, industrialization, population growth, farming and traditional irrigation systems have resulted in a significant increase in water demand in Turkey, Syria and Iraq and will therefore aggravate the decline of water flow with time (Al-Ansari *et al.* 2021,161-199; Ahmed 2021, 1-12). Likewise, water flow from the Euphrates has substantially decreased from 30 billion cubic meters before the construction of these dams to 15 billion cubic meters thereafter (Chomani and Bijmens 2016, 1-18).

In addition, the construction of dams on the Tigris and Euphrates in Turkey is expected to have a notable negative impact on the quality and quantity of the Iraqi water resources. For instance, the Ilisu and Crizer Dams among others have a substantial effect on the Tigris water flow into Iraq. The Ilisu Dam which is located upstream to the Mosul Dam, drains a major watershed area of the Dam. The Mosul Dam was originally designed to have a 54,900km² watershed area, which is projected to decline to about one fifth of the total area, a study has estimated that based on the current flow, if these two dams were to fully operate, inflow to Mosul Dam would decrease by 22% (Sitchinava 2021,69-79; Al-Madhhachi, Rahi, and Leabi 2020, 1-14).

These projects would have a huge impact on the availability of access clean water for people. For example, about 3.8 million people in Baghdad depend on Tigris River for their water needs. Any decrease in the water flow will affect the quality of water supply according to the international standards of WHO. The quality of the water from the Shatt Al-Arab will also deteriorate as a result of the declining water flow from the Tigris and Euphrates Rivers (Save the Tigris and Iraqi Marshes Campaign *et al.* 2015). The implementation of GAP is also harmful to the Marshes, which is known as the Garden of Eden, with an area of 15,000-20,000 km² (Al-Ansari 2013, 667-684). The Marsh Arabs live near the confluence of the Tigris and Euphrates, which is listed by UNESCO as a world cultural heritage site due to its unique ecology. The Marshes was a crucial habitat for a diversity of species which have vital roles in food production such rice, wheat, millet and dates, in addition to its value for fishery and in providing fin fish and penaeid shrimps (Priestley 2020, 1-23).

The Iraqi government is faced with obstacles from various factors to ensure safety, health and socio-economic stability, particularly upstream water projects (Amin 2022, 7-16). As a consequence of upstream countries using water projects as an economical and political weapon, the Iraqi people particularly, women and the minority groups are deprived from accessing fresh water (Ibid). Iraq currently only has 1,390.95 m³/cap/year per person, which is below the threshold for water scarcity of 1700 m³/cap/year (Ethaib *et al.* 2022, 1-15).

Water crisis is detrimental to the socio-economic development of a country. For instance, the agriculture sector will face more challenges, such as damage to agricultural land, increased salinity which can cause desolation of land. As a result, Iraq which was once a large exporter of wheat has now become one of its largest importers in the world. (Al-Ansari *et al.* 2021, 161-199). Agriculture once contributed to about one-third of the country's GDP, now makes up for only 6.07 % of the country's GDP (The World Bank 2019) as a result of prolonged poor water management which caused soil degradation and desertification.

Filling the reservoirs of these dams would also cause dire consequences to the agricultural sector in downstream riparian countries. For instance, Iraq used to receive 29 km³ of water from Euphrates River before 1990 but after 2000 the volume declined to about 4 km³. (A reduction of approximately 90%). As a result, the area of agricultural lands in Iraq has been reduced from 650,000 hectares to 240,000 hectares (Al-Ansari *et al.* 2018, 95-121). Whereas it is expected that 696,000 hectares of agricultural land will be abandoned due to the reduction of the flow of Tigris River when Ilisu Dam is completed, Iraq will then only receive 9.7 km³ (Al-Ansari *et al.* 2018, 95-121; Hussein 2017, 239-248).

These water projects are also expected to reduce hydropower production, decrease the level of ground water and hence cause more regional conflicts (Hussein 2017, 239-248; Al-Ansari 2013, 667-684). In addition, water shortage would also increase desertification and the loss of thousands of hectares of arable land, which can contribute to more dust storms in the country. Accordingly, these water issues may precipitate the internal migration from the rural area to the city thereby affecting fishery and livestock (Hussein 2017, 239-248).

Some scholars believe that despite its socio-economic approach, the GAP project also has political aims. Internally the Turkish government is trying to resolve the plight of the Kurdish through the GAP project in the southeast of the country. Simultaneously, water control empowers Turkey to exert political pressure on downstream countries such as Iraq (Sitchinava 2021, 69-79; Ahmed 2021, 1-12). At the same time, the current Iranian water projects that run through the Haweizeh Marshes have caused a lower water flow into Shatt al Arab River, thus increasing the salinity of the river which has a negative impact on the agriculture and poses

risks to the Mesopotamian Marshes (UN-ESCWA and BGR 2013).

The operation of the Iranian water projects such as the Daryan Dam and Nawsud Tunnel are expected to cause a total severance of the water flow into the Kurdistan region in north of Iraq. This would deprive water to about 3,200 hectares of agricultural land within the Sulaymaniyah and Halabja Governorates. The Iranian water projects also impacts the other parts of Iraq in the south especially in the Diyala Governorate which relies on Sirwan River (known as Diyala River in the Diyala Governorate). About 20 to 30 percent of the annual water flow from Tigris River via Iran comes into Iraq through the Sirwan and Alwan Rivers (Chomani and Bijmens 2016, 1-18). The reduction of water flow from Iran due to the construction of dams on these rivers have cause serious environmental threats as a result of water scarcity, poor water quality, increased salinity, lose green cover, drought and high temperature in the Tigris and Shatt-Al Arab River area (Al-Asadi and Muttashar 2022, 1-13; Al-Ansari *et al.* 2021, 161-199). The absence of a clear and effective agreement between Iran and Iraq regarding rivers is the main obstacle that needs to be addressed urgently (Chomani and Bijmens 2016, 1-18; UN-ESCWA and BGR 2013).

5.0 water agreements entered between iraq, turkey and iran

There have been bilateral and tripartite agreements and protocols signed between Iraq, Turkey and Iran to create a transboundary management and cooperation. However, these agreements are not effectively enforced and are inadequate to address the current water tension in the region, some of them are discussed below:

5.1 iraq-turkey agreements

After the collapse of the Ottoman Empire some treaties were signed by all riparian states to equally share crucial resources benefits. For instance, in 1923 under the Lausanne Agreement signed between Turkey and the allied countries, it was agreed that transboundary water issues were to be dealt with separately and with mutual respect. It also provided in article 109 that Turkey has to conduct a consultation with Iraq before venturing into any hydraulic project (Al-Ansari 2016, 140-172).

In 1926 the “Treaty of Friendship and Good Neighborly Relations” was signed between Turkey and the Allied Powers for the cooperation on the usage of the Euphrates Basin. Thereafter the “Ankara Treaty for Friendship and Good Neighborliness” was entered in 1946 between Iraq and Turkey, which is considered as the first legal means for cooperation. Protocol No. 1 of 1949, included a significant emphasis in its preamble on the construction of conservation works on the rivers in Iraq to prevent water disaster such as floods. This is important for the equitable benefit of the socio-economic development of both countries. To achieve these goals, the treaty provided some critical mechanisms on information exchange, joint monitoring and assessment (UN 1949). Despite that and several discussions on the issue of transboundary water through bilateral (Turkey-Iraq) or tripartite meetings (Turkey-Syria and Iraq) in most previous decades (such as in 1965, 1989, 2002), there is still no clear and effective agreement signed to find a common ground for equal benefits to resolve the tension between all parties. (Salewicz, Sakamoto and Nakayama 2021, 171-204; Yousuf, Rapantova and Younis 2018, 1-19; Al-Ansari 2016, 140-172).

Additionally, Protocol No.1 of 1949 (which is related to regulation of the water of Tigris and Euphrates and its tributaries) to the 1946 Treaty of Friendship and Neighborly Relation between Iraq and Turkey states that,

The Government of Turkey agrees to inform Iraq of any projects relating to protection

works it may decide to construct on either river or on its tributaries in order to render such works, as far as possible, serve the interest of Iraq as well as serve the interest of Turkey.

Articles 3 and 5 of the 1946 Treaty require consultation between Iraqi and Turkish governments, if this consultation does not reach a solution, the conflict could be brought to the UN Security Council (UN 1946).

5.2 *iraq-iran agreements*

Historically, the first vital agreement called the Istana Protocol was signed in Constantinople (now Istanbul) in 1913. Then, in 1914 the demarcation of the river border in the Shatt al-Arab area was done by a special boundary commission (Yousuf, Rapantova and Younis 2018, 1-19). There are other water protocols and agreements between Iran-Iraq like the Protocol of 1937 and “1975 Algiers Agreement”. Based on the 1975 Algiers Agreement the Iraqi president at that time, Saddam Hussein gave up Iraq’s sovereignty over the other half of the Shatt al-Arab to Iran under the condition that Iran would no longer support the Kurdish Revolution in Northern Iraq (currently named the Kurdistan region) (UN1976). In addition, this Agreement emphasized the demarcation of the river border and the freedom of international navigation without taking into account the importance of freshwater inflow sustainability. It has been proposed that a Freshwater Sustainability Principle be incorporated in the recent accord to on the security and sustainability of SAR (Al-Asadi and Muttashar 2022, 1-13). The tension that persists till today is the proof that previous agreements and protocols between Iraq, Turkey and Iran are inadequate and ineffective to tackle transboundary water resources among these countries.

Turkey and Iran do not respect the principles and rules that exist with regard to the management of transboundary water resources by riparian countries to prevent or reduce transboundary impacts. Some of these rules and principles are briefly discussed below.

6.0 *the principles and rules on transboundary water sharing under international law*

The right of water sharing among riparian countries is recognized at the international level. There are rules and principles to regulate transboundary rivers and the usage of international watercourses between riparian countries (Zarei 2020, 81-94) in a fair manner as well as to avoid impact on water sharing rights among them. Whether Turkey and Iran have violated Iraq’s water rights in the course of the construction of their water project will be analyzed below.

6.1 *The Environmental Impact Assessment (EIA)*

International law emphasizes on the obligation of riparian countries to prevent transboundary harm to neighboring countries. It is a requirement for a party under EIA to analyze any possible environmental consequence or impact before any project is commenced. In the case of *Argentina v. Uruguay* (2010) for example, the International Court of Justice (ICJ) enunciated the duties and obligations of a party that wishes to carry out works that can affect a river, to exercise due diligence and the duty of vigilance and prevention by undertaking a compensative assessment to identify the risks and impact of the proposed works at para 204 as follows:-

[I]t may now be considered a requirement under general international law to undertake an environmental impact assessment where there is a risk that the proposed industrial activity may have a significant adverse impact in a transboundary context, in particular, on a shared resource. Moreover, due diligence, and the duty of vigilance and prevention which it implies, would not be considered to have been exercised, if a party planning works liable to affect the régime of the river or the quality of its waters did not undertake an environmental impact

assessment on the potential effects of such works (Pulp Mills on the River Uruguay in the case of *Argentina v. Uruguay* 2010).

Additionally, the Rio Declaration which was announced at the United Nations Conference on Environment and Development (UNCED) in 1992 also clearly mentions the EIA as a means to preserve the environment as Principle 17 states that: -

“Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.” (UNCED1992).

The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes at Helsinki on 17 March 1992 in Article 3 states that legal, administrative, economic, financial and technical measures must be adopted by the parties to prevent or minimize or control transboundary impact, one of which is the EIA, as can be seen in para “(h) Environmental impact assessment and other means of assessment are applied;” Although, Turkey and Iran are not a part of this convention, the recommendations are still useful in this regard.

Thereafter, the 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourse also suggested some mechanisms to prevent or reduce transboundary impact. For instance, Article 7 emphasized on obligation of upstream countries to take all appropriate measures to not cause significant harm to other countries. Although EIA is not explicitly specified as one of the measures, nevertheless it should be recommended under this provision.

It is clear from the above discussion that both the governments of Turkey and Iran have failed to follow the requirements of EIA to assess the effects of these dams on the downstream countries (Save the Tigris and Iraqi Marshes Campaign 2014). The water projects in Turkey and Iran did not successfully take into consideration the climate change impact in the GAP region and requires reassessment (Dezfuli, Razavi and Zaitchik 2022, 1-8). Although, Turkey and Iran did not ratify the aforementioned Convention on international watercourses, they are obliged to abide by the outcomes of the convention based on customary international law (Save the Tigris and Iraqi Marshes Campaign 2014).

6.2 The Convention of Biological Diversity (CBD)

The Convention of Biological Diversity (CBD) in 1992 also emphasized on the assessment of such impact and attempt to minimize adverse outcomes (UN 1991). Article 3 of the Convention states that,

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction. (UN 1992).

This provision recognizes the sovereignty of a country to exploit resources within its boundary, without neglecting its legal responsibility based on United Nation’s Charter and the principles of international law to ensure that no environmental harm is caused to other countries due to activities within its jurisdiction.

As discussed previously, water project developments by Turkey and Iran have had environmental impact on Iraq. This is a violation of the aforementioned rules. For example, intensive water projects in Turkey and Iran caused damage to the Marsh’s ecology due to a

water decline in the south of Iraq at the confluence of the Tigris and Euphrates which is recognized as unique cultural site and called the Garden of Eden. The ecosystem of the marshes is also considered crucial for a key biodiversity site globally. However, today the drought and upstream water projects have damaged the Iraqi marshes and caused internal displacement and socio-economic damage to the people who live there (Ethaib *et al.* 2022, 1-15; Save the Tigris and Iraqi Marshes Campaign *et al.* 2015).

In fact, all riparian countries of the Tigris and Euphrates Rivers (Turkey, Iran, Syria and Iraq) who are parties to the convention of biological diversity have a duty to respect the environment and biodiversity of other states while they exploit their own resources.

6.3 World Charter for Nature (WCN) 1982

Para 16 of the United Nations' World Charter for Nature (WCN) 1982 requires governments to carry out effective consultation and gather responses from the public within a suitable time in respect of all planned projects to be carried out as follows: -

All planning shall include, among its essential elements, the formulation of strategies for the conservation of nature, the establishment of inventories of ecosystems and assessments of the effects on nature of proposed policies and activities; all of these elements shall be disclosed to the public by appropriate means in time to permit effective consultation and participation (WCN 1982).

According to customary international law and the 1997 UN convention for international watercourse, upstream countries should consult downstream countries on any transboundary water project development and its impact. However, the governments of Turkey and Iran failed to consult directly with the Iraqi government and affected community in Iraq before implementing their water plans in contravention of customary international law. (Save the Tigris and Iraqi Marshes Campaign *et al.* 2015). Para 21 (d) of the WCN1982 further states the obligation of a country to prevent any harm or damage to the natural system of other countries as follows "ensure that activities within their jurisdictions or control do not cause damage to the natural systems located within other States or in the areas beyond the limits of national jurisdiction." (WCN 1982). Therefore, upstream water projects by Turkey and Iran pose risks to the Iraqi environment due to significant water shortages.

6.4 The Rio Declaration 1992

Principle 2 of The Rio Declaration 1992 allows a state to enjoy their own resources within the national jurisdiction provided that it does not cause harm or damage to another state or area beyond the limits of national jurisdiction. Principle 2 reads as follows:-

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction. (UNCED 1992).

A precaution is emphasized in principle 15 of the Rio Declaration, which states that:-

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-

effective measures to prevent environmental degradation.(UNCED 1992).

For instance, the decision to build the Ilisu Dam, which failed to take into consideration the well being of Iraqi downstream communities can result in them facing severe water scarcity and further undermine thousands of hectares of agricultural land, causing environmental destruction. These uncertainties and threats were not addressed well because a comprehensive EIA, as discussed above was not carried out. (Save the Tigris and Iraqi Marshes Campaign 2014). However, there are international and regional conventions which may be referred to as a legal framework that promises some rules for transboundary water resources management among riparian countries as will be discussed below.

6.5 *The Convention on the Protection and use of Transboundary Watercourses and International Lakes in 1992 and Convention on the Law of the Non-navigational Uses of International Watercourses on 21 May 1997; entered into force on 17 August 2014 (UN Watercourse Convention)*

These two conventions have laid down the general rules and principles (Zarei, 2020) with provisions that clarifies the duty of riparian states on utilization of their natural resources and respecting neighboring states' rights by not infringing their environmental rights.

6.5.1 Convention on the Protection and Use of Transboundary Watercourses and International Lakes. Helsinki, 17 March 1992 (UNECE)

This Convention was conducted by the "Senior Advisers to the Economic Commission for Europe Governments on Environmental and Water Problems" at their fifth session at Helsinki from 17 to 18 March 1992 and entered into force on 6 October 1996. It is considered a significant international legal binding instrument for the parties to take some measures inter alia to prevent or minimize transboundary impact through institutional cooperation, sustainable management for shared water, peaceful settlement of disputes and regional integration (UNECE 2022).

This convention has rules and principles that should be taken into consideration by riparian countries to prevent transboundary impact. They include general provisions which encourage parties to take measures to prevent, reduce and control of transboundary impact such as water pollution, rationalize water management to preserve water and the environment and ensuring that transboundary waters are used in a reasonable and equitable way (Article 2).The convention further states, "To prevent, control and reduce transboundary impact, the Parties shall develop, adopt, implement and, as far as possible, render compatible relevant legal, administrative, economic, financial and technical measures, in order to ensure, inter alia, that:... (h) Environmental impact assessment and other means of assessment are applied;" (Article 3). Therefore, EIA and other forms of evaluation must be applied by a riparian state to prevent or minimize transboundary impact.

In addition, this convention (Article 9) pushes for riparian countries to enter into an agreement or revise existing agreements to cooperate in transboundary water management, when it states that, "The Riparian Parties shall on the basis of equality and reciprocity enter into bilateral or multilateral agreements or other arrangements, where these do not yet exist, or adapt existing ones, where necessary to eliminate the contradictions with the basic principles of this Convention." Para 2 of the same Article calls for the creation of a mutual institution to coordinate the implementation of EIA for transboundary waters based on international rules as it states that, "(j) To participate in the implementation of environmental impact assessments relating to transboundary waters, in accordance with appropriate international regulations." (Table 4).

Table 4: *Convention on the Protection and Use of Transboundary Watercourses and International Lakes. Helsinki, 17 March 1992. (Source: UNECE 1992)*

No.	Convention
1.	Convention on the Protection and Use of Transboundary Watercourses and International Lakes. Helsinki, 17 March 1992
Article 2 General Provisions	1. The Parties shall take all appropriate measures to prevent, control and reduce any transboundary impact. 2. The Parties shall, in particular, take all appropriate measures: (a) To prevent, control and reduce pollution of waters causing or likely to cause transboundary impact (b) To ensure that transboundary waters are used with the aim of ecologically sound and rational water management, conservation of water resources and environmental protection. (c) To ensure that transboundary waters are used in a reasonable and equitable way, taking into particular account their transboundary character, in the case of activities which cause or are likely to cause transboundary impact (d) To ensure conservation and, where necessary, restoration of ecosystems. To prevent, control and reduce transboundary impact, the Parties shall develop, adopt, implement and, as far as possible, render compatible relevant legal, administrative, economic, financial and technical measures, in order to ensure, inter alia, that: (h) Environmental impact assessment and other means of assessment are applied (i) Sustainable water-resources management, including the application of the ecosystems approach, is promoted (j) Contingency planning is developed (k) Additional specific measures are taken to prevent the pollution of groundwaters (l) The risk of accidental pollution is minimized
Article 3 Prevention, Control and Reduction	
Article 9 Bilateral and Multilateral Cooperation	1. The Riparian Parties shall on the basis of equality and reciprocity enter into bilateral or multilateral agreements or other arrangements, where these do not yet exist, or adapt existing ones, where necessary to eliminate the contradictions with the basic principles of this Convention, in order to define their mutual relations and conduct regarding the prevention, control and reduction of transboundary impact. 2. The agreements or arrangements mentioned in paragraph 1 of this article shall provide for the establishment of joint bodies. The tasks of these joint bodies shall be, inter alia, and without prejudice to relevant existing agreements or arrangements, the following: (j) To participate in the implementation of environmental impact assessments relating to transboundary waters, in accordance with appropriate international regulations.

6.5.2 Convention on the Law of the Non-navigational Uses of International Watercourses. 17 May 1997. Entered into force on 17 August 2014 (UN Watercourse Convention)

This Convention is applicable to the non-navigation use of international watercourses and for the protection, development and management of these international waters (Article 1). Based on Article 2, “(a) “watercourse” means a system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus” and international watercourse is defined as “a watercourse, parts of which are situated in different States”.

This Convention lays down the general rules and principles regarding the utilization of international watercourses which should be heeded. A riparian or watercourse state should participate in the utilization, development and preservation of international watercourse in an equitable and reasonable manner (Article 5). However, one of the vital provisions of the convention is the “Obligation not to cause significant harm” (Article 7), in that a riparian state when using the watercourse in its territory should not cause significant harm to other watercourse states. Although, ‘significant harm’ has not been unequivocally defined, yet it is still a crucial obligation that should be observed.

This Convention also highlighted other obligations that watercourse or riparian states should abide by which include information exchange and mutual consultation, timely notification about planned measures with possible adverse impacts, protection of environment of watercourse (Article 20), pollution prevention, reduction or control (Article 21).

Additionally, in case of disputes between watercourse states regarding the interpretation

of the Convention when there can be no amicable agreement, the states should take a peaceful approach to tackle such disputes. For instance, as stated in Article 33, Para 2,

If the parties concerned cannot reach agreement by negotiation requested by one of them, they may jointly seek the good offices of, or request mediation or conciliation by, a third party, or make use, as appropriate, of any joint watercourse institutions that may have been established by them or agree to submit the dispute to arbitration or to the International Court of Justice.

In 1997, the International Court of Justice, justified its decision to invoke the UN Watercourses Convention in a dispute regarding the Danube River (Loures *et al.* 2015). Iraq ratified the UN Watercourse Convention in 2001, likewise Syria, which also has water share on the Tigris and Euphrates Rivers. However, Turkey voted against while Iran have not signed Convention. (Sirwan 2022). However, according to experts of international law “it is nonetheless bound to respect it” (Save the Tigris and Iraqi Marshes Campaign 2015).

Table 5: *Convention on the Law of the Non-navigational Uses of International Watercourses. Adopted on 21 May 1997. Entered into force on 17 August 2014. (Source: UN 2014)*

2.	Convention on the Law of the Non-navigational Uses of International Watercourses. Adopted on 21 May 1997. Entered into force on 17 August 2014
Article 5 Equitable and reasonable utilization and participation	1. Watercourse States shall in their respective territories utilize an international watercourse in an equitable and reasonable manner. In particular, an international watercourse shall be used and developed 2. Watercourse States shall participate in the use, development and protection of an international watercourse in an equitable and reasonable manner. Such participation includes both the right to utilize the watercourse and the duty to cooperate in the protection and development thereof, as provided in the present Convention.
Article 7 Obligation not to cause significant harm	1. Watercourse States shall, in utilizing an international watercourse in their territories, take all appropriate measures to prevent the causing of significant harm to other watercourse States.
Article 11 Information concerning planned measures	Watercourse States shall exchange information and consult each other and, if necessary, negotiate on the possible effects of planned measures on the condition of an international watercourse.
Article 12 Notification concerning planned measures with possible adverse effects	Before a watercourse State implements or permits the implementation of planned measures which may have a significant adverse effect upon other watercourse States, it shall provide those States with timely notification thereof. Such notification shall be accompanied by available technical data and information, including the results of any environmental impact assessment, in order to enable the notified States to evaluate the possible effects of the planned measures.
Article 20 Protection and Preservation of Ecosystem	Watercourse States shall, individually and, where appropriate, jointly, protect and preserve the ecosystems of international watercourses.
Article 21 Prevention, Reduction and Control of pollution	2. Watercourse States shall, individually and, where appropriate, jointly, prevent, reduce and control the pollution of an international watercourse that may cause significant harm to other watercourse States or to their environment, including harm to human health or safety, to the use of the waters for any beneficial purpose or to the living resources of the watercourse. Watercourse States shall take steps to harmonize their policies in this connection.
Article 33 Settlement of Disputes	1. In the event of a dispute between two or more parties concerning the interpretation or application of the present Convention, the parties concerned shall, in the absence of an applicable agreement between them, seek a settlement of the dispute by peaceful means in accordance with the following provisions. 2. If the parties concerned cannot reach agreement by negotiation requested by one of them, they may jointly seek the good offices of, or request mediation or conciliation by, a third party, or make use, as appropriate, of any joint watercourse institutions that may have been established by them or agree to submit the dispute to arbitration or to the International Court of Justice.

Although Turkey and Iran have not ratified the said Convention on international watercourses, they, like all other countries are still under an obligation to obey the rules and principles of the Convention based on customary international law (Save the Tigris and Iraqi Marshes Campaign 2014).

6.6 Iraq has a right to receive compensation if the operation of the Ilisu or Daryan Dam causes harmful consequences to it

The ICJ has explicitly recognized that “it is a well-established rule of international law that an injured State is entitled to obtain compensation from the State which has committed an internationally wrongful act for the damage caused by it.” (See: Gabčíkovo-Nagymaros Project (Hungary/Slovakia) at 81, para 152; mentioned by (Save the Tigris and Iraqi Marshes Campaign 2014). Therefore, Iraq is legally entitled to submit a dispute to the ICJ and UN Security Council as recommended by another study. Notwithstanding the same, Iraqi government should determine the extent of the damage as a result of the upstream water projects to be able to request an immediate prevention or mitigation of the harm and to seek for an appropriate compensation (Hussein 2017, 239-248).

In addition, based on Article 33 of the United Nations 1997 Convention, committed countries which are unable to resolve their conflicts in peaceful manner may request a third party or use a joint watercourse institution for mediation or conciliation or submit any dispute for arbitration or to the ICJ to prevent any threat to security and peace of the international community as a result of water conflicts. Historically many waters related disputes and tensions have been resolved through mediation by the United Nations or its agencies, for instance, the disputes on the Al-Sindh waters (India and Pakistan) and the waters of the Kang (India and Bangladesh); or through arbitration, like the dispute regarding the Malando River (Afghanistan and Iran); or by the judiciary, such as the disputes concerning the Banana River (Belgium and the Netherlands) and the Oder River (Poland and the Czech Republic), etc. (Yousuf, Rapantova and Younis 2018, 1-19).

Hussein in his study (2017) suggested to the Iraqi government to initiate collaboration to resolve the issue with an international community and the United Nations that in the event the riparian countries do not respond to this effort, Iraq should make an attempt based on the principle of good will and good-neighboring, to ask for a mediation by a third party to tackle the problem in accordance with a clear agreement. In case mediation fails, Iraq will need to go for arbitration based on international rules and principles in accordance with Article 109 of the Lusanne Treaty 1923 for a settlement. However, if these modes are still unable to solve the issue between the Iraq as a downstream country with Turkey and Iran as upstream countries, he recommended that the Iraqi government sues those states in the International Court of Justice (ICJ) according to Article 40(1) of the Statute of ICJ to protect the rights of the people of Iraq to enjoy their natural resources for the present and future generations (Hussein 2017, 239-248).

In addition to the above discussion, it should be noted that historically Iraq has acquired rights which have now been recognized by international law to enjoy a continuous usage of an appropriate share of water from the Tigris and Euphrates Rivers. Thus, this acquired right of Iraq which has been affirmed by international rules and principles must therefore be respected by all parties (Hussein and Mohamed 2021, 130-137).

7.0 *climate change expedited water challenge in the region*

Iraq is located in the region between the Middle East and North Africa (MENA region), which is projected to be the most vulnerable area in the world in terms of climate change events

including higher temperatures, intense heat waves, desertification, decreasing precipitation and the shifting of distribution patterns and higher evaporation (Zarei 2020, 81-94; Price 2018; Issa, et al. 2014, 421-432).

Iraq is considered as the fifth-most vulnerable country to the impact of climate change in the world and compromised water and food insecurity based on the UN report, yet it lags behind its neighbors in planning for water management (Sirwan 2022). As a result, Iraq currently suffers from loss of cultivated land, desertification, recurrent droughts, sand storms and decreasing agriculture yields which give rise to socio-economic harms (Elaiwi, Hasan and Al-Hadithi 2020, 1-7; Al-Ansari et al. 2018, 95-121).

A new study was conducted by Dezfuli, Razavi and Zaitchik (2022) to indicate potential future changes in the Middle East region (as the most vulnerable areas to climate change globally) through climate model projections of precipitation and temperature for the very high emissions scenario, SSP5-8.5, by comparing a baseline period (1981–2010) with the middle (2040–2069) and end (2070–2099) of the twenty first century. The results show Tigris-Euphrates headwaters as the hotspot of future impact of climate change in the Middle East for the coming decades. The study also detected the GAP region as a hotspot for upcoming climate change, which is expected to pose risks for the GAP region and the downstream water security. As a consequence, water conflicts and migration are predicted. Therefore, a reconsideration of the risk-benefit evaluation of GAP is necessary (Dezfuli, Razavi and Zaitchik 2022, 1-8).

Based on this study, a downstream country of the Tigris and Euphrates such as Iraq is highly vulnerable to the harmful consequences of climate related events in the region for decades ahead. The study claims “the negative impacts of GAP may outnumber its benefits, and this study attempts to warn the decision-makers of the urgent need to integrate these trends to water resource planning and international negotiations.” (Dezfuli, Razavi and Zaitchik 2022, 1-8). Hence, the upstream countries’ water management policies are the major reason for the unprecedented water stresses that Iraq is faced with today, since Turkey, Iran and Syria provide a greater part of the Iraqi water resources ((Amin 2022,7-16). Accordingly, the water tensions in the region should be considered as the consequence of a combined effect of water projects (such GAP and TWO) and climate change (Dezfuli, Razavi and Zaitchik 2022, 1-8).

8.0 recommendation to call for a new agreement

It cannot be denied that a long-term sustainable solution for transboundary water resources requires the approval of all riparian countries (Yousuf, Rapantova and Younis 2018, 1-19). Historically, protocols and agreements were signed to manage transboundary water resources for equal socio-economic purposes between all parties of the Tigris and Euphrates Rivers. However, transboundary water tensions remained unsolved.

Although, Iraq, Turkey and Iran have shared water resources, there is no sufficient and effective treaty to ensure adequate water supply to Iraq and equitable benefit of water resources ((Salewicz, Sakamoto and Nakayama 2021, 171-204; Chomani and Bijmens 2016, 1-18; Al-Ansari 2016,140-172; Save the Tigris and Iraqi Marshes Campaign 2015; UN-ESCWA and BGR 2013). The present intensive water projects in Turkey (GAP) and Iran (TWP) pose risks to the Iraqi environment as discussed above due to a significant decline in the water flow into Iraq.

Although, Iraq and Syria have signed an agreement in July 2021 to cooperate administratively and technically and also to exchange data and apportion their share of water in view of the decreased water flow (Sirwan 2021; IRAQI NEWS AGENCY 2021), there is no

an appropriate agreement signed between Turkey, Syria, Iran and Iraq to shape a common ground for the exploitation and management of sustainable transboundary water. This may lead to water crises and tensions between these riparian countries, like the Iraqi-Iran war in 1980-1988 which caused dire consequences to both countries (Zarei 2020, 81-94).

The current situation has deprived thousands of people from access to water in Syria and Iraq, where farmers are forced to leave their lands due to draught and desertification. This situation is expected to aggravate the existing tensions between the two countries and might even lead to war if no attempt is made to solve it through negotiations (Al-Ansari 2016, 140-172). Hence, water diplomacy is a crucial tool for all riparian countries on shared water to solve problems, enhance collaboration, reach an agreement and “institution building” on transboundary waters to mitigate the dire consequences of water crises (Yeganeh and Bakhshandeh 2022, 331-358; Kyirewiah 2022, 32-42).

Iraq has significant relations with both Turkey and Iran which is affected inter alia by different socio-economic factors, particularly strategic economic, security and cultural aspects (Yousuf, Rapantova and Younis 2018, 1-19). Thus, Iraq should use these factors diplomatically to make a clear understanding based on the new agreement to determine the rights and obligations of all parties. It is noted that the trade exchanges between Iraq-Turkey and Iraq-Iran is high, with Turkey and Iran annually receiving a huge revenue from Iraq as an importer. Therefore, Iraq may be able to rely on such trade deals to apply pressure upon these countries to reach a sustainable solution in a proper water diplomacy.

Turkey, Syria, Iran and Iraq should have a clear agreement that highlights the duties and rights of all sides, particularly, in consideration of the current effects of water management by upstream countries and the expected climate change consequences in the region. It is crucial to urgently sign a new water agreement between all parties under the supervision of the UN. Based on the above discussion and analysis, Iraq as a downstream country has encountered severe water crises and environmental catastrophes which has led to more socio-economic harm as a result of violation of internationally recognized Iraqi water rights by Turkey and Iran (Amin 2022, 7-16; Dezfuli, Razavi and Zaitchik 2022, 1-8).

In brief, based on customary international law and international watercourse conventions and other regional agreements between riparian countries of the Tigris and Euphrates Rivers as discussed above, Turkey and Iran have the legal obligation to respect Iraq's water rights by preventing any negative impact on the downstream communities which are currently facing unprecedented water scarcity problems due to reduced water flow at an alarming right. This issue should clearly be addressed in accordance with the new agreement particularly between Iraq-Turkey and Iran under the supervision of the UN to avoid politicizing of water sharing rights.

Conclusion

Although, Iraqi water resources are encountering a considerable challenge due to poor water management as internal factors, external factors also exacerbated the water crises such as climate change and neighboring water projects on the Tigris and Euphrates Rivers which are the main surface water resources in Iraq have expedited the water scarcity problem. The present paper found that the customary international law and other related international conventions and principles emphasized on the obligation of the riparian countries to respect equitable water sharing rights for all, and the upstream countries should not act in a way that causes harm to transboundary downstream water and to the environmental rights of other downstream states.

Therefore, the governments of Turkey and Iran have violated Iraq's water rights based on international water laws. In the present situation, it is imperative for all riparian countries in the Tigris and Euphrates Basin particularly Iraq, Turkey and Iran under UN supervision to take the first step in reaching a new clear agreement that can prevent the escalation of disputes or politicizing of water resources in the climate change era in the region. However, Iraq should scale up efforts to shape a more prudent and sustainable water management strategy under the climate change scenario, which the country is currently facing.

Funding: This study does not receive any external funding.

Acknowledgments: This paper was presented at SOLAS 2021 international seminar and published as an e-proceedings book. However, this version has been improved scientifically based on the latest data.

Conflicts of Interest: The authors declare that there is no conflict of interest.

References

- Al-Madhhachi, Abdul-Sahib T., Khayyun A. Rahi, and Wafa K. Leabi. 2020. "Hydrological Impact of Ilisu Dam on Mosul Dam; the River Tigris." *Geosciences*. 10(120), 1–14. [doi:10.3390/geosciences10040120](https://doi.org/10.3390/geosciences10040120)
- Sarhat, Abdulmutalib, R..2022. "Iranian Tropical Water Project on Sirwan River and its impact on some environmental aspects in Garmian Region." *Journal of University of Garmian*. (Special issue). The 10th Scientific Conference: Drought and Water Scarcity Management. 6(1). 273-287. <https://doi.org/10.24271/garmian.21080325>
- Ahmed, Sundus Serhan.2021. "Turkish water policy towards Iraq." *Al-Mansour Journal/ Issue* (35), 1-12. <https://www.iasj.net/iasj/download/1afe30b0a2994892>
- Al-Ansari, Nadhir. 2016. "Hydro-Politics of the Tigris and Euphrates Basins." *Engineering*. 03.(8), 140-172. <http://dx.doi.org/10.4236/eng.2016.83015>
- Al-Ansari, Nadhir.2013. "Management of Water Resources in Iraq: Perspectives and Prognoses." *Engineering*. 05(08), 667–684. <https://doi.org/10.4236/eng.2013.58080>
- Al-Ansari, Nadhir, Ammar. A. Ali and Sven Knutsson. 2014. "Present Conditions and Future Challenges of Water Resources Problems in Iraq." *Journal of Water Resource and Protection*, 06(12). 1066–1098. <https://doi.org/10.4236/jwarp.2014.612102>
- Al-Ansari, Nadhir, Sabbar Saleh, Twana Abdullah and Salwan Ali Abed.2021. "Quality of Surface Water and Groundwater in Iraq." *Journal of Earth Sciences and Geotechnical Engineering*. Vol. 11, No. 2.161-199. <https://doi.org/10.47260/jesge/1124>
- Al-Saadi, Nawar and Khafaja Ahmed Mays Sadkhan. 2021. "Water Resources Decrease of River Euphrates and its Impacts on the Environment in Iraq." *International Journal of Ecology and Environmental Sciences*.(January)33-59
- Al-Asadi, Safaa A. R. , Wasan Sabeh Al-Qurnawi , Adnan B. Al Hawash, Hussein Badr Ghalib and NoorAl-Huda A. Alkhelifa .2020. "Water quality and impacting factors on heavy metals levels in Shatt Al-Arab River Basra, Iraq." *Applied Water Science*, 10(5). 1–15. <https://doi.org/10.1007/s13201-020-01196-1>
- Al-Asadi, Safaa A. R. , Wisam R. Muttashar.2022. "Impact of the environmental degradation of rivers on the reappraisal of international agreements related to the transboundary watercourse, Shatt Al-Arab River (Southern Iraq): a case study." *Sustain. Water Resour. Manag.* 8(84). 1-13. <https://doi.org/10.1007/s40899-022-00669-2>
- Al-Ansari, Nadhir, Sadeq AlJawad , Nasrat Adamo , Varoujan K. Sissakian , Jan Laue and Sven

- Knutsson 2018. "Water quality within the Tigris and Euphrates catchments." *Journal of Earth Sciences and Geotechnical Engineering*. Vol.8. No.3. 95–121.
- Amin, Bakir H.. 2022. "Access to Clean Water for Women in Iraq: Accorded Rights." *wH2O: The Journal of Gender and Water*. Vol.9(1). 7-16
<https://repository.upenn.edu/wh2ojournal/vol9/iss1/2/>
- Bilgen, Arda. 2018. "Turkey's Southeastern Anatolia Project (GAP): A qualitative review of the literature review of the literature." *British Journal of Middle Eastern Studies*. 00(00). 1–20. <https://doi.org/10.1080/13530194.2018.1549978>
- Chabuk, [Ali](#), [Qais Al-Madhlom](#), [Ali Al-Maliki](#), [Nadhir Al-Ansari](#), [Hussain Musa Hussain](#) and [Jan Laue](#) .2020. "Water quality assessment along Tigris River (Iraq) using water quality index (WQI) and GIS software." *Arabian Journal of Geosciences*, 13, 654. 1-23. <https://doi.org/10.1007/s12517-020-05575-5>
- Chomani, Kamal and Toon Bijmens. 2016. "The impact of the Daryan Dam on the Kurdistan Region of Iraq." In *Save the Tigris and Iraqi Marshes* (Issue October).
https://www.waterkeepersiraq.org/uploads/9/2/7/0/9270858/daryan_dam_en.pdf
- Dezfuli, Amin, Saman Razavi, and Benjamin F. Zaitchik. 2022. "Compound effects of climate change on future transboundary water issues in the Middle East." *Earth's Future*, 10, e2022EF002683. 1-8. <https://doi.org/10.1029/2022EF002683>
- Elaiwi, Ala H., Karima Hasan and Mufid Al-Hadithi. 2020. "Management of Natural Iraqi Water Resources , Aims And Challenges." 3rd International Conference on Sustainable Engineering Techniques (ICSET 2020). 1-7 . <https://doi.org/10.1088/1757-899X/881/1/012181>
- Faraj, Dana Muhammad and Kawa Zaidan. 2020. "The Impact of the Tropical Water Project on Darbandikhan Dam and Diyala River Basin." *IRAQI JOURNAL OF CIVIL ENGINEERING*. 014–001. <https://www.iasj.net/>
- Hussein, Omar Ahmed and Khadijah Mohamed. 2021. "Legal Rights of International Water Resources: A Case of Tigris and Euphrates Rivers." *International Journal of Law, Government and Communication*. 6 (22), 130-137. DOI: 10.35631/IJLGC.6220012.
- Hussein, Omer, Ahmed. 2017. "Projects Constructed on the Tigris and Euphrates international watercourses and their impacts on Iraq's water utilization: An international law approach." PhD diss., Universiti Utara Malaysia.
- Issa, I. E., N. A. Al-Ansari, Govand Sherwany and S. Knutsson. 2014. "Expected Future of Water Resources within Tigris-Euphrates Rivers Basin, Iraq." *Journal of Water Resource and Protection*. 06(05). 421-432. <https://doi.org/10.4236/jwarp.2014.65042>
- Kyirewiah, Francis Kwesi. 2022. "Water Diplomacy: And the Share of the Nile River between Egypt, Ethiopia and Sudan." *Mediterranean Journal of Social Sciences*. Vol 13 No 1. <https://doi.org/10.36941/mjss-2022-0004>
- Mason, Michael. 2022. Infrastructure under pressure: Water management and state-making in southern Iraq. *Geoforum*. 132 (June) 52-61. <https://doi.org/10.1016/j.geoforum.2022.04.006>
- Adamo, Nasrat, Nadhir Al-Ansari, Varoujan K. Sissakian , Sven Knutsson and Jan Laue.2018. "Climate Change : Consequences on Iraq' s Environment," *Journal of Earth Sciences and Geotechnical Engineering*. 8, no. 3. 43–58.
- Allafta, [Hadi](#) and [Christian Opp](#) .2020. "Spatio-temporal variability and pollution sources identification of the surface sediments of Shatt Al-Arab River, Southern Iraq." *Sci Rep*. 10:6979. 1–16. <https://doi.org/10.1038/s41598-020-63893-w>
- Priestley, Cara. 2020. " We Won't Survive in a City. The Marshes are Our Life " : An Analysis of Ecologically Induced Genocide in the Iraqi Marshes. *Journal of Genocide Research*, 0(0), 1–23. <https://doi.org/10.1080/14623528.2020.1792615>
- Ethaib, Saleem, Salah L. Zubaidi and Nadhir Al-Ansari. 2022 "Evaluation water scarcity based

- on GIS estimation and climate-change effects: A case study of Thi-Qar Governorate, Iraq.” *Cogent Engineering*. 9:1, 2075301. 1-15. DOI: 10.1080/23311916.2022.2075301
- Salewicz, Kazimierz A., Maiko Sakamoto and Mikiyasu Nakayama. 2021. “Management of Water Resources Using Storage Reservoirs.” Edited by Laith. A. Jawad, Tigris and Euphrates Rivers: Their Environment from Headwaters to Mouth. Springer. Volume 11. 171-204. https://doi.org/10.1007/978-3-030-57570-0_6
- Sitchinava, Bukhuti. 2021. “WATER SECURITY IN THE MIDDLE EAST ON THE EXAMPLE OF IRAQI KURDISTAN.” *Ante Portas – Security Studies*. No 1(16).69-79. DOI: 10.33674/120215
- Tosun, Hasan. 2019. “Regional development projects and a case study from Turkey. 3rd International Regional Development and The Role of Universities Symposium - IRDARUS’19. https://www.researchgate.net/publication/340583637_REGIONAL_DEVELOPMENT_PROJECTS_AND_A_CASE_STUDY_FROM_TURKEY
- Yeganeh, Yasaman and Ehsan Bakhshandeh. 2022. “IRAN’S MODEL OF WATER DIPLOMACY TO PROMOTE COOPERATION AND PREVENT CONFLICT OVER TRANSBOUNDARY RIVERS IN SOUTHWEST ASIA.” *World Affairs*, 185(2). 331–358. <https://doi.org/10.1177/00438200221081210>
- Yousuf, Mahmood A., Nada Rapantova and Jalal H. Younis. 2018. “Sustainable Water Management in Iraq (Kurdistan) as a Challenge for Governmental Responsibility.” *Water*, 10,1651. 1-19. doi:10.3390/w10111651
- Yousif, Omed S. Q. , Kawa Zaidn , Younis Alshkane , Abdulrahman Khani, Salar Kareem Hama.2019. “Performance of Darbandikhan Dam during a major earthquake on November 12, 2017.” 3rd meeting of EWG Dams and Earthquakes. An international symposium. Portugal | Lisbon | LNEC - May 6 – 8. 295-308.
- Zarei, Mohanna.2020. “The water-energy-food nexus: A holistic approach for resource security in Iran, Iraq, and Turkey.” *Water-Energy Nexus*, 3. 81–94. <https://doi.org/10.1016/j.wen.2020.05.004>
- Corona, Austin . 2020. “How Mangled Dam Diplomacy Is Shaping Iraq’s Water Crisis”. Accessed June 14, 2022. <https://www.washingtoninstitute.org/policy-analysis/how-mangled-dam-diplomacy-shaping-iraqs-water-crisis>
- Save the Tigris and Iraqi Marshes Campaign. 2014. “ILISU DAM AND LEGAL CONSIDERATIONS IN IRAQ.” <https://www.iraqicivilsociety.org/wp-content/uploads/2014/04/ILISU-DAM-AND-LEGAL-CONSIDERATIONS-IN-IRAQ-Eng.pdf>
- Dilan, Sirwan.2021. “Tigris, Euphrates water levels drop more than 50 percent: water ministry.” *Rudaw*, June 16, 2022. <https://www.rudaw.net/english/middleeast/iraq/220820213>
- Ministry of Industry and Technology. GAP. 2021. “Southern Anatolia Project, Regional Development Administration.” Accessed June 17, 2021. <http://www.gap.gov.tr/en/what-is-gap-page-1.html>.
- Human Rights Watch.2019. “Basra is Thirsty; Iraq’s Failure to Manage the Water Crisis.” Accessed May 3, 2022. <https://www.hrw.org/report/2019/07/22/basra-thirsty/iraqs-failure-manage-water-crisis>
- United Nation.1946. “Treaty of Friendship and Neighborly Relations between Iraq and Turkey.” *Collection of Treaties*. No. 580, 281-331. Accessed June 15,2022. http://www.internationalwaterlaw.org/documents/regionaldocs/Iraq-Turkey-Friendship_1946.pdf
- IRAQI NEWS AGENCY.2021. “Iraqi-Syria agreement about water.” Accessed June 16, 2022. <https://www.ina.iq/130552--.html>
- Loures, Flavia,Alistair Rieu, Marie-Laure Vercambre and Lesha Witmer. 2015. “Everything you need to know about the UN Watercourses Convention.” *Rivised* January 2015.

- https://wwfeu.awsassets.panda.org/downloads/wwf_un_watercourses_brochure_for_web_july2009_en.pdf
- Price, Roz. 2018. "Environmental risks in Iraq." K4D Helpdesk Report. Brighton, UK: Institute of Development Studies.
- Save the Tigris and Iraqi Marshes Campaign, Iraqi Social Forum, Iraqi Civil Society Solidarity Initiative, Counter Current – GegenStrömung / INFOE, Environmental Defender Law Center (EDLC), Initiative to Keep Hasankeyf Alive, The Corner House and Un ponte per. 2015. "The Ilisu dam and its impact on human rights in Iraq: The Iraq government's failure to act." Report submitted to the U.N. Committee on Economic, Social and Cultural Rights for its 56th Session, 21 September - 9 October 2015.
https://www.iraqicivilsociety.org/wp-content/uploads/2015/09/CESCRIraq_Submission-by-Save-Tigris-Campaign-1.pdf
- Sala, Daniela and Bart von Laffert. 2021. "Tensions rise as Iranian dams cut off Iraqi water supplies." DW, June 14, 2022.
<https://www.dw.com/en/tensions-rise-as-iranian-dams-cut-off-iraqi-water-supplies/a-58764729>
- Sirwan, Dilan. 2022. "Iraq will discuss water issue with Iran, Turkey at 36th FAO Regional Conference." Rudaw, June 15, 2022.
<https://www.rudaw.net/english/middleeast/iraq/08022022>
- Travers, Alannah. 2022. "New report urges immediate action to tackle water stress in Iraq's Euphrates-Tigris Basin." Rudaw, June 16, 2022.
<https://www.rudaw.net/english/middleeast/iraq/21022022>
- United Nations. 1976. "Treaty Concerning the State Frontier and Neighbourly Relations Between Iran and Iraq." Treaty Series
<https://treaties.un.org/doc/Publication/UNTS/Volume%201017/volume-1017-I-14903-English.pdf>
- United Nations. 1991. "Convention on Biological Diversity."
<https://www.cbd.int/doc/legal/cbd-en.pdf>
- United Nations. 2013. "water in Iraq factsheet."
http://iq.one.un.org/documents/161/Water_Fact_Sheet_March_2011.pdf
- UNCED. 1992. "REPORT OF THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT-Rio Declaration on Environment and Development." United Nation Publication
- UNECE. 2022. "About the water convention." Accessed June 15, 2022
<https://unece.org/environment-policy/water/about-the-convention/introduction>
- United Nations. 2014. "Convention on the Law of the Non-navigational Uses of International Watercourses Adopted by the General Assembly of the United Nations on 21 May 1997." Accessed June 12, 2022.
<https://legal.un.org/avl/ha/clnuiw/clnuiw.html>
- United Nations. 1992. "Convention on the Protection and Use of Transboundary Watercourses and International Lakes." Helsinki, on 17 March 1992. Accessed June 15, 2022.
https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXVII-5&chapter=27&clang=en
- UN-ESCWA and BGR (United Nations Economic and Social Commission for Western Asia; Bundesanstalt für Geowissenschaften und Rohstoffe). 2013. "Inventory of Shared Water Resources in Western Asia." Beirut. Chapter 5, Shatt al Arab, Karkheh and Karun Rivers. http://waterinventory.org/surface_water/shatt-al-arab-karkheh-and-karun-rivers
- Worldometer. 2022. Iraqi population. Accessed July 12, 2022.
<https://www.worldometers.info/world-population/iraq-population/>